



Water Conservation Plan

JANUARY 2009



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Executive Summary



Introduction

The City of Thornton has historically maintained one of the lowest residential daily per capita water consumption rates among cities in the Front Range. This is a result of numerous efforts that Thornton has pursued to create and instill solid water conservation ethics throughout the community. The dominant desire of the City of Thornton is to create a legacy of strong water conservation ethics for the benefit of current and future generations. The Water Conservation Plan outlined in this document builds upon the successes of the past by aggressively pursuing strategies to help change customer belief systems and behaviors over the long-term. In addition, this Water Conservation Plan will provide assistance to customers in the form of education and incentives designed to promote increased water use efficiencies.

The dominant desire of the City of Thornton is to create a legacy of strong water conservation ethics for the benefit of current and future generations.

This Water Conservation Plan establishes long-term water conservation goals that encourage efficient use of available water resources and reduce the amount of additional water needed to serve existing and future customers, while maintaining a high-quality urban environment. The Water Conservation Plan will provide guidance in planning conservation programs consistent with the City's water resources management strategy and with community values. This plan is also intended to replace the September 2001 Water Conservation Plan that was approved by the Colorado Water Conservation Board (CWCB) and fulfill the requirements of the State of Colorado Water Conservation Act of 2004 (HB 1365) by following the guidelines provided by the CWCB. A copy of the Water Conservation Act of 2004 can be found in Appendix A.

Requirements/Participation

The Water Conservation Plan lays out a vision of how Thornton will achieve greater water use efficiency. As such, high expectations are placed on each department, division, and employee to help implement the plan and achieve greater water savings. One key to the success of this plan is cross departmental cooperation in helping to make improved water use efficiency a priority and a reality. The second key to the success of this plan is the continued support of the community to embrace the City's water use efficiency program as they have historically done.

Sustainability Connections with Water Conservation



While the focus of this plan is on water conservation, it is important to point out the larger connection that water conservation in the City of Thornton has with sustainability and climate change that will help make our planet a better place for future generations. For every gallon of water that is saved the benefits are leveraged into other areas that ultimately help reduce our community's greenhouse gas emissions and combat climate change. Examples include: **1) Saving water saves energy.** Conserving water leads to less energy being used to treat and pump water through the water treatment

plant and throughout the water distribution system to the customers. On the wastewater side of the equation, reducing the amount of water that is sent down the drain and to the wastewater treatment plant has the potential to save energy by reducing the flows that has to be pumped throughout the wastewater system for treatment. **2) Saving energy saves water.** Most of the nation's electric power plants use water for cooling purposes in the power generation process. By increasing energy efficiency customers can help conserve water that would otherwise be needed for cooling purposes at power plants.¹

Other connections with water conservation include a reduction in many of the things associated with the water treatment process, including less fuel being used in the transportation process of products, and less water and energy being used to manufacture these products.

Conservation, whether it be water, energy, or re-cycling are all connected and if everyone is willing to do their small part, then collectively everyone can make a difference and help make our community and world a better place for future generations.

Conservation, whether it be water, energy, or re-cycling are all connected...

Sustainable Development

Water efficiency measures will play an important role in sustainable development. Installation of ultra-efficient plumbing fixtures and low-water use landscapes during the construction phase is a cost-effective way to achieve water savings in commercial and residential developments. The City plans to investigate incentives to encourage sustainable development.

Foster Partnerships

Developing partnerships will be a very valuable component of the City's water conservation efforts. After all, the success of this program ultimately hinges on the partnerships the City is cultivating with

the citizens of our community to help achieve the goals set out in this plan. In addition to partnering with our individual citizens, exploring partnerships with corporate, non-profit, governmental and community organizations to help leverage awareness of water use efficiency can assist with the effectiveness of the water conservation programs. The intent is to form long-term partnerships with organizations that share common or related goals. City staff will continue to seek out and develop relationships such as those in the successful examples highlighted below.

The intent is to form long-term partnerships with organizations that share common or related goals.

Corporate

City staff worked closely with Home Depot to host a radio remote event. The event publicized the **2007 Water Drive** marketing campaign with radio advertising on KOOL 105 and utilized high visibility signage to draw attention to the water-saving devices on Home Depot's shelves. Home Depot donated a patio set and a water-efficient toilet for a drawing at the event. The goal is to organize a similar event with Home Depot or other corporate partner's annually.



Non-Profit

Since 2005, the City has partnered with the Center for Resource Conservation to provide the Landscape Irrigation Inspection program. The Landscape Irrigation Inspection program is so well received by Thornton residents that there have been waiting lists each irrigation season.

City staff is actively involved with the Colorado WaterWise Council, whose mission is to promote the efficient use of Colorado's water. The Colorado WaterWise Council provides important educational and networking opportunities for water conservation professionals throughout the State.

Government

The Environmental Protection Agency's (EPA) WaterSense program was created to provide consumers with a nationally recognized water efficiency brand for products and services. The City was eager to join the EPA WaterSense Program as a Promotional Partner in 2007 and staff actively participates in associated committees.

Thornton partners with the Cities of Northglenn and Westminster to coordinate and fund the Water Festival, an annual event designed to educate fourth and fifth grade students about water conservation and other water-related disciplines.

Community

The City has fostered relationships with the Girl Scouts and Cub Scouts of America. Girl Scout and Cub Scout groups have distributed City sponsored water conservation kits and Water Drive pledge cards in Thornton neighborhoods. Water Resources and Engineering staff coordinate to provide storm water and conservation related presentations and resources for these groups.

Water Efficiency Marketing Campaign

The City of Thornton believes that one of the keys to a successful water conservation plan hinges on the voluntary willingness of its customers to change water use habits and practices to enhance water use efficiency to higher levels. Since 2007 Thornton has carried out an award winning marketing campaign designed to show customers the benefits of using water in a more sustainable manner. The campaign is based in social science research that has shown people are more willing to implement behavioral change when barriers to change are identified and benefits of adopting change are demonstrated. Thornton wants to encourage and make it easier for its customers to voluntarily move towards more sustainable water use practices rather than seeking to achieve change solely through mandate and regulation. The marketing campaign sends a consistent message to the community about the importance of water use efficiency and is the centerpiece of the City's overall water conservation plan because it effectively markets the numerous programs and efforts being offered and pursued.

Since 2007 Thornton has carried out an award winning marketing campaign designed to show customers the benefits of using water in a more sustainable manner.





Existing System and Demands

The City of Thornton is located approximately 10 miles north of downtown Denver and is adjacent to Interstate 25. The service area is comprised mostly of single-family residential homes with a mix of multi-family dwelling units and commercial development. At the beginning of 2008 the City provided water and sewer service to an estimated 134,700 residents and also provided bulk treated water deliveries to the City of Westminster. The City's service area for the beginning of 2008 was comprised of 117,870 people residing inside the City's corporate boundaries and 16,830 people residing within the City's extended service area.

Thornton's raw water supply originates primarily from mountain snowpack in the South Platte River and Clear Creek basins. City-owned reservoirs have a combined capacity of 32,064 acre-feet. Raw water is treated at two drinking water treatment plants, the Wes Brown Water Treatment Plant (WBTP) and the Thornton Water Treatment Plant (TWTP). The newly renovated WBTP uses advanced water treatment processes including state-of-the-art ultra filtration membranes to remove suspended solids in the source water and ultraviolet (UV) disinfection technologies to provide high-quality drinking water. In addition, the City also operates the TWTP which is a conventional plant utilizing UV disinfection.


The single-family residential customer class is the largest customer class followed by multi-family residential, commercial, and irrigation accounts. Additionally, the City of Thornton also provides treated water to the City of Westminster per contract through one connection point. Residential customers are by far the largest consumer of the City's total annual treated water demand. The remaining treated water demand, in descending order by volume used, is irrigation customers, commercial customers, treated water deliveries to the City of Westminster, and non-account water. Approximately one-half of Thornton's treated water is used for landscape irrigation purposes.



Conservation Goals

The City possesses adequate water supplies to meet demand over the 20-year planning horizon used in this plan. The planning horizon identified with this plan is 2008 through 2027, although the plan will not be adopted until 2009. Notwithstanding, the City recognizes that water conservation is an essential component of the City's long-term water supply planning strategy. Through water conservation, Thornton can reduce the amount of water that the City must ultimately acquire or develop in order to meet its build-out demand. The water conservation goals were established with this in mind and are intended to benefit both the City and its customers.

New programs will be brought on-line at an aggressive pace with one new program being implemented each year through 2015. These initiatives will ultimately target all customer classes to achieve savings from all water customers. Thornton's goals look forward at 5-year, 10-year, and 20-year periods with this Water Conservation Plan to set specific acre-foot goals that the City can attain. This plan will achieve up to 900 AF of savings annually by 2012, up to 1,500 AF annually by 2017, and up to 2,800 AF annually by 2027. To put these water savings in perspective, the City can supply 2,150, 3,590 and 6,700 typical single-family residences, respectively, with these water savings.



The City possesses adequate water supplies to meet demand over the 20-year planning horizon used in this plan.

Due to the residential class being the single largest customer class within the City's water service area, the City of Thornton has set a goal of establishing its residential water use at 85 gallons per capita day (gpcd) or less, based upon a five-year rolling average, by 2016. Achieving 85 gpcd represents a 20% decrease when compared to 106.2 gpcd usage during the pre-drought year of 2001 and prior to the enactment of water use restrictions. The 2003-2007 average, which includes periods when mandatory and voluntary water restrictions were in effect, is 88.7 gpcd. The residential water use goal has been demonstrated to be achievable in Thornton during periods of water use restrictions when customers were allowed to water their landscaping no more than three times per week. During these periods water restrictions were not extreme and most customers realized their landscaping could be maintained adequately on a three-day watering schedule. The City recognizes that a simple comparison of per-capita water use from year to year will be difficult due to climate conditions and changes in the service area and population profiles. The use of a five-year rolling average to track gpcd recognizes this inherent annual volatility in water use and will help the City track its on-going water conservation progress in the residential customer class.

Other customer classes are addressed with this conservation plan; however, it will be necessary to develop additional data associated with the other customer classes to set and monitor meaningful and quantifiable goals. Examples of data that will be developed include: irrigated areas for the irrigation customer class; types of businesses, square footage of commercial space, and number of employees for the commercial customer class; and the number of multi-family units and population estimates for the multi-family customer class. Goals will be set for other customer classes as the City develops additional data to allow the establishment of quantitative water conservation goals.



Current Water Conservation Activities

The City of Thornton has had conservation measures and programs in place for many years. The following list includes Thornton's current water conservation activities.

Currently Implemented:

- Thornton Water Efficiency Marketing Campaign
- Residential Washing Machine Rebates
- Water Conservation Plan
- Public Outreach, Festivals, Presentations, etc.
- Residential Toilet Rebates
- Water Restrictions (as needed)
- City Code, includes Conservation of Water Resources (Water waste is always prohibited)
- Tiered Rate Billing Structure
- Residential Showerhead Exchanges
- Landscape Codes Incorporating Water Wise Principles
- Annual 4th & 5th Grade Water Festival
- Automatic Irrigation System Inspections
- Industrial, Commercial, & Institutional Benchmarking Workgroup
- Colorado Water Wise Council Participation
- Leak Repair on Distribution System
- Reusable Water Rights Operations
- Water Line Replacement Program



The City of Thornton estimates the City's current conservation efforts result in approximately 41 acre-feet in demand reduction each year. The demand reduction is attributed to the pipeline replacement program, toilet and clothes washer rebates, showerhead exchanges, and irrigation system inspections. The water saved by these efforts is equivalent to the annual amount of water that the City uses to supply 98 single-family residences.



Evaluation and Selection of Conservation Measures and Programs

Eighteen measures and programs were initially screened based on three criteria, and were selected for evaluation to estimate the cost and benefit of each program. The screening criteria are listed below.

- 1) **Authority of the City of Thornton to implement measure/program.**
- 2) **Ability to sustain the water savings over the long-term.**
- 3) **Ability to defer or avoid costs by implementing the measure or program.**

The measures and programs that met the initial screening criteria were then compared based on cost, water savings and net benefit. The net benefit was calculated in terms of cost of water saved over the life of the estimated water savings compared to the cost of developing future water supplies. The evaluation process showed a high net benefit of continuation of current programs. Some of the new measures and programs that were identified in the evaluation and selection process include:

- Implementation of a campaign encouraging all customers to irrigate their landscaping during the cooler times of the day. Convincing customers to avoid irrigating their landscaping during the daytime hours of 10:00 AM and 6:00 PM when higher temperatures increase evaporation rates can save significant amounts of water.
- Rebates for multi-family toilet replacements;
- Rebates for commercial urinal and toilet replacements;
- Increased rebate amounts for toilets meeting EPA WaterSense program standards;
- Rebates for weather-based evapotranspiration controllers that automatically adjust the amount of water applied to a landscape based on weather conditions;
- Free residential indoor audits.



Implementation Plan, Monitoring, Evaluation, and Revision

The new measures and programs discussed in this plan will be implemented over the next seven years. The measures and programs will be monitored and evaluated to determine water savings and costs. Implementation of the Water Conservation Plan is a long-term endeavor that will require continuous monitoring and evaluation. The City of Thornton intends to update the plan, at a minimum, every seven years as required by the Water Conservation Act of 2004.

While this plan is intended to layout the strategies that the City will pursue over the next several years to enhance water use efficiency, in order for water conservation planning to be successful the plan needs to be flexible enough to allow for modifications in strategies. As technological advancements are made and brought onto the market and as further research indicates greater promise with other focuses, this plan needs to have the ability to alter course when appropriate. As the measures and programs set out in this plan are monitored for progress it might be necessary to amend certain aspects of the plan to more effectively accomplish the City's overall goal.

Section 1: Profile of Existing Water System

This section summarizes the key characteristics of the City of Thornton's water system as it exists in 2008. Included are descriptions of the geographic area served, population, connections served, key facilities, customer water demand, water costs and pricing, a review of current policies and planning initiatives, and current water conservation activities.



1.1: Characteristics of the Existing Water Supply System

Service Area and Population

The City of Thornton water service area is approximately 35 square miles, within which the City provides water and wastewater services. The City serves an estimated population of 134,700 as of the beginning of 2008. This includes an estimated population of 117,870 with the City's corporate boundaries and 16,830 in the extended service area. In addition, the City provides 2.0 mgd of treated water to the City of Westminster. The City also provides water service to commercial, industrial, and institutional customers. The service area includes portions of unincorporated Adams County consisting of the Western Hills, Sherrelwood, Welby, Holly Crossing, and Wright Farms neighborhoods. The service area extends roughly from the Boulder Turnpike on the south to 168th Avenue on the north, from roughly Zuni Street on the west to Yosemite Street on the east. A map of the 2008 water service area is provided in Figure 1 and a map of the 2008 sanitary sewer system is provided in Figure 2.

The City serves an estimated population of 134,700 as of the beginning of 2008.

The service area includes residences, businesses, schools, parks and open space. The majority of the existing service area consists of residential development; however, commercial development has begun to increase in the area of I-25 and E-470 in the northwest portion of the service area. There are significant areas within the service area that remain undeveloped. It is estimated that the Thornton business sector provided jobs to approximately 18,856 people as of the end of 2005.


Treated Water Customers

There are 34,537 metered connections to Thornton's treated water system. All connections to the treated water system are metered. Residential customers are the single largest customer class connected to the City's treated water system. Residential customers make up 96.4% of the water connections and account for 62.7% of the City's treated water use. The second largest customer class connected to the system is irrigation customers making up 1.9% of the connections and accounts for 12.3% of the City's water use. The third largest customer is the City of Westminster which has a single connection point to Thornton's system which accounts for 9.6% of the City's water use. The fourth largest customer class is commercial making up 1.7% of the connections and 8.5% of the water use.

Treated Water Facilities

Thornton operates two water treatment plants that have a combined capacity of 70 million gallons per day (mgd). The Wes Brown Water Treatment Plant located at 3651 East 86th Avenue has a capacity of 50 mgd. The Thornton Water Treatment Plant located at 9420 Ellen Court has a capacity of 20 mgd. The service area contains approximately 521 miles of water lines that distribute treated water to

customers. Thornton shares interconnections with the treated water systems of Denver Water, City of Northglenn, and the City of Westminster. The interconnections with Denver Water and the City of Northglenn are for emergency situations. The City of Westminster is a Thornton treated water customer and the interconnection serves as the single delivery point to Westminster.



Residential customers make up 96.4% of the water connections and account for 62.7% of the City's treated water use.



1.2: Sources of Water

Surface Water Supplies

The City maintains a significant portfolio of water rights associated with its ownership of stock in several ditch and reservoir companies. The City also owns several water rights it has developed since the 1970's. The priorities of the water rights that Thornton relies upon for its water supplies range from the early 1860's to 2006. The water associated with these water rights is delivered into storage at several reservoirs owned by the City and into reservoirs where the City shares ownership with other entities. Thornton's raw water supply originates primarily in the form of melting snow high in the mountains of the South Platte River and Clear Creek basins.

Thornton has acquired and developed substantial reservoir storage capacity to store water diverted from its water rights. As of October 2008 Thornton has 36,346 acre-feet of storage capacity that is on-line within its system. A summary of Thornton reservoir storage capacity can be found in Table 1.

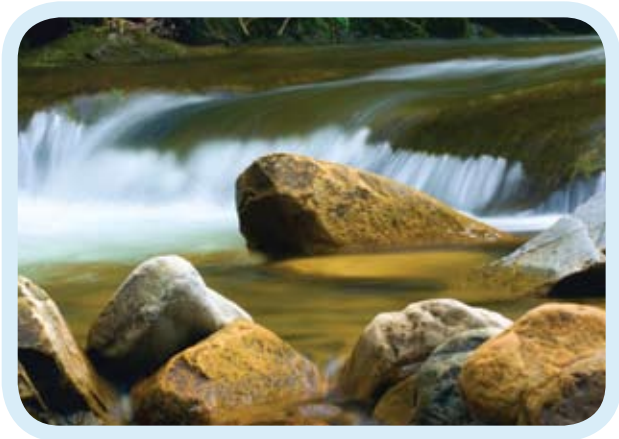
Table 1: Thornton Reservoir Storage Capacity (As of October 2008)

Reservoir	Storage Capacity (acre-feet)
Standley Lake	11,550
West Gravel Lake No. 1	503
West Gravel Lake No. 2	1,723
West Gravel Lake No. 3	614
Brannan West	360
Brannan East	528
South Tani	7,241
East Gravel Lake No. 4	2,807
South Dahlia	1,777
North Dahlia	2,568
Cooley West	4,282
Duck Lake	412
Wellington	1,981
TOTAL	36,346

East Sprat Platte Reservoir is an additional reservoir that is near completion and it will ultimately be connected to the system of reservoirs that feed the Wes Brown Water Treatment Plant. The storage capacity of East Sprat Platte Reservoir is estimated to total 1,500 acre-feet.

For Thornton's operational purposes, the Clear Creek basin is divided into upper and lower systems. Water from the upper system is delivered into storage at Standley Lake from the Church Ditch, the Farmers' High Line Canal, the Croke Canal, and the Kinnear Ditch. The water stored in Standley Lake is conveyed to the Thornton Water Treatment Plant through an eleven-mile pipeline.

Water from the lower system is delivered into storage at Brannan Lakes and at the West Gravel Lakes from the Lower Clear Creek Canal and the Colorado Agricultural Canal. The water stored in Brannan Lakes can be pumped back to the Lower Clear Creek Canal and conveyed to the West Gravel Lakes for storage. The water stored in the West Gravel Lakes is pumped to the Wes Brown Water Treatment Plant. Cooley West Reservoir is filled from tributary groundwater wells and can return water to the South Platte River to operate exchanges.



Thornton's South Platte River basin system consists of a series of reservoirs located along the Burlington Canal which store water delivered from the canal. Thornton's reservoirs that take delivery of water conveyed through the Burlington Canal are South Tani Reservoir, East Gravel Lake No. 4, South Dahlia Reservoir and North Dahlia Reservoir. These reservoirs are all connected through a series of pipes. The water stored in these reservoirs is pumped to the Wes Brown Water Treatment Plant from East Gravel Lake No. 4.

Additional components of the South Platte River basin system are Duck Lake and Wellington Reservoir, both of which are located high in the mountains. Duck Lake is on Geneva Creek and Wellington Reservoir is on Buffalo Creek. Water stored in these reservoirs is then released and conveyed down the South Platte River where Thornton recaptures it at the Burlington Canal. A map of Thornton's raw water system can be found in Figure 3.

Water stored in Standley Lake can be delivered to the West Gravel Lakes through a pipeline from the Thornton Water Treatment Plant. Water stored in East Gravel Lake No. 4 can be pumped through a pipeline to the Thornton Water Treatment Plant.

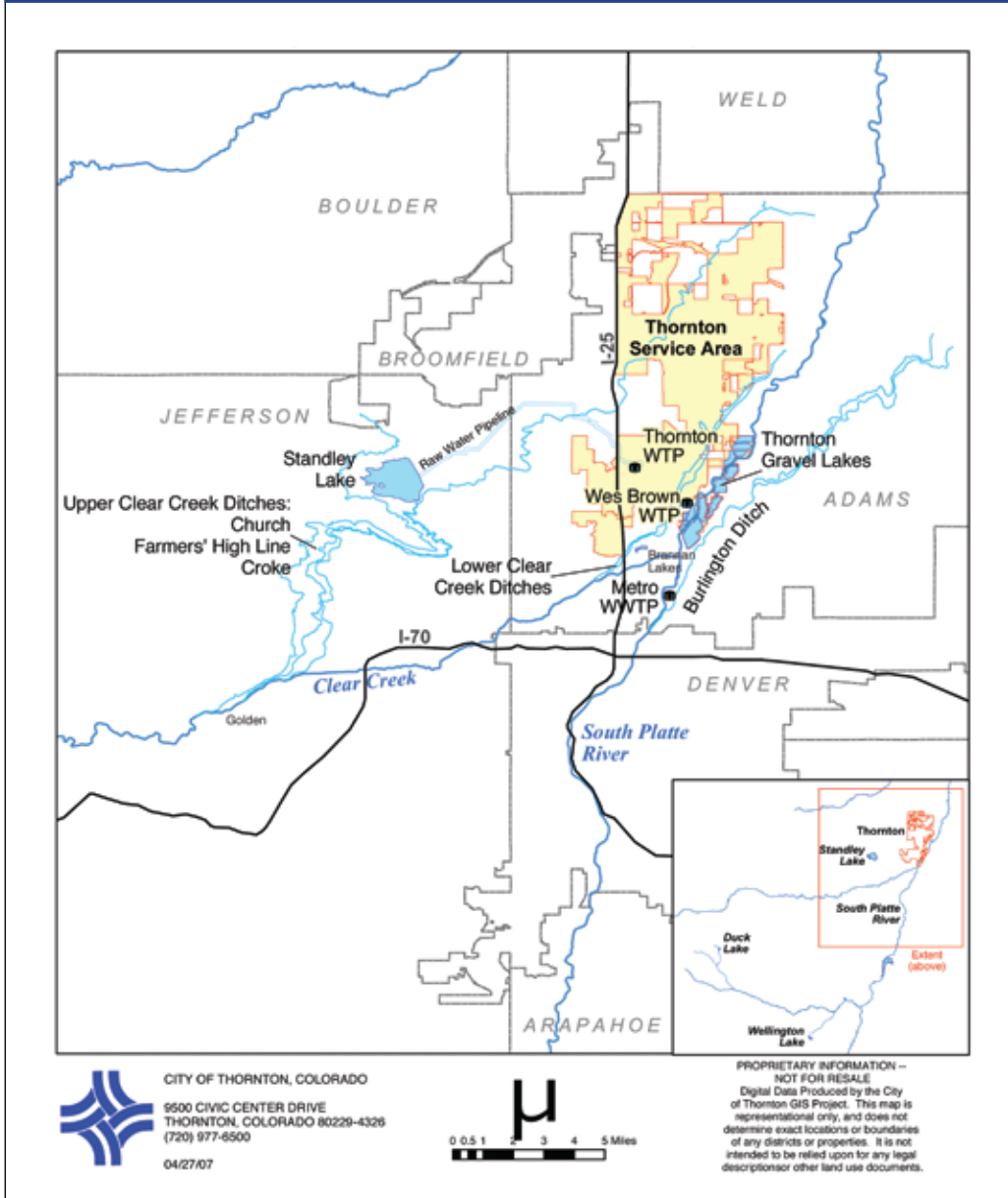
Thornton also provides the City-owned Thorncreek Golf Course with raw water delivered from Big Dry Creek.

Groundwater Supplies

Thornton has developed a series of alluvial wells adjacent to the South Platte River. There are 11 wells that pump groundwater into South Dahlia Reservoir, and one well that pumps groundwater into East Gravel Lake No. 4. There is also one horizontal well that captures high groundwater levels and conveys the water by gravity into East Gravel Lake No. 4.

Thornton has constructed six nontributary groundwater wells that supply water for park irrigation at Community Park, Grange Creek Park, and the City's sports fields at the Margaret W. Carpenter Recreation Center.

Figure 3: City of Thornton – Raw Water System





1.3: System Limitations

Designated Critical Water Supply Areas

The entire South Platte basin where Thornton's water supplies originate has been identified as a "gap" area by the Statewide Water Supply Initiative, meaning that even with all the water supply projects identified there will still be a significant shortage of regional water supplies by the year 2030. Thornton has acquired sufficient water supplies to meet anticipated demands beyond the year 2030; however, the City still needs to construct the infrastructure to deliver the water to Thornton. The City will continue its water supply development efforts in order to meet future demands beyond 2030.

Shortages and Supply Emergencies

At the onset of the severe drought experienced throughout the State in 2002, Thornton followed the steps and options outlined in its Drought Management Plan to efficiently and wisely manage its water supplies. A mix of voluntary and mandatory water restrictions were enacted between 2003 and 2006 to ensure an adequate amount of water remains in storage to meet the critical needs of the City in subsequent years. During the period when water restrictions were in effect Thornton water customers responded well and reduced their water usage thereby avoiding the need to enact a stricter program. Thornton also implemented a new landscape code that emphasized water wise landscaping principles. The City also successfully secured the use of additional short-term water supplies through various cooperative arrangements.

Unaccounted For and Lost Water

The City follows procedures outlined by the American Water Works Association to monitor distribution system water loss. Distribution system loss is a measure of the percentage of produced water that fails to reach customers and cannot otherwise be accounted for though authorized usage. System loss under 10% is generally considered acceptable. Thornton's system loss has historically averaged approximately 5%. The system loss in 2007 was approximately 9.5%. Due to an increasing trend in water line breaks being experienced primarily in the older sections of Thornton distribution system, the City has developed a Maintenance Improvement Program (MIP) that will be implemented on an annual basis to replace pipelines. Under the MIP the City expects to replace approximately 2,400 linear feet of old pipe each year.

Population Growth

The 2000 United States Census estimated Thornton's population to be 82,384 and as of the beginning of 2008 Thornton estimates the City's population to be 117,870. The City estimates that its extended service area population is 16,830. The rate of growth in Thornton, as shown in Table 2, has slowed during the period 2002 through 2007.

Table 2: Yearly Rate of Growth 2002 through 2007

Year	Growth Rate
2002	5.00%
2003	4.30%
2004	3.80%
2005	3.50%
2006	2.60%
2007	0.60%

Source: City of Thornton, Community Development Department

The population projections used in this plan are based on the projections used in the City's Long Range Water Plan. The current extended service area is essentially fully developed and the City expects the population in these areas to remain relatively constant through 2027. The City's anticipated water service area population, including areas outside the City's corporate boundaries, is projected to be 167,354 in 2027.



1.4: Water Costs and Pricing

Thornton utilizes an increasing tiered rate structure (a.k.a. increasing block rate structure) that was implemented in May 2003 to help promote efficient water use. The tiered rate structure is designed to encourage and reward water conservation efforts, particularly regarding outdoor irrigation, while discouraging misuse of the City's water supply. The tiered rate structure recognizes that customers come in different sizes and that indoor water usage varies from home to home and business to business.

Thornton's increasing tiered rate structure charges an increased unit price for water as the volume of water consumed increases. Customers who use low or average volumes of water are charged a more modest unit price and rewarded for conservation; those using significantly higher volumes of water pay higher unit prices. There is also a standard customer monthly service charge applied to

The tiered rate structure is designed to encourage and reward water conservation efforts, particularly regarding outdoor irrigation, while discouraging misuse of the City's water supply.

all customer classes, regardless of the amount of water consumed. This tiered rate structure sets an indoor monthly allocation called the Average Winter Consumption (AWC) and it is based on the customer's average monthly usage for the previous November through February. All water usage above the indoor allocation is attributed to outdoor use. Irrigation customers are charged based on this tiered rate structure; however, the AWC is not applicable to irrigation customers, their outdoor watering allocation is based on customer classification and meter size. A complete listing for 2008 Thornton water rates and charges can be found in Appendix C, Ordinance 3084. Table 3 provides a summary of Thornton's current rate structure for domestic customers residing inside the City's corporate boundaries.

Table 3: 2008 Tiered Rate Structure Summary for Domestic Inside the City Quantity Charges

Tier	Charge	Explanation
N/A	\$2.61	Cost of monthly service charge, regardless of the amount of water consumed by the customer.
1	\$3.28	Cost per 1,000 gallons for customer's AWC = average monthly usage for the previous November through February.
2	\$3.28	Cost per 1,000 gallons for customer's Outdoor Allocation: up to 21,000 gallons per month over AWC.
3	\$4.92	Cost per 1,000 gallons over the combined total of customer's AWC + the outdoor allocation of 21,000 gallons per month.
4	\$9.84	Cost per 1,000 gallons when usage goes over the AWC + 42,000 gallons per month (double the outdoor allocation of 21,000 gallons).



1.5: Review of Current Planning Initiatives

In 2006 the City of Thornton initiated the process of updating the Comprehensive Plan and it was adopted by City Council on September 11, 2007. Thornton's Comprehensive Plan provides a broad overview of how the City will grow and where future development and redevelopment will occur. The updated Comprehensive Plan examined a wide range of issues related to future land uses, character of development, transportation systems, utility systems, and social and economic dynamics. The Comprehensive Plan provides strategic direction for the future of the City and projections to the year 2030.

A major planning effort recently completed by the City of Thornton is the development of the Long Range Water Plan. This study was performed to determine the City's water and wastewater utility needs through build-out, currently anticipated to be in approximately 2065. The study identified annual treated and raw water demands through build-out. In order to plan for the future costs associated with developing the City's raw water, treated water, and wastewater systems, City staff developed an itemized list of capital projects and operations and maintenance items necessary to accommodate Thornton's anticipated growth over the next sixty years. These projects include new raw water storage facilities, upgrades to existing water treatment plants, installation of new pipelines, replacement of existing pipelines, and non-potable irrigation projects, as well as new facilities, staffing requirements, fuel costs, and vehicle needs. The information developed in this study was utilized in the development of this updated Water Conservation Plan.

Thornton is actively pursuing development of additional raw water storage reservoirs. A large component of the development of additional raw water storage reservoirs involves the recapture of Thornton's reusable water supplies that will be used to effectuate water rights exchanges that will provide additional yield to the City's raw water system. These efforts will reduce the amount of water that the City would ultimately need to acquire or develop in order to meet demand at build-out.

The City owns a significant block of water that was purchased in the 1980's in Larimer and Weld counties. This water is a portion of the City's future water supply. Thornton is actively pursuing the most economical means available to transport and deliver this existing water supply to the City.

1.6: Summary of Current Water Conservation Activities

City Code

Major policies that are designed to affect water use under normal conditions include provisions of the City Code. The landscape code was revised in 2003 to incorporate additional water-wise landscaping principals associated with new development. The Conservation of Water Resources section of the City Code prohibits water waste. Additionally, the City's tiered water rate structure is designed to encourage wise water use.

Water Efficiency Marketing Campaign/Public Outreach

Current public outreach efforts also involve a Water Efficiency Marketing Campaign. The campaign debuted the spring of 2007 and focused on encouraging the enhancement of voluntary wise water use practices throughout the community. It is the City's desire to display to the community that the City is an advocate of wise water use because it is the right thing do for our community and environment. The City wishes to become less of a regulator on this issue by encouraging voluntary change for the benefit of the entire community. The City is also involved with efforts to implement a similar campaign on a statewide basis through the cooperation of other similarly focused entities.

In support of the City's goal of instilling a water conservation ethic throughout the community, public outreach efforts are pursued as a component of the overall water conservation strategy. The City regularly provides information to the public to increase community support for wise water use practices and programs. Thornton undertakes these efforts to help create an increased recognition throughout the community of the value of water and its role in our community and society. Information about water saving practices and programs are disseminated to the community through a wide host of avenues including: use of the City's "Inside Thornton" magazine; the City's government access KTV Cable Channel 8; the City's internet web page; press releases; bus shelter advertisements; mass mailings to customers; mailings to specifically targeted customers; placement of flyers and brochures in public areas of City buildings; and purchasing advertising space in the local "Sentinel" and "Thornton Frontier" newspapers.



The City also takes advantage of opportunities to reach out to the public by maintaining a presence at City sponsored festivals that large numbers of citizens attend each year. The City's annual Thorntonfest and Harvest Fest events are opportunities to promote the City's water conservation programs and educate citizens. At each festival the City provides water conservation related information and items such as water efficient fixtures, low-flow faucet aerators, long lasting toilet flappers, rain gauges, Xeriscape booklets, etc. Water conservation program information is also distributed at these events. Staff is available at these events to answer questions.

Irrigation System Inspections

The City has offered free irrigation system inspections to customers with automatic sprinkler systems each summer since 2005. Significant quantities of water savings can be achieved with the efficient operation of automatic sprinkler systems. Customers utilizing automatic sprinkler systems can tend to have a "set it and forget it" mode of operation. Irrigation controllers get set permanently for the amount of water a landscape requires during the hottest part of the summer and end up using more water than necessary during months when the weather isn't as hot and dry. Thornton's free irrigation system inspection program provides customers with information about the uniformity of water distributed by their automatic sprinkler system and the water pressure of their system. Customers also receive information about their soil type, root depth of their lawn, improvements that can be made to their system, and a customized watering schedule developed for their landscape.



Clothes Washing Machine Rebates

Thornton has offered a high efficiency clothes washing machine rebate program since 2003. The City provides a \$125 rebate in the form of a credit on the customer's water bill for purchasing a new qualifying front load water-efficient washing machine. Through this popular program Thornton customers have purchased 2,740 front load clothes washing machines during the period May 2003 through December 2008.

Toilet Rebates

Since 2003 the City has also offered water customers the opportunity to receive a \$100 rebate for replacing water-wasting toilets with a 3.5 gallon per flush (gpf) or greater with a new water conserving 1.6 gpf toilet. Thornton customers have installed 1,374 water efficient toilets during the period May 2003 through December 2008.

Showerhead Exchanges

Thornton has offered water customers an opportunity to exchange old water-wasting showerheads for new water conserving showerheads since May 2003. Customers are required to remove their old water-wasting showerheads and exchange them for new water efficient showerheads (2.0 gallons per minute). There is no cost to the customer. By requiring customers to bring in their old showerheads the City can be confident that nearly all the new showerheads distributed will be installed.

A maximum of two showerheads per household may be exchanged. During the period May 2003 through December 2008 Thornton water customers have exchanged 1,121 showerheads.

WaterSense



In 2007, the City partnered with the EPA on their WaterSense program. The mission of the program is to protect the future of our nation's water supply by promoting and enhancing the market for water-efficient products and services. Through this program products will be labeled with a WaterSense logo to enable consumers to identify water efficient fixtures and services. In order for products and services to qualify for a WaterSense label they must be

independently certified by a licensed certification body to confirm that the products and services meet EPA criteria for efficiency and performance. By choosing products and services labeled through the WaterSense program, consumers will know that they will be saving water for future generations.

Through WaterSense, EPA is creating a nationwide ethic of water efficiency—a symbol that represents the importance of protecting water resources in the United States. WaterSense is partnering with manufacturers, retailers and distributors, promotional partners, and other organizations to help make water-efficient products and practices commonplace. Participation in this program will strengthen the City's water efficiency outreach efforts with a credible, national brand and a strong, consistent message. This program will also reduce staff time spent on product research and increase confidence in promoting water-efficient products that meet or exceed WaterSense specifications.

School Education

The City of Thornton has partnered with the cities of Northglenn and Westminster each year since 2004 to conduct an annual Water Festival for local 4th and 5th grade students in each of the cities. The Water Festival offers local students a day of fun educational workshops. This event is attended by approximately 1,000 students each year and provides active learning and hands-on applications, teaching students about water conservation, water chemistry, the water cycle, local watersheds, water treatment, Colorado water law, aquatic wildlife, and ecology. Over 40 professional volunteers from local, state, federal, non-profit, and private organizations donate their time and expertise to present water related topics to students.

Presenters from well known organizations, such as WB2 News, Ocean Journey, Denver Zoo, Butterfly Pavilion, Colorado Division of Wildlife, Colorado Foundation for Agriculture, and Metro Wastewater Reclamation District have volunteered for previous Water Festivals. Some presenters, such as The National Theatre for Children and the University of Colorado Science Discovery Program are hired to entertain and educate students.



The City of Thornton understands the need to provide water resource education to youth and take advantage of the opportunity to instill a wise water-use ethic which will benefit the community over the long-term. Because the three cities share Standley Lake as a water supply it makes sense to combine resources on this large educational effort. The goal is to convey an ongoing message of the value of water in nature and society in order to preserve water resources for future generations. The Water Festival immerses a large number of youth with this message each year. This helps students learn about the importance of water in their lives and become empowered with ideas on how to use water responsibly. The Water Festival supports this mission by bringing real-world science to area students in a memorable event.

The City provides staff for presentations on water conservation and other water related topics if requested by local teachers. Education Brochures that list City resources are mailed to Thornton schools each year. The availability of these resources is posted on the City's web site to inform the public.

Annual Water Line Replacement Program

The City has analyzed water line breaks and repairs within the distribution system. This analysis identified areas, primarily in the oldest part of the system that showed an increasing trend in the number of breaks. As a result of the analysis the City developed a strategy for replacing approximately 2,400 linear feet of pipe each year to reduce the number of breaks and leaks in the distribution system.

Participation in Professional Organizations

Participation in water conservation and educational organizations offer the City opportunities to become involved with local, regional, and statewide water conservation efforts that benefit the City and community.

Colorado Water Wise Council (CWWC)

Staff participates on the CWWC which is a non-profit organization of water conservation professionals representing water utilities, business interests, and water conservation advocates. The goal of the CWWC is to promote the efficient use of Colorado's water. CWWC provides a forum for water conservation program

development, information exchange and training. CWWC partnered with the Metro Mayors Caucus to draft Water Conservation Best Management Practices in which Thornton was actively involved. The City of Thornton has one staff member on the CWWC Board who also participates with CWWC committees. Additionally, two of Thornton's staff attended and completed "Conservation Training for Water Professionals" provided by CWWC.

Industrial, Commercial and Institutional (ICI) Water Conservation Workgroup

Since 2005 Thornton has participated with several Front Range water providers focused on water conservation in the ICI sector. The efforts of this workgroup involve development of benchmark studies of the ICI sector in order to assist with development of effective water conservation strategies that can be focused on this sector. This work has been performed with the support of two Pollution Prevention Advisory Board grants. This is a collaborative effort amongst Thornton, Aurora, Boulder, Denver Water, Fort Collins, Greeley, Longmont, Loveland, Westminster, Northern Colorado Water Conservancy District, South Adams County Water and Sanitation District, and the Town of Superior.

Colorado Foundation for Water Education (CFWE)

The City of Thornton is a member of the CFWE that was created in 2002. Participation and membership in this organization allows the City to increase its level of knowledge about water education activities and strategies throughout the State. CFWE is a statewide non-profit, non-advocacy organization providing water resource information and education. Membership includes a subscription to Headwaters quarterly magazine, which features interviews, legal updates, and in-depth articles on fundamental water resource topics.

Section 2: Water Use & Forecast Demand

This section describes current water use and estimated future water demands. The information in this section relied largely on the Long Range Water Plan study conducted by City of Thornton staff.



2.1: Current Water Use

Current water use in Thornton is based on different factors including population and customer class. Customer demand can be influenced significantly by climate conditions and rate charges. Depending on whether irrigation season temperatures and precipitation are hotter and dryer or cooler and wetter has a significant influence on customer water demands. This section discusses Thornton water use by customer class.

Thornton provides potable and nonpotable water. Potable water is water that has been treated, to meet or exceed Safe Drinking Water Act standards, by the City's water treatment plants before being sent out to homes and businesses. In Thornton's system, nonpotable water is raw water that has not been treated and this water is used only for irrigation purposes.

Customer Class

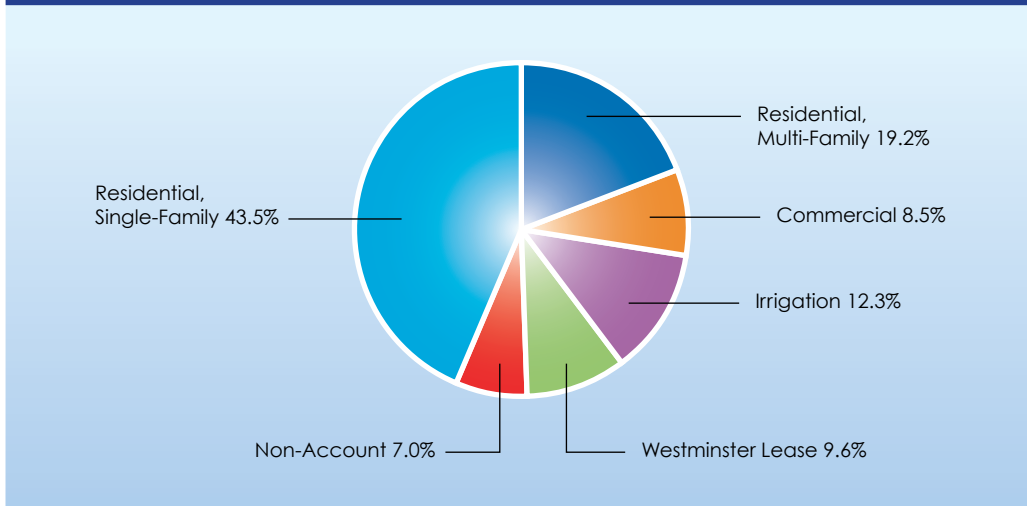
Water requirements for Thornton's service area depend upon both the size of the area served as well as how the land is used. Customer classes have been grouped to correspond with the water requirements of the land uses served. Customer classes include:

- **Single-Family Residential.** Low-, medium-, and high-density residential, residential estates, and rural areas.
- **Multi-Family and Mobile Home.** High-density residential development and a portion of mixed-use categories.
- **Irrigation.** Parks, Home Owner Association common areas, medians, and other landscaped areas in large commercial developments.
- **City of Westminster.** Treated water delivered to the City of Westminster.
- **Industrial/Commercial/Institutional.** All other uses.

Treated Water Demands by Customer Class

Figure 4 below shows the amount of water delivered to each customer class in 2005. This particular year was chosen for analysis since it was considered a relatively average year in precipitation and water use. Thornton was not under mandatory water restrictions in 2005, although voluntary water restrictions were in effect. The year 2005 percent of water deliveries by customer class were not significantly different from those shown in the City's 2001 Water Conservation Plan approved by the Colorado Water Conservation Board.

Figure 4: Summary of 2005 – Percent of Water Deliveries by Customer Class



Single-Family Demands

Single-family residences use more water than any other customer class in Thornton's service area. In 2005, single-family accounts received 43.5% of the total metered deliveries by Thornton. The annual water consumption for the single-family class in 2005 was 9,086 acre-feet.

Multi-Family and Mobile Home Demands

The City's water billing database combines water deliveries to multi-family residences and mobile homes. Water use patterns for these two types of water customers appear to be similar. This group of customers is second to single-family residences in terms of overall annual water use. In 2005, multi-family and mobile homes received 19.2% of the total metered deliveries by Thornton. The annual water consumption for the multi-family and mobile home class in 2005 was 4,006 acre-feet.

Irrigation Account Demands

Irrigation accounts deliver water only to large irrigation systems for multi-family common spaces, city parks, medians, and commercial irrigated areas. In 2005, irrigation accounts received 12.3% of the total metered water deliveries by Thornton. The annual water

consumption for the irrigation class in 2005 was 2,575 acre-feet. All irrigation water is delivered seasonally, from April to October.

City of Westminster Demand

Water is delivered to the City of Westminster under the terms of a supply contract. Thornton typically supplies Westminster with approximately 1.8 million gallons of water per day. Westminster used 1,997 acre-feet of treated water in 2005 totaling 9.6% of Thornton's total metered deliveries. A provision in the lease allows for restricted deliveries to Westminster if rationing is imposed on Thornton's customers. Restricted deliveries are required to be in the same proportion as restrictions imposed within Thornton.

Industrial, Commercial & Institutional Demands

The ICI category comprises a diverse group of customers. Office buildings, hotels, schools, retail stores, restaurants, car washes and manufacturing facilities all fall within its limits. ICI accounts received 8.5% of the total metered deliveries by Thornton in 2005. The annual water consumption for the ICI class in 2005 was 1,779 acre-feet.

Non-Account Water

Thornton's non-account water totaled 7.0% in 2005. The annual non-account water for 2005 totaled 1,458 acre-feet. Non-account water includes system losses due to leaks, fire hydrant flushing, and disinfection of new water lines. This is a measure of the percentage of produced water that fails to reach customers and cannot otherwise be accounted for through authorized usage. System loss under 10% is generally considered acceptable by the American Water Works Association.

Nonpotable Demands

Thornton provides nonpotable water to the City's Thorncreek Golf Course and select parks. Thorncreek Golf Course is provided with nonpotable water diverted from Big Dry Creek. In 2006 the irrigation system at Civic Center Park was taken off the potable water system to allow the park to be irrigated with water stored in Croke Lake. This lake is filled with water diverted from Clear Creek. The nonpotable water demand totaled 250 acre-feet in 2005.

The City provides nonpotable water delivered from the Lower Clear Creek Ditch to a nursery and landscape business owned by Urban Farmer. The water is used to irrigate the company's nursery stock. The nonpotable water demand by Urban Farmer totaled 11.4 acre-feet in 2005.

As of 2006 the City started using nontributary groundwater to irrigate Community Park and Grange Creek Park. There are two wells at Community Park and one well at Grange Creek Park. In 2007 the City began irrigating Cherry Park with nonpotable surface water. In 2008 the City began irrigating Woodglenn/Brookshire Park and the Multi-Purpose Fields at the Margaret W. Carpenter Recreation Center.

Seasonality of Water Use

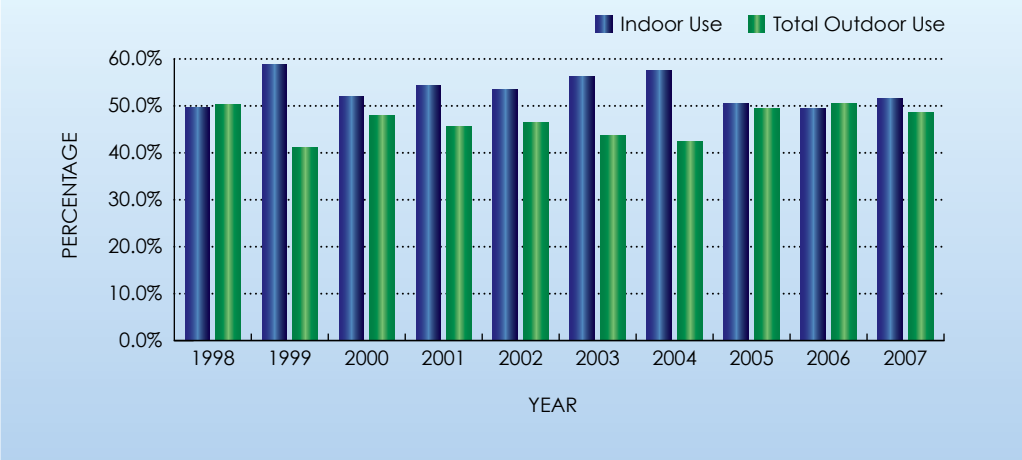
Water demand varies with the seasons and is influenced by climate conditions. The landscape irrigation season is generally May through October; however, during the recent drought years Thornton experienced significant increases in April demands. This was attributed to warmer winters with less than average precipitation that prompted customers to begin watering their landscaping earlier than normal.

Indoor and Outdoor Water Use

During 2005, as a percentage of total water treatment plant production, indoor water use was estimated to be 50.6% and outdoor water use was estimated to be 49.4%. The City of Westminster treated water deliveries are not included in this estimate. This estimate was developed by using the assumption that water use during the months of December through February is used indoors; thereby, providing a reasonable estimate of monthly indoor use. The indoor use was then subtracted from the total annual volume of water produced by the City's water treatment plants to estimate outdoor water use. Figure 5 shows estimated percentage of indoor and outdoor water use, treated water deliveries to the City of Westminster are excluded.

Figure 5: Estimated Percentage of Indoor/Outdoor Water Use 1998 - 2007

(Westminster Deliveries Not Included)



Trends in Water Use

The current trends in percent of total water use by customer class are not expected to shift significantly over the study period, 2008 through 2027, used in this report. In terms of the overall water demand pattern, the most significant change that is expected is with the deliveries to the City of Westminster. As annual water demands increase due to development within Thornton's water service area the fixed contract delivery rate to Westminster will remain constant, thus, reducing Westminster's percentage compared to the overall annual water demand. Figures 6 and 7 depict Thornton's daily per capita demands for the period 2002 through 2007.



2.2: Forecasting Method

Future water demands were estimated using Worksheet 2-1 (Appendix C). Water use from 2005 was used as the baseline year for future demand projections. As mentioned previously, this particular year was chosen for analysis since it was considered a relatively average year in precipitation and water use. Thornton was not under mandatory water restrictions in 2005, although voluntary water restrictions were in effect. Using 2005 as the base year for future water demand projections inherently includes active conservation measures that were in place at the time, including drought awareness campaigns and incentive based programs offered by the City.



2.3: Demand Forecast

Using the methodology shown in Worksheet 2-1 (Appendix C) along with population estimates used in the Long Range Water Plan, 2005 water use was broken down by customer class to calculate an annual per capita water use value. These per capita water use values were then applied to the population projections to develop baseline demand forecasts for 5-, 10-, and 20-year horizons. The preliminary treated water baseline demand forecast indicates 27,912 acre-feet of water will be needed to meet customer demand in 2027. Adding a 10% safety factor puts the 2027 treated water demand at 30,703 acre-feet. It is important to note that this baseline treated water demand forecast does not include Thornton's raw water system demands. The baseline demand forecasts have not included adjustments for future water conservation activities contemplated by this plan. Figures 6 and 7 show estimates of the residential sector per capita day demands and the combined per capita day demands of the residential, commercial, and irrigation classes.

Figure 6: Daily Per Capita Demand – Residential

(Includes Single Family & Multi-Family – Mobile Homes Excluded)

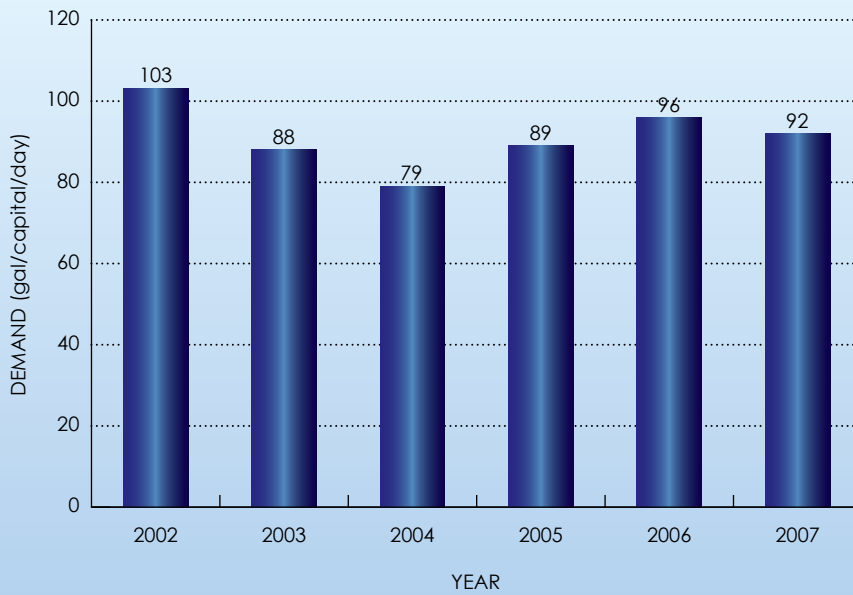
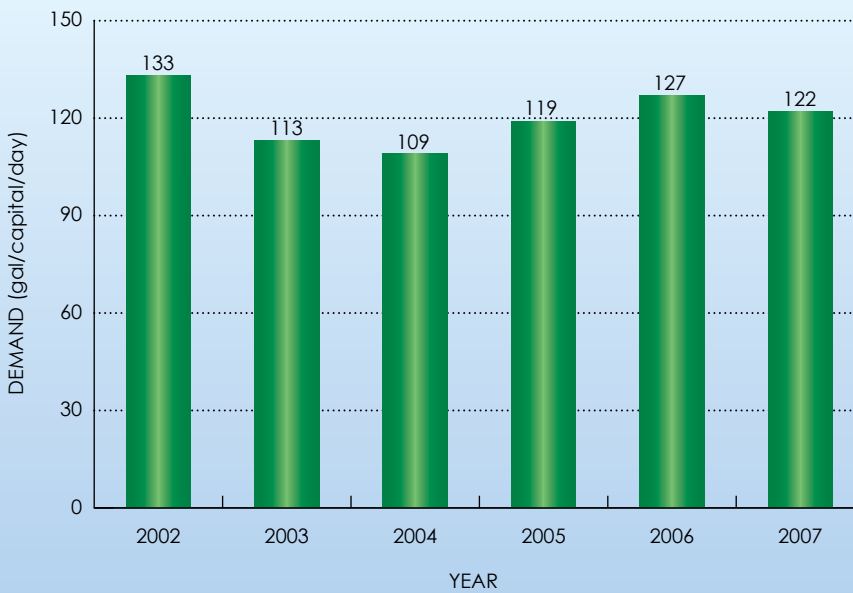
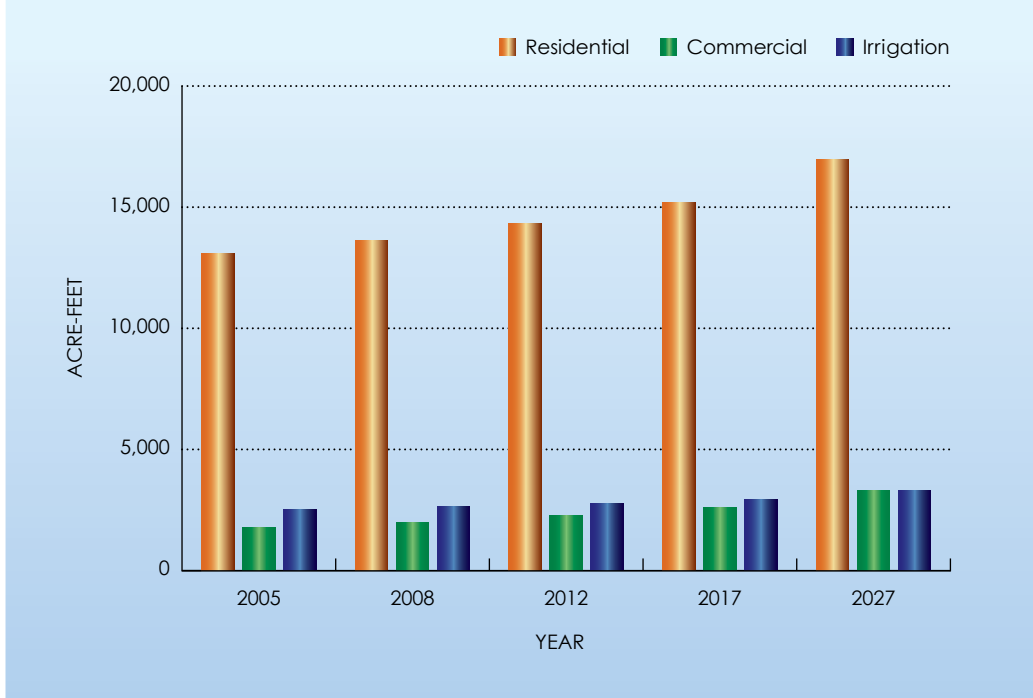


Figure 7: Daily Per Capita Demand – Residential, Commercial & Irrigation



The residential sector will continue to be the single largest group of water users in Thornton with a projected annual demand of 16,967 acre-feet in 2027. The 2027 annual demands for the ICI and irrigation sectors are projected to be 3,301 acre-feet and 3,294 acre-feet respectively. These projections do not include a safety factor. Figure 8 shows Thornton's preliminary demand forecast for the residential, commercial and irrigation classes.

Figure 8: Preliminary Demand Forecasts – Residential, ICI & Irrigation



Section 3: Proposed Facilities

Section 3 describes the improvements planned for Thornton's system and the anticipated costs associated with the improvements. As previously discussed, the information in this section relies largely on the Long Range Water Plan (LRWP) developed by City of Thornton staff. The proposed facility needs are limited to those improvements identified by the LRWP over the 20-year planning horizon used for this Water Conservation Plan.



3.1: Potential Facility Needs

In order to plan for the future costs associated with developing the City's raw water, treated water, and wastewater systems, City staff developed an itemized list of capital projects and operations and maintenance items necessary to accommodate Thornton's projected growth over the next 20 years. These projects include new raw water storage facilities, upgrades to existing water treatment plants, installation of new pipelines, replacement of existing pipelines, and non-potable irrigation projects, as well as new facilities, staffing requirements, fuel costs, and vehicle needs. A general summary of the projected costs associated with these potential facilities have been categorized by type of system project and are shown at the end of Section 3.1 in Table 4. The major projects and facility improvements forecasted through 2027 are identified below.

Northern Project Water Deliveries

Delivery methods for the water associated with the Thornton Northern Project (Northern Project) are being investigated as of the writing of this Water Conservation Plan. The Northern Project involves a substantial block of water that the City of Thornton acquired for future water supplies. The water is derived from Thornton's share ownership in the Water Supply and Storage Company which currently supplies water to agricultural interests located in Larimer and Weld Counties. Possible methods for delivering the Northern Project water include by exchange or by pipeline. For the purposes of this Plan, costs associated with delivering the water by exchange have been used. Costs include design, permitting and construction of recharge and return flow facilities, and ditch improvements to ensure continued delivery to non-Thornton Water Supply and Storage Company shareholders.

Water Share Acquisition

Additional local senior water rights on Upper and Lower Clear Creek will be pursued when available to increase the drought reliability of the City's Clear Creek water supply system. Additional shares in South Platte ditch companies will also be pursued to provide additional yield to Thornton's system, and act as a buffer to address changing river conditions (more reuse of water by Denver and others) or administration (no more out of priority storage in off-stream reservoirs) that might impact the amount of water available to Thornton's system.

Raw Water Storage

There are several projects underway or planned that will increase the City's raw water storage capacity. The City's storage projects are intended to meet one of the following functions:

- 1) operational storage that can supply water directly to the treatment plants;
- 2) storage that is used for regulation and exchange of reusable effluent; or
- 3) storage that is needed to operate the Northern Project by exchange. Costs for facilities to move raw water into and out of gravel pit storage are included with the gravel pit storage project costs.

Raw Water Transmission Facilities

Additional facilities to move raw water from one location to another are needed to effectively operate the raw water system. Raw water transmission projects include the Cooley West Raw Water Return Line project that consists of a pump station and pipeline to move water from Cooley West to Tani #4 or the WBTP, and development of a pipeline and associated facilities to operate a ditch exchange with the Burlington Ditch.

Water Quality and Treatment Facilities

Due to declining water quality in the form of increased nitrate levels in the South Platte River supply as well as the Lower Clear Creek supply, biological pretreatment will be constructed at the East Gravel Lakes. Biological pretreatment will serve as a mechanism to remove excess nitrates from the raw water supplied from these two sources prior to treatment at the WBTP.

The TWTP currently treats raw water using conventional treatment methods. Due to the age of the TWTP, several upgrades will be required between now and 2027. These upgrades include the chlorine system replacement, chemical system replacement, filter rehabilitation, Supervisory Control and Data Acquisition system upgrade, and chemical feed equipment replacement.

The WBTP recently underwent an expansion that increased the capacity of the plant from 30 mgd of conventional treatment to 50 mgd using ultra filtration treatment technology. No additional expansions are planned for this facility; however, it is anticipated that the existing chemical storage tanks and membranes will need to be replaced every ten years based on the manufacturer's recommendations.

Treatment plant operations and maintenance (O&M) costs include chemicals and power required to deliver the treated water from the plant and throughout the distribution system. The Long Range Water Plan depicts the incremental increase in treatment costs starting in 2006.

Waterline Over-Sizing

All future treated water distribution pipelines greater than 16-inches in diameter were identified based on the projected build-out of the extended service area. For the purposes of this study it was assumed that developers would be responsible for installing all pipelines and be reimbursed by Thornton for the difference in costs of installing any pipelines greater than 16-inch diameter.

Treated Water Storage Tanks

The following new treated water storage tanks will be required due to increased demand, and emergency and fire flow needs:

- 1) Zone 1, 5 million gallon storage tank was constructed in 2007 and has been placed into service.
- 2) Zone 1, 5 million gallon storage tank to be constructed in 2024.

Treated Water Pipeline Replacement Program

The pipeline replacement program will focus on asbestos cement (AC) and cast iron (CI) pipe. AC and CI pipe are typically the oldest pipelines in the distribution system and have contributed to the majority of the pipeline breaks occurring over the past ten years. The criteria for the pipeline replacement program was developed to minimize the overall costs required to replace aging AC and CI pipe in the distribution system while also ensuring reliable service and minimizing the costs associated with emergency repairs. For 2006 through 2020, replacement criteria has been developed which prioritizes the pipes needing repairs and ensures that pipes in fair condition are not needlessly replaced.

Standley Lake Pipeline Replacement

Thornton and the City of Northglenn share approximately 40,000 lineal feet of a 48-inch diameter pipeline that conveys water from Standley Lake to each of the cities. Costs have been estimated for the replacement of Thornton's portion of the pipeline. Thornton is the sole owner of the 36-inch diameter pipeline extending approximately 21,100 lineal feet from the bifurcation at the 48-inch pipeline to the Thornton Water Treatment Plant. The replacement costs in the plan assume that portions of the pipeline will be replaced from 2020 through 2022 for the 48-inch section of the pipeline.



Non-potable Irrigation Analysis for Future Parks

Community Services provided a list of proposed park sites planned over the next 20 years. It might be feasible to implement additional non-potable irrigation systems by utilizing existing raw water conveyance facilities already in place throughout the City. The parks identified include the following:

- 1) 136th Avenue and Holly Street Sports Complex - 50 acre multi-purpose fields at the southwest corner;
- 2) Baseball Complex at Aylor property near 136th Avenue and Quebec Street - roughly the same size as the Thornton Sports Complex at 104th Avenue and McKay Road;
- 3) Additional Multi-purpose field space - roughly 20 acres;
- 4) Baseball/Softball Complex - location not determined; likely to be sized similar to Thornton Sports Complex at 104th Avenue and McKay Road;
- 5) Community Level Park - location and amenities not yet determined;
- 6) Additional Multi-purpose field space - roughly 20 acres; site not determined.

Sewer Fund Capital Projects

The capital projects identified in the sewer fund portion of the LRWP study include all facilities and upgrades that will be required to support a build-out extended service area. The major facilities include the Big Dry Creek parallel interceptor and the Big Dry Creek lift station replacement.

Yearly capital improvement projects include the Wastewater O&M projects which consists of the rehabilitation and/or replacement of deteriorating 50 year old sanitary sewer lines on a priority basis. This is a maintenance project to rehabilitate concrete sewer mains throughout the system, but primarily in Original Thornton and the Western Hills Subdivision. The Wastewater O&M project also consists of rehabilitating deteriorated concrete manholes with a spray-on concrete lining application and then finishing each manhole with a waterproofing epoxy coating.

Operations and Maintenance Costs

Operations and maintenance costs were determined and itemized by year based on equipment and staffing needs, fuel costs, and vehicles. The items identified in the operations and maintenance needs include only additional items required based on the expected population growth and the associated growth of the utilities system.

Table 4: City of Thornton Summary of System Improvements/O&M Necessary to Meet Demand

Category	2008-2012 Total	2013-2017 Total	2018-2027 Total	2008-2027 Total
Source of Supply	\$100,752,944	\$34,353,600	\$86,746,000	\$221,852,544
Water Treatment Facilities	\$10,400,000	\$8,580,000	\$4,500,000	\$23,480,000
Treated Water Storage	\$0	\$0	\$6,010,000	\$6,010,000
Major Transmission Lines	\$22,446,000	\$9,851,000	\$17,229,000	\$49,526,000
Wastewater System	\$3,861,000	\$2,800,000	\$750,000	\$7,411,000
Water System Facilities	\$1,073,750	\$0	\$798,000	\$1,871,750
Wastewater System Facilities	\$773,100	\$0	\$400,000	\$1,173,100
Water System Operations & Maintenance	\$4,587,586	\$8,161,041	\$24,223,120	\$36,971,748
Wastewater System Operations & Maintenance	\$721,890	\$1,701,852	\$3,037,147	\$5,460,889
Grand Total	\$144,616,270	\$65,447,493	\$143,693,267	\$353,757,030



3.2: Incremental Cost Analysis

An incremental cost analysis was performed to estimate the cost of each additional gallon of new capacity associated with the anticipated water supply facilities and wastewater facilities necessary by 2027 to accommodate the City's projected demands. Worksheet 3-2 (Appendix C) was used to develop the estimates for the incremental cost analysis. Incremental costs were separated into six categories: source of supply, water treatment facilities, treated water storage, major transmission lines, water purchases, and wastewater facilities. These six categories include anticipated projects such as:

- Source of supply projects include costs for raw water operational facilities such as pipelines and pump stations, reservoirs, and canal conveyance improvements.
- Water treatment facilities include chemical storage tanks, biological pre-treatment processes, and ultra-violet treatment equipment.
- Treated water storage facilities include treated water storage tanks throughout the service area.
- Major transmission lines include waterlines for the treated water system, booster pump stations, and nonpotable systems.
- Water purchases include costs for water rights acquisitions, water rights transfers and water rights protection.
- Wastewater facilities include lift station improvements and sanitary sewer lines.

The estimated incremental costs are in 2006 dollars and annualized over the useful life of the anticipated projects. A summary of the incremental cost per gallon for these five categories can be found in Table 5.

Table 5: Incremental Supply Costs

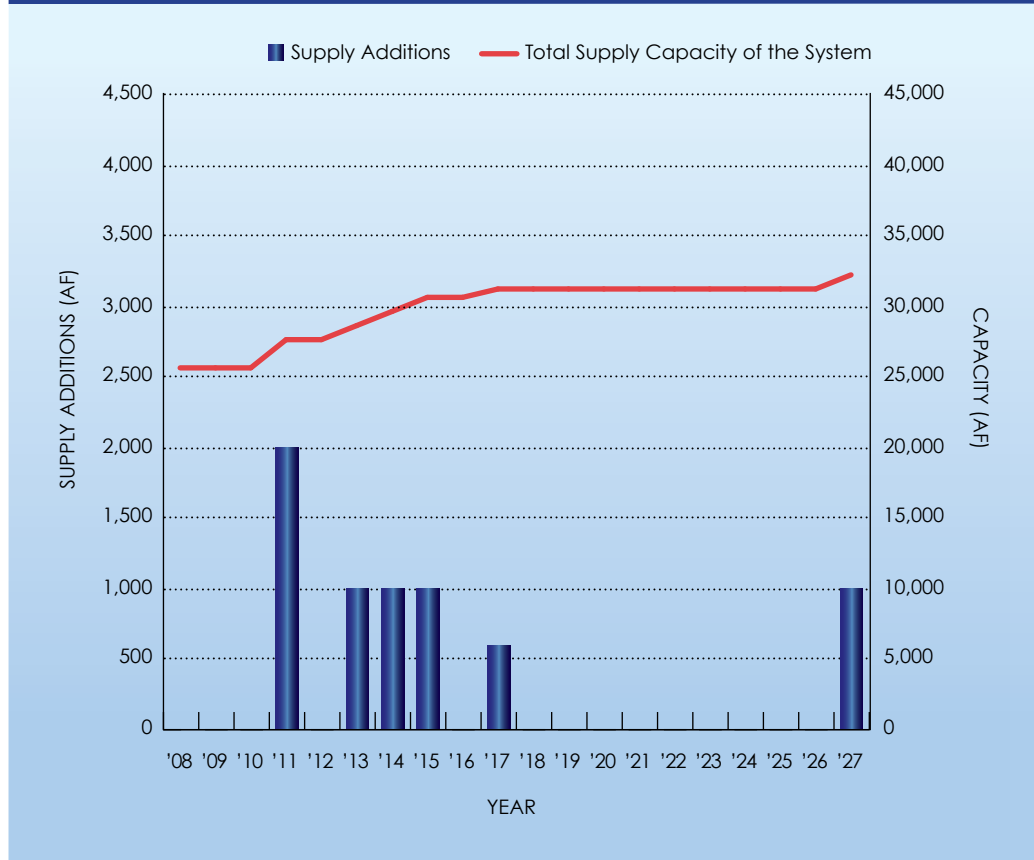
Category	Incremental Costs (per gallon)
Source of Supply	\$0.00154
Water Treatment Facilities	\$0.00113
Treated Water Storage	\$0.00216
Major Transmission Lines	\$0.00056
Water Purchases	\$0.00383
Wastewater System	\$0.00606
Total Simple Incremental Supply Cost	\$0.01528



3.3: Preliminary Capacity Forecasts

The City of Thornton has acquired sufficient water supplies to serve anticipated service area demands beyond 2027; however, there are substantial infrastructure requirements that are necessary in order to allow delivery of this water to Thornton. Worksheet 3-4 (Appendix C) was used to summarize the preliminary annual supply-capacity additions to Thornton's raw water system. Figure 9 illustrates the anticipated volumes of water supply additions and timing of these additions.

Figure 9: Preliminary Annual Supply-Capacity Forecast – 2008 through 2027



Section 4: Conservation Goals

This section identifies the water conservation goals developed by the City of Thornton.



4.1: Water Conservation Goals

The City possesses adequate water supplies to meet demand through and beyond 2027, the planning horizon used in this plan. The planning horizon identified in this plan is 2008 through 2027, although the plan will not be adopted until 2009. Notwithstanding, the City recognizes that water conservation is an essential component of the City's long-term water supply planning strategy. Through water conservation Thornton will reduce the amount of water that the City must ultimately acquire or develop in order to meet its build-out demand. The water conservation goals were established with this in mind and are intended to benefit both the City and its customers.

The efforts outlined in this Water Conservation Plan are estimated to achieve significant water savings for the City of Thornton when compared to projected demands absent new water conservation efforts. New programs will be brought on-line at an aggressive pace with one new program being implemented each year through 2015. These initiatives will ultimately target all customer classes to achieve savings from all water customers. Thornton's goals look forward at 5-year, 10-year, and 20-year periods with this Water Conservation Plan to set specific acre-foot goals that the City can attain. This plan will achieve up to 900 AF of savings annually by 2012, up to 1,500 AF annually by 2017, and up to 2,800 AF annually by 2027. To put these water savings in perspective, the City can supply 2,150, 3,590 and 6,700 typical single-family residences, respectively, with these water savings.

Through water conservation Thornton will reduce the amount of water that the City must ultimately acquire or develop in order to meet its build-out demand.

Due to the residential class being the single largest customer class within the City's water service area, the City of Thornton has set a goal of establishing its residential water use at 85 gpcd or less, based upon a five-year rolling average, by 2016. Achieving 85 gpcd represents a 20% decrease when compared to 106.2 gpcd usage during the pre-drought year of 2001 and prior to the enactment of water use restrictions. The 2003-2007 average, which includes periods when mandatory and

voluntary water restrictions were in effect, is 88.7 gpcd. The residential water use goal has been demonstrated to be achievable in Thornton during periods of water use restrictions when customers were allowed to water their landscaping no more than three times per week. During these periods water restrictions were not extreme and most customers realized their landscaping could be maintained adequately on a three-day watering schedule. The City recognizes that a simple comparison of per-capita water use from year to year will be difficult due to climate conditions and changes in the service area and population profiles. The use of a 5-year rolling average to track gpcd recognizes this inherent annual volatility in water use and will help the City track its on-going water conservation progress in the residential customer class.



Other customer classes will be addressed with this conservation plan; however, it will be necessary to develop additional data associated with the other customer classes to set and monitor meaningful and quantifiable goals. Examples of data that will be developed include: irrigated areas for the irrigation customer class; types of businesses, square footage of commercial space, and number of employees for the commercial customer class; and the number of multi-family units and population estimates for the multi-family customer class. Goals will be set for other customer classes as the City develops additional data to allow the establishment of quantitative water conservation goals.

4.2: Goal Development Process

The process with setting the City of Thornton's water conservation goals involved a comprehensive look at existing water supplies, existing customers and associated water demands, existing indoor and outdoor water use trends, projected demands for water, and anticipated water system improvements and planning level costs for the improvements necessary to meet demand by year 2027. Analysis of current and projected water demands identified areas of water use that the City will target in order to achieve its water conservation goal.

Section 5: Identification of Conservation Measures & Programs

This section identifies measures and programs that will be considered by the City of Thornton for implementation as a part of the City's water conservation strategy. A conservation measure is a technology or practice that directly reduces water use. A conservation program is an action or policy that encourages, requires, or otherwise leads to implementation of water-saving measures.

5.1: Identification of Measures and Programs

A comprehensive list of conservation measures and programs were identified for consideration, including those required to be considered under Colorado's water conservation planning statute (C.R.S. §37-60-126). Staff identified numerous measures and programs by conducting research on the available literature and other successful water provider programs. Many of the measures and programs are currently implemented at the City of Thornton.



The list of identified demand-side measures includes water-efficient fixtures and appliances, efficient landscape technologies and efficient industrial and commercial processes. Identified supply-side

measures include water re-use systems, distribution system efficiency, and source optimization. Both demand and supply side measures are detailed in Worksheet 5-1 (Appendix C).

The list of conservation demand-side programs includes public education, technical assistance, rate structures, regulations and incentives. Various supply-side programs which increase distribution system efficiency were also identified. Worksheet 5-2 (Appendix C) lists these programs in detail.



5.2: Screening of Measures and Programs

The identified measures and programs were screened based on the degree to which the measures and programs match the City's conservation goals. The screening criteria developed and used to evaluate whether to implement specific measures and programs are:

- Authority of the City of Thornton to implement measure/program. If the City does not have the legal authority to implement the measure/program it was excluded from consideration.
- Ability to sustain the water savings over the long-term. If a measure or program could not provide sustainable water savings over the long-term it was generally excluded from consideration.
- Ability to defer or avoid costs by implementing the measure or program. If implementing a measure or program demonstrated an increased potential for deferring or avoiding additional water purchases it was granted additional weight for consideration.

Section 6: Evaluation & Selection of Conservation Measures & Programs

This section provides a summary of measures and programs that were analyzed, considered, and selected by Thornton. An explanation of why certain measures and programs were not selected is also provided.



6.1: Identification of Conservation Measures and Programs

Table 6 provides a list of the conservation measures and programs that were identified to be considered for the development of this water conservation plan.



6.2: Evaluation Method

A series of Worksheets 6-1 (Appendix C) were developed to estimate the costs and water savings anticipated to be achieved over the life-span of each measure or program where it was applicable. The net benefit was calculated in terms of cost of water saved over the life of the estimated water savings compared to the cost of developing future water supplies as envisioned in the City's Long Range Water Plan. For example, toilet replacements are estimated to have a life-span of 20-years; therefore, the net benefit of a toilet replacement program is based on cost of the estimated water savings over a 20-year period (toilet replacement program) and what it costs the City to supply that same amount of water if it was not saved with the program.

Supply and demand-side conservation measures and programs were initially evaluated by estimating water savings, implementation costs, cost-effectiveness and net benefits. Conservative water savings estimates were used in these analyses.



6.3: Comparison of Benefits and Costs

Table 7 provides a summary of the benefits and costs of the measures and programs evaluated. This comparison is on a one-year basis and shows the estimated cost of the measure/program, anticipated water savings, cost per gallon of water saved, and the net benefit. The measures and programs have been ranked in descending order of net benefit.



6.4: Evaluation Criteria

The measures and programs were evaluated based on estimated reductions in average day, maximum day and annual demand. The criteria used to evaluate the measures and programs are based on cost and the screening criteria listed in Section 5.2.



6.5: Measure/Program Selection

The measures and programs showing the highest net benefit of water saved are likely candidates for implementation. In order to help achieve the City's goal of reducing future water development needs, programs from the top ten in the list showing the highest net benefit in reducing annual demand were generally selected. All of the City's existing programs are in the top ten, except the showerhead exchange program. However, the showerhead exchange program has been accepted under the screening criteria due to the program's compatibility with the community. Residential audit kits may also be considered as a low-cost service to the residential community with the potential to save water if customers follow the audit procedures and perform repairs as needed. Table 7 summarizes the measures/programs selected and those that were eliminated.

Table 6: Water Conservation Measures and Programs

Measure/Program	Already Implemented	Evaluated In Plan	Comments
DEMAND-SIDE MEASURES			
Water-efficient Fixtures and Appliances			
Toilets - Rebates for replacement of 3.5 gpf or greater	Yes	Yes	Continue to offer \$100 rebates
Toilets - Increased rebates for EPA WaterSense toilets	No	Yes	Will be offering \$125 rebates
Urinals: Ultra-low flush	No	Yes	Commercial accounts
Showerheads	Yes	Yes	Free showerhead exchange program
Faucets	No	Yes	
Washing machines	Yes	Yes	Continue to offer \$125 rebates
Free faucet aerator giveaways	Yes	Yes	ECOBA study determined these types of device giveaways do not produce statistically significant water savings. Won't pursue any further
Landscape Efficiency			
Low water use landscapes	Yes	No	City landscape codes revised June 1, 2003
Drought-resistant vegetation	Yes	No	City landscape codes revised June 1, 2003
Artificial turf	No	No	Artificial turf is prohibited by City Code except as allowed through Development Permit process for designated sports fields on public property. Use of artificial turf on City property for a sports field must be approved by City Council
Efficient irrigation	Yes	No	City landscape codes revised June 1, 2003
Rain sensor shutoff devices	Yes	Yes	Section 18-495 of the City code requires rain sensor shutoff devices; applies to nonresidential districts; and multifamily, single-family attached properties and manufactured home park common areas
ET-based controllers	No	Yes	Will be offering rebates for installation of these devices. Details still need to be developed
Scheduling	Yes	Yes	Thornton provides free irrigations system inspections & develops customized irrigation system scheduling for participants
Industrial and Commercial Efficiency			
Water-efficient processes	No	No	Will be evaluated in the future
Cooling equipment efficiency	No	No	Will be evaluated in the future
Northern Colorado Utilities ICI Workgroup	Yes	No	Participation in group studying strategies for the ICI sector

Table 6: Water Conservation Measures and Programs (continued)

Measure/Program	Already Implemented	Evaluated In Plan	Comments
SUPPLY-SIDE MEASURES			
Water Reuse Systems			
Management of reusable effluent	Yes	Yes	Thornton utilizes its reusable water rights by exchange and to pay historic return flow obligations per decree requirements
Management of reusable lawn irrigation return flows	Yes	Yes	Thornton utilizes its reusable water rights by exchange and to pay historic return flow obligations per decree requirements
Distribution System Efficiency			
Leak repair	Yes	Yes	Continuous program to check for leaks and replace older water lines
Removal of phreatophytes	No	No	Phreatophytes not a significant issue in Thornton. Phreatophytes located next to ditches and trails are considered to be a community asset
Temporary Transfers from Agriculture			
Dry year leasing	Yes	No	Implemented as necessary and available
Rotational fallowing	No	No	Not allowed by decrees
Water salvage	No	No	Not allowed by decrees
Source Optimization			
Conjunctive use	No	No	Thornton has a surface water based water supplies
System integration with other utilities	Yes	No	Inter-connects with Denver, Northglenn, and Westminster for emergency situations
Standing agreements with several entities	Yes	No	Several agreements already exist. Opportunities evaluated as they become apparent or are presented
Temporary raw water leases	Yes	No	Implemented as necessary and available

Table 6: Water Conservation Measures and Programs (continued)

Measure/Program	Already Implemented	Evaluated In Plan	Comments
DEMAND-SIDE PROGRAMS			
Education/Information Dissemination			
Public education	Yes	No	Cannot quantify water savings due to these efforts. Currently use City magazine, web site, mass mailings, newspaper advertising, flyers, City festivals, and active participation on the Colorado Water Wise Council
Water-saving demonstrations	Yes	No	Provided at City festivals
Xeriscape™ Demonstration Garden	Yes	No	Located at Margaret Carpenter Recreation Center
Xeriscape™ Seminars	No	No	Will be evaluated in the future
School programs	Yes	No	5th Grade Water Festival. City staff available upon request for presentations
Informative & understandable water bill	Yes	No	
Water bill inserts	No	No	City has opted to forego further use of inserts because not all citizens receive a water bill from the City
Social marketing campaign	Yes	Yes	Implemented in May 2007
System for Billing to flag high water users and notify water conservation staff	No	No	Will be evaluated in the future
Water efficiency E-newsletter education programs in the future.	No	No	Cannot quantify water savings. Will be evaluated as a component of public ECOBA study determined these types of device giveaways do not produce statistically significant water savings. Won't pursue any further
Technical Assistance			
Free Irrigation System Inspections - Targeted at large residential landscapes	Yes	Yes	Residential customers targeted since 2005
Free Irrigation System Inspections - Targeted at large HOA/Commercial landscapes	Yes	Yes	HOA/Commercial customers targeted since 2006
Free Residential Indoor Audits/Kit Distribution	No	Yes	Free residential indoor audits and distribution of free "do it yourself" audit kits for customers who don't want people in their home
Water conservation expert available	Yes	No	Two staff members available

Table 6: Water Conservation Measures and Programs (continued)

Measure/Program	Already Implemented	Evaluated In Plan	Comments
DEMAND-SIDE PROGRAMS (continued)			
Rate Structures and Billing Systems Designed to Encourage Efficiency			
Volume billing	Yes	No	Based on customer water usage
Conservation (tiered) rate structure	Yes	No	Implemented in May 2003
Increased (monthly) billing frequency	Yes	No	Already billed on a monthly basis
Commercial tap fee rebate for ultra-low volume toilets/urinals	No	No	Will be evaluated in the future
Commercial tap fee adjustment according to ICI benchmarks	No	No	Will be evaluated when benchmarks are developed by the ICI workgroup
Incentive to reduce water usage (credit on water bill)	No	No	Rejected: May be interpreted as unfair to customers already using low amounts of water
Regulations/Ordinances			
Addressing fixtures & appliances			
Standards for fixtures & appliances	No	No	Rebate incentives are already offered. Voluntary approach is more compatible with the community rather than a regulatory approach
Time of sale upgrades	No	No	Rebate incentives are already offered. Voluntary approach is more compatible with the community rather than a regulatory approach
Addressing landscapes			
Turf restrictions	Yes	No	New developments, varying levels of maximum limits allowed depending on land use
Landscape design/layout	Yes	No	Requires all new developments to follow water-wise landscaping principles
Soil preparation	Yes	No	Landscape Code
Irrigation equipment	Yes	Yes	Rain sensors required on automatic irrigation systems for nonresidential districts; and multifamily, single-family attached properties and manufactured home park common areas
Efficient Landscape Irrigation Campaign (No watering between 10 am and 6 pm)	No	Yes	Voluntary rule limiting landscape watering to cooler hours of the day
Irrigation audit required for new developments	No	No	May require additional City Development staff. Will be evaluated in the future
Separate irrigation tap requirement	No	No	Will be evaluated in the future

Table 6: Water Conservation Measures and Programs (continued)

Measure/Program	Already Implemented	Evaluated In Plan	Comments
DEMAND-SIDE PROGRAMS (continued)			
Regulations/Ordinances (continued)			
Irrigation tap sizing requirement to meet "no watering between 10 am and 6 pm rule"	No	No	May require additional City Development staff. Will be evaluated in the future
Homeowner Association Irrigation Efficiency Program	No	No	Will be evaluated in the future
Water waste prohibition	Yes	No	Already enforced
Incentives			
High efficiency clothes washing machine rebates - \$125	Yes	Yes	Ongoing
Increased rebates for EPA WaterSense toilet rebates	No	Yes	Will be offering \$125 rebates
Replacement of toilets with 3.5 gpf or > - \$100 rebate	Yes	Yes	Ongoing
Showerhead exchanges for 3.0 gpm or >	Yes	Yes	Ongoing showerhead exchange program offering 2.0 gpm showerheads
ET based irrigation controllers	No	Yes	Will be offering rebates for installation of these devices. Details still need to be developed
Soil amendment rebate	No	No	Will be evaluated in the future
Give-aways	Yes	No	Provided at City festivals – water conservation related items such as faucet aerators, soil moisture probes, irrigation controllers, xeric seeds, and water conservation information
Homeowner Association Irrigation Efficiency Incentive Program	No	No	Will be evaluated in the future
SUPPLY-SIDE PROGRAMS			
Distribution System Efficiency			
Leak identification	Yes	Yes	Ongoing
Meter source water	Yes	No	All source water is measured
Meter service connections	Yes	No	All service connections are measured
Meter testing and replacement	Yes	No	Ongoing standard program
Improved water accounting	Yes	No	Detailed water accounting already in place
Analysis of non-account water	Yes	Yes	Already monitored
Water line replacement program	Yes	Yes	Standard program to replace old water lines annually

Table 7: Comparison of Benefits and Costs

Line	Conservation Measure/Program [a]	Annual Cost for the Measure/Program [b]	Anticipated Annual Water Savings in (gallon) [c]	Cost of Water Saved by the Measure (\$/gallon) [d]	Net Benefit of Implementing the Measure/Program [e]	Selected Program	Primary Criteria for Selecting or Rejecting the Conservation Measure/Program for Implementation
1	Efficient Landscape Irrigation Campaign (Voluntary No watering 10am to 6pm)	\$13,458	72,954,364	\$0.00001	\$22,285,690	Selected	Potential to reduce overall water demand and to sustain the water savings over the long-term.
2	Pipeline Replacement Program	\$333,586	5,192,129	\$0.00128	\$3,633,965	Selected	Potential to reduce overall water demand and to sustain the water savings over the long-term.
3	Social Marketing Campaign	\$96,458	21,330,141	\$0.00045	\$3,163,415	Selected	Cost of implementation versus the amount of water saved.
4	Multi-Family Submetering	\$1,400	5,336,000	\$0.00001	\$1,629,596	Rejected	Cost of implementation versus the amount of water saved.
5	Toilet Rebates	\$36,525	2,374,920	\$0.00077	\$689,390	Selected	Cost of implementation versus the amount of water saved.
6	Clothes Washing Machine Rebates	\$103,640	4,117,236	\$0.00210	\$651,442	Selected	Cost of implementation versus the amount of water saved.
7	Multi-Family WaterSense Toilet Rebates	\$18,420	2,199,000	\$0.00042	\$562,187	Selected	Potential to reduce overall water demand and to sustain the water savings over the long-term.
8	ULF Urinals	\$28,445	1,029,600	\$0.00138	\$286,261	Selected	Cost of implementation versus the amount of water saved.
9	Residential WaterSense Toilet Rebates	\$16,570	549,750	\$0.00151	\$168,036	Selected	Cost of implementation versus the amount of water saved.
10	Commercial WaterSense Toilet Rebates	\$13,445	584,000	\$0.00115	\$165,060	Selected	Potential to reduce overall water demand and to sustain the water savings over the long-term.
11	Flapperless Toilet Rebates	\$16,570	549,750	\$0.00151	\$151,466	Rejected	Potential to reduce overall water demand and to sustain the water savings over the long-term.
12	ET Controller Rebates	\$11,334	400,050	\$0.00142	\$110,945	Selected	Potential to reduce overall water demand and to sustain the water savings over the long-term.

Table 7: Comparison of Benefits and Costs (continued)

Line	Conservation Measure/Program [a]	Annual Cost for the Measure/Program [b]	Anticipated Annual Water Savings in (gallon) [c]	Cost of Water Saved by the Measure (\$/gallon) [d]	Net Benefit of Implementing the Measure/Program [e]	Selected Program	Primary Criteria for Selecting or Rejecting the Conservation Measure/Program for Implementation
13	Irrigation System Inspections	\$24,107	1,680,000	\$0.00287	\$104,270	Selected	Cost of implementation versus the amount of water saved.
14	Rain Sensor Rebates	\$2,435	144,000	\$0.00169	\$19,572	Selected	Potential to reduce overall water demand and to sustain the water savings over the long-term.
15	Residential Audit Kits	\$1,855	150,000	\$0.00247	\$9,607	Selected	Potential to reduce overall water demand and to sustain the water savings over the long-term.
16	Hot water recirculation systems	\$7,185	100,000	\$0.00719	\$8,098	Selected	Cost of implementation versus the amount of water saved.
17	Residential Indoor Audits	\$7,285	150,000	\$0.00971	\$4,177	Selected	Cost of implementation versus the amount of water saved.
18	Showerhead Exchanges	\$1,473	20,220	\$0.01457	\$72	Selected	Cost of implementation versus the amount of water saved.
19	Commercial Indoor Audits	\$4,785	50,000	\$0.01914	-\$964	Rejected	Cost of implementation versus the amount of water saved.
20	Faucets-Aerator Giveaways	\$1,200	0	\$0.00000	-\$1,200	Rejected	Potential to reduce overall water demand and to sustain the water savings over the long-term.
21	Residential Turf Replacement Rebates	\$22,285	100,000	\$0.02229	-\$7,002	Rejected	Potential to reduce overall water demand and to sustain the water savings over the long-term.

[a] = Combined measures and programs that produce joint conservation savings should be treated as one measure/program to avoid duplicate counting.

[b] = From Worksheet 6-1, line 8.

[c] = From Worksheet 6-1, line 11.

[d] = From Worksheet 6-1, line 14.

[e] = From Worksheet 6-1, line 18. Note: This estimate of net benefit does not consider societal benefits and costs. New monetary benefit is not the only legitimate criterion for ranking and selection of measures/programs. See the text.



6.5.1: Additional Water Conservation Efforts

While this plan is intended to layout the strategies that the City will pursue over the next several years to enhance water use efficiency, in order for water conservation planning to be successful the plan needs to be flexible enough to allow for modifications in strategies. As technological advancements are made and brought onto the market and further research indicates greater promise with other focuses this plan needs to be able to alter course when appropriate. As the measures and programs set out in this plan are monitored for progress it might be necessary to amend certain aspects of the plan to more effectively accomplish the City's overall goal.

In addition to the measures and programs selected in this plan for implementation staff will also devote efforts on developing new methods to enhance the City's water conservation program. This includes refining the City's ability to further break down customer class categories to allow the City to track water use of sub-categories and investigating possible City Code revisions that could potentially increase water savings. These concepts are discussed in greater detail below.

Water Consumption Data

In the process of compiling water consumption data for this plan, the need to develop a well-defined customer class of categories became evident. The categories have been developed for billing purposes and should be refined for accurate water consumption analyses by customer class. For example, City Development land use categories could be incorporated to break the commercial water customer class into sub-categories. This would enable analysis of water consumption by commercial customer class. This would be useful for benchmarking and projecting water savings more accurately when developing commercial water conservation programs. Developing consistent definitions for each customer class will assist in the creation of internal monthly and annual water consumption reports. The project will also be useful for water demand modeling when incorporating water conservation factors. This project may require staff time from multiple areas, including Water Resources, Information Technology, GIS, City Development, and Utility Billing.

Related Data Collection

Benchmarking water use for each commercial class requires information specific to each class. For example, nursing homes can be benchmarked according to water consumption per room or bed. Office buildings are typically benchmarked using building square footage. This type of information could be collected when the water account is established and entered into the database.

Landscaped area is an important factor in estimating outdoor water demand by parcel. This information can be used to analyze water use and help to effectively target programs where they can be most beneficial. Calculating water consumption per square foot of landscaped area allows for a more accurate comparison of accounts. An account that appears to be a high water user may actually be

on a large parcel and using water efficiently. By developing a system to collect and record landscaped area for each new development by parcel, outdoor water demand per square foot can be calculated. For existing parcels, some water providers have used Geographic Information System software designed to calculate landscaped area using current aerial photography. Customized educational materials for commercial and residential customers could be developed using this information, indicating appropriate water use for each parcel. The Water Resources Division will investigate this application for the feasibility of future implementation.

Multi-Family Submetering

A potential source of water savings is in the multi-family sector where the owner is billed through one master meter and the residents pay for their water and wastewater as part of their monthly rent. This situation does not provide an incentive to the end water user to reduce water usage because a price signal is not sent directly to the multi-family unit resident. A 2004 study found that multi-family units that are submetered achieved a water savings of 7,957 gallons per year per dwelling unit when compared to units that are not submetered.² As of the end of the year 2006, there are approximately 5,040 multi-family units and 3,360 mobile home units in Thornton that are not billed based on an individual water meter for each unit. The Water Resources Division will investigate the feasibility and implications of requiring sub-metering in these sectors.

Automatic Irrigation Systems

The City's free irrigation system inspection program has revealed that a high percentage of the automatic irrigation systems inspected are not designed or installed adequately. Results from the inspections conducted in 2005 and 2006 indicate that a large percentage of the irrigation zones inspected were deemed to be below irrigation industry standards. Notable conclusions from 2005 and 2006 Thornton inspections include:

- 2005 - 83%; 2006 - 76%; irrigation zones below irrigation industry standards for the uniformity of water distributed on the landscape.
- 2005 - 76%; 2006 - 70%; irrigation zones with spray heads with water pressures that were too high. This causes misting and the water tends to evaporate and float away from the intended target. Most residential settings tend to use spray heads because they are designed to irrigate smaller areas.

A requirement that each new automatic irrigation system in new developments must pass an irrigation system inspection could help save water by ensuring the systems are designed to be efficient and are installed correctly. A useful requirement for property owners/managers would be to have a copy of the irrigation system inspection, an irrigation schedule developed from the inspection and an as-built irrigation plan posted at each time clock controller. The Water Resources Division will investigate the feasibility and implications of requiring sprinkler system inspections for new development.

² Mayer, P.W., et al National Multiple Family Submetering and Allocation Billing Program Study. Aquacraft, Inc. and the East Bay Municipal Utility District, 2004.

Soil Amendments

After participating in discussions with the Code Enforcement Division of the City about issues related to poorly maintained yards, particularly in the older sections of town, it became evident that part of the problem is related to poor soils on these properties. The soils in Thornton are typically high in clay content and tend to cause water to runoff landscapes and into the street. The City's current landscape code addresses soil amendments with new development; however, providing an incentive program that would assist existing customers to properly amend their soils could potentially be an additional water saving strategy. The Water Resources Division will investigate the feasibility of offering an incentive program targeting these properties.

Water Rate Structure

As previously described, Thornton utilizes an increasing tiered rate structure (a.k.a. increasing block rate structure) to help promote efficient water use. The tiered rate structure is designed to encourage and reward water conservation efforts, particularly regarding outdoor irrigation, while discouraging misuse of the City's water supply. Tier 1 is the customer's indoor use which is generally associated with cooking, bathing, and cleaning. Tier 2 is the customer's outdoor water use allotment which is largely used on landscape irrigation. Tiers 1 and 2 are charged at the same unit price. Tiers 3 and 4 have larger volumes of water associated with them and the unit prices increase aggressively to signal the customer that they have crossed the threshold and are using excessive volumes of water.

The water rate structure used by the City of Thornton has strong pricing signals that increase aggressively with the volume of water use when moving into Tier 3 and Tier 4. There might be some additional water use efficiencies to be gained by adjusting downward the volumes of water allocated to the outdoor water use tiers. For example, the existing outdoor volume of water for Tier 2 is 21,000 gallons of water per month which might be very generous. An analysis of the water use patterns in the service area might find that it is possible to reduce the monthly tier threshold to send a pricing signal sooner to customers who might be using more water than their landscape actually requires. An analysis would need to be conducted to determine whether a lower monthly tier threshold would be appropriate.

Water Budgets³

A strategy associated with water rate structures is to investigate the feasibility of developing a water budget rate structure. A water budget involves developing individually customized water allocations that meet the needs of each individual customer. To develop the individually customized water allocation a number of items need to be taken into consideration, including: lot size; irrigable area, type of landscaping, and number of person residing in the household. A properly designed water budget (monthly allotment) provides enough water for each customer's inside water use needs as well as basic landscape irrigation needs. If a

customer exceeds their monthly water budget, the excess amount of water used over their budget is charged at a higher rate. Thornton's existing water rate structure is a hybrid of a true water budget rate structure because it allows customer's an indoor budget based on actual water use during the winter and allows a separate allocation of up to 20,000 gallons per month for outdoor use. Outdoor use above the 21,000 gallons per month is charged at a higher rate to discourage excessive water use.

While there are few water providers in the Western United States that utilize a true water budget rate structure, there are a few existing examples in the Front Range. The Centennial Water and Sanitation District in Highlands Ranch and the City of Boulder have each implemented water budget rate structures. Implementing a true water budget rate structure would require a very significant amount of research to properly tailor a budget to adequately meet each customer's indoor and outdoor water needs.

Tap Fee Structure/Sizing Research

There might be water use efficiencies to be gained that are associated with tap fee structures and tap sizing requirements. Perhaps by offering an incentive in the form of a reduced tap fee for new development where the most efficient fixtures and irrigation systems are installed the City could achieve water savings. Additionally, it might be possible to offer a tap fee incentive to irrigation only customers that utilize state of the art irrigation systems. Some commercial and irrigation class customers might opt out of installing an additional or separate irrigation tap to avoid the additional fee. In these situations it might be impossible for customers to avoid irrigating their landscaping during the daytime when evaporation losses are the highest because they need to run their irrigation system longer to irrigate their entire property. From a long-term water efficiency standpoint, it is beneficial to separately meter indoor and outdoor water use. It would assist customers with monitoring their water use if they could track their indoor and outdoor water use separately. It would also assist the City with evaluating water efficiency measures. The Water Resources Division will research the potential for water savings and the implications of irrigation tap requirements and incentives.

Section 7: Modified Demand Forecast

This section addresses anticipated water conservation effects on the demand projections developed in Section 2.

7.1: Revised Demand Forecast

The demand forecasts shown in Worksheet 2-1 (Appendix C) were modified by incorporating the water conservation measures and programs selected in Section 6. As previously mentioned, the City of Thornton possesses adequate water supplies and capacity within its existing system to meet demand over the planning horizon used in this plan. Table 8 shows the projected daily demands with and without water conservation. The effects are shown at 5-, 10-, and 20-years.

Table 8: Modified Demand Forecast

Item	Current Year (2008)	Year 5 (2012)	Year 10 (2017)	Year 20 (2027)
Average-day demand before conservation (gal/day)	19,741,000	20,842,000	22,201,000	24,918,000
Average-day demand after conservation (gal/day)		20,642,000	21,767,000	24,000,000
Reduction in average-day demand (gal/day)		200,000	433,000	918,000
Maximum-day demand before conservation (gal/day)	47,821,000	50,488,000	53,779,000	60,363,000
Maximum-day demand after conservation (gal/day)		49,399,000	52,114,000	57,537,000
Reduction in maximum-day demand (gal/day)		1,089,000	1,666,000	2,826,000

7.2: Identification of Project Specific Water Savings

While the most accurate water savings estimates were used in the development of this Plan, achieving these results for the measures and programs identified are highly dependent on the level of public participation. The measures and programs identified with this planning effort will not enable the elimination of future capital improvement projects necessary to meet the City's projected demands.

The water conservation savings contemplated with this planning effort are envisioned to help reduce the amount of water that the City must ultimately acquire or develop in order to meet demands at build-out. Worksheet 7-2 (Appendix C) provides an estimate of potential water savings that could be achieved by 2027. Water savings have been estimated based on the data available and the use of prudent assumptions, there is not enough certainty in the data to support water capacity design decisions. As additional data becomes available, the estimated water savings in this Water Conservation Plan may need to be revised.

7.3: Revised Supply Capacity Forecast

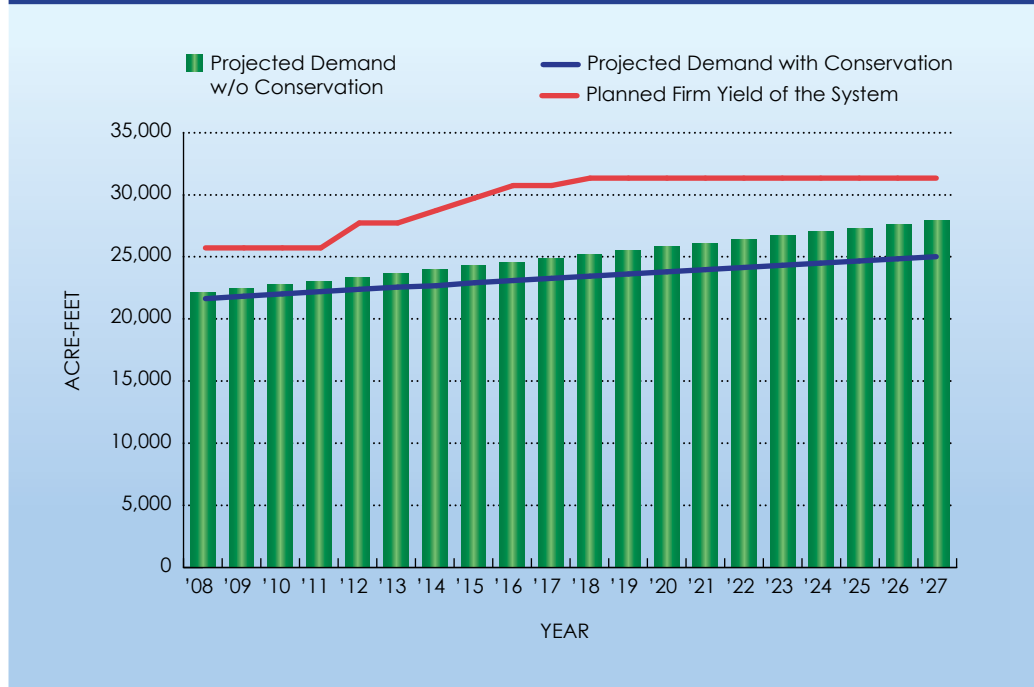
Table 9 summarizes projected annual treated water system demands taken from Section 2 (Worksheet 2-1, Appendix C), and compares potential reductions in system demand due to conservation savings.

Year	Projected Demand w/o Conservation (annual AF)	Planned Firm Yield of the System (annual AF)	Projected Conservation Water Savings (annual AF)	Projected Demand with Conservation (annual AF)
2005	20,862			
2012	23,346	27,775	891	22,455
2017	24,868	30,775	1,533	23,335
2027	27,912	31,370	2,838	25,074

7.4: Forecast Modifications and Benefits of Conservation

Potential conservation savings shown in 2027 are not certain enough to eliminate continued development of the City's existing water supplies to ensure adequate supplies at build-out. Water supply planning and development requires years of planning to ensure adequate water supplies are available when they are needed. Due to the uncertainty of conservation savings it would not be prudent on the City's part to rely on estimated water savings as a justification for delaying or eliminating planned and needed system development. In the future, as conservation savings become evident, conservation savings may well reduce the amount of water that the City must ultimately acquire or develop in order to meet demand at build-out. Figure 10 illustrates Thornton's projected demands and the estimated effects of water conservation.

Figure 10: Supply & Projected Demands With & Without Conservation



7.5: Revenue Effects

The selected water conservation measures and programs will potentially have an impact on revenue, should the assumptions used to estimate water savings associated with the identified measures and programs prove to be on target. Water rates and charges are studied by the City on a regular basis. Conservation effects on revenue will be addressed by the City as necessary.

Section 8: Implementation Plan

This section provides a schedule for when the selected measures and programs are to be implemented. Included in this section is a summary of the estimated cost of implementing the Water Conservation Plan as it is presented. It also defines when the Plan will be updated to reflect on-going efforts and to incorporate new approaches for the City's overall water conservation strategy.

8.1: Implementation Schedule

The implementation of the measures and programs are anticipated to follow the schedule shown in Table 10. Implementation of measures and programs will be subject to available funding.

Table 10: Implementation Schedule for Measures and Programs

Measure/Program	Required Action	Beginning Date	Completion Date
Social Marketing Campaign	Currently Implemented	2007	On-going
Pipeline Replacement Program	Currently Implemented	2008	On-going
Clothes Washing Machine Rebates	Currently Implemented	2008	On-going
Toilet Rebates	Currently Implemented	2008	On-going
Irrigation System Inspections	Currently Implemented	2008	On-going
Showerhead Exchanges	Currently Implemented	2008	On-going
Residential WaterSense Toilet Rebates	Advertise availability	2008	On-going
Efficient Landscape Irrigation Campaign (Voluntary No Watering 10am to 6pm)	Market with existing social marketing campaign	2009	On-going
Residential Audits/Kits	Advertise audits and purchase kits	2009	On-going
Multi-Family Toilet Rebates	Develop program details	2010	On-going
ULF Urinals	Develop program details	2011	On-going
Toilets - Commercial	Develop program details	2012	On-going
ET Controller Rebates	Develop program details	2013	On-going
Rain Sensor Rebates	Develop program details	2014	On-going
Update Water Conservation Plan	Plan evaluation and update as required by statute	2014	2014
Hot Water Re-Circulation Systems	Develop program details	2015	On-going



8.2: Implementation Plan

The implementation plans for the new measures and programs shown in Table 10 are more thoroughly described below.

Efficient Landscape Irrigation Campaign (Voluntary Lawn Watering Program) 2008 Implementation

Program Description

Implementation of an enhanced campaign to encourage customers to voluntarily follow the City's recommended watering program. This program will remain consistent with the program the City began promoting in 2007. The program consists of a two day per week watering schedule with an optional third day added to the schedule during the hottest weeks of the summer. Watering between the hours of 10:00 AM and 6:00 PM will be discouraged. The voluntary irrigation efficiency program will be wrapped into the existing marketing campaign that was implemented in 2007. In order to provide flexibility to the City's customers for their irrigation scheduling the program will not dictate the days of the week that irrigation can occur.

Benefits

This program will allow the City to remain consistent with the voluntary program rolled out in 2007 and offers potentially significant water savings as more customers follow the recommended program. Promoting this program will allow the City to continue to build momentum with the efforts started in 2007. This voluntary program will allow the City to continue to be seen as more of a partner with customers rather than a regulator. Mandating the number of days and the time of day that watering is allowed can increase resentment amongst the City's water customers. This dictate could lead to increased water use by some customers because they might think they have to water their grass on their designated day whether their grass needs it or not. Once a customer understands the benefits of following the City's voluntary program then they might be more apt to change their practices on a permanent basis allowing the City to realize consistent water savings. Successfully changing customer habits of watering during the daytime alone has the potential to save an estimated 292 acre-feet of water per year in evaporation savings.



Limiting irrigation to the cooler hours of the day is not a new concept as it has been required in Thornton during temporary water restrictions in the past. Continuing to the program and building participation on a permanent basis will enhance water conservation effectiveness by saving an estimated 15% to 30% of evaporation loss when irrigation of landscaping occurs during the hottest hours of the day.

Challenges

The largest challenge anticipated with promoting the program is motivating customers to change their existing habits by communicating the benefits of following the City's recommended program. An additional challenge faced by the City is public perception about how City owned properties are managed. Some customers will be less likely to follow the recommended program if they perceive the City is not following their own recommendations. The City, where they can, will need to lead by example when irrigating City owned properties. Anticipated issues that the City faces are related to irrigation operations at heavily used sports fields.


The City's sports fields require different level of care than a lawn at a typical single-family residence due to the high impact uses and number of citizens utilizing the fields. During hot weather conditions the grass requires a brief application of water (syringing) during the mid-day to cool the grass and prevent damage.

Safe conditions must be maintained with sports turf to minimize injuries due to fields that are either too hard or too soft. Safety of citizens utilizing City sports fields is a concern and requires different water management practices than a typical single-family residential lawn. The City's sports fields are also used by the public well into the evening hours of the day during the summer which reduces the amount of time available to irrigate within the recommended watering window. Additional challenges faced by owner's of large properties, including the City and some HOA properties, is due to irrigation systems with a high number of irrigation zones that might not be able to irrigate every zone within the 16 hour watering window.

Staff will need to be prepared to respond to questions, concerns, complaints, and reported violations.

Staffing and Budget Implications

Will require approximately 1,040 staff hours per year during the irrigation season to respond to questions, concerns, complaints, reported water waste violations, and to educate customers.



The City, where they can, will need to lead by example when irrigating City owned properties.

Program Details

- Customers will be encouraged to select two days per week for their watering schedule with an optional third day added to the schedule during the hottest weeks of the summer. Customers can select the days of the week that fit best with their personal schedules.
- Spray irrigation between the hours of 10 AM and 6 PM will be discouraged.
- Customers will be encouraged to:
 - participate in the City's irrigation inspection program.
 - install smart irrigation technology, such as ET controllers and rain sensor shutoff devices.
 - Utilize the services of certified WaterSense landscape irrigation professionals.
- New Turf Seed/Sod Installation: The City will educate customers about the benefits of installing new turf seed or sod in the spring and fall rather than in the heat of the summer. There will be no restrictions on watering new seed or sod.

Implementation

The Efficient Landscape Irrigation Campaign will be publicized and wrapped into the City's existing marketing campaign beginning in 2008.

WaterSense Residential Toilet Rebate Implementation Plan 2008 Implementation

Program Description

The WaterSense Toilet Rebate program will offer a \$125 rebate incentive for the replacement of 3.5 gallon per flush or greater toilet with a WaterSense labeled toilet. This program will be offered to qualifying residential customers.

Benefits

The City of Thornton has partnered with the EPA on their new WaterSense program. The mission of the program is to protect the future of our nation's water supply by enhancing the market for water-efficient products and services. Certified products are labeled with the WaterSense logo to enable customers to identify water efficient fixtures.

WaterSense labeled toilets have been certified by the EPA for performance and efficiency. These toilets do not exceed 1.28 gpf and therefore are more water efficient than the standard 1.6 gpf toilet.

Challenges

The availability of WaterSense toilets is limited in the Denver Metro area because the program is so new. As more products are certified by the EPA and are made available on the market, the rebates for standard 1.6 gpf toilets will be phased out.

WaterSense toilets on the market in the Denver-metro area are currently priced higher than some of the standard 1.6 gpf models. The City will offer an increased rebate of \$125 as an incentive for customers to purchase WaterSense labeled toilets.

Staffing and Budget Implications

Increased rebate amounts will be paid from the existing rebate budget.

Program Details

WaterSense toilet rebates will be offered to residential water customers as an additional component of the existing rebate programs. The current rebate application and rules will be modified to include WaterSense toilet rebates. The benefits of WaterSense toilets will be marketed to the community.

The Water Resources Division will work with Administrative and Utility Billing staff to facilitate a smooth transition to the new program. Rebate participant data will be entered in the City's database and reported along with the high-efficiency clothes washer, standard 1.6 gpf toilet and showerhead exchange programs.

Rebate requirements will be as follows:

- The WaterSense toilet must replace a 3.5 gpf or greater toilet.
- Entire toilet must be replaced.
- The rebate is limited to 2 toilets per household.
- A copy of the receipt must be attached to the application.
- A photograph of the removed, broken toilet must be attached to the application.


Implementation

The WaterSense Toilet Rebate program will be implemented in 2008.

Residential Indoor Audits/Kit Distribution Implementation Plan 2009 Implementation

Program Description

The City will offer free indoor audits and distribute free kits upon request to residential customers within the water service area. An indoor audit involves checking for plumbing leaks and inefficient fixtures such as faucet aerators, toilets, showerheads, and providing the customer with recommendations to improve their water use efficiency. Audits kits will also be provided to customers who wish to perform their own audit and will include directions on how to perform an indoor audit, tools to perform the audit, and educational resources.



An indoor audit involves checking for plumbing leaks and inefficient fixtures such as faucet aerators, toilets, showerheads, and providing the customer with recommendations to improve their water use efficiency.

Benefits

Providing audits will allow for one-on-one educational opportunities with customers. Some customers might want to perform their own audit and providing free kits are not only a useful tool for residential customers to improve their indoor water efficiency, but also an educational tool to raise awareness. Customers who call the City for plumbing leak checks may especially benefit from this program.

If the City performs/distributes 50 kits per year, the Residential Audit/Kit program has the potential to save 0.5 acre-feet per year. Considering the reasonable cost of an estimated \$3,165 per acre-foot saved, this program will be a valuable benefit to both the residential customer and the City.

Challenges

Offering the audits/kits may not be enough to motivate customers to perform indoor audits. This program will be incorporated into the existing marketing campaign in order to raise awareness of the benefits of indoor audits.

Actual water savings from this program may be difficult to quantify. Monthly water consumption is recorded in thousands of gallons in the City's database. Savings less than 1,000 gallons per month may not register in the participant's monthly usage data.

Staffing and Budget Implications

Audits are estimated to cost \$100 each and kits cost \$5 per kit. Assuming the City performs a combination 50 audits/kit distributions per year, the annual cost will be \$5,000 per year. This will require approximately 100 staff hours per year.

Program Details

Residential Audits/Kits will be available to residential customers upon request at the Utility Billing and Water Resources Division offices.

Implementation

The Residential Audits/Kit program will be implemented in 2009.

Multi-Family Toilet Rebate Implementation Plan 2010 Implementation

Program Description

The Multi-Family Toilet Rebate program will offer a \$50 rebate incentive for the replacement of 3.5 gpf or greater toilet with a WaterSense labeled toilet. This program will be offered to qualifying water customers in the multi-family sector.

Benefits

The City of Thornton has partnered with the EPA on their new WaterSense program. The mission of the program is to protect the future of our nation's water supply by enhancing the market for water-efficient products and services. Certified products are labeled with the WaterSense logo to enable customers to identify water efficient fixtures.

WaterSense labeled toilets have been certified by the EPA for performance and efficiency. These toilets do not exceed 1.28 gpf and therefore are more water efficient than the standard 1.6 gpf toilet. When implemented according to the Water Conservation Plan, the Multi-Family Toilet Rebate program has the potential to save 6.75 acre-feet per year.

Challenges

This will be the first water conservation incentive program offered to the multi-family sector. The rebate program and the benefits of WaterSense toilets will need to be marketed to property owners and managers.

Staffing and Budget Implications

Rebate amounts will be paid from the annual rebate budget. Rebates will be subject to the availability of funding. An estimated 100 hours of additional staff time will be required for inspection of rebated toilet installations (200 toilet limit per year ÷ 4 toilets per account x 2 hour inspection = 100 hours).

Program Details

A new Multi-Family Toilet Rebate application will be developed for this program. Marketing materials targeting multi-family building owners and managers will also be developed.

The Water Resources Division will work with Administrative and Utility Billing staff to facilitate a smooth transition to the new program. Rebate participant data will be entered in the City's database and reported along with the residential rebate programs.

Rebate requirements will be as follows:

- The WaterSense toilet must replace a 3.5 gpf or greater toilet.
- Entire toilet must be replaced.
- The rebate is limited to a total of 200 toilet replacements in the multi-family account sector per year.
- Copies of the receipts must be attached to the application.
- Toilet installations must be inspected by a City of Thornton representative.

Implementation

The Multi-Family Toilet Rebate program will be implemented in 2010.

Commercial Urinal Rebate Implementation Plan

2011 Implementation

Program Description

The Commercial Urinal Rebate program will offer a \$100 rebate incentive for the replacement of a 1.5 gpf or greater urinal with an ultra-low flow (0.5 gpf) or waterless urinal. Urinals are not currently being certified by the EPA WaterSense program. If WaterSense labeled urinals are available in 2011, rebates will apply to them. This program will be offered to qualifying water customers in the commercial sector.

Benefits

When implemented according to the Water Conservation Plan, the Commercial Urinal Rebate program has the potential to save 3.2 acre-feet per year. These savings are based on 0.5 gpf urinals. The savings estimates will be greater if waterless urinals are installed.

Challenges

This will be the first incentive program offered to water customers in the commercial sector. The urinal rebate program and the benefits of ultra-low flow and waterless urinals will need to be marketed to business owners and managers. The amount of the rebate offered might have to be re-evaluated to ensure the incentive is adequate to encourage replacement of these old urinals.

It may not be feasible to track actual water savings of rebate participants that share a master meter with other businesses. Water savings attributed to this program will need to be estimated through other means, such as data collection on the rebate application (i.e. number of employees, number of customers, type of urinal that was replaced, etc.).

Staffing and Budget Implications

Assuming that 50 participants each install four urinals, the annual budget will be \$20,000. An estimated 100 hours of staff time will be required for the inspection of rebated urinal installations (50 participants per year x 2 hour inspection = 100 hours).

Program Details

The Commercial Urinal Rebate program will offer a \$100 rebate incentive for the replacement of a 1.5 gpf or greater urinal with an ultra-low flow (0.5 gpf) or waterless urinal. A new Commercial Urinal Rebate application will be developed for this program. Marketing materials targeting business owners and managers will also be developed.

The Water Resources Division will work with Administrative and Utility Billing staff to facilitate a smooth transition to the new program. Rebate participant data will be entered in the City's database and reported along with the residential rebate programs.

Rebate requirements will be as follows:

- The ultra-low flow urinal must replace a 1.5 gpf or greater urinal.
- Rebates are subject to the availability of funding.
- Copies of the receipts must be attached to the application.
- Urinal installations must be inspected by a City of Thornton representative.

Implementation

The Commercial Toilet Rebate program will be implemented in 2011.


Commercial Toilet Rebate Implementation Plan 2012 Implementation

Program Description

The Commercial Toilet Rebate program will offer a \$100 rebate incentive for the replacement of a 3.5 gpf or greater toilet with a WaterSense labeled toilet. This program will be offered to qualifying water customers in the commercial sector.

Benefits

The City of Thornton has partnered with the EPA on their new WaterSense program. The mission of the program is to protect the future of our nation's water supply by enhancing the market for water-efficient products and services. Certified products are labeled with the WaterSense logo to enable customers to identify water efficient fixtures.



The City of Thornton has partnered with the EPA on their new WaterSense program.

WaterSense labeled toilets have been certified by the EPA for performance and efficiency. These toilets do not exceed 1.28 gpf and therefore are more water efficient than the standard 1.6 gpf toilet. When implemented according to the Water Conservation Plan, the Commercial Toilet Rebate program has the potential to save 1.8 acre-feet per year.

Challenges

The toilet rebate program and the benefits of WaterSense toilets will need to be marketed to business owners and managers. It may not be feasible to track actual water savings of rebate participants that share a master meter with other businesses. Water savings attributed to this program will need to be estimated through other means, such as data collection on the rebate application (i.e. number of employees, number of customers, type of toilet that was replaced, etc.).

Staffing and Budget Implications

Assuming that 50 toilets will be rebated per year, the annual budget will be \$5,000. An estimated 25 hours of additional staff time will be required for inspection of rebated toilet installations (50 toilets installed per year ÷ 4 toilets per account x 2 hour inspection = 25 hours).

Program Details

A new Commercial Toilet Rebate application will be developed for this program. Marketing materials targeting business owners and managers will also be developed.

The Water Resources Division will work with Administrative and Utility Billing staff to facilitate a smooth transition to the new program. Rebate participant data will be entered in the City's database and reported along with the residential rebate programs.

Rebate requirements will be as follows:

- The WaterSense toilet must replace a 3.5 gpf or greater toilet.
- Entire toilet must be replaced.
- Rebates are subject to the availability of funding.
- Copies of the receipts must be attached to the application.
- Toilet installations must be inspected by a City of Thornton representative.

Implementation

The Commercial Toilet Rebate program will be implemented in 2012.

ET Controller Rebate Program Implementation Plan 2013 Implementation

Program Description

Evapotranspiration (ET) is the combined process of soil evaporation and plant transpiration, which is influenced by the weather. ET-based irrigation controllers estimate lawn water requirements and automatically regulate irrigation based on local weather factors.

The ET Controller Rebate Program will provide an incentive to replace a time-based irrigation controller with a qualifying ET controller or install an ET controller with a new irrigation system. The program will offer the lesser of \$200 or 50 percent off the purchase price of an ET controller to residential, commercial and irrigation water customers.

Benefits

The ET controller offers a convenient alternative to time-based irrigation. This technology eliminates the need for the homeowner or landscape manager to make regular scheduling adjustments because the controller adjusts the schedule automatically as weather changes. Assuming there are 50 participants per year, this program, when implemented in 2013, has the potential to save 1.2 acre-feet of water per year.

Challenges

The challenge with this program is conveying to the water customer the benefits of the ET controller technology over the time-based irrigation controller. One ET controller was given away at the 2006 Thorntonfest and it was clear that many people didn't understand the technology. The ET controller rebate program will need to be incorporated into the existing social marketing campaign with a strong educational component.

Staffing and Budget Implications

An estimated 200 staff hours per year are expected for program implementation and maintenance. Assuming an average rebate amount of \$100 for 50 ET controllers per year, the annual budget estimate is \$5,000.

Program Details

The ET Controller Rebate Program will offer the lesser of \$200 or 50 percent off the purchase price of a qualifying ET controller to residential, commercial and irrigation water customers. Annual rebate numbers and participant water consumption will be tracked to monitor the effectiveness of the program.

The program requirements will be as follows:

- The City will provide a list of ET controllers that qualify for the rebate.
- The rebate will be limited to one ET controller per water customer.
- The customer will be required to perform a simple irrigation system check to ensure that the system is working properly. The customer must sign an affidavit that the system was checked.
- The irrigation system and installed ET controller will be subject to inspection by City staff.

Implementation

The ET Controller Rebate Program will be implemented in 2013.

Rain Sensor Rebate Program Implementation Plan 2014 Implementation

Program Description

A rain sensor is an inexpensive device that can be easily installed with most automatic irrigation systems. The sensor is designed to interrupt the normal irrigation cycle when natural rainfall is detected. The Rain Sensor Rebate Program will provide a \$25 incentive to install a qualifying rain sensor shut-off device on an automatic irrigation system. The rebate will be offered to residential, commercial, and irrigation customers.

Benefits

Rain sensor shut-off devices limit irrigation system over-watering during natural rainfall events, thereby reducing water waste. Because rain sensors are inexpensive and easy to install, this may be a well received incentive program for the community. Assuming there will be 50 participants per year; this program has the potential to save 0.5 acre-foot of water per year.

Challenges

Water savings attributed to this program may be challenging to accurately track due to the variability of rain events in the Thornton area.

Staffing and Budget Implications

An estimated 200 staff hours per year are expected for program implementation and maintenance. Assuming an average of 50 participants per year at \$25 per rebate, the annual budget estimate is \$1,250.

Program Details

The Rain Sensor Rebate Program will offer \$25 for the purchase of a qualifying rain sensor to residential, commercial and irrigation water customers. Annual rebate numbers and participant water consumption will be tracked to monitor the effectiveness of the program.

The program requirements will be as follows:

- The City will provide a list of rain sensors that qualify for the rebate.
- The rebate will be limited to one rain sensor per water customer.
- The customer will be required to perform a simple irrigation system check to ensure that the system is working properly. The customer must sign an affidavit that the system was checked.
- The irrigation system and installed rain sensor will be subject to inspection by City staff.

Implementation

The Rain Sensor Rebate Program will be implemented in 2014.

Hot Water Recirculation System Rebate Implementation Plan 2015 Implementation

Program Description

The City will offer a \$100 rebate for the installation of a qualifying hot water recirculation system. A hot water recirculation system consists of pipes with a motor driven pump that recirculates water between the water heater and hot water fixtures. This rebate will be offered to single-family residential water customers.

Benefits

Hot water recirculation systems deliver hot water to fixtures quickly without having to wait for the water to get hot, helping to reduce water waste in the home. If 50 systems are installed per year, this program has the potential to save 0.3 acre-feet per year.

Challenges

Actual water savings from this program may be difficult to quantify. Monthly water consumption is recorded in thousands of gallons in the City's database. Savings less than 1,000 gallons per month may not register in the participant's monthly usage data.

Staffing and Budget Implications

Assuming the City provides 50 rebates per year, the annual budget will be \$5,000. An estimated 100 hours of staff time will be required for inspection of installed systems.

Program Details

The Hot Water Recirculation Rebate program will offer a \$100 rebate to single family residential water customers for the installation of a qualifying system. Rebate participant data will be entered in the City's database and reported along with the residential rebate programs.

Rebate requirements will be as follows:

- Hot water recirculation system must be demand-actuated, not timer-actuated. Demand-actuated systems provide both water and energy savings.
- Hot water recirculation systems must be installed by a licensed plumber.
- One rebate per household.
- Installed system must be inspected by a City of Thornton representative.

Implementation

The Hot Water Recirculation System Rebate program will be implemented in 2015.



8.3: Implementation Plan Costs

The estimated costs of the implementation of this Water Conservation Plan for the period 2008 through 2015 as presented are summarized in Table 11.

Table 11: Estimated Costs of the Implementation Plan – 2008 through 2015

Measure/Program	Existing/New	Year	O&M/CIP	2008	2009	2010	2011	2012	2013	2014	2015
Efficient Landscape Irrigation Campaign (Voluntary No Watering 10am to 6pm)	New - wrapped into existing social marketing campaign	2008	O&M		\$75,000	\$75,000	\$75,000	\$75,000	\$75,000	\$75,000	\$75,000
		2008	O&M	\$61,942							
Social Marketing Campaign	Existing	2008	CIP	\$520,000	\$340,000	\$340,000	\$350,000	\$526,000	\$510,000	\$510,000	\$538,000
Pipeline Replacement Program	Existing	2008	O&M	\$3,259	\$3,259	\$3,259	\$3,259	\$3,259	\$3,259	\$3,259	\$3,259
School Education Programs	Existing	2008	O&M	\$4,402	\$4,402	\$4,402	\$4,402	\$4,402	\$4,402	\$4,402	\$4,402
Public Outreach Festivals/Seminars	Existing	2008	O&M	\$73,250	\$73,250	\$73,250	\$73,250	\$73,250	\$73,250	\$73,250	\$73,250
Clothes Washing Machine Rebates	Existing	2008	O&M								
Residential Toilet Rebates with Phased in WaterSense Toilet Program	Existing	2008	O&M	\$27,200	\$27,200	\$27,200	\$27,200	\$27,200	\$27,200	\$27,200	\$27,200
Irrigation System Inspections	Existing	2008	O&M	\$10,815	\$11,000	\$11,000	\$11,000	\$11,000	\$11,000	\$11,000	\$11,000
Showerhead Exchanges	Existing	2008	O&M		\$576	\$576	\$576	\$576	\$576	\$576	\$576
Residential Indoor Audits/Kits	New	2009	O&M		\$6,250	\$6,250	\$6,250	\$6,250	\$6,250	\$6,250	\$6,250
Multi-Family Toilet Rebates	New	2010	O&M			\$11,075	\$11,075	\$11,075	\$11,075	\$11,075	\$11,075
ULF Urinals	New	2011	O&M				\$21,100	\$21,100	\$21,100	\$21,100	\$21,100
Toilets - Commercial	New	2012	O&M					\$6,100	\$6,100	\$6,100	\$6,100
ET Controller Rebates	New	2013	O&M						\$6,100	\$6,100	\$6,100
Rain Sensor Rebates	New	2014	O&M							\$1,250	\$1,250
Hot Water Re-Circulation Systems	New	2015	O&M								\$6,000
Total				\$700,868	\$540,937	\$552,012	\$583,112	\$765,212	\$755,312	\$756,562	\$790,562
Total CIP				\$520,000	\$340,000	\$340,000	\$350,000	\$526,000	\$510,000	\$510,000	\$538,000
Total O&M				\$180,868	\$200,937	\$212,012	\$233,112	\$239,212	\$245,312	\$246,562	\$252,562

Notes:

Cost estimates do not include adjustments for inflation.

Cost estimates do not include staff salaries and benefits.



8.4: Staffing Implications

The measures, programs, data development, various research efforts, and increased levels of customer education are estimated to require one additional full time employee hired in 2008. A summary of the estimated additional staffing requirements to assist with new water conservation efforts discussed in this plan are shown in Table 12.

Table 12: Estimated Staffing Implications Due to New Programs, Monitoring, & Research

Program	Year Implemented	Estimated Staff Time (hours/year)	Comment
Tap Fee Structure/Sizing Research	N/A	1,040	one time
Multi-Family Submetering Research	N/A	1,040	one time
Efficient Landscape Irrigation Campaign	2008	1,040	ongoing
Data Collection, Analyses, Research, and Program Monitoring	2009	1,040	ongoing
Automatic Irrigation Systems Inspections	2009	160	ongoing
Soil Amendments	2009	160	ongoing
Residential Indoor Audits and Kits	2009	100	ongoing
Multi-Family Toilet Rebates	2010	100	ongoing
Commercial Urinal Rebates	2011	100	ongoing
Commercial Toilet Rebates	2012	25	ongoing
ET Controller Rebates	2013	200	ongoing
Rain Sensor Rebates	2014	200	ongoing
Hot Water Re-Circulation System Rebates	2015	100	ongoing
Total Estimate Annual Staff Hours By 2015		5,305	
Total One Time Staff Hours		2,080	
Total Annual Ongoing Staff Hours		3,225	



8.5: Public Participation in the Process of Plan Review and Comment

The Water Conservation Act of 2004 requires that the Draft Water Conservation Plan be made available to the public for review and comment. The City of Thornton will comply with this requirement by placing the Draft Water Conservation Plan on the City Council meeting agenda, providing public notice of the plan as an agenda item, allowing time for public review and comment, and adoption of the plan after it is approved by the Colorado Water Conservation Board. This process complies with City of Thornton Charter requirements which include provisions for public advertisement, review, comment, and adoption by the City Council.



8.6: Monitoring and Evaluation Processes

The measures and programs outlined in this Plan will be monitored to determine their effectiveness in achieving the long-term water savings goals of the City. Measures and programs determined not to be significantly effective will be discontinued.



8.7: Plan for Updating and Revising the Conservation Plan

The City of Thornton intends to update the Plan, at minimum every seven-years, as required by Colorado's water conservation planning statute. The City will continue to collect and analyze data on a regular basis. Future revisions of the Plan will incorporate updated and new data sources.



8.8: Plan Adoption, Completion, and Approval

The City of Thornton Water Conservation Plan was adopted by City Council May 12, 2009.