Water Conservation Plan

Cottonwood Water and Sanitation District

February 2011

Cottonwood
Water & Sanitation District
Parker, Colorado

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NOLTE
BEYOND ENGINEERING

In association with Douglas County, CO

DOUGLAS COUNTY
COLORADO

Table of Contents

List of Tables

List of Figures

List of Abbreviations

acre-foot (AF)	Unit of volume to measure water, equivalent to an acre of area covered with one foot of water (325,850 gallons)
AFY	Acre-feet per year
AWE	Alliance for Water Efficiency
AWWA	American Water Works Association
BMP	Best Management Practice
CWCB	Colorado Water Conservation Board
GPM	Gallons per minute
HOA	Home Owner's Association
IWA	International Water Association
MG	Million gallons
MGD	Million gallons per day
RO	Reverse Osmosis
RWCPP	Regional Water Conservation Planning Program
SMWSA	South Metro Water Supply Authority
SFE	Single family equivalent
SWSI	Statewide Water Supply Initiative

TE	Tap equivalent
ULFT	Ultra Low Flow Toilet
WTP or WWTP	Water Treatment Plant or Waste Water Treatment Plant
WCP	Water Conservation Plan
WSD	Water and Sanitation District

Section 1: Introduction

1.1 Purpose

The **Cottonwood Water and Sanitation District (CWSD)** developed this water conservation plan (WCP, the Plan) as part of the Douglas County Regional Water Conservation Planning Program (RWCPP). This program provides assistance for preparing WCPs for as many as 20 water providers, then compiling those plans into a regional WCP for Colorado Water Conservation Board (CWCB) approval.

The CWSD Plan is consistent with the State's emphasis on regional planning in the SWSI efforts, coupled with new developments in the field of water conservation. The Douglas County region is heavily dependent on nonrenewable Denver Basin groundwater; water conservation is an essential element in helping the region achieve long-term sustainability. To that end, this Plan has been funded by a grant from the CWCB and contribution by the Douglas County Board of Commissioners.

The purposes of the Plan are to:

- Characterize water use and demand forecasts
- Identify, evaluate, and select conservation measures and programs

Throughout its history, CWSD has delivered reliable potable water to its commercial, residential, and irrigation water users. CWSD is committed to sustainable and efficient use of its water resources and will be implementing this WCP as a key element of an integrated water resources planning approach. That planning also includes full reuse capability and development of new supplies in partnership with the SMWSA. The Plan is also warranted as water conservation technology has improved to the point that water use efficiency can be planned and implemented more reliably and predictably than at any time in the past.

This Plan identifies recommended water conservation measures and programs that will promote, support and sustain efficient water use by the CWSD customers. The Plan identifies the various stages of water conservation for the next five to ten years, and follows the scope of work agreed upon by the Colorado Water Conservation Board (CWCB) and Douglas County in establishing the Douglas County RWCPP.

1.2 Organization

In keeping with that scope of work, this Plan is organized as follows:

1. Introduction
2. Existing system, water sources, and limitations
3. Current water use
4. Pricing structures and existing conservation efforts
5. Identification and screening of proposed conservation measures
6. Demand forecasts with different conservation programs
7. Impacts of conservation programs
8. Implementation and monitoring plan

Section 2: Existing System, Water Sources, and Limitations

2.1 District Formation

CWSD is a quasi-municipal corporation and a political subdivision of the State of Colorado. CWSD was created pursuant to Article 1 of Title 32 C.R.S. for the purpose of providing complete water supply and sanitary sewer systems for the CWSD customers, and was formed in 1981.

2.2 Geography and Demographics

The District is located along the northern border of Douglas County and is bisected by Parker Road with 2/3 of the District within the Town of Parker and the remainder in unincorporated Douglas County, Colorado. The service area is shown in Figure 2-1.

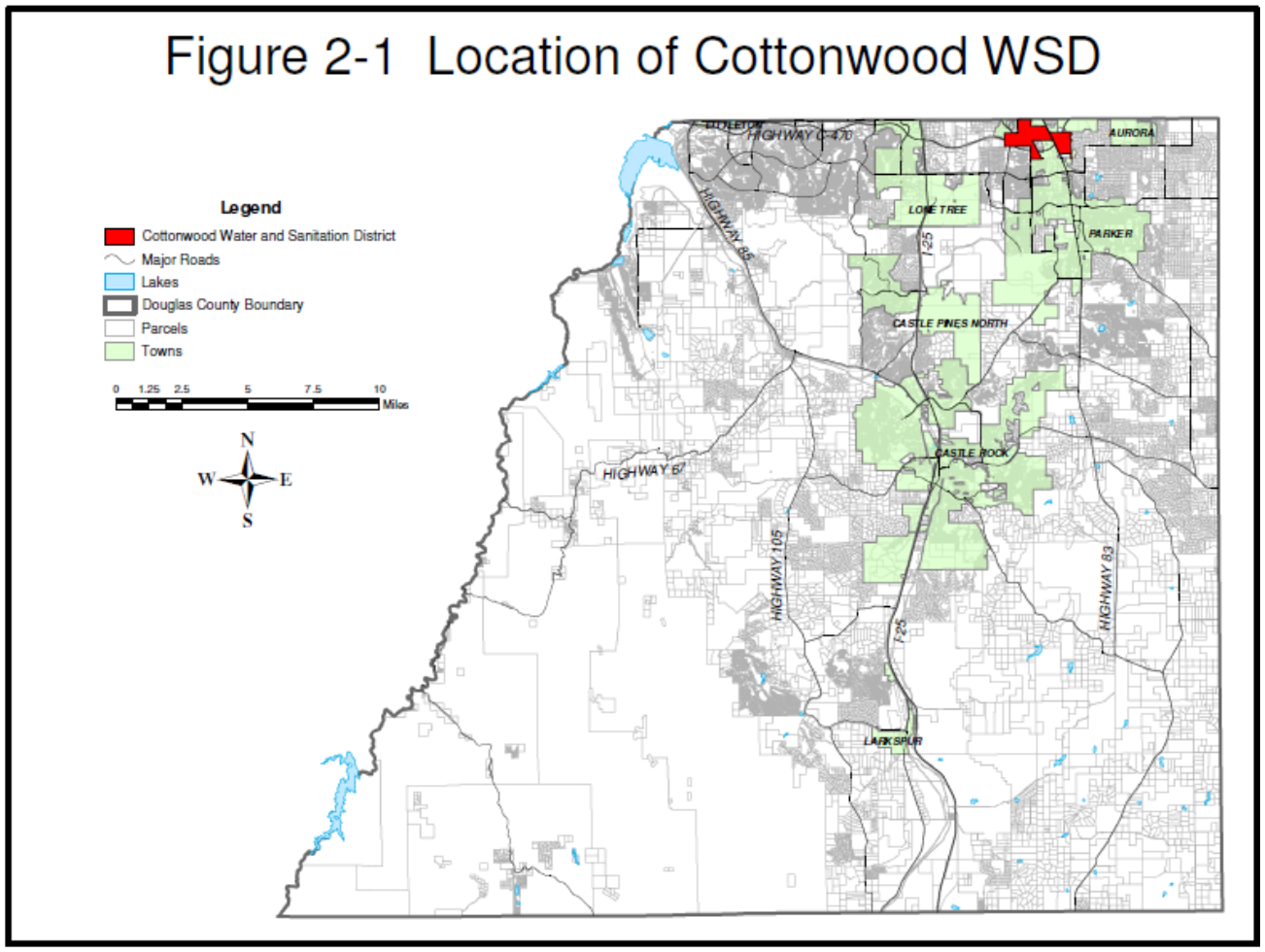

Figure 2-1
Location of CWSD

2.3 Historical Water System Development

CWSD consists of approximately 1,300 acres located in an area of limited and unreliable surface water supplies. Cherry Creek flows through the District and is the largest stream in the area. Until 2010, most of Cottonwood's water came from deep wells. Groundwater supplies in the Denver basin formation were

readily available, drought resistant, could be developed incrementally at a relatively low cost, and needed minimal treatment. The deep wells, however, are a nonrenewable source of water and thus are not replenished by snow and rainfall. CWSD has alluvial wells along Cherry Creek to capture its renewable water, but the water is of poor quality and requires treatment. In an effort to use a greater share of renewable water, the District teamed with the Arapahoe County Water and Wastewater Authority (ACWWA) in 2003 to plan and build the Joint Water Purification Plant (JWPP). The plant opened in June 2010 and is fully operational, treating CWSD's Cherry Creek alluvial groundwater. The District's water supply today is more than 50 percent from renewable sources and almost all the water is being reused.

CWSD consists primarily of residential customers. In 2010, the District serves 1536 single family homes, 1435 condominiums/apartments, and 70 commercial customers that include the Parker Adventist Hospital. Douglas County estimates the population at 4,751. More residential growth is expected in the years ahead with an estimated build-out in 2025. The average age of the District's water transmission and distribution system is 15 years, and it is in excellent condition. Forecasting efforts have involved the development of a Capital Improvement Plan listing projects that will require $26M to serve build-out needs. This amount includes the purchase of 362 AF of renewable water rights.

2.3.1 Nontributary Groundwater

CWSD's existing nontributary groundwater supplies are derived from five wells drilled in the Denver Basin. The Denver Basin formations underlying the service area include the Dawson, Denver, Arapahoe and Laramie-Fox Hills formations. Figure 2-3 is an illustrative cross-section of the Denver Basin aquifer formations.

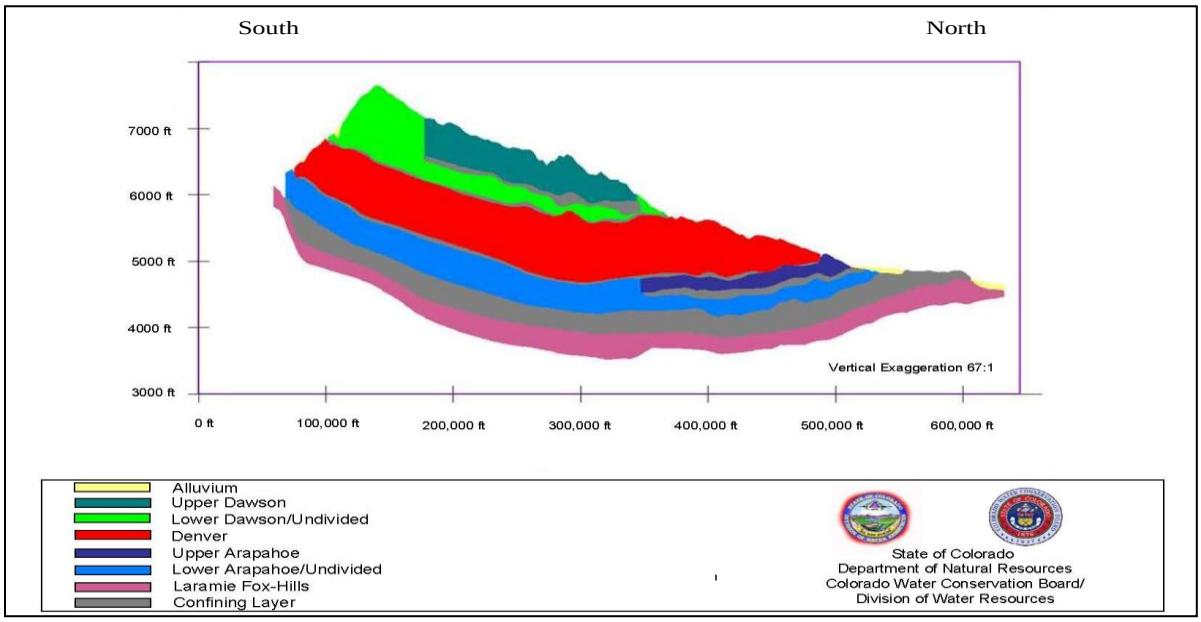

Figure 2-2
Denver Basin Aquifer South-North Cross Section
South Platte Basin
(Source: CWCB South Platte DSS)

The initial groundwater development to meet CWSD's water demands occurred within the district boundaries. Wells were drilled incrementally as development occurred. The non-tributary groundwater supplies developed by CWSD require minimal treatment. Treatment to meet regulatory requirements for disinfection is done at individual well sites. Table 2-1 provides information on the number, location and aquifer source of CWSD's existing nontributary groundwater wells.

2.4 Water Sources and Yields

A summary of average annual yield of the major water sources for CWSD are summarized in Table 2-1.

Water Supply Source	Aquifer	Annual Yield (AFY)	Water Rights (AFY)	Comments
In district groundwater: 5 Nontributary wells	Arapahoe	924	924	D1, D2, D3, D4-A, D11
In district surface water: 5 Alluvial wells	Cherry Creek	520	766	DD1 (2010), DD2, DD4*, DD7 *Wells operated under the CWSD/ACWWA JWPP agreement Well CCC4 operational in 2010
Augmentation Water	Cherry Creek	1,444	0	
Total		**2,888**	**1,690**	

Table 2-1
Summary of Major Water Sources

2.5 Ability to Serve

CWSD currently relies on wells from the Denver Basin aquifers for approximately 58 percent of its first use water supply. That groundwater is pumped from five wells. CWSD gets the remaining 42 percent of its first use water from alluvial wells along Cherry Creek. CWSD, either through direct use or augmentation, effectively doubles its available water supply. With its capacity in the JWPP, the District is able to meet projected peak day demands through build-out in an average year. However, there can be a significant shortfall during drought.

CWSD has conducted internal planning studies for the raw and treated water systems that describe the planning of water supply acquisitions, treatment plant capacity, pumping, storage and major distribution pipelines. Based on that analysis, CWSD is seeking to acquire an additional 362 AFY of renewable water supply and delivery capacity by 2020 through its membership in the South Metro Water Supply Authority (SMWSA). The District is working to reduce its reliance on the nonrenewable groundwater used by many throughout the region, identified in SWSI as a critical water supply area. With current development at 60 percent of build-out, additional capacity is needed to meet the future drought year demands for full build-out. A summary of system conditions is shown in Table 2-2.

Planning Questions	Yes	No	Comments
Does the system frequently experience shortage of supply emergencies?		x	
Does the system have substantial unaccounted-for and lost water?		x	
Is the system experiencing a high rate of population and/or growth?		x	
Is the system planning substantial improvements or additions?	x		CWSD is pursuing import of 362 AF of renewable water that will be required to meet the build-out demands.
Are increases to wastewater system capacity anticipated within the planning horizon?	X		Wastewater capacity is provided by ACWWA

Table 2-2
Summary of System Conditions
Inverness Water and Sanitation District

2.6 System Limitations

CWSD does not currently use all of the water allowed under its augmentation plan and surface water rights. However, the CWSD Capital Improvement Plan does include development of additional wells to use all of its water rights. As mentioned in the previous section, the District is also seeking additional water rights to meet future demands at build-out projected for 2025.

Section 3: Current Water Use

3.1 Annual Water Use by Customer Class

The CWSD customer base consists of residential, commercial, and irrigation-only accounts. The baseline of water use in 2008 was selected because it was fairly recent, has complete data readily available, and was a relatively average year with regard to precipitation. It is important to note that 2008 water usage is impacted by the post 2002 drought reductions in demand experienced throughout the Front Range. The long-term effects of the "drought shadow" are unknown. As shown in Table 3-1, single and multi-family residential use represented 64 percent of metered use, commercial at 23 percent, with irrigation at 12 percent. When considered on the basis of water production as shown in Figure 3-1, unaccounted for water represented less than 8 percent of the total.

			Number of Taps								
General Class	**2008 Total (in 1,000 gal)**	**% of Total Metered**	**3/4"**	**1"**	**1.5"**	**2"**	**3"**	**Total Taps**	**Total TEs**	**Unit Demand (gpd/TE)**	**GPCD (Note 2)**
Single Family	138,057	48.1%	1,536					1536	1,536	246	
Multi-Family	45,794	16.0%		2	14	56		72	508	247	
Residential Subtotal	**183,851**	**64.1%**							**2,044**	**246**	**88**
Commercial, Industrial, Institutional	67,137	23.4%		15	15	3	7	40	240	766	
Irrigation (potable)	24,656	8.6%	2	14	12	9		37	150	450	
Irrigation (non-potable)	11,131	3.9%	2			1		3	10	3,050	
Nonresidential Subtotal	**102,924**	**35.9%**							**400**	**705**	**N/A**
Total	***286,775***	***100%***	***1,540***	***31***	***41***	***69***	***7***	***1688***	***2,444***	***322***	

[1] Percents may not equal 100% due to rounding.
[2] Per Douglas County estimates, there are 2.8 people per residence in CWSD.

Table 3-1
Annual Water Use in 2008 by Customer Class

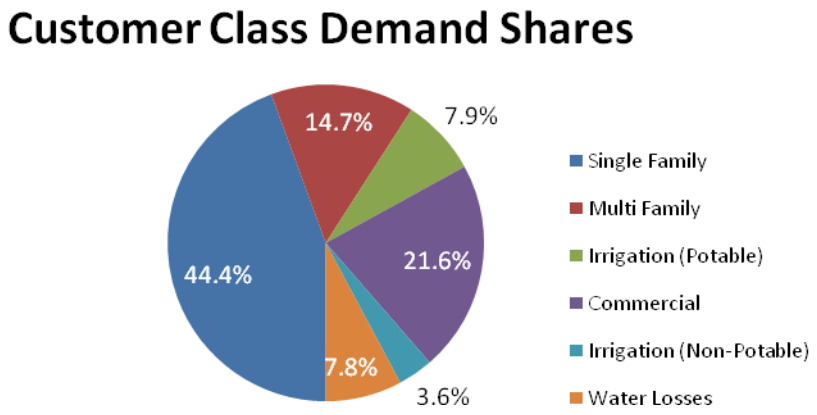

Figure 3-1
Percent of Annual Water Use in 2008 by Customer Class

3.2 Historical Water Demand

Total annual water production for 2003 through 2009 is shown in Figure 3-2, including nonpotable water usage. As seen in Figure 3-2, demand dipped in 2004 by almost 13 MG from 278 MG, but then steadily rose to a high in 2007 of 316 MG. The 2009 water usage declined by about 20 percent to 249 MG. A similar drop in water usage was seen regionally that year, likely due to above-average precipitation during the irrigation season.

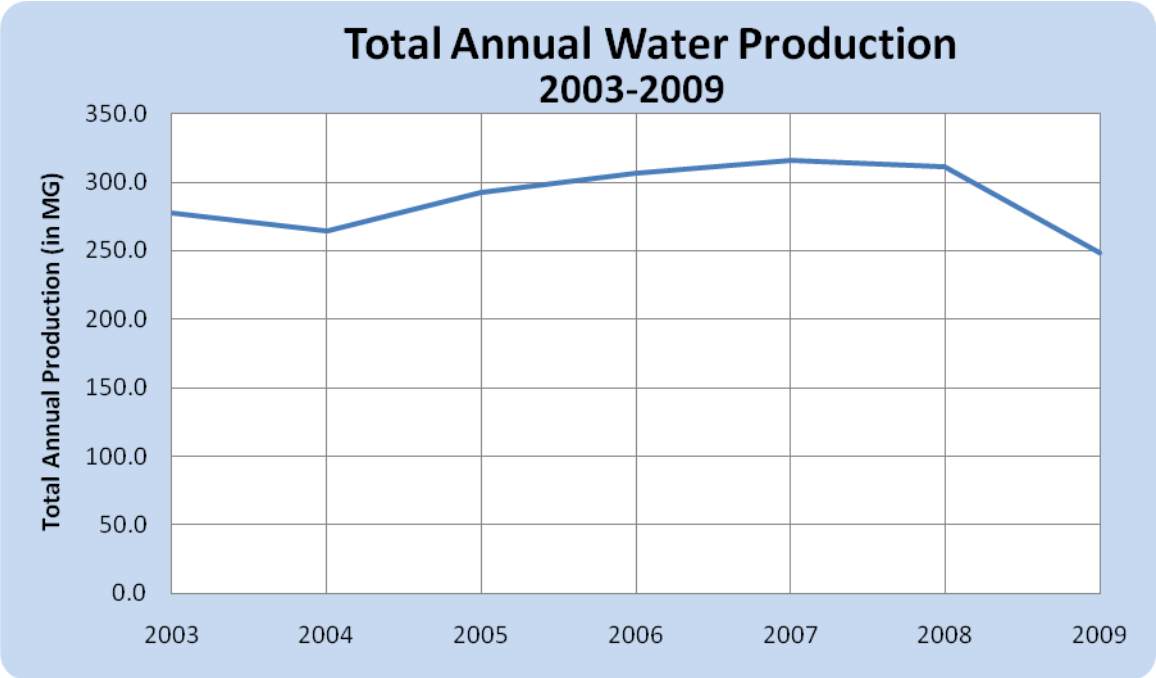

Figure 3-2
Total Annual Water Production

CWSD tracks the number of water customers as single-family equivalents (SFEs), another term for tap equivalents (TEs). One TE is the estimated water use for a ¾-inch water tap. Larger water taps are converted to TEs as shown in Table 3-2.

Tap Size (inches)	Tap Equivalents
3/4	1
1	2
1.5	4
2	8
3	18
4	30
6	64*

*Determined by Board of Directors

Table 3-2
Tap Equivalents by Tap Size

3.2.1 Unit Water Demands

An analysis of per capita water demand is a common measurement of water use. But given that CWSD has a large share of nonresidential demand, unit demands must be separately analyzed for both residential and nonresidential sectors. (All District customers are metered.) Average daily water demand divided by the number of TEs served provides the unit demand in gallons per day per TE (gpd/TE). Unit water demands by customer class have been calculated for 2008 and are shown in Table 3-1. The total unit demand for CWSD in 2008 was 322 gpd/TE.

That total includes residential demands which averaged 246 gpd/TE. For an average of 2.8 people per residence, this unit demand equates to only 88 gpcd (gallons per capita per day). CWSD's per capita demand is very low as compared to 2007 residential demands for Centennial WSD (Douglas County's largest water provider) which averaged 103 GPCD (Centennial WCP, 2007, pg 21).

Nonresidential demands can vary significantly, depending on the specific customer characteristics in each area. CWSD's 2008 nonresidential demands averaged 705 gpd/TE. This unit demand compares favorably to billed nonresidential demands for Centennial WSD in 2007 that averaged approximately 830 gpd/TE. (Centennial WCP, 2007, pg 22).

3.2.2 Peak Water Demands

Monthly water production for the 2008 baseline year is shown in Figure 3-3. In the case of CWSD, water production is solely reliant upon well production. The peak month production/ demand for 2008 occurred in July. That month's production of 50 MG was 100 percent higher than the average annual production of 25 MG per month for a peak month to average month ratio of 2.0 to 1.

CWSD's irrigation demands are primarily supplied with potable water that is metered separately from in-building use for commercial customers. The District also supplies nonpotable water for park irrigation, consisting of raw water directly from alluvial wells. However, in 2011, CWSD plans to complete a reuse line connecting an existing Cottonwood reuse line on S. Chambers Rd. to the Cottonwood Park irrigation system. This will allow direct irrigation use of tertiary treated water from ACWWA's Lone Tree Creek Water Reuse Facility.

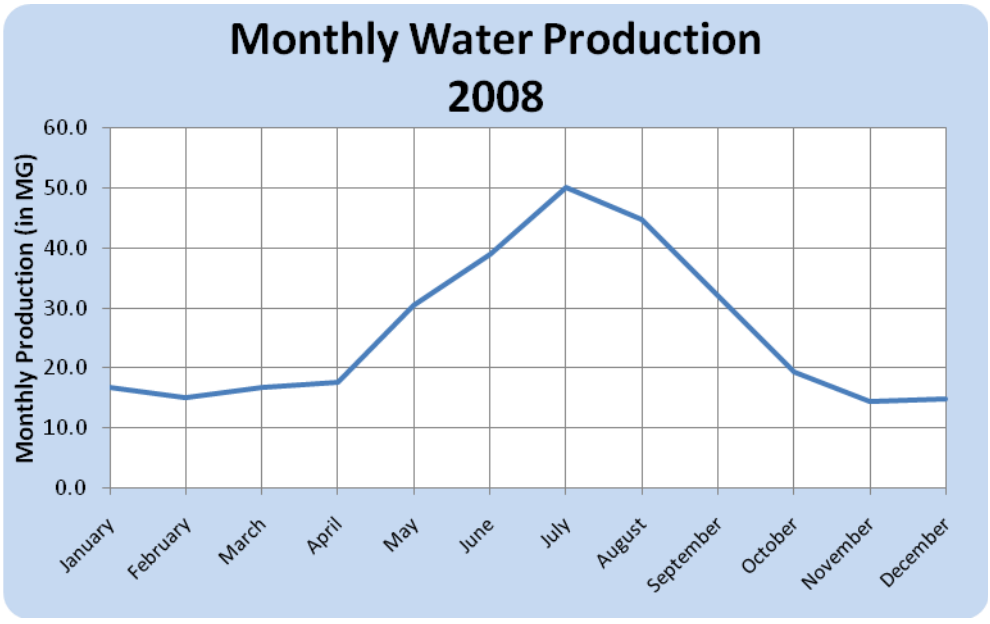

Figure 3-3 Monthly Water Production 2008

3.3 Water Loss Accounting

The description of current water use in this Plan is meant to be consistent with the International Water Association (IWA) and American Water Works Association (AWWA) Water Balance approach, which was published in 2000 as part of the IWA publication Performance Indicators for Water Supply Services to provide utilities a consistent methodology for assessing water loss. Though the full assessment of a water balance is outside the realm of this report, the terminology is consistent. The main categories discussed for CWSD are revenue (metered) and non-revenue (metered and unmetered) water, which are defined in Figure 3-4 below.

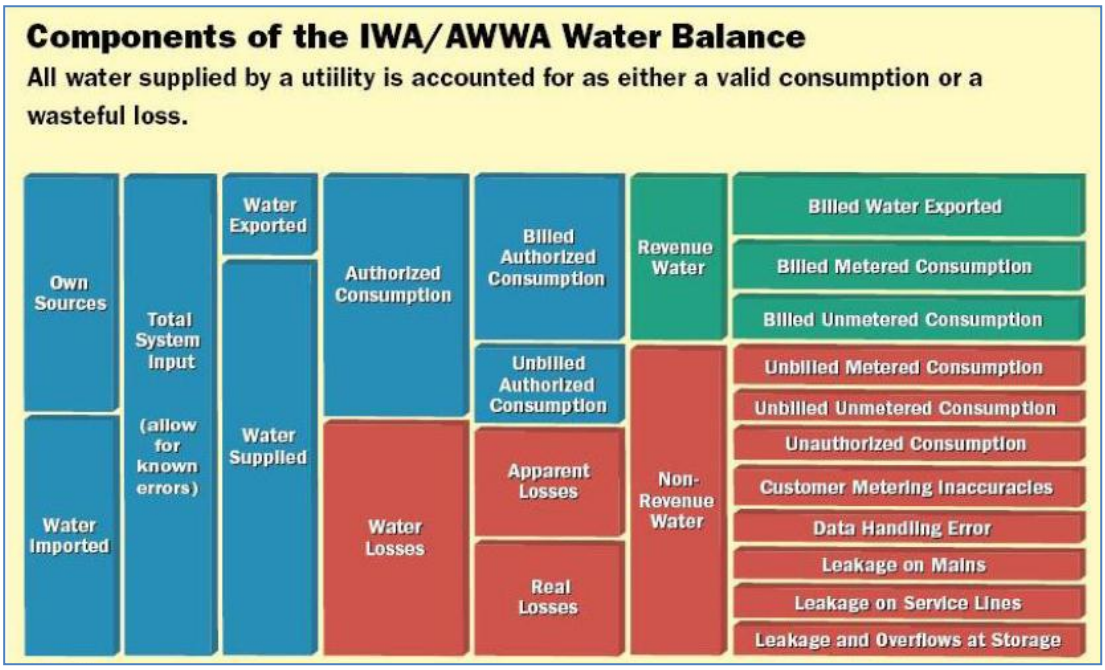

Figure 3-4
IWA/AWWA Water Balance Summary
(Source: AWWA Publication, Opflow, October 2007)

All of CWSD's water use is metered and billed. There are no customers that receive water that is unbilled, and all metered water use is Revenue Water as defined in the IWA/AWWA Water Balance. The non-revenue water use for the CWSD system includes:

- Unbilled, unmetered consumption (see below)
- Customer metering inaccuracies
- Data handling errors
- Leakage on mains
- Leakage on service lines
- Leakage and overflows at storage

Unbilled, unmetered consumption includes such uses as the annual waterline and fire hydrant flushing program conducted by CWSD (estimated at 1 million gallons per year)

A comparison of estimated total water production vs. total water billed in 2008 is shown in Figure 3-1. The difference between total production and billed is water losses or unaccounted for water. This is the same as the non-revenue categories described above. Although AWWA now recommends evaluating non-revenue (or unaccounted-for) water without reference to percentage of water produced, such a reference has been

a standard practice in the industry for many years ("Water Wiser," 2010) (Angers, 2001). At the level of analysis in this water conservation plan, it is helpful to consider the District's water system with respect to the accepted benchmark of up to 15 percent unaccounted-for water. As shown in Figure 3-1, the District had only 7.8 percent unaccounted-for water in 2008 and is well within the acceptable range.

Section 4: Pricing Structure and Existing Conservation Efforts

CWSD has used water conservation measures to manage water demands and conserve water since it was formed, but the District has stepped up its conservation efforts significantly since 2003. The CWSD water conservation program offers a diverse range of programs and measures targeted at all water demand customer classes. Demand management strategies have included conservation measures designed to manage peak day demands and also measures designed to reduce total annual demands.

CWSD has implemented a conservation-oriented, tiered rate structure for all customers. Other measures include a rebate program, public education, and irrigation metering. The current program is described in this section and summarized in Table 4-4.

4.1 Pricing Structure

CWSD's rate structure has been a very effective means of encouraging efficient water use, and all of their customers are metered. The District implemented a tiered, increasing-block rate structure in 2003. That is also when the District went to monthly billing for all customers, providing more immediate feedback to customers on the effects of those tiered rates. The District updated its rates in 2010 to charge customers as follows:

	Within Annual Allocation (per 1,000 gal)	In Excess of Annual Allocation (per 1,000 gal)	In Excess of 150% of Annual Allocation (per 1,000 gal)
Service Fee	$3.32	$6.64	$9.96

Table 4-1
Water Rate Tiers

For residential customers, the allocation includes 65 GPCD for indoor use assuming 3 people per single-family home and 2.2 people per multi-family home, and 30 inches of irrigation annually on an average 2,900 sf yard. Commercial allocations are based on historic indoor use, and 30 inches of irrigation annually on each lot's irrigated area.

4.2 Operational Utility Side Measures

Integrated Resources Planning – CWSD has practiced integrated resources planning (IRP) as part of its overall water supply and demand management strategy. A least-cost analysis of demand and supply options resulted in the conclusion that water conservation and demand management options were cost-effective and, as a result, incorporated into future supply planning. As implemented by CWSD, the integrated resources planning approach is a comprehensive planning effort that incorporates water conservation as a key component for meeting future needs. The results of the integrated resources planning approach has resulted in savings to CWSD as described in Section 7.

Conservation Coordinator – Mr. Luis Tovar of Mulhern MRE (the firm that professionally manages CWSD) serves as the District's water conservation coordinator, and he can draw on the resources of the Douglas County Water Resource Authority (DCWRA) as needed.

4.3 Water Loss Control Program

Water Loss Control Program – Total well production currently represents total water production. However, this year, the JWPP (a new Reverse Osmosis (RO) water plant) will make all of their consumable return flow water (effluent and lawn irrigation return flows) usable once there are a sufficient number of alluvial wells to supply water to the new plant. Total water production is compared to total water billed to determine water losses. Losses are at less than 8 percent and well within industry standards. As CWSD monitors water loss accounting, it will implement a leak detection program if warranted by increasing losses.

4.4 Education and Public Information

Conservation Public Information Campaign – Water conservation information is disseminated via a recently improved website. The District also plans to acquire customer e-mail addresses to deliver notices electronically. Water conservation topics include information on the turf removal and low-flow fixture rebate programs, irrigation management, xeriscaping and other water saving tips. Staff responds to residential and commercial customers with water use or billing questions and requests for water conservation information.

School Education Programs – CWSD is a member of the DCWRA, and the education resources of DCWRA are available to customers. A DVD on Xeriscape prepared by DCWRA was distributed to every customer. A proactive education program to visit schools with water conservation programs is also underway.

4.5 Indoor Efficiency

Water budgets for residential accounts – Water budgets for residential use were first implemented in 2003. Water budget allotments were set based on the number of people living in a household and the number of days in a cycle.

Low-Flow Fixtures – CWSD has a Residential Rebate Program providing rebates to customers that purchase and install low-flow fixtures in their home. The District has an annual budget of $5,000 to reimburse customers for their efforts.

- $100 per ultra low volume toilet. Toilet replaced must use more than 3 gallons per flush to qualify for this program. Limit 3 per household.
- $125 per horizontal axis/front loading washer. Limit 1 per household.
- $ 20 per low flow showerhead. Limit 3 per household.

Currently the district has 2-3 requests/month for rebates on washers, toilets, and showerheads. The annual budget allocated for rebates has not been spent for each year of the rebate program, but the District expects the number of rebates to increase with the recently improved public outreach efforts. Table 4-2 shows the actual amount in rebates from 2003 through 2009.

Efficiency Rebates for Calendar Years 2003 - 2009		
YEAR	Actual Total	Annual Budget Total
2003	$3,616	$5,000
2004	$500	$5,000
2005	$1,020	$5,000
2006	$515	$5,000
2007	$1,210	$5,000
2008	$750	$5,000
2009	$1,029	$5,000

Table 4-2
Residential Indoor Fixture Rebates

Water Conservation Measure
Operational Utility Side Measures
Integrated Resources Planning
Conservation Coordinator
Water Loss Control Program
Tracking of Water Losses
Education and Public Information
Conservation Public Information Campaign
School Education Programs (via DCWRA)
Indoor Efficiency
Water Budgets for In-Building Accounts
Low Flow Fixtures

Table 4-3
Current Water Conservation Program

Section 5: Identification and Screening of Proposed Conservation Measures

CWSD has implemented a comprehensive water conservation program described in Section 4. Significant water use savings have been realized. As part of this water conservation plan, existing water conservation measures and additional water conservation programs and measures were evaluated. It is important to note that as a water district, CWSD does not have land use or building permit regulatory authority. As a result, CWSD does not have the regulatory authority to require certain water conservation measures.

In July, 2008, the CWCB awarded an efficiency grant to Colorado Water Wise, a water conservation non-profit group, to create a best management practices guidebook specific to Colorado. The guidebook will assist water providers with the selection and implementation of effective water conservation programs and measures. The Colorado WaterWise Guidebook of Best Practices for Municipal Water Conservation in Colorado is a planning tool prepared for the purpose of improving and enhancing water efficiency in Colorado. The Best Practices Guidebook for Municipal Water Conservation in Colorado (Best Practices Guidebook) offers a detailed description of specific water conservation measures, program elements, regulations, policies, and procedures that can be implemented by Colorado water providers to help ensure reliable and sustainable water supplies for future generations.

The existing CWSD water conservation measures were evaluated and compared to the Best Practices Guidebook to determine if there were potential best practices to be considered that are not part of the current CWSD water conservation program. The Best Practices are shown in Table 5-1. The Best Practices Guidebook was also used to evaluate potential additional conservation measures.

Measure	Best Practice	Category or Sector Impacted
Full metering	BP 1	ALL
Conservation oriented rates	BP 1	ALL
Conservation oriented tap fees	BP 1	ALL
Integrated resource planning, goal setting and monitoring	BP 2	Utility
Water loss control	BP 3	Utility
Conservation coordinator	BP 4	ALL
Water waste ordinance	BP 5	ALL
Public information and education	BP 6	ALL
Landscape water budgets	BP 7	Outdoor irrigation
Rules and regulations for landscape design and installation	BP 8	Outdoor irrigation
Certification of landscape professionals	BP 8	Outdoor irrigation
Water efficient design, installation and maintenance practices for new and existing landscapes	BP 9	Outdoor irrigation
Irrigation efficiency evaluations	BP 10	Outdoor irrigation
Rules for new construction (residential and non-residential)	BP 11	ALL
High efficiency fixtures and appliances-Residential	BP 12	Residential
High efficiency fixtures and appliances-Non Residential	BP 12	CII
Residential water surveys and evaluations, targeted at high demand customers	BP 13	Residential
Specialized non-residential surveys, audits, and equipment efficiency improvements	BP 14	CII

Table 5-1
Water Conservation Best Practices from Guidebook

Descriptions of the existing and proposed conservation measures that were evaluated are included below. A summary of the water conservation measures are shown in Table 5-2.

5.1 Operational Utility Side Measures

Integrated Resources Planning – This is an existing measure and will continue to be the foundation of CWSD's water supply and demand management strategy. As described in Section 7, this approach has resulted in significant savings in infrastructure and water rights development and O&M costs. This measure is listed as a Best Practices Guidebook - Best Practice. **(BP #2)**

Full Metering – All CWSD customers and associated water use will continue to be metered and billed**. (BP #1)**

Modifications to increasing block rate structure – CWSD will continue to refine its water rate structure to promote water conservation. **(BP #1)**

Water Use Based Irrigation Tap Fees – CWSD will continue to implement irrigation tap fees that are based on irrigated area and planting materials. **(BP #1)**

Renewable Water Supply Charge – CWSD will continue its program to develop renewable water supplies and reduce dependence on nontributary groundwater. The District will consider financing this with a Renewable Water Supply Charge if warranted. **(BP #1)**

Mandatory Watering Days – The District has used mandatory watering days in the past, and it can implement such a program again if it becomes necessary. Currently the District accomplishes the same result by allocating acceptable use and by penalizing customers with significantly higher rates when they exceed the allocation.

Conservation Coordinator – CWSD will continue to have a water conservation coordinator with support from DCWRA. **(BP #4)**

Water surveys and evaluations, targeted at high demand customers – CWSD has an existing water budget program and aggressive increasing water block rates that limit water use and discourage high water users. To implement this measure, the District can contact high water users and assists them with better management of demands. **(BP #13)**

5.2 Water Loss Control Program

Water Loss Control Program – CWSD averages 7 to 8 percent water loss. The District will continue to monitor its unaccounted-for water and implement a leak detection program if warranted. **(BP #3)**

5.3 Education and Public Information

Conservation Public Information Campaign – In addition to its existing in-house public education program, CWSD will use the services of Douglas County and DCWRA for dissemination of water conservation information. **(BP #6)**

School Education Programs – CWSD will use the services of the DCWRA for implementation of school education programs. **(BP #6)**

Annual Large Irrigators Water Conservation Meetings – CWSD's water conservation program is very effective and its large irrigators are knowledgeable about water conservation. The District does not currently see the need for an annual meeting, as the staff meets with large irrigators on an "as needed" basis. **(BP #6)**

Xeriscape Design Clinics – CWSD will work with DCWRA on the implementation of Xeriscape Design Clinics for all water providers in the DCWRA.

5.4 Indoor – Residential

Low-Flow Fixture Rebates – CWSD will continue its low-flow fixture rebate program. The annual budget allocated for rebates will be evaluated annually. **(BP #12)**

Rules for New Construction – CWSD as a water district does not have the regulatory authority to require high efficiency plumbing fixtures or other conservation measures for new residential construction. CWSD will work through the DCWRA and the Douglas County Board of Commissioners on the development of residential building regulations for areas covered by DCWRA water providers. **(BP #11)**

5.5 Indoor – CII

Rules for new construction - building codes requiring high efficiency fixtures and process equipment – CWSD as a water district does not have the regulatory authority to require high efficiency plumbing fixtures or other conservation measures for new Commercial, Industrial or Institutional construction. CWSD will work through the DCWRA and the Douglas County Board of Commissioners on the development of CII building regulations for areas covered by Douglas County water providers. **(BP #11)**

Specialized non-residential surveys, audits and equipment efficiency improvements – CWSD will incorporate billing reviews and support for reducing demands of high-use customers. CWSD will consider greater use of non-residential surveys, audits and equipment efficiency improvements. **(BP #14)**

5.6 Outdoor Efficiency - Landscapes and Irrigation

Water budgets for irrigation accounts – Water budgets for irrigation accounts have been implemented. **(BP #7)**

Irrigation System Water Conservation Requirements and Certification of Landscape Professionals – Irrigation design and water use requirements will continue as a performance standard. All irrigation system designs must be submitted for review and approval prior to the issuance of an irrigation tap for non-single family residential properties and inspected after installation. The irrigation designer shall be a Certified Irrigation Designer (Commercial) as certified by The Irrigation Association or other professional with extensive experience in the design of commercial irrigation systems as determined by the District Manager. **(BP #8).**

Water Efficient Maintenance Practices for New and Existing Landscapes – The District has discussed replacement of nozzles in their existing landscape areas, but currently lacks the funding to do so. In the future, District irrigation design standards will require that a regular maintenance schedule be submitted to ensure irrigation efficiency. A landscape irrigation audit for large commercial irrigation customer accounts must be performed every 5 years by an auditor approved by the District and a copy of the audit shall be provided to the district. **(BP #9)**

E-T Irrigation Controllers – If large commercial irrigation customers request financial assistance for the replacement of E-T irrigation controllers, CWSD will evaluate the request on a case specific basis to determine if there is potential for significant water savings from replacement of controllers. All irrigation

controllers must have battery backup or be unaffected by a power interruption and be secured to prevent tampering. Financial assistance from CWSD to large irrigation customers, if approved, will be phased over several years based on actual water use reductions achieved by the irrigators. **(BP #9)**

Efficient Irrigation Systems Program – If large commercial irrigation customers request financial assistance for the replacement of existing irrigation systems or installation of new systems with highly efficient irrigation systems, CWSD will evaluate the request on a case specific basis to determine if there is potential for significant water savings. Efficient irrigation systems include irrigation methods to reduce evaporation losses and increase overall irrigation efficiency. The irrigation customer must show the ability to perform recommended operations and maintenance for the life of the system as a prerequisite to financial assistance from CWSD. **(BP #9)**

Limits on turf landscaping for new construction – CWSD as a water district does not have the regulatory authority to limit turf landscaping for new construction and does not intend to pursue this with local governments at this time.

Rebates for turf replacement – CWSD will continue a rebate program for the replacement of turf. The annual budget allocated for such rebates will be evaluated annually. **(BP #12)**

5.7 Water Reuse Systems

Nonpotable irrigation system – Beginning in 2012 to the extent practicable, CWSD plans to supplement water supply with some reuse of consumable treated effluent from ACWWA's Lone Tree Creek Water Reuse Facility in which CWSD owns a share of capacity, or through other nonpotable alluvial sources.

Reuse of consumable effluent return flows – CWSD has been and will continue using consumable wastewater flows, to the extent practicable, either through direct reuse or augmentation pumping of Cherry Creek alluvial wells.

Water Conservation Measure	Existing Measure to be Continued	CWSD has Regulatory Authority?	Best Practices Guidebook BP #	Retained for Continued and/or Future Implementation?
Operational Utility Side Measures				
Integrated Resources Planning	Yes	Yes	2	Yes
Full Metering	Yes	Yes	1	Yes
Modifications to increasing block rate structure	Yes	Yes	1	Yes
Renewable Water Charge	No	Yes	1	TBD
Mandatory Watering Days (if necessary)	No	Yes	1	TBD
Conservation Coordinator	Yes	Yes	4	Yes
Water Loss Control Program				
Water Loss Control Program	No	Yes	3	If warranted by increasing losses
Education and Public Information				
Conservation Public Information Campaign	Yes	Yes	6	Yes
School Education Programs	Yes	Yes	6	Yes

Water Conservation Measure	Existing Measure to be Continued	CWSD has Regulatory Authority?	Best Practices Guidebook BP #	Retained for Continued and/or Future Implementation?
(via DCWRA)				
Xeriscape design clinics	No	Yes	6	TBD
Indoor – Residential				
Low Flow Fixture Rebates	Yes	Yes	12	Yes
Rules for New Construction (Building Codes requiring high efficiency fixtures)	No	No	11	Will work through DCWRA
Indoor – CII				
Rules for new construction - building codes requiring high efficiency fixtures and process equipment	No	No	12	Will work through DCWRA
Specialized non-residential surveys, audits and equipment efficiency improvements	No	Yes	14	TBD
Outdoor Efficiency - Landscapes and Irrigation				
Water budgets for Irrigation Accounts	Yes	Yes	7	Yes
Irrigation System Water Conservation Requirements and Certification of Landscape Professionals	No	Yes	8	TBD
Water Efficient Maintenance Practices for New and Existing Landscapes	Yes	Yes	9	Yes
E-T Irrigation controllers	No	Yes	9	TBD
Efficient Irrigation Systems Program	No	Yes	9	TBD
Residential Irrigation Efficiency Evaluations	No	Yes	10	TBD
Limits on turf landscaping for new construction	No	No		Will work through DCWRA
Rebates for turf replacement	Yes	Yes		TBD
Water Reuse Systems				
Nonpotable system augmented by reusable return flow credits	Yes	Yes		yes
Recapture and reuse of reusable effluent	Yes	Yes		Yes

Table 5-2
Evaluated Water Conservation Program Activities

Section 6: Demand Forecasts with Different Conservation Programs

The Alliance for Water Efficiency (AWE) Conservation Tracking Tool was used to project water demands. The Water Conservation Tracking Tool is an Excel-based spreadsheet tool for evaluating the water savings, costs, and benefits of urban water conservation programs. In addition to providing users a standardized methodology for water savings and benefit-cost accounting, the tool includes a library of pre-defined, fully parameterized conservation activities from which users can construct conservation programs. Detailed information on the inputs, assumptions and methods used in Water Conservation Tracking Tool can be found in the User Guide.

Three demand forecasts were made using the Water Conservation Tracking Tool:

1. Baseline
2. Baseline + plumbing code savings
3. Baseline + plumbing code savings + existing and planned water conservation program savings

6.1 Baseline Demand Forecast

The baseline forecast represents the CWSD demand forecast based on projecting the 2008 demands shown in Section 3, including unaccounted-for water. It is estimated that CWSD is currently at 60% build-out with 2,444 TEs (relatively unchanged from 2008). Based on current levels of density, CWSD's service area will reach build-out by 2025 at 4,057 TEs; 3,393 TEs of residential demand and 664 TEs of nonresidential demand. This projection results in a 2020 water demand of 1,196 AFY and a build-out demand of 1,320 AFY. These demand forecasts include estimated water losses, but do not include raw water supply planning safety factors. For the purposes of this plan, demand forecasts will be treated water forecasts, understanding that firm yield raw water supply requirements could be approximately 10 percent greater.

6.2 Baseline + Plumbing Code Savings Forecast

The Baseline + Plumbing Code Savings forecast includes forecasted reductions in demand that have or will occur as a result of National Plumbing Code efficiency standards. For example, ULFT toilet requirements included in the National Energy Policy Act took effect in 1994. New efficiency requirements for clothes washers will take effect in 2011.

The Baseline + Plumbing Code Savings demand forecast is approximately 1,162 AFY in 2020, a savings of 34 AFY.

6.3 Baseline + Plumbing Code Savings + Program Savings Forecast

The Baseline + Plumbing Code Savings + Program Savings forecast includes forecasted reductions in demand from the existing and planned water conservation program in addition to the savings projected to occur as a result of National Plumbing Code efficiency standards.

The following existing and planned water conservation programs were included as inputs into the AWE Water Tracking Tool to estimate and forecast the water savings from the existing and planned programs. Water savings have been estimated for the major existing programs listed in Table 6.1. These programs are forecast to save an additional 51 AFY by 2020 for a total savings of 85 AFY compared to 2010. This represents the potential for up to 7.1 percent total savings over the baseline water demands as shown in Table 6.2.

It is estimated that the District's current conservation measures, particularly its tiered water rates and water budgets, have already saved 22 AFY in demand based on 2010 development. Adding the savings to date to the projected savings through 2020, the 2020 demand is expected to be 107 AFY less than it would have been with no plumbing code or conservation savings; a savings of 8.9 percent.

Customer Class	Water Conservation Activity Name
Residential	Residential HE Toilets, SF
Residential	Residential HE Toilets, MF
Residential	Residential HE Washer, SF
Irrigation	Large Land. Irrigation Controller
Residential	Residential Increasing Block Rates
Institutional	Large Landscape Water Budgets
Irrigation	Large Landscape Water Budgets

Table 6-1
Water Conservation Activities included in AWE Tool

Service Area Water Savings	Units	Average Annual Savings in 2020
Residential HE Toilets, SF	AF	17
Residential HE Toilets, MF	AF	9
Residential HE Washer, SF	AF	8
Overall Plumbing Code Water Savings	AF	34
Large Land. Irrigation Controller	AF	11
Increasing Block Rates, Additional Savings	AF	10
Large Landscape Water Budgets, Institutional	AF	15
Large Landscape Water Budgets, Irrigation	AF	15
Overall Program Water Savings	AF	51
Total Water Savings	**AF**	**85**
% of Baseline Demands	**%**	**7.1%**

Table 6-2
Projected Water Conservation Savings

Section 7: Impacts of Conservation Programs

CWSD implemented a very aggressive water conservation program in 2003 and plans to continue that program for future savings. Despite significant growth from 2003 to 2008 (primarily commercial growth), CWSD's water demand only grew by 12 percent over that same period. The District's conservation program has obviously been very effective. **In recognition of the accrued conservation benefits, CWSD plans to obtain an additional five percent climate-adjusted reduction in demands by 2020, as compared to the 2008 baseline year.**

The forecast total water savings of 107 AFY possible by 2020 represents significant benefits. Figure 7-1 shows the projected annual water production to meet demands based on the baseline, baseline + code savings and baseline + code savings + program savings projected beyond 2010. The current limiting factor is renewable water supply. The continued successful implementation of conservation measures can delay the need to add capacity, and a total demand savings of 133 AFY is projected for build-out in 2025 based on continued development at current levels of density. However, the District has indicated that they are planning for build-out at significantly higher levels of density. Should that occur, there could be significantly higher conservation savings.

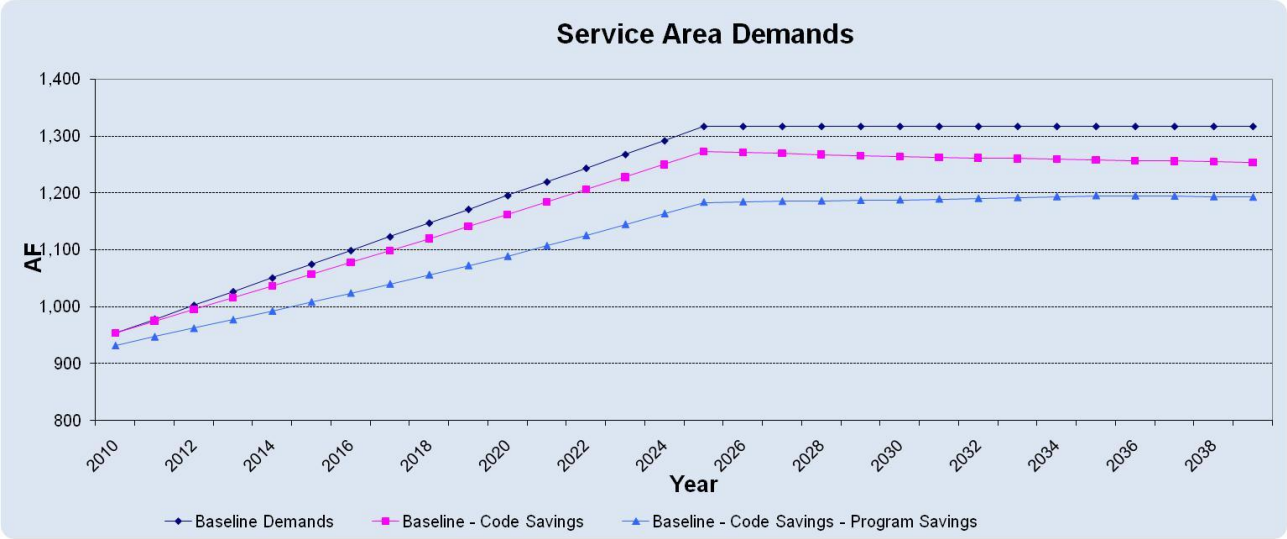

Figure 7-1
Forecast Total Water Demands

7.1 Benefits and Financial Savings

The following benefits and potential financial savings in capital improvements have been identified based on the projected water savings. It will require ongoing conservation efforts to ensure the identified water conservation savings can be made permanent:

Water Supply and Delivery – As CWSD saves on its water demands, the cost savings can be categorized as savings in operation and maintenance (O&M) or capital costs. Marginal savings in water demands will save on O&M of existing equipment and facilities; typically considered the volume charge component. This would include such costs as electrical demands for well pumping, and electrical and chemical costs for reverse-osmosis treatment. Based on budget-level costs in 2010, the O&M costs for water supply and delivery total $3.80 per 1,000 gal. or $1,240 per AF.

More substantial demand savings over time will save not only on O&M, but could defer the need for some capital improvements. The high-end capital savings is based on CWSD's plans to acquire 362 AFY in renewable water supplies to meet a portion of build-out water demand. As a member of SMWSA, it appears likely that CWSD will benefit from an interruptible supply contract with Denver Water and Aurora to obtain that water. The regional infrastructure to deliver that water is estimated at $460 M (Baysinger, et al. 2010), and SMWSA members expect that system to deliver 40,670 AFY throughout the region at build-out (Strother, 2010). Approximating the cost on a unit basis, the infrastructure will then cost $11,300 per AFY.

In addition, annual costs payable to Denver and Aurora are expected to range from $4.00 to $6.00 per 1,000 gal. We will assume an average cost of $5.00 per 1,000 gal. To this, the operating, maintenance, and replacement cost of the regional system must be added. That annual cost was estimated at $34.6 M to operate the system for 35,000 AFY (Baysinger, et al. 2010), or approximately $3.00 per 1,000 gal. The total then would be approximately $8.00 per 1,000 gal. or $2,600 per AF. This exceeds the current O&M costs of $1,240 per AF, so we will use the higher number.

CWSD will likely have an interest in purchasing 362 AFY of renewable water via the SMWSA agreement to offset the escalating costs of continued use of Denver Basin groundwater and provide long-term sustainability, regardless of how much water is saved through conservation. For simplicity, we will assume that the long-term costs for Denver Basin water approach those of the regional system water.

Wastewater Charges – As CWSD saves on its indoor water demands, it will also reduce wastewater flows and the O&M costs for its wastewater system, primarily wastewater treatment costs. Based on budget-level costs in 2010, the O&M costs for wastewater system O&M total $5.80 per 1,000 gal. or $1,890 per AF.

Projected Savings - The conservation savings to CWSD for capital and O&M expenditures are summarized in Table 7-1. The total savings possible in avoided capital expenditures for water supply and delivery infrastructure based on a potential build-out savings of 133 AF compared to the baseline projection without conservation is $1.50 M. In addition, the District could save $470,000 in annual O&M costs at build-out, in 2010 dollars. Ongoing water conservation programs will be needed to ensure that these savings are permanent.

Description	Water Demand Units	Total Water Conservation Program Forecast Demand Reductions	Estimated Unit Cost	Total Savings if Demand Reductions are Permanent ($ M)
Capital - Water Supply, Delivery, and Treatment	AFY	133	$11,300	**$1.50**
Annual O&M, Water System	AFY	133	$2,600	$0.35
Annual O&M, Wastewater System	AFY	67	$1,890	$0.13
Total Annual O&M	---	---	---	**$0.47**

Table 7-1
Projected Capital Expenditure Savings

7.2 Other Considerations

There are other considerations in addition to reduced capital project expenditures when evaluating the impacts of the water conservation program.

Reduced Nonpotable Irrigation Supply – As irrigation demands are reduced, the lawn irrigation return flow credits generated from irrigation are also reduced. This results in less augmentation supply available to offset well pumping. The impacts on the nonpotable system have not been quantified for this analysis, but will be monitored on an ongoing basis as part of the nonpotable irrigation accounting.

Section 8: Implementation and Monitoring Plan

8.1 Implementation

CWSD will continue its current water conservation programs. In addition it will implement the new programs previously described in Section 5 and shown in Table 8-1. This table also indicates the proposed dates of implementation, and the District plans to update the table as measures are selected.

Water Conservation Measure	Date of Implementation if New Measure
Operational Utility Side Measures	
Integrated Resources Planning	Ongoing
Full Metering	Ongoing
Modifications to increasing block rate structure	TBD
Renewable Water Supply Charge	TBD
Mandatory Watering Days (if needed)	TBD
Conservation Coordinator	Ongoing
Water Waste Ordinance	TBD
Residential water surveys and evaluations, targeted at high demand customers	TBD
Education and Public Information	
Conservation public information campaign	Ongoing
School education programs (via DCWRA)	Ongoing
Annual water conservation meetings with HOAs	TBD
Customer on-line access to water use history	TBD
Xeriscape design clinics	TBD
Indoor - Residential	
Residential clothes washer rebates	Ongoing
Residential toilet rebates	Ongoing
Residential toilet rebates for WaterSense high efficiency only	Ongoing
Indoor - CII	
CII high efficiency toilet and urinal rebates	TBD
Outdoor Efficiency - Landscapes and Irrigation	
Water budgets for residential and irrigation accounts	Ongoing
Irrigation System Water Conservation Requirements and Certification of Landscape Professionals	TBD
Water Efficient Maintenance Practices for New and Existing Landscapes	TBD
Efficient Irrigation Systems Program	TBD
E-T Irrigation controllers	TBD
Residential Irrigation Efficiency Evaluations	TBD
Water Reuse Systems	
Nonpotable system augmented by reusable return flow credits	Ongoing
Recapture and reuse of reusable effluent	Ongoing

Table 8-1
Future Water Conservation Measures

8.2 Ongoing Monitoring

CWSD will track the impacts of the conservation plan annually. Monitoring of total and billed water usage will provide information on water use and progress toward the water conservation goals. With County and State support, CWSD could produce a progress report on the conservation program in 2015 that includes a detailed description of plan implementation as well as the measured impacts on usage.

8.3 Plan Refinement

CWSD will periodically evaluate its program and implementation for conformance with this Plan. The District may adjust the programs identified in this Plan as warranted due to new technology or analysis of the effectiveness of individual programs.

8.4 Compliance with State Planning Requirements

Colorado Statutes Title 37 Water and Irrigation – Colorado Water Conservation Board (CWCB) and Compacts 37-60-126 requires a state approved water conservation plan for covered entities as a condition of seeking financial assistance from the CWCB. Because CWSD is not categorized as a covered entity, those provisions are not applicable to this Plan, although it is largely based on the key planning requirements of that statute.

References

Colorado WaterWise. Guidebook of Best Practices for Municipal Water Conservation in Colorado. Denver, CO: Colorado WaterWise. 2010. Print

Centennial Water and Sanitation District (2007). Water Conservation Plan. Centennial, CO: Centennial Water and Sanitation District. 2007. Print.

D'Audney, L. & Mayer P. (2010) "Guidebook of Best Practices for Municipal Water Conservation in Colorado", Fort Collins, CO: Fort Collins Utilities. Presentation

Strother, B. (2010, July). "Regional Partnerships for a Sustainable Water Future". South Metro Water Supply Authority Presentation on WISE to the Rural Water Authority of Douglas County, Denver, CO. 25 August 2010. Presentation.

Baysinger, Donaldson, Foreman, Larsen, Mangen, and Piper. *Douglas County Rural Water Project Appraisal Report: Rural Water Supply Program*. Loveland, CO: US Department of the Interior: Bureau of Reclamation, 2010. Print.

Author Undefined. (2010). Water Wiser - Water Loss Control Terms Defined in *American Water Works Association.* Retrieved November 13, 2010, from www.awwa.org/resources.

Angers, J. (2001, July). How can we determine how much water was lost? AWWA Opflow.