City of Dallas

Water Conservation Five-Year Work Plan

April 2016

City of Dallas Water Utilities
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Water Conservation Five-Year Work Plan

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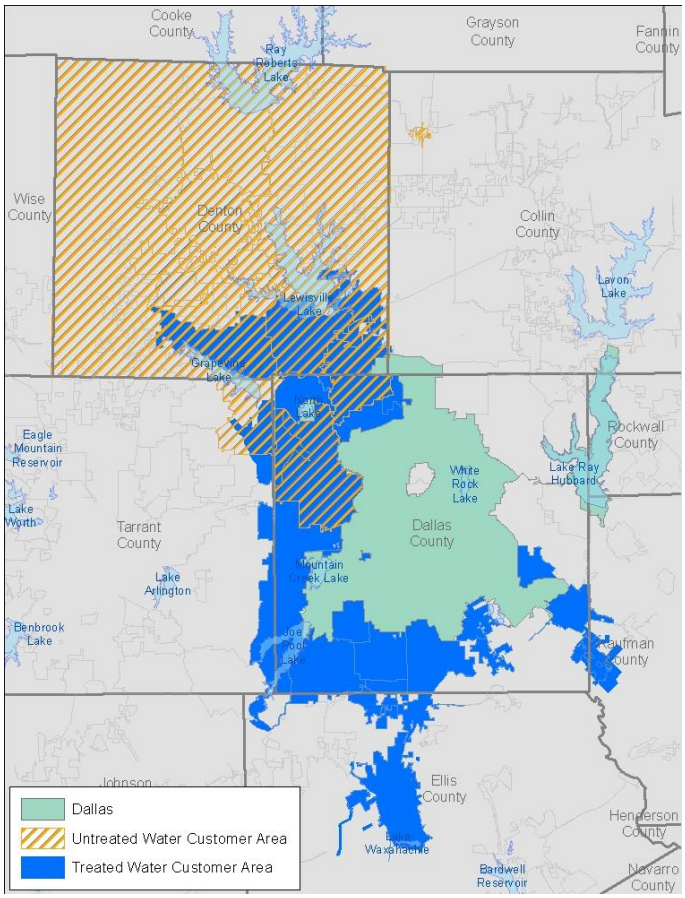
ES. Executive Summary

Dallas Water Utilities (DWU) is a major retail and wholesale provider of water in North Texas that currently serves over 2.4 million people within a 700 square mile service area. DWU has met the water and wastewater needs of the City of Dallas since 1881 and currently supplies treated water to 23 wholesale treated water customers. DWU also supplies untreated water to an additional three wholesale customers.

Dallas meets these needs through a system of seven surface water reservoirs and through its transmission, treatment, and distribution facilities. These seven geographically diverse reservoirs are located 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.

Figure ES-1: Dallas Water Utilities Service Area



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 in order to optimize available water supplies
- **Wholesale Customer Requirements:** The water conservation plan must include a requirement in every water supply contract entered into 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

- **A 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 by which the conservation plan is enforced.

- **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 2016 Water Conservation Five-Year Work Plan serves as a road map for compliance with the State's mandates. It also serves as a major component of Dallas' Long Range Water Supply strategies.

Benefits of Water Conservation

A well-designed Water Conservation Plan will not deprive the community of essential water uses; rather, it will provide a blueprint for efficient water use. The benefits of water conservation not only include those derived from avoided costs, but other benefits that may not be as easily enumerated in terms of dollars yet hold significant importance to the City 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 in order 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 its customers' 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 good will and promoting a positive image for Dallas. Water Conservation is Dallas' most cost-effective water supply. Since 2001, the city's broad-based water efficiency measures have worked in tandem to save approximately 316 BG (billion gallons) or 62 million gallons per day (MGD).

Additionally, DWU's Water Conservation Program is directly responsible for changing the perceptions and behaviors of its customers. Since 2001, the city's GPCD has been reduced by 26%. Annual surveys indicate that customer awareness of the watering ordinance is up from 60%

to 76%, and that customers' positive water conservation behaviors are up from 46% to more than 71%. However, water conservation alone will not solve Dallas' long-term water needs. Continued customer engagement and on-going re-evaluation 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, they will be substantially lost.

FY 2015 marked the 10th anniversary of Dallas' Water Conservation strategic planning efforts. Water demand has been greatly 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

Thirteen (13) measures have been identified for implementation and/or continuation for the 2016 Water Conservation Five-Year Work Plan (hereafter referred to as the 2016 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.

Table ES-1: Proposed Measures by User Group

Proposed Measure	User Group				Action		
	SF	MF	ICI	DWU	Ongoing	Enhance	New
Continued Customer Engagement							
1. Residential Irrigation System Rebate Program	✓	✓					★
2. ICI Financial Incentive Program			✓		★	★	
3. Multi-Family Outreach Partnership with Department of Code Compliance		✓					★
4. Wholesale Customer Cities Monitoring, Measurement, and Reporting				✓			★
5. Targeted Outreach to ICI & Large Campus Style Properties	✓	✓	✓				★
6. Enhanced Residential Public Outreach	✓	✓	✓		★	★	
7. Increased Enforcement Efforts	✓	✓	✓	✓	★	★	
Water System Improvements							
8. Water Loss Reduction				✓	★	★	
9. Meter Reading (Apparent Loss Reduction)				✓	★	★	
10. Complete Modernization of Meter Reading Process				✓	★	★	
11. Water Treatment Plant Backwash Optimization				✓	★	★	
Ordinance Changes							
12. Landscape Ordinance Amendment	✓	✓	✓	✓	★	★	
13. Evaluate Alternative Rate Options (DWU Rate Study)		✓					★

SF = Single Family; MF = Multi-Family; ICI = Industrial, Commercial, and Institutional

ES.2. 2016 Work Plan Development Process

The inaugural Five-Year Strategic Plan adopted in 2005 and the subsequent 2010 Update were completed by outside consultants[1] with assistance from City of Dallas Water Utilities' staff. The 2016 Work Plan was completed by DWU staff with assistance from Alan Plummer Associates, Inc.

The 2016 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 water conservation staff from other cities and public/private stakeholders.

City of Dallas water use data was examined to identify strategic areas to target for 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. Strategies that will continue from previous plans include:

- Public Awareness Campaign
- Toilet Rebate Programs
- Minor Plumbing Repair Program
- Environmental Education Initiative
- Irrigation System Check-Up Program

ES.3. Organization of the 2016 Work Plan

The following information and procedures are provided in the 2016 Work Plan:

- ***Section 1.0, City of Dallas Water Use Profile*** describes the customer make-up 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*** documents the water conservation measures implemented to date and the resulting water savings. Measure descriptions, the extent to which measures have been implemented and implementation costs are also discussed.
- ***Section 3.0, Advancing City of Dallas Water Conservation Efforts (FY 2016 through FY 2020)*** describes planned program enhancements as well as new conservation measures that are likely to be implemented.
- ***Section 4.0, Projected Water Savings, Estimated Costs, Benefits and Staffing*** includes projected water savings, potential benefits, estimated costs, recommended budgets and staffing needs for the proposed measures.
- ***Section 5.0, 2016 Work Plan Implementation and Schedules*** describe detailed annual action plans for FY 2016 through FY 2020.
- Appendix

[1] 2005 City of Dallas Water Conservation Five-Year Strategic Plan completed by Enviromedia and Alan Plummer Associates, Inc. in association with: Chris Brown Consulting and Baker Consulting Associates. 2010 City of Dallas Water Conservation Five-Year Strategic Plan Update completed by Alan Plummer Associates, Inc. in association with: Amy Vickers & Associates, Inc., CP&Y, Inc., Miya Water and BDS Technologies, Inc.

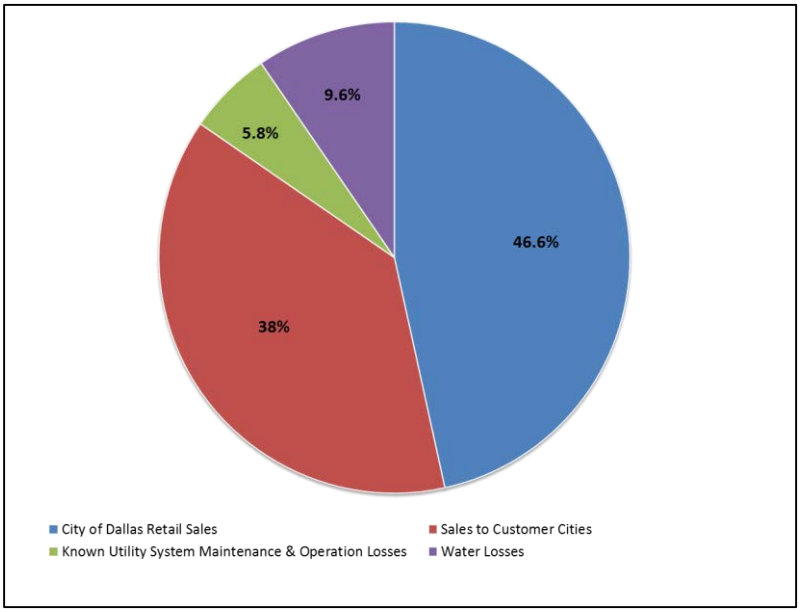
1. City of Dallas Water Use Profile

To make recommendations that are technically sound and economically feasible, water conservation planners must understand the customer make-up and water use patterns of the service area. For FY 2011 through FY 2015, summary data showing monthly water use by water user category was analyzed. Categories included residential, general service (GS), optional general service (OGS), municipal, wholesale, and unbilled. In the summary data:

- Residential water use is assumed to be single-family
- The General Service (GS) category has two classifications- Multi-Family and Commercial
- Optional GS water users consist primarily of large industrial customers
- Unbilled water, also known as non-revenue water, is a combination of unbilled authorized consumption and water loss. Unbilled authorized consumption includes unbilled municipal uses such as, 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, Multi-Family, Commercial, Large Industrial and Municipal)
- Billed Metered is the sum of Total Billed Retail and Wholesale water use

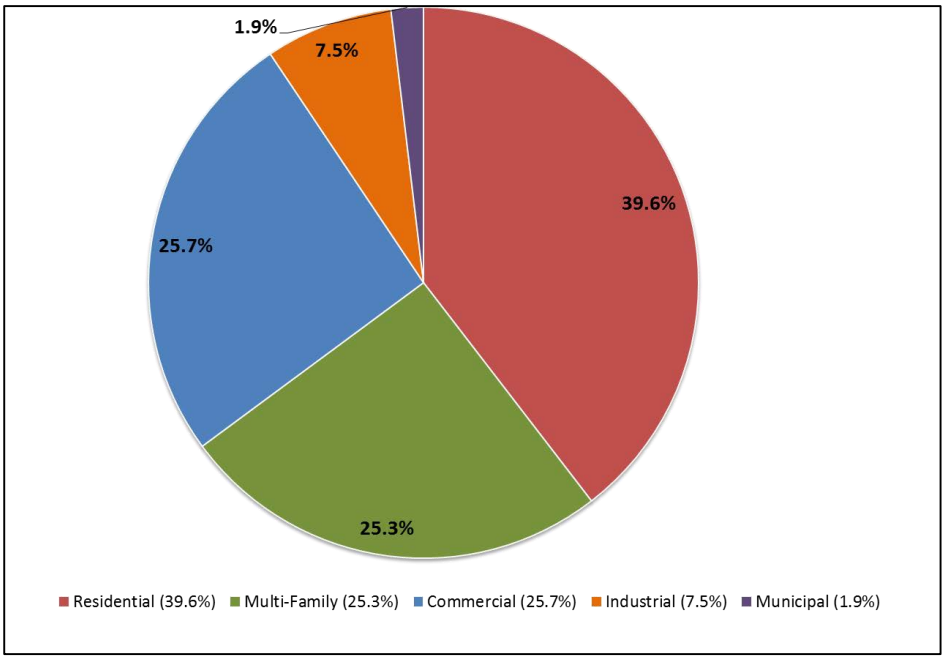
From FY 2011 through FY 2015, Dallas' average annual treated water production was 143.6 billion gallons. Total treated water use is divided into City of Dallas retail sales, known utility system maintenance and operation losses, sales to customer cities and water losses. During the review period, retail sales accounted for 46.6 percent of total treated water use and wholesale water sales accounted for 38.1 percent.

Figure 1-1: Summary of DWU Total Treated Water Use FY 2011 through FY 2015



Currently, Dallas provides treated water to more than 330,000 active retail customers. The division of billed retail water use into customer categories is shown in **Figure 1-2**. Single-family residential customers comprise the largest water use category, accounting for 39.6 percent of billed retail water use during the analysis period.

Figure 1-2: Summary of DWU Total Billed Retail Water Use FY 2011 - FY 2015



Understanding "base" and "seasonal" water use helps in the targeting of 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 month for a given year
- Assumed to be constant throughout each year for each category

Seasonal water use is generally associated with irrigation and cooling water uses and estimated to be all water use greater than the base. Base and seasonal water uses are shown by category and year in **Figures 1-3 and 1-4**. Among retail customers, residential (single-family), commercial, and institutional accounts used between 37 to 40 percent of all water supplied for seasonal purposes. Multi-family and large industrial accounts had much lower seasonal water use.

Figure 1-3: Seasonal Water Use by Category FY 2011- FY 2015

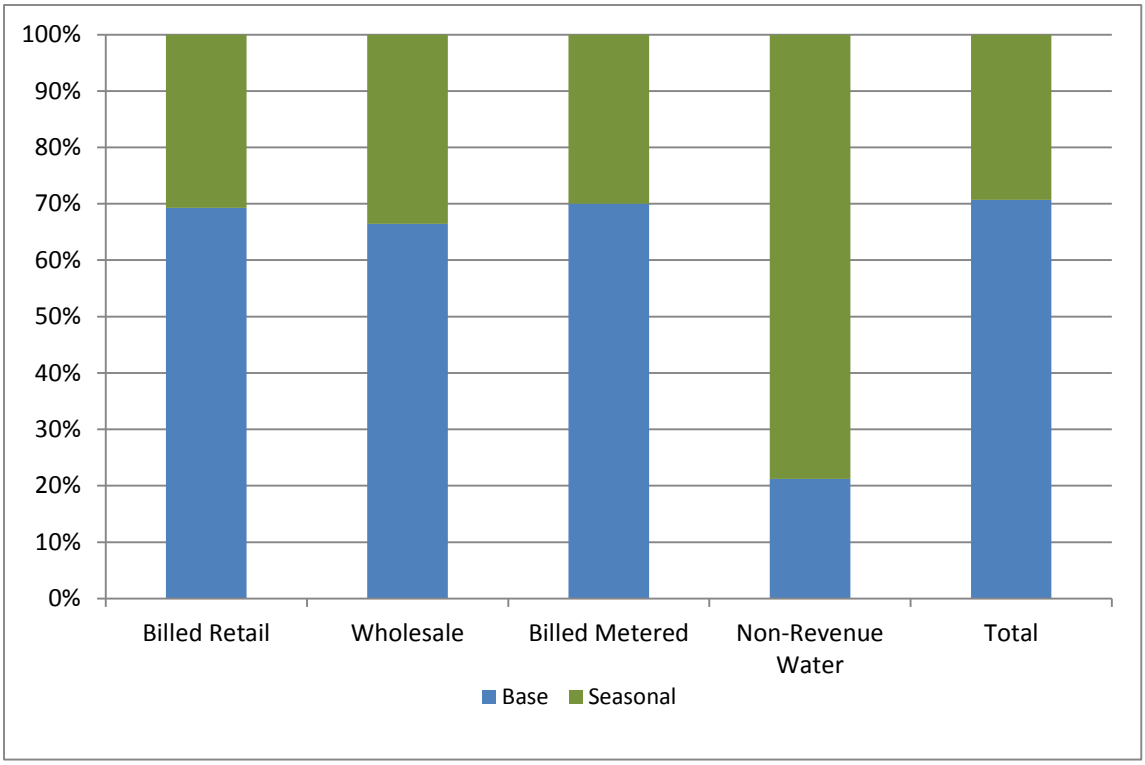
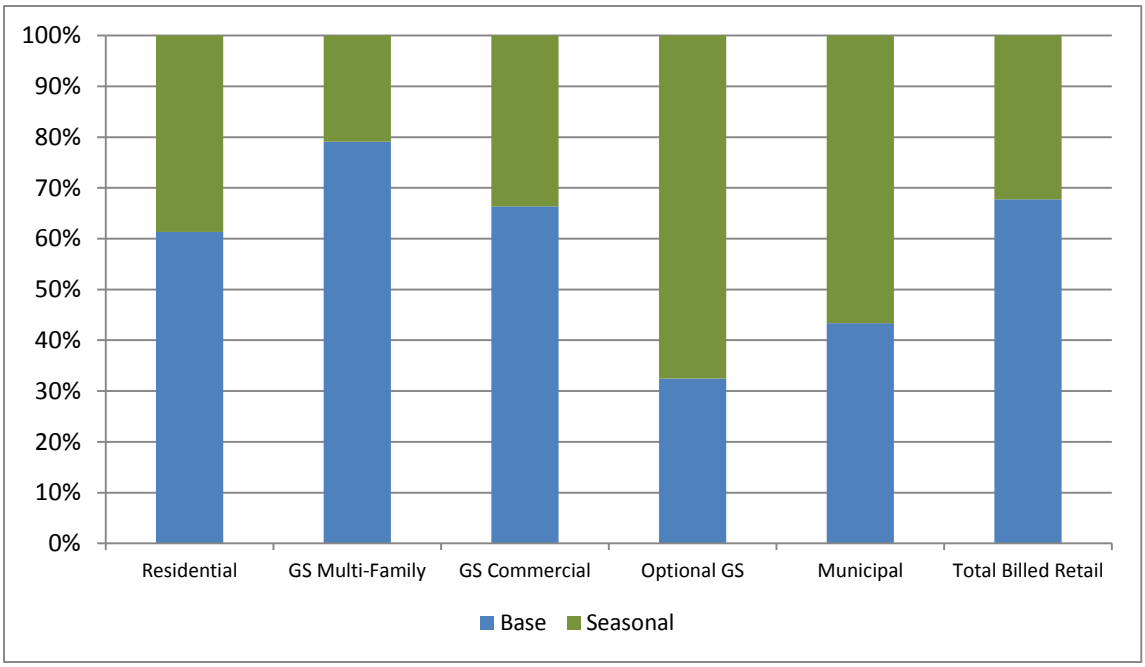
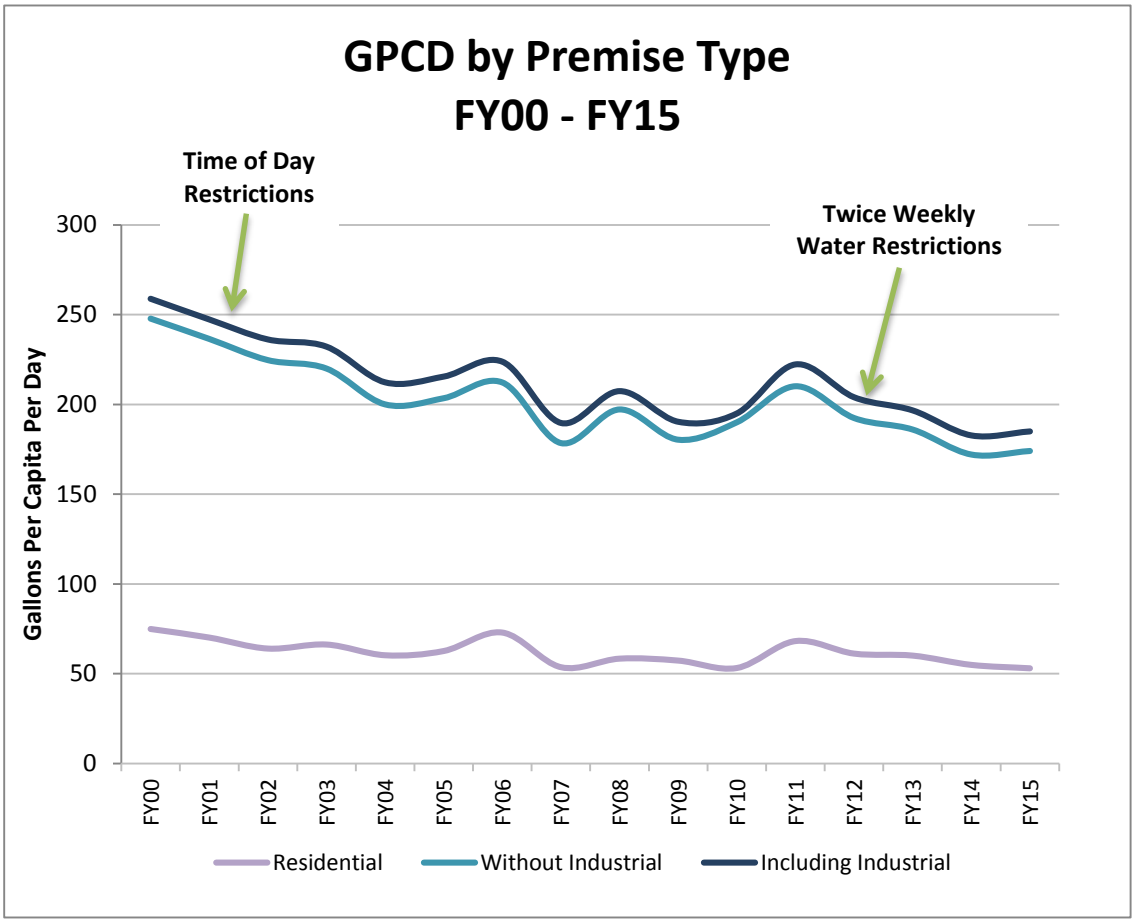


Figure 1-4: Seasonal Billed Retail Water Use by Category FY 2011 – FY 2015



GPCD is a metric that helps water purveyors track their consumption patterns. The Water Conservation Implementation Task Force Best Management Practices Guide[2] recommended standard methodologies for calculating GPCD and residential per capita water use. Using this methodology, 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 fourteen years. Total per capita water use has steadily declined from its FY 2000 peak to the present as indicated in **Figure 1-5**.

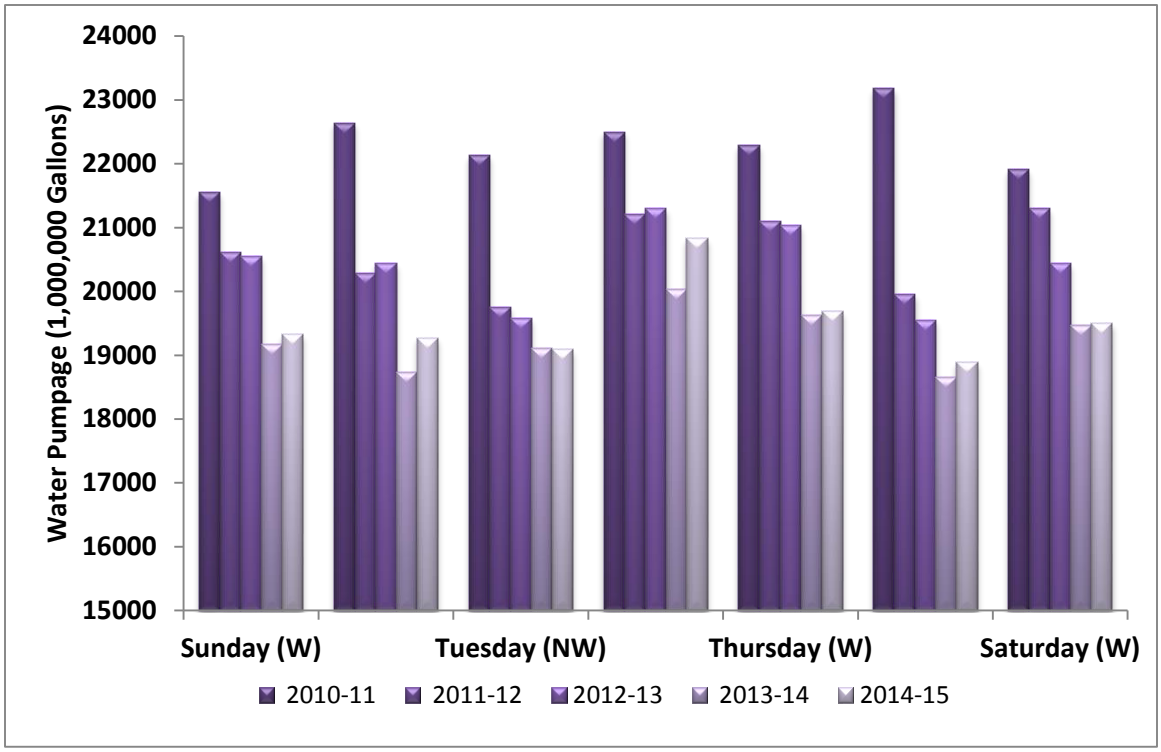
Figure 1-5: GPCD by Premise Type



Another interesting trend to note is that DWU implemented a mandatory maximum twice-weekly watering schedule for the City of Dallas in the Spring of 2012. **Figure 1-6** clearly shows that when any day watering was allowed, significant amounts of water were used. However, since FY 2011, when maximum twice weekly watering schedules were implemented, water savings have been achieved on non-watering days.

[2] Published and distributed by the Texas Water Development Board, P.O. Box 13231, Capital Station, Austin, Texas 78711-3231

Figure 1-6: Water Consumption (MG) on Watering (W) Vs. Non-Watering (NW) Days



2. City of Dallas Water Conservation Progress

DWU has a long history of providing leadership in the area of water conservation. This section provides a description of the existing program and the enhancements and new measures that have been implemented to reduce per capita consumption and curb water waste.

2.1 Water Conservation Program Chronology

The City of Dallas has had a water conservation program since the early 1980's. Beginning in 1981, DWU began adding bill inserts to encourage customers to conserve water. In 1984, DWU initiated 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.

In the mid-1980's, DWU conservation efforts focused on media relations, speaking engagements, and special events and promotions. Media relations consisted of news coverage of conservation techniques 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 ongoing distribution of showerheads upon request.

In 1988, DWU began promoting water-wise landscapes with exhibits, brochures, and seminars (in partnership with the 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 also began sponsoring annual recognition awards and a tour of homes with water-wise landscaping.

In October 2001, the Dallas City Council amended the city's water and wastewater ordinance to include conservation water rates and a prohibition on landscape water waste. The inverted block rate structure was amended so that residential customers using more than 15,000 gallons per month paid a higher unit rate for the additional water (currently $8.20 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 also pay a higher unit rate. 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[3] (except irrigation by hand and the use of soaker hoses)

[3] This requirement was amended in FY 2006. Time-of-day restrictions were formerly from June 1 through September 30.

- Irrigation in excess of twice per week based on the property street address.[4] Designated watering days are assigned based on the last digit of the property address. Addresses ending in an even number are allowed to water on Sundays and Thursdays and those ending in odd numbers are allowed to water on Saturdays and Wednesdays

Finally, the ordinance amendment required all irrigation systems be equipped with rain-sensing devices and freeze sensors by January 1, 2005. The amendment provided for warnings on a first violation of the ordinance and fines between $250 and $2,000 for subsequent violations.

In 2002, DWU initiated an extensive, ongoing multimedia Public Awareness Campaign to educate customers about landscape irrigation practices and new restrictions from the ordinance amendment. The award winning campaign is themed "Save Water. Nothing Can Replace It."

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 was to reduce per capita water consumption by an average of 1% per year from FY 2006 through FY 2010. The 2005 Strategic Plan was subsequently updated in FY 2010 with a new goal of reducing per capita consumption by an average of 1.5% per year from FY 2011 through FY 2015.

2.2 City of Dallas Water Conservation Measures

This section provides a description of DWU's existing water conservation program and the enhancements and new conservation measures that have helped to achieve DWU's stated water conservation goal.

Accurate 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' WTPs are metered at the plants. DWU's Wholesale Customer Cities (WSCC) contracts (treated and untreated water) require that a meter be provided and is 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 on a monthly basis.

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 as well. Dual metering is currently provided to some customers based on the individual needs of the user. All treated water pumped from the WTPs is compiled in an annual Pumped Water Report, which shows water pumped on a monthly basis.

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.

[4] This amendment was adopted in April, 2012.

Meter Testing and Repair

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

Periodic Meter Replacement

Most residential meters in the City of Dallas are replaced at 10- or 15-year intervals depending on meter size and accuracy life of the meter. Most large and high capacity general service meters are tested on an annual basis. DWU will also repair or replace any meter reported as inaccurate by a water customer.

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

DWU has an extensive leak detection and repair program and is committed to maintaining a rate of less than 10 percent for unaccounted-for water losses in its water system. Annual unaccounted-for water, based on the difference between treated water pumped and sold, averaged 9.35 percent in 2015.

Currently, DWU has an annual budget of $25 million for maintenance and upkeep of the distribution system. The majority 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 the visual observation of field crews or are reported by the public.

DWU also has fourteen staff members to detect hard-to-find leaks. The Leak Detection Program has the goal of surveying the entire water system and improving the integrity of the water system by identifying weaknesses in water pipelines before breaks develop. The goal is to survey all pipelines every 2.5 years, 40% annually. 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 and in FY 2015 surveyed approximately 95% of the entire system.

Monitoring and Record Management of Water Deliveries, Sales and Losses

DWU regularly 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 on a regular basis, as needed. All water sources and service connection accounts are individually metered and read on a regular basis to facilitate accurate comparisons and analysis.

Continuing Public Education Program

The City of Dallas' public education program is considered one of the best information and education programs in the State of Texas. DWU's program has received recognition from the Texas Water Development Board, the Texas Section of the American Water Works Association (TAWWA), the Texas Water Conservation Association, the American Advertising Federation, the U.S. Environmental Protection Agency (EPA), and the Obama Administration's 2011 Clean Water Framework Report. The school program has received awards from the TAWWA, Keep Texas Beautiful, and the Oak Cliff Chamber of Commerce.

Public Awareness Campaign

Launched in the summer of 2002, the city's Public Awareness Campaign, branded "Save Water, Nothing Can Replace It," promotes water conservation with television ads on major stations, radio ads during peak traffic periods, billboards on heavily traveled thoroughfares, and print ads in the Dallas Morning News and minority publications. A web site featuring the "Save Water" logo contains information about water conservation programs, the water conservation ordinance restrictions, and various "green" events sponsored by the city. The website can be accessed by visiting www.savedallaswater.com.

Although the Dallas-Fort Worth area receives water service from many different water providers, it is a single media market. As a result, the DWU Public Awareness Campaign delivers messages within other water service areas and the DWU water service area receives water conservation messages from other water providers. In 2009, DWU partnered 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 and to leverage its Public Awareness Campaign budget. Dallas has historically spent approximately $750,000 annually for media coverage.

An additional $750,000 in media exposure is leveraged annually through the TRWD partnership. Since 2002, Dallas has spent over $16 million on its public awareness campaign thus demonstrating its continuing commitment to water conservation for the entire North Texas region.

Environmental Education Initiative K-12

In FY 2006, DWU augmented its existing school education programs with an Environmental Education Initiative (EEI) through a collaborative effort with the City of Dallas Department of Sanitation to provide programs for grades kindergarten through twelve in the Dallas and Richardson Independent School Districts. The EEI web site[5] is an online resource for teachers with links to videos on outdoor water use, indoor water use, watersheds, and surface-groundwater interactions. The web site also has a description of recycling lessons and water lessons for kindergarten through fifth grade children. Teachers can also register for a free in-class presentation through this web site. To date, the EEI has reached over 190,000 students and parents.

Water Conservation Mascot

In 2006, DISD students elected Dallas' official water conservation mascot "DEW". Through frequent public appearances and community outreach, DEW helps to educate kids and adults alike about the importance of using water wisely. DEW has reached an annual average of approximately 1,500 Dallas residents and businesses since his 2006 debut. More information on DEW's efforts can be accessed through the "Kids Corner" link on the city's water conservation webpage, www.savedallaswater.com.

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[5] URL: http://dallaseei.org/

Free Irrigation System Inspections

DWU added two licensed irrigators to its water conservation division staff and began providing free irrigation system inspections in FY 2007. These inspectors serve residential and commercial customers and work with other city departments on proper maintenance and operation of city irrigation systems. The inspections include identification of potential system leaks, diagnosis of equipment malfunctions, and recommendations for equipment upgrades to enhance efficiency. Over 5,700 inspections have been performed since the program was launched. Projected water savings based on implemented recommendations for FY 2015 is over 39 million gallons per year (MG/Y).

Water Wise Landscape Events

FY 2015 marked the 21st anniversary of the city's Water-wise Landscape Tour of Homes and Awards program. This initiative is designed to raise public awareness and save water by showcasing demonstration gardens, recognizing water-wise award winners, and promoting the replacement of water-thirsty yards with landscaping that requires minimal water and maintenance.

The city also maintains "water-wise" landscapes and demonstration gardens at the historic White Rock Lake Pump Station and at Fair Park. The use of water-wise landscaping is also promoted through semi-annual water-wise seminars. From FY 2011 through FY 2015, the city hosted 31 water-wise landscape events. It is difficult to quantify water savings achieved specifically from these events. However, this conservation measure heightens awareness of the need for water conservation and provides tools for landscape conversion and proper maintenance.

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Water savings resulting from customer conversion to water-wise landscaping is not tracked by the city, but continued education events and potential water-wise landscape ordinances for future construction are expected to contribute to water use reduction over time.

Other Public Education

The City of Dallas also uses other approaches to public education, including water bill inserts, brochures, speaking engagements, special events and promotions, and conservation-oriented signs in city facilities.

Industrial, Commercial, and Institutional (ICI) Free Water Efficiency Surveys

In FY 2012, the Dallas City Council authorized an ICI Water Efficiency Survey Program to help commercial entities and small businesses save water and money by identifying opportunities to increase water use efficiency and to reduce water, wastewater and electricity costs.

The city's free assessments include a full examination of:

- Cooling Towers, Boilers & Other Thermodynamic Operations
- Metering, Monitoring and Measurement
- Plumbing Fixtures, Fittings & Equipment
- Landscape
- Irrigation
- Food Service Operations
- Laundry Operations
- Laboratory & Medical Facilities
- Swimming Pools, Spas & Fountains
- Vehicle Washes
- Alternate Sources of Water

Over 320 water efficiency assessments have been performed since the program was launched with an estimated water savings of over 337 MG/Y if recommended process and equipment improvements are implemented.

ICI Hospitality Industry Program

In FY 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 is voluntary. Participating hotels and motels urge guests to embrace fewer linen and towel changes, as well as, serve water on request only in their dining areas. The City provides free public service announcements to participating lodging facilities to educate their guests about the program. Dallas area restaurants are also encouraged to serve water on request only. This simple measure not only saves our water resources but also provides energy savings through less frequent dishwasher and heated water use. Free marketing and promotional materials are provided for participating establishments. Over 75 facilities currently participate in the program.

ICI Training Programs (Under development during FY 2016)

DWU plans to develop, lead, and manage ongoing water efficiency training programs for:

- ICI facility managers and engineers, and
- Irrigators and commercial landscape professionals

Topics will include industrial cooling, food processing, irrigation management, and leakage control. Bi-monthly or quarterly training programs will be conducted. As facility managers and irrigators become more aware of available water-efficient technologies and methods, they will begin to implement these measures. DWU will work with local businesses, green building organizations, and energy utilities to seek their input on the curriculum development and certification process.

ICI Business Partnership Program (Under development during FY 2016)

DWU plans to establish an ongoing Business Partnership Task Force or work group for the purpose of engaging the ICI community in DWU's water conservation program, particularly business leaders who represent companies that are top water users. The Task Force will meet four to six times per year for discussion of water conservation practices, sharing of conservation success stories, and discussion of DWU ICI water conservation programs.

Water Conservation Division Staff

DWU currently maintains 13 staff positions in the Water Conservation Division, up from 7 full-time employees in 2005. New staff members have been added to analyze and track Best Management Practices (BMPs), provide customer water audits, administer education programs, and facilitate retrofit programs. Significant expansion of water conservation programs with the implementation of the Strategic Plan required more water conservation staff to coordinate and support the enhanced program.

Retrofit of City Owned Facilities

Retrofits of city facilities have included replacement of indoor plumbing fixtures and irrigation audits and corresponding improvements. The city has also increased its employee and public awareness with campaigns publicizing improvements or retrofits at city-owned facilities. These improvements were made possible through the City Leadership Grant Program which provides funding to city departments for water conservation improvement projects. Grants are awarded on a competitive basis annually. Since, FY 2009, grants totaling $681,654 have been awarded with an estimated water savings of 2.56 MG/Y.

Water-Wise Landscape Design Requirements (Under Review FY 2016)

DWU is collaborating with the city's Sustainable Development and Construction Department to revise (upon City Council approval and adoption) its landscape ordinance to promote water conservation best management practices. Items under review include limiting turf areas in new landscapes, minimum soil depths, soil amendments, and turf grass dormancy capability. Turf grass requires more water than native grasses and low-water-use plants. Reducing the turf grass area in new landscapes will reduce irrigation water use.

ICI Commercial Equipment Rule

With the adoption of the International Green Building Construction Code (Section 5.14), the city has put into place requirements for certain water efficiency standards for new and newly-occupied ICI establishments.

Toilet Voucher/Rebate Program

The New Throne for Your Home program, initiated in July 2007, offers vouchers and rebates for the replacement of older, inefficient toilets with high efficiency (HET) models. Applicants must be DWU customers whose toilets were installed prior to January 1, 1994 and who do not already have HETs. Single-family vouchers are limited to two per household. A rebate option is also available for up to $90 per toilet. The program is promoted in print, radio and occasionally on television, as well as, the DWU water conservation web site[6]. To date, more than 91,000 toilets have been replaced through the New Throne for Your Home program. These efficient toilets are projected to save over 392 MG/Y.

[6] www.savedallaswater.com

Minor Plumbing Repair Program

The Minor Plumbing Repair (MPR) program was initiated in FY 2006 with the goal of assisting low-to-moderate income water customers reduce water waste and increase water use efficiency. The program is designed to replace inefficient water use fixtures such as toilets (up to 2 per household), faucets and showerheads with more efficient fixtures. The program also includes minor repairs to leaking faucets, hose bib leaks, easily accessible pipe joint leaks, and water heaters. To date, over 3,770 families have participated. Measures implemented through the MPR program are projected to save over 26 MG/Y.

ICI Rebate Program (Recommended for Restructuring)

In FY 2012, the Dallas City Council authorized funding for ICI rebates in an effort to help corporations and small businesses 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 processes that conserve water at existing facilities. All ICI water users served by the City of Dallas Water Utilities are eligible to apply. A free City of Dallas water efficiency facility assessment is required for eligibility. Four customers have been identified for potential rebates to date.

Residential Irrigation/Landscape System Incentive (Recommended For Implementation FY 2013. Program not implemented)

This program was not implemented because the region was in a severe drought and it was determined that a rebate program would not succeed if there was a possibility that watering restrictions might be elevated to stage 2 or above (possibly no outdoor irrigation). However, the program is included among the proposed measures for the FY 2016 Work Plan.

DWU plans to offer a rebate or other incentive to single-family and multifamily residential customers that retrofit their existing irrigation systems with water-conserving equipment. Qualifying equipment may include:

- Drip irrigation equipment
- Spray heads with greater distribution uniformity
- Smart irrigation controllers
- Other devices

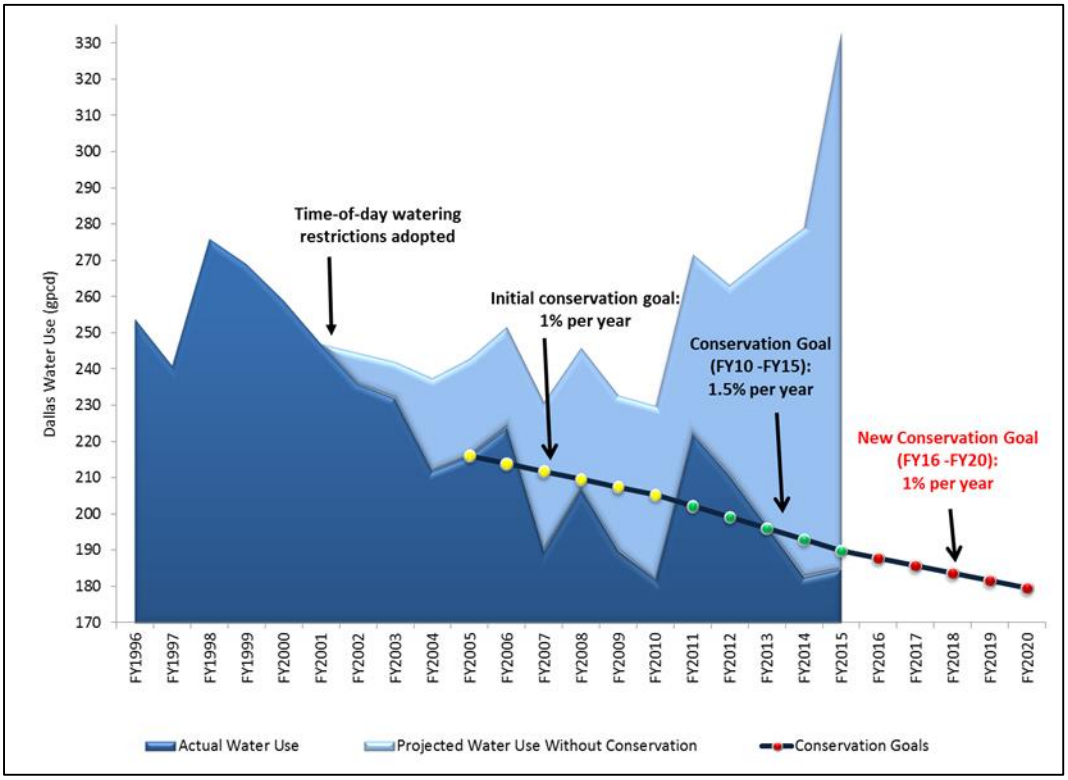
3. Advancing City of Dallas Water Conservation Efforts FY 2016 through FY 2020

Water Conservation Goals

The City of Dallas is committed to continuing its conservation efforts and building on past accomplishments. The goals identified in the 2016 Work Plan are designed to:

- Continue to develop and implement water conservation programs aimed at:
  - Reducing seasonal peak demands
  - Reducing water loss and waste
  - 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
- 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 in facilitating regional conservation efforts among DWU Wholesale Customer Cities and neighboring municipalities
- Target an average 1 percent per year reduction in per capita consumption for the five-year planning period **(Figure 3-1).** This target is exclusive of any credit for indirect reuse diversion volumes
- Establish the foundation for continuation of water savings targets for the following five-year period

Figure 3-1: Per Capita Water Consumption Goal, FY 2016 through FY 2020



3.1 Water System Improvements

Measures in this category are designed to impact the annual average of 22.1 BG in unbilled water use that is comprised of:

- Unbilled Water Loss
- System Maintenance (flushing, meter testing and sewer cleaning)
- Treatment Plant Process Water
- Main Breaks
- Maintenance on storage facilities
- Fires and fire training
- Unbilled municipal uses

Apparent Losses

Apparent losses, sometimes referred to 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 generally without DWU's knowledge. According to the EPA, unauthorized consumption includes water theft, illegal meter by-passes, vandalism, or un-metered hydrant use for construction or recreation. The amount of water involved is very 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. Currently, the DWU Water Delivery Program is developing methods in which to reduce water theft. However, this is a difficult process - 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. Efforts have been made to regularly spot check tanker trucks and these efforts are reducing the amount of theft within the system. The department has made progress by adding an inspector position for portable meter inspection.

Other areas where unauthorized consumption may occur are illegal meter by-passes 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 by-pass 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. DWU is evaluating the feasibility of conducting a study to determine if additional measures are warranted.

Customer Meter Accuracy and Meter Exchange

A major part of DWU's operations involve the repair and replacement of water meters. Review of data and interviews with Meter Operations 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 catalogue of meters both in service and in the warehouse, and conducts ongoing repairs. Currently, all service work, meter replacements, and new installations are conducted by city staff.

Over the past fifteen 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
- Re-alignment of staff in the Large Meter Division to enhance Quality Assurance in Large Meter testing and rebuilding

As water meters age, their internal mechanisms begin to deteriorate which can lead to lower measurements. An aging meter will likely 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, it also allows the city to more fully recover its revenues.

As of September 30, 2015, DWU maintained 329,578 water meters. Of these, 274,421 were residential meters, 53,457 commercial meters, 1,612 municipal meters, and 88 Optional General Services meters. The current average age of small meters within the DWU system is approximately 7.3 years.

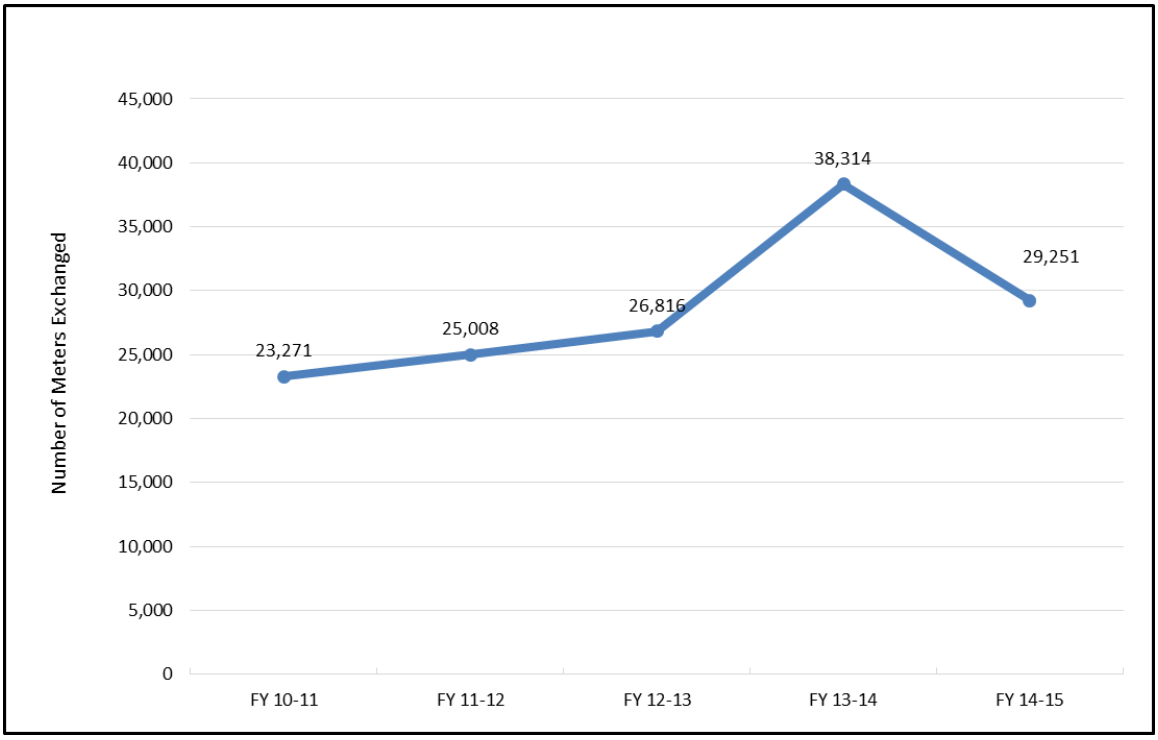
According to a recent engineering study, when a small meter reaches about 15 years old, the ability to accurately report water usage is diminished by approximately 10%[7]. By replacing meters at DWU's current rate, the system is reporting water usage numbers with less than a 4% loss.

As a policy, large meters (three-inch diameter and larger) are tested at least annually, and the highest-use meters are tested as often as every six months. Large meters are generally flow tested in situ (without removing the customer meter) using a Sensus W1250™ portable large meter tester. These portable testers are used to test flows up to five hundred gallons per minute. There are approximately 6,800 large meters, including 3,300 industrial meters and 3,500 detector check meters, which allow priming of fire sprinkler systems while metering any low flows into a customer's fire control system.

DWU maintains a staff of 54 employees and 10 Supervisors in the Small Meters Section that are able to completely maintain all of the small water meters in the DWU system. In the Large Meter Section, DWU maintains a staff of 10 – two employee crews and 2 crew leaders that are able to field repair and test large meters.

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 3-2** reflects the number of meters that have been exchanged over the past 5 years.

Figure 3-2: Meter Exchange Rate within DWU

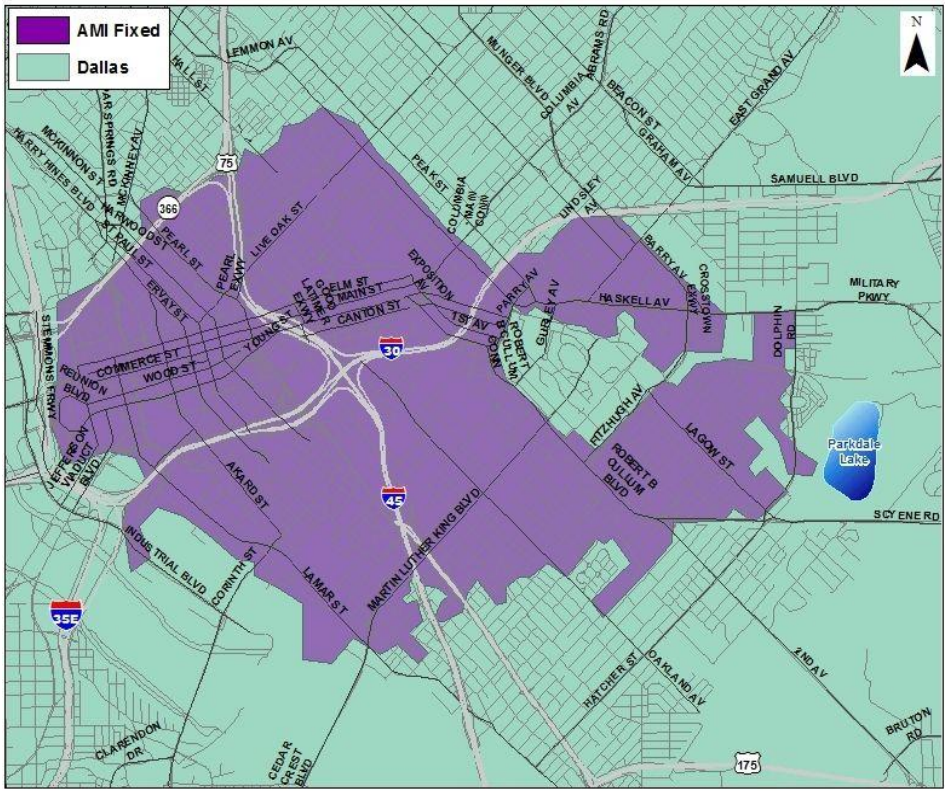


[7] *Final Water Meter Review and Testing Phase Two, for the City of Dubuque, IA*. HDR Engineering, Inc. March, 2009. Exhibit C; Table 5-1, Page 11. 1/30/2015: http://www.cityofdubuque.org/DocumentCenter/Home/View/1945

Meter Reading Using Advanced Technology

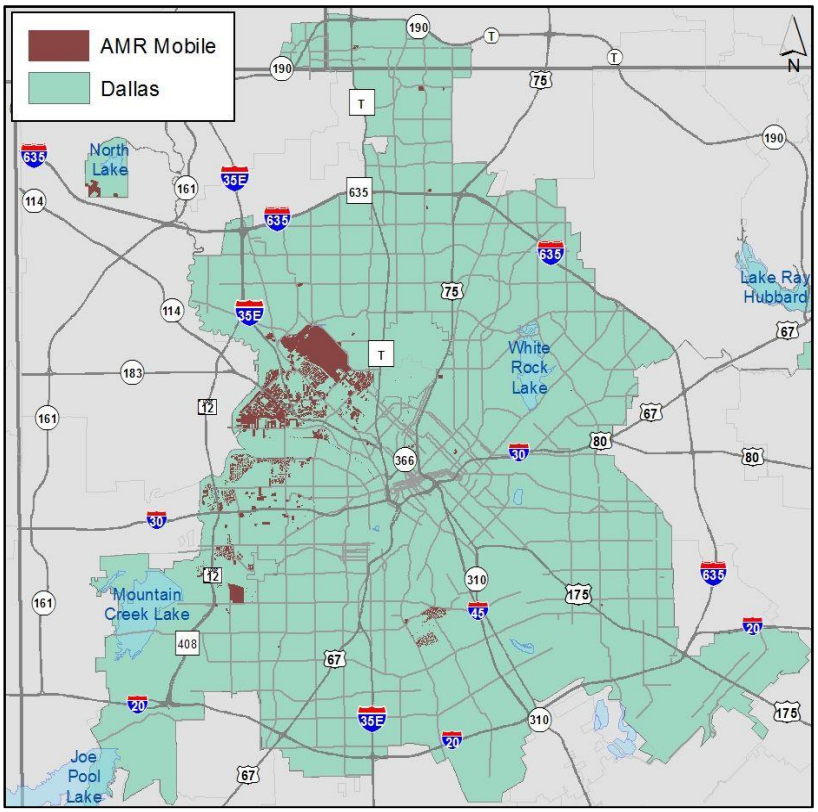
Prior to FY 2009, DWU meters were read manually utilizing a touchpad device. In FY 2009, DWU launched a pilot project to begin the modernization of its meter reading process. The AMI Fixed Network was deployed in the Central Business District, Deep Ellum and Fair Park. Approximately 7,000 meters are currently being read through the AMI Fixed Network as depicted in **Figure 3-3**.

Figure 3-3: City of Dallas AMI Fixed Network System



In FY 2014, the modernization process was enhanced with the deployment of the AMR Mobile Network. AMR Mobile Network units are installed in sections of West Dallas, Cypress Waters and some controlled access properties. Approximately 15,700 meters are currently being read through AMI Mobile technology as depicted in **Figure 3-4**.

Figure 3-4: City of Dallas AMR Mobile Network System



At the beginning of FY 2015, approximately 65,130 meters had been replaced with AMR/AMI ready meters. There are approximately 265,400 traditional meters remaining in the system. At the current rate of exchange (approximately 38,000 meters annually), the entire DWU system could be fully AMR/AMI ready in about 5 years.

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

It is recommended that DWU continue to procure and install the AMI infrastructure. Field deployment should be performed over a five-year period 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).

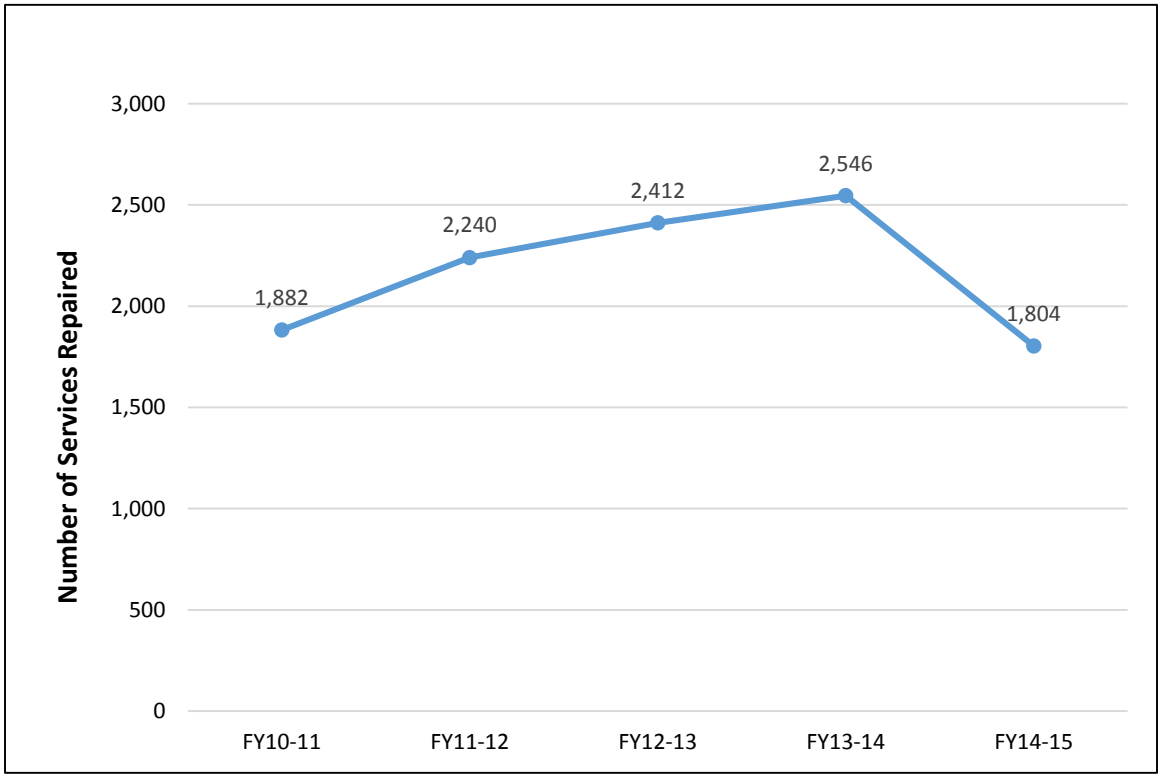
An active AMR/AMI ready meter has the ability to broadcast meter readings (water usage) in time increments as small as every 15 minutes or less. Ultimately, having a system that is AMR/AMI capable will reduce the cost of meter reading and provide timely water usage data to improve:

- Customer service
- Water planning
- System modeling and pressure zone management
- Water Conservation
- Enforcement Efforts

Service Repairs

DWU's Service Repair Initiative works as a companion program to its Customer Meter Accuracy initiatives. Service Repairs are generally small leaks that develop at a water service (meter) and are caused by worn gaskets, washers, or other small mechanical failures. When reported, a repair crew is dispatched to repair these minor leaks. Between FY 2011 and FY 2015, approximately 11,000 leaks were repaired – about 7 leaks a day. Considering that each minor leak may allow as much as 5 gallons of water to escape each day, DWU has saved approximately 49.4 million gallons since FY 2011 alone. **Figure 3-5** reflects the number of service repairs in the last 5 years.

Figure 3-5: Water Service Leak Repairs



Data Handling Errors

Data errors can occur with the 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 re-enter 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 the consumption is valid or if field verification is needed before invoicing the account. Manual reports are maintained to account for the accuracy of the manual meter reads which currently stands at approximately 99.93%.

Real Losses

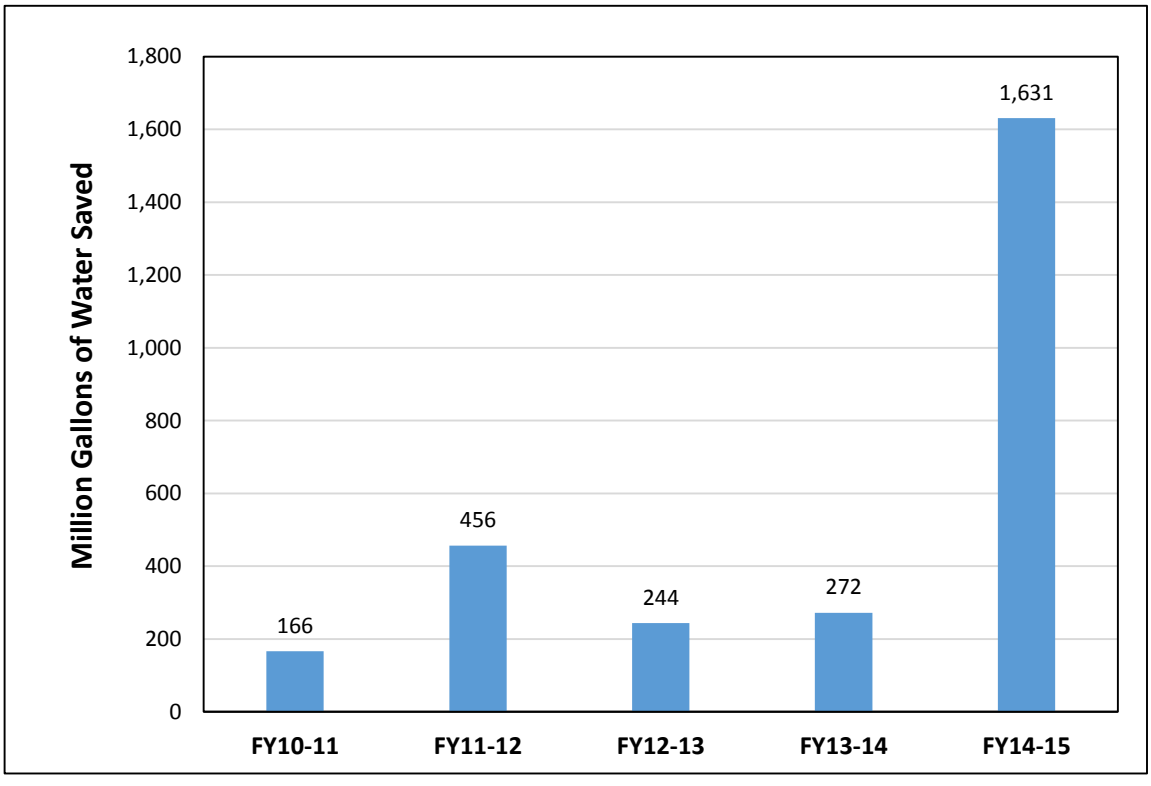
Real Losses consist of leakage from transmission and distribution mains, leakage and overflows from the system's storage tanks, and leakage from service connections up to and including the meter. DWU has implemented several programs and initiatives designed to keep track of and repair various real losses within the distribution system. The following sections describe some of these initiatives and programs in greater detail.

Proactive Leak Detection and Repairs Using Advanced Technology

DWU has been very 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 (approximately 40% of the system per year) using state-of-the-art leak detection technology. Since Fiscal Year 2011, leak detection crews have met or exceeded this goal. During FY 2015, crews surveyed approximately 95% of the entire system.

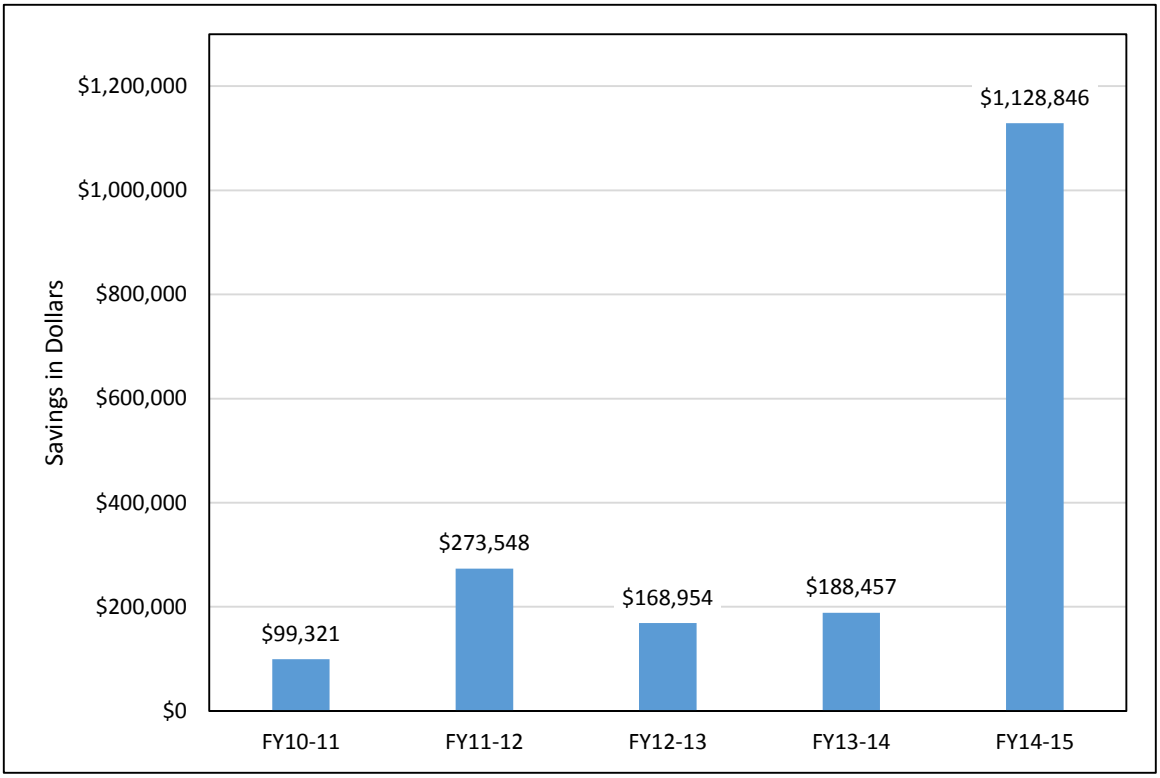
By surveying most of the system each year, significant water savings are being realized. In fact, by having a focused leak detection staff of four 2-person crews, the City located and repaired 2,769 leaks from FY 2011 through FY 2015, which has saved approximately 2.8 billion gallons of water since FY 2011. This represents savings of approximately $1.9 million in water treatment and delivery costs[8] (See **Figures 3-6 and 3-7**).

Figure 3-6: Millions of Gallons of Water Saved Due to the Proactive Leak Detection Program (Advanced Technology)



[8] Based on average treatment and delivery costs of $700 per million gallons.

Figure 3-7: Dollar Savings per Year for Proactive Leak Detection and Repairs Using Advanced Technology



The benefits of proactively detecting leaks include:

- Reducing water lost
- Lowering utility costs
- Minimizing the potential for property damage from pipeline breaks
- Improving public relations as a result of ongoing visibility and promotion of maintenance
- Reducing disruption to customers with fewer unscheduled repairs and service interruptions

Small diameter pipelines (those two to twelve inches in diameter) make up approximately eighty-five percent of the potable water system, while larger than twelve inch diameter pipelines make up the remaining fifteen percent.

Small diameter pipelines are surveyed with noise surveys or acoustic leak detection equipment. Noise surveys utilize a high frequency contact microphone on water services 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 leak listening devices used in conjunction with an AC Digital™ or TriCorr Touch Correlator™ to pinpoint the location of the leak. 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.

Valve and Pressure Reducing Valve Check Crew

From time to time, valves within the system are closed for various 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.

Since the inception of the Proactive Leak Detection Program, nearly 8,000 valves have been checked and more than 99% 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 30 Pressure Reducing Valves (PRVs) and other means to control how the system pressure is distributed.

Adjusting PRVs requires specialized training and expertise. A recommendation is being made to add additional funding for valve and pressure reducing valve checks. This will reduce the burden of checking valves on the Proactive Leak Detection Program allowing them to be more productive as well as provide resources with specialized knowledge of the operation of the distribution system.

Traditional Main Break and Main Leak Repairs

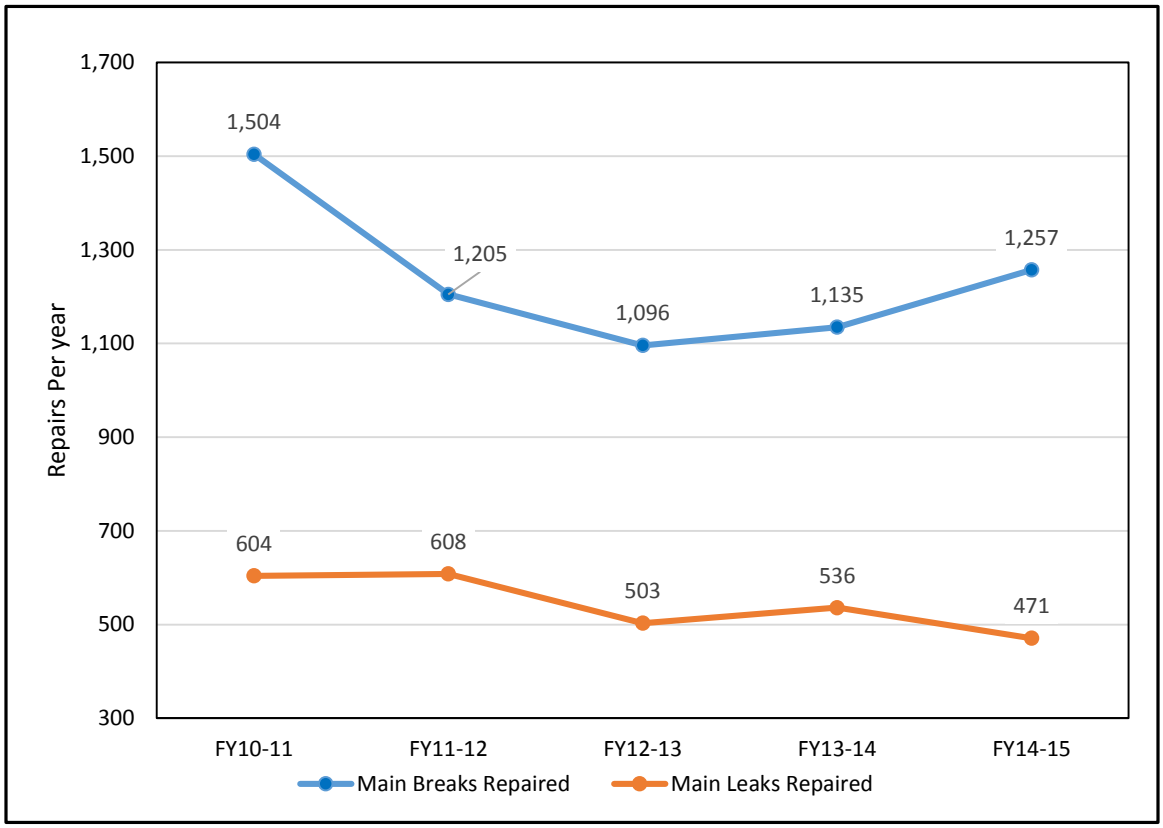
In addition to the Proactive Leak Detection and Repair program, DWU maintains traditional repair crews, charged with repairing two different types of water line leaks: breaks, where there is a circumference crack or a gaping hole in the pipe, and leaks where there is a small amount of water leaking from 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. The crews have significant resources including backhoes, trucks, pneumatic equipment, service centers, etc. The DWU repair crews pride themselves on their ability to quickly repair any type of leak that may occur. The repair crews devote considerable effort in training and honing their skills. For instance, on July 1, 2013, an 84" diameter water line burst near White Rock Lake. DWU crews were able to find the break, shut off the water, excavate the pipe, repair the pipe, and begin disinfection within 44 continuous hours.

Records for main breaks have been kept for a number of years. However, records for main leaks have been kept separately since FY 2011. It is important to note that prior to FY 2011, the number of main breaks being repaired was on a continuous rise. Since then, main breaks have been declining. With all of the proactive leak detection, repairs, and pipeline replacements being performed, it is evident that the system is becoming more efficient.

Figure 3-8 shows that the total number of main repairs conducted each year has remained fairly consistent. Reasons for this consistency might include an aging system and different areas aging at the same rate. In addition, recent drought conditions and the resulting expansive soils may generate increased external loads, which often cause pipes to start leaking. Currently, data collected on the Main Breaks and Main Leaks Programs include the location, type of break, and the date the break or leak was repaired.

Figure 3-8: Number of Main Breaks and Main Leaks Repaired FY 2011 through FY 2015



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 will act to cause individual pipes to require repair or replacement. In some cases, pipelines will catastrophically fail and can result in washed out roads, flooded houses, and videos on the nightly news. In many cases, pipelines will be deemed to have failed because the cost to continually make repairs exceeds the cost to replace them. Other factors may also contribute to the decision to replace a particular pipeline. For instance, a pipeline failure could result in higher repair costs and significant potential customer impacts such as:

- Service interruptions at schools, hospitals, homes, and businesses
- Damaged roads
- Formation of sinkholes
- Dangerous conditions from frozen water on roadways
- 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 of time. The Distribution Division maintains a database of the number of pipeline leaks and breaks that have been repaired, how often a particular 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, together with several other parameters, including, possible property damage (in the case of a catastrophic break), pipe size and other critical issues are rolled together 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.

At the end of FY 2015, DWU was maintaining approximately 4,925 miles of potable water pipeline. Of this, 309 miles of pipeline, or about 6.3% of the system had been identified for replacement based on the criteria described above. **Figure 3-9** illustrates the quantity of pipe replaced each year since FY 2011. Over the last five years, DWU has replaced an average of 55.6 miles per year through the Pipeline Replacement Program. The Program's annual budget ranged from approximately $33 million to $70 million. Since FY 2011, DWU has spent approximately $248 million and repaired approximately 278 miles of pipe. **Figure 3-10** reflects the annual budget of the Pipeline Replacement Program.

Figure 3-9: Quantity of Pipe Replaced Since FY 2011

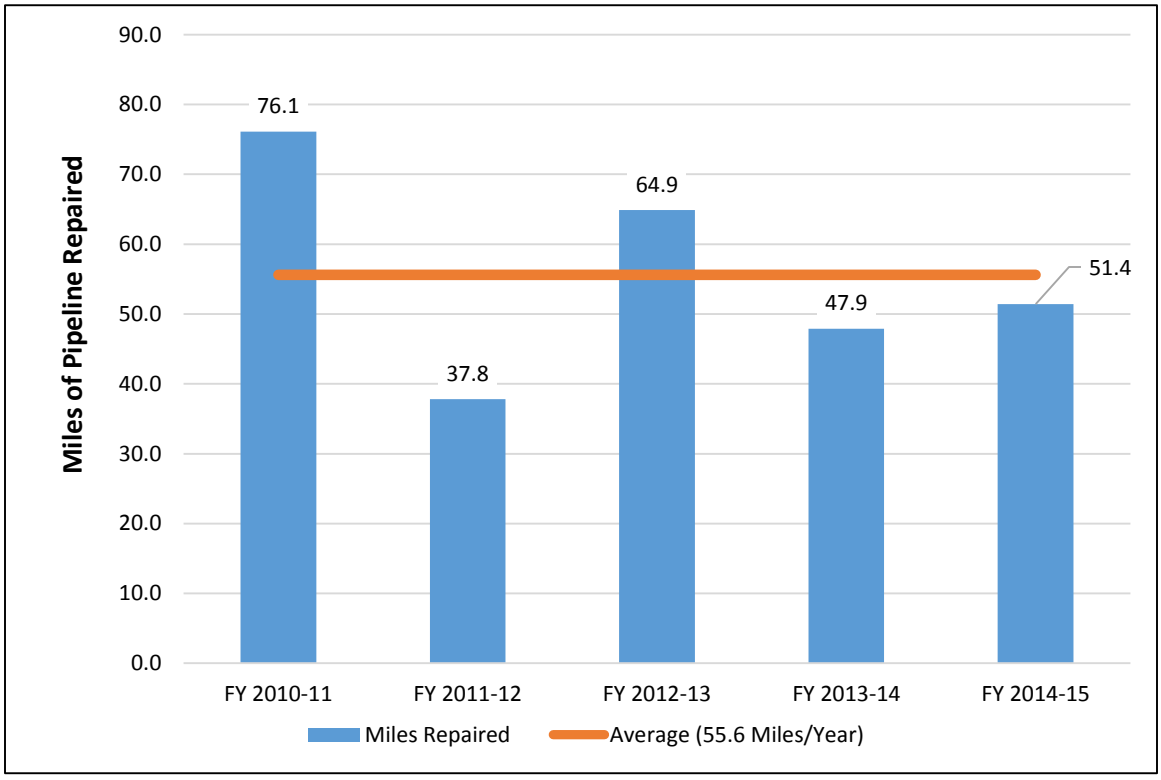
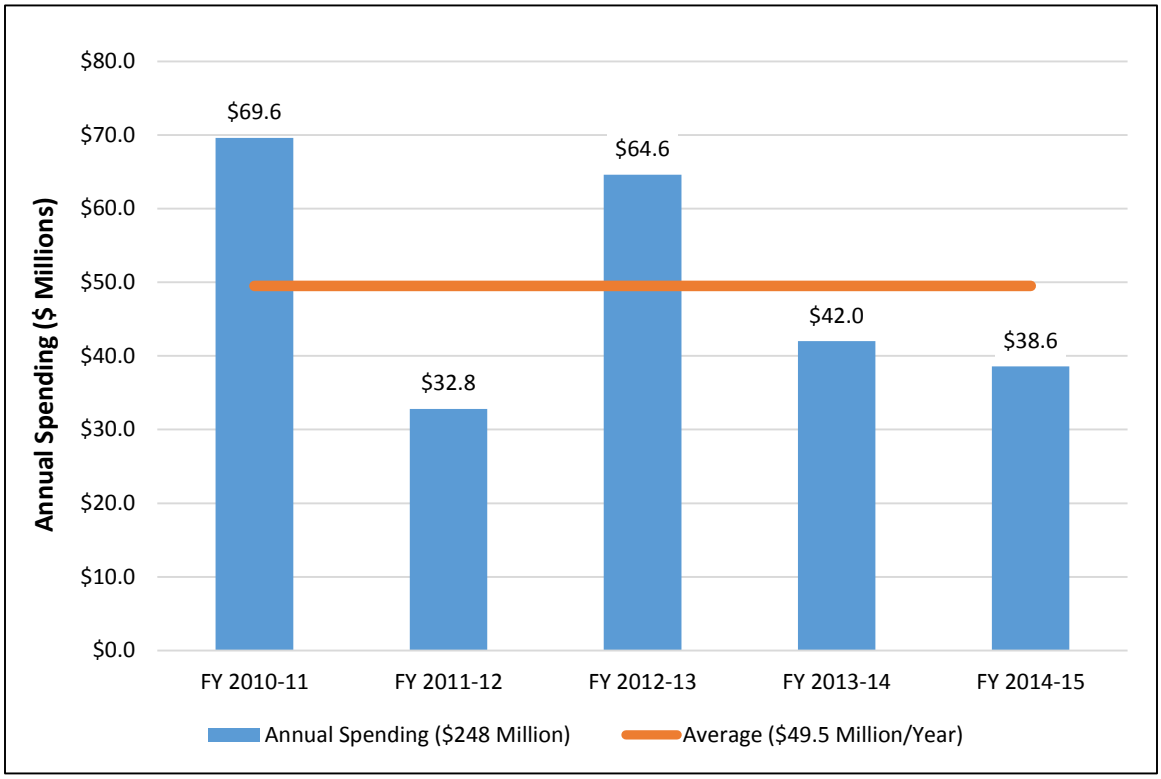
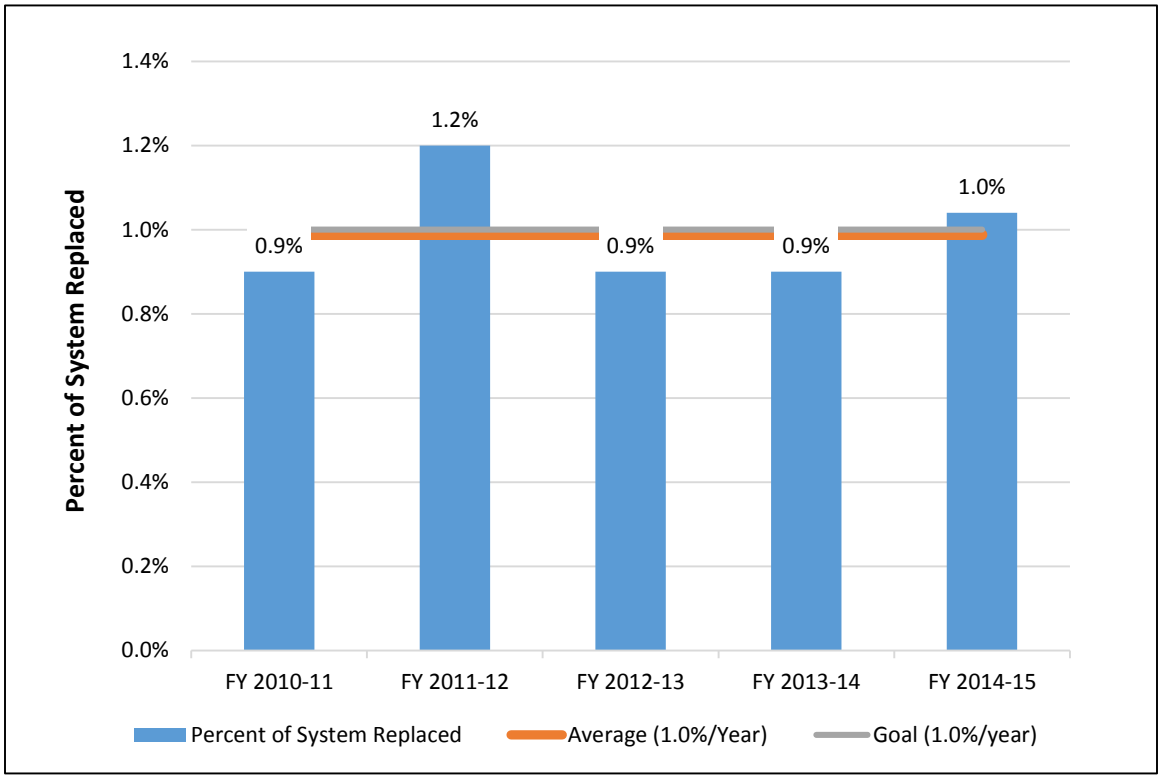


Figure 3-10: Annual Spending for the Pipeline Replacement Program



In 2002, an Efficiency Study was completed on the DWU pipeline system. At that time, the recommendation was made to replace 50% of the water distribution system in the next 30-years to achieve a 70 year replacement cycle (averaging 1.4% per year). Since 2001, DWU has reduced the percent of system older than 50 years from 48% to 42% and main breaks per miles have decreased from 0.6 to 0.3. Since FY 2010-11, as is shown in **Figure 3-11**, the Pipeline Replacement Program has managed an average replacement rate of about 1% of the system per year.

Figure 3-11: Percent of System Replaced



Water Treatment Plant Backwash Optimization

At the three water treatment plants, Bachman, Elm Fork and East Side, the final procedure in the potable water treatment process involves the use of a number of filters to remove small suspended particles (called suspended solids) from the raw water. Following the initial clarification processes (flocculation and sedimentation), the water is introduced to the top of the filter, where it passes through layers of different sized media (anthracite carbon over graded sand and gravel). As the water passes through the media, the suspended solids are retained within the media. The filtered water then passes to a series of collection pipes under the media and is stored within clear wells before being pumped to the distribution system.

As the filters are used, the suspended solids begin to build up, eventually reducing the filter's ability to pass water through it. Hence, a necessary part of the filtration process is the periodic cleaning, or backwashing, of the filters. Backwashing is done by forcing already filtered water backwards through the filters, expanding the media and washing away any suspended solids into specially designed pipes. The pipes empty into a lagoon where the suspended solids are allowed to settle to the bottom. The backwash water is then pumped from the lagoon to the head of the water treatment plant and reintroduced to the system as untreated water. At the Bachman WTP, where this process was analyzed, the backwash process is often done every other day and can last as long as nine minutes per filter. During a nine minute backwash process, as much as 110,000 gallons of water may be forced through a given filter.

After the backwashing process, the filtering media remains unsettled and is not capable of adequately filtering the suspended solids. To resolve this, a process called "filter ripening" allows new unfiltered water to flow through the filter to consolidate the media and allow the filter to perform as needed. The water consumed during the ripening process is also carried to a lagoon where the suspended solids are allowed to settle to the bottom. This water is also recycled to the head of the water treatment plant. This part of the process, called "Filter to Waste", may last 30 minutes or more and may utilize as much as 41,640 gallons of water per backwash per filter. With 32 filters at the Bachman Water Treatment plant to backwash and even more at Elm Fork and East Side, the amount of water used in these processes can be substantial.

Backwash Optimization Process

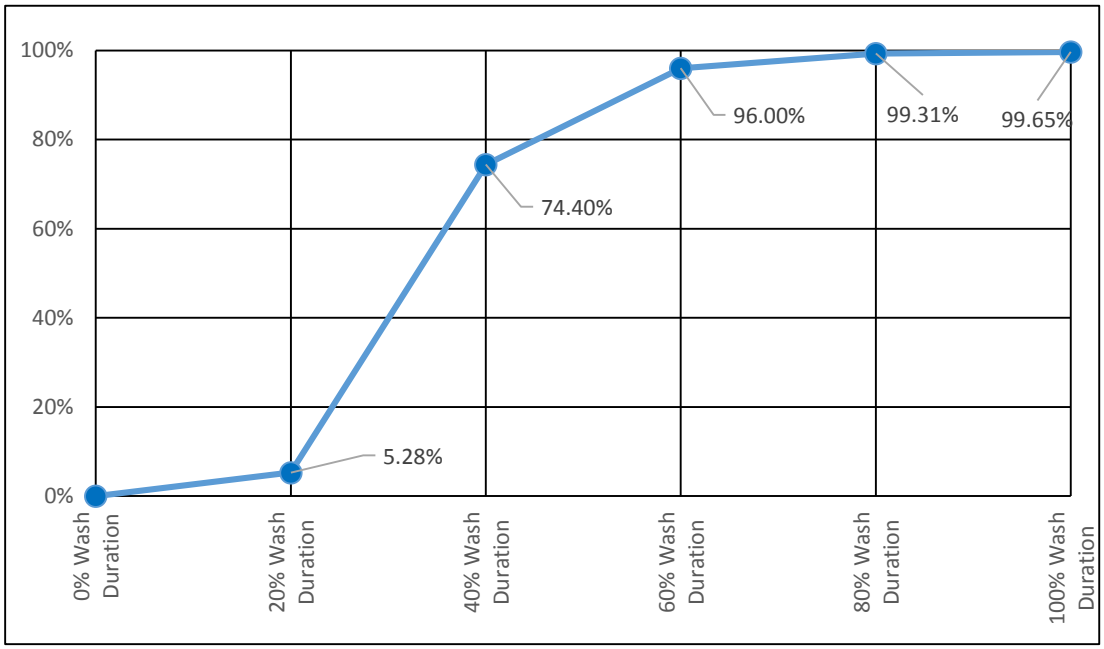
Over the last few years, various procedures in the treatment process have been analyzed with the goal of optimizing plant operations in general. More specifically, in 2011, methods were explored to reduce the amount of water used during the filtration process. At that time, the following was discovered:

- There were no strict standards or procedures concerning how the filters were backwashed
- Personnel involved in backwashing filters had different criteria to determine what defined "clean" water for this process and there was no established optimal duration of the backwash cycle
- There were no departmental or prescribed methods, goals, guidelines, or suggestions on how to improve the filtration process

To quantify the amount of water used in both the backwash and the ripening processes, a test filter was selected at Bachman WTP and a turbidity meter was installed. This meter measures the turbidity of the process water.

Figure 3-12 depicts the turbidity level over a fifteen minute wash cycle and shows that 96% of the turbidity was removed during the first 60% of the cycle. This results in a reduction of backwash duration and a water savings of approximately 50,000 gallons per filter per backwash.

Figure 3-12: Turbidity Removed as a Percent of Backwash Duration



Through this test, DWU staff were able to determine how much turbidity could be left in the filter without impacting the effectiveness of the next run cycle. It was found that the characteristics of the filter run at 60% duration were minimally affected by the changes in the wash water used.

An additional benefit was noted after a reduced wash cycle: The "Ripening Period" greatly decreased, which allowed the filter to come back into service much faster.

Prior to the initiation of new backwash procedures at the Bachman WTP, the following was noted:

- 504.9 million gallons of wash water was used per year
- On average 13 filters are washed per day
- An average wash used about 109,781 gallons

After the implementation of the new backwash procedures at Bachman, the expected water savings are as follows:

Table 3-1: Water Saving Per Year – New Backwash Procedures

Item	Comments (Savings)
Average Filters washed per day:	13 Filters
Average amount of water per wash:	75,000 gallons
Average amount of water used for backwash per day:	975,000 gallons
Average amount of water used for backwash per year:	355,875,000 gallons
Total amount of water saved per year: (Former amount – new amount)	149,025,000 gallons (504,900,000 gallons – 355,875,000 gallons)

Filter Ripening Optimization

By using a more optimized backwash process, it takes much less time for the media to settle and thus requires less water to ripen the filters. The "Filter to Waste" time has been reduced at the Bachman WTP from about 30 minutes to about 5 minutes and has saved an approximate total of 99 MG/Y.

Additional Water Savings

Since initiation of new backwash procedures, the filtering media can settle saving approximately 17,000 gallons of water per wash and resulting in a savings of approximately 80.7 MG/Y.

The resulting annual water savings at the Bachman WTP are shown below:

Table 3-2: Water Savings Per Year – Modified Filter-to-Waste Time

Original water used for filter ripening per year:	131,721,000 gallons
Amount of water used per filter ripening using new procedures: (5 minutes x 1,388 gallons per minute)	6,940 gallons
Amount of water used per year for filter ripening using new procedures: (13 filters per day x 6,940 gallons per filter x 365 days per year)	32,930,300 gallons
Savings of new filter ripening procedures: (131,721,000 gallons – 32,930,300 gallons)	98,790,700 gallons

Projected Water Savings for all Water Treatment Plants

- Reducing the backwash water for all 32 filters in the Bachman WTP from approximately 504.9 million gallons per year to approximately 355.9 million gallons per year results in a water savings of approximately 149 million gallons per year
- Reducing the immediate drain water from approximately 17,000 gallons per backwash to zero will save approximately 80.7 million gallons of water per year
- Reducing the filter-to-waste time from approximately 30 minutes to about 5 minutes will save approximately 98.8 million gallons of water per year

Therefore, the Filter Optimization process at the Bachman WTP will save approximately 328.5 MG/Y. Assuming a base price of $0.73[9] per 1000 gallons, the annual savings for Filter Optimization at Bachman WTP will save approximately $240,000 per year.

In 2012 the Bachman WTP processed approximately 93.3 MGD, which is a little more than 34 BG of potable water per year. The filter optimization process is projected to save approximately 1.0% of the processed water.

Applying these ratios to the Elm Fork and East Side Water Treatment Plants, the Filter Optimization Program, once implemented, is projected to result in a total savings at all three plants of as much as 1.56 BG/Y and $1,140,000.

DWU Water Reuse Studies and Reports

The following studies and reports were reviewed to summarize historic and on-going water reuse strategies:

- 2000 Update to the City of Dallas Long Range Water Supply Plan, CP&Y, Inc., 2000
- Dallas Water Utilities Recycled Water Implementation Plan, Volume I, Alan Plummer Associates, Inc. (APAI) and CP&Y, August 30, 2005
- Dallas Water Utilities Recycled Water Implementation Plan, Volume II: Water Supply Augmentation with Recycled Water - DRAFT, APAI and CP&Y, August 2005
- 2005 Update to the City of Dallas Long Range Water Supply Plan, CP&Y and Mehta West Brashear (MWB) Group, December 31, 2005
- City of Dallas Water Conservation Five-Year Strategic Plan, APAI, June 2010
- Dallas Water Utilities Wastewater Treatment Facilities Strategic Plan, Carollo, December 1, 2010
- Appraisal Report, Dallas Trinity River Recycled Water Project – Final Draft, United States Department of Interior-Bureau of Reclamation (USDI-BOR), March 2010
- Feasibility Plan of Study, Dallas Trinity River Recycled Water Project, USDI-BOR, May 2011
- Dallas Water Utilities Southwest Dallas Reuse Plan, DWU, March 2012
- Region C Water Conservation and Reuse Study, Freese and Nichols Inc. (FNI), APAI and CP&Y, April 2009
- 2011 Region C Water Plan, FNI, APAI, CP&Y and Cooksey Communications, October 2010
- Water for Texas 2012 State Water Plan, TWDB, January 2012
- Lake Tawakoni Recycled Water Study, Alan Plummer Associates, Inc. (APAI), February 2008.

[9] Dallas Water Utilities Water Treatment & Delivery Fiscal Year 2014-15 Operating Budget.

Summary of DWU Water Reuse Alternatives

Tables 3-3 and 3-4 summarize historic and ongoing direct non-potable and indirect potable water reuse strategies respectively.

Table 3-3: DWU Direct Non-Potable Reuse Water System Alternatives

Direct Reuse Alternative	Average Supply (mgd)	System Capacity (mgd)	Recommended Completion Date	Capital Construction Cost ($Million)	Unit Costs per 1,000 gal (50-year)
Existing and Proposed Projects Under Construction					
Cedar Crest Golf Course	0.50	3.50	Existing	N/A	N/A
Cedar Crest Pipeline Extension	2.25	3.50	Completed Fall 2014	$10.66	$0.93
White Rock Pipeline	16.50	30	2013	$55.20	$0.72
Trinity Corridor	10.72	(1)	(1)	(1)	(1)
Alternatives Evaluated and Not Recommended					
Far South Dallas / Red Bird Corridor WF(2)	0.62(3)	NI(4)	N/A	$6.53	NI
Love Field Corridor (Convert Storm water overflow WWTP(5) to WF)	0.43(3)	NI	N/A	$10.98	NI
Love Field Service Area WF	2.25	4.50	N/A	$22.14	$1.82
White Rock Lake / North Dallas WF	(6)	(6)	N/A	(6)	(6)
Lower White Rock Lake Service Area WF	2.50	5.00	N/A	$23.30	$1.75
Upper White Rock Lake Service Area WF	7.50	15.0	N/A	$40.20	$1.09
Southwest Dallas Service Area WF & Phases I-III	1.00	5.00	N/A	$16.51	$3.02
Southwest Dallas Option 1	0.39	2.00	N/A	$16.96	$7.94
Southwest Dallas Option 2	0.39	2.00	N/A	$11.84	$5.64
Southwest Dallas Option 2a	0.95	2.00	N/A	$17.00	$3.27
Southwest Dallas Option 3	0.39	2.00	N/A	$16.15	$8.06
Southwest Dallas Option 4	0.39	2.00	N/A	$13.48	$6.86
Southwest Dallas Option 5	0.69	2.00	N/A	$15.41	$4.58

(1) Feasibility-level investigation is recommended for this project to determine system capacity, recommended infrastructure and estimated costs.
(2) WF is water factory.
(3) Values provided are average daily demand from 2000 LRWSP.
(4) NI is not included.
(5) WWTP is wastewater treatment plant.
(6) Consideration of this project was recommended in the 2000 LRWSP. However, demands were not estimated and therefore no details regarding this system were provided.

For indirect potable reuse, additional treatment processes will be necessary at the Central and Southside WWTPs. These planned wastewater treatment improvements and associated capital costs are necessary for future regulatory effluent requirements. Additional or different treatment may be necessary depending on actual requirements.

Table 3-4: DWU Indirect Potable Reuse Water System Alternatives

Indirect Reuse Alternative	Receiving Water	Reuse Water Source	Projected Average Supply (mgd)	Recommended Completion Date	Capital Construction Cost ($Million)
Existing and Proposed Projects					
Return Flows[1]	[1]	[1]	37.5[2]	Existing	N/A
Agreement with NTMWD	Lake Ray Hubbard	NTMWD-operated WWTPs	28.2[2]	2013	$31.3[8]
Ray Hubbard 1 (RH1)	Lake Ray Hubbard	Southside WWTP	60	[3]	$166.4
Alternatives & No Currently Recommended					
Lewisville Lake 1 (LL1)	Lewisville Lake	Central WWTP	60	[3]	$159.7
Ray Hubbard - Lewisville Lake RHLL1[4][5]	Lake Ray Hubbard & Lake Lewisville	Central & Southside WWTPs	120[6]	[3]	$361.9
Lewisville Lake LL2[4]	Lewisville Lake	Central WWTP	60	N/A	$186.3
City of Lewisville (CL1)	Lewisville Lake	City of Lewisville WWTP	18	N/A	$30.1
Lewisville Lake – Ray Roberts 1 (LLRR1)	Lewisville Lake & Ray Roberts	Central & Southside WWTPs	120[6]	N/A	$395.2
Lewisville Lake – Ray Roberts 2 (LLRR2[4])	Lewisville Lake & Ray Roberts	Central & Southside WWTPs	120[6]	N/A	$447.0
Ray Hubbard (RH2)	Lake Ray Hubbard	Southside WWTP	60	N/A	$138.9
Lake Tawakoni (LT1)	Lake Tawakoni	Southside WWTP or Trinity River	120	N/A	$272.0
Ray Hubbard – Lake Tawakoni (RHT1)	Lake Ray Hubbard & Lake Tawakoni	Southside WWTP or Diversion Point on Trinity River	120[6]	N/A	$317.9

(1) Includes return flows to various DWU water sources from Flower Mound, Lewisville, Denton, NTMWD and UTRWD.
(2) Projected average supplies are for Year 2020. Flows are projected to increase though the Year 2060.
(3) Augmentation of Lake Ray Hubbard and Lewisville Lake has been put on hold.
(4) Conveyance facilities and costs include 20 mgd of capacity to serve potential direct use customers in the White Rock Corridor.
(5) This alternative would be constructed in lieu of RH1 and LL1. Further analysis was recommended to determine the best alternative.
(6) Flow is split equally between the two lakes.
(7) Cost interpolated from a known cost of $100M for 90mgd.

3.2 Ordinance Changes

Measures in this category are designed to strengthen the city's prohibition of wasteful water use practices and to sustain the advances made in water conservation.

Landscape Ordinance Amendment

On June 9, 2010, The City of Dallas adopted the *2010 Water Conservation Five-Year Strategic Plan Update (Strategic Plan Update).* "Appendix G: Recommendation to Amend the Dallas Landscape Ordinance (2010 Appendix G)" included a review of various city ordinances and statewide legislation resulting in the development of recommended ordinance amendments and updates. Since the adoption of the Strategic Plan in 2010, certain water conservation requirements have been updated at the state as well as the municipal level, particularly with regard to automatic irrigation systems. In addition, the City's construction code has also been updated. This section will identify the recommendations that have since been adopted, those recommendations that are still in the process for possible adoption, and the recommendations that were reviewed but deemed unpractical at this point in time.

Adoption of 2010 Recommendations

Dallas City Code

Some of the recommendations included in the Strategic Plan were already part of Dallas City Code and/or State law or have since been adopted. The following are examples of these:

- Allow hand watering at any time
- Require working rain and freeze sensors on automatic irrigation systems
- Repair irrigation system leaks and replace broken sprinkler heads
- Require drip irrigation in bedding areas & narrow strips

Of greatest consequence in terms of impact was the adoption on April 23, 2012 of a conservation ordinance requirement for maximum twice weekly landscape watering. DWU customers are assigned watering days based on the last digit of their service address.

Variances to the maximum twice weekly requirement were included in the provisions to allow for extenuating circumstances.

An additional recommendation in the Strategic Plan Update suggested that existing code requirements be crossed referenced in the Landscape Ordinance.

State Legislative Water Conservation Initiatives

During the 83rd Legislative Session, a number of Bills related to water were passed. Although many of these were not identified in the Strategic Plan Update, these demonstrate the ongoing approach to codifying water conservation efforts at the state level. Among the legislative bills adopted were:

- **HB 4** creates a $2 Billion state water implementation fund (SWIFT) that would collect revenue to help provide financial assistance for water-related government projects
- **SB 198** makes it illegal for a homeowners association to prohibit drought-resistant, water-wise landscaping

- **SB 654** allows municipalities to enforce water ordinances through a civil action, rather than bringing criminal suits

- **HB 857, HB 1461 and HB 3605** require utilities to conduct annual audits of water lines to check for water loss, to inform customers of audit results, and to use a portion of state assistance funds in order to repair leaks discovered by such audits

- **SB 700** requires the State Energy Conservation Office to develop a template for state agencies to use in creating comprehensive energy and water management plans, requires that agencies set percentage goals for reducing its water, electric and gas usage, and requires that state agencies update these plans annually

- **HB 2781** requires new state buildings with a roof measuring at least 10,000 square feet to employ rainwater harvesting

Water bills related to conservation that passed in the 84th (2015) Legislative session included:

- **HB 30** provides that each regional planning group indicate their regional water plan opportunities for desalination facilities for brackish groundwater or seawater.

- **HB 1902** expands usable wastewater to include other sources deemed appropriate by TCEQ.

- **SB 551** requires the State Water Conservation Advisory Council to submit recommendations for advancing water conservation in the state.

- **SB 991** requires General Land Office and TWDB to conduct a study about using renewable energy for water desalination.

Water priorities for the 2015 Legislative session included: continued state investment in meeting water needs, funding seawater desalination projects, reviewing water use and ways to reduce freshwater use in oil and gas and other industrial uses, and providing incentives for new technology, conservation and recycling.

Recommended Items Currently Under Review for Implementation

Zoning and Ordinance Committee Review

In February of 2015, the City of Dallas Zoning Ordinance Committee (ZOC) began a broad review of the Landscape Ordinance for the purpose of considering appropriate updates. This review has been in the planning stages for a number of years.

In addition to the recommendations proposed in the 2010 Water Conservation Strategic Plan Update, the impetus to amend the ordinance has been driven by a number of converging interests including but not limited to:

- Dallas Green Building Ordinance

- Recent irrigation ordinance updates at the state and local levels

- iSWM Criteria Manual for Construction

- forwardDallas! Comprehensive Plan

- Urban Forest Advisory Council
- New urban forest research and technology
- New industry standards and best management practices, and
- General public interest including the development and conservation communities

The general consensus has been that the current ordinance as it stands now is outdated. As stated in the "2010 Appendix G":

Dallas's current Landscape Ordinance provides a set of standards and requirements that are designed primarily for the purposes of urban beautification, protection of property values, and preservation of large trees. When the ordinance was adopted 16 years ago, it likely served those objectives. Today, however, Dallas's Landscape Ordinance is outdated and limited in terms of what is commonly included in a water conservation-oriented landscape ordinance: requirements for landscape design, installation and maintenance that promote water efficiency, including but not limited to specifications for soil, turf, plants, trees, and irrigation technology, maintenance and operation

- The ZOC established a process to consider a chart of issues for the two major categories- landscape and trees. Some of the items that were identified in the Strategic Plan Update will be included in the "chart of issues." These include:
    - Updating the "Purpose" section to include water conservation and efficient irrigation and landscape design
    - Cross-referencing other sections of the City Code related to water conservation, specifically irrigation system rules
    - Expanding the list of acceptable plant materials
    - Limiting the areas for high-volume plant material
    - Expanding the soil planting area requirement to include minimum depth of topsoil, mulching requirement and possibly annual mulching
    - Expanding the "Landscape Plan" sections to include water conservation landscape design and related irrigation components
    - Allowing for water efficiency training needs of city landscape plan reviewers and inspectors
    - Expanding the "Landscape Checklist" to include non-plant materials and related irrigation components
    - Reviewing and allowing for effective enforcement

NOTE: The ZOC will review the enforcement and fines component for any new and expanded portion of the Landscape Ordinance. A review of enforcement options for overall water conservation ordinance requirements is addressed in Section 3.3 of this work plan

Regional Consideration

Increasingly, DWU and other major providers have recognized the need to create a more unified approach at the regional level. This approach is currently being demonstrated in areas such as media outreach partnerships and in formal organizations such as the Water Efficiency Network of North Texas (WENNT).

Looking Ahead

Dallas has made significant strides in curbing landscape water waste. However, opportunities for further water waste reductions are apparent. One of the acknowledged effective strategies to deal with water waste has been through incorporation of ordinance requirements. The ongoing efforts of the ZOC are too early in their development to determine the eventual results.

One of the approaches under consideration is that some of the specific items recommended in the 2010 Strategic Plan Update may not actually be codified in the ordinance. In actuality, the items may be listed in a standards reference manual as "best practices" and referenced as such in the ordinance. DWU will continue to monitor and recommend amendments that will help reach our water conservation goals. Additional and ongoing efforts will be considered when the City of Dallas Green Building Task Force reconvenes.

Retail Cost of Service and Rate Study

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.

Evaluating Additional Customer Classes for Commercial Customers

DWU is in the process of finalizing a Request for Qualifications (RFQ) to update its retail cost of service and rate model. The scope of the project will include an evaluation of current cost allocations between customer classes as well as an examination of additional tiers for all customer classes. The assessment is projected to be completed by Fall 2016 and subsequently presented for City Council consideration.

3.3 Continued Customer Engagement

Measures in this category are designed to expand the city's outreach efforts through advanced technologies, financial incentives and technical support.

Wholesale Customers Monitoring, Measurement & Reporting

Impact of Wholesale Water Customers on Water Demand

Wholesale water customers account for a significant portion of DWU's water demand. These customers currently use approximately 40 percent of all water (treated and untreated) and 32 percent of treated water supplied by DWU.

Water use by DWU's current wholesale water customers could increase to approximately 54 percent of all water and 49 percent of treated water by the year 2070. Therefore, water demand reductions by DWU's wholesale customers are considered essential in helping to achieve its long range water supply objectives.

Background

DWU has several customer types. Within the city limits of Dallas, retail customers include residential, municipal, industrial, commercial and institutional accounts. As a regional wholesale provider, DWU has treated water, untreated water, wastewater, and irrigation wholesale customers. Wholesale customers comprise about 38% of DWU's total treated water demand.

The majority of DWU's wholesale treated water contracts are other local municipalities. Dallas' water rights were granted by the State of Texas with the understanding that Dallas would provide water to smaller surrounding cities.

As the North Texas region has grown, expansion of Dallas' water rights has occurred with the understanding that this arrangement would continue. City of Dallas retail and wholesale rates are based on the capital and operating costs needed to purchase, treat and deliver water. Both wholesale and retail rates are determined by Cost of Service studies performed annually by DWU. Wholesale Customer Cities (WSCC) are briefed on rates every year and Cost of Service studies are available for review. Dallas' wholesale rates are lower than retail rates because all costs associated with storage, distribution and billing are the responsibility of the wholesale customer. 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. WSCC 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.

The State requires that all public water providers with more than 3,300 connections submit a Water Conservation Plan, Utility Profile, Water Conservation Implementation Report and Drought Contingency Plan to the Texas Commission on Environmental Quality (TCEQ). The Texas Water Development Board (TWDB) requires submittal of the same Water Conservation Plan and Water Conservation Implementation Report, as well as a Water Loss Audit Report. These State plans and reports are due every five years, according to a specific schedule.

WSCC contracts require that they provide copies of these State reports to DWU. However, there has not been a process in place by the State or within DWU to evaluate the effectiveness of their water conservation or drought plans. WSCC outreach has been primarily centered on water service and contractual issues. Because water conservation is such a vital part of long range water supply planning, DWU intends to develop a Wholesale Customer Outreach Program to evaluate WSCC plans and assist WSCC in their water conservation efforts.

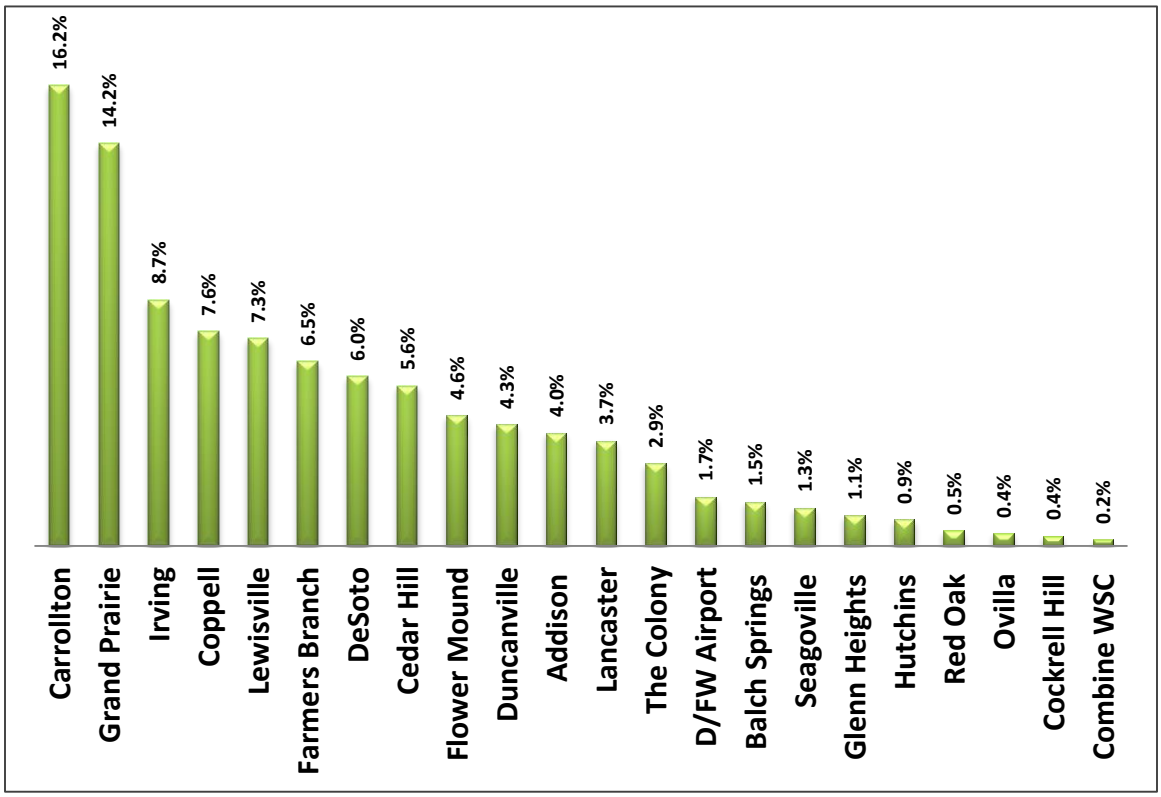
Purpose/Goal

The primary purpose of a *Wholesale Customer Outreach Program* is to ensure WSCC consumption is declining in partnership and on par with DWU. Reduced consumption is vital to the reliability of DWU's long term planning, which also has a direct impact on WSCC. An outreach program would establish additional communication and strengthen the working relationship between DWU and the wholesale customer. Effective water efficiency strategies and reduced consumption by all water providers is vital to ensure water is available for the future.

Process

Because treated water contracts result in the most significant wholesale consumption and have more similarities as a group, they will be the initial outreach program focus. Untreated and smaller treated WSCC may prefer different kinds of assistance, so they will both be deferred as a group until the completion of programs for larger treated water customers. All customer groups will be prioritized by consumption volume. The top five largest treated wholesale customers will receive outreach efforts first, followed by the next five highest volume users and so on **(Figure 3-13)**.

Figure 3-13: Wholesale Customer Cities (Treated Water) FY 2012 – FY 2015



Initially, the proposed program will consolidate existing records on WSCC water use and reports. A system will be developed to monitor and provide an overview of all the WSCC plans submitted to DWU. Dallas currently has 23 treated water wholesale customers (Ellis County WCID #1 is not taking water), 19 are required to submit State reports.

DWU will also consolidate and track additional metrics in order to better document the historical consumption by wholesale customers. These metrics will include:

- Population and residential GPCD
- Overall consumption
- Peak consumption
- Water Loss
- Five and 10 year per capita trends

Once these detailed consumption trends have been determined, DWU will review WSCC State Water Conservation Plans. Although determining the efficacy of specific programs and measures may be extremely difficult to establish, cumulative combined programs should indicate a downward trend in consumption. A review of the Water Conservation Plans and the Implementation Reports will include:

- Water Conservation Plans
  - Reduction goals for consumption and water loss
  - Rate structure
  - Landscape ordinances or requirements and enforcement
  - Conservation programs in place
  - Conservation programs proposed
- Water Conservation Five-year Implementation Report or Water Conservation Plan Annual Report
  - Trends
  - Consistency in reporting

DWU will continue to pursue opportunities to hold its Wholesale Customers accountable for implementing water conservation measures that comply with their contractual obligations and state of Texas mandates.

Drought Contingency Plans will not be able to be evaluated for efficacy, since the impact of drought response measures on consumption can only be measured during drought conditions. North Texas area water providers, including DWU, have encouraged wholesale customers to adopt a simple and consistent regional drought plan in order to minimize customer confusion and simplify enforcement efforts. WSCC are not required to adopt the regional plan, but that will be one element to be evaluated. Additional elements include:

- Whether the WSCC drought plan triggers when DWU enters their drought plan
- Number of Drought Stages
- Reduction Goals
- Response Actions

After State submitted plans have been evaluated, DWU will meet with individual WSCC who have succeeded in meeting reduction goals. Discussion topics will include:

- Successful WSCC conservation strategies and programs
- WSCC challenges for implementing strategies and programs
- How DWU has or could help WSCC efforts
- Whether they would be willing to be an information resource for other WSCC
- How they would like to be recognized for their efforts
- DWU will also meet with those WSCC who appear to be having difficulties in meeting their reduction goals to discuss:
- WSCC challenges
- How DWU could help WSCC conservation efforts
- Resources for those WSCC struggling to attain conservation goals
  - Possible quarterly or semi-annual workshops with successful DWU WSCC of a similar size
  - Encourage emulation or participation in DWU activities as appropriate

Recognize efforts

As part of the Wholesale Outreach Program, DWU will recognize WSCC who have achieved their water efficiency and reduced consumption goals. While meeting with WSCC during outreach efforts, DWU will discuss what sort of recognition, if any, is desired.

The purpose for 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.

Some recognition methods to be considered include:

- 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
- Luncheon with the Director of DWU
- Memorandum to TCEQ

Increased Multi-Family Outreach Efforts

It is recommended that DWU provide education and technical assistance to its multi-family customers through the city's Code Compliance Multi-Tenant Community Integrity Division. Information on water conservation best management practices and water efficiency management should be disseminated to multi-tenant property managers.

DWU staff should also work with the Apartment Association of Greater Dallas to explore opportunities to increase awareness of the city's incentive programs.

Revised ICI Financial Incentive Program

The following section describes the city's current ICI Financial Incentive Program. In short, the program is open to all DWU ICI customers and provides financial incentives (rebates) for new equipment/processes that conserve water at existing facilities. Under the current program, the financial incentive available for each project is the lessor of: (1) half the cost of the purchase price of the equipment up to $100,000, or (2) $1.00 for each gallon per day of water saved up to 100,000 gallons for a maximum rebate of up to $100,000.

The rebate program does not cover the cost of labor. DWU also provides free irrigation system audits to ICI customers and educational support to hospitality industry customers (restaurants, hotels).

Customer participation in the existing ICI Rebate Program has not met DWU expectations. Based on customer feedback, modifications are needed to improve program flexibility and customer accessibility ultimately resulting in increased participation and a reduction in ICI water consumption.

Two program options are recommended- 1) a cost sharing option similar to the residential toilet rebate program and 2) free water saving fixtures distribution option that includes a commercial distribution program component. These options incorporate various measures to garner improved customer accessibility for targeted user groups, program flexibility, and offer more

attractive financial incentives. Water savings will be calculated for each project to ensure a cost benefit exists.

Option 1: ICI Cost Sharing Rebates

Rebates for Manufacturing, Reclamation and Reuse Projects

This program will offer rebates for up to 50% of any indoor or process related water conservation project. Rebates will be issued for manufacturing and process improvements and advanced water reclamation and reuse projects. The maximum rebate amount will be $100,000.

Rebates for Irrigation System Improvements

This program will provide rebates for up to 50% of any irrigation system related improvements. The maximum rebate amount will be $100,000.

Rebates for Commercial Domestic Plumbing Fixtures

This program will offer rebates on domestic plumbing fixtures for qualifying customers. Rebate amounts will be similar to the residential toilet rebate program. Often, properties such as hotels and multifamily residential establishments, have very specific brand and model requirements for domestic fixtures. Hospitals often have very specialized fixtures that may not make sense to offer through a distribution program, and condominiums offer a unique challenge. For example, although they are considered a single commercial customer, they are made up of individually owned residential units. It is unlikely that these customers will participate in a distribution program. However, they can represent significant water savings.

Option 2: Free Water Saving Fixtures

This program will offer free products to qualifying commercial customers. When purchased in bulk and through a wholesale contract, the City can provide quality products to its DWU customers at a much lower price than would be available to the end user.

Products may include:

- High Efficiency Residential Toilets
- High Efficiency Industrial Toilets & Flush Valves
- High Efficiency Urinals
- High Efficiency Faucet Aerators
- Cooling Tower Conductivity Controllers
- Landscape Irrigation System Controllers
- High Efficiency Showerheads
- Rain and Freeze Sensors
- Kitchen Pre-Rinse Spray Valves
- Car Wash Wand Nozzles and Nozzle Guards

Program could also have free fixture and installation component for non-profit organizations. Many academic and non-profit facilities have little or no funding for water efficiency improvements.

A program related to educational and non-profit facilities will offer rebates or free installation of water efficiency fixtures for qualifying institutions.

Qualifying institutions may include, but are not limited to:

- Colleges & Universities
- Public Schools
- Government Offices
- 501- (c)(3) Organizations

On May, 11, 2016, the Dallas City Council adopted the Property Assessed Clean Energy (PACE) in a Box program. The PACE program enables private sector owners of commercial, industrial and multifamily properties with five or more dwelling units to obtain low-cost, long-term loans to pay for water and energy saving retrofits. DWU will plan, develop and implement a PACE financing option as a component of its ICI financial incentive program.

Programs for ICI and Large Campus Style Properties

According to the EPA, a water budget is a site-specific method of calculating an allowable amount of water to be used by the landscape and then designing the landscape to meet this budget. The budget takes into account plant type, plant water needs, irrigation system design, and applied water that the landscape receives either by irrigation or by precipitation. Water budgets must be associated with a specified amount of time, such as a week, month, or year.[10]

Given that a water budget program has been identified as a conservation BMP to help customers make the most of the resources they have, DWU should implement a water budget outreach program to complement its existing ICI efforts. It is recommended that the city consider the Denver Water Budget Program as a model for planning, development and implementation.

Denver Water Budget Program

Program Overview

While in the program, participants must still abide by Denver Water's regular restrictions:

- Do not water lawns between 10 a.m. and 6 p.m.
- Do not waste water by allowing it to pool in gutters, streets and alleys
- Do not waste water by letting it spray on concrete and asphalt
- Repair leaking sprinkler systems within 10 days
- Do not water while it is raining or during high winds

Water Budget Program participants receive a report after each meter read cycle is complete. The reports provide a comparison of the site's consumption to the water budget. If a participant regularly exceeds the target water budget, Denver Water's conservation department offers suggestions for other programs or techniques to use water more efficiently.

[10] WaterSense Water Budget Approach, Version 1.02, July, 24, 2014. http://www.epa.gov/WaterSense/water_budget/index.html.

How outdoor consumption is calculated

The outdoor budget is based on weather and the size of irrigable area within the property's boundaries. The irrigable area is defined by the customer during the water budget application process and multiplied by how much water that landscape needs to determine each month's water budget. Historically, the Denver-metro area requires about 18 gallons of water per square foot for the entire irrigation season (April 15 – Oct. 15). Denver Water also makes additional allotments for cooling towers, pools and industrial processes as they are identified.

The Water Budget program does not impose additional penalties for customers over-budget. All water budget customers are subject to their normally billed rates. However, wasting water is essentially wasting money. If a participant regularly exceeds the target water budget, Denver Water's conservation department makes suggestions for other programs or techniques to help the customer use water more efficiently.

There is no water budget allocation for ponds, new plant establishment or line breaks. At the request of the customer, Denver Water calculates a reasonable amount of water necessary to operate pools and/or cooling towers. Calculations are based on verified volume or capacity.

Planning, development and implementation

The Denver Water Budget Program was launched in 2013. According to Denver Water staff[11], approximately 400 customers currently participate in the Water Budget Program. Only commercial customers with more than one acre of irrigable land are eligible for the program. Current program participants are primarily parks and schools. During the 2013 drought, the program helped customers save more than 4 million gallons of water.[12]

The program is staffed by one full-time specialist. The program was developed utilizing Denver Water's Information Technology (IT) and Geographic Information Systems (GIS) staff.

It is recommended that Dallas use its internal GIS, CIS and DWU Technology Solutions teams to plan, develop and implement the program over a 3-5 year phased-in approach. Aside from the financial savings that may be achieved by deploying existing resources, the in-house implementation approach will also provide a smoother transition to a budget based rate structure should this become a consideration in the future.

The Golf Course Industry

The golfing industry views increasing water shortages as one of its major challenges. Consequently, water conservation is a top priority and the industry is proactively seeking ways to help reduce water use through a number of strategies. One of the strategies they actively promote is the development and adoption of irrigation and landscape best management practices. Local leadership of the Golf Courses Association of America have expressed an interest in partnering with DWU to promote best management practices to its member golf courses and to create a water conservation certification program for golf courses as a way of encouraging water conservation practices. They would also like to see rebate opportunities for irrigation upgrades as part of the ICI financial incentives program.

[11] Personal communication, J. Tehral, Denver Water Conservation Manager, April, 15, 2015.

[12] Denver Water Budget Program website, http://www.denverwater.org/Conservation/WaterBudget/.

Residential Irrigation System Rebate Program

While not implemented in the 2010 strategic planning cycle, Dallas should implement the 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. An example of a possible program model is outlined below.

Residential Irrigation System Design Rebate

Through the Residential Irrigation Design Rebate Program, DWU 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.

Who is Eligible?

Existing single-family and multi-family residential customers who receive water service from Dallas Water Utilities. Applicant must have an existing in-ground automatic irrigation system.

Terms of the Rebate:

A one-time rebate of up to $500 per property for any combination of options, depending on the number of zones converted or capped. Only existing systems are eligible for rebates.

Procedures:

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

Table 3-5: Proposed Irrigation System Design Rebate Amounts

Amount	Procedure	Description
$200	Irrigation Controllers	Controller must have the following features: • Day of week scheduling capabilities or seven day programming feature • Seasonal adjust or water budget percentage settings
$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 1 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 1 gallon/minute per head.
$150	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.
$100	General Irrigation System Repairs	Credit for materials to repair system leaks and heads.

External Customer Web and Mobile Applications

WaterSmart Software©

WaterSmart is an educational tool that purports to reduce water consumption by conducting targeted outreach and education to households in a jurisdiction/region. In 2014, the City of Dallas received this tool as a prize for winning the Wyland Foundation's National Mayor's Challenge for Water Conservation. The prize included a six month pilot program targeted to 5,000 randomly selected DWU customers.

WaterSmart is a unique tool for informing its participants about their water use relative to similar households in their neighborhood (definition varies across jurisdictions and regions). This tool

profiles households in three groups, high, average and efficient water users. Based on the profile type, residents receive targeted water saving tips e.g., a household with a large backyard and high water use would receive tips for reducing irrigation water consumption. WaterSmart boasts that this method of education and outreach results in reduction of water consumption over a specified period of time.

The Dallas pilot program ran from October 2014 through March 2015. The aforementioned households were randomly selected from a pool of DWU e-bill customers and equally distributed among the city's fourteen (14) city council districts. E-bill customers were targeted to avoid the cost of printing and postage. Each customer received a "Home Water Report" on the third Saturday of every month over the six month period. A typical Home Water Report consisted of three sections:

1. Gallons Per Day (GPD) number (calculated based on the previous month's water consumption) and a water consumption profile (high, average or efficient water use), based on the GPD number
2. Targeted water saving tips based on individual water use profile, demography and property information i.e., yard size and number of household occupants. Up to three water-saving tips were provided on each Home Water Report along with the projected financial savings for each suggested tip
3. Promotional information, water trivia and links to City of Dallas Water Conservation Program web page

Currently, DWU has developed an interactive water use calculator for its residential customers to:

- Demonstrate how the water bill is calculated by rate tier
- Allow customers to validate the water portion of their utility bill
- Estimate the cost impact of higher water use

DWU should develop a request for proposals (RFP) for an online program designed to provide specific tools and recommendations aimed at helping residents and businesses achieve greater automatic irrigation system efficiencies. Examples of specifications include but are not limited to:

- The ability to provide residents and businesses access to ETo (potential evapotranspiration) data for the northern and southern sectors of the City of Dallas
- The ability to distribute weekly recommendations on the amount (in inches) of supplemental irrigation needed to sustain a north Texas landscape

Mobile Applications

DWU should research the many mobile apps that are now available to determine the best platform for its customers. The candidate app should provide end-users the convenience of accessing the following information through their smartphones, tablets and other mobile devices.

- Dashboard – The dashboard page should provide monthly water use summary information. It should also provide a personalized weather tool to inform residents about local precipitation forecasts

- Advice and Recommendations – Links should be provided to the DWU homepage as well as the SaveDallasWater.com webpage in order to help customers learn more about water regulations and the city's water conservation rebate and incentive programs

Notifications – The app should have the ability to remind residents of their watering and non-watering days to help them avoid unnecessary fines.

Enhanced Enforcement Efforts

DWU administers various components of the Water Conservation Program as authorized by the Dallas City Code, Chapter 49, Water and Wastewater. The enforcement of the water rate structure and metering is automatic. However, water conservation lawn and landscape restrictions are enforced by the Department of Code Compliance (DCC). The DWU budget includes funding for enforcement activities by the DCC equivalent to two full-time personnel. For wholesale customers, clauses within their water supply contracts require development of water conservation plans to ensure that available supplies are used efficiently.

Enhanced Enforcement Initiative

The original City of Dallas Water Conservation Five-Year Strategic Plan adopted in 2005, 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 Code 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 (2010 Plan) acknowledging that up to that point, enforcement of the water conservation restrictions had been a challenge.

Over the course of the two previous five-year planning cycles, several observations have been made of conditions that in all probability have contributed to inadequate enforcement of the ordinance. Some of these include:

- Violations had to be processed through the criminal courts
- Violations had to be observed by Code Compliance inspectors at the time of the offense
- Code inspectors worked standard "business" hours while most water waste violations occurred before or after routine staff schedules
- Due to the nature of automatic irrigation systems, watering event violations occur during a very limited time frame, on average one to two hours. This provides a very narrow window of opportunity in which to observe a violation

During August and September of 2014, 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.

DCC utilized six Code Compliance inspectors during the campaign who worked periodic overtime from 4 a.m. to 8 a.m. and from 8 p.m. to midnight - periods when they are not normally on duty but during which irrigation normally takes place. The inspectors targeted areas of high water usage and positive mosquito trap tests.

The results of the campaign suggest that this approach is considerably more effective than the customary approach. During FY 2014 for example, there were 3,593 water conservation cases logged into the system of which 41% were created proactively by inspectors. Proactively means

that inspectors observed the violation while patrolling their assigned area as opposed to the violation having been previously reported.

By contrast, during the pilot program 1,704 cases were reported citywide, almost half of the total cases for the year. Of these cases, 89% were in the pilot targeted areas and 77% were proactive.

The enforcement process includes a notice of violation prior to the issuance of a citation. A citation is typically issued upon a second violation during the subsequent 12 months after the notice of violation is issued.

For the pilot program, the notice of violation process was used to maximize education and minimize citations. This included the placement of a reminder yard sign at the property where a violation was found to help increase property owner awareness. The yard sign provided a phone line with a recorded educational message for people with questions about the sign in their yard. Code inspectors also reached out to community groups in the target areas to inform them about increased enforcement.

Based on the results of the pilot, DCC and DWU are developing a program for systematic and continued enhanced enforcement. The program includes vehicle signage, inserts and handouts, yard signs and additional overtime funding to provide periodic enforcement coverage from 4 a.m. to 8 a.m. and from 8 p.m. to 12:00 midnight, including weekends. This effort could also be conducted year round to reduce watering during precipitation and freezing events.

The projected annual costs are estimated at a maximum of $115,000 for overtime during drought years with lesser amounts for non-drought years. An additional cost of approximately $5,000 would be incurred 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. These costs have been included in the FY2016 budget.

Additional amendments to 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. Subsequently, on January 28, 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, the 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 will significantly reduce the efforts and burden on Code inspectors.

Historically, inspectors have spent significant efforts tracking down offenders to personally identify and serve them as required under the criminal process. In addition, under the criminal process the inspector was required to appear at the hearing whereas the new process only requires their appearance if requested or appealed. The number of cases with findings of liability is expected to be at a much higher rate than guilty findings under the criminal process because the burden of proof is greater on the defendant. In addition, if the defendant fails to appear for the hearing, he/she will be considered to have admitted liability.

A summary of all the water conservation strategies recommended in this Work Plan and discussed in Section 3 are listed in **Table 3-6**.

Table 3-6: Recommended Measures Summary

Strategy	Recommendation
Water System Improvements	
Water Loss Reduction	• Additional resources needed for Pressure Reducing Valve maintenance and one vehicle. Total costs $120K • Additional resources needed for system repairs over the five year period – including equipment and materials • One-time funding of $200K for large diameter leak condition assessment plus $50K per year after the 1st year • Additional resources needed for leak detection including one vehicle and supplies. Total costs $160K
Meter Reading (Apparent Loss Reduction)	• Perform focused data analytics to determine water consumption anomalies • Implement automated process to enhance large meter maintenance program for improved quality assurance
Filter Cleaning at Water Treatment Plants	• Continue processes: o To reduce backwash water o To reduce immediate drain water o To reduce the filter-to-waste time o Expand process to Elm Fork and East Side WTP
Modernization of Meter Reading Process	• Continue to procure and install AMR Fixed Network infrastructure o Deploy all components within 5 years o Perform field deployment in phases o Phase I- Installation of Endpoints on existing AMI Ready Meters o Phase I.1- Installation of Communication Grid (parallel with Phase I) o Phases II and III- Installation of AMI Meter/Endpoints (route by route)
Ordinance Changes	
Landscape Ordinance Amendments	• Assist Department of Sustainable Development and Construction with Article X Revision and Recommendations by o Including water conservation as one of the objectives in the ordinance o Including water conservation options as a means of acquiring required "points" for landscape design permit o Assisting in developing water conservation best management practices in the Landscape Manual to be provided as a reference guide for the ordinance
Retail Cost of Service and Rate Study	• Finalize Request for Qualifications to update retail cost of service and rate model o Scope should include evaluating ▪ *Current cost allocations between customer classes* ▪ *Additional tiers for all customer classes*

Table 3-6: Recommended Measures Summary (Continued)

Strategy	Recommendation
Continued Customer Engagement	
Wholesale Customer Cities Monitoring, Measurement and Reporting	• Monitor Wholesale Customers' State required water conservation and drought plans • Consolidate, track and analyze current and historical consumption, GPCD and other pertinent metrics • Recognize and promote Wholesale Customers' water conservation achievements • Assist Wholesale Customers in enhancing and expanding their existing programs
Increased Multi-Family Outreach Efforts	• Partner with the Department of Code Compliance to distribute ordinance information during multi-family property managers' outreach events • Conduct training on landscape best management practices • Perform spatial analysis in an effort to target programming to geographical areas with low customer participation
Revised ICI Financial Incentive Program	• Two options are recommended for implementation • ICI Cost Share Program o Rebates will be offered for up to 50% of any indoor or process related water conservation project o Program will provide rebates for up to 50% of any irrigation system related improvements o Program will offer rebates on domestic fixtures for properties such as hotels and multifamily residential establishments • Free Water Saving Fixtures Distribution Program o Program will offer free products to qualifying commercial customers. When purchased in bulk and through a wholesale contract, the City can provide quality products to its DWU customers at a lower price than would be available to the end user o Program will offer free installation of water efficiency fixtures to not for profit organizations such as faith-based organizations, colleges/universities, government agencies
Programs for ICI and Large Campus Style Properties	• Implement a water budget program to complement existing rebate and public outreach efforts o ICI and large residential properties with 1 acre or more of irrigable landscape will be eligible o DWU should partner with CIS and GIS to implement program over a 3-5 year phased-in approach • Develop Golf Course Certification Program o Work with the Golf Course Superintendents Association of America to actively promote water conservation BMPs to its members o Create a Water Wise Certification program for local golf courses that adopt formal best management practices o Incorporate program into existing ICI program

Table 3-6: Recommended Measures Summary (Continued)

Strategy	Recommendation
Continued Customer Engagement	

Residential Irrigation System Rebate Program	• Program should complement highly successful irrigation system check-up program and water wise landscape seminars
	• Examples of incentives include
	  ○ Drip irrigation
	  ○ Spray heads with more efficient distribution patterns
	  ○ Weather-based (smart) controllers

Enhanced Residential Outreach	• Research and Implement Mobile App
	  ○ App can be used on Smartphones, tablets and computers
	  ○ Will allow users to set up email reminders for their watering days and times based on zip code
	  ○ Smart alerts will inform users of rain forecasts
	• Develop and implement online interactive water calculator for residential customers
	  ○ Demonstrates how the water bill is calculated by tier
	  ○ Allows customers to validate the water portion of their utility bill
	  ○ Tool to estimate the cost impact of higher water use

Enhanced Enforcement Efforts	• Provide overtime funding to Department of Code Compliance to develop year-round program to provide systematic coverage from 4 AM to 8 AM and from 8 PM to 12:00 midnight, including weekends
	  ○ Vehicle signage
	  ○ Handouts
	  ○ Yard signs

4. Projected Water Savings, Costs, Benefits and Staffing

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

4.1 Projected Water Savings from Selected Residential and ICI Measures

The projected water savings for the 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 4-1)**.

Water Use and Unit Water Savings

In **Table 4-1**, the water use figures are the average indoor and outdoor water use 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 twenty-five percent 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 shown are based on the experience of other utilities and benchmark data. As such, they are estimates, and actual water savings will vary. Some customers will realize greater water savings, while others will realize less due to a number of variables that affect individual water use. Once each strategy is in operation, DWU staff should verify that customers are realizing the projected water savings. If they are not, the program should be re-evaluated 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 that have 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 customers. At the same time, water users in the top 25th percentile will 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.

Several factors impact the projected water savings over time. Measure life 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 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 on a monthly basis as recommended during a customer audit).

Table 4-1: Target Customer Water Use, Target Customer Markets, and Projected Water Savings

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)
Continued Customer Engagement								
Wholesale Customer Cities Monitoring, Measurement & Reporting	4,112,414	1,062,310	Treated Water Customers	0.25%	0.25%	12,937	5	15%
Increased Multi-Family Outreach Efforts	1,356	92	All	2%	2%	29	5	n/a
Revised ICI Financial Incentive Program								
ICI Cost Share Program	11,965	3,327	Top 10% Priority	31.7%	31.7%	4,848	10	5%
Multi-Family Toilet Distribution Program	1,356	92	Older Toilets (3.5 GPF and Above)	19%	0%	256	25	n/a
Free ICI Toilet Program	1,443	412	Older Toilets (3.5 GPF and Above)	10%	0%	144	25	n/a
Academic & Non-Profit Facility Incentives	1,443	412	Older Toilets (3.5 GPF and Above)	10%	0%	144	25	n/a
Programs for ICI & Large Campus Style Properties	5,416	1,552	Top 25% Priority	10%	10%	697	5	15%
Residential Irrigation System Rebate Program	526	355	Top 25% Priority	0%	20%	71	10	5%
Enhanced Residential Public Outreach								
DWU Residential Rate Calculator	148	54	All	0%	6%	3	5	n/a
Customer Web & Mobile Applications	148	54	All	6.4%	6.4%	13	5	n/a
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

Table 4-1: Target Customer Water Use, Target Customer Markets, and Projected Water Savings (Continued)

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)
Ordinance Changes								
Landscape Ordinance Amendments								
Residential Landscape Ordinance Amendment	148	54	New Construction	0%	25%	14	20	n/a
Multi-Family Landscape Ordinance Amendment	1,356	92	New Construction	0%	25%	23	20	n/a
ICI Landscape Ordinance Amendment	1,443	412	New Construction	0%	25%	103	20	n/a
Evaluation of Commercial Customer Classes	1,356	92	All	2%	2%	29	1	n/a

Assumptions
(a) Water use in gallons per account per day
(b) **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
(c) **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.

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 virtually no removals due to customer dissatisfaction. Replacements of faulty equipment are assumed to have the same water use and efficiency features as the original product.

Program Participation

Program participants are DWU customers who can reasonably be expected to adopt the selected water conservation measures. Customer participation goals were 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 the regulatory strategies (e.g., Landscape Ordinance Amendment) 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 4-2** 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.

Water Savings from Selected Residential and ICI Strategies

The projected water savings for the selected residential and ICI strategies **(Table 4-3)** are based on the unit water savings, target customer markets, program participation assumptions, measure life, and annual savings decay assumptions described in the previous sections.

Table 4-2: Customer Participation Assumptions for Projected Water Savings

Selected Water Conservation Strategies	Measures Per Account	Projected Number of New Participating Accounts / Incentive Each Year				
		FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	FY 2019-20
Continued Customer Engagement						
Wholesale Customer Cities Measuring, Monitoring & Reporting	1	5	5	5	5	2
Increased Multi-Family Outreach Efforts	1	0	2,100	2,100	2,100	2,100
Enhanced Residential Public Outreach						
DWU Residential Rate Calculator	1	2,500	5,000	5,000	5,000	5,000
Customer Web & Mobile Applications	1	0	7,500	7,500	7,500	7,500
Revised ICI Financial Incentive Program						
ICI Cost Share Program	1	0	20	20	20	20
Multi-Family Toilet Distribution Program	13.2	0	2,403	2,403	2,403	2,403
Free ICI Toilet Distribution Program	1	0	2,336	2,336	2,336	2,336
Academic & Non-Profit Facility Incentives	1	0	880	880	880	880
Programs for ICI and Large Campus Style Properties	1	0	20	20	40	40
Residential Irrigation System Rebate Program	1	0	0	125	375	500
Enhanced Enforcement						
Residential Enhanced Enforcement	1	3,750	3,750	3,750	3,750	3,750
Multi-Family Enforcement	1	1,250	1,250	1,250	1,250	1,250
ICI Enhanced Enforcement	1	1,250	1,250	1,250	1,250	1,250
Ordinance Changes						
Landscape Ordinance Amendments						
Residential Landscape Ordinance Amendment	1	0	0	0	700	1,400
Multi-Family Landscape Ordinance Amendment	1	0	0	0	700	1,400
ICI Landscape Ordinance Amendment	1	0	0	0	700	1,400
Evaluation of Commercial Customer Classes	1	0	0	36,057	36,057	36,057

Assumptions

[a] Participation in the Multi-Family Toilet Distribution Program, ICI Toilet Program, and Non-Profit Facility Incentives is shown as the number of toilets retrofitted

[b] Participation for the Sprinkler App. Program and the Home Water Efficiency Report are anticipated new participants by year based on efforts by DWU to increase participation each year.

4.2 Projected Water Savings from Selected Water Loss Measures

All of the projected water savings for the 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 percent over the past five years has ranged from 12.1 percent to 16.8 percent, with an average of 15.6 percent. 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 percent. Based on experience with other utilities, the consultant team projected the water savings from the selected water loss reduction strategies **(Table 4-3).** The projected real loss reduction of 11.2 million gallons per day by FY 2020 corresponds to a reduction in total water loss percent from 12.1 percent to 7.5 percent.

Long-Term Implications of Projected Savings

The water savings from the selected strategies are expected to continue beyond FY 2020. 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 growing population. Assuming that all of the selected strategies are implemented as described in this chapter, it is projected that the measures implemented during the five-year planning period will save a total of approximately 43.1 BG over the next twenty years.

Table 4-3: Projected Water Savings from Selected Strategies

Selected Water Conservation Strategies	Projected Water Savings (gal/year)				
	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	FY 2019-20
Existing Conservation Programs - Implemented Savings					
New Throne for Your Home (Based on FY 2013-14 Recorded Savings)	56,319,865	112,639,730	168,959,595	225,279,460	281,599,325
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
TOTAL ANNUAL SAVINGS	**428,089,885**	**856,179,770**	**1,101,769,655**	**1,347,359,540**	**1,592,949,425**
Continued Customer Engagement					
Wholesale Customer Cities Measuring, Monitoring & Reporting	23,609,679	43,677,906	60,735,900	75,235,194	73,393,786
Increased Multi-Family Outreach Efforts	0	22,303,544	44,607,088	66,910,632	89,214,176
Enhanced Residential Public Outreach					
DWU Residential Rate Calculator	0	2,956,500	8,869,500	14,782,500	20,695,500
Customer Web & Mobile Applications	0	35,390,400	70,780,800	106,171,200	141,561,600
Revised ICI Financial Incentive Program					
Multi-Family Toilet Distribution Program	0	17,029,198	34,058,396	51,087,594	68,116,792
ICI Cost Share Program (Includes Domestic Fixture & Landscape Rebates)	0	35,387,217	69,005,074	100,942,037	131,282,152
Free ICI Toilet Program	0	123,035,952	246,071,904	369,107,856	492,143,808
Academic & Non-Profit Facility Incentives	0	46,349,160	92,698,320	139,047,480	185,396,640
Programs for ICI and Large Campus Style Properties	0	5,086,640	9,410,284	18,172,021	25,619,498
Residential Irrigation System Rebate Program	0	0	3,239,375	12,795,531	25,113,255
Enhanced Enforcement					
Residential Enhanced Enforcement	19,436,250	38,872,500	58,308,750	77,745,000	97,181,250
Multi-Family Enhanced Enforcement	1,679,000	3,358,000	5,037,000	6,716,000	8,395,000
ICI Enhanced Enforcement	7,519,000	15,038,000	22,557,000	30,076,000	37,595,000
TOTAL ANNUAL SAVINGS	**52,243,929**	**388,485,017**	**725,379,391**	**1,068,789,045**	**1,395,708,457**

Table 4-3: Projected Water Savings from Selected Strategies (Continued)

Selected Water Conservation Strategies	Projected Water Savings (gal/year)				
	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	FY 2019-20
Ordinance Changes					
Landscape Ordinance Amendments					
Residential Landscape Ordinance Amendments	0	0	0	3,449,250	10,347,750
Multi-Family Landscape Ordinance Amendments	0	0	0	587,650	1,762,950
ICI Turf Landscape Ordinance Amendments	0	0	0	2,631,650	7,894,950
Evaluation of Commercial Customer Classes	0	0	381,136,913	381,136,913	381,136,913
TOTAL ANNUAL SAVINGS	**0**	**0**	**381,136,913**	**387,805,463**	**401,142,563**
Water System Improvements					
Water Loss Reduction					
Large Diameter Leak Condition Assessment	153,738,000	225,481,670	297,225,340	368,969,010	440,712,680
Enhanced Leak Detection- Additional Leak Repair Resources	0	50,589,000	101,178,000	151,767,000	202,356,000
Enhanced Leak Detection- Additional Leak Detection Resources	0	133,400,200	200,100,300	266,800,400	333,500,500
Enhanced Leak Detection - Additional Pressure Reducing Valve Resources	0	13,340,020	26,680,040	40,020,060	53,360,080
Water Treatment Plant Backwash Optimization	328,515,695	328,515,695	328,515,695	328,515,695	328,515,695
TOTAL ANNUAL SAVINGS	**482,253,695**	**751,326,585**	**953,699,375**	**1,156,072,165**	**1,358,444,955**

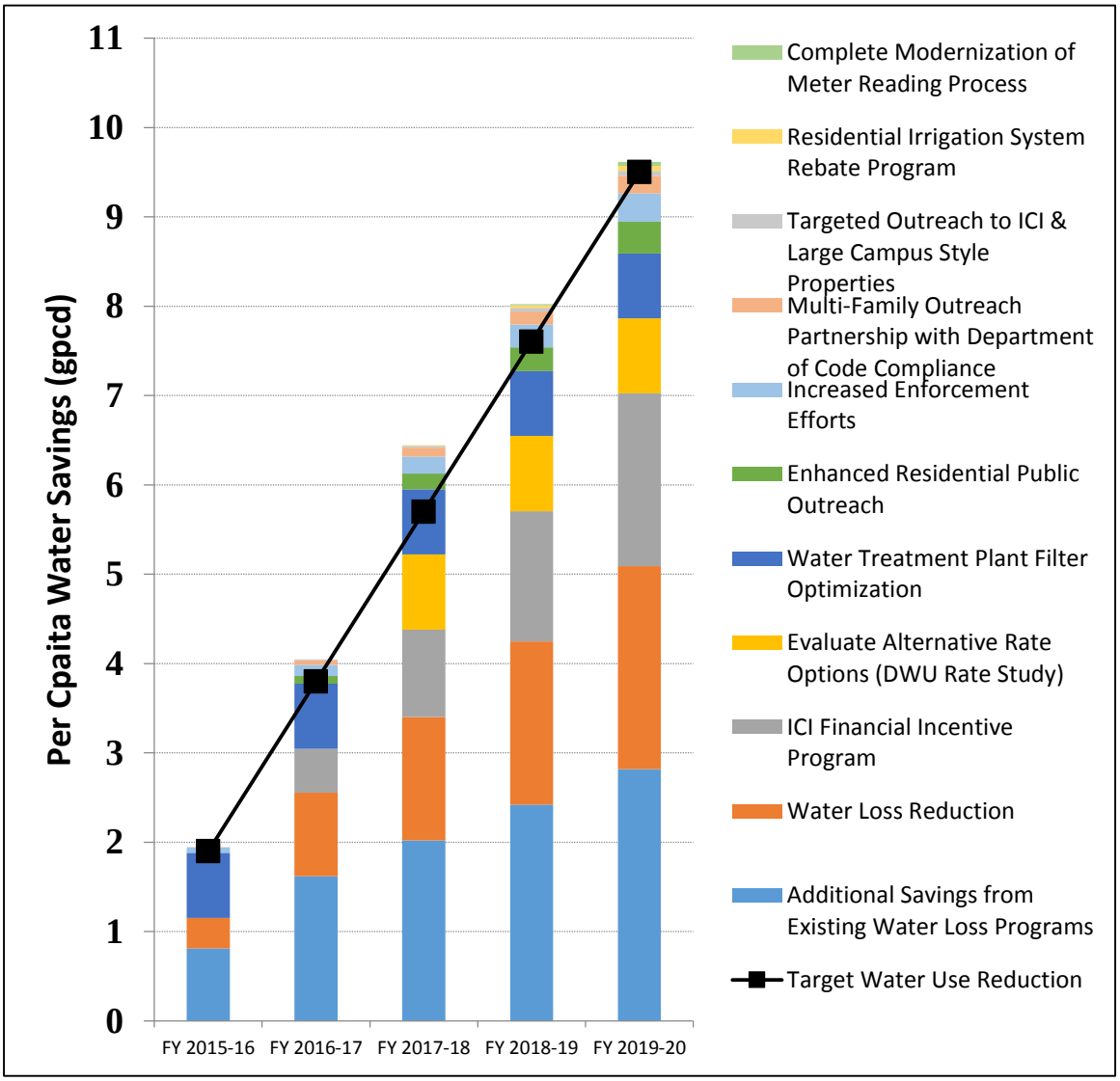
Table 4-3a: Projected Water Savings from Selected Strategies Summary

Category	Projected Water Savings (gal/year)				
	FY 2015-16 GPCD	FY 2016-17 GPCD	FY 2017-18 GPCD	FY 2018-19 GPCD	FY 2019-20 GPCD
Savings from Existing Implemented Water Conservation Programs	428,089,885	856,179,770	1,101,769,655	1,347,359,540	1,592,949,425
Savings from Water System Improvements	482,253,695	751,326,585	953,699,375	1,156,072,165	1,358,444,955
Savings from Ordinance Changes	0	0	381,136,913	387,805,463	401,142,563
Savings from Continued Customer Engagement	52,243,929	388,485,017	725,379,391	1,068,789,045	1,395,708,457
TOTAL PROJECTED ANNUAL SAVINGS	**962,587,509**	**1,995,991,373**	**3,161,985,333**	**3,960,026,214**	**4,748,245,401**
TARGET (GPCD Reduction)	1%	2%	3%	4%	5%
TARGETED ANNUAL SAVINGS	855,997,591	1,714,707,045	2,576,128,361	3,440,261,539	4,307,106,580
ANTICIPATED GPCD REDUCTION BASED ON TARGETED ANNUAL SAVINGS	1.90	3.80	5.70	7.60	9.50
NEW GPCD GOAL BASED ON 5 YEAR ROLLING AVERAGE OF 190 GPCD	188	186	184	182	181

4.3 Projected Per Capita Water Savings

Figure 4-1 depicts the conversion of the projected savings **(Table 4-3)** to per capita water savings by selected water conservation strategy, ordered from greatest projected savings to least. The selected strategies are projected to achieve the target per capita water use reduction (an average of 1.0 percent per year) in each year of the planning period. The three most important strategies contributing towards achieving the savings goal are the additional savings from existing water loss programs, enhanced water loss reduction, and revised ICI financial incentives.

Figure 4-1: Projected Per Capita Water Savings from Selected Strategies



Water Conservation Benefits

Water conservation has both economic and non-economic benefits. Water conservation:

- Extends the life of existing water supplies and delays 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.

- Reduces 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.

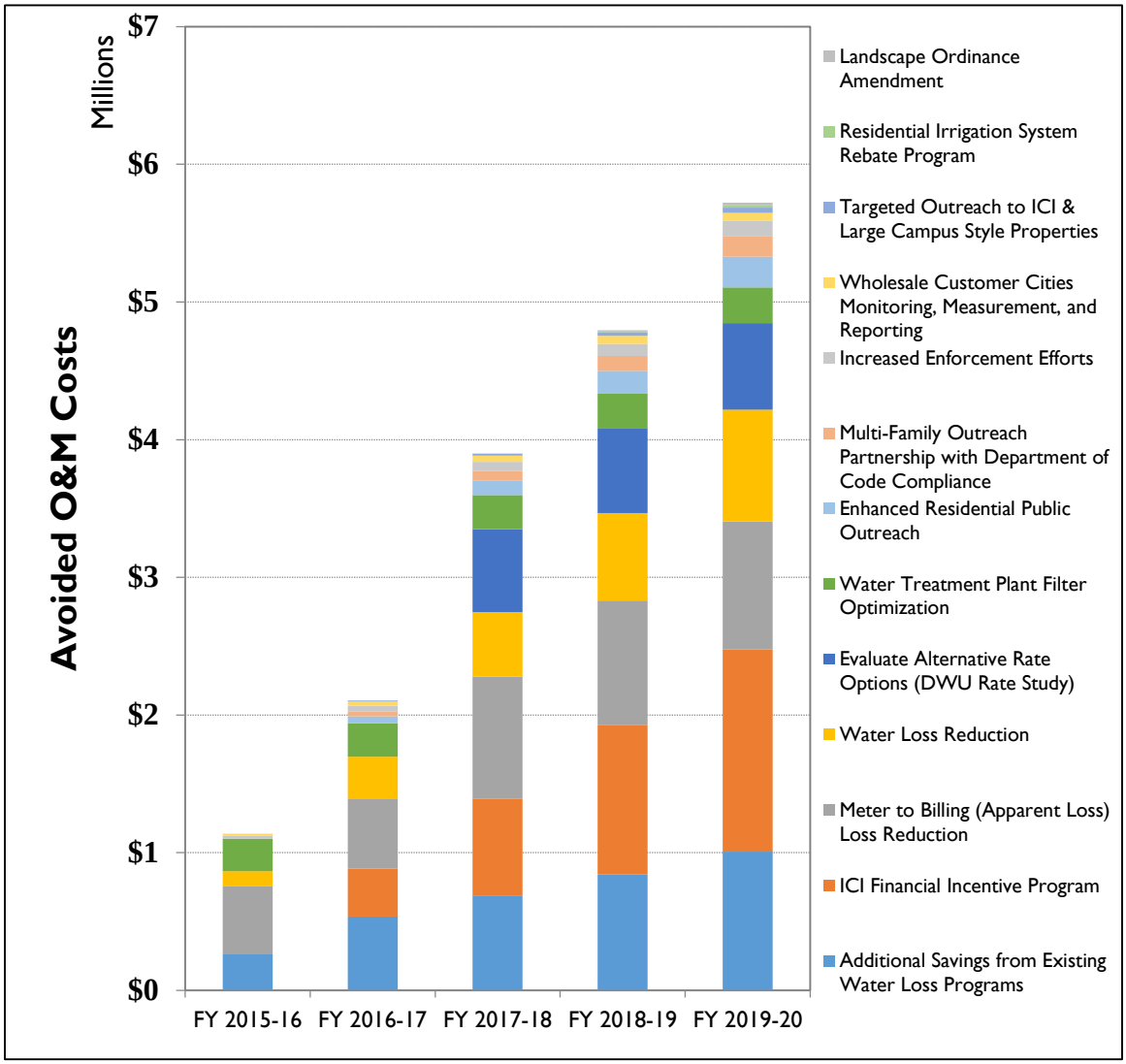
Lowers capital and operating costs of the existing system. Deferral of new water supply development or infrastructure expansion allows the utility to avoid associated capital costs. In addition, operational costs, such as power and chemicals, are reduced.

- Positions the city to obtain future water rights. In the Long Range Water Supply Plan and in the 2016 Region C Initially Prepared Plan, Dallas has identified future water sources that would involve interbasin transfer of raw water. 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 include 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.

The projected water savings are based on the unit water savings, target customer markets, measure life, annual savings decay, and program participation assumptions depicted in **Tables 4-1 and 4-2**.

Figure 4-2: Potential Reduced O&M Costs from Selected Strategies



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, the 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 O&M costs.

According to DWU staff, the marginal O&M cost for water treatment and delivery is $732 per MG, and the marginal O&M cost for wastewater service is $809 per mg.[13] 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.

[13] 2016 dollars. Avoided O&M costs are assumed to increase at an annual inflation rate equal to the historical average inflation rate from 1990 through 2010 (2.35 percent per year). Historical average inflation rate calculated from the Dallas Federal Reserve Bank trimmed mean personal consumption expenditures inflation rate.

For most of the selected strategies, the potential costs reduction associated with a given strategy is simply the projected water savings multiplied by the avoided O&M costs. The exception is the Meter Reading (Apparent Loss Reduction) strategy which does not reduce water usage. Instead, this enables the utility to enhance revenue recovery for water that is used.

In recent years, DWU's apparent losses have averaged 7.6 gallons per connection per day and have varied from 2.4 gal/conn/day to 10.5. Based on experience with other utilities, the consultant team projected the additional billed water from each component of the apparent loss reduction strategies **(Table 4-4)**. The additional billed water is projected to amount to 600,000 gallons per day by FY 2020. It was assumed that this water would be billed at an average rate of $3.77 per thousand gallons.

The potential reduced O&M costs from the selected water conservation strategies is about $5.7 million per year by FY 2020 **(Figure 4-2)**. The three measures that contribute the most benefits are additional savings from existing water loss programs, revised ICI financial incentives, and apparent loss reduction. Assuming that all of the selected strategies are implemented as described in this section, the potential reduced O&M costs for the measures implemented during the five-year planning period is approximately $38.3 million over the next twenty years.

Estimated Costs

In the following sections, unit cost assumptions are described and estimated costs for the 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)

Table 4-4: Projected Additional Billed Water Use from Apparent Loss Reduction

Selected Water Conservation Strategies	Projected Additional Billed Water Use (gal/day)				
	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	FY 2019-20
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**

n/a means that additional billed water was not projected for this component

4.4 Unit Cost Assumptions for Selected Residential and ICI Strategies

Unit cost assumptions for the selected residential and ICI water conservation strategies are presented in **(Table 4-5)**. The Incentive amount is the projected amount of the 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 either DWU staff or a contractor to provide the incentive, training, or audit.

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

Table 4-5: Unit Cost Assumptions for Selected Residential and ICI Strategies

Selected Water Conservation Strategies	Unit Cost Assumptions ($/Measure)		
	Incentive	Labor	Combined
Continued Customer Engagement			
Residential Irrigation System Rebate Program	$270	$124	$394
Enhanced Residential Public Outreach			
-DWU Residential Rate Calculator	-	-	-
-Customer Web & Mobile Applications	$12.36	-	$12.36
Enhanced Enforcement			
-Residential Enhanced Enforcement	-	$17.97	$17.97
-Multi-Family Enhanced Enforcement	-	$17.97	$17.97
-ICI Enhanced Enforcement	-	$17.97	$17.97
Increased Multi-Family Outreach	-	-	-
Programs for ICI and Large Campus Style Properties	-	$1,550	$1,550
Wholesale Customer Cities Program	-	-	-
Ordinance Changes			
Landscape Ordinance Amendment	-	-	-
-Residential Landscape Ordinance Amendment	-	-	-
-Multi-Family Landscape Ordinance Amendment	-	-	-
-ICI Landscape Ordinance Amendment	-	-	-
Evaluation of Commercial Customer Classes	-	-	-
Revised ICI Financial Incentive Program			
-ICI Cost Share Program	$23,450	$1,550	$25,000
-Multi-Family Toilet Distribution Program	$90	$13	$103
-Free ICI Toilet Program	$200	$13	$213
-Academic & Non-Profit Facility Incentives	$200	$70	$270

"-" The measure will be implemented without cost or will be performed by existing Water Conservation Division Staff.
Costs shown are in 2015 dollars

Estimated costs for the selected water conservation strategies are presented in **Table 4-6**. The estimated costs for most of the residential and ICI strategies are based on the program participation assumptions **(Table 4-2)** and the unit cost assumptions **(Table 4-5)** 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 in Section 4.3. By FY 2020, the total estimated costs for the selected strategies is approximately $8.3 million per year **(Table 4-6)**.

Table 4-6: Estimated Cost for Selected Strategies

Recommended Water Conservation Division Budgets by Fiscal Year					
Anticipated Program Costs in Dollars per Year	**FY 2015-16**	**FY 2016-17**	**FY 2017-18**	**FY 2018-19**	**FY 2019-20**
Existing Budget items					
Program Administration	$1,416,593	$1,299,651	$1,243,280	$1,281,756	$1,345,119
Minor Plumbing Repair Program	$400,000	$400,000	$419,021	$419,021	$419,021
Public Awareness Campaign	$951,800	$951,800	$997,060	$1,020,491	$1,020,491
Regional Campaign (TRWD)	$148,462	$150,000	$150,000	$150,000	$150,000
Environmental Education Initiative	$358,713	$358,713	$358,713	$358,713	$358,713
Toilet Rebate Program	$1,050,000	$1,050,000	$1,050,000	$1,050,000	$1,050,000
ICI Audits	$150,000	$150,000	$150,000	$150,000	$150,000
ICI Rebate Program	$0	$0	$239,332	$257,881	$276,866
ICI Training Program	$0	$0	$25,000	$25,000	$25,000
Existing Budget Items Subtotal	**$4,675,568**	**$4,560,164**	**$4,807,406**	**$4,887,862**	**$4,970,210**
Additional Budget Items					
Landscape Ordinance Amendment	$0	$0	$0	$0	$0
Residential Irrigation System Rebate Program	$0	$0	$49,250	$147,750	$197,000
Increased Multi-Family Outreach Efforts	$0	$0	$0	$0	$0
Programs for High Users and Large Properties	$0	$32,474	$33,237	$68,037	$69,636
Enhanced Residential Public Outreach	$0	$0	$132,627	$135,744	$138,934
Enhanced Enforcement	$114,939	$113,345	$120,405	$123,234	$126,130
Additional Budget Items Subtotal	**$114,939**	**$145,819**	**$335,519**	**$474,765**	**$531,700**
Total	**$4,790,507**	**$4,705,983**	**$5,142,925**	**$5,362,627**	**$5,501,910**

Table 4-6: Estimated Cost for Selected Strategies (Continued)

Recommended Water Operations Budget by Fiscal Year					
Existing Real Loss Program	**$1,800,000**	**$1,842,300**	**$1,885,594**	**$1,929,906**	**$1,975,258**
Water Loss Reduction					
Leak Detection and Repair	$0	$0	$289,035	$688,960	$760,493
Large Diameter Leak Condition Assessment	$200,000	$0	$50,000	$50,000	$50,000
Water Loss Reduction Subtotal	**$200,000**	**$0**	**$339,035**	**$738,960**	**$810,493**
Total Water Operations Division Budget	**$2,000,000**	**$1,842,300**	**$2,224,629**	**$2,668,866**	**$2,785,751**
Totals Anticipated Annual Costs	**$6,790,507**	**$6,548,283**	**$7,367,554**	**$8,031,493**	**$8,287,661**
Cumulative Change in Funding Required from FY 2016		**-$242,224**	**$577,047**	**$1,240,986**	**$1,497,154**

It is projected that if DWU reduces the amounts shown in **Table 4-6**, then it will not realize the projected water savings shown in **Table 4-3**. However, there is an important 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.

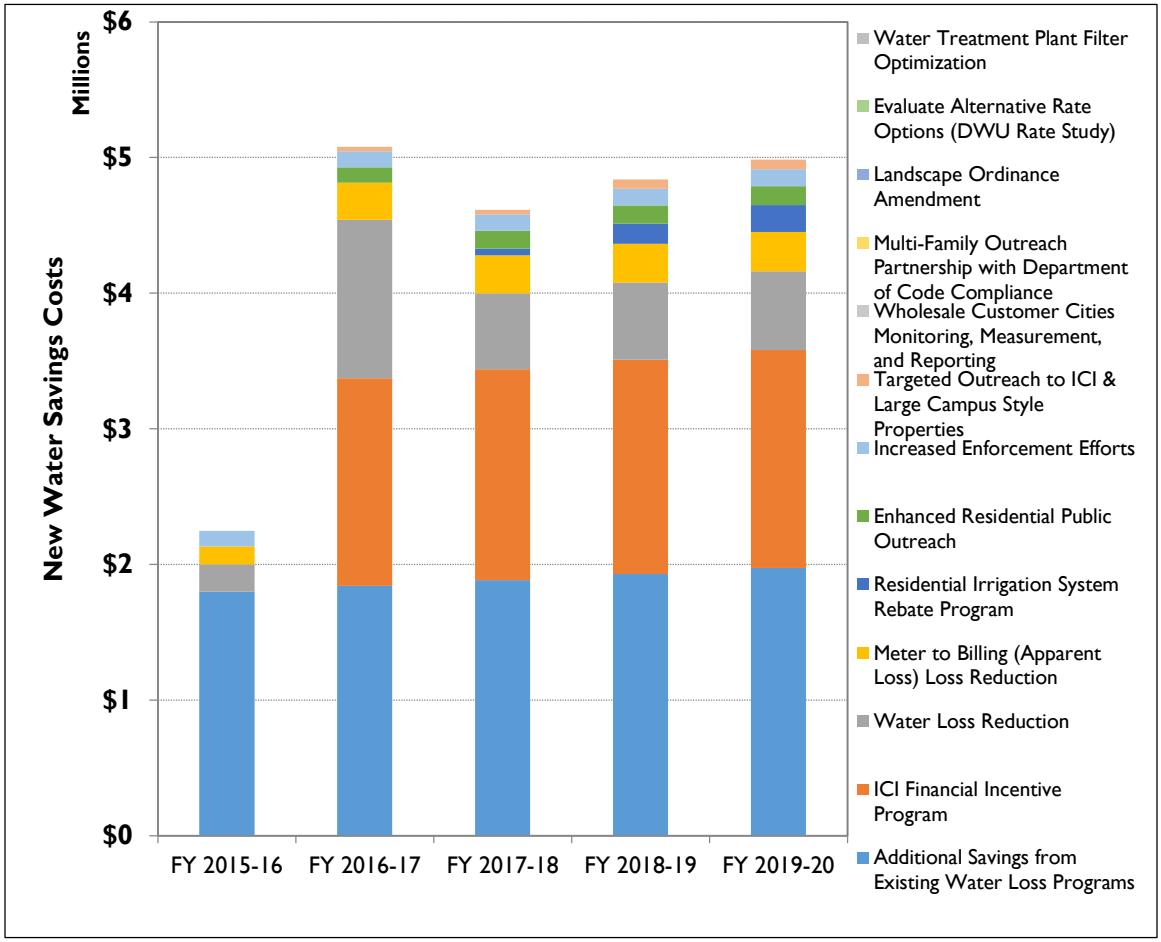
Each of the remaining selected strategies will require an increased budget authorization according to the estimated costs shown in **Table 4-6**.

Some of the recommended water conservation strategies require no additional DWU labor (e.g., enhanced multifamily outreach and landscape ordinance amendments). However, some of the recommended measures may require staff time for employees of other city departments. This will largely be dependent upon what ordinance measures are adopted and the level of enforcement required. Additional staff time for employees of city departments other than DWU is not included in the estimated costs.

The estimated costs are presented in **Figure 4-3**. By FY 2020, the measures with costs greater than $1 million per year are the existing water loss program and the revised toilet rebate programs.

Assuming that all of the selected strategies are implemented as described in this section, the estimated costs over the next twenty years for the measures implemented during the five-year planning period is approximately $25.5 million with the costs actually be incurred during the first five years. Comparing the twenty-year estimated costs to the projected twenty-year water savings gives a unit cost for the water savings of approximately $0.37 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 **(Section 4.3).**

Figure 4-3: Estimated Costs for Selected Strategies



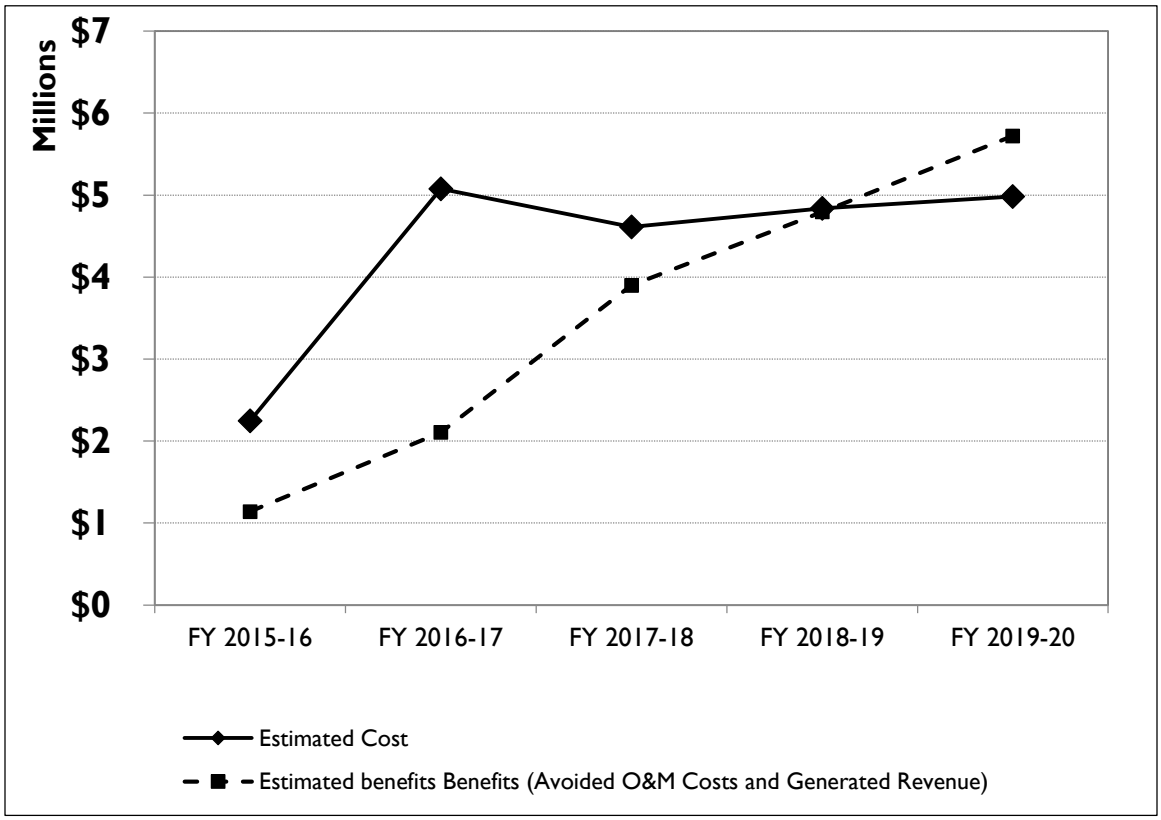
4.5 Benefit-Cost Analysis

For the five-year planning period, estimated costs and benefits are compared for the selected strategies in **Figure 4-4**. By FY 2018, the potential reduced O&M costs is projected to exceed the estimated cost of implementing the selected strategies.

Assuming that all of the selected strategies are implemented as described in this chapter, the estimated net benefit is approximately $38.3 million over the next twenty 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 4-4: Potential Reduced O&M Costs and Estimated Costs for Selected Strategies



4.6 Recommended Staffing Levels

It is anticipated that DWU will use existing resources, seasonal labor and contractors to implement the proposed strategies. 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.

5.0 2016 Work Plan Implementation

While significant analysis and efforts have gone into development of the 2016 Work Plan, it should be reassessed annually to make sure that 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 DWU's water conservation program over the past ten years, all of the water conservation strategies presently employed by DWU are recommended for continuation or enhancement under the 2016 Work Plan.

It is also recommended that DWU implement each of the strategies that were evaluated in detail (as described in Section 4) during the next five years. It is projected that these new or enhanced strategies will enable DWU 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 twenty years.

To maximize the success of the recommended water conservation strategies, DWU 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 occurs 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 particular 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 short time prior to full-scale implementation and should continue to some degree 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

Table 5-1 Recommended Implementation Schedule FY 2016 through FY 2020

Summary of Recommended Implementation Schedule						
Program	Projected Water Savings Rank	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	FY 2019-20
Water Loss Reduction	1	1				
Revised ICI Financial Incentive Program	2	2				
Water Treatment Plant Backwash Optimization	3	3				
Evaluate Alternative Rate Options (DWU Rate Study)	4		4			
Enhanced Enforcement	5	5				
Mobile Apps and Customer Portals	6	6				
Wholesale Customer Cities Program	7	7				
Increased Multi-Family Outreach Efforts	8	8				
Programs for ICI and Large Campus Style Properties	9	9				
Residential Irrigation System Rebate Programs	10	10				
Landscape Ordinance Amendment	11	11				
Modernization of Meter Reading Process	12	n/a				
Meter to Billing Loss Reduction	13	n/a				

Savings Rank: lower numbers mean higher water savings
Strategy Planning and Development
Implementation
No Action

5.1 Method to Monitor the Effectiveness of the Plan

The effectiveness and efficiency of the water conservation program will be monitored on an ongoing basis by DWU staff. DWU determines 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 the first of these yearly reports on April 26, 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. Results

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