OWRB / USACE TULSA DISTRICT

WATER FOR 2060 – PHASE 2

TECHNICAL MEMORANDUM NO. 2
WATER FOR 2060 HOT SPOT BASIN WATER CONSERVATION ANALYSES

FINAL
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100 N.E. 5TH STREET • OKLAHOMA CITY, OKLAHOMA 73104 • P. 405.840.7785

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1.0 INTRODUCTION

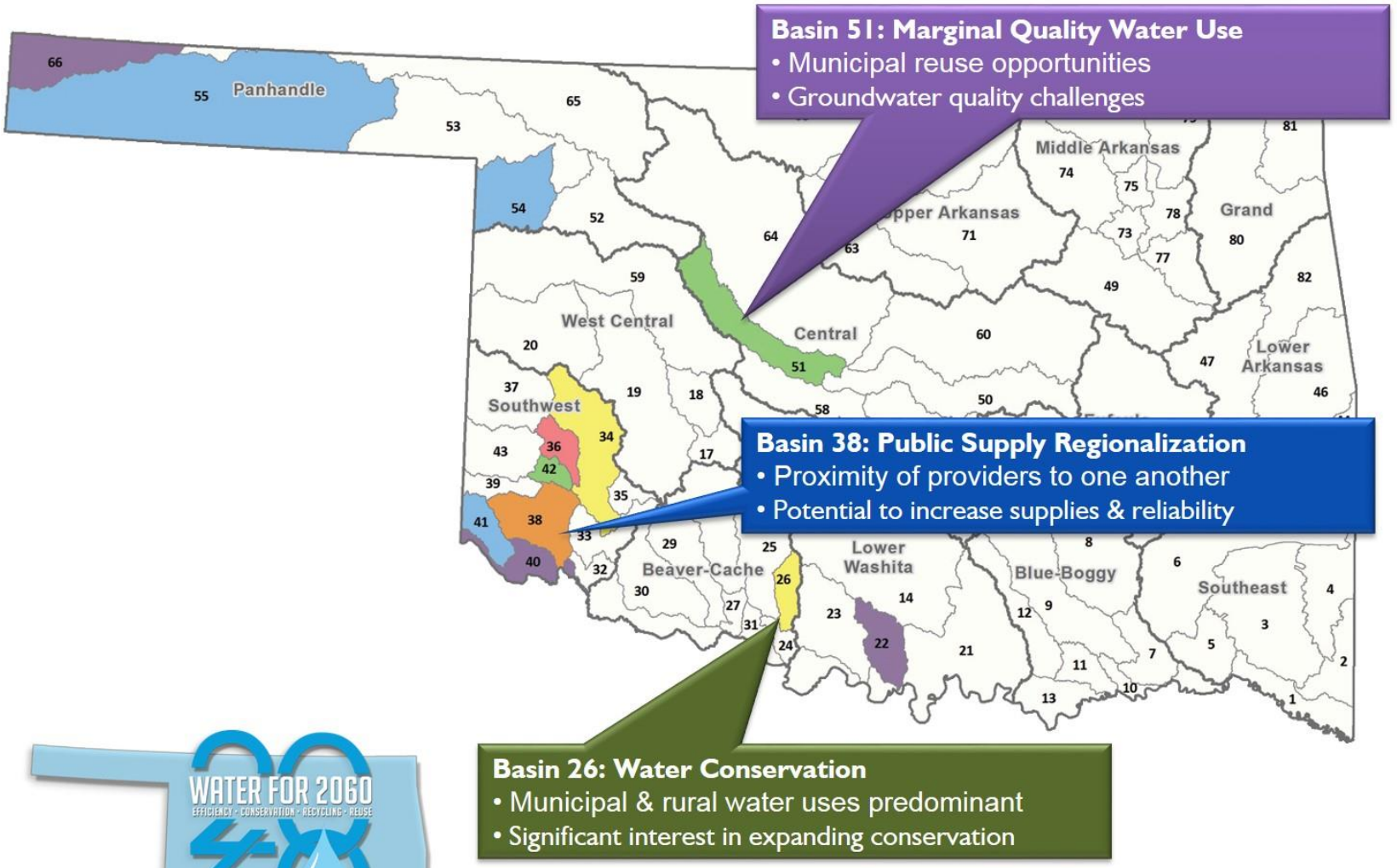
The Governor of Oklahoma signed the Water for 2060 Act into law in 2012. It set a statewide goal of consuming no more fresh water in 2060 than was consumed in 2012, while continuing to grow the state's population and economy. Water for 2060 emphasizes the use of education and incentives, rather than mandates, to achieve this goal. Toward this goal, the Oklahoma Water Resources Board (OWRB) is promoting water efficiency in partnership with the U.S. Army Corps of Engineers (USACE) through a series of Water for 2060 activities, with an emphasis on potential means of alleviating the water shortages projected in the 2012 Update of the Oklahoma Comprehensive Water Plan (OCWP).

This Technical Memorandum (TM) No. 2 provides information on the potential benefits and costs of implementing conservation programs on a local scale. Conservation activities are those water saving measures that happen every day, every year (versus drought management or short-term activities initiated in response to reduced water supply). Conservation can occur on both the demand side (i.e., switching to low flow fixtures) and supply side (i.e., reducing non-revenue water). The hot spot basin analyses focuses on locally implementable conservation activities in Basin 26 in the Beaver-Cache Region, but serves as a demonstration of how conservation can be implemented in communities across Oklahoma.

The analyses are presented on an informational basis only. Public water supply systems (PWS) discussed here are offered this information as a resource to support local planning efforts. However, there is no requirement for any PWS to implement any project contemplated in this TM.

2.0 BACKGROUND

OWRB, in partnership with USACE, is implementing a phased set of activities to support the Water for 2060 goals. More information on the overall program is available at www.owrb.ok.gov/2060. Phase 2 services focus on mitigating the projected surface water supply gaps and groundwater depletions in the "hot spot" basins, defined in the OCWP as those basins with the greatest future water supply challenges. Figure 2.1 illustrates the OCWP hot spot basins and those selected as part of Water for 2060 Phase 2 (as documented in TM No. 1) to demonstrate how conservation, marginal quality water supplies, and PWS regionalization strategies can address the local water needs. This TM focuses on the conservation analyses. Other TMs address the marginal quality water and regionalization demonstration projects.



WATER FOR 2060 PHASE 2, BASIN LEVEL DEMONSTRATION ANALYSES

FIGURE 2.1

OWRB/USACE TULSA DISTRICT
WATER FOR 2060 HOT SPOT BASIN MARGINAL QUALITY WATER ANALYSES

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Basin 26 showed a high potential for use of conservation activities to minimize future projected water shortages. Basin 26 is located in the Beaver-Cache Watershed Planning Region and is generally located along Cow Creek upstream of Waurika. Based on projected demand and historical hydrology, surface water gaps and bedrock groundwater depletions are expected by 2020, as shown in Table 2.1. Recent years' climatic conditions provided clear evidence that water supplies in the region can be severely strained in times of severe and extended drought.

Table 2.1 Magnitude and Probability of Annual Gaps and Storage Depletions in Beaver-Cache Region, Basin 26

Planning Horizon	Maximum Gap/Storage Depletions (acre-feet per year [AFY])			Probability of Gaps/Storage Depletions (%)	
	Surface Water	Alluvial GW	Bedrock GW	Surface Water	Alluvial GW
2020	20	0	60	60	0
2030	40	0	110	76	0
2040	60	0	170	84	0
2050	80	0	230	86	0
2060	110	0	290	88	0

Notes:
(1) From OCWP Beaver-Cache Watershed Planning Region Report (www.owrb.ok.gov/supply/ocwp).

Basin 26 was identified as an OCWP hot spot basin because of the frequency of surface water gaps expected. Bedrock groundwater depletions will occur every year, and both surface water gaps and bedrock groundwater depletions are projected to increase in magnitude over time as demands in the basin increase.

3.0 BASELINE DEMANDS AND MEASURES CONSIDERED

The Basin 26 active conservation analyses focused on demand and supply side conservation activities for the public water supply, or municipal and industrial (M&I), sector which is the predominant demand sector in the basin. The goal of the hot spot basin water conservation analyses was to identify locally-applicable conservation measures, building on the existing conservation efforts already in use in Basin 26 communities, and to estimate the costs and effectiveness of those measures in reducing demands in selected PWSs. The analysis also sought to evaluate the effectiveness of the projected reduction in demand associated with new conservation measures in reducing the basin's projected water supply shortages.

The cities of Duncan and Comanche and Stephens County Rural Water District (RWD) #3 participated in the conservation analyses. These PWSs represent different size communities and use different types of water supplies. Basin 26 experienced water supply

issues during the recent extended drought, and PWSs and customers responded by implementing drought management measures.

3.1 Baseline Demands

Baseline demands were analyzed for each of the three PWSs, in order to document the anticipated water use that will occur without implementation of additional active conservation measures. Each PWS studied has some degree of active conservation messaging and measures in place. The baseline water demand projections reflect projections of passive conservation, and because they are based on system-specific per-capita demand data, also assume the continued use of existing active conservation measures.

The data inputs and results of the baseline demand analyses are documented in the materials presented in Appendix 2B (Duncan), Appendix 2C (Comanche), and Appendix 2D (Stephens County RWD #3). This includes, for each PWS, an analysis of:

- Recent years' and projected future PWS service area populations (through 2060),
- Recent years' water production and per-capita demands (expressed in gallons per capita per day [gpcd]),
- A comparison of recent years' per-capita demand to annual precipitation and the timing of water use restrictions (since drier years tend to drive outdoor water use up, unless/until water use restrictions are implemented),
- An analysis of monthly/seasonal water use patterns and peak-day to annual-average peaking factors,
- An analysis of recent years' indoor versus outdoor water use, and
- A disaggregation of OCWP county-level passive conservation projections to estimate the net annual water demand for each PWS studied through 2060.

Water demand projections were based on anticipated normal-year demands without water use restrictions. In most cases, this resulted in the use of per capita demand data from 2009 through 2011 (where available) as the basis for future projections.

Per capita demands are not directly comparable from one PWS to another, due to system-specific characteristics. Factors such as industrial uses, tourism, the prevalence and size of outdoor landscaping features and pools, and countless other characteristics of the community can cause significant differences, even in neighboring communities.

The analyses of indoor/outdoor use ratios showed that both indoor and outdoor water uses are significant portions of the demand in all of the three PWSs evaluated, indicating potential benefits of water conservation programs targeting both indoor and outdoor water use.

The OCWP assessment of non-revenue water for each PWS was also considered in developing recommendations for conservation measures. Non-revenue water is the difference between the amount of water that is produced and the amount of water that is

sold to customers. As detailed in the OCWP Conservation and Climate Change Report, losses in conveyance (water transmission and distribution piping) are just one of many different causes of non-revenue water. Therefore, the OCWP used a goal of 10 percent non-revenue water for its PWS conservation analyses. That same threshold was used in the current analyses.

3.2 Role of Conservation

There is an ongoing role for increased water conservation to reduce pressure on local supplies, even in normal precipitation years. Conservation measures reduce water demand through every day activities, while drought management actions are those we take in response to short term reductions in supply (like Comanche's mandatory water use restrictions through recent severe drought) or temporary responses to infrastructure failures.

By reducing demands through conservation, many water supply systems are able to “save up” more water in storage facilities (e.g., raw water supply reservoirs), which in turn helps provide supplies for a longer time through an extended drought. Because water infrastructure sizing is driven by peak summer demands (usually related to seasonal outdoor water use), conservation can also offer infrastructure benefits by reducing peak water demands and thereby delaying or deferring the need for capital projects.

3.3 Identification of Candidate Conservation Measures

Two primary categories of water conservation are recognized in the industry, as detailed in the OCWP Conservation and Climate Change Report: passive conservation and active conservation measures. Passive conservation was defined in that report as “water savings that are the direct result of state and federal implementation of plumbing codes requiring individuals to install water efficient plumbing fixtures.”

Essentially, passive conservation is the water demand savings that will occur due to previously-established federal legislation with no further action on the part of PWSs. As older homes and businesses are renovated, water-using fixtures are replaced with higher-efficiency models, resulting in reductions in water use. The OCWP developed projections of passive conservation on a county level through 2060. Passive conservation was not analyzed further in the current evaluations.

In contrast, active conservation measures and programs are those that are intentionally implemented by a PWS. Active conservation measures occur and succeed only to the degree they are initiated by the PWS, and depending on the conservation measure, are oftentimes successful only to the degree they are embraced by and implemented by the supplier’s customers.

The American Water Works Association (AWWA) Manual of Water Supply Practices Manual M26 for Water Conservation Programs is an industry standard in conservation planning. The Hot Spot Basin water conservation analyses described in this TM are not intended to constitute a thorough or complete water conservation plan for each of the three PWSs discussed. However, elements of the approach recommended in AWWA

Manual M26 and other industry standard practices were utilized to gauge the relative potential for additional active conservation measures in each of these PWSs, and the corresponding costs and water savings that may be associated with each.

The Basin 26 conservation analyses build upon work completed in the OCWP Conservation and Climate Change Report (available at www.owrb.ok.gov/supply/ocwp). Manual M26 encourages planners to identify measures that may be appropriate for the area as an initial starting point for consideration of measures for potential implementation. Potential measures were screened from a variety of industry references for potential consideration for use in the Basin 26 PWSs studied.

Table 2.2 summarizes the potential conservation activities considered by the planning team to be potentially implementable in one or all of the three PWSs studied, considering the following:

- Degree to which certain conservation measures are already prevalent in the area,
- Public awareness, understanding, and anticipated acceptance of conservation measures, the need for conservation, and the effectiveness of various measures,
- Types of water use prevalent in the area (indoor/outdoor water use ratios, types of development, residential vs. commercial vs. industrial uses, etc.),
- Complexity and cost of implementation, and
- Experiences of other Oklahoma and regional communities.

A description of each of the measures in Table 2.2 is provided in the subsections that follow. Details of the conservation activities were developed and discussed in coordination with each participating PWS. The discussion materials for each PWS's analysis are provided in the appendices (Appendix 2B for Duncan, Appendix 2C for Comanche, and Appendix 2D for Stephens County RWD #3).

3.3.1 Conservation Program Administrator

A conservation program administrator provides oversight of and coordinates conservation activities. This person also may serve as a source of information for the pubic on the overall PWS's conservation program (through making presentations, giving tours, etc.). Most of the conservation activities considered have some level of administrative work associated with them (for example, processing rebates, answering questions on ordinances, conducting or scheduling water audits). This potential conservation activity wraps those administrative duties up to a single responsible person. For estimating costs, $50,000 per year was used to represents the cost of a staff member dedicated to this role. No direct water savings are associated with this activity, however increasing the visibility and assigning responsibility for the conservation program improves the likelihood of water savings being realized from other conservation activities.

Table 2.2 Basin 26 Candidate Conservation Activities

Potential Activity	Description	Water Savings[3]	Program Costs[3]	Implementation Notes
Conservation Program Administrator	Provides oversight of, coordination of, and serves as a source of information to the public on PWS's conservation program.	[1]	$50,000/year.	Consider using regional administrator to provide cost savings and consistency in programs.
Public information and education programs	Activities include public presentations to civic and student groups, distribution of flyers, tours of water facilities. Activities serve to enhance public image, increase visibility of water issues, and are a key component to recognizing water savings through other conservation activities.	Varies Study assumed that 25% of recent drop in water use (through outreach during drought) will remain permanent with enhanced outreach program.	Varies[3] Study assumed $1 per household.	Current public information and education programs have resulted in water savings, evident from reduction in indoor water use.
Conservation Water Rates	Rate structure that promotes water efficiency while covers cost of water treatment, delivery, and infrastructure repair/replacement.	Varies[3,4] Study assumed that by increasing rates of top 5% of water users, water savings of 2% will be recognized.	$25,000 - $50,000 for cost of service (rate) study.	Assumed one time water use reduction.
Leak Detection Program	There is unavoidable loss, like water lost due to line flushing, fire hydrant testing, fire department training, etc. Program seeks to minimize real loss (through water leaks) and apparent loss (meter inaccuracies).	Varies Water savings recognized at 1% per year until goal of less than 10% non-revenue water is met.	Varies[5] Study assumed $588 per acre-foot of water saved.	

Table 2.2 Basin 26 Candidate Conservation Activities

Potential Activity	Description	Water Savings[3]	Program Costs[3]	Implementation Notes
Water Audits	Water audits conducted by the PWSs, targeted to high water use customers.	Varies. Study assumed water savings 26 gallons per day (gpd) for single family and 208 gpd for multi-family units.	$190 for single family. $130 per unit for multi-family complex.[3]	Water savings and costs are highly variable based on who conducts the audits and whether replacement/repairs are made as part of audit.
Toilet Leak Repairs	Leak detection dye tablets available for customer use.	Assumed 9 gpcd.[6]	$0.25 per dye tablet kit.	Utility could accomplish intent by providing information on how to test for leaks using food coloring over telephone or as bill insert (in lieu of making dye tablets available)
Require High Efficiency Fixtures	Ordinance requiring high efficiency fixtures in all new and replacement toilets, showerheads, and faucets.	Varies based on age of fixture being replaced.[7]	$0	May not be applicable to PWSs without lawmaking authority
Require Rain Switches	Ordinance requiring rain switches (automatically prevents irrigation system from turning on when it is raining) in new systems.	Varies	$0	May not be applicable to PWSs without lawmaking authority
Set Max Percent Turf	Ordinance that set a maximum amount of turf grass allowable in new landscaping.	Varies	$0	May not be applicable to PWSs without lawmaking authority - Demonstration areas may help customers better understand low water landscaping alternatives

Table 2.2 Basin 26 Candidate Conservation Activities

Potential Activity	Description	Water Savings[3]	Program Costs[3]	Implementation Notes
Require Irrigation Meters	Ordinance that requires an irrigation meter for all new construction.	Varies	$0	May not be applicable to PWSs without lawmaking authority - Assists with educating customers about their outdoor water use, also may be used for billing outdoor water use at different rate.
Permanent Odd/Even Watering	Ordinance requiring permanent odd/even outdoor watering schedule.	[2]	$0	May not be applicable to PWSs without lawmaking authority.
Water Conservation Landscaping Rebates	Rebates for various landscaping improvements which reduce outdoor water use.	Varies based on customer implemented changes 7 Study assumed: • 15 AFY/sf of turfgrass replaced with low water use landscaping. • 0.001 AFY/ sprinkler head replaced. • 0.02 AFY/ smart controller installed. • 0.003 AFY/ rain/freeze switch installed.	Varies Study assumed: • $1/sf of turf grass replaced with low water use landscaping. • $2/each for replacement using high efficiency sprinkler heads. • $125/each for installing smart irrigation controllers. • $50/each for installing rain/freeze switch for irrigation controllers (existing landscaping).	

Table 2.2 Basin 26 Candidate Conservation Activities

Potential Activity	Description	Water Savings[3]	Program Costs[3]	Implementation Notes
High Efficiency Fixture Rebates	Rebates for replacing existing fixtures with high efficiency models.	Varies[7] Study assumed 0.018 AFY/toilet replaced.	$75/toilet replaced.	Other high efficiency fixtures can be considered (like shower heads, aerators for faucets) and could be provided as part of other conservation activities (like water audits). Care should be taken to not double count water savings if high efficiency fixture ordinance is implemented.

Notes:

(1) Enhances the visibility of water issues and supports other conservation programs. Water savings accounted for in other activities.

(2) Making odd/even watering restrictions permanent may not result in water savings. However, it can reduce peak demands and defer or reduce the need for infrastructure capacity expansions.

(3) Source: Texas Water Development Board (see Appendix 2A).

(4) Source: City of Austin, Texas (see Appendix 2A).

(5) Source: Sturm and Thornton (see Appendix 2A).

(6) Source: Vickers (see Appendix 2A).

(7) Source: U.S. EPA WaterSense Program (see Appendix 2A).

3.3.2 Public Information and Education

During the recent severe drought, extra attention was placed on water supply issues. A detailed analysis of water use during this period for each PWS revealed that public outreach and awareness of drought conditions impacted not just outdoor water use (where restrictions were in place) but also indoor water use (which had no use restrictions). The activity proposed in this study builds upon current work and assumes that public awareness will continue to some degree, despite the significant drought relief experienced in May 2015. It was assumed that 25 percent of per-capita water savings seen in recent years will become permanent with ongoing public awareness and public information and education programs.

The costs of public information and education activities vary widely based on what is being provided. It can be as simple as a conservation note on the water bill or more complicated like implementing a water conservation curriculum at schools. To estimate program costs in this study, a low cost program of approximately $1 per household was assumed.

3.3.3 Conservation Water Rates

Conservation water rates refer to a pricing structure that sends a price "signal" to users, in which higher uses incur a significantly higher cost per thousand gallons of water used. This allows for basic indoor needs to be covered with baseline monthly bills, while those users that drive peak demands highest (and thereby drive the sizing of infrastructure) pay the most for that peak water use.

PWSs face the challenge of encouraging water efficiency and conservation while covering the cost of water treatment, delivery, and infrastructure repair and replacement. Conservation water rates seek to structure the rates and fee schedules to achieve both goals. Conservation rates can be implemented in a variety of ways:

- Seasonal water rates can be used to reduce peak demands during summer months.
- Excessive use charges for amounts above all normal and necessary uses. Typically, these are greater than one hundred percent higher than base rates.
- Budget billing, whereby a budget is established for indoor and outdoor use based on the size of the building and its property. Users exceeding their allocated budget pay higher costs per unit of water used.
- Provide steeper steps between blocks or tiers in an increasing block rate structure. Research has shown that price increases are more effective if increases are at least 50 percent higher from one "block" or "tier" of water use to the next.

This analysis was not concerned with setting actual water rates, as there are many variables that must be considered, but assumed that by increasing the monthly bills for the top 5 percent of customers (those customers with the highest water use) by 10 percent, a water savings of 2 percent can be recognized. Water savings resulting from implementation of conservation water rates was assumed to occur just once (when rates are implemented).

To implement this strategy, a cost of service (rate) study is needed. Fees for rate studies vary based on the complexity, but were estimated at $25,000 to $50,000 (independent of water savings).

3.3.4 Leak Detection Program

The goal of this supply side program is to reduce the amount of non-revenue water. Non-revenue water includes

- Water lost due to leakage and excess system pressure.
- Water apparently lost due to meter accuracy or unauthorized water use.
- Water unavoidably lost due to line flushing, fire hydrant testing, or fire department training.

A goal of no non-revenue water is unrealistic, as water will always be needed for line flushing and fire hydrant testing, reducing leakage to zero is impractical, and other non-revenue water causes are unavoidable. However, reducing the non-revenue water is possible through preventative line maintenance/replacement programs (in areas prone to leakage), looped distribution systems (reduce need for line flushing), and meter testing to improve accuracy in water use measurements.

This analysis set the goal of reducing systemwide non-revenue water for each PWS to less than 10 percent, consistent with OCWP conservation analyses, with an annual reduction of 1 percent each year until the goal is met. Costs for leak detection programs vary widely. This study used an average cost of $588/AFY of water saved.

3.3.5 Water Audits

Water audits are used to identify specific opportunities for increased efficiency and/or leaks or other problems in a specific home or business. Water audits can be conducted in a variety of ways. Water audits can be conducted by utility staff, homeowners (with guidance from PWS staff or on website), or as part of an education program. If conducted by the utility (or outside contractor), simple water saving replacements, like sink aerators or sprinkler heads, may be made as part of the audit, or, alternatively or in addition to, the auditor may provide a written summary of findings including a list of items that customer can address to save water. Water audits conducted by utility staff are more expensive than providing information on utility's website. Water savings from audits depend on which measures are implemented by the customer.

For this analysis, it was assumed that audits would be focused on residential customers, and that water savings would be equal to 26 gpd for single family units and 208 gpd for multifamily units at a cost of $190/unit and $130/unit for single and multi-family units respectively.

For a limited time, the Oklahoma Department of Environmental Quality (ODEQ) is offering a free water loss audit for public water supply systems with less than 10,000 customers. More information on the program is available from ODEQ’s drought and water conservation

program in the Water Quality Division (contact ODEQ at 405-702-0100 or http://www.deq.state.ok.us/conservation).

3.3.6 Toilet Leak Repairs

Repairing a leaky toilet can save a significant amount of water over the course of one year (approximately 3,285 gallons assuming a water savings of 9 gpcd). At no additional cost to utility, PWSs can tell customers how to determine if their toilet is leaking using food coloring; this can be accomplished either over the telephone (when an inquiry is made) or through public outreach methods. At a small cost, the utility can have dye tablets available for customer use. For this analysis, it was assumed that the utility would make dye kits available to approximately half of its customers annually. Approximately 5 percent of those using dye kits would make repairs that result in 9 gpcd of water savings. To reflect the potential for recurring leaks after several years, water savings were held constant once 20 percent of the households have made repairs, even though the cost of the program continues.

3.3.7 Ordinances and Rebates

Implementing water efficiency ordinances is an essentially "no-cost" option for those PWSs that have the authority to do so, or operate within a governing entity that does (like a city), to promote long-term conservation. Water efficiency ordinances generally address new construction or replacement fixtures (like toilets).

In this analysis, water savings were estimated for implementing an ordinance that requires that all new and replacement fixtures meet the EPA WaterSense guidelines. EPA WaterSense-labeled fixtures are optional ultra-low-flow fixtures that go beyond current mandatory plumbing code. Therefore, implementing WaterSense fixtures will not necessarily occur without active promotion at the local level, and it is therefore an active, not passive, water conservation measure.

The water savings were based on the number of households converting from older fixtures. A similar analysis was conducted in the OCWP of new and replacement fixtures meeting the national plumbing code, in order to estimate passive conservation savings. Here, it was assumed that the conversion was made to WaterSense fixtures instead, and that all new customers would install the WaterSense fixtures.

A rebate programs is an option for speeding up conservation water savings through encouraging changes (fixtures, landscaping, etc.) in existing systems or when use of ordinances is not a viable option. Generally, to receive the rebates, customers must complete an application and provide proof (receipt, photos, field verification, etc.) that qualifying replacements were made. The costs (to the PWS) and effectiveness of rebate programs are primarily a function of:

- The PWS's chosen rebate value (e.g., rebate dollars per toilet),
- The number of rebates offered per year,
- Local availability of rebated products,

- Consumer acceptance of rebated products, and
- Customer awareness of rebate programs.

The following rebate programs were considered in this analysis, using assumed per-rebate dollar values that would be offered:

- WaterSense Toilet Rebate - rebate for replacing an older toilet with one meeting the EPA WaterSense standards. A unit water savings of 0.018 AFY/toilet at a cost of $75/toilet were used.
- Turfgrass Replacement Rebate - rebate for replacing turfgrass with low water use landscaping. A unit water savings of 15 AFY at $1.00 per square foot of turfgrass replaced was used.
- Sprinkler head Replacement Rebate - rebate for replacing older sprinkler heads with efficient-delivery (rotating streams instead of spray/mist) models. A unit water savings of 0.001 AFY at $2.00 per sprinkler head replaced were used.
- Smart Controller Installation Rebate - this rebate is provided for installing a smart controller on an existing irrigation system. Smart controllers use soil moisture and temperature to determine need for and amount of irrigation needed. Unit water savings of 0.02 AFY at $125 per smart controller installed was used in this analysis.
- Rain/Freeze Sensor Installation Rebate - this rebate is provided for installing rain/freeze sensors on an existing irrigation system to prevent operation during/after precipitation or under freezing conditions. Unit water savings of 0.003 AFY at $50 per sensor installed were used in this analysis.

4.0 RESULTS OF WATER CONSERVATION ANALYSES

Three PWSs, including Duncan, Comanche, and Stephens County RWD #3, participated in the conservation demonstration project. Each participating PWS was asked to provide historical information (described in Section 3.1). PWS-provided data and supplemental information from the OCWP was used to estimate potential water savings from potential new active conservation activities. Potential conservation activities were compared using the total amount of water likely to be saved and the cost of implementing the conservation activity. Meetings were held with each PWS to review potential water savings and costs. Water savings from conservation activities that were viewed as locally implementable (e.g., customer acceptance, cost of program, and political will) summed to determine potential water savings for the PWS. Savings were then summed for the three participating PWSs to estimate water savings at the basin level.

The following sections summarize information for each participating provider. More detailed information is provided in Appendices 2B, 2C, and 2D.

The conservation activities that were viewed as locally implementable varied between providers, but there were some commonalities. For example, all three participating PWSs indicated an interest in a conservation program administrator, and each saw benefits in having consistent conservation programs throughout the region. However, none of the PWS

participants viewed this as implementable in the near-term because of the cost of staffing an administrator position for their own system, or the challenge of setting up a regional administrator across multiple governing bodies.

Other examples of programs not viewed as locally implementable for any of the studied PWSs were rebate programs for high-efficiency fixtures and low water use landscaping. These generally had high unit costs per acre-foot of water saved, making the activity a high cost item without significantly reducing water demands. Also, some participating PWSs indicated a willingness to promote water-efficient fixtures and low water use landscaping as part of their public outreach program. Options that restrict or reduce the amount of turf grass in landscaping (i.e., ,setting a maximum percent of allowable turf grass in landscaping by ordinance, or reducing turf grass square footage through replacement rebates) were viewed as inconsistent with local quality of life considerations.

4.1 City of Duncan

The City of Duncan uses surface water from Waurika Lake, Lake Humphreys, and Lake Fuqua. It currently serves approximately 22,400 people and is projected to serve approximately 24,000 by 2060.

Duncan already has implemented several conservation measures. The city meters all water users. Non-revenue water in Duncan has already been reduced through leak identification and repair programs and other measures to approximately 6 percent, well below the goal of 10 percent described earlier in this TM. The City actively participates in public outreach through civic presentations and flyers. With the recent severe drought, the City also worked regularly with various news agencies to increase public awareness of water issues and the need for water efficiency. These public outreach efforts resulted in significant water use reductions (see Table 2.3 for recent years' per capita use trends). It is neither reasonable nor desirable for water use restrictions to remain at the drought emergency levels. However, through continuing public outreach it is hoped that some of the water use efficiency will become permanent.

Table 2.3 City of Duncan Recent Per Capita Water Demand

Year	Per Capita Demand (gpcd)	Note
2009	174	Pre-drought
2010	180	Pre-drought
2011	208	Driest year, no watering restrictions
2012	175	Drought awareness increased
2013	148	Watering restrictions initiated in May 2013

Estimates for water savings and costs for the various conservation activities analyzed were reviewed with city staff. Based on their feedback, Table 2.4 summarizes conservation activities believed to be locally implementable. If these programs are implemented, Duncan could build on its existing conservation programs and see an additional 5 percent

reduction in its water use (relative to normal demands without drought water use restrictions) by 2020.

Table 2.4 Proposed Conservation Program for Duncan

Conservation Activity	Estimated Cumulative Water Savings through 2020	Estimated Cumulative Activity Cost through 2020	Estimated Unit Cost ($/AF saved)
Ordinance - Require High Efficiency Fixtures	20 AFY	$0	$0
Ordinance - Permanent Odd/Even Outdoor Watering	(1)	$0	$0
Expanded Public Information / Education Programs(2)	101 AFY	$52,000(3)	$400
Implement Conservation Water Rates	26 AFY	$25,000 to $50,000(4)	$1,400
Implement Water Audits	27 AFY	$77,000(5)	$2,900

Notes:

(1) Making odd/even watering restrictions permanent may not result in water savings. However, it can reduce peak demands and defer or reduce the need for infrastructure capacity expansions.

(2) Enhances the visibility of water issues and supports other conservation programs.

(3) Includes development and distribution of communication materials, presentations to civic and student groups, tours of water facilities, etc. (approx. $10,000/year).

(4) Cost to conduct a one-time cost-of-service and rate study.

(5) Costs to conduct audits for 105 households per year (94 single family and 11 multi-unit households, approx. $19,300/year).

Water use efficiency ordinances seemed to be a good fit for the City of Duncan. As an essentially no-cost option, this could be implemented without causing additional financial burden. Duncan's water metering software offers the ability to track customer's historical water use and present information on customers' bills. This may be used to identify high water use customers, customers with sudden increases in water use, or, to supplement a water auditing program. As part of regular utility practice, Duncan conducts periodic cost of service studies. Discussions were held with City staff about including an alternative to evaluate use of conservation water rates in the City's next rate study.

4.2 City of Comanche

The City of Comanche currently uses surface water from Waurika Lake. The City currently serves approximately 1,650 people and is expected to serve approximately 1,670 people by 2060.

Comanche Public Works already has implemented several conservation measures. This includes fully metering all water users and participation in public education and outreach activities. Similar to Duncan, public outreach efforts were significantly increased during the recent drought.

Estimates for water savings and costs for the various conservation activities analyzed were reviewed with city staff. Based on their feedback, Table 2.5 summarizes conservation activities believed to be locally implementable.

Table 2.5 Proposed Conservation Program for Comanche

Conservation Activity	Estimated Cumulative Water Savings through 2020	Estimated Cumulative Activity Cost through 2020	Estimated Unit Cost ($/AF saved)
Ordinance - Require High Efficiency Fixtures	1.5 AFY	$0	$0
Reduce Non-Revenue Water	25 AFY	$15,000(2)	$600
Expanded Public Information / Education Programs(1)	56 AFY	$3,500(3)	$700
Implement Water Audits	3 AFY	$5,000(4)	$1,700
Implement Conservation Water Rates	3 AFY	$25,000 to $50,000(5)	$12,500

Notes:

(1) Enhances the visibility of water issues and supports other conservation programs.

(2) Costs associated with distribution system leak detection and repair program.

(3) Includes development and distribution of communication materials, presentations to civic and student groups, tours of water facilities, etc. (approx. $700/year).

(4) Costs to conduct audits for 5 households per year (4 single family and 1 multi-unit households, approx. $1,000/year).

(5) Cost to conduct a one-time cost-of-service and rate study.

If these programs are implemented, Comanche could build on its existing conservation programs and see an additional 25 percent reduction in its water use (relative to normal demands without drought water use restrictions) by 2020. The conservation savings are driven by two key programs – reducing non-revenue water and expanding public information/education programs. Comanche saw remarkable reductions in indoor water use between 2009 and 2013. As there were no restrictions placed on indoor water use, this reduction is likely a result of public outreach and awareness of drought conditions.

Water use efficiency ordinances seemed to be a good fit for Comanche as they are a no-cost option. Similar to Duncan, Comanche can build upon its existing public outreach program in an effort to maintain a portion of the water savings achieved during the recent years' drought restrictions.

Outside of the conservation demonstration project, the City is pursuing installation of automatic meter reading system and capital projects to loop distribution system lines. Improved metering allows for better accounting of how the water is used, and can aid in more quickly detecting leaks on the customer side. Looping distribution lines reduces the need to flush distribution lines, thereby reducing water being unavoidably lost. These activities, along with proactive pipeline replacement in known areas with leaks (as funding allows), will aid in reducing non-revenue water.

4.3 Stephens County Rural Water District #3

Stephens County RWD #3 utilizes groundwater as its water supply source. The District currently serves approximately 1,630 people and is projected to serve about 1,720 by 2060.

Stephens County RWD #3 has already implemented several conservation measures. This includes fully metering all water users, and having successfully reduced non-revenue water to 10 percent.

Estimates for water savings and costs for the various conservation activities analyzed were reviewed with District staff. Based on their feedback, Table 2.6 summarizes conservation activities believed to be locally implementable. If these programs are implemented, Stephens County RWD #3 could see a 13 percent reduction in its water use by 2020.

Table 2.6 Proposed Conservation Program for Stephens County RWD #3

Conservation Activity	Estimated Cumulative Water Savings through 2020	Estimated Cumulative Activity Cost through 2020	Estimated Unit Cost ($/AF saved)
Expanded Public Information / Education Programs(1)	15 AFY	$2,900(2)	$200
Implement Water Audits	1 AFY	$4,000(3)	$4,000
Implement Conservation Water Rates	1.3 AFY	$25,000 to $50,000(4)	$28,800

Notes:
(1) Enhances the visibility of water issues and supports other conservation programs.
(2) Includes development and distribution of communication materials, presentations to civic and student groups, tours of water facilities, etc. (approx. $600/year).
(3) Costs to conduct audits for 5 households per year (4 single family and 1 multi-unit households, approx. $1,000/year).
(4) Cost to conduct a one-time cost-of-service and rate study.

Stephens County RWD #3 benefits from public outreach conducted by other PWSs, including Waurika Lake Master Conservancy District, in the region. Although the District uses different sources (local groundwater), the District's customers listen to or read from the same news outlets as those customers using surface water (widely publicized impacts of recent drought on surface water supplies). Even though Stephens County RWD #3 did

not explicitly restrict its customers' water use, the District recorded a drop in per capita demand and staff attributes that drop to a regional recognition of drought impacts on water supply. Staff indicated an interest in including conservation notes on monthly water bills (or as a separate flyer).

Staff expressed some concern about conducting system wide water audits, but did think high water use customers or those with a sudden jump in their bill would be open to having a water audit. District staff, like other participants, fields phone calls when there is an unexpected increase in a customer's water bill. They already provide customers with information on how to find leaks but may consider expanding their response to include water use efficiency items (like faucet aerators).

Water efficiency ordinances are unlikely to be implemented, as this would require legislation at the county level. Other conservation activities seemed unlikely to be implemented locally. In part, this was because these activities were unlikely to receive funding at this time.

4.4 Basin-Level Reductions in Demand and Supply Shortages

If all selected water conservation programs are implemented in Duncan, Comanche, and Stephens County RWD #3, water use in the three PWS service areas would be reduced by approximately 280 AFY by 2020. However, portions of these three PWS service areas lie beyond the boundaries of Basin 26. Using geographic information systems (GIS) analysis methods, projections of water savings for each PWS analyzed were allocated proportionally to Basin 26 based on the percent of the PWS service area located within the Basin 26 boundaries.

These analyses determined that the selected programs in Duncan, Comanche, and Stephens County RWD #3 would reduce Basin 26 demands by about 165 AFY by 2020. By 2060, this would correspond to a reduction of approximately 300 AFY (9 percent of the total Basin 26 projected demand), considering all demands (i.e., other PWSs in the basin and uses in other demand sectors).

With this overall basin-wide reduction in water use, Basin 26 will see a reduction in both the magnitude and frequency of the projected 2060 surface water gap, shown in Table 2.7. This analysis focused on surface water gap reductions, due to the significantly higher amount of surface water used by the three PWSs studied relative to their overall groundwater use. The reduction in the magnitude of the surface water gap is particularly significant, reducing the size down to about one-third of the severity that it would otherwise be in 2060.

Table 2.7 Impacts of Conservation on Surface Water Gaps in Basin 26		
Condition	**2060 Surface Water Gap**	**2060 Surface Water Gap Probability**
Existing Condition(1)	110 AFY	88%
With additional active conservation programs in Duncan, Comanche, and Stephens County RWD #3	40 AFY	76%
Reduction in Surface Water Gap Magnitude due to Water Conservation in Duncan, Comanche, and Stephens County RWD #3	64%	N/A
Notes (1) As defined in the OCWP.		

5.0 STATEWIDE APPLICABILITY

Conservation can reduce water demands cost-effectively, using measures and programs that are tailored to each community. Some programs, like enhanced public outreach, water audits, and conservation water rates, were of interest to all participating PWSs, regardless of size or water supply source. Other programs, like water efficiency ordinances, were of interest to those PWSs with authority, because of the zero cost and long-term demand reduction benefits.

In many cases, demand reductions through conservation are less expensive than implementing new sources of supply. Use of the unit cost per acre-foot of water saved may be an appropriate way to compare the cost of conservation programs to new supply source development. In most areas, a combination of conservation and new supplies can be used to efficiently and cost-effectively meet current and future demands.

In Basin 26, this analysis demonstrated that even PWSs that have existing conservation programs can implement additional programs to achieve further savings. Moreover, the analyses demonstrate that even modest reductions in demands can result in significant reductions in supply shortages. Similar results would be expected in other basins across Oklahoma.

APPENDIX 2A – REFERENCES

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APPENDIX 2B – DETAILED CONSERVATION ANALYSES AND REFERENCE MATERIALS – CITY OF DUNCAN

Water Demand Projections – Baseline Population Projections

Year	Duncan Population = Service Area Population
2009	22,000
2010	22,100
2011	22,200
2012	22,300
2013	22,400
2020	**22,620**
2030	**22,830**
2040	**23,235**
2050	**23,607**
2060	**24,070**

Assume that wholesale customers are responsible for their own conservation plan.

Notes:
Historic population provided by City of Duncan.
2020, 2030 projections provided by City of Duncan. 2040-2060 projections from OCWP.

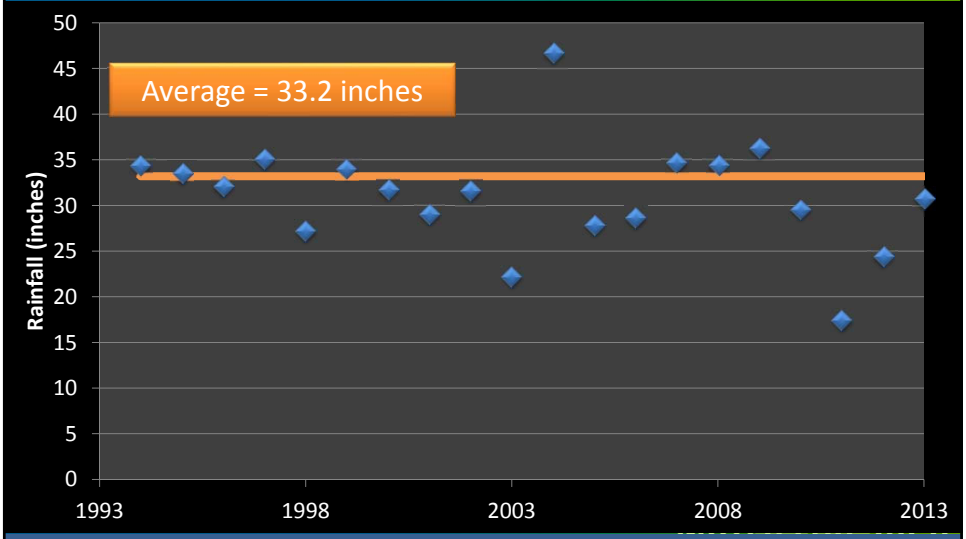
Water Demand Projections – Historic per capita demands

Year	Duncan's Service Area Population	Annual Water Produced (MG)	Per Capita Demand (gpcd)
2009	22,000	1,394	174
2010	22,100	1,453	180
2011	22,200	1,682	208
2012	22,300	1,428	175
2013	22,400	1,212	148

Average per capita demand = 177 gpcd

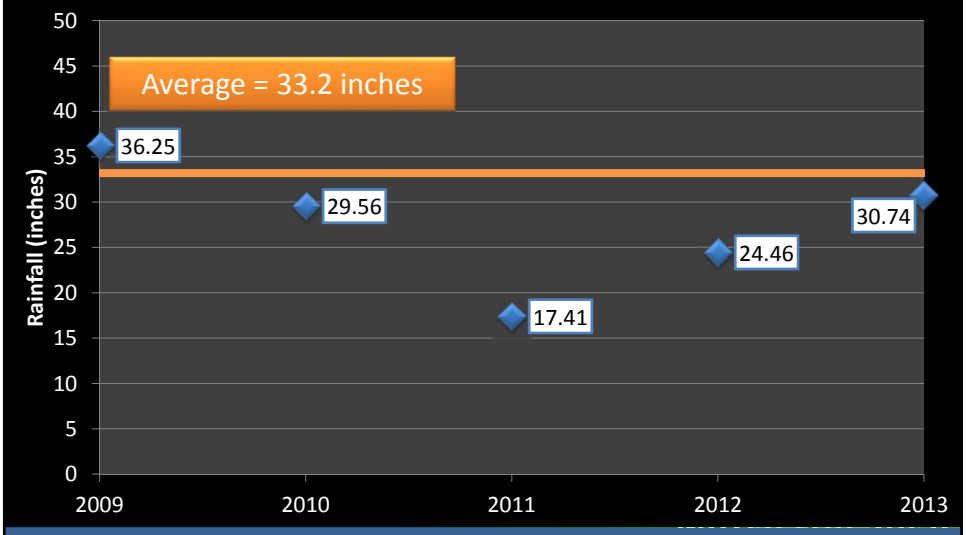
WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Duncan's Historic Per Capita Use Related to Annual Precipitation



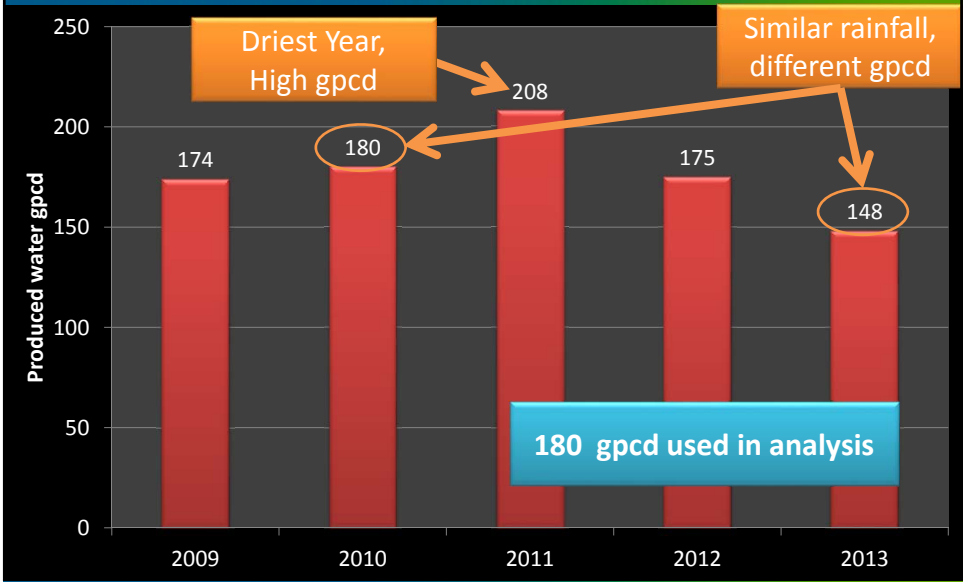
Notes:
From Waurika Mesonet site .

Duncan's Historic Per Capita Use Related to Annual Precipitation



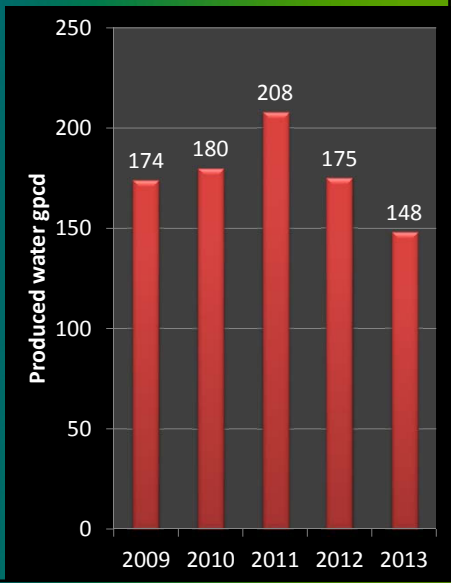
Notes:
From Waurika Mesonet site .

Duncan's Historic Per Capita Use Related to Annual Precipitation



Duncan's Historic Per Capita Use Related to Restrictions on Water Use

- Stage 1 – Voluntary conservation of outside water use
- Stage 2 – Mandatory restriction of outside water usage to every other day (May 2013)
- Stage 3 – Mandatory restriction of outside water usage to two days per week (Sept. 2013)
- Stage 4 – Mandatory restriction of outside water usage to one day per week (Sept. 2014)
- Stage 5 – Mandatory prohibitions of outside water usage



Duncan's Water Demands – Historic peaking factors

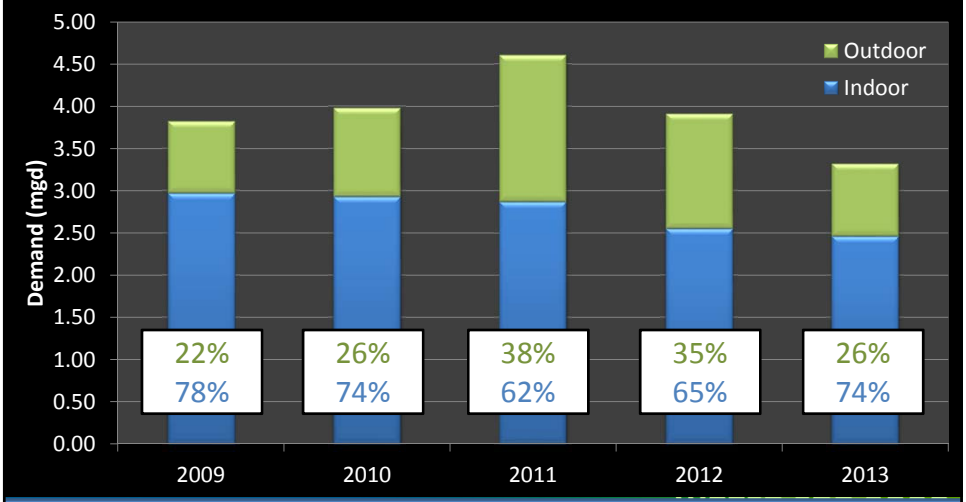
Year	Service Area Population	Annual Water Produced (MG)	Per Capita Demand (gpcd)	Peaking Factor
2009	22,000	1,394	174	1.75
2010	22,100	1,453	180	1.71
2011	22,200	1,682	208	2.06
2012	22,300	1,428	175	2.10
2013	22,400	1,212	148	1.89

Peaking Factor = Peak Day / Annual Average

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

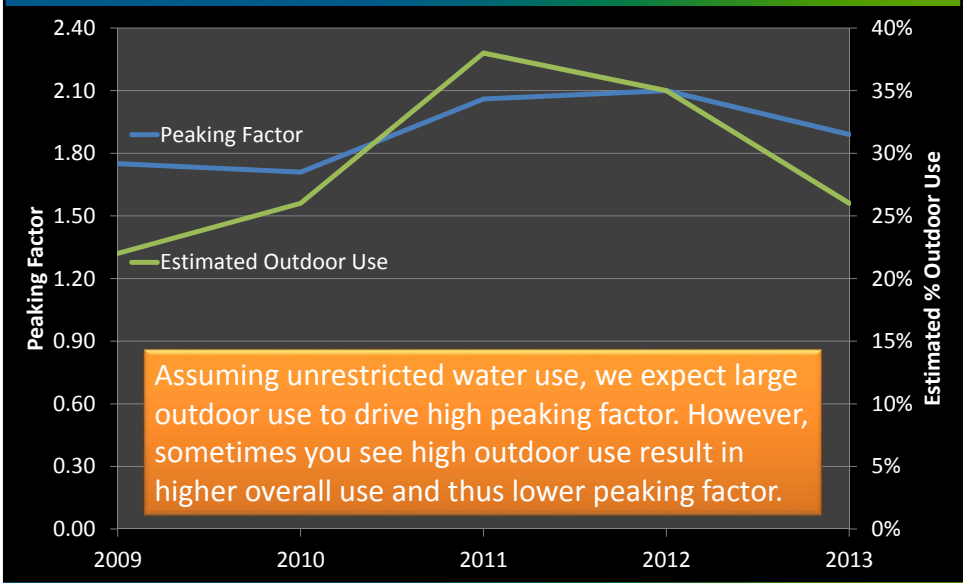
Water Demand Projections – Duncan's historic monthly use

Water Demand Projections – Duncan's indoor/outdoor water use

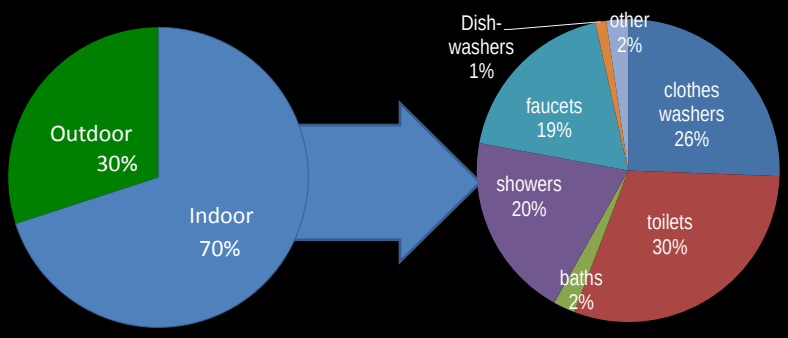


Indoor use assumes constant monthly use at 100% of December, January, and February average demand.

Water Demand Projections – Duncan's indoor/outdoor water use

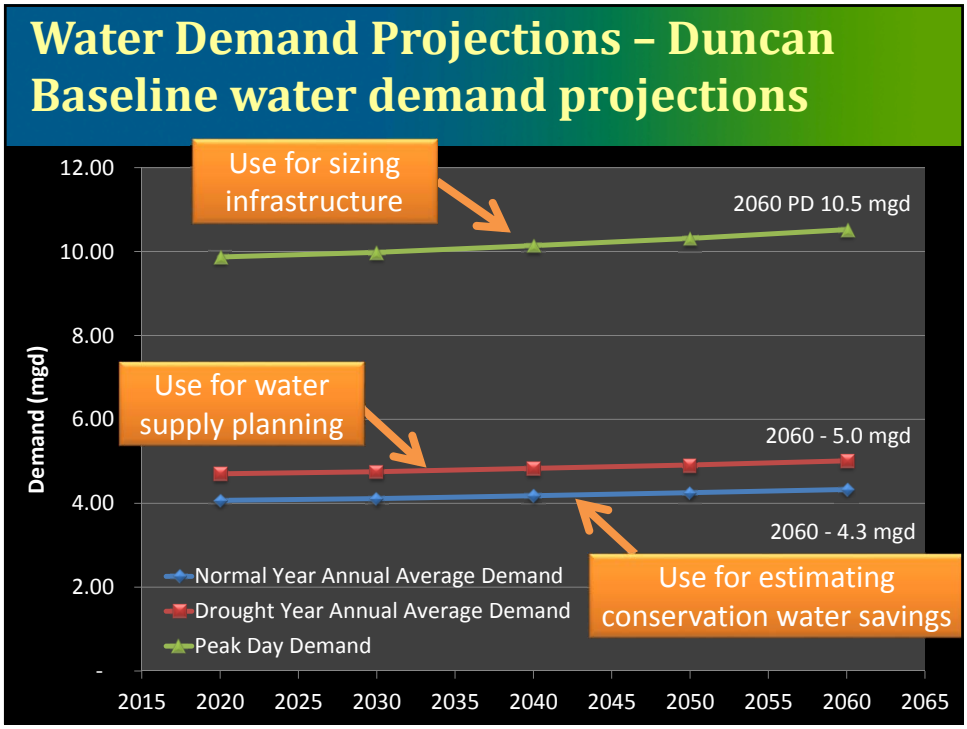


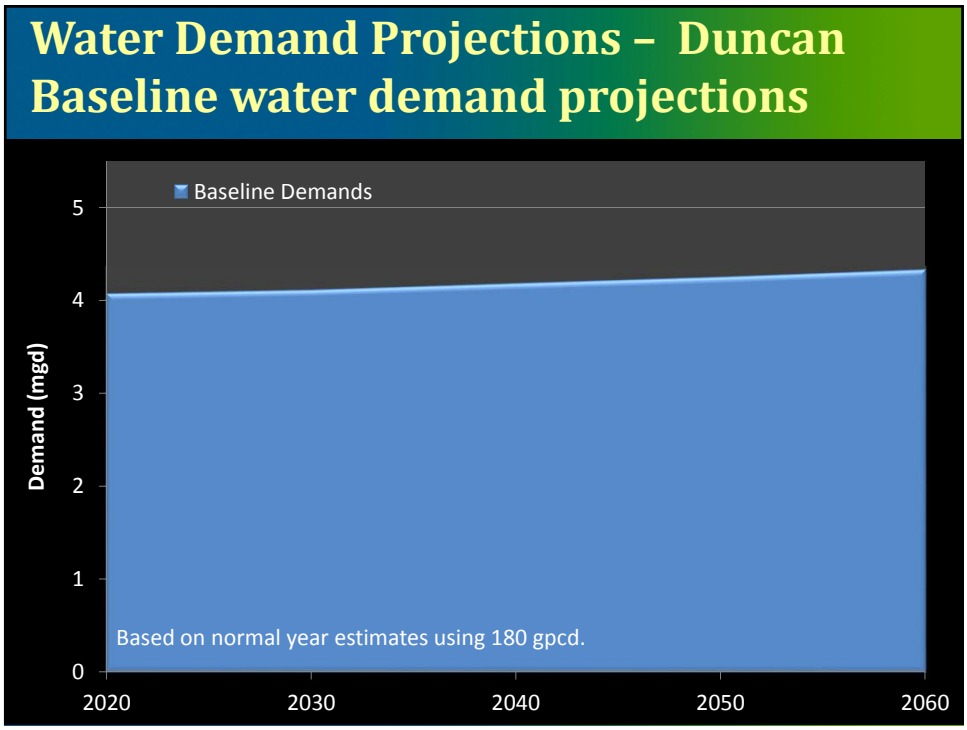
Water Demand Projections – Understanding sources of demand can guide priorities



Duncan's average indoor/outdoor water use estimate from years with no mandatory water restrictions

Typical Household Use from AWWA Manual M52


Water Demand Projections – Duncan
Baseline water demand projections
Use for sizing infrastructure
2060 PD 10.5 mgd
Use for water supply planning
2060 - 5.0 mgd
2060 - 4.3 mgd
Use for estimating conservation water savings
Normal Year Annual Average Demand
Drought Year Annual Average Demand
Peak Day Demand
Demand (mgd)
12.00
10.00
8.00
6.00
4.00
2.00
-
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065

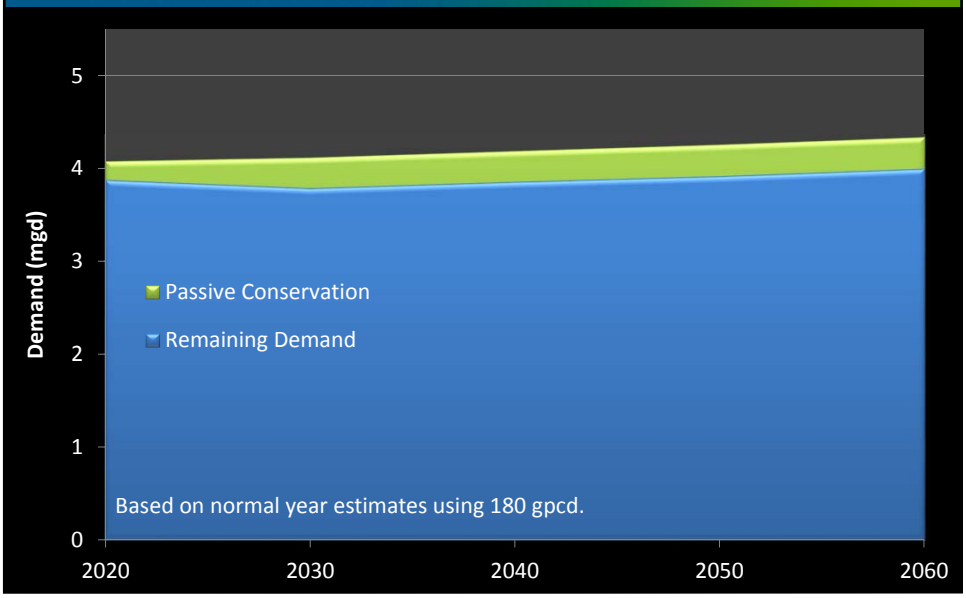

Water Demand Projections – Duncan
Baseline water demand projections
Baseline Demands
Based on normal year estimates using 180 gpcd.
Demand (mgd)
5
4
3
2
1
0
2020
2030
2040
2050
2060

Projections of Passive Conservation Savings for Duncan's Service Area

Year	OCWP Additional Residential + Non-residential Savings (post 2010), Stephens County (AFY)	OCWP Duncan's Population as a Percent of Stephens County	Duncan's Public Supply Passive Savings relative to 2010 (AFY)	Annual Average Passive Savings (mgd)
2020	353	64%	226	0.20
2030	570	64%	365	0.33
2040	578	64%	370	0.33
2050	588	64%	377	0.34
2060	602	64%	385	0.34

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Impacts of passive conservation on Duncan's demand



Duncan's Current Conservation Activities

- ✓Metering
  - 100% metering
  - 2011 AMR completed
  - Reduced NRW to about 6%
- ✓Public education
  - Flyers in bills
  - Presentations

Duncan – Potential Conservation Activities

- Metering
- Water use audits
- Public education
- Rebates
- Leak detection and prevention
- Conservation billing rates

Potential Conservation Activities – Conservation program administrator

Water Savings

- Provides oversight of, coordination of, and serves as a source of information to the public on the provider's conservation programs
- Water savings are accounted for in other programs

Program Costs

- $50,000 / year

Implementation

- Consider using "regional" administrator

Potential Conservation Activities – Public information and education programs

Water Savings

- Current public information and education programs have resulted in water savings, evident from the reduction in indoor water use
- Activities include public presentations to civic and student groups, distribution of flyers, tours of water facilities, etc.
- Public information and education programs enhanced public image, increase visibility of water issues, and are a key component to recognizing water savings in other programs

Program Costs *

- $1-$4 / customer, assuming information provided at least four times per year
- $1-$4 per student for curriculum
- $3-$6 per student for entertainment program
- $45 per student for prepackaged curriculum program

Implementation Schedule

- Year 1 – develop public information plan
- Years 2+ - implement plan

* Texas Water Development Board, Report 362 Water Conservation Best Management Practices Guide. All costs in 2014 dollars.

Potential Conservation Activities – Duncan public information and education programs

Year	Cumulative Water Savings [2] (AFY, mgd)	Program Cost [1] ($/yr)
2020	101, 0.09	$10,000
2030	101, 0.09	$11,000
2040	101, 0.09	$11,000
2050	101, 0.09	$11,000
2060	101, 0.09	$11,000

Notes:
1. Assumed low cost public information and education program implemented. All costs in 2014 dollars . Staff currently participates in public information/education programs as part of existing budget. Cost assumes slight expansion of existing programs.
2. Water savings based on historical data. It is assumed that 25% of water savings seen in the area (prior to mandatory watering restrictions) will be retained even after the current drought ends, assuming that public information and education programs continue.

Potential Conservation Activities – Conservation water rates

Water Savings *

- For every 10% increase in customer bill, you will see a 1% to 3% reduction in water usage

Program Costs

- $25,000 - $50,000 for rate study

Implementation Schedule

- Year 1 – conduct rate study, develop ordinance
- Year 2 - implement and evaluate savings/revenue impacts

* Texas Water Development Board, Report 362 Water Conservation Best Management Practices Guide and Water Price Elasticities for Single-Family Homes in Texas.

Conservation Water Rates

- Challenge: Encourage efficiency and conservation while covering the cost of water treatment, delivery, and infrastructure repair/replacement.
- Price increases are more effective if increases are at least 50% higher.
- Seasonal rates can be used to reduce peak demands during summer months.
- Can use excess use charges (at greater than 100% of base charge) for amounts above all normal and necessary uses.

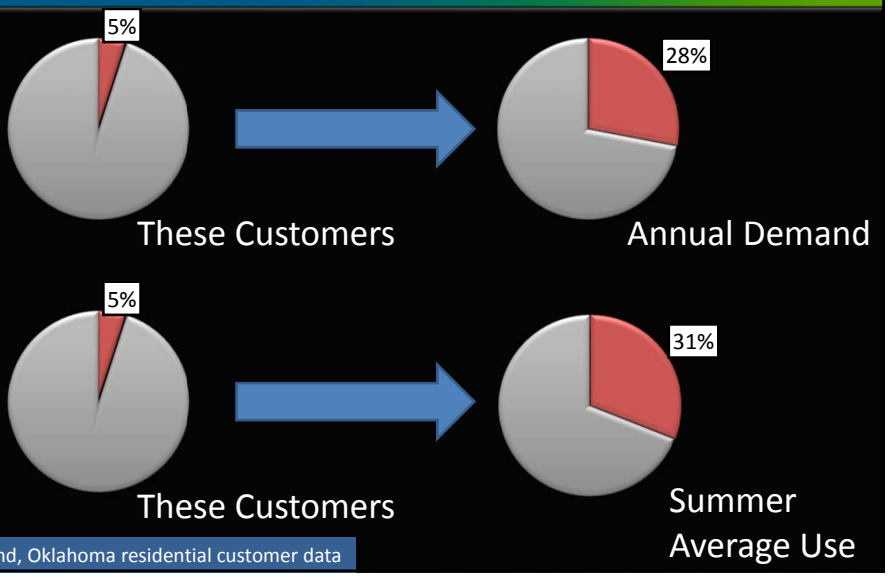
WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Water Price Elasticity Study

- As the price of water increases, water use decreases.
- Price elasticity is used to measure the sensitivity of customers to price at a point on a demand curve.
- Price elasticity is defined as the % change in water used divided by the % change in water price.
- Price elasticity generally does not vary by house age or household income.
- Improve effectiveness of conservation water rates to reduce water consumption by:
  - Simplify rates
  - Educate customers about end-use water consumption
  - Improve water bill information

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Potential Conservation Activities – Example customer/demand correlation



*Edmond, Oklahoma residential customer data

Duncan Current Rate Structure

	Water Rates Within City Limits Effective 1/1 /2014 (adjusted annually) *
1000 gallons (minimum)	$9.88
Each additional 1000 gallons	$4.28
Bulk Sales (per 1000 gallons)	$17.26

*Does not include temporary $5.00 surcharge.

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Potential Conservation Activities – Duncan conservation water rates

If you structure rates so that the top 5% (by usage) of customer's bills increase by 10%, you may see a 1% - 3% reduction in their water use.

Year	Cumulative Water Savings (AFY, mgd) [1]
2020	26, 0.02
2030	26, 0.02
2040	26, 0.02
2050	26, 0.02
2060	26, 0.02

Notes:
1. Assumes new rates go into effect in 2016 .

Potential Conservation Activities – Water audits

Water Savings

- Varies based whether replacement/repairs made as part of audit
- Prioritize higher water use customers first

Program Costs *

- $65 to $190 for single family home
- $130 per unit for multi-family complex
- Administrative and equipment costs

Implementation Schedule

- Year 1 – develop program
- Years 2+ – conduct audits in 1% of single and 1% of multi-family units each year

* Texas Water Development Board, Report 362 Water Conservation Best Management Practices Guide. All costs in 2014 dollars.

Potential Conservation Activities – Duncan water audits

Year	Number of single unit households audited	Number of multi unit households audited	Cumulative Water Savings (AFY, mgd) [1, 3]	Estimated Cost ($/yr) [2]
2020	94	11	26, 0.02	$19,300
2030	95	11	95, 0.08	$19,500
2040	95	11	144, 0.13	$19,500
2050	95	11	144, 0.13	$19,500
2060	95	11	144, 0.13	$19,500

Notes:
1. Assumes water surveys start in 2016. Cumulative water savings relative to baseline demand.
2. Based on $190/single family survey and $130 /multifamily survey. All costs in 2014 dollars.
3. Water savings assume that household surveyed improve outdoor irrigation practices and replace showerheads and faucet aerators.
4. Water savings are capped when 20% of households have completed water audits. It is assumed that the program will continue (annual cost continues) but no new water savings are recognized.

Potential Conservation Activities – Toilet leak repairs

Water Savings

- Varies based on use and repairs made (assumed 9 gpcd in households making repairs)

Program Costs *

- $0.25 leak detection dye tablets
- Assumed that customer will pay for toilet repair equipment

Implementation Schedule

- Year 1 – develop program
- Years 2+ – leak detection dye tablets available for customers

* Web search for dye tablet packages. All costs are in 2014 dollars

Potential Conservation Activities – Duncan toilet leak repairs

Year	Cumulative Water Savings (AFY, mgd) [1]	Estimated Cost ($/yr) [2]
2020	24, 0.02	$1,300
2030	24, 0.02	$1,300
2040	24, 0.02	$1,300
2050	24, 0.02	$1,400
2060	24, 0.02	$1,400

Notes:
1. Assumes distribution of dye tablets start in 2016. Assumes that 50% of households use dye tablets and 5% of those make water savings repairs. Water savings are capped when 20% of households have made some type of repair. It is assumed that the program will continue (annual cost continues) but no new water savings are recognized.
2. All costs are in 2014 dollars. Cost assume that tablets are purchased for approximately 50% of meters.

Potential Conservation Activities – High efficiency fixtures

Water Savings

- Varies based on fixture being replaced
- Water savings may be impacted by other conservation activities

Program Costs

- $0

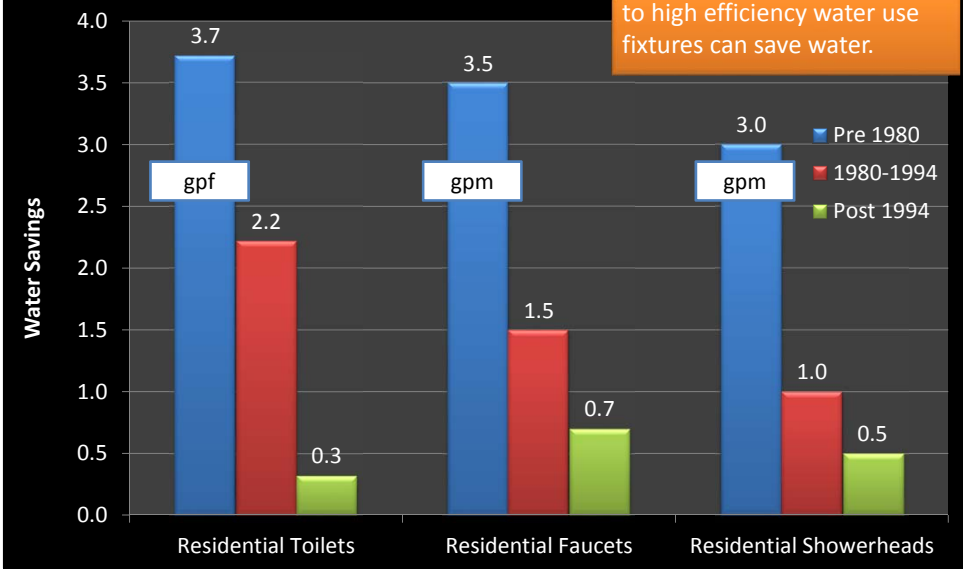
Implementation Schedule

- Year 1 – develop program
- Year 2+ – pass ordinance requiring high efficiency fixtures in all new and replacement fixtures (toilets, showerheads, faucets)

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Potential Conservation Activities – Low water use fixtures

Converting from older fixtures to high efficiency water use fixtures can save water.



Potential Conservation Activities – Duncan low water use fixtures

Year	Number of Households Converting to HE Fixtures [2]	Cumulative Water Savings, above passive conservation savings (AFY, mgd) [1]
2020	338	20, 0.02
2030	222	100, 0.09
2040	127	100, 0.09
2050	72	100, 0.09
2060	77	100, 0.09

Notes:
1. Assumes ordinance goes into effect in 2016.
2. Assumes that high efficiency fixtures will be used as toilets are replaced and as new residents are established. Timing of fixture replacement uses OCWP replacement timeline. Beginning in 2030, conversion from post 1994 fixtures to high efficiency fixtures begins.

Potential Conservation Activities – Ordinances

Ordinances

- High efficiency fixtures for all new construction
- Rain switches for all new irrigation systems
- Max percent turf for all new landscaping
- Require irrigation meters for all new construction
- Permanent odd/even watering restrictions

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Potential Conservation Activities – Rebates

Water Conservation Landscaping

- $1.00 per square foot of turf grass replacement with low-water use (Xeriscape or hardscape) landscaping
- $2.00 each for rotary/high-efficiency sprinkler head replacement
- 50% of cost up to $300 for smart irrigation controllers (evapotransporation)
- 50% of cost up to $50 for rain/freeze switch for irrigation controllers

High Efficiency Fixtures

- $75 per toilet replaced

* All costs in 2014 dollars.

Potential Conservation Activities – Duncan rebates

Rebate Program	Program Funding [1] ($/yr)	Number of Items Rebated	Estimated Water Savings [2] (AFY, mgd)
Low Water Use Toilets	$5,000	67 toilets	1.1, 0.001
Turf Grass Replacement	$5,000	5,000 sf	0.23, 0.0002
Sprinkler Head Replacement	$5,000	2,500 sprinkler heads	3.5, 0.0031
SMART Controller Addition	$5,000	40	0.8, 0.007
Rain/Freeze Sensor Addition	$5,000	100	0.32, 0.0003

- Did not include washing machines, as these are mostly offered only as high efficiency models now.
- Also could consider give-aways like sink aerators, low flow showerheads, etc. (either as their own program or as part of water audits).

Notes:
1. All costs in 2014 dollars .
2. Water savings are realized each year that rebates are offered.

Conservation Activities – Locally implementable discussion

- Which of these programs seem most likely to succeed in your service area?
  - Acceptable to customers
  - Acceptable to officials
  - Reduce long term water use
  - Can be funded
  - Other success factors

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Potential Conservation Activities – Duncan Summary

- ✓ Metering
- Water use audits
- Public education
- Rebates
- ✓ Leak detection and prevention
- Conservation billing rates

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Duncan Summary of Potential Conservation Activities	Estimated Cumulative Water Savings through 2020 (AFY, mgd)	Estimated Cumulative Program Cost through 2020 ($)	Estimated Unit Cost ($/AF saved)
Conservation Program Administrator [1]	N/A	$250,000	N/A
Ordinance - High Efficiency Fixtures [2]	20, 0.02	$0	$0
Ordinance – Permanent odd/even	[3]	$0	N/A
Toilet Leak Repairs	24, 0.02	$7,000	$300
Public Information and Education Programs [1]	101, 0.09	$52,000	$400
Rebate – sprinkler head replace.	19, 0.02	$25,000	$1,300
Conservation Water Rates	26, 0.02	$25,000-$50,000	$1,400
Water audits	27, 0.02	$77,000	$2,900
Rebate – high efficiency toilets [2]	6, 0.01	$25,000	$4,200
Rebate – SMART controller	4, 0.004	$25,000	$6,300
Rebate – rain/freeze sensor	1.6, 0.001	$25,000	$15,600
Rebate – turf grass replacement	1.2, 0.001	$25,000	$21,700

Notes:
1. These line items serve to enhance the visibility of water issues and support other conservation programs.
2. Water savings can be recognized from only one of these programs.
3. Making odd/even watering restrictions permanent, may not result in water savings, however, it can reduce the peak demand (which drives infrastructure sizing.)

Duncan Summary of Potential Conservation Activities [3]	Estimated Cumulative Water Savings through 2020 (AFY, mgd)	Estimated Cumulative Program Cost through 2020 ($)	Estimated Unit Cost ($/AF saved)
Conservation Program Administrator [1]	N/A	$250,000	N/A
Ordinance - High Efficiency Fixtures [2]	20, 0.02	$0	$0
Ordinance – Permanent odd/even	[4]	$0	N/A
Toilet Leak Repairs	24, 0.02	$7,000	$300
Public Information and Education Programs [1]	101, 0.09	$52,000	$400
Rebate – sprinkler head replace.	19, 0.02	$25,000	$1,300
Conservation Water Rates	26, 0.02	$25,000-$50,000	$1,400
Water audits	27, 0.02	$77,000	$2,900
Rebate – high efficiency toilets [2]	6, 0.01	$25,000	$4,200
Rebate – SMART controller			$6,300
Rebate – rain/freeze sensor			$15,600
Rebate – turf grass replacement			$21,700

If shaded programs are implemented, PWS can recognize potential water savings of 5% by 2020

Notes:
1. These line items serve to enhance the visibility of water issues and support other conservation programs.
2. Water savings can be recognized from only one of these programs.
3. Shading indicates programs that may be implementable locally.
4. Making odd/even watering restrictions permanent, may not result in water savings, however, it can reduce the peak demand (which drives infrastructure sizing.)

APPENDIX 2C – DETAILED CONSERVATION ANALYSES AND REFERENCE MATERIALS – CITY OF COMANCHE

Water Demand Projections – Baseline Population Projections

Year	Comanche Population = Service Area Population
2009	1,516
2010	1,664
2011	1,658
2012	1,650
2013	1,650
2020	**1,650**
2030	**1,675**
2040	**1,675**
2050	**1,670**
2060	**1,670**

Assume that wholesale customers are responsible for their own conservation plan.

Notes:
Historic and projected population estimates provided by City of Comanche.
City population estimates are approximately 8% lower than 2060 OCWP projection.

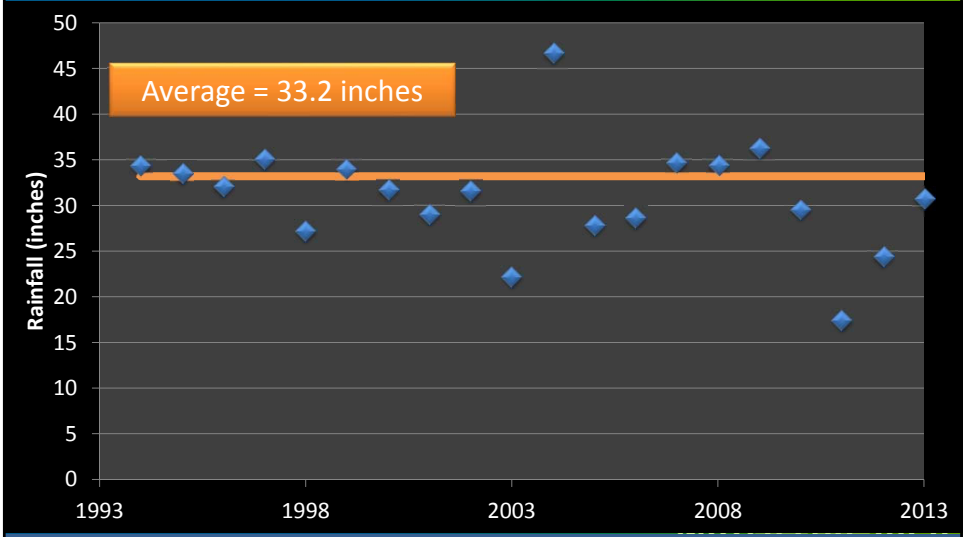
Water Demand Projections – Historic per capita demands

Year	Comanche Service Area Population	Annual Water Produced (MG)	Per Capita Demand (gpcd)
2009	1,516	174	314
2010	1,664	167	275
2011	1,658	211	349
2012	1,650	180	299
2013	1,650	122	203

Average per capita demand = 288 gpcd

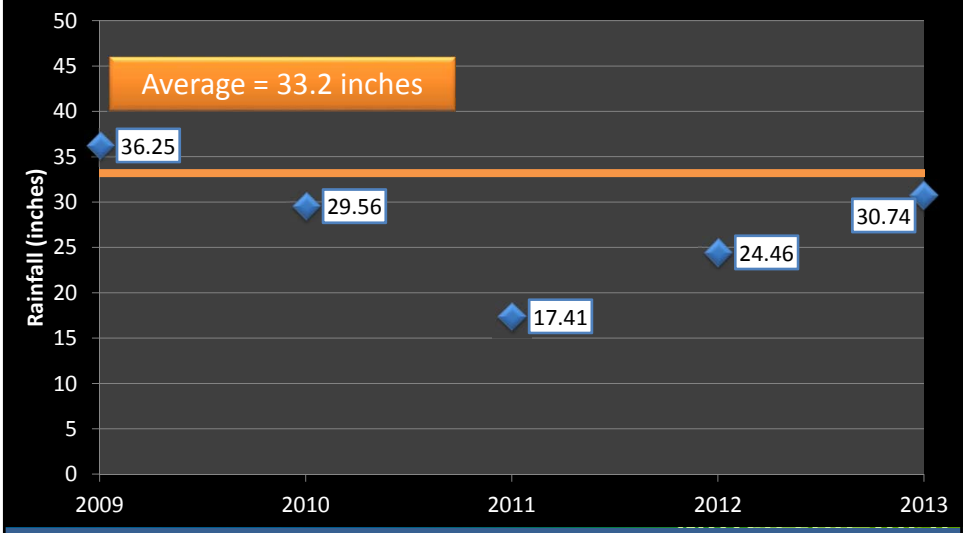
WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Comanche's Historic Per Capita Use Related to Annual Precipitation



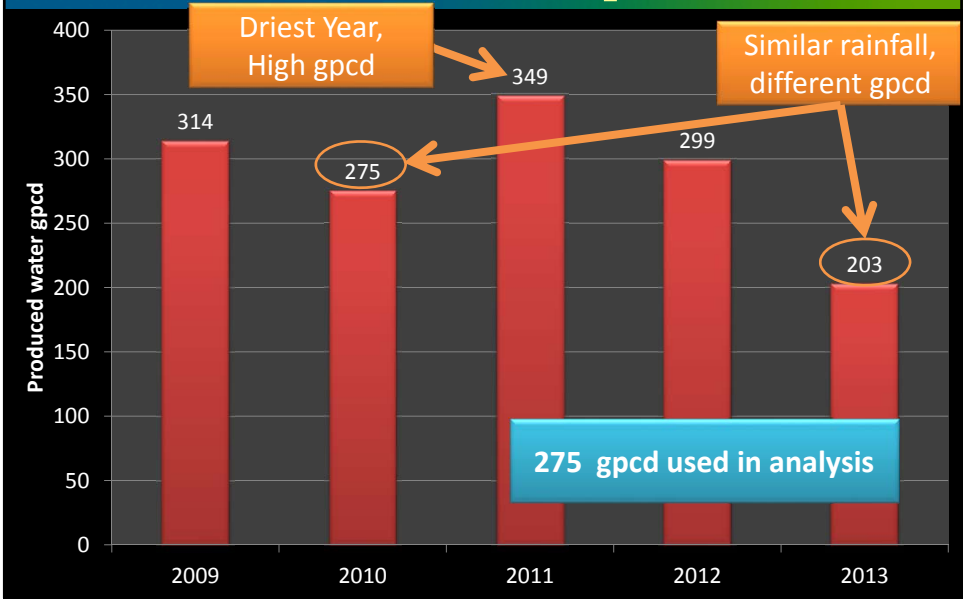
Notes:
From Waurika Mesonet site .

Comanche's Historic Per Capita Use Related to Annual Precipitation



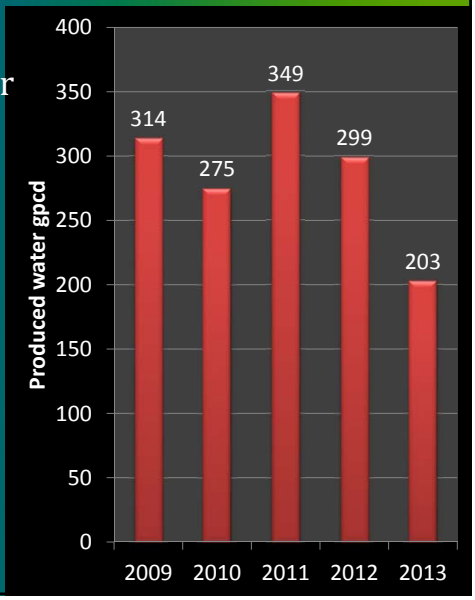
Notes:
From Waurika Mesonet site .

Comanche's Historic Per Capita Use Related to Annual Precipitation



Comanche's Historic Per Capita Use Related to Restrictions on Water Use

- Stage 1 – Voluntary conservation of outside water use
- Stage 2 – Mandatory restriction of outside water usage to every other day (2/2014)
- Stage 3 – Mandatory restriction of outside water usage to two days per week
- Stage 4 – Mandatory prohibition of all nonexempt outside water usage



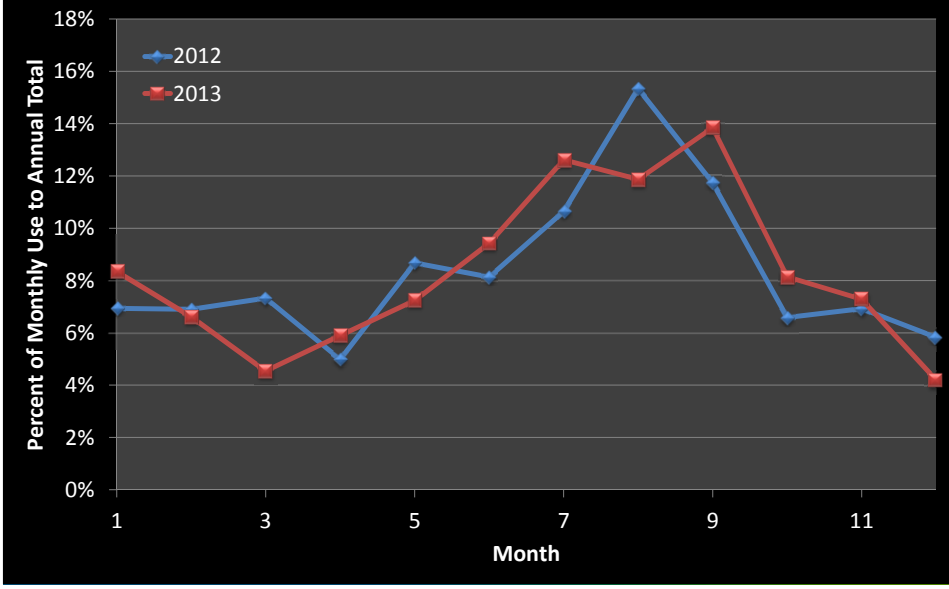
Comanche's Water Demands – Historic peaking factors

Year	Service Area Population	Annual Water Produced (MG)	Per Capita Demand (gpcd)	Peaking Factor
2009	1,516	174	314	
2010	1,664	167	275	
2011	1,658	211	349	
2012	1,650	180	299	2.16
2013	1,650	122	203	1.97

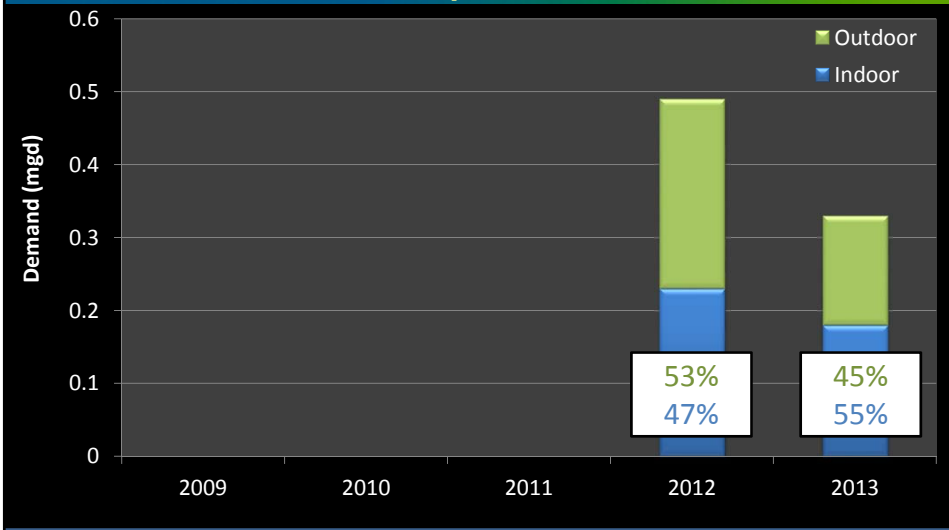
Peaking Factor = Peak Day / Annual Average

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Water Demand Projections – Comanche's historic monthly use

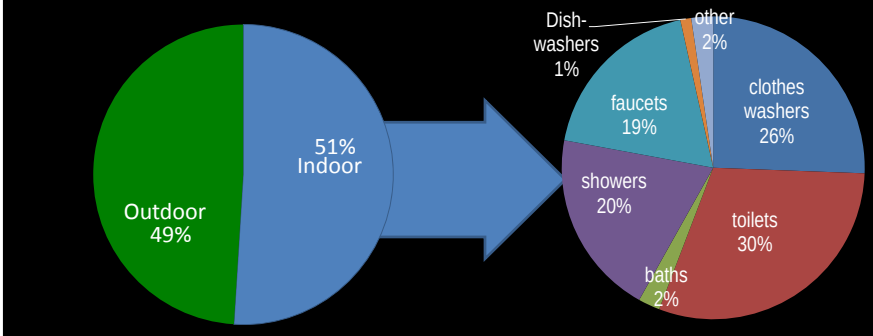


Water Demand Projections – Comanche's indoor/outdoor water use



Indoor use assumes constant monthly use at 100% of December, January, and February average demand.

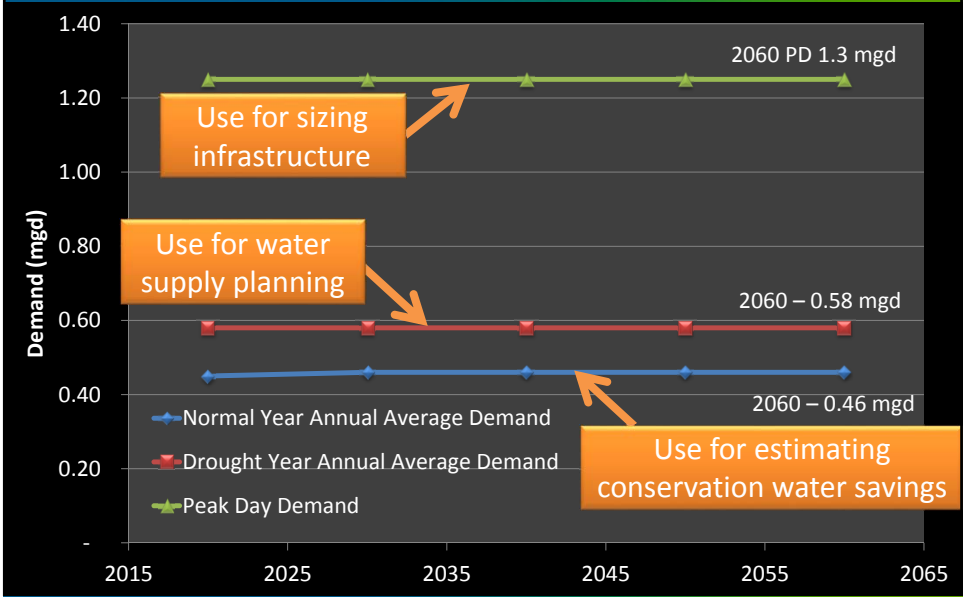
Water Demand Projections – Understanding sources of demand can guide priorities



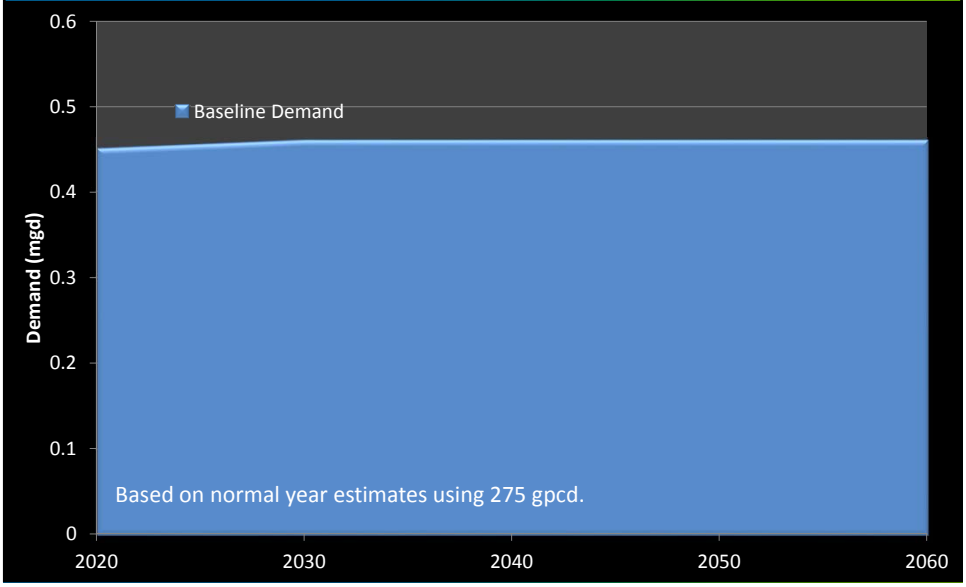
Comanche's average indoor/outdoor water use

Typical Household Use from AWWA Manual M52

Water Demand Projections – Comanche Baseline water demand projections



Water Demand Projections – Comanche Baseline water demand projections

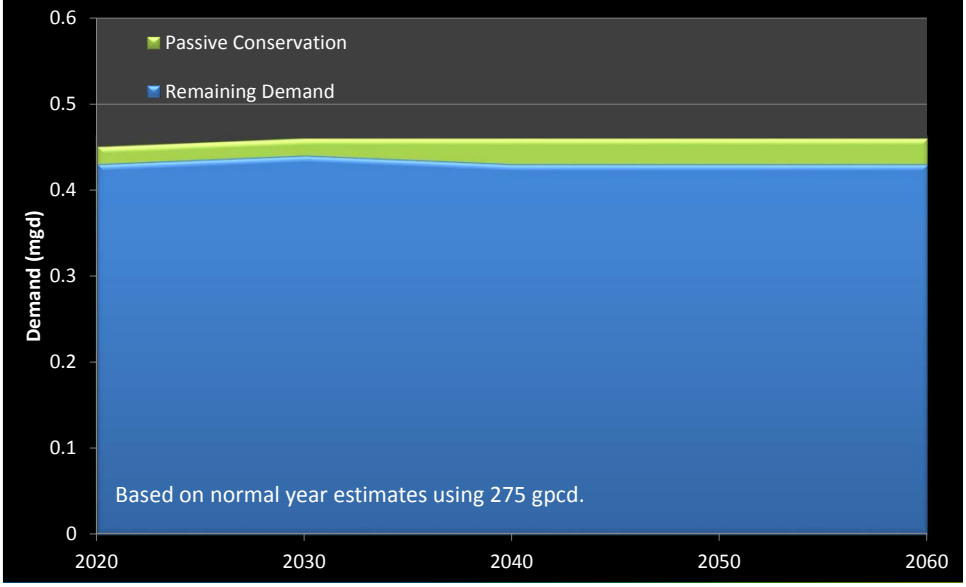


Projections of Passive Conservation Savings for Comanche's Service Area

Year	OCWP Additional Residential + Non-residential Savings (post 2010), Stephens County (AFY)	OCWP Comanche's Population as a Percent of Stephens County	Comanche's Public Supply Passive Savings relative to 2010 (AFY)	Annual Average Passive Savings (mgd)
2020	353	5%	18	0.02
2030	570	5%	28	0.02
2040	578	5%	29	0.03
2050	588	5%	29	0.03
2060	602	5%	30	0.03

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Impacts of passive conservation on Comanche's demand



Comanche's Current Conservation Activities

- ✓Metering
  - 100% metering
- ✓Public education
  - Newsletter with conservation tips

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Comanche – Potential Conservation Activities

- Metering
- Water use audits
- Public education
- Rebates
- Leak detection and prevention
- Conservation billing rates

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Potential Conservation Activities – Conservation program administrator

Water Savings

- Provides oversight of, coordination of, and serves as a source of information to the public on the provider's conservation programs
- Water savings are accounted for in other programs

Program Costs

- $50,000 / year

Implementation

- Consider using "regional" administrator

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Potential Conservation Activities – Public information and education programs

Water Savings

- Current public information and education programs have resulted in water savings, evident from the reduction in indoor water use
- Activities include public presentations to civic and student groups, distribution of flyers, tours of water facilities, etc.
- Public information and education programs enhanced public image, increase visibility of water issues, and are a key component to recognizing water savings in other programs

Program Costs *

- $1-$4 / customer, assuming information provided at least four times per year
- $1-$4 per student for curriculum
- $3-$6 per student for entertainment program
- $45 per student for prepackaged curriculum program

Implementation Schedule

- Year 1 – develop public information plan
- Years 2+ - implement plan

* Texas Water Development Board, Report 362 Water Conservation Best Management Practices Guide. All costs in 2014 dollars.

Potential Conservation Activities – Comanche public information and education programs

Year	Cumulative Water Savings [2] (AFY, mgd)	Program Cost [1] ($/yr)
2020	56, 0.05	$700
2030	56, 0.05	$700
2040	56, 0.05	$700
2050	56, 0.05	$700
2060	56, 0.05	$700

Notes:

1. Assumed low cost public information and education program implemented. All costs in 2014 dollars . Staff currently participates in public information/education programs as part of existing budget. Cost assumes slight expansion of existing programs.
2. Water savings based on historical data. It is assumed that 25% of water savings seen in the area (prior to mandatory watering restrictions) will be retained even after the current drought ends, assuming that public information and education programs continue.

Potential Conservation Activities – Conservation water rates

Water Savings *

- For every 10% increase in customer bill, you will see a 1% to 3% reduction in water usage

Program Costs

- $25,000 - $50,000 for rate study

Implementation Schedule

- Year 1 – conduct rate study, develop ordinance
- Year 2 - implement and evaluate savings/revenue impacts

* Texas Water Development Board, Report 362 Water Conservation Best Management Practices Guide and Water Price Elasticities for Single-Family Homes in Texas.

Conservation Water Rates

- Challenge: Encourage efficiency and conservation while covering the cost of water treatment, delivery, and infrastructure repair/replacement.
- Price increases are more effective if increases are at least 50% higher.
- Seasonal rates can be used to reduce peak demands during summer months.
- Can use excess use charges (at greater than 100% of base charge) for amounts above all normal and necessary uses.

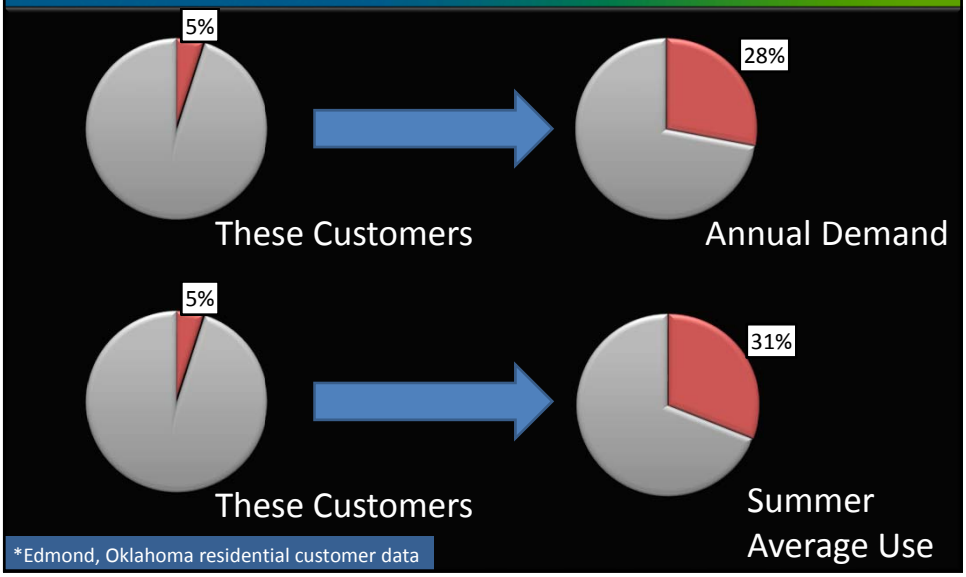
WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Water Price Elasticity Study

- As the price of water increases, water use decreases.
- Price elasticity is used to measure the sensitivity of customers to price at a point on a demand curve.
- Price elasticity is defined as the % change in water used divided by the % change in water price.
- Price elasticity generally does not vary by house age or household income.
- Improve effectiveness of conservation water rates to reduce water consumption by:
  - Simplify rates
  - Educate customers about end-use water consumption
  - Improve water bill information

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Potential Conservation Activities – Example customer/demand correlation



Comanche Current Rate Structure

	Water Rates Effective 7/1/2014 (adjusted annually)
2000 gallons (minimum)	14.98
Each additional 1000 gallons	$2.4823

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Potential Conservation Activities – Comanche conservation water rates

If you structure rates so that the top 5% (by usage) of customer's bills increase by 10%, you may see a 1% - 3% reduction in their water use.

Year	Cumulative Water Savings (AFY, mgd) [1]
2020	3, 0.003
2030	3, 0.003
2040	3, 0.003
2050	3, 0.003
2060	3, 0.003

Notes:
1. Assumes new rates go into effect in 2016 .

Potential Conservation Activities – Leak detection programs

Water Savings

- Highly Variable (water savings estimated assuming current average NRW reduced to 10%)

Program Costs *

- Highly variable
- Estimated $370 to $790 per AF of water saved

Implementation Schedule

- Year 1 – conduct water audit and implement leak reduction plan
- Years 2+ - update water audit, continue implementation (and revise) leak reduction plan

* Average from *Water Loss Control in North America: More Cost Effective than Customer Side Conservation – Why wouldn't you do it?!* Cost adjusted to 2014 dollars.

Leak Detection Program (or Reduce Non-revenue Water)

- Supplier Water Audit
  - Real Losses – losses due to leakage and excess system pressure
  - Apparent Losses – losses due to meter accuracy error, data errors between meter and billing, and loss due to unauthorized water use
  - Unavoidable Losses – losses due to line flushing, fire hydrant testing/fire department training, etc.
- Technical Indicator of Real Losses (TIRL)

$$TIRL = \frac{\text{Current annual volume of real losses}}{\text{Number of service connections}}$$

- Unavoidable Annual Real Losses (UARL)

  Estimate using AWWA M36 Manual (Water Audits and Leak Detection) as the theoretically low level of annual real losses that could exist in a system using current BMP for leak detection

- Infrastructure Leakage Index (ILI)

$$ILI = \frac{TIRL}{UARL}$$

Closer ILI is to 1 the better, TWDB recommends ILI of 3

Potential Conservation Activities – Comanche reduce NRW program

Year	Estimated Cumulative Water Savings (AFY, mgd)	Program Cost ($/yr)
2020	25, 0.022	$2,900
2030	75, 0.067	$2,900
2040	125, 0.11	$2,900
2050	140, 0.13	$2,900
2060	140, 0.13	$2,900

Current NRW average of 37%

Notes:
1. Assumes NRW reduced 5 AFY each year beginning in 2016 until a NRW of 10% is reached.

Potential Conservation Activities – Water audits

Water Savings

- Varies based whether replacement/repairs made as part of audit
- Prioritize higher water use customers first

Program Costs *

- $65 to $190 for single family home
- $130 per unit for multi-family complex
- Administrative and equipment costs

Implementation Schedule

- Year 1 – develop program
- Years 2+ – conduct audits in 1% of single and 1% of multi-family units each year

* Texas Water Development Board, Report 362 Water Conservation Best Management Practices Guide. All costs in 2014 dollars.

Potential Conservation Activities – Comanche water audits

Year	Number of single unit households audited	Number of multi unit households audited	Cumulative Water Savings (AFY, mgd) [1, 3]	Estimated Cost ($/yr) [2]
2020	5	2	2.8, 0.003	$1,000
2030	5	2	12, 0.01	$1,000
2040	5	2	15, 0.01	$1,000
2050	5	2	15, 0.01	$1,000
2060	5	2	15, 0.01	$1,000

Notes:
1. Assumes water surveys start in 2016. Cumulative water savings relative to baseline demand.
2. Based on $190/single family survey and $130 /multifamily survey (minimum $1,000). All costs in 2014 dollars.
3. Water savings assume that household surveyed improve outdoor irrigation practices and replace showerheads and faucet aerators.
4. Water savings are capped when 20% of households have completed water audits. It is assumed that the program will continue (annual cost continues) but no new water savings are recognized.

Potential Conservation Activities – Toilet leak repairs

Water Savings

- Varies based on use and repairs made (assumed 9 gpcd in households making repairs)

Program Costs *

- $0.25 leak detection dye tablets
- Assumed that customer will pay for toilet repair equipment

Implementation Schedule

- Year 1 – develop program
- Years 2+ – leak detection dye tablets available for customers

* Web search for dye tablet packages. All costs are in 2014 dollars

Potential Conservation Activities – Comanche toilet leak repairs

Year	Cumulative Water Savings (AFY, mgd) [1]	Estimated Cost ($/yr) [2]
2020	1.3, 0.012	$100
2030	1.3, 0.012	$100
2040	1.3, 0.012	$100
2050	1.3, 0.012	$100
2060	1.3, 0.012	$100

Notes:
1. Assumes distribution of dye tablets start in 2016. Assumes that 50% of households use dye tablets and 5% of those make water savings repairs. Water savings are capped when 20% of households have made some type of repair. It is assumed that the program will continue (annual cost continues) but no new water savings are recognized.
2. All costs are in 2014 dollars. Cost assume that tablets are purchased for approximately 50% of meters (minimum of $100).

Potential Conservation Activities – High efficiency fixtures

Water Savings

- Varies based on fixture being replaced
- Water savings may be impacted by other conservation activities

Program Costs

- $0

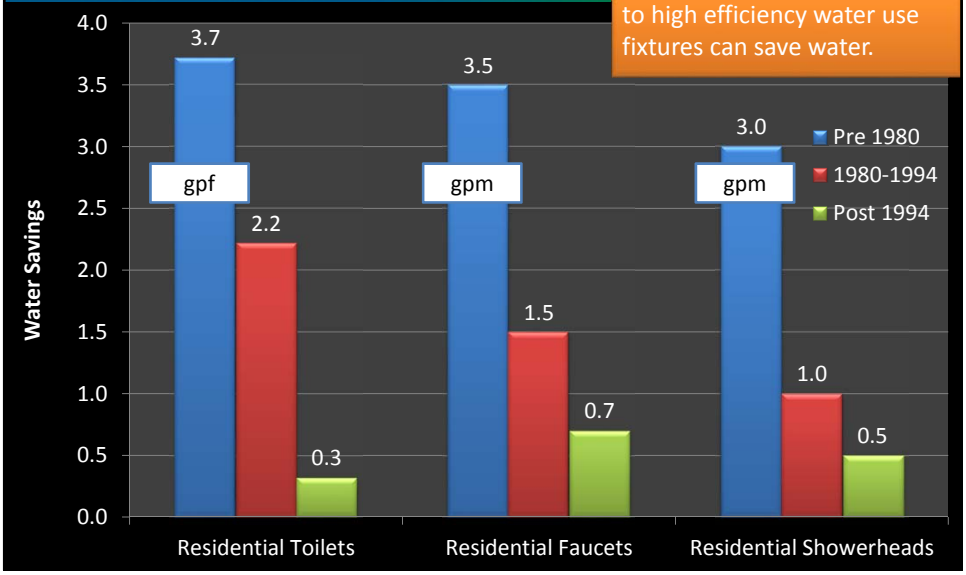
Implementation Schedule

- Year 1 – develop program
- Year 2+ – pass ordinance requiring high efficiency fixtures in all new and replacement fixtures (toilets, showerheads, faucets)

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Potential Conservation Activities – Low water use fixtures

Converting from older fixtures to high efficiency water use fixtures can save water.



Potential Conservation Activities – Comanche low water use fixtures

Year	Number of Households Converting to HE Fixtures [2]	Cumulative Water Savings, above passive conservation savings (AFY, mgd) [1]
2020	21	1.5, 0.0013
2030	15	5.7, 0.0051
2040	7	6.9, 0.0062
2050	4	7.9, 0.0070
2060	4	8.9, 0.0079

Notes:
1. Assumes ordinance goes into effect in 2016.
2. Assumes that high efficiency fixtures will be used as toilets are replaced and as new residents are established. Timing of fixture replacement uses OCWP replacement timeline. Beginning in 2030, conversion from post 1994 fixtures to high efficiency fixtures begins.

Potential Conservation Activities – Ordinances

Ordinances

- High efficiency fixtures for all new construction
- Rain switches for all new irrigation systems
- Max percent turf for all new landscaping
- Require irrigation meters for all new construction
- Permanent odd/even watering restrictions

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Potential Conservation Activities – Rebates

Water Conservation Landscaping

- $1.00 per square foot of turf grass replacement with low-water use (Xeriscape or hardscape) landscaping
- $2.00 each for rotary/high-efficiency sprinkler head replacement
- 50% of cost up to $300 for smart irrigation controllers (evapotransporation)
- 50% of cost up to $50 for rain/freeze switch for irrigation controllers

High Efficiency Fixtures

- $75 per toilet replaced

* All costs in 2014 dollars.

Potential Conservation Activities – Comanche rebates

Rebate Program	Program Funding [1] ($/yr)	Number of Items Rebated	Estimated Water Savings (AFY, mgd)
Low Water Use Toilets	$1,000	13 toilets	0.21, 0.002
Turf Grass Replacement	$1,000	1,000 sf	0.05, 0.0005
Sprinkler Head Replacement	$1,000	500 sprinkler heads	0.7, 0.006
SMART Controller Addition	$1,000	8	0.16, 0.0001
Rain/Freeze Sensor Addition	$1,000	20	0.06, 0.0001

- Did not include washing machines, as these are mostly offered only as high efficiency models now.
- Also could consider give-aways like sink aerators, low flow showerheads, etc. (either as their own program or as part of water audits).

Notes:
1. All costs in 2014 dollars .
2. Water savings are realized each year that rebates are offered.

Conservation Activities – Locally implementable discussion

- Which of these programs seem most likely to succeed in your service area?
  - Acceptable to customers
  - Acceptable to officials
  - Reduce long term water use
  - Can be funded
  - Other success factors

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Potential Conservation Activities – Comanche Summary

- ✓ Metering
- Water use audits
- Public education
- Rebates
- Leak detection and prevention
- Conservation billing rates

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Comanche Summary of Potential Conservation Activities	Estimated Cumulative Water Savings through 2020 (AFY, mgd)	Estimated Cumulative Program Cost through 2020 ($)	Estimated Unit Cost ($/AF saved)
Conservation Program Administrator [1]	N/A	$250,000	N/A
Ordinance - High Efficiency Fixtures [2]	1.5, 0.001	$0	$0
Toilet Leak Repairs	1.3, 0.001	$500	$400
Reduce Nonrevenue Water	25, 0.022	$15,000	$600
Public Information and Education Programs [1]	56, 0.05	$3,500	$700
Rebate – sprinkler head replace.	4, 0.004	$5,000	$1,300
Water audits	3, 0.003	$5,000	$1,700
Rebate – high efficiency toilets [2]	1.1, 0.0009	$5,000	$4,800
Rebate – SMART controller	0.8, 0.0007	$5,000	$6,300
Conservation Water Rates	3, 0.003	$25,000 - $50,000	$12,500
Rebate – rain/freeze sensor	0.3, 0.0003	$5,000	$16,700
Rebate – turf grass replacement	0.05, 0.00005	$5,000	$100,000

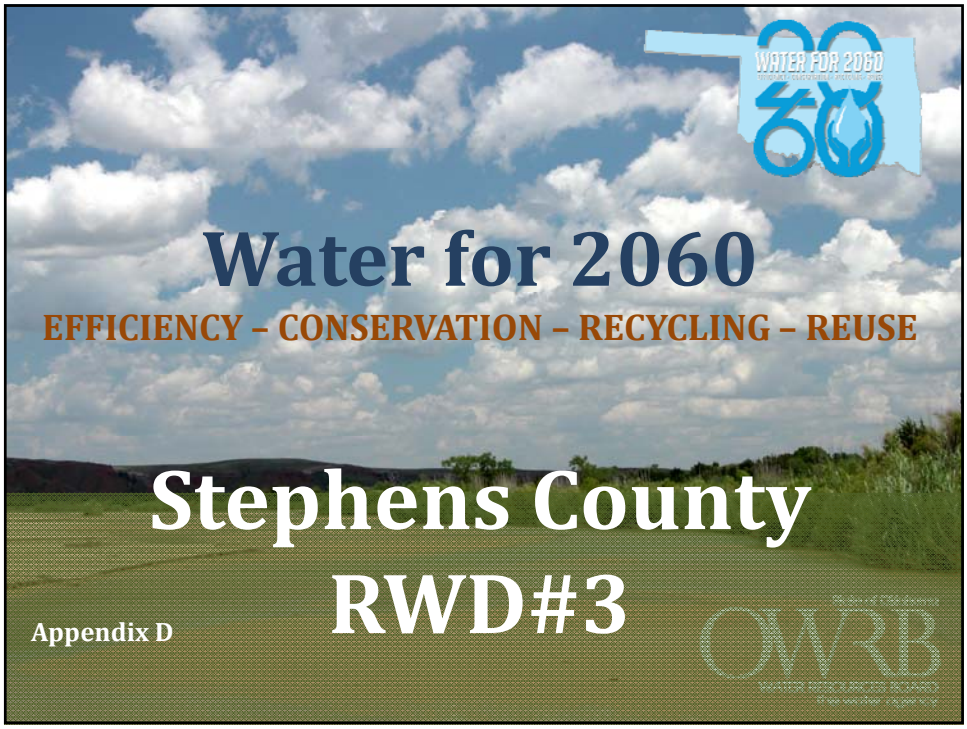
Notes:
1. These line items serve to enhance the visibility of water issues and support other conservation programs.
2. Water savings can be recognized from only one of these programs.

Comanche Summary of Potential Conservation Activities [3]	Estimated Cumulative Water Savings through 2020 (AFY, mgd)	Estimated Cumulative Program Cost through 2020 ($)	Estimated Unit Cost ($/AF saved)
Conservation Program Administrator [1]	N/A	$250,000	N/A
Ordinance - High Efficiency Fixtures [2]	1.5, 0.001	$0	$0
Toilet Leak Repairs	1.3, 0.001	$500	$400
Reduce Nonrevenue Water	25, 0.022	$15,000	$600
Public Information and Education Programs [1]	56, 0.05	$3,500	$700
Rebate – sprinkler head replace.	4, 0.004	$5,000	$1,300
Water audits	3, 0.003	$5,000	$1,700
Rebate – high efficiency toilets [2]	1.1, 0.0009	$5,000	$4,800
Rebate – SMART controller	0.8, 0.0007	$5,000	$6,300
Conservation Water Rates	3, 0.003	$25,000 - $50,000	$12,500
Rebate – rain/freeze sensor	0.3, 0.0003		
Rebate – turf grass replacement	0.05, 0.00005		

If shaded programs are implemented, PWS can recognize potential water savings of 25% by 2020

Notes:
1. These line items serve to enhance the visibility of water issues and supp
2. Water savings can be recognized from only one of these programs.
3. Shading indicates programs that may be implementable locally.

APPENDIX 2D – DETAILED CONSERVATION ANALYSES AND REFERENCE MATERIALS – STEPHENS COUNTY RWD #3



Water Demand Projections – Baseline Population Projections

Year	Stephens Co RWD #3 Service Area Population
2009	1,600
2010	1,600
2011	1,600
2012	1,600
2013	1,600
2020	**1,629**
2030	**1,644**
2040	**1,663**
2050	**1,690**
2060	**1,722**

Notes:
Historic population provided by Stephens County RWD#3 in the OWRB annual water use reports.
2020-2060 projections from OCWP.

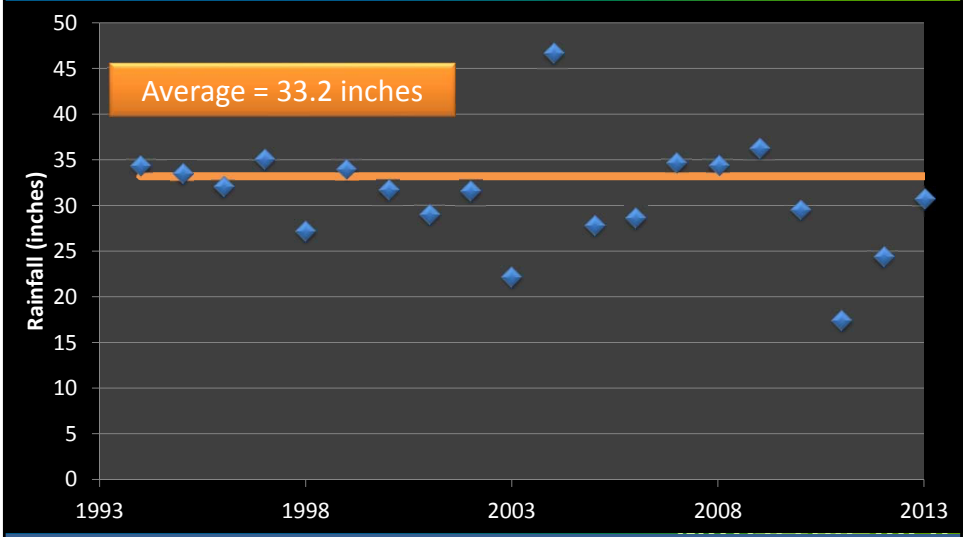
Water Demand Projections – Historic per capita demands

Year	Stephens Co RWD #3 Service Area Population	Annual Water Produced (MG)	Per Capita Demand (gpcd)
2009	1,600	73	125
2010	1,600	74	127
2011	1,600	74	127
2012	1,600	60	103
2013	1,600	50	86

Average per capita demand = 114 gpcd

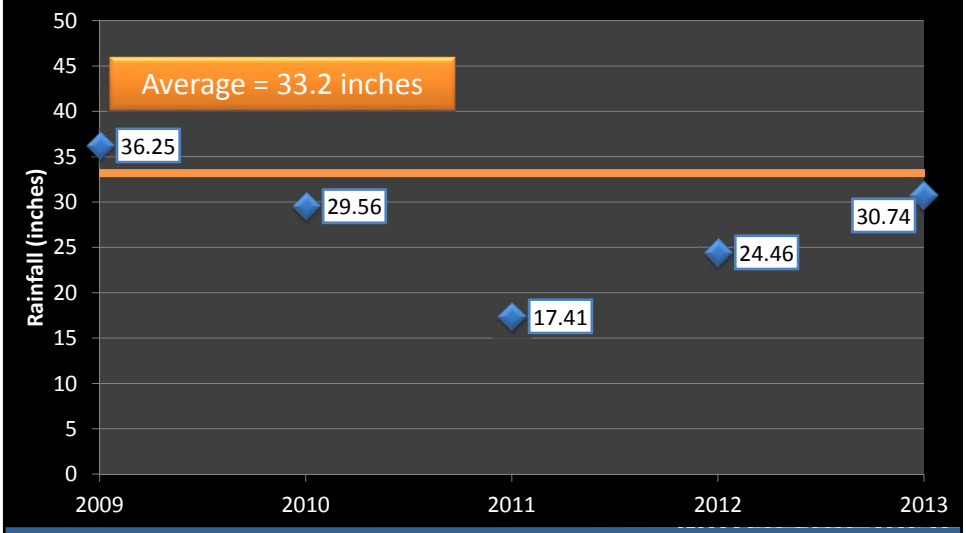
WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

SCRWD3's Historic Per Capita Use Related to Annual Precipitation



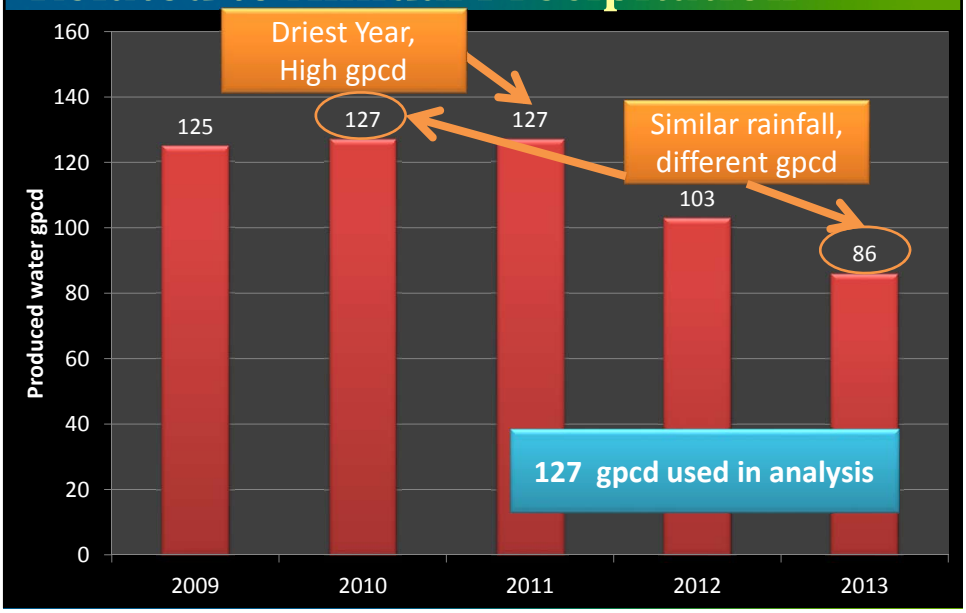
Notes:
From Waurika Mesonet site .

SCRWD3's Historic Per Capita Use Related to Annual Precipitation



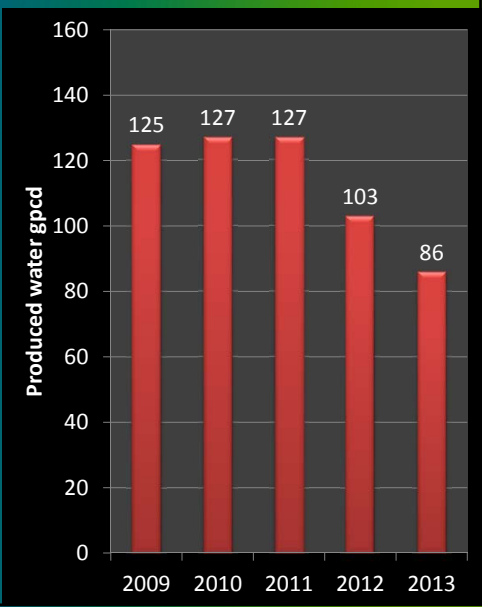
Notes:
From Waurika Mesonet site .

SCRWD3's Historic Per Capita Use Related to Annual Precipitation



SCRWD3's Historic Per Capita Use Related to Restrictions on Water Use

- No ordinance
- Ask customers to conserve water during drought



SCRWD3's Water Demands – Historic peaking factors

Year	Service Area Population	Annual Water Produced (MG)	Per Capita Demand (gpcd)	Peaking Factor
2009	1,600	73	125	1.4
2010	1,600	74	127	1.6
2011	1,600	74	127	1.7
2012	1,600	60	103	1.7
2013	1,600	50	86	1.5

Peaking Factor = Peak Day / Annual Average

WATER FOR 2060
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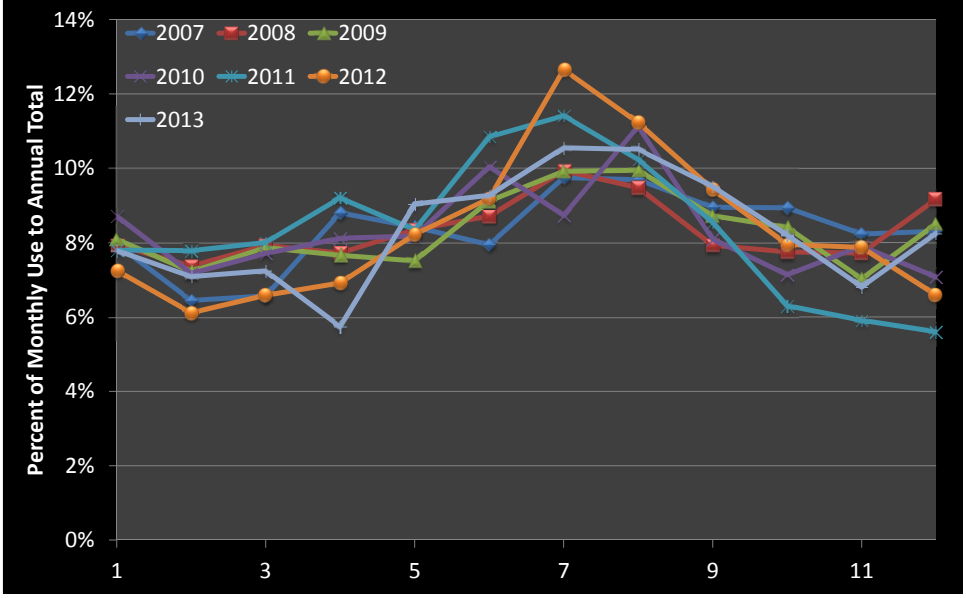
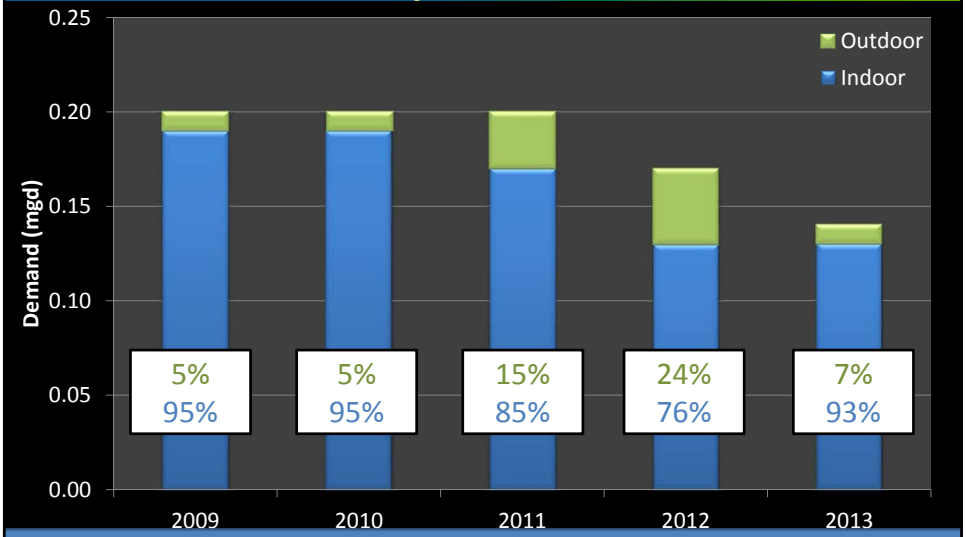
Water Demand Projections – SCRWD3's historic monthly use

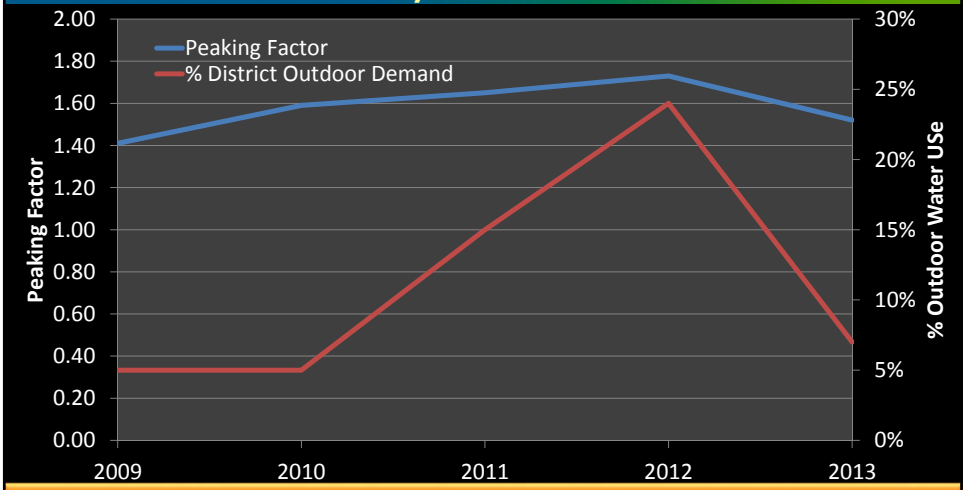


Water Demand Projections – SCRWD3's indoor/outdoor water use



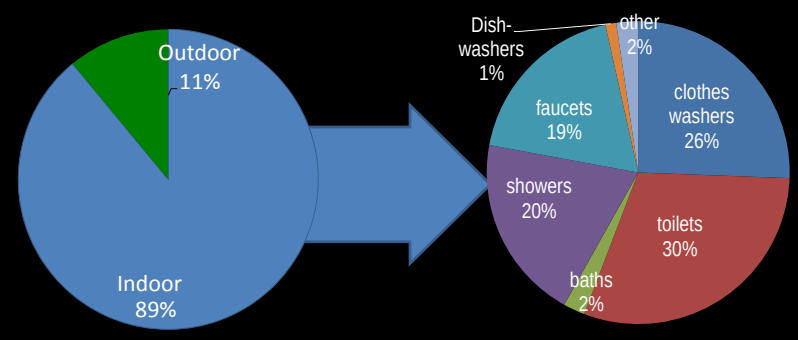
Indoor use assumes constant monthly use at 100% of December, January, and February average demand. 2009-2013 monthly data from OWRB water use reports.

Water Demand Projections – SCRWD3's indoor/outdoor water use



Assuming unrestricted water use, we expect large outdoor use to drive high peaking factor. However, sometimes you see high outdoor use result in higher overall use and thus lower peaking factor.

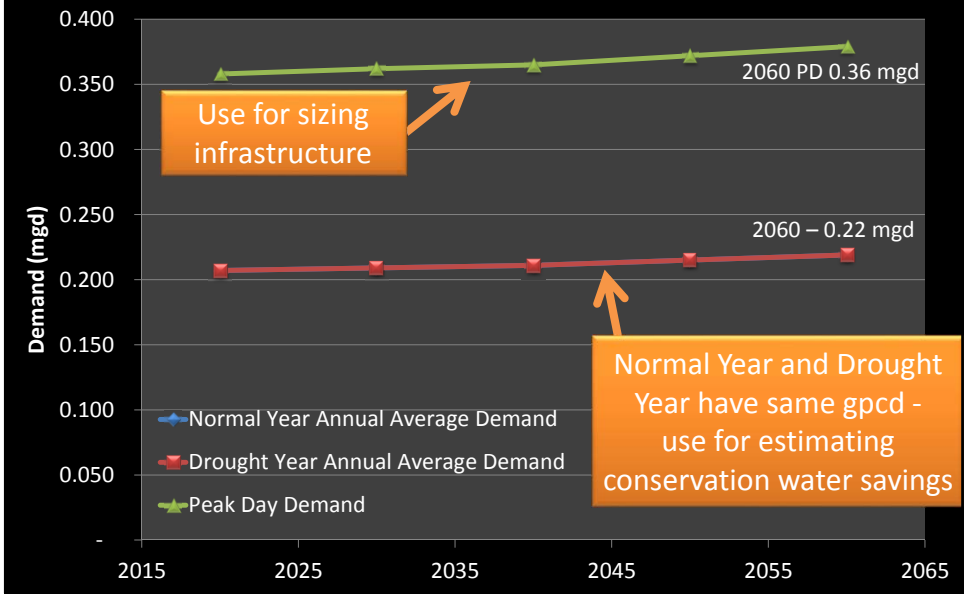
Water Demand Projections – Understanding sources of demand can guide priorities



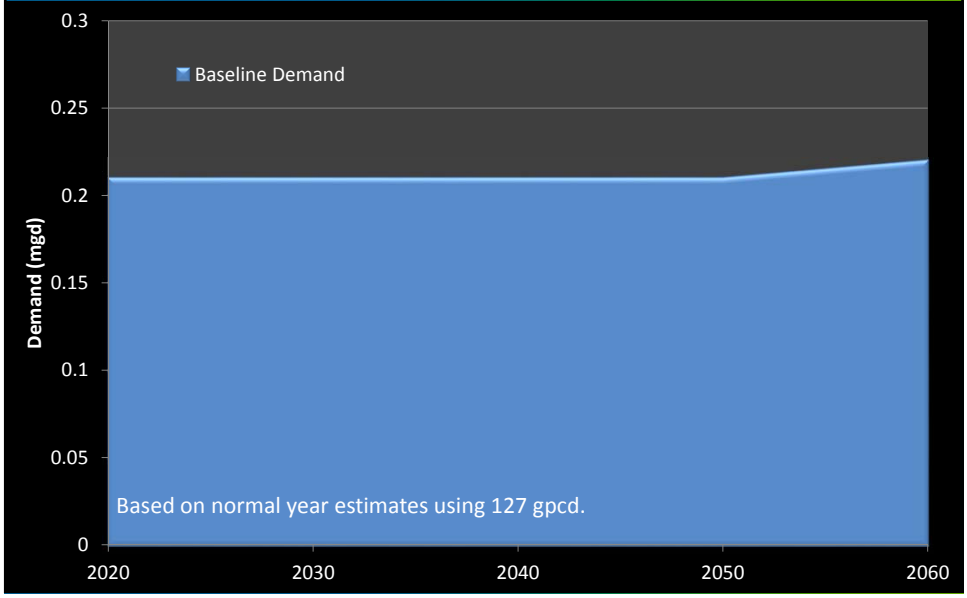
Stephens County RWD#3 's average indoor/outdoor water

Typical Household Use from AWWA Manual M52

Water Demand Projections – SCRWD3
Baseline water demand projections



Water Demand Projections – SCRWD3
Baseline water demand projections



Projections of Passive Conservation Savings for SCRWD3's Service Area

Year	OCWP Additional Residential + Non-residential Savings (post 2010), Stephens County (AFY)	OCWP SCRWD3's Population as a Percent of Stephens County	SCRWD3's Public Supply Passive Savings relative to 2010 (AFY)	Annual Average Passive Savings (mgd)
2020	353	5%	18	0.02
2030	570	5%	28	0.02
2040	578	5%	29	0.03
2050	588	5%	29	0.03
2060	602	5%	30	0.03

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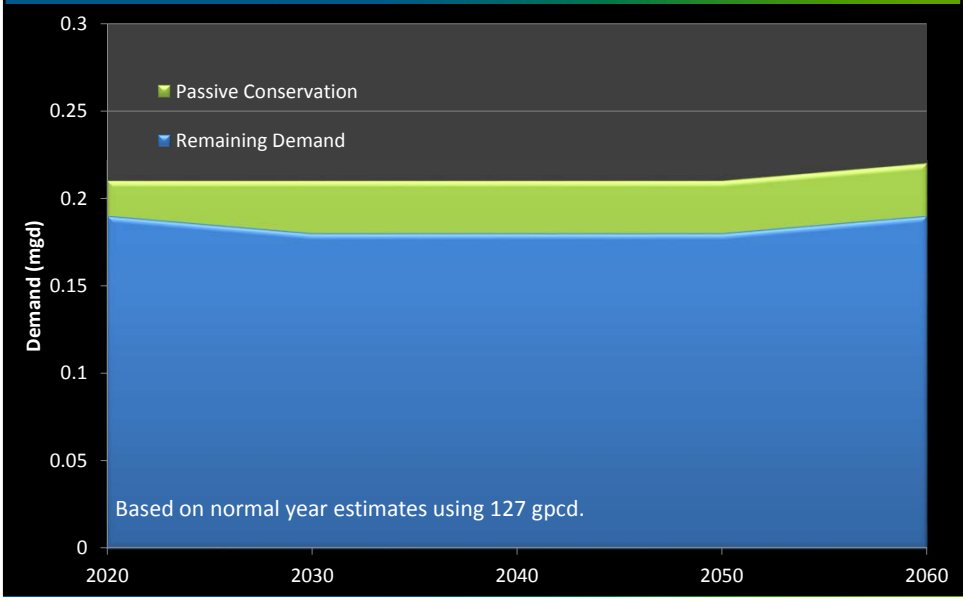
Impacts of passive conservation on SCRWD3's demand



SCRWD3's Current Conservation Activities

- ✓Metering
  - 100% metering
  - NRW estimated at 10%
- Public education

SCRWD3 – Potential Conservation Activities

- Metering
- Water use audits
- Public education
- Rebates
- Leak detection and prevention
- Conservation billing rates

Potential Conservation Activities – Conservation program administrator

Water Savings

- Provides oversight of, coordination of, and serves as a source of information to the public on the provider's conservation programs
- Water savings are accounted for in other programs

Program Costs

- $50,000 / year

Implementation

- Consider using "regional" administrator

WATER FOR 2060
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Potential Conservation Activities – Public information and education programs

Water Savings

- Current public information and education programs have resulted in water savings, evident from the reduction in indoor water use
- Activities include public presentations to civic and student groups, distribution of flyers, tours of water facilities, etc.
- Public information and education programs enhanced public image, increase visibility of water issues, and are a key component to recognizing water savings in other programs

Program Costs *

- $1-$4 / customer, assuming information provided at least four times per year
- $1-$4 per student for curriculum
- $3-$6 per student for entertainment program
- $45 per student for prepackaged curriculum program

Implementation Schedule

- Year 1 – develop public information plan
- Years 2+ - implement plan

* Texas Water Development Board, Report 362 Water Conservation Best Management Practices Guide. All costs in 2014 dollars.

Potential Conservation Activities – SCRWD3 public information programs

Year	Cumulative Water Savings [2] (AFY, mgd)	Program Cost [1] ($/yr)
2020	14, 0.013	$600
2030	14, 0.013	$600
2040	14, 0.013	$600
2050	14, 0.013	$600
2060	14, 0.013	$600

Notes:
1. Assumed low cost public information implemented. All costs in 2014 dollars . Staff currently participates in limited public information programs as part of existing budget, however they do benefit from public information/education efforts by others in the region. Cost assumes slight expansion of existing programs.
2. Water savings based on historical data. It is assumed that 25% of water savings seen in the area (prior to mandatory watering restrictions in the region) will be retained even after the current drought ends, assuming that public information and education programs continue.

Potential Conservation Activities – Conservation water rates

Water Savings *

- For every 10% increase in customer bill, you will see a 1% to 3% reduction in water usage

Program Costs

- $25,000 - $50,000 for rate study

Implementation Schedule

- Year 1 – conduct rate study, develop ordinance
- Year 2 - implement and evaluate savings/revenue impacts

* Texas Water Development Board, Report 362 Water Conservation Best Management Practices Guide and Water Price Elasticities for Single-Family Homes in Texas.

Conservation Water Rates

- Challenge: Encourage efficiency and conservation while covering the cost of water treatment, delivery, and infrastructure repair/replacement.
- Price increases are more effective if increases are at least 50% higher.
- Seasonal rates can be used to reduce peak demands during summer months.
- Can use excess use charges (at greater than 100% of base charge) for amounts above all normal and necessary uses.

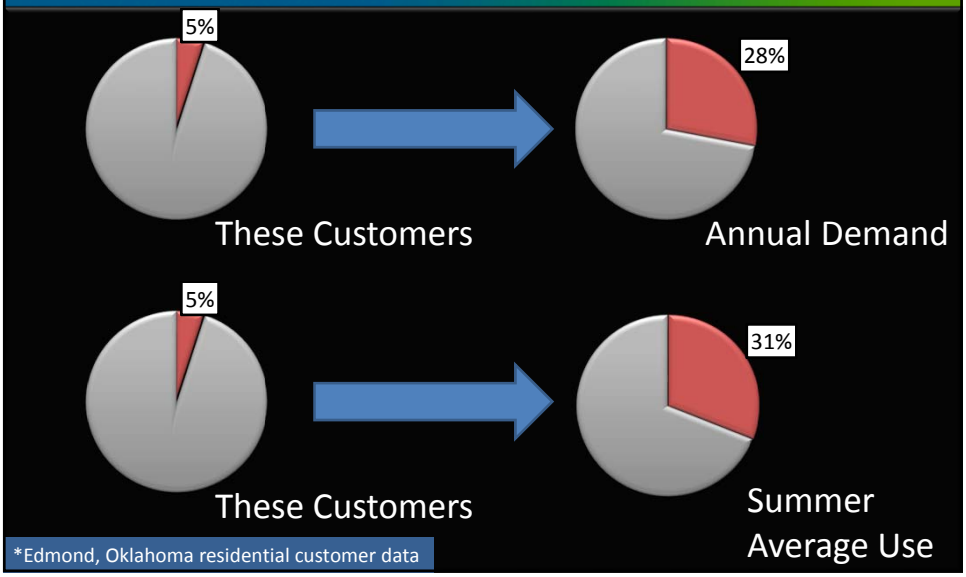
WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Water Price Elasticity Study

- As the price of water increases, water use decreases.
- Price elasticity is used to measure the sensitivity of customers to price at a point on a demand curve.
- Price elasticity is defined as the % change in water used divided by the % change in water price.
- Price elasticity generally does not vary by house age or household income.
- Improve effectiveness of conservation water rates to reduce water consumption by:
  - Simplify rates
  - Educate customers about end-use water consumption
  - Improve water bill information

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

Potential Conservation Activities – Example customer/demand correlation



SCRWD3 Current Rate Structure

Effective 01/01/2011	Residential	Commercial
2000 gallons (minimum)	$13	$14
2001 to 5000 gallons (per 1000 gallons)	$4.46	$4.46
5001 to 10000 gallons (per 1000 gallons)	$4.73	$4.73
10001+ gallons (per 1000 gallons)	$4.88	$4.88

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Potential Conservation Activities – SCRWD3 conservation water rates

If you structure rates so that the top 5% (by usage) of customer's bills increase by 10%, you may see a 1% - 3% reduction in their water use.

Year	Cumulative Water Savings (AFY, mgd) [1]
2020	1.3, 0.001
2030	1.3, 0.001
2040	1.3, 0.001
2050	1.3, 0.001
2060	1.3, 0.001

Notes:
1. Assumes new rates go into effect in 2016 .

Potential Conservation Activities – Water audits

Water Savings

- Varies based whether replacement/repairs made as part of audit
- Prioritize higher water use customers first

Program Costs *

- $65 to $190 for single family home
- $130 per unit for multi-family complex
- Administrative and equipment costs

Implementation Schedule

- Year 1 – develop program
- Years 2+ – conduct audits in 1% of single and 1% of multi-family units each year

* Texas Water Development Board, Report 362 Water Conservation Best Management Practices Guide. All costs in 2014 dollars.

Potential Conservation Activities – SCRWD3 water audits

Year	Number of single unit households audited	Number of multi unit households audited	Cumulative Water Savings (AFY, mgd) [1, 3]	Estimated Cost ($/yr) [2]
2020	4	1	1.6, 0.001	$1,000
2030	4	1	3.4, 0.003	$1,000
2040	4	1	4.0, 0.004	$1,000
2050	4	1	4.0, 0.004	$1,000
2060	4	1	4.0, 0.004	$1,000

Notes:
1. Assumes water surveys start in 2016. Cumulative water savings relative to baseline demand.
2. Based on $190/single family survey and $130 /multifamily survey (minimum $1,000). All costs in 2014 dollars.
3. Water savings assume that household surveyed improve outdoor irrigation practices and replace showerheads and faucet aerators.
4. Water savings are capped when 20% of households have completed water audits. It is assumed that the program will continue (annual cost continues) but no new water savings are recognized.

Potential Conservation Activities – Toilet leak repairs

Water Savings

- Varies based on use and repairs made (assumed 9 gpcd in households making repairs)

Program Costs *

- $0.25 leak detection dye tablets
- Assumed that customer will pay for toilet repair equipment

Implementation Schedule

- Year 1 – develop program
- Years 2+ – leak detection dye tablets available for customers

* Web search for dye tablet packages. All costs are in 2014 dollars

Potential Conservation Activities – SCRWD3 toilet leak repairs

Year	Cumulative Water Savings (AFY, mgd) [1]	Estimated Cost ($/yr) [2]
2020	2.0, 0.002	$100
2030	3.6, 0.003	$100
2040	3.6, 0.003	$100
2050	3.6, 0.003	$100
2060	3.6, 0.003	$200

Notes:
1. Assumes distribution of dye tablets start in 2016. Assumes that 50% of households use dye tablets and 5% of those make water savings repairs. Water savings are capped when 20% of households have made some type of repair. It is assumed that the program will continue (annual cost continues) but no new water savings are recognized.
2. All costs are in 2014 dollars. Cost assume that tablets are purchased for approximately 50% of meters (minimum of $100).

Potential Conservation Activities – High efficiency fixtures

Water Savings

- Varies based on fixture being replaced
- Water savings may be impacted by other conservation activities

Program Costs

- $0

Implementation Schedule

- Year 1 – develop program
- Year 2+ – pass ordinance requiring high efficiency fixtures in all new and replacement fixtures (toilets, showerheads, faucets)

WATER FOR 2060
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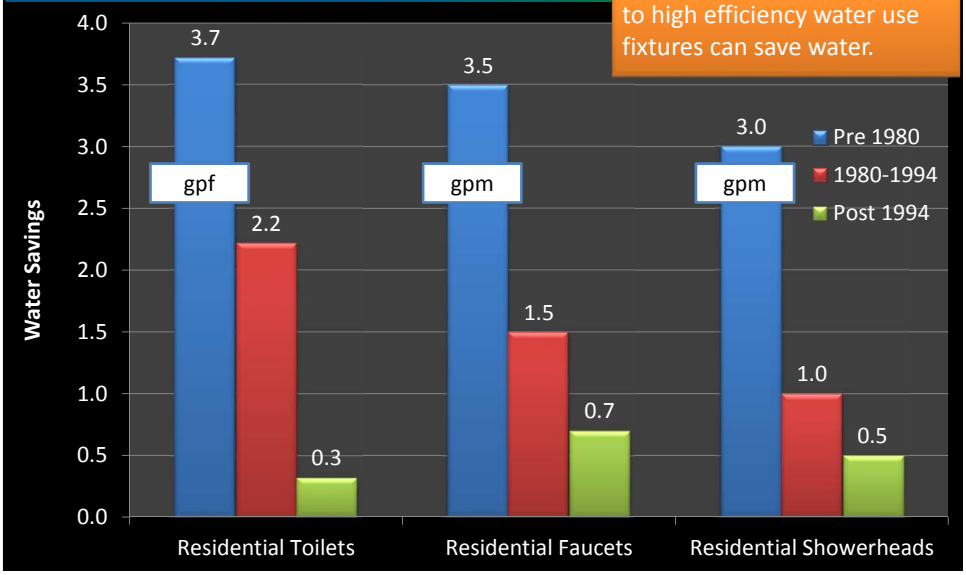
Potential Conservation Activities – Low water use fixtures

Converting from older fixtures to high efficiency water use fixtures can save water.



Potential Conservation Activities – SCRWD3 low water use fixtures

Year	Number of Households Converting to HE Fixtures [2]	Cumulative Water Savings, above passive conservation savings (AFY, mgd) [1]
2020	18	1.7, 0.0015
2030	13	5.8, 0.0052
2040	7	7.4, 0.0066
2050	4	8.4, 0.0075
2060	4	9.4, 0.0084

Notes:
1. Assumes ordinance goes into effect in 2016.
2. Assumes that high efficiency fixtures will be used as toilets are replaced and as new residents are established. Timing of fixture replacement uses OCWP replacement timeline. Beginning in 2030, conversion from post 1994 fixtures to high efficiency fixtures begins.

Potential Conservation Activities – Ordinances

Ordinances

- High efficiency fixtures for all new construction
- Rain switches for all new irrigation systems
- Max percent turf for all new landscaping
- Require irrigation meters for all new construction
- Permanent odd/even watering restrictions

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Potential Conservation Activities – Rebates

Water Conservation Landscaping

- $1.00 per square foot of turf grass replacement with low-water use (Xeriscape or hardscape) landscaping
- $2.00 each for rotary/high-efficiency sprinkler head replacement
- 50% of cost up to $300 for smart irrigation controllers (evapotransporation)
- 50% of cost up to $50 for rain/freeze switch for irrigation controllers

High Efficiency Fixtures

- $75 per toilet replaced

* All costs in 2014 dollars.

Potential Conservation Activities – SCRWD3 rebates

Rebate Program	Program Funding [1] ($/yr)	Number of Items Rebated	Estimated Water Savings (AFY, mgd)
Low Water Use Toilets	$1,000	13 toilets	0.17, 0.002
Turf Grass Replacement	$1,000	1,000 sf	0.05, 0.00005
Sprinkler Head Replacement	$1,000	500 sprinkler heads	0.7, 0.006
SMART Controller Addition	$1,000	8	0.16, 0.001
Rain/Freeze Sensor Addition	$1,000	20	0.06, 0.001

- Did not include washing machines, as these are mostly offered only as high efficiency models now.
- Also could consider give-aways like sink aerators, low flow showerheads, etc. (either as their own program or as part of water audits).

Notes:
1. All costs in 2014 dollars .
2. Water savings are realized each year that rebates are offered.

Conservation Activities – Locally implementable discussion

- Which of these programs seem most likely to succeed in your service area?
  - Acceptable to customers
  - Acceptable to officials
  - Reduce long term water use
  - Can be funded
  - Other success factors

WATER FOR 2060
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Potential Conservation Activities – SCRWD3 Summary

- ✓ Metering
- • Water use audits
- • Public education
- • Rebates
- ✓ Leak detection and prevention
- • Conservation billing rates

WATER FOR 2060
EFFICIENCY - CONSERVATION - RECYCLING - REUSE

SCRWD3 Summary of Potential Conservation Activities	Estimated Cumulative Water Savings through 2020 (AFY, mgd)	Estimated Cumulative Program Cost through 2020 ($)	Estimated Unit Cost ($/AF saved)
Conservation Program Administrator [1]	N/A	$250,000	N/A
High Efficiency Fixtures [2]	1.7, 0.0015	$0	$0
Toilet Leak Repairs	2.0, 0.002	$400	$200
Rebate – sprinkler head replace.	3.5, 0.003	$5,000	$1,400
Public Information and education programs [1]	15, 0.013	$2,900	$2,600
Water audits	1.0, 0.001	$4,000	$4,000
Rebate – high efficiency toilets [2]	0.9, 0.0008	$5,000	$5,900
Rebate – SMART controller	0.8, 0.0007	$5,000	$6,300
Rebate – rain/freeze sensor	0.3, 0.0003	$5,000	$16,700
Rebate – turf grass replacement	0.25, 0.0002	$5,000	$20,000
Conservation Water Rates	1.3, 0.001	$25,000 - $50,000	$28,800

Notes:
1. These line items serve to enhance the visibility of water issues and support other conservation programs.
2. Water savings can be recognized from only one of these programs.

SCRWD3 Summary of Potential Conservation Activities [3]	Estimated Cumulative Water Savings through 2020 (AFY, mgd)	Estimated Cumulative Program Cost through 2020 ($)	Estimated Unit Cost ($/AF saved)
Conservation Program Administrator [1]	N/A	$250,000	N/A
Ordinance - High Efficiency Fixtures [2]	1.7, 0.0015	$0	$0
Toilet Leak Repairs	2.0, 0.002	$400	$200
Rebate – sprinkler head replace.	3.5, 0.003	$5,000	$1,400
Public Information and education programs [1]	15, 0.013	$2,900	$2,600
Water audits	1.0, 0.001	$4,000	$4,000
Rebate – high efficiency toilets [2]	0.9, 0.0008	$5,000	$5,900
Rebate – SMART controller			$6,300
Rebate – rain/freeze sensor			$16,700
Rebate – turf grass replacement	0.25, 0.0002	$5,000	$20,000
Conservation Water Rates	1.3, 0.001	$25,000 - $50,000	$28,800

If shaded programs are implemented, PWS can recognize potential water savings of 13% by 2020

Notes:
1. These line items serve to enhance the visibility of water issues and support other conservation programs.
2. Water savings can be recognized from only one of these programs.
3. Shading indicates programs that may be implementable locally.