



WATER DEPARTMENT DRAFT TECHNICAL MEMORANDUM

DATE: October 24, 2012

TO: Heidi Luckenbach, Desalination Program Coordinator

FROM: Toby Goddard, Water Conservation Manager

SUBJECT: Evaluation of Potential for Additional Long-Term Water Demand Reduction through Water Conservation Measures

Background

The City of Santa Cruz has long recognized the importance of conserving water as a responsible water management strategy to help protect the area's natural resources, to stretch existing water supplies, to help downsize and/or delay the need for costly additional water supply, treatment, and distribution upgrades, and to fulfill the City's overall goal of ensuring a safe, reliable, and adequate water supply.

Over the last decade, the Water Department's priorities and work plan have been guided by two principal documents: 1) Memorandum of Understanding Regarding Urban Water Conservation in California (MOU), and 2) the Department's Long-Term Water Conservation Plan.

In June 2001, the City of Santa Cruz became a signatory to the [MOU](#) and joined the [California Urban Water Conservation Council](#) (CUWCC) in promoting water conservation locally and statewide. By becoming a signatory, the City committed to implementing all urban water conservation Best Management Practices (BMPs) contained in the MOU deemed to be locally cost-effective, and to reporting progress made to the CUWCC.

The other guiding document was a 10-year, Long-Term Water Conservation Plan adopted by the City in 2000 (Gary Fiske & Assoc. 2000). The Long-Term Water Conservation Plan identified 17 demand reduction programs (many of which overlapped with those contained in the MOU) to implement over a period of ten years. The planning horizon for the document has recently expired and it is in need of reevaluation.

The City has made considerable progress during this time, both in terms of reducing overall demand for water and reducing the amount of water used per capita. Overall water use has declined by nearly 900 million gallons or 23 percent over the last decade, and per capita water use (total water production divided by service area population) has dropped from 126 gallons per capita per day (gpcd) in 2001 to 93 gpcd in 2010, a 26 percent decline. The City's 10-year average daily per capita water use (ending 2010) is 113 gallons per capita per day, considerably less than the 192 gpcd average for the state as a whole or 154 gpcd average for the Central Coast region. Of the 349 urban water suppliers reporting their per capita water in their latest 2010 Urban Water

Management Plans, only 22 or 6 percent of California water agencies have an average per capita water use that is lower than the City's.

A full description of the various programs implemented to date and water savings achieved is in presented in the City's 2010 Urban Water Management Plan.

Updated Water Conservation Master Plan

The City has just begun the process of retaining a consultant to update its Water Conservation Master Plan. The primary objective is to better understand how much further reduction in water use can be feasibly attained through potential water conservation measures out to the 2030 planning horizon. The specific goals of this project are to:

- Systematically evaluate and quantify the City's maximum practical long-term water conservation potential,
- Determine which water conservation measures and implementation mechanisms represent the best approach to achieve these water savings, and
- Prepare a master plan to guide the Water Department in carrying out future conservation programs and to meet its GPCD target under SB7.

This project will be completed in early 2014.

As a first step in the process, the City has undertaken a Residential and Commercial Water Use Baseline Survey project, which is close to being complete. The goal of this project is to develop accurate estimates of the current saturation or market penetration of water-conserving fixtures, devices, equipment, and features within residential and commercial properties; to take stock of existing conditions; and to assess progress following implementation of the City's existing (2000) Water Conservation Plan.

The data acquired through this survey will inform the upcoming technical analysis of possible water-saving technologies, programs, and services that could further reduce future water demand, to identify remaining long-term water conservation potential across the service area, and to fashion a similar Water Conservation Master Plan for the City through 2030. This effort is scheduled to begin in early 2013 and will take approximately one year to produce. When completed, the City's updated Water Conservation Master Plan will provide a long-range road map for future water conservation efficiency efforts. The results will be used to help refine the City's water demand projections, and will be factored into overall water supply planning efforts.

Water Demand Projections

The City updated and extended its water demand projections to 2030 as part of its recent General Plan update and 2010 Urban Water Management Plan processes. The new demand projections are lower than previously estimated. The City's service area population is expected to grow by about 10,000 people (about 11%) over this time. With anticipated population growth and ongoing community development, demand for water is projected to rise from about 3.5 billion gallons per year in 2010 (normalized to adjust for temporary reductions due to recent water restrictions and weather effects) to just over 4.0 billion gallons per year in 2030.

The 2030 water demand projections mentioned above incorporate efficiency levels already achieved by existing customers, based on data from a recent water demand modeling analysis project (Weber Analytical, 2010). It also takes into account certain anticipated water efficiencies in new development. It does not, however, incorporate future water savings from recently adopted California Green building standards codes, ongoing programs, or additional new water conservation programs.

Purpose

As stated above, the question of how much additional water conservation efforts might lessen the projected increase in water demand between 2010 and 2030 will not be known until the next Water Conservation Master Planning process is complete, which is expected sometime in early 2014. For meeting the information needs of the environmental analysis for the desalination project, the City's Water Conservation section undertook a preliminary analysis of the potential for additional long-term reduction in water demand in fall 2012. The purpose of this analysis was to develop future estimates of water savings associated with both ongoing programs, as well as with possible new programs through 2030, to serve as an interim estimate, or placeholder, until the formal plan is completed. The object of this technical memorandum is to summarize the findings and to estimate the magnitude of feasibly attainable water savings. It is not the purpose of this analysis to commit the City to undertaking any or all of these programs, until a more thorough evaluation has been done, cost-effectiveness of all options analyzed, and public input addressed.

The analysis and discussion that follows is organized into two parts: 1) Water Savings from Ongoing Programs, and 2) Water Savings from Potential New Programs.

Water Savings from Ongoing Programs

The City of Santa Cruz offers a variety of programs, and incentives to help city water customers become more water-efficient. This section describes the ongoing programs, in the order that they appear in the MOU, and provides an estimate of long term water savings expected from continuation of existing water conservation activities through 2030.

Water Conservation Coordinator: The City of Santa Cruz has employed a full-time water conservation coordinator since 1986. The current Water Conservation Manager is responsible for planning, organizing, and directing the operations of the Water Conservation section and for reporting on BMP implementation. The Water Conservation section is staffed with one Environmental Projects Analyst, and two Water Conservation Representatives who operate existing programs and assist with new program development.

Water Waste Prevention: Under the MOU, water waste prevention consists of enacting, enforcing, or supporting legislation, regulations, ordinances, or terms of service that prohibit water waste by existing users and in new development, or that facilitate implementation of water shortage response measures. The City's water conservation ordinance (Santa Cruz Municipal Code 16.02) has been in operation since 1981 and was updated in 2003. Among other things, the ordinance prohibits watering of landscaping in a manner or to an extent that allows excess water running off the property, allowing plumbing leaks to go unrepaired, and outdoor washing of structures, vehicles, or surfaces without the use of an automatic shut-off nozzle. In addition, the City has a comprehensive landscape water conservation ordinance (Santa Cruz Municipal Code

16.16, updated in 2010) to ensure landscapes and irrigation systems in new and renovated development are designed to reduce the overall amount of potable water needed, and to minimize the potential for water losses and waste.

Water Loss Control: The City conducts an annual water audit of the City's water distribution system using the approach described in the American Water Works Association M36 "Manual of Water Supply Practices". The purpose of the audit is to quantify how much water and revenue is lost through physical leaks and apparent losses and to identify steps to minimize system losses and improve the operational efficiency of the water system.

Metering with Commodity Rates: All of the City's 24,351 water connections are fully metered with Automated Meter Reading (AMR) technology. Water meters are required for all new service connections. In addition, a separate, dedicated irrigation meter is required for all new and renovated multi-family and commercial landscape projects with over 5,000 square feet of landscaped area. All customers are billed according to the volume of water consumed. Inside-City customers, large volume accounts, and irrigation accounts now are all billed on a monthly basis.

Retail Conservation Pricing: The City uses a five-tier, inclining block rate structure for its 18,884 single residential and approximately 1,500 two-unit customers. For all other customers, including multi-family (3 or more dwelling units), business, industrial, municipal, and irrigation customers, water is billed at a uniform rate corresponding with block 2.

Public Information: The City of Santa Cruz Water Department actively promotes public awareness and education about the City's water resources and the importance of water conservation, through various methods and media.

School Education: The City offers school education activities for students ranging from upper elementary age children up to the University level. The program gives students an opportunity to learn about the City's water supply system and water conservation through field trips, curriculum, and presentations.

Residential Assistance Programs: The City currently offers a H₂ome Water Survey program to both single-family and multi-family customers. Water Conservation staff reviews water consumption and billing information with the customer, teaches them how to read the meter and how to use it to detect household leaks, inspects home plumbing fixtures, and offers free showerheads and aerators. The primary emphasis of the City's H₂ome Water Survey program is in assessing outdoor water use and providing water saving recommendations through a landscape water survey. In addition, the Water Conservation Office stocks and offers free 2.0 gpm showerheads, 1.5 gpm lavatory faucet aerators, 2.0 gpm kitchen aerators, hose nozzles, toilet dye tablets, and hose timers on request to any interested water customer.

Landscape Water Survey: As part of the City's H₂ome Water Survey program, a conservation representative analyzes the customer's utility bill, evaluates the existing landscaped area, design, and the types of plant materials in place, and checks the irrigation system. Each irrigation station is run and evaluated for flow rate, coverage, and problems such as runoff, overspray, uneven distribution, and broken or leaking equipment. For turf areas, a catch can test is run to determine sprinkler output and distribution uniformity. The customer receives a list of site-specific recommendations to help conserve water both inside and outside the home. An irrigation schedule tai-

lored to the customer's landscape is also provided. Customers are given training on how to operate their irrigation controllers, including the use of water-saving features and scheduling strategies to reduce runoff.

High Efficiency Clothes Washer Program: The City offers its residential customers a \$100 rebate for purchasing an Energy Star labeled, High-Efficiency Clothes Washer (HECW), and processes between 500 and 700 HECW rebates annually. The City works with appliance retailers to promote the program at local retail outlets in coordination with residential clothes washer rebates concurrently offered by PG&E.

WaterSense Specification Toilets: The City has operated a rebate program to promote the installation of ultra-low-flush (ULF) toilets in residential accounts since 1995. The program originally featured a \$75 rebate as a financial incentive for customers to remove their older, higher-volume toilets and replace them with 1.6 gallon per flush toilets. In 2007, the City began to also offer a \$150 rebate for 1.28 gallon per flush toilets, referred to as High Efficiency Toilets (HETs). The \$75 rebate was discontinued in 2010. The City now only rebates toilets meeting WaterSense specifications with a maximum flush volume of 1.28 gallons. Over 11,000 residential toilets have been replaced under this rebate program.

In 2003, the City adopted a plumbing fixture retrofit ordinance. This regulation requires that all residential, commercial, and industrial properties be retrofitted with low consumption showerheads, toilets, and urinals when real estate is sold. Under the law, the seller of the property is responsible for retrofitting any older toilets, urinals, and showerheads on the property with low consumption fixtures, and for obtaining a water conservation certificate from the Water Department. The City has processed over 7,000 individual properties under this ordinance, including some of the City's largest commercial properties.

Commercial, Industrial, and Institutional Programs: The City offers several programs to encourage commercial customers to become more water efficient by using water-saving technology. These include

- Smart Rebates Program
- Monterey Bay Area Green Business Program
- City-administered Rebates
- Plumbing Fixture Retrofit Regulations

Landscape Programs: The City administers three major programs addressing landscape water use, described below.

Water Efficient Landscape Ordinance. For new development projects, a complete landscape plan must be submitted and found to satisfy the standards of the ordinance before a building permit can be issued. The purpose of this ordinance is to ensure that the City's limited water supply is used efficiently and effectively in new landscapes within the City's water service area and to avoid certain landscape and irrigation design aspects that have the potential to result in water waste.

Large Landscape Water Budget Program. For customers with large landscapes and dedicated irrigation accounts, the City contracts with a consultant, WaterFluence LLC, to map landscape ar-

eas using aerial imagery, to develop irrigation budgets for the City’s 235 largest irrigation accounts, and to distribute the information through monthly Landscape Water Use Reports. The reports provide a site-specific irrigation budget based on landscape size and plantings, type of irrigation, and real-time local weather conditions. As part of this program, a professional irrigation audit service is made available to large landscape customers through the contract with WaterFluence.

Lawn Removal Rebate Program. The City offers a rebate program to promote turf removal to encourage and expand landscape water conservation opportunities for customers and to provide an option for customers seeking to mitigate high utility bills. Single-family customers are eligible to receive up to a \$250 rebate (equal to 500 square feet) and multi-family and commercial customers may receive up to \$1,000.

In addition, the City provides rain barrels to its customers at a reduced cost, on a seasonal basis.

The estimated savings from ongoing programs is presented in five year increments out to 2030 in Table 1, and illustrated in Figures 1 and 2. Estimates are based on end use savings from the CUWCC and literature; rates of participation experienced in recent years, and assumptions for longevity of the measure or equipment. A discount of 50 percent was applied to all outdoor water savings to avoid double-counting since temporary water savings in this sector are already counted and planned in the City’s water use curtailment portion of the Integrated Water Plan.

Table 1. Estimate of Water Conservation Savings from Ongoing Programs (million gallons/yr)

Water Conservation Program	Method(s)	Estimated Water Savings:				Comment
		2015	2020	2025	2030	
Water Conservation Coordinator	-	0.0	0.0	0.0	0.0	Not quantified
Water Waste Prevention	Education, Regulation	0.0	0.0	0.0	0.0	Factored into current existing efficiency levels
Water Loss Control	Utility Operations	0.0	0.0	0.0	0.0	Factored into current existing efficiency levels
Metering with Commodity Rates	Utility Operations	0.0	0.0	0.0	0.0	Factored into current existing efficiency levels
Retail Conservation Pricing	Utility Operations	0.0	0.0	0.0	0.0	Factored into current existing efficiency levels
Public Information	Information, Education	0.0	0.0	0.0	0.0	Not quantified
School Education	Information, Education	0.0	0.0	0.0	0.0	Not quantified
Residential Assistance Programs	Technical Assistance, Device Distribution, Regulation	2.5	7	8	6	4.5 gpd; 9,000 households; 5 year savings
Landscape Water Survey	Technical Assistance	1.6	1.6	1.6	1.6	60 gpd; 900 households; 3 year savings
High Efficiency Clothes Washers	Financial Incentive	20	43	54	65	30.8 gpd, 5800 households; permanent water savings
WaterSense Specification Toilets	Financial Incentive, Regulation	15	28	34	37	5 mgd for combined rebate and retrofit regulations declining to <1 mgd by 2030
Commercial, Industrial, and Institutional	Technical Assistance, Financial Incentive, Device Distribution, Regu-	0.3	0.7	0.9	1.1	0.1 mgd for combined rebates and retrofit regulations declining to 0.03 mgd by 2030

Water Conservation Program	Method(s)	Estimated Water Savings:				Comment
		2015	2020	2025	2030	
	lation					
Water Efficient Landscape Ordinance	Regulation	0.4	0.8	0.8	0.6	0.25 mgy; 10 year water savings
Large Landscape Water Budget Program	Technical Assistance	4.0	8.0	8.0	8.0	Based on estimates of over-watering at commercial sites and homeowner associations
Lawn Removal Rebate Program	Financial Incentive	0.5	1.1	1.1	2.2	22 gal/sq ft; 440 properties; ongoing water savings
Rain Barrels	Education, Financial Incentive	0.2	0.4	0.7	0.9	260 gal/yr; 3600 customers; 20 year savings
Total (million gallons per year) *		45	89	109	122	

* Total water savings are cumulative, not additive

Together, water savings from these existing programs is estimated to total almost 90 mgy by 2020 and reach approximately 120 mgy in 2030.

As illustrated below in Figures 1 and 2, the majority of long-term water savings is achieved mainly through ongoing toilet and clothes washer replacement in the residential sector. The savings from these programs is expected to diminish over time as market saturation continues to increase.

Figure 1.

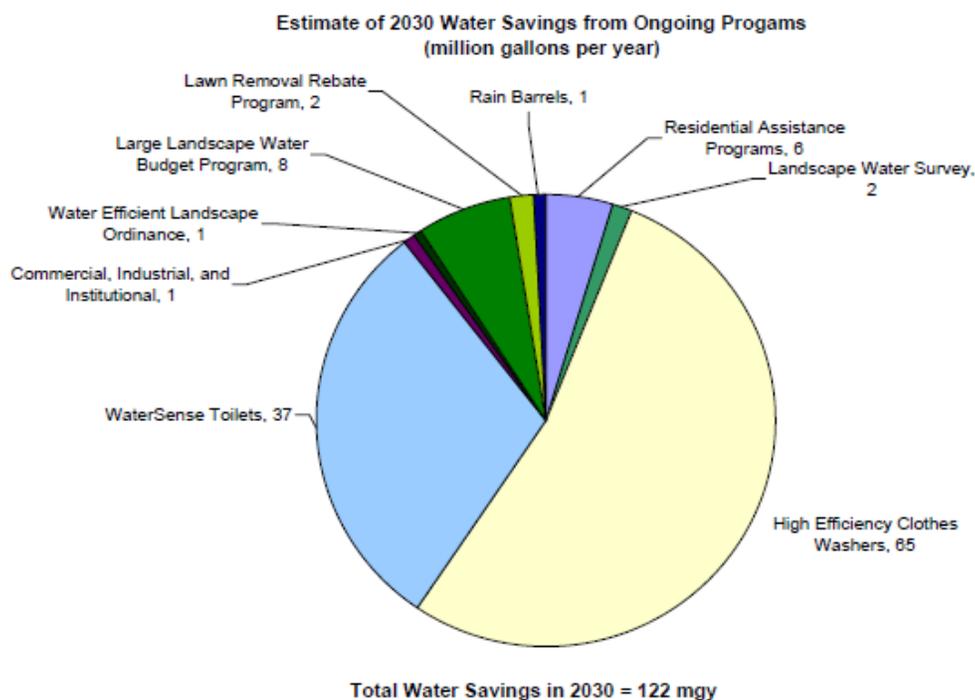
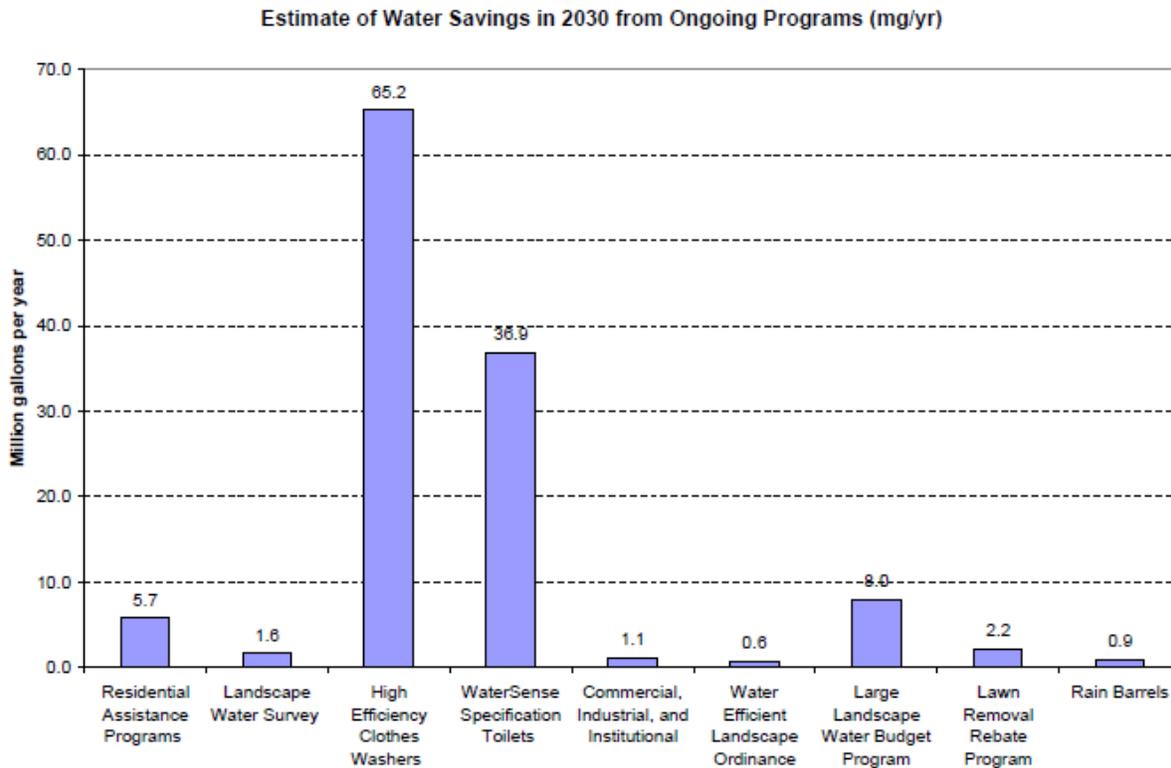


Figure 2.



Water Savings from Potential New Programs

The second step in this preliminary analysis of the potential for additional long-term reduction in water demand was to identify possible new water efficiency programs or ways to expand the reach of existing programs. The City’s approach to water use efficiency in the long run generally puts priority on measures that are sustainable (i.e. technologies that reduce daily per capita water use in a reliable, long-lasting way), quantifiable, and have widespread social acceptance to maximize savings. The list of 26 possible programs and proposed delivery mechanisms that follow was developed through a review and screening of public suggestions presented during the environmental review scoping process for the scwd² desalination program and during the development of the City’s 2010 Urban Water Management Plan (refer to Appendix A), a review of new technologies and opportunities known to be available, and review of programs conducted by other water agencies. A more formal identification of program options and thorough screening process will be conducted as part of the updated Water Conservation Master Plan. Estimated savings are considered tentative given the lack of real world experience with the effectiveness of some measures and uncertainties about the willingness or interest by the general public to participate in these new initiatives.

These new or expanded programs are grouped into five categories, to be consistent with the MOU.

1. Utility Operations Programs

Advanced Metering Infrastructure: The City of Santa Cruz currently uses radio read, or Automated Meter Reading (AMR), technology to collect water meter readings on a monthly or bi-

monthly cycle for utility billing purposes. Advanced Metering Infrastructure (AMI) is the next generation of meter reading systems that enable continuous measurement and collection of detailed (e.g., hourly) water use information, which is transmitted via communications network to the service provider, where it is processed, analyzed, and stored in a specialized Meter Data Management System. AMI offers various system operation, customer service, and financial benefits. For purposes of water conservation, AMI systems help the utility and its customers monitor consumption, detect leaks on the customer's side of the meter and provide notification before a bill is sent, provide feedback on conservation efforts, and assist in monitoring compliance and enforcement of water restrictions.

Enhanced Water Loss Control: Even though the City has a comparatively low level of system water loss, additional actions are possible to further reduce leakage to a level that is economically achievable. These actions include actively performing sonic leak detection surveys to find unreported leaks, optimizing leak repair activities, managing pressure, and increasing the level of water main and service line replacement. Of these four approaches, active leak detection and accelerating main and service line replacement where there is a high burst frequency are the two areas where potential exists for reducing system water losses.

Monthly Billing outside City of Santa Cruz: The City bills all inside City customers, all large users, and all dedicated irrigation accounts on a monthly cycle and bills most outside City customers on a bi-monthly cycle. This program would involve changing the frequency of utility billing by converting approximately 8,500 water customers outside the City of Santa Cruz to a monthly billing cycle. Monthly billing potentially allows customers to detect property-side leaks earlier and therefore manage their water use more efficiently. Customers also may find it easier to manage their monthly budget.

Pricing: The City currently uses a five-tier rate structure for single family and two-unit customers and a uniform rate structure for all other customer classifications. The average cost per unit of water, as reflected by the Tier 2 price, ranges between \$4.00 within the city and \$5.10 outside the city. Assuming no changes to this rate structure, future rate increases are expected to track at least with the overall inflation rate as measured by the Consumer Price Index, estimated at 2-3 percent per year. Continuing the projected inflation-based increases over the next 18 years of 2-3 percent per year will result in an overall rate increase by 2030 of 42 to 70 percent, with Tier 2 rates between \$5.71 and \$6.81 within the City and \$7.28 and \$8.68 outside the City in 2030. As the price of water increases, residential and commercial customers will likely respond by using less water over time.

2. New Construction

Water Efficiency in New Construction - CA Green Building Standards Code

The City of Santa Cruz adopted the 2010 California Green Building Standards Code (CalGreen), which currently applies to newly constructed residential and commercial buildings and structures (but not remodels at this time), and is administered by the City's Building Inspection Services. CalGreen effectively requires a schedule of plumbing fixture and fixture fittings that will reduce the overall use of potable water within the building by at least 20 percent. The schedule calls for maximum plumbing water consumption of 1.28 gallon per flush (gpf) for toilets, 0.5 gpf for urinals, 2.0 gpm for shower heads, 1.8 gpm for kitchen faucets, and 1.5 gpm on bathroom faucet

flows on residential construction. An optional performance path may also be chosen instead. In new commercial construction projects, CalGreen requires even more efficiency limiting lavatory faucet flows to 0.4 gpm. In addition to mandatory requirements, further efficiencies are available either to the jurisdiction or the builder through the application of voluntary measures.

3. Residential Programs

WaterSense Specification High-Efficiency Faucets Aerators/Accessories: Faucets use an estimated 15 percent of indoor household water. Current plumbing codes require maximum flow rates of 2.2 gallons per minute (gpm) on kitchen and bathroom faucets, although actual flow rates are often lower, depending on household water pressure and other variables. WaterSense fixtures are independently certified to use 20 percent less water and have a maximum flow rate of 1.5 gpm. This program would expedite the retrofit of existing, older bathroom faucets or replacement of faucet aerators in existing buildings them with WaterSense labeled faucet accessories or faucet aerators. Each installed WaterSense faucet aerator can save about 1-2 gallons per day.

WaterSense Specification High-Efficiency Shower Heads: Showers use an estimated 17 percent of indoor household water. Current plumbing codes require maximum flow rates of 2.5 gallons per minute (gpm) on shower heads, although actual flow rates are often less, depending on household water pressure and other variables. The City in 2000 delivered water efficient showerheads and related devices to all single family homes and many multifamily properties. The City also has a Plumbing Fixture Retrofit regulation which requires replacement of existing shower heads with 2.5 gpm models at the time of sale of real property in the service area. High performing WaterSense shower heads use 20 percent less water than standard water saving showerheads and have a maximum flow rate of 2.0 gpm. The City already provides 2.0 gpm showerheads free to customers upon request. This program would accelerate water savings by replacing existing 2.5 gpm shower heads with 2.0 gpm WaterSense labeled shower heads. Each installed WaterSense showerhead could save about 2-3 gallons per day.

High Efficiency Clothes Washers: The City could consider modifying its existing program by offering residential customers a larger financial incentive to choose the most efficient appliances on the market. The City currently offers a \$100 rebate for purchasing an Energy Star labeled, High-Efficiency Clothes Washer. These appliances have a water factor (gallons of water used per load per cubic foot of capacity) of 6 or less. The most efficient machines have a water factor of less than 3. A significantly higher incentive could increase participation rate in this program by making it financially more rewarding for customers to choose the highest efficiency models than standard top-loading washers.

WaterSense Specification High-Efficiency Toilets (HETs): Toilets are the largest source of water use in the home, estimated to use up to 30 percent of residential indoor water. The city currently promotes HETs, which use 1.28 gallons per flush (gpf), by offering a \$150 rebate for the replacement of toilets flushing 3.5 gpf or more with HETs. HETs are certified to use 20 percent less water than the current national 1.6 gpf volume standard. Beginning in January 2014, state law (AB 715) requires all toilets sold or installed to be HETs. This program could expand the city's current toilet rebate program for HETs by allowing rebates for the replacement of older model 1.6 gpf with HETs, thereby saving at least 0.3 gallons per flush. In addition, the City could consider giving additional rebates for replacement of 1.6 gpf toilets with Ultra-High Effi-

ciency Toilets (UHETs) that flush using 1.0 gallons or less. Another method to accomplish toilet replacement in the residential sector could involve a direct installation program, where the Water Department contracts for outside services to procure and install HETs in older apartment buildings with inefficient (3.5 gpf or more) toilets at no cost to the customer. One suggestion called for the City to update its plumbing fixture retrofit standard to the lowest flow standard available; however this action is considered unnecessary because 1) the majority of toilets being installed as a result of the City's retrofit ordinance now are HETs, and 2) state law requires only HETs be installed and sold beginning in 2014.

Composting Toilets: Composting toilets are alternative toilets that are typically used in situations where no suitable public water supply or wastewater treatment facility is available. They decompose human excrement using an aerobic processing system on little to no water. Several manufactured composting toilet models are on the market, or they can be self built. They require periodic maintenance and management of decomposed matter. Both the 2010 California Plumbing Code, Sections 303 and 304, and Santa Cruz Municipal Code section 6.12.140 currently prohibits their use, except in limited-density, owner-built, rural dwellings, and where approved by the local health official. Therefore, composting toilets do not provide a viable conservation opportunity at this time. Nevertheless, some individuals continue to assert that this alternative technology should be promoted by the City as a way to save water. The City is aware of no examples of people who are actively removing existing toilets in existing homes and replacing them with composting toilets, nor of any new residences being constructed with this technology. However, codes could change in the future, and some people may choose to use this technology.

Sub-Metering for Existing Multi-Family Accounts: The City requires individual metering of dwelling units in new multi-family construction projects wherever feasible. Many older multi-family buildings, however, were constructed with only a single domestic water meter serving the entire building. Sub-metering involves installing individual water meters on existing dwelling units within a multifamily complex. This strategy allows property owners, managers, or homeowner associations to re-bill each household for their own water consumption, thereby increasing awareness of individual water use and promoting efficiency. This program would give incentives for the installation of sub-meters on existing multi-family water accounts, such as mobile home parks, condominium associations, and apartment complexes, where it is feasible to do so.

Landscape Conversion/Lawn Removal: Outdoor water use accounts for 20 to 25 percent of residential water use in Santa Cruz, and irrigated lawn requires large quantities of water. The city currently offers its customers a rebate of up to \$250 for residential customers and \$1000 for multi-family and commercial customers who remove irrigated lawn area from their landscape and convert it to a water efficient landscape. This program would expand upon the existing lawn removal rebate program by offering larger rebates for such a conversion, and by increasing the allowable landscape area eligible for a lawn removal rebate.

Water-Efficient Irrigation Equipment Upgrades: This new program would offer financial incentives for improving irrigation efficiency of existing irrigation equipment with water conserving, low volume drip or micro spray irrigation, low-volume rotary nozzles, and rain shutoff devices.

Weather-Based Irrigation Controllers: Weather-based irrigation controllers (commonly referred to as ET controllers or Smart controllers) are advanced irrigation controllers that are programmed to use prevailing local weather conditions, current and historic evapotranspiration data,

and other relevant factors to target the specific irrigation needs of plants on each irrigation station or valve. The City presently requires weather-based irrigation controllers on new and renovated development projects. Expansion of this program would encourage the replacement of conventional irrigation timers with weather-based irrigation controllers on existing landscapes by offering financial incentives and technical assistance with controller replacement and set-up.

Graywater Systems/Retrofit: Graywater is untreated wastewater from laundry, showers, and lavatory sinks that is then reused on-site for landscape irrigation. This program would give technical and financial assistance for water customers who wish to set up a graywater system in their home in accordance with state and local codes.

Rain Harvesting Systems: This program could expand upon the City's current program of promoting the collection and use of rain water with subsidized rain barrels by offering a financial incentive and technical assistance for those interested in installing larger or different catchment systems or cisterns for landscape irrigation.

Promote Mulching: The City of Santa Cruz promotes mulching as a way to reduce water use in the garden, mainly through education and written materials, and through landscape regulations in new development. Mulch is any layer of material applied to the surface of an area of soil. Its purposes are to conserve moisture, cool the soil surface, improve the fertility and health of the soil, reduce weed growth, and enhance the visual appeal of a landscape. Mulch is usually, but not exclusively, organic in nature and includes wood chips, bark, or decomposed organic material. This program could further promote the use of mulch either through free distribution or by financial incentives.

Commercial, Industrial and Institutional (CII) Programs

High Efficiency Faucet Aerators and WaterSense Shower Heads for Commercial Customers: Current Building Code requires commercial faucet flows of no more than 2.2 gpm and public restroom faucets to flow no more than 0.5 gpm and to have an automatic turn-off feature. High efficiency fixtures are at least 20 percent more efficient than those currently required by plumbing codes. This program would offer 0.5 gpm or less ultra-high efficiency faucet aerators, as well as WaterSense shower heads (2.0 gpm) to business, industrial, and governmental customers in order to expedite replacement of older, inefficient fixtures.

High Efficiency Toilets (HETs) and Urinals (HEUs): The City currently offers commercial, industrial and institutional (CII) customers rebates for replacing older, higher flush volume toilets and urinals with high efficiency toilets and high efficiency urinals (0.5 gpf or less). CII customers can currently obtain rebates both through the statewide Smart Rebate program and through the City's own rebate program. Beginning January 2014, only HETs and HEUs will be sold in California. As a result, the Smart Rebate program will be phased out in 2012. The City will continue to offer its own rebate program for CII customers. Another method to accelerate toilet and urinal replacement in the commercial, industrial, and institutional sector could involve a direct installation program, where the Water Department contracts for outside services to administer a program for procuring and installing HETs and HEUs in older buildings with inefficient (3.5 gpf or more) toilets at no cost to the customer.

School/Institutional Efficiency Improvements (Indoor/Outdoor): The City currently offers water use surveys for CII customers through its Green Business Certification Program. CII sites are surveyed for maximum water uses efficiencies both indoors and outdoors. This program could expand the survey program to include CII customers interested in water efficiency but not yet ready for the Green Business certification, which requires approval in energy efficiency, pollution prevention, solid waste management, and other environmentally beneficial activities. In addition, the City could consider funding the cost of retrofitting public institutions such as schools and government buildings that are unlikely to transfer, renovate, or replace fixtures. Creating an incentive to retrofit these buildings with HETs, HEUs, high efficiency faucet aerators, and WaterSense shower heads would achieve water savings less likely to otherwise occur.

Large Landscape Programs

Retrofit Mixed-Use Commercial, Industrial, and Institutional Accounts with Separate Irrigation Meters: Currently, there are approximately 100 older commercial, industrial, and institutional customers with significant irrigated landscape area on property that is served by a single, mixed use water meter. This program would retrofit those accounts so that the domestic water and irrigation water service are provided on separate, dedicated meters. This improvement would allow customers to better manage their irrigation water and detect leaks earlier. It would also benefit the customer by reducing wastewater charges.

Weather-Based Irrigation Controllers: Weather-based irrigation controllers (commonly referred to as ET controllers or Smart controllers) are advanced irrigation controllers that are programmed to use prevailing weather conditions, current and historic evapotranspiration data, and other relevant factors to target the specific irrigation needs of plants on each irrigation station or valve. The City presently requires weather-based irrigation controllers on new and renovated commercial development projects and currently has a large landscape water budget program to provide each separately metered irrigation account with its own weather-based landscape water budget. Weather-based irrigation controllers would further facilitate water efficiency for existing commercial and institutional irrigation customers, particularly those that are having difficulty meeting the landscape water budget goals. This program would offer financial incentives and technical assistance for the replacement of conventional irrigation timers with weather-based irrigation controllers on existing large commercial or institutional landscapes.

Water-Efficient Irrigation Equipment Upgrades: This new program, like that for the residential sector, would offer financial incentives for improving the irrigation efficiency of existing irrigation equipment with water conserving, low volume drip or micro spray irrigation, low-volume rotary nozzles, and rain shutoff devices.

Landscape Conversion/Lawn Removal: The city currently offers its multi-family, commercial, municipal, and other public customers a rebate of up to \$1000 for removing irrigated lawn area from their landscape and converting it to a water efficient landscape. This program would expand upon the existing lawn removal rebate program by offering larger rebates that provide a significant cost share for this kind of landscape conversion and by increasing the allowable landscape area that is presently eligible for a lawn removal rebate.

Budget Based Pricing for Dedicated Irrigation Accounts: The city currently has a Large Landscape Water Budget program that calculates water budgets for large landscape customers based

on landscape area, type of plant materials, and the weather-based water needs of each landscape. Customers can use this information to program irrigation for actual needs of their landscape area. This measure would expand the city’s current irrigation budget program to bill on a tiered rate system properties with dedication irrigation accounts, including golf courses, cemeteries, parks, schools, homeowner associations, and commercial properties. Sites watering over their budget would pay higher rates for the portion of their usage over the water budget, and rate based incentives would create a motive for watering at or under budget. This change in the way landscape water is priced could accelerate water savings. However, current limitations with the City’s utility billing system would have to be overcome to put this type of system in place.

Discussion

The estimated savings from new and expanded programs is presented, in five year increments out to 2030, in Table 2 below, and is illustrated by major category in Figure 3 and by individual program savings in Figure 4.

Table 2. Estimate of Water Conservation Savings from New and Expanded Programs (million gallons/yr)

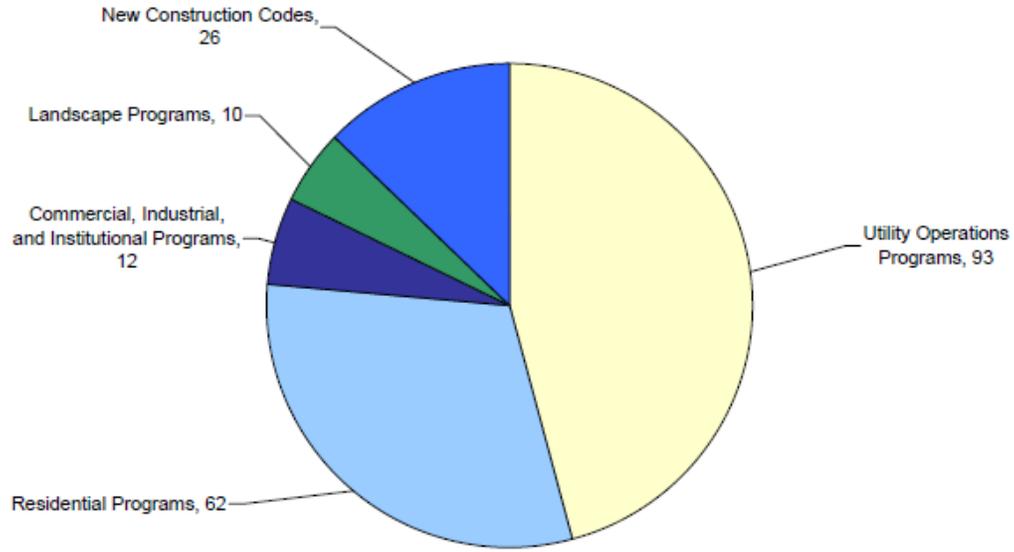
Water Conservation Program	Method(s)	Estimated Water Savings				Comment
		2015	2020	2025	2030	
Utility Operations Programs:						
Advanced Metering Infrastructure	Utility Operations	-	35	36	37	Full implementation not expected until at least year 2020
Enhanced Water Loss Control	Utility Operations	3	3	4	4	More aggressive main replacement and active leak detection
Monthly Billing Outside City	Utility Operations	5*	5*	5*	5*	Count savings only if AMI is not implemented
Retail Conservation Pricing	Pricing	7	19	35	52	Assume 2.5% inflationary increase in rates and elasticity of -0.025%; i.e. overall decrease of 1.4% accompanying a 56% percent increase over next 18 years
New Construction Programs – CA Green Building Standards Code:						
Water Efficiency in New Residential Construction	Code	3	8	11	15	Estimate codes result in 7.5 percent reduction in overall water use by new residential and commercial development
Water Efficiency in New Commercial Construction	Code	3	5	8	10	
Residential Programs:						
WaterSense Specification Faucets Aerators/Accessories	Device Distribution	3	3	3	3	Assume one-time distribution to 20,000 customers; 25 percent install equipment
WaterSense Specification Shower Heads	Device Distribution	5	5	5	5	
High Efficiency Clothes Washers	Increased Financial Incentive	12	26	32	39	Significant rebate increase yields 60 % increase in participation
Replacing ULFTs with WaterSense Specification Toilets (HETs)	Financial Incentive	0.3	0.9	1.4	2.0	1.5 gal/day, 200 customers/year
Replacing ULFTs with 0.8 gpf UHETs	Financial Incentive	0.4	1.2	1.9	2.6	4.0 gal/day, 100 customers/year
Replacing Remaining Non-Efficient Toilets with WaterSense Specification Toilets via Direct Installation	Direct Install	4	7	7	7	11 gal/day; participation varies from 300 units/year to 0 by 2030

Water Conservation Program	Method(s)	Estimated Water Savings				Comment
		2015	2020	2025	2030	
Composting Toilets	Financial Incentive	0	0	0	0	Prohibited by CA Plumbing Code and Santa Cruz Municipal Code
Sub-Metering for Existing Multi-Family Accounts	Financial Incentive	0.8	2.2	2.2	2.2	250 gal/day, 500 households sub-metered
Landscape Conversion/Lawn Removal Program	Financial Incentive	0.5	1.1	1.1	1.1	Assume participation could double by tripling rebate amount to \$1.50/sq ft and doubling allowable area
Water Efficient Irrigation Equipment Upgrades	Technical Assistance, Financial Incentive	0.2	0.3	0.3	0.3	
Weather Based Irrigation Controllers	Technical Assistance, Financial Incentive	0.1	0.2	0.2	0.3	Assume 7percent savings in outdoor water use; 370 participating accounts
Residential Gray Water	Technical Assistance, Financial Incentive	0.2	0.4	0.4	0.3	Assume 30 gal/day, 180 days/yr; 130 systems
Rain Harvesting Systems	Financial Incentive	0.1	0.2	0.2	0.3	5,000 gal/yr; 5 hh/yr
Promote Mulching	Distribution	0.1	0.2	0.2	0.2	Reduces irrigation by 25 % in covered area saving 400 gal/yr; 100 hh/yr
CII Programs:						
Ultra-High Efficiency Faucet Aerators and WaterSense Shower Heads	Device Distribution	0.2	0.3	0.0	0.0	520 gal/yr; 200 properties and 50% installation rate
High Efficiency Toilets (HETs) and Urinals (HEUs)	Financial Incentive, Regulation, Direct Install	6	10	10	10	8,000 gal/yr/toilet; 200 units per year 4,000 gal/yr/urinal 100 units; 5 yr program length
School/Institutional Efficiency Improvements	Direct Install	1	1	2	2	Indoor and Outdoor
Landscape Programs:						
Retrofit Mixed-Use CII Accounts with Separate Irrigation Meters	Financial Incentive	0.3	0.3	0.5	0.5	Assume 25 meters feasible to separate; 5 customers/yr, 5 years for program completion, save 10% or 50CCF/irr season
Weather Based Irrigation Controllers for CII	Technical Assistance, Financial Incentive	0.1	0.1	0.2	0.2	Assume 10% saturation at 500 accounts and 2% savings
Water Efficient Irrigation Equipment Upgrades	Technical Assistance, Financial Incentive	0.1	0.1	0.1	0.1	Assume program savings of 50,000 gallons/yr, maxing out at 250,000 after five years
Large Landscape Conversion/Lawn Removal Program	Financial Incentive	0.4	0.9	1.1	1.3	
Budget Based Pricing for Dedicated Irrigation Accounts	Pricing	4	8	8	8	Landscape overwatering at commercial sites and homeowner associations is further reduced one-third on top of one-third reduction from WU reports by 2020
Total (million gallons per year) **		52	137	169	203	
*Monthly Billing savings are not included in total sums because savings generated from AMI installations would include monthly billing and its associated savings. ** Total water savings are cumulative, not additive						

Figure 3 below illustrates the proportion of estimated water savings, by major category; Figure 4 presents estimated water savings graphically by individual program.

Figure 3.

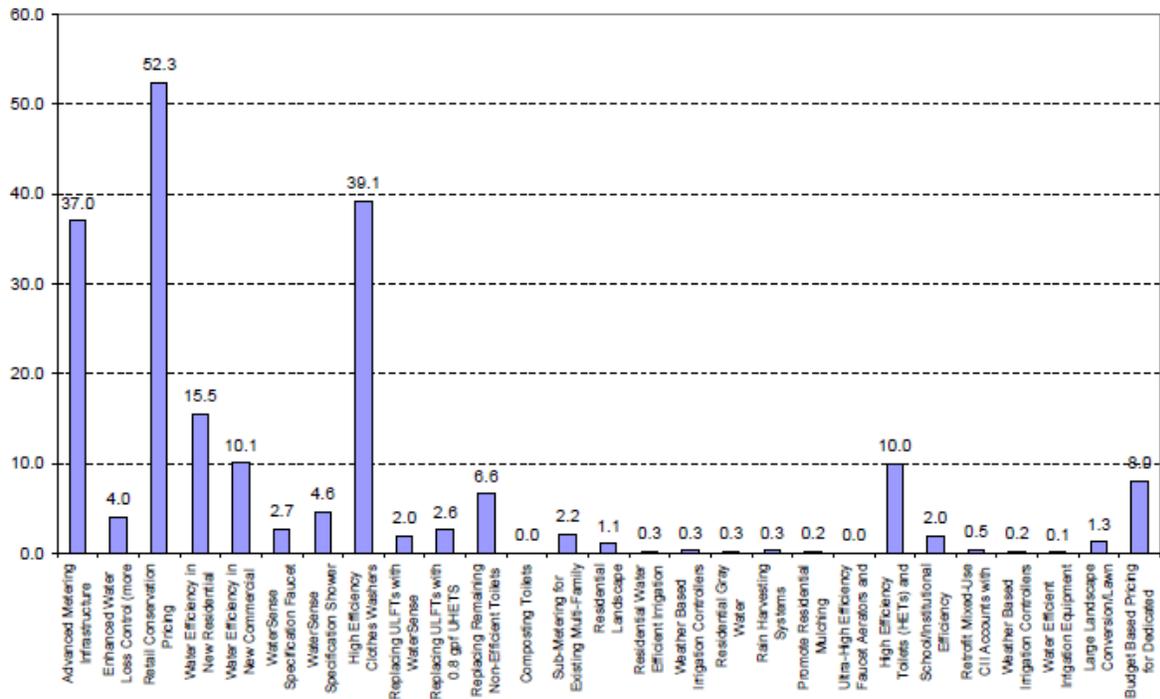
Estimate of Water Savings in 2030 from New or Expanded Programs, by Category (million gallons per year)



Total Water Savings in 2030 = 203 mgy

Figure 4.

Estimate of Water Savings in 2030 from New or Expanded Programs (mg/yr)



The estimated water savings that could be obtained by potential new programs and expansion of existing programs, based on this preliminary analysis, totals approximately 200 million gallons per year. The greatest water savings 128 mgy or 63% of the total is seen to occur from three programs: implementation of Advanced Metering Infrastructure, pricing, and an accelerated high efficient clothes washer program. This estimate, however, should be considered highly provisional for the following reasons:

- The above aggregate total represents an optimistic estimate of savings because it assumes all programs (except AMI) are begun at the same time starting in year 2013. From a practical standpoint though, it would be unrealistic to expect this to occur. Instead, programs are normally phased in over a period of time, which would delay or defer the time that they are in effect and therefore lessen the potential water savings in 2030.
- Many variables are involved in estimating conservation program effectiveness. Until a program is implemented and evaluated, it isn't possible to know with any precision the level of customer interest and participation or actual impact in consumptive water use. Even with careful analysis afterwards, it can be difficult to determine actual effects. The above estimates rely on best professional judgment, informed by literature results and the experiences of other water suppliers.

Summary

Table 3 below summarizes the findings of this preliminary analysis, and the potential adjustment to future water demand that could be expected.

Table 3. Total Water Savings from Both Ongoing and Potential New Programs (million gallons/yr)

	2015	2020	2025	2030
Water Savings from Ongoing Programs	45	89	109	122
Water Savings from Potential New Programs	52	137	169	203
Total Water Savings	97	226	278	325
Water Demand Forecast, Scenario 2 (mgy) (a)	3,684	3,847	3,946	4,046
Water Demand Forecast Adjusted for Water Savings from Ongoing Programs (b)	3,639	3,758	3,837	3,924
Water Demand Forecast Adjusted for Ongoing Programs and Potential New Programs (b)	3,587	3,621	3,668	3,721

Notes

(a) City of Santa Cruz 2010 Urban Water Management Plan

(b) No adjustment for miscellaneous water uses and losses

As shown above, this preliminary analysis suggests that overall water demand could be reduced in 2030 from the forecasted 4.0 billion gallons per year (bgy) to about 3.9 bgy, when adjusted for water savings from ongoing programs, or to about 3.7 bgy, when adjusted for water savings for both ongoing programs and potential new programs. Given real world experience with existing programs, there is confidence in incorporating the water savings from ongoing programs into the City's water demand forecast. However, considering the numerous uncertainties inherent in pro-

jecting water savings for potential new programs, and the likelihood that not all the water savings listed above under new programs would be realized at the exact time or in the exact amounts as indicated in Table 3, it is suggested that an intermediate value of 3.8 billion gallons per year in 2030 be used for planning purposes going forward until the time when the updated Water Conservation Master Plan is complete and a more formal adjustment to the City's water demand forecast can be made.

Appendix A. Review of Public and Suggestions Related to Water Conservation

Ideas and suggestions concerning additional water conservation – proposed as alternatives to the desalination project - were submitted by the public during the Notice of Preparation period and during the development of the City’s Urban Water Management Plan.

All suggestions received were reviewed and grouped into certain categories. A number of these ideas will be carried forward for analysis; others will not for reasons stated below.

Suggestions that will be considered and carried forward for analysis:

- Smart irrigation controllers
- Replace public lawns with drought tolerant plants
- Install drip irrigation systems
- Promote mulching
- Include incentives and technical assistance for gray-water systems/fund residential laundry gray-water systems/provide a significant cost-share or subsidy to fund residential laundry gray-water systems
- Require cisterns for all new construction
- Include incentives and technical assistance for rainwater and storm water catchment
- Promote composting toilets
- Review water rates for landscaping, agriculture and golf courses
- Provide significant cost-share for removing non-functional turf and retrofitting spray irrigation systems to low-volume systems at MF and commercial facilities
- Annually update the standards for all low-flow retrofits to adjust standards to current lowest-flow standard available
- Commission a new study of incentive-based rates. Evaluate incentive pricing for non-residential customers.

Suggestions that will not be carried forward for analysis, for reasons indicated:

Ideas are already being implemented by Water Department (or other responsible Department)

- Perform water audits and customize plans to reduce landscape irrigation
- Include incentives/rebates and technical assistance for turf replacement with drought-tolerant plants
- Require mulching in new development
- Work to change regulations to allow greater use of gray water
- Use bio-swales to capture rainwater in new development
- Include incentives for water-saving washing machines
- Incentivize landlords to implement water-conserving devices and fixtures
- Replace toilets with low-flow toilets
- Reduce the standard low flush toilet from 1.6 gallons to 1.28 gallons
- Require all new housing be constructed per green building codes

- Require green building practices
- Pricing policies and/or rates to discourage outdoor use and encourage conservation
- Ensure that businesses and hospitality industry are conserving
- Conservation measures need to be implemented and enforced on commercial and multi-family properties
- Provide manual shower shut-off valves
- Put more effort into promoting high-efficiency clothes washer rebate program
- Other rebate programs in place: If less than 90% saturated, these programs should continue and more resources directed to them
- Expand and promote water use audits
- Evaluate the savings of each conservation measure. Use WaterTrack software for tracking savings.

Suggestions are applicable more for short-term use curtailment than to long-term water conservation.

- These (drought curtailment and restrictions) should be made permanent to reduce water consumption on an on-going basis
- Implement a gallon-per-day limit
- Increase curtailment efforts
- Eliminate lawns
- Increase rates for blocks 3-5 as a disincentive for inefficient irrigation systems and water waste
- Enforce water waste ordinance by hiring a code enforcement officer

Water savings are not quantifiable.

- Increase public education about conservation
- Campaign for a Water Use Commitment

Not applicable, or will be considered as alternative water supply

- Install purple pipes so that recycled water can be used for irrigation
- Harvest water above Soquel Creek instead of having it erode the watershed
- Capture rainwater and runoff to replenish aquifer (use syphon action, water towers, ram pumps, etc.)
- Develop fog-capturing technology to capture additional water
- Use treated gray water on golf-courses, sports fields, cemeteries, and large lawns ()

Insurmountable practical, legal, or other obstacles

- Require farmers grow low water use crops
- Use gray water for commercial buildings, institutions, and schools
- Include rainwater harvesting with potential capacity of 510 mg/yr
- Use rainwater for toilet uses in residential
- Mandate water-collection containers for all customers

- New ordinance to require new construction to collect all rainwater
- Raise water rates with subsidies for those with limited income
- Meter and charge for all water being drawn from aquifers
- Apply the water use efficiency provisions of the updated California Water Efficiency Landscape Ordinance to all existing MF residential and commercial properties with dedicated irrigation accounts (e.g., employ metering, mandatory drip systems in new development, and price-incentivized water budgets)
- Develop low cost and streamlined permit process for stormwater reuse for toilet flushing and irrigation systems
- Expand Retrofit Upon Sale Ordinance provisions to rental units upon vacancy, offering free installation of water-efficient fixtures to be paid for by proposed water demand offset program (see water-neutral development)
- Offer low interest loans for water efficiency improvement projects

Better measure is available to achieve water savings

- Offer free dual flush converter kits
- Replace toilets with gray-water flushing toilets