1.4. High-Efficiency Clothes Washer (HEW). (BMP 6)

High-efficiency washing machines are designed to save both energy and water. The San Diego County Water Authority reports that these machines 65% less water and 55% less energy per load than standard machines. The SDCWA offers $175 rebates.[91] They may or may not be front-loading. The difference in cost between low- and high-efficiency washing machines is estimated to be between $400 and $1,000. Savings are estimated at 85-109 gallons per week per machine, 14.4 to 28.7 gpd/machine SFR and 53.8 to 107.7 gpd/machine MFR.[92]

The Oak Ridge National Laboratory did a field study of high-efficiency washers for the U.S. Department of Energy, and found there was a 37.8% combined savings of water and energy use and impact on wastewater system. Rebates from the agencies involved in the study ran between $25 and $150, although it is noted that the agency offering the $25 rebate had requested more funding to raise the amount of the rebate, to make it more attractive to customers. The Consortium for Energy Efficiency (CEE) started a high-efficiency washing machine rebate program. The CCE reported an average savings of 13 gallons per load. The CEE estimated the savings potential from high-efficiency washers to be up to 59%, or about 9,000 gallons annually. A Tampa Water Department study found a 46.8% decrease in water use in washing machines. The Seattle Home Water Conservation Study found 37.7% water savings for high-efficiency washers.[93]

The Santa Cruz Water Conservation Office reports that newer front-loading machines use 20 to 25 gallons per load (a savings of at least 15 gallons per load). A typical family of four does 400 loads of wash each year. A household of four, doing seven loads of laundry a week, can save 5000 gallons or more each year. Santa Cruz offer $100 rebates.[94]

The California Urban Water Council reports that, for both residential and commercial machines, resource-efficient clothes washers use 35%-50% less water and approximately 50% less energy. They offer a $150 rebate for residential washers, and $400 for commercial washers.[95]

The Los Angeles Metropolitan Water District is offering up to $340 per high-efficiency commercial machine purchased.[96] Puget Sound Energy offers $200 for commercial HEWs.[97] The Contra Costa Water District offers up to $200 per commercial HEW to commercial customers.[98]

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[91] *High-Efficiency Clothes Washer Voucher Incentive Program.* San Diego County Water Authority. http://www.sdcwa.org/manage/conservation-hew.phtml.

[92] A&N Technical Services, Inc. *BMP Costs and Savings Study: A Guide to Data and Methods for Cost-Effectiveness Analysis of Urban Water Conservation Best Management Practices.* March 2005. The California Urban Water Conservation Council.

[93] A&N Technical Services, Inc. *BMP Costs and Savings Study: A Guide to Data and Methods for Cost-Effectiveness Analysis of Urban Water Conservation Best Management Practices.* March 2005. The California Urban Water Conservation Council..

[94] *High-Efficiency Clothes Washer Rebate Program.* Santa Cruz City Water Conservation Office. http://www.ci.santa-cruz.ca.us/wt/wtcon/clotheswasher.html

[95] *Product News: Welcome to the Smart Rebates Program!_* Council on Urban Water Council. http://www.cuwcc.org/smartrebates/smartrebates_fixtures.lasso#Residential.

[96] *Save Water, Save a Buck: High-Efficiency Clothes Washers.* L.A. Metropolitan Water District. http://www.mwdsaveabuck.com/laundry.htm

[97] *Energy Efficiency Rebate Programs.* Puget Sound Energy. http://www.pse.com/solutions/rebateComWasher.aspx.

[98] *Water Conservation: Rebates.* Contra Costa Water District. http://www.ccwater.com/conserve/rebates.asp

COST-BENEFIT ANALYSIS, RESIDENTIAL: (Table 19)

Savings in AF over 20 years:	127.70
Average AF/Y savings:	6.721
Total net savings in $$$ over 20 years:	$331,730.25
Average net $$$/year savings:	$ 16,586.51
Years until costs are paid off:	Approx.2.5
% Water savings, all meters:	3.45%
Savings:Cost ratio:	9.2:1

RECOMMENDATIONS: It is recommended that the District undertake this measure for the SFR category, with a 10% MP of the SFR of customers. The rewards per investment are encouraging and, if follow-up analysis of the program warrants it, it would be recommended that the program be expanded in future years until saturation becomes evident.

The commercial laundromat in town has recently upgraded its washers to HEW models. Therefore, no incentive program for the commercial sector is needed at this time.

Table 19: *PROJECTED COSTS* AND SAVINGS OF HIGH-EFFIENCY CLOTHES WASHER PROGRAM WITH A 10% MARKET PENETRATION, SINGLE-FAMILY RESIDENCE CATEGORY, OVER 20 YEARS (SAVINGS: 6000 GALLONS/HOUSEHOLD/YEAR)

Year	#SFR Meter	(SFR) Meters w/ 10% MP	Estimd. Popul. w/10% MP	SFR AFY Required w/o Measure	Saved: SFR AFY/All Meters (6000 Gal/ Meter/Yr)	Cost of Water/AF w/3% inflat.	$$Savings/ Year (w/ 3% infl/yr)	Rebate ($100 ea)	5% Share of Shared Program Costs	Office Admn Costs (10% of Prg.Costs	Total Costs	NET SAVINGS (Total Savings minus Total Costs)	Years to Pay Off Original Invest. (Rebates, Costs)
2008	3647	365	1,256	214.255	6.72	$2,060.00	$13,844.98	$36,500.00	$3,445	$344.50	$40,289.50	**-$26,444.52**	~2.5
2009				221.154	6.72	$2,121.80	$14,260.33	$0.00	$0.00	$0.00	$0.00	**$14,260.33**	
2010				228.275	6.72	$2,185.45	$14,688.14	$0.00	$0.00	$0.00	$0.00	**$14,688.14**	
2011				235.626	6.72	$2,251.02	$15,128.78	$0.00	$0.00	$0.00	$0.00	**$15,128.78**	
2012				243.213	6.72	$2,318.55	$15,582.64	$0.00	$0.00	$0.00	$0.00	**$15,582.64**	
2013				251.044	6.72	$2,388.10	$16,050.12	$0.00	$0.00	$0.00	$0.00	**$16,050.12**	
2014				259.128	6.72	$2,459.75	$16,531.63	$0.00	$0.00	$0.00	$0.00	**$16,531.63**	
2015				267.472	6.72	$2,533.54	$17,027.58	$0.00	$0.00	$0.00	$0.00	**$17,027.58**	
2016				276.084	6.72	$2,609.55	$17,538.40	$0.00	$0.00	$0.00	$0.00	**$17,538.40**	
2017				284.974	6.72	$2,687.83	$18,064.56	$0.00	$0.00	$0.00	$0.00	**$18,064.56**	
2018				294.150	6.72	$2,768.47	$18,606.49	$0.00	$0.00	$0.00	$0.00	**$18,606.49**	
2019				303.622	6.72	$2,851.52	$19,164.69	$0.00	$0.00	$0.00	$0.00	**$19,164.69**	
2020				313.399	6.72	$2,937.07	$19,739.63	$0.00	$0.00	$0.00	$0.00	**$19,739.63**	
2021				323.490	6.72	$3,025.18	$20,331.82	$0.00	$0.00	$0.00	$0.00	**$20,331.82**	
2022				333.907	6.72	$3,115.93	$20,941.77	$0.00	$0.00	$0.00	$0.00	**$20,941.77**	
2023				344.658	6.72	$3,209.41	$21,570.02	$0.00	$0.00	$0.00	$0.00	**$21,570.02**	
2024				355.756	6.72	$3,305.70	$22,217.13	$0.00	$0.00	$0.00	$0.00	**$22,217.13**	
2025				367.212	6.72	$3,404.87	$22,883.64	$0.00	$0.00	$0.00	$0.00	**$22,883.64**	
2026				379.036	6.72	$3,507.01	$23,570.15	$0.00	$0.00	$0.00	$0.00	**$23,570.15**	
2027				391.241	6.72	$3,612.22	$24,277.25	$0.00	$0.00	$0.00	$0.00	**$24,277.25**	
			TOTAL:	**5,887.696**	**127.70**	**n/a**	**$372,019.75**	**$36,500.00**	**$3,445.00**	**$344.50**	**$40,289.50**	**$331,730.25**	
			AVERAGE:	**294.385**	**6.721**	**n/a**	**$18,600.99**	**$1,825.00**	**$172.25**	**$17.23**	**$2,014.48**	**$16,586.51**	

GENERAL BENEFITS AND COSTS OF LANDSCAPE WATER CONSERVATION

BENEFITS:

- Reduced peak water demand.
- Reduced groundwater overdraft and contamination.
- Reduced water costs.
- Improved long-term water utility revenue stability and less frequent rate adjustments.
- Smaller water-supply and wastewater facilities.
- Reduced runoff, soil erosion, and costs for stormwater management.
- Creation of distinctive, attractive properties.
- Reduced use of chemicals (fertilizers, pesticides, and herbicides).
- Reduced energy costs for landscape maintenance (electric and gasoline mowers, blowers and edgers).
- Reduced air pollution and noise from gasoline-powered mowers and landscape equipment.
- Extended life for lawn-mowing equipment and irrigation systems.
- Reduced labor costs for mowing and landscape maintenance.
- Increased native plant diversity.
- Preservation of wildlife habitat and instream flows.
- Reduced plant disease, rot, and mortality caused by overwatering.
- Reduced need for construction and operation of alternative supply systems.

COSTS:

- Resistance to changing outdoor water-use habits, despite long-term benefits.
- Increased time and care for maintenance during the transition from a conventional to a water-efficient landscape.
- Difficulty in accepting the look of low-water-use and native plants compared with water-intensive turf and exotic imported plants.
- Potential reductions in business among conventional green industry product and service providers who do not offer water-wise and natural landscaping services.
- Potential short-term water utility revenue instability and more frequent rate adjustments during the years when outdoor demand drops as a result of conservation.[99]

2. HARDWARE RETROFITS AND REBATES FOR LANDSCAPE

- **2.1. Smart irrigation controller provision or rebate**
- **2.2. Rebates for conversion from turf to drought-tolerant plantings**
- **2.3. Provision of landscape irrigation efficiency items**

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2. **HARDWARE RETROFITS AND REBATES FOR THE LANDSCAPE.** (Possibly BMP 5) The difference between the amount of water used in the peak (summer) and trough (winter) billing periods is considered "seasonal water use." This is also typically considered to be the amount of water used on the customer's landscape. The water used in the winter/trough months is considered to be indoor water use (irrigation usually does not take place, or is greatly

[99] Vickers, Amy. *Handbook of Water Use and Conservation.* Amherst, MA: Water Plow Press. 2001.

decreased, during cold, rainy months). The water used during the peak (warmer summer) months are considered to have a portion attributable to landscape irrigation. There is more potential for water savings in the outdoor/landscape portion of a customer's water use than there is in the indoor portion of their use. [100]

There is an increase in summer water use for all District customer categories. The average District customer's seasonal water use is 69.15% of their entire annual water use. The two categories that are candidates for water conservation in the landscape are the SFR and Landscape categories. The SFR category has an average of 62.18% seasonal water use, and the Landscape category has an average of 48.26% seasonal water use. (Table 5).

If the District's customers were able to save 15% of their seasonal water use alone the savings would be significant (Tables 8, 9). Based on the year 2006, one year's savings for SFR would be 187.508 AF ($375,06.84), Landscape 21.599 AF ($24,326.49), and for all categories 245,427 AF ($490,853.25) (Table 8,9).

Projected out 20 years, with the year 2006 as the baseline, 3.22% annual growth in number of meters (average for the years 2001-2006), and 3% increase in water price (with the marginal water price baseline of $2000), the total savings would be 7176.141 AF ($83,885,673.82).

2.1. Irrigation "Smart" Irrigation Controller Provision or Rebate.

(Related to BMP 1, 2)

Poor irrigation scheduling (watering too often and for too long) is the primary source of water waste associated with landscape irrigation[101].

According to the California Department of Water Resources, most water audits of residential landscapes find a distribution uniformity of 50% or less (recommended uniformity is >70%).[102]

"Smart" Irrigation Controllers are designed to make adjustments to the system programming to match the demands of the climate. After the initial setup and programming, the controllers get their programming-adjustment cues from a variety of sources: CIMIS weather stations, satellites, or other data-broadcasting systems. The better ones are quite sophisticated in variations of the programming. The majority of the programming is set up upon installation (or changed during the recommended maintenance checks), and the broadcast climate information adjusts the frequency and amount of water applied.

There are large water savings that can be achieved by the proper installation and programming of a "smart" controller, either as an initial irrigation controller installation or a replacement of an existing "non-smart" controller. All irrigation systems will fail to produce maximum savings if the "set it and forget it" approach is taken. To be dependably efficient in using water, irrigation systems must be regularly checked (at least once a year) for distribution uniformity, and must receive programming changes to meet the landscape's needs as climatary changes occur and as the needs of the plants change. For old-style, non-satellite-programmed systems, it is up to the homeowner or landscaper to make these frequent changes. For "Smart" controllers, the programming changes are delivered automatically by satellite or other data feed.

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[100] A&N Technical Services, Inc. *BMP Costs and Savings Study: A Guide to Data and Methods for Cost-Effectiveness Analysis of Urban Water Conservation Best Management Practices*, March 2005. The California Urban Water Conservation Council.

[101] Vickers, Amy. *Handbook of Water Use and Conservation.* Amherst, MA: Water Plow Press. 2001.

[102] Vickers, Amy. *Handbook of Water Use and Conservation.* Amherst, MA: Water Plow Press. 2001.

The vast majority of lawns are overwatered. Overwatering can cause an increase in disease and pests, and damp blades of grass can provide a habitat for mosquito larvae. Overwatering can also result in increased water bills, degradation of asphalt in streets and parking lots, and damage to fences and other hardscapes.

The increase in the presence of diseases and pests can lead to applications of pesticides and herbicides, and any portion of landscape irrigation that flows down the sidewalk, into the gutters, and into storm drains will carry the chemicals applied to the landscape.

The amount of lawn chemicals applied to residential properties is significant: homeowners apply nearly 10 times more pesticide per acre of turf than farmers use on crops.[103] Turf grass planted on residential, commercial and government properties covers an estimated 30 million to 50 million acres in the United States, an area larger than Pennsylvania and greater than the acreage used to grow any single U.S. agricultural crop. An estimated 600million gallons of gasoline are used annually for lawn mowing equipment in the U.S.[104]

The issue of overwatering is not just pertinent to excessive water use and higher costs to both the water supplier and the customer, but is an important factor in stormwater management. The County of San Luis Obispo is about to adopt a new ordinance by which it will be illegal to cause anything but clean rainwater to enter a storm drain. An overwatered lawn and landscape has a higher potential of causing water to leave the intended landscape and flow down the gutter to the nearest storm drain. With this landscape water is carried the residuals of fertilizers, pesticides, herbicides and other chemicals applied to the lawn and landscape.[105]

Contrary to what many homeowners believe, watering a lawn "deeply" does nothing for the lawn. Most turf grasses have fibrous roots about 4" in depth, so any irrigation beyond a 4" depth does nothing for the lawn. It increases the water bill, however. For lawns that are watered by hose and sprinkler, to optimally water a lawn the irrigator would have to water the lawn two or three times a week, moving the sprinkler every 5 to 15 minutes, to achieve very basic uniformity and saturation. Optimal, efficient irrigation of lawn needs to be done far more frequently and in lower volumes than is required by trees, shrubs, and drought-tolerant plant material.

To reach the level of accuracy of a "smart" controller, the irrigator would have to first, before each irrigation, access CIMIS or other climate-data resource, download the latest data, and then do calculations to determine how much water the turf (or other plant material) had lost since the last irrigation, then, using the rate of water application from the garden hose and sprinkler and the crop coefficient for each type of plants to be watered, ascertain how long the sprinkler had to run on each section before moving it.

If the lawn or other plant material is growing in soil with a high amount of clay (especially if any landscape slope is involved), for optimum, efficient irrigation, each application should be split into smaller increments to allow adequate time for the water applied to soak into the soil.

For the older-model automatic irrigation systems, where seasonal changes in irrigation timing and frequency must be set by hand, and where the "set it and forget it" approach is often used, turf is often overwatered. Few homeowners or landscapers perform periodic water audits for

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[103] Vickers, Amy. *Handbook of Water Use and Conservation.* Amherst, MA: Water Plow Press, 2001.
[104] Vickers, Amy. *Handbook of Water Use and Conservation.* Amherst, MA: Water Plow Press, 2001.
[105] *An Ordinance Amending Title 8 of the San Luis Obispo County Code to add Chapter 8.68 regarding Stormwater Pollution Prevention and Discharge Control.* IDDE Ordinance Public Hearing Draft, 08/21/2007.

uniformity of the coverage of the irrigation system, nor do they, as recommended, check and change programming, if warranted, on a monthly basis. They discover there is a problem with uniformity usually when an area of the turf turns brown. Many homeowners or landscapers would not, at this point, do a water audit to assess for uniformity and amount being delivered to the turf. Instead, they would turn up the irrigation system amount for that station (or, worse yet, for ALL stations). If the brown spot in the turf didn't turn green, they might even try turning up the system some more. If the brown spot was due to insufficient irrigation, eventually the system would be turned up for all sprinklers in that station enough that the station with the brown spot would turn green. Once again, the entire lawn would be green, but all of the turf except for the previous brown spot would be overwatered.

The economic and environmental costs associated with a heavily irrigated, manicured green lawn are especially high. The U.S. Environmental Protection Agency has estimated that about 70 million pounds of lawn chemicals are applied in the U.S. annually, and this amount increases by 5% to 8% every year.[106]

There have been many studies of water savings with "smart" controllers. The savings can be very high, and this incentive stimulates cities, universities, government agencies, and "smart" irrigator companies to do lots of studies.

Over the years, these studies have demonstrated that, while there are very gratifying savings to be obtained from Smart irrigation systems, a program which is not well constructed—even if the controllers are handed out for free—will not get very impressive results.

The City of SLO believes that advancements in irrigation technology appear to a major source of water savings.[107]

Simple measures such as installing a rain sensor, which shuts off the irrigation system when it rains, can, for irrigation systems that continue to irrigate even when it is raining, save 16% of water used for landscape irrigation, and cost around $25.[108] More sophisticated weather-sensing systems save considerably more, have more potential to save water, but also require maintenance to obtain and retain savings[109,110,111]

Smart controllers, or ET (evapotranspiration) controllers, adjust irrigation systems' scheduling and run times by real-time measures of evapotranspiration and/or temperature, rainfall, soil moisture, and sunlight intensity. These systems access information by a satellite pager and/or telephone lines.[112]

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[106] Vickers, Amy. *Handbook of Water Use and Conservation.* Amherst, MA: Water Plow Press. 2001.
[107] Henderson, Gary, Munds, R. *City of San Luis Obispo 2006 Water Resources Status Report, June 2006.*
[108] *Rain Sensor Devices.* WAV, Providing and Preserving Water. (www.wavh20.com)
[109] Irrigation controllers: timers for the homeowner. July 2003. US Environmental Protection Agency et al. http://www.epa.gov/owm/water-efficiency/index.htm.
[110] Hunt, T.; Lessick, D. et al. *Residential weather-based irrigation scheduling evidence from the Irvine "ET Controller" study. Irvine Ranch Water District.* June 2001. (http://www.irwd.com/welcome/FinalETRpt.pdf)
[111] Bamezai. *A. Los Angeles Dept. of Water and Power weather-based irrigation controller pilot study.* August 2004. LADWP. (http://www.cuwcc.org/uploads/product/LADWP-IrrigationController-Pilot-Study.pdf).
[112] A&N Technical Services, Inc. BMP Costs and Savings Study: A Guide to Data and Methods for Cost-Effectiveness Analysis of Urban Water Conservation Best Management Practices. March 2005. The California Urban Water Conservation Council.

According to the Municipal Water District of Orange County, switching to a "smart" irrigation controller can save 20% to 25% of water use and customer water bills, and reduces urban runoff of up to 50%. The Metropolitan Water District of Orange County offers rebates of $60 per active valve (maximum rebate of $540), not to exceed the cost of the "smart" controller.[113]

The City of Newport Beach, to address both water conservation and storm runoff problems, has initiated a program in which free water audits and installation of WeatherTrak Smart controllers, as well as the monthly $4 data-broadcast charge, are provided to residents primarily in the south-coast area of the city. The installation and water audits are funded by the City and performed by a trained landscaper.[114] The homeowner is responsible for correcting any problems identified in the water audit before the WeatherTrak is installed.

The Irvine Ranch Water District and the Metropolitan Water District of Orange County did a seven-year study of "smart" (ET) controllers and the impact on the change in metered water consumption and reduction in measured urban runoff. The four foci of the study were to investigate ET controllers used both in residential landscapes and large landscape areas; to evaluate the effectiveness of an educational program targeting residential homeowners; to study the relationship between proper irrigation of landscapes and dry-season runoff; and to assess the acceptance level of controller-technology-based water management. They found that for accounts using ET controllers water use was decreased an average of 41 gallons per day per SFR (approximately 10% of total household water use). The majority of the savings were found in the summer and fall periods. Fifteen large landscape sites with dedicated irrigation meters (0.14 to 1.92 acres) showed an average water reduction of 545 G/D. Regarding runoff, comparing the control group to the group having undergone controller retrofit, there was a 71% reduction in dry-season runoff. Regarding acceptance of the ET controllers, 72% of the participants reported they liked the controllers, and 70% ranked their landscape as looking good to excellent.[115]

The IRWD conducted the "ET Controller Study" which tested a controller system that automatically adjusted according to the weather, using a broadcast signal. In addition to the group that received the ET controllers, there was a control group and a group that received postcards with ET information but no automatic controller adjustments. The group with the automated ET controllers saved an average of 37 gallons per household per day.[116]

Aqua Conserve in a study published in 2002 reported that ET controllers adjusted with historical data and temperature sensors conserved water for high-volume residential customers in California and Colorado. The study was based on post-intervention consumption related to five years' historical consumption, and the study included a control group. In Denver, total outdoor water saved was 21%, with an average savings per participant of 21.47%. In Sonoma, California the total savings were 23%, and an average savings per participant of 7.37 %. Valley

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[113] Municipal Water District of Orange County, *Smart Timer Rebate Program*. www.mwdoc.com.
[114] Brennan, Pat. *Newport Rolls out Robot Sprinklers*. The Orange County Register, 12/05/2006.
[115] A&N Technical Services, Inc. BMP Costs and Savings Study: A Guide to Data and Methods for Cost-Effectiveness Analysis of Urban Water Conservation Best Management Practices, March 2005. The California Urban Water Conservation Council.
[116] A&N Technical Services, Inc. BMP Costs and Savings Study: A Guide to Data and Methods for Cost-Effectiveness Analysis of Urban Water Conservation Best Management Practices, March 2005. The California Urban Water Conservation Council.

of the Moon Water District showed a total savings of 28% and an average savings per participant of 25.1%.[117]

A study in 2003 by Aquacraft of WeatherTRAK controller installations in Colorado indicated that the 10 sites in their study (combination of volunteer and high-volume sites, all residential except for one commercial) averaged savings of 26,000 gallons per year per site. The five largest-saving sites' savings were 68,000 gallons per site. For the group, the controller water-application was 94% of ETo (28 inches of water).[118]

Bamezai in 1996 reported in a study for the Los Angeles Department of Water and Power an average savings of 34% (with controls for climate and landscape size) for multiple sites connected to a central ET controller that controlled irrigation based on ET for each meter. Interestingly, most of the savings were achieved for diverse plant materials on sloped landscape areas.

Limitations include proper maintenance and operation which is necessary to receive the full benefits from ET controllers. In some cases outdoor water consumption was estimated because the sites did not have separate landscape meters. High-use customers and volunteers were more frequently targeted. This group tended to achieve large absolute savings figures (but not necessarily larger percentage of savings), and they tend to be more receptive to conservation than the average customer. The cost of equipment may be related to the number of purchases and installations. The extent of the tailoring of the program design for each site is important, as are the different levels of outreach and support over time. Another factor is the accuracy of the local CIMIS station in reflecting the microclimate of the irrigation site. The Nipomo Mesa has a CIMIS station located in the Woodlands.

Program costs can (if purveyor shares the costs) include for the purchase, installation, operation and maintenance. In addition, costs can include administration, contractors and marketing costs.

According to the IRWD study of 2001, ET controllers cost approximately $100 per unit to buy, and $75 to install. There is a monthly signal fee of $5. The expected life is 10 to 15 years.

The 2003 Aquacraft study of WeatherTRAK Smart controller installations indicated that it took between 2.25 and 4 hours per site to install the ET controllers, and some sites included moisture sensors.

Another study reported regarding controllers with soil moisture sensors total costs "for repairs and replacements" were $270. Average annual repairs and replacement was approximately $12 per controller.[119]

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[117] A&N Technical Services, Inc. BMP Costs and Savings Study: A Guide to Data and Methods for Cost-Effectiveness Analysis of Urban Water Conservation Best Management Practices. March 2005. The California Urban Water Conservation Council.

[118] A&N Technical Services, Inc. BMP Costs and Savings Study: A Guide to Data and Methods for Cost-Effectiveness Analysis of Urban Water Conservation Best Management Practices. March 2005. The California Urban Water Conservation Council.

[119] A&N Technical Services, Inc. BMP Costs and Savings Study: A Guide to Data and Methods for Cost-Effectiveness Analysis of Urban Water Conservation Best Management Practices. March 2005. The California Urban Water Conservation Council.

Table 20: ANALYSIS OF SMART CONTROLLERS FOR IRRIGATION ADEQUACY AND EXCESS (Center for Irrigation Technology)[120]						
	Irrigation Adequacy			Irrigation Excess		
Controller	Min. of 6 Test Zones	Max. of 6 Test Zones	Mean/Average Of 6 Test Zones	Min. of 6 Test Zones	Max. of 6 Test Zones	Mean/Average of 6 Test Zones
AlexTronic Enercon Plus	100%	100%	100%	0%	3.6%	1%
Alex-Tronix Smart Clock	100%	100%	100%	0%	1.1%	0.2%
Calsense ET2000e-24-GR-RB with RB-1 Tipping Rain Bucket	100%	100%	100%	0%	0%	0%
ETwater Smart Controller	100%	100%	100%	0%	6.3%	1.5%
Hunter ET System with Pro-C 300 Controller	100%	100%	100%	0%	2.3%	0.5%
Irritol Smart Dial*	100%	100%	100%	0%	0%	0%
Rain Bird ET Manager with ESP-TM Controller	100%	100%	100%	0%	0%	0%
Toro IntelliSense*	100%	100%	100%	0%	0%	0%
Weathermatic SL1600	100%	100%	100%	0%	2.3%	0.4%
WeatherTrak	100%	100%	100%	0%	0%	0%

*Uses WeatherTrak ET Everywhere ET/rainfall data and WeatherTrak Secheduling Engine to provide custome schedule.
WeatherTRAK ET Everywhere delivers daily ET updates via a wireless network for self-adjusting irrigation scheduling based on changing weather; collects data from more than 14,000 weather stations across the U.S. including the NOAA network, state and local networks, and private weather stations.
Applies scientific modeling techniques to validate local weather to 1 km^2.
WeatherTRAK Scheduling Engine calculates irrigation schedules based on zone-specific, Irrigation Association recommended parameters including plant, soil, slope and sprinkler type; supports user-defined water windows, water days, and manual watering; built-in and customizable plant settings; automated cycle and soak times according to soil and slope settings.

[120] *Smart Controller Efficiency Testing.* Irrigation Assocation. http://www.irrigation.org/SWAT/Industry/ia-tested.asp.

Table 21: ANALYSIS OF SMART CONTROLLERS FOR STANDARD FEATURES (Center for Irrigation Technology)						
Controller	**Installation**	**Data Source**	**Data Link**	**Initial Purchase**	**Add'l Hardware**	**Additional Fees**
Alex-Tronix Enercon Plus	Replaces existing controller or is installed on a new system.	Tested with on-site temp. sensor w/optional rain sensor.	Hardwired	Purchase price includes temp. sensor mounted within pedestal.	*Rain mount. *Rain and temp sensors pole-mount. *Latching solenoid. *Lightning protection.	None.
Alex-Tronix Smart Clock	Replaces existing controller or is installed on a new system.	Tested with on-site temp. sensor w/optional rain sensor.	Hardwired	Purchase price includes temp. sensor.	*Rain switch pole mount. *Rain and temp. sensors pole mount. *Latching solenoid. *Stainless stell pedestal mount.	None.
Calsense ET2000e-24-GR-RB with RB-1 Tipping Rain Bucket	Replaces existing controller or is installed on a new system.	SWAT tested w/wireless internet link to CIMIS weather station #80.	Wireless network (optional hardwire, phone, radio, Ethernet, WiFi)	Purchase price based on # of zones and other options.	*Optional RB-1 tipping rain bucket. *Optional on-site ET gauge. *Optional wind gauge.	Additional charges dependent upon selected communication option.
ETwater Smart Controller	Replaces existing controller or is installed on a new system.	Local weather station through ETwater server.	*Model 100: Residential-Internet via landline phone (add'l charge for wireless cell phone option) *Model 200: Commercial-Interent via landline or wireless cell phone	*Purchase price is based on # zones initially activated. *Additional zones may be activated at a later time at an additional cost.	Residential: One-time optional hardwere purchase allows phone connection through household electrical wiring rather than direct-wired phone.	*First year of internet-based scheduling is free. *3-year subscription or discounted lifetime service purchase options are available thereafter.

Hunter ET System with Pro-C 300 Controller	Retrofit to Hunter SmartPort enabled controllers.	ET system onsiet sensor suite.	Direct low-voltage wiring into Hunter SmartPort	ET System must be purchased separately from compatible Hunter controller model: SRC, Pro-C, ICC.	ET WIND is an optional anemometer for measuring wind speed.	None.
Irritol Smart Dial*	May replace existing controller or be installed on a new system.	Contractor or end-suer calls to activate WeatherTRAK ET Everywhere.	Wireless network	Purchase price is based on #of zones. Wireless receiver is integral.	Optional wired or wireless rain sensor and wireless rain/freeze sensor.	Annual subscription signal fee. Multi-year package prices available.
Rain Bird ET Manager with ESP-TM Controller	Retrofits with an existing controller or installs on a new system.	Weather Reach Signal Provider accesses a weather station and sends local weather information hourly to the ET Manager.	Wireless paging.	ET Manager wireless receiver is integral.	*Optional tipping bucket rain guage. *Optional external antenna. *Outdoor enclosures.	Varies depending on Weatehr Reach Signal Provider.
Toro IntelliSense*	May replace existing controller or be installed on a new system.	Contractor or end-user calls to activate WeatherTRAK ET Everywhere	Wireless network	Purchase price is based on # of zones. Wireles receiver is integral.	Optional wired or wireless rain sensor and wireless rain/freeze sensor.	Annual subscription signal fee; multi-year package prices available.
Weathermatic SL1600	Replaces existing controller or is installed on a new system	Weathermatic on-site weather monitor.	Direct low-voltage wire or wireless.	Purchase price is based on #of zones. Weather monitor is an add'l cost.	None required	None.
WeatherTrak	May replace existing controller or be installed on a new system.	Contractor or end-user calls to activate WeatherTRAK ET Everywhere.	Wireless network	Purchase price is based on # of zones. Wierless receiver is integral.	Optional wireless rain or rain/wind/ freeze/flow sensor.	Annual subscription signal fee. Multi-year package prices available.

Table 22: ANALYSIS OF SMART CONTROLLERS FOR ADDITIONAL FEATURES (Center for Irrigation Technology)					
Controller	**Zones**	**Time of Day**	**Day of Week**	**Other**	**If Data Link is Discontinued**
AlexTronic Enercon Plus	Available in a base model of 4 zones; can control up to 24 by installing add'l station modules in groups of 4.	Capable of restricting the time of day for watering.	Capable of restricting watering days by selection or interval.	*Multiple start times. *Programmable rain delay. *5-yr battery life with low battery indication.	May be used as a standard irrigation controller including %adjust and 4 independent programs w/multiple start times.
Alex-Tronix Smart Clock	Available with 6 zones.	Capable of restricting the time of day for watering.	Capable of restricting watering days by selection or interval.	*Multiple start times. *Programmable rain delay. *5-yr battery life with low battery indication.	Smart Clock may be used as a standard irrigation controller including %adjust and 4 independent programs w/multiple start times.
Calsense ET2000e-24-GR-RB with RB-1 Tipping Rain Bucket	Available in 6, 8, 12, 16, 24, 32, 40, 48 zone models	Capable of restricting the time of day for watering.	Capable of restricting watering days by selection or interval.	*Flow monitoring and mngmt. *Optional integrated radio remote. *Cycle and soak. *Shared weather data using personal computer and *Command CENTER software.	Calsense controllers feature a historical ET database that is used in the event communication is interrupted. It may also be used as a standard irrigation controller, including cycle and soak features.
ETwater Smart Controller	Model 100: Residential, 3-12 zones. Model 200: Commercial, 12-48 zones. Both models are activated via the internet.	Capable of restricting the time of day for watering.	Capable of restricting watering days by selection or interval.	*Sets initial watering schedule based on user's landscape profile. *Remote monitoring and mngmt. Via 2-way internet interface. *Unlimited number of programs. *Unlimited cycle and soak start times. *Water budget only when connected to internet-based scheduling. *Max. water time unlimited. *Rain sensor capable.	If the ETwater Smart Controller Internet-based scheduling is discontinued it may be used as a standard irrigation controller with cycle and soak capability.

Hunter ET System with Pro-C 300 Controller	Original Hunter controller may have up to 48 zones, depending on the model.	Separately programmale start times for ET controlled zones. Note: ET System WiltGard will override time of day restrictions.	ET System has day of week, even/odd date, and interval day scheduling (up to 31 days). Note: ET System WiltGard will override day of week restriction.	*WiltGard technology enables it to trigger protective watering when extreme conditions threaten plants. *ET information combines w/each zone's particular plant, soil, sun and sprinkler data. *Easiy upgrades most Hunter controllers to weather-based control with no high-voltage AC wiring required. *Non-volatile memory.	If wiring to on-site ET system sensor is removed, system displays fault message and operates on lawst full 24-hr ET average. Traditional controller schedules may be selected manually if sensor service is required.
Irritol Smart Dial*	SmartDial: 6,9,12 stations. Indoor and Outdoor Mount options.	Capable of restricing the time of day for watering.	Capable of restricting watering days by selection or interval.	*Includes copy button to simplify programming. *Remote internet-based irrigation mngmt. Via 2-way wireless. *Standard program mode for plant establishment. *Alert functionality. *Unlimited cycle and soak, and # of programs.	If the ET Everythwere scheduling is discontinued it may be used as a standard irrigation controller w/water budget and cycle and soak capability.
Rain Bird ET Manager with ESP-TM Controller	Available # of zones contingent upon type of interconnected controller.	Capable of restricting watering time to a user-defined water window, independent of connected controller.	Capable of restricting watering days by odd, even or custom, independent of connected controller.	*ET Manager Scheduler software included. *ET Manager resource CD included. *Compatible w/virtually any standard sprinkler controller. *Built-in historical weather database. *Programmable delay for excessive weather conditions (wind, rain, freezing). *Based on IA recommended ASCE formula for determining ET using all required weather parameters.	The ET Manager features an historical weather database that is used in the event the Weather Reach Signal is interrupted.
Toro IntelliSense*	TIS-612: 6,9,12 stations; inddor and outdoor mount options. TIS-24: 24 stations.	Capable of restricing the time of day for watering.	Capable of restricting watering days by selection or interval.	*Includes copy button to simplify programming. *Remote internet-based irrigation mngmt. Via 2-way wireless. *Standard program mode for plant establishment. *Alert functionality. *Unlimited cycle and soak, and # of programs.	If the ET Everywhere scheduling is discontinued it may be used as a standard irrigation controller w/water budget and cycle and soak capability.

Weathermatic SL1600	Available in 4-8, 4-24, 12-48 zone models.	Capable of restricing the time of day for watering.	Capable of restricting watering days by selection or interval.	*Built-in valve locator feature. *calculates irrigation schedules based on zone-specific, Irrigation Assoc. recommended parameters including plant, soil, slope and sprinkler types. *On-board multi-meter.	If weather monitor is discontinued it may be used as a standard irrigation controller with water budget and cycle and soak capability.
WeatherTrak	WeatherTrak: 9-48 stations; indoor and outdoor mont options.	Capable of restricing the time of day for watering.	Capable of restricting watering days by selection or interval.	*Includes copy button to simplify programming. *Remote internet-based irrigation mngmt. Via 2-way wireless. *Standard program mode for plant establishment. *Alert functionality. *Unlimited cycle and soak, and # of programs.	If the ET Everywhere scheduling is discontinued, it may be used as a standard irrigation controller w/cycle and soak capability.

RECOMMENDATION: Recommendation is not made for a "RainClick" or other rain-sensing add-on attachment to existing irrigation systems. In California, the majority of our rainfall is during just a few months, during the cooler months of the year. It is easy for homeowners or landscapers to simply turn off the irrigation system during those months. The savings, therefore, would be only those homeowners/landscapers who did not turn off their systems during the rainy, cooler months of the year. In addition, a "RainClick" addition to a system, without first conducting a water audit to assess for distribution uniformity, would be much less likely to return the anticipated savings.

If this measure is selected for inclusion in the program, far greater savings are capable with the installation of a Smart controller. While all of the ones evaluated have potential for savings, it is believed that the WeatherTRAK would be the best choice for the District. It is easy to program, has advanced features such as "cycle and soak" which splits up the irrigation duration into increments, with off periods in between, to allow for clay soils to absorb the water, ensuring efficient irrigation and no run-off, and "slope" which allows programming for degree of slope and location of valve on the slope.

Another advantage to the WeatherTRAK system is the fact that locally the Shea Trilogy homes have these systems in place, and have already had informational presentations regarding the "smart" controllers. It would be anticipated that with a greater local presence there would be more trained landscapers and more company support available.

The WeatherTRAK systems have three components: a network of weather stations that can be downloaded remotely, a central data processing and communications hub, and the WeatherTRAK ET controllers at each landscape site. Information sent to the controller is via a pager-like technology. Information can be sent as one message to a group of landscape sites (i.e., for a group of sites all sharing the same ET information), and to individual sites (by serial numbers). The WeatherTRAK controllers have crop coefficients built in which modifies the climate data sent from the communications center.

The WeatherTRAK helpline has information available in both English and Spanish, and some adjustments can be made remotely.

In a study done in Colorado, the typical time to install the WeatherTRAK controller on site was 1.25 hours, and an hour to analyze the site for square footage and plant type. A water audit would typically take another 1.25 hours. In total, it would typically take 3.5 hours to perform the water audit, analyze the square footage and plant type, and install the controller. The amount of time for addressing the problems in uniformity and leakage identified on water audit would vary depending on the number and extent of the problems.

The City of Newport Beach, in their WeatherTRAK program, is paying for the WeatherTRAK controller, the water audit and the installation, as well as a portion of the monthly signal-broadcast charge.

For a "smart" controller to be maximally efficient, the water audit and installation/initial programming must be correctly performed, and the landscape brought up to uniformity efficiency before the controller is installed. Typically, programs that simply offer a rebate or even give away the controllers do not have a high rate of return in water savings. The best results appear to be obtained when water audit, installation and initial programming is done by a trained professional.

The following "smart" controller program is recommended:

1. A small, initial pilot program of only 10 single-family residences selected to fine-tune the program and assess for efficacy of the program.

2. Purchase of WeatherTRAK controllers for the 10 pilot sites: approximately $400 each (for <100 purchased at a time).
3. Pay for a trained landscaper to perform a water audit, identify irrigation problems in the current system, to certify (once homeowner, at homeowner's cost, has corrected problems identified in the water audit) that problems have been corrected, and pay for installation of the WeatherTRAK controller and initial site programming: approximately $275, based on Newport Beach's experience.
4. Pay for first year of ET broadcast subscription: approximately $48 to $60.

Depending on the savings demonstrated, the District could elect, year to year, to continue paying the nominal ET broadcast subscription fee. Since subscription to the programming broadcast system is integral to receiving maximum benefits from the program, the District could view paying the subscription fee as an investment in getting the best return for the program's initial investment.

To qualify for the WeatherTRAK controller program, recipients would be required to:
1. Be a District SFR customer (one rebate-program participant per customer).
2. Have 1000 ft^2 or greater of turf.
3. Have below-ground, automatic irrigation system currently in place.
4. Undergo a water audit, correct all identified problems, and bring existing system up to 70% or greater distribution uniformity.
5. Attend all four District landscape workshops.
6. Commit to subscription to ET information broadcast service by which the controller is adjusted for climatary changes.
7. Sign appropriate agreement outlining expectations and benefits of program.

It is believed that the District's payment for the water audit, installation, and monthly charge for ET broadcast subscription will accomplish the following:
- Communicate to the customer program recipients, and non-recipients, the worth and desirability of using the latest technology to save water in landscape irrigation.
- Ensure more participants in the program. Recipients would have to make a significant commitment and investment to qualify for the program, and to bring their current irrigation system up to par (uniformity and absence of leaks). Having part of the costs underwritten by the District would provide the financial incentive to encourage customers to make this commitment and expenditure.
- Get water audits and correction of problems done in residential landscapes which may not have otherwise been accomplished.
- Communicate to customers the District's on-going commitment to both water conservation and making the conservation easier to accomplish by customers.
- Serve as a positive public-relations outreach opportunities.

Table 23: *PROJECTED COSTS AND SAVINGS* IN SEASONAL WATER USE OF ET-CONTROLLER PILOT PROGRAM, .27% MARKET PENETRATION, SINGLE-FAMILY RESIDENCES , OVER 15 YEARS

Year	SFR #Meters	(SFR) #Meters in Pilot Study (.27%)	Estimd. Popul.	SFR AFY (Seasonal) Required w/o Measure	Saved: AFY w/ measure (25%)	Cost of Water/AF w/3% inflat.	$$Savings/ Year (w/ 3% infl/yr)	Cost of Equip, Install, Audit ($735 ea)	20% Share of Shared Program Costs	Office Admn Costs (10% of Prg.Costs)	Total Costs	NET SAVINGS (Total Savings minus Total Costs)	Years to Pay Off Original Invest. (Rebates, Costs)
2008	3647	10	34	3.650	0.912	$2,060.00	$1,879.73	$7,350.00	$13,780.00	$1,378.00	$22,508.00	-$20,628.27	<11
2009				3.650	0.912	$2,121.80	$1,936.12	$0.00	$1,378.00	$137.80	$1,515.80	$420.32	
2010				3.650	0.912	$2,185.45	$1,994.21	$0.00	$1,419.34	$141.93	$1,561.27	$432.93	
2011				3.650	0.912	$2,251.02	$2,054.03	$0.00	$1,461.92	$146.19	$1,608.11	$445.92	
2012				3.650	0.912	$2,318.55	$2,115.66	$0.00	$1,505.78	$150.58	$1,656.36	$459.30	
2013				3.650	0.912	$2,388.10	$2,179.13	$0.00	$1,550.95	$155.10	$1,706.05	$473.08	
2014				3.650	0.912	$2,459.75	$2,244.50	$0.00	$1,597.48	$159.75	$1,757.23	$487.27	
2015				3.650	0.912	$2,533.54	$2,311.83	$0.00	$1,645.40	$164.54	$1,809.94	$501.89	
2016				3.650	0.912	$2,609.55	$2,381.19	$0.00	$1,694.77	$169.48	$1,864.24	$516.95	
2017				3.650	0.912	$2,687.83	$2,452.62	$0.00	$1,745.61	$174.56	$1,920.17	$532.45	
2018				3.650	0.912	$2,768.47	$2,526.20	$0.00	$1,797.98	$179.80	$1,977.78	$548.43	
2019				3.650	0.912	$2,851.52	$2,601.99	$0.00	$1,851.92	$185.19	$2,037.11	$564.88	
2020				3.650	0.912	$2,937.07	$2,680.05	$0.00	$1,907.47	$190.75	$2,098.22	$581.83	
2021				3.650	0.912	$3,025.18	$2,760.45	$0.00	$1,964.70	$196.47	$2,161.17	$599.28	
2022				3.650	0.912	$3,115.93	$2,843.26	$0.00	$2,023.64	$202.36	$2,226.00	$617.26	
			TOTAL:	54.749	13.69	n/a	$34,960.98	$7,350.00	$37,324.95	$3,732.50	$48,407.45	-$13,446.47	
			AVERAGE:	3.650	0.91	n/a	$2,330.73	$918.75	$2,488.33	$248.83	$3,227.16	-$896.43	

Initial investment in equipment with benefits reaped over years.

COST-BENEFIT ANALYSIS, PILOT PROGRAM: (Table 23)
If this water-conservation measure is selected, it is recommended that an initial pilot (10 residences) project be performed before expanding the program to greater numbers of residences. It is projected that the following savings would be achieved from the pilot program (Table xxx).

Note that costs for the pilot program are more per participating account, and the costs take longer to pay back, because the shared program and administrative costs are distributed across only 10 accounts.

Savings in AF over 15 years:	13.69
Average AF/Y savings:	.91
Total net savings in $$$ over 15 years:	$-13,446.47
Average net $$$/year savings:	$ -896.53
Years until costs are paid off:	<11
% Water savings, all meters:	.0246%
Savings:Cost ratio:	0.7:1

Table 24: *PROJECTED COSTS AND SAVINGS* IN SEASONAL WATER USE OF ET-CONTROLLER PROGRAM, 5% MARKET PENETRATION, SINGLE-FAMILY RESIDENCES , OVER 15 YEARS

Year	SFR #Meters	(SFR) #Meters (5% MP)	Estimd. Popul.	SFR AFY (Seasonal) Required w/o Measure	Saved: AFY w/ measure (25%)	Cost of Water/AF w/3% inflat.	$$Savings/ Year (w/ 3% infl/yr)	Cost of Equip, Install, Audit ($735 ea)	20% Share of Shared Program Costs	Office Admn Costs (10% of Prg.Costs)	Total Costs	NET SAVINGS (Total Savings minus Total Costs)	Years to Pay Off Original Invest. (Rebates, Costs)
2008	3647	182	627	66.557	16.639	$2,060.00	$34,276.92	$134,027.25	$13,780.00	$1,378.00	$149,185.25	**$114,908.33**	**<5**
2009				66.557	16.639	$2,121.80	$35,305.23	$0.00	$1,378.00	$137.80	$1,515.80	**$33,789.43**	
2010				66.557	16.639	$2,185.45	$36,364.39	$0.00	$1,419.34	$141.93	$1,561.27	**$34,803.11**	
2011				66.557	16.639	$2,251.02	$37,455.32	$0.00	$1,461.92	$146.19	$1,608.11	**$35,847.21**	
2012				66.557	16.639	$2,318.55	$38,578.98	$0.00	$1,505.78	$150.58	$1,656.36	**$36,922.62**	
2013				66.557	16.639	$2,388.10	$39,736.35	$0.00	$1,550.95	$155.10	$1,706.05	**$38,030.30**	
2014				66.557	16.639	$2,459.75	$40,928.44	$0.00	$1,597.48	$159.75	$1,757.23	**$39,171.21**	
2015		**Initial investment with**		66.557	16.639	$2,533.54	$42,156.29	$0.00	$1,645.40	$164.54	$1,809.94	**$40,346.35**	
2016		**benefits reaped over years.**		66.557	16.639	$2,609.55	$43,420.98	$0.00	$1,694.77	$169.48	$1,864.24	**$41,556.74**	
2017				66.557	16.639	$2,687.83	$44,723.61	$0.00	$1,745.61	$174.56	$1,920.17	**$42,803.44**	
2018				66.557	16.639	$2,768.47	$46,065.32	$0.00	$1,797.98	$179.80	$1,977.78	**$44,087.54**	
2019				66.557	16.639	$2,851.52	$47,447.28	$0.00	$1,851.92	$185.19	$2,037.11	**$45,410.17**	
2020				66.557	16.639	$2,937.07	$48,870.69	$0.00	$1,907.47	$190.75	$2,098.22	**$46,772.47**	
2021				66.557	16.639	$3,025.18	$50,336.82	$0.00	$1,964.70	$196.47	$2,161.17	**$48,175.65**	
2022				66.557	16.639	$3,115.93	$51,846.92	$0.00	$2,023.64	$202.36	$2,226.00	**$49,620.92**	
			TOTAL:	**998.357**	**249.59**	**n/a**	**$637,513.52**	**$134,027.25**	**$37,324.95**	**$3,732.50**	**$175,084.70**	**$462,428.82**	
			AVERAGE:	**66.557**	**16.64**	**n/a**	**$42,500.90**	**$16,753.41**	**$2,488.33**	**$248.83**	**$11,672.31**	**$30,828.59**	

COST-BENEFIT ANALYSIS, EXPANDED PROGRAM: (Table 24)
If the pilot program proves successful, and the demonstrated savings warrant the District's resource expenditure, it is recommended that an expanded program of 5% of SFRs (182 homes) be initiated, expanding the program to greater numbers of residences. It is projected that the following savings would be achieved from the expanded program (Table xxx).

Savings in AF over 15 years:	249.59
Average AF/Y savings:	16.64
Total net savings in $$$ over 20 years:	$462,428.82
Average net $$$/year savings:	$ 30,828.59
Years until costs are paid off:	<5
% Water savings, all meters:	.45%
Savings:Cost ratio:	3.6:1

2.2. Rebates for conversion from traditional landscape plantings to drought-tolerant.

> *"The landscape of the United States will shift drastically in the next few decades. Western states are running out of water. Baby boomers everywhere are worked up about chemicals on the lawns where their kids play. And a traditional lawn sometimes just takes too much time to care for."*
>
> --Margaret Roach, garden editor of *Martha Stewart Living.*

Replacement with artificial turf. A recommendation for replacing turf with artificial turf will not be made at this time because of concerns of contamination of stormwater and groundwater by heavy metals (zinc, copper, barium and chromium).[121,122] In addition, there are concerns about increased occurrence of multi-drug-resistant bacterial abscesses and infections in players who play sports on artificial turf,[123] and these methicillin-resistant infections may be spread to others both from the contaminated turf itself as well as in a locker-room setting.[124]

Replacement with drought-tolerant plant material. A reduction of 25% to 40% of water used for landscape irrigation could be realized by landscape management, landscape design and hardware improvements. Improving efficiency and increasing water savings are the most economical, easiest and least destructive tools that can be used to meet California's water needs in the future.[125]

A turf-replacement rebate program produced reported savings of 398 gallons per day participant-weighted average savings of both commercial and residential accounts.[126] This translates to an average savings of 145,270 gallons per year, 194.18 units per year, and .438 acre-feet per year.

In Austin, Texas after the initiation of a turf-replacement rebate program, the average water savings per participant site was 214 gallons per day in the summer when compared to water use for the previous landscaping.[127]

A xeriscape conversion study performed for the Southern Nevada Water Authority(SNWA) found that its Smart Landscape Program yielded a 37% positive return, bringing in $1.58 for each $1.00 spent in rebates and incentives. Conversion from lawn to xeriscape produced average water savings of 33%, with the greatest savings in the summer. The average cost to convert was $1.55/square foot. The average area of turf replaced was 2160 ft^2. The average savings in maintenance was about 2.2 hours a month, both in hours and direct costs, for the whole property when xeriscape principles (See *Appendix 2*) were applied, translating to $206/year in costs (or $7.80/hour).[128]

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[126] Padilla, A., and D. Torres. *Water Savings from a Turf Rebate Program in the Chihuahuan Desert.* AWWA Water Resources Conference Proceedings, 2004.
[127] City of Austin, Texas. *Xeriscaping: Sowing the Seeds for Reducing Water Consumption."* Prepared for the U.S. Bureau of Reclamation, Austin, Texas. May 1999.
[128] Sovocool, Kent A. *Xeriscape conversion study final report.* Southern Nevada Water Authority, 2005.

According to the *Source Book on Natural Landscaping for Public Officials*, "The major savings of natural landscaping is the lost cost of landscape maintenance. The combined costs of installation and maintenance for a natural landscape over a ten-year period may be one-fifth of the costs for conventional landscape maintenance."[129]

Shifting to xeriscape plants in the landscape produces considerable savings. In a study of SFRs, presented at an American Water Works Association conference, xeriscape plants used 17% less water than traditional landscapes.[130]

SNWA entices its customers to conserve water in the landscape by offering them a wide range of rebates and support services, including $1/ft^2$ for conversion from turf to xeriscape, rebates for clock upgrades, a list of water-smart landscapers, and a landscape awards program.[131]

Cathedral City, California offered its water users $500 to convert their lawns to xeriscape.[132]

In 2004, Clark County (Nevada) began considering a program of removal of approximately 2 million ft^2 of turf, replacing it with xeriscape landscaping, estimating that 60 million gallons of water a year could be saved.[133]

The Metropolitan Water District has devoted millions for its campaign to get consumers to switch to xeriscape plants.[134]

RECOMMENDATION:
A rebate-assisted program for replacement of turf by drought-tolerant ("xeriscape") plants is recommended, following basic principles of:

- Sound landscape planning and design.
- Limitation of turf placement to appropriate areas.
- Use of drought-tolerant plant material.
- Efficient irrigation.

TEXT BOX 1

TURF-XERISCAPE CONVERSION PROJECTION

STUDY UPON WHICH 16% ESTIMATES ARE BASED:
Based on min. 500 ft2 turf conversion to xeriscape, or new xeriscape installation; trees to cover 50% of property with canopy when mature;non-gravel/rock; in-ground irrigation system in place; cap of 2000 ft2; rebate $.48/ft2. Produced 30% savings of total water use, with highest savings in summer. (SNWA Xeriscape study).

Average amount converted: 2160 ft^2

Average monthly savings: 30% of water bill.

Average monthly savings per ft^2 converted: .0153%

(Sovocal, Kent A. *Xeriscape Conversion Study, Final Report, 2005.* Southern Nevada Water Authority.)

Adjusting SNWA evapotranspiration rate to Nipomo's ET rate (by dimensional analysis):

SNWA ET rate = 90 in/yr
NCSD ET rate = 47.4 in/yr

90" 47.44"
___ x ____
30% **15.81%=Nipomo % estimated savings.**

Rebate cap: 1000 ft^2 ($528.00)
Rebate min: 500 ft^2 ($264.00)

[129] *A Sourcebook on Natural Landscaping for Public Officials.* U.S. Environmental Protection Agency. http://www.epa.gov/glnpo/greenacres/toolkit/index.html.
[130] Nelson, J.O.; Kruta, J.C. *Water saved by single family xeriscapes.* 1994 Annual conference proceedings; American Water Works Association, June 1994.
[131] Water Smart Rebates and Services. Southern Nevada Water Authority, 2003. (http://www.lvvwd.com/html/ws_rebates.html).
[132] Bowles, *J. Anti-drought push gets funds.* Riverside Press-Enterprise, October 2004.
[133] *Vegas-area schools consider removing turf to save water.* September 2004. WaterWiser, American Water Works Association from US Water News. (http://www.awwa.org/waterwiser/watch/archive.cfm).
[134] Bowles, J. *Anti-drought push gets funds.* Riverside Press-Enterprise, October 2004.

- Soil amendments.
- Use of mulches.
- Proper landscape maintenance procedures

If this program is selected, it is recommended that a limited pilot program of 10 SFR homes be selected for the program, with subsequent expansion of the program if outcome analysis warrants it, and after the details of the program have been fine tuned.

Participant eligibility:

- Must be District SFR customer (one rebate-program participant per household).
- Submission by customer of drawing (with measurements) indicating dimensions of entire yard and dimensions and location of landscape area to be converted to drought-tolerant planting, including placement and basic canopy size of trees to be conserved.
- Submission of representative photographs of the areas to be converted to drought-resistant landscape.
- Completion a series of NCSD free workshops on water conservation in the landscape, drought-resistant plants (selection and maintenance), composting and soil amendments, irrigation, and basic landscape design.
- Submission of a basic proposed turf-replacement landscaping plan, indicating plant names, numbers of plants, and location in the landscape.
- Sign a contract representing the requirements and benefits of programs.

Customer Benefits of Program:

- Assistance in obtaining a beautiful, integrated landscape.
- Assistance with part of the costs of converting turf to drought-resistant plants.
- Discount from local nurseries for plants purchased for the turf-replacement project.
- Instruction on basic principles of landscaping (soil/compost, irrigation, plant selection, landscape design).
- Follow-up with horticulturist during and after project.
- Availability of horticulturist to answer questions/assist with problem-solving.
- Free software (while available) on drought-resistant plants and landscaping.
- Pride in supporting community efforts to conserve water and protect the Nipomo Mesa aquifer.
- Eligibility for yearly Nipomo Water-Wise Landscape of the Year Contest.

Program Design: Based on the much referenced study, *Xeriscape conversion study final report*, Southern Nevada Water Authority, 2005, with adjustments of percentage savings for Southern Nevada's 90'/year evapotranspiration rate to Nipomo's 47.4" ET/year (see Text Box 1 for specifics).

- Rebate: $0.48/ft2, minimum of 500 ft2 and maximum of 1000 ft2 rebated.
- Percentage of Shared Program Costs: 10% ($5120).
- Number of enrollees: Minimum of 10, maximum of 50, per year.
- Workshops Required for Enrollees: 4.
- Contract outlining basic requirements and benefits of program.

This program will be conducted in two phases:

1. A small (10 homes) pilot program to fine-tune program design and assess for costs and savings.
2. Subsequent 5% (182 or less homes) increments, assessing for efficacy and feasibility of the program after each increment is completed.

Table 25: PROJECTED COSTS AND SEASONAL-WATER-USE-SAVINGS OF TURF REPLACEMENT WITH DROUGHT-TOLERANT PLANT MATERIAL; PILOT PROGRAM (10 HOMES, 0.27% OF ALL SFR METERS) SINGLE-FAMILY RESIDENCE CATEGORY, OVER 20 YEARS (SAVINGS: 16% OF ANNUAL WATER USE)

Year	SFR #Meters	#Meters (0.27% of SFR Meters) (10 homes)	Est'd popul'n (10 homes)	SFR AFY (Seasonal) Required w/o Measure	Saved: SFR AFY/All Meters (16%/ Meter/Yr)	Cost of Water/AF w/3% inflat.	$$Savings/ Year	Rebate (up to $500 ea)	10% Share of Shared Program Costs	Office Admn Costs (10% of Prg.Costs)	Total Costs	NET SAVINGS (Total Savings minus Total Costs)	Years to Pay Off Original Invest. (Rebates, Costs)
2008	3647	10	34	3.650	0.58	$2,060.00	$1,203.03	$5,000.00	$6,890.00	$1,189.00	$13,079.00	-$11,875.97	<10
2009	One-time investment yielding results over years.				0.58	$2,121.80	$1,239.12	$0.00	$0.00	$118.90	$118.90	$1,120.22	
2010					0.58	$2,185.45	$1,276.29	$0.00	$0.00	$122.47	$122.47	$1,153.83	
2011					0.58	$2,251.02	$1,314.58	$0.00	$0.00	$126.14	$126.14	$1,188.44	
2012					0.58	$2,318.55	$1,354.02	$0.00	$0.00	$129.93	$129.93	$1,224.09	
2013					0.58	$2,388.10	$1,394.64	$0.00	$0.00	$133.82	$133.82	$1,260.82	
2014					0.58	$2,459.75	$1,436.48	$0.00	$0.00	$137.84	$137.84	$1,298.64	
2015					0.58	$2,533.54	$1,479.57	$0.00	$0.00	$141.97	$141.97	$1,337.60	
2016					0.58	$2,609.55	$1,523.96	$0.00	$0.00	$146.23	$146.23	$1,377.73	
2017					0.58	$2,687.83	$1,569.68	$0.00	$0.00	$150.62	$150.62	$1,419.06	
2018					0.58	$2,768.47	$1,616.77	$0.00	$0.00	$155.14	$155.14	$1,461.63	
2019					0.58	$2,851.52	$1,665.27	$0.00	$0.00	$159.79	$159.79	$1,505.48	
2020					0.58	$2,937.07	$1,715.23	$0.00	$0.00	$164.59	$164.59	$1,550.65	
2021					0.58	$3,025.18	$1,766.69	$0.00	$0.00	$169.52	$169.52	$1,597.17	
2022					0.58	$3,115.93	$1,819.69	$0.00	$0.00	$174.61	$174.61	$1,645.08	
2023					0.58	$3,209.41	$1,874.28	$0.00	$0.00	$179.85	$179.85	$1,694.43	
2024					0.58	$3,305.70	$1,930.51	$0.00	$0.00	$185.24	$185.24	$1,745.27	
2025					0.58	$3,404.87	$1,988.42	$0.00	$0.00	$190.80	$190.80	$1,797.62	
2026					0.58	$3,507.01	$2,048.08	$0.00	$0.00	$196.52	$196.52	$1,851.55	
2027					0.58	$3,612.22	$2,109.52	$0.00	$0.00	$202.42	$202.42	$1,907.10	
	TOTAL:				11.10	n/a	$32,325.83	$5,000.00	$6,890.00	$3,972.98	$15,862.98	$16,260.44	
	AVERAGE:				0.58	n/a	$3,078.65	$476.19	$656.19	$388.02	$1,520.40	$1,548.61	

COST-BENEFIT ANALYSIS: The study upon which this is based (Sovocal, Kent A. *Xeriscape Conversion Study, Final Report, 2005.* Southern Nevada Water Authority) was selected because it was the most complete and detailed study available, and the savings given were well within the savings reported by studies on other water purveyors and regions. Because of the vast differences in climate between Southern Nevada and Nipomo, the two areas' evapotranspiration rates were used to convert the savings in Southern Nevada into savings more likely to occur in Nipomo. SNWA's savings were 30% of annual water use; converting with Nipomo's ET rate, the savings for Nipomo' s residents would be 16%.

(Table 25) For the **pilot program, 10 homes only**, the costs-benefits are as follow:

Savings in AF over 20 years:	11.10
Average AF/Y savings:	.58
Total net savings in $$$ over 20 years:	$16,260.44
Average net $$$/year savings:	$ 1,548.61
Years until costs are paid off:	<10
% Water savings, all meters:	.02%
Savings:Cost ratio:	2.1:1

The costs for the pilot program are more per participating account and the costs take longer to pay back because the shared program and administrative costs are distributed across only 10 accounts.

If the pilot program proved successful and savings were believed to warrant expansion of the program, it is recommended that the program then be expanded in increments of 5% or less of the SFRs (182 homes).

(Table 26) The costs-benefits for **5% of SFR residences** are as follow:

Savings in AF over 20 years:	212.98
Average AF/Y savings:	10.65
Total net savings in $$$ over 20 years:	$283,381.45
Average net $$$/year savings:	$ 22,847.96
Years until costs are paid off:	<5
% Water savings, all meters:	0.29%
Savings:Cost ratio:	4.4:1

Table 26: *PROJECTED COSTS* AND SEASONAL-WATER-USE SAVINGS WITH XERISCAPE TURF-REPLACEMENT PROGRAM, 5% MARKET PENETRATION (182 HOMES), SINGLE-FAMILY RESIDENCES , OVER 20 YEARS

Year	#SFR Meters	#SFR Meters (5% MP)	Estimd. Popul.	SFR AFY (Seasonal) Required w/o Measure	Saved: AFY w/ measure (16%)	Cost of Water/AF w/3% inflat.	$$Savings/ Year	Cost of Rebates (Max: $500 ea)	10% Share of Shared Program Costs	Office Admn Costs (10% of Prg.Costs	Total Costs	NET SAVINGS (Total Savings minus Total Costs)	Years to Pay Off Original Invest. (Rebates , Costs)
2008	3647	182	627	66.557	10.649	$2,060.00	$21,937.23	$91,175.00	$6,890.00	$9,806.50	$107,871.50	-$85,934.27	<5
2009	Initial investment with benefits reaped over years.			66.557	10.649	$2,121.80	$22,595.35	$0.00	$0.00	$980.65	$980.65	$21,614.70	
2010				66.557	10.649	$2,185.45	$23,273.21	$0.00	$0.00	$1,010.07	$1,010.07	$22,263.14	
2011				66.557	10.649	$2,251.02	$23,971.40	$0.00	$0.00	$1,040.37	$1,040.37	$22,931.03	
2012				66.557	10.649	$2,318.55	$24,690.55	$0.00	$0.00	$1,071.58	$1,071.58	$23,618.96	
2013				66.557	10.649	$2,388.10	$25,431.26	$0.00	$0.00	$1,103.73	$1,103.73	$24,327.53	
2014				66.557	10.649	$2,459.75	$26,194.20	$0.00	$0.00	$1,136.84	$1,136.84	$25,057.36	
2015				66.557	10.649	$2,533.54	$26,980.03	$0.00	$0.00	$1,170.95	$1,170.95	$25,809.08	
2016				66.557	10.649	$2,609.55	$27,789.43	$0.00	$0.00	$1,206.08	$1,206.08	$26,583.35	
2017				66.557	10.649	$2,687.83	$28,623.11	$0.00	$0.00	$1,242.26	$1,242.26	$27,380.85	
2018				66.557	10.649	$2,768.47	$29,481.80	$0.00	$0.00	$1,279.53	$1,279.53	$28,202.28	
2019				66.557	10.649	$2,851.52	$30,366.26	$0.00	$0.00	$1,317.91	$1,317.91	$29,048.35	
2020				66.557	10.649	$2,937.07	$31,277.24	$0.00	$0.00	$1,357.45	$1,357.45	$29,919.80	
2021				66.557	10.649	$3,025.18	$32,215.56	$0.00	$0.00	$1,398.17	$1,398.17	$30,817.39	
2022				66.557	10.649	$3,115.93	$33,182.03	$0.00	$0.00	$1,440.12	$1,440.12	$31,741.91	
2023				66.557	10.649	$3,209.41	$34,177.49	$0.00	$0.00	$1,483.32	$1,483.32	$32,694.17	
2024				66.557	10.649	$3,305.70	$35,202.81	$0.00	$0.00	$1,527.82	$1,527.82	$33,674.99	
2025				66.557	10.649	$3,404.87	$36,258.90	$0.00	$0.00	$1,573.66	$1,573.66	$34,685.24	
2026				66.557	10.649	$3,507.01	$37,346.67	$0.00	$0.00	$1,620.87	$1,620.87	$35,725.80	
2027				66.557	10.649	$3,612.22	$38,467.07	$0.00	$0.00	$1,669.49	$1,669.49	$36,797.57	
			TOTAL:	1,331.143	212.98	n/a	$589,461.59	$91,175.00	$6,890.00	$34,437.36	$132,502.36	$283,381.45	
			AVERAGE:	66.557	10.65	n/a	$29,473.08	$8,683.33	$344.50	$1,721.87	$6,625.12	$22,847.96	

In summary, estimates indicate that a turf-replacement program would require an initial outlay, but should pay for itself in less than five years, and after that continue to produce both water and costs savings.

It is felt that, because of the initial costs over administering the program, a minimum of 10 enrollees is required each year for the program. The exception would be the first year when word may not have reached all of the District's customers, and customers may not have yet become inspired by the new water rates' impact on their water bills next summer.

It is felt that, based on the personnel hours required to administer and set up the program, 30 customers would be the maximum number accepted each year. Should more personnel be made available, the program could be expanded.

2.3. Landscape irrigation efficiency equipment.

There are a number of low-cost equipment items that can assist in efficient irrigation of the residential landscape. Poor irrigation scheduling (watering too often and for too long) is the primary source of water waste associated with landscape irrigation. Other contributing factors are inefficient and poorly maintained irrigation systems.[135]

A garden hose can deliver up to 10 gallons per minute. Equipment such as automatic shut-off nozzles for hand-watering and timers that shut off hose-end sprinklers can help eliminate wasted irrigation water. To help eliminate overwatering, a soil moisture probe can give an objective assessment of the soil moisture content. The stick-finger-in-soil method is highly subjective and, unless the applicator is very strong, does not reach 3" to 4" to assess if there is still water available at the plant root level. Rain gauges are inexpensive and a good way to reinforce homeowner awareness of the hydrologic cycle, and give objective feedback regarding what kind of plants can reasonably be supported by the native climate and the amount of funds dedicated to pay for landscape irrigation. Finally, educational products, such as a water drop wheel, can give easily accessible information regarding amount of water used and saved by water conservation measures.

Water Wheel

RECOMMENDATIONS: It is recommended that 250 sets of outdoor irrigation efficiency equipment be provided to SFR customers. The kit would contain a soil moisture probe, lawn sprinkler timer, garden-hose nozzle, rain gauge, and water-drop education/information wheel.

Studies on actual savings from these measures could not be found. The cost for each set would be $18.19 ($4,547.50 for 250 kits). The benefits would include those listed on page **xxxx65**, "General Benefits and Costs of Landscape Water Conservation."

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[135] Vickers, Amy. *Handbook of Water Use and Conservation.* Amherst, MA: Water Plow Press, 2001.

NOTE: An integral part of the landscape portion of the program would be working with local growers, nurseries and landscapers to ensure that the program design is appropriate for our area, and to facilitate revenue from changes in residential landscape design and maintenance remaining, when possible, with our local businesses.

Table 27: COMPARISON/ TALLY OF SAVINGS FOR NON-CORE PROGRAM MEASURES

Measure	Target Category	TotalSavings Avg. AFY	Avg. AFY Consum. For All Categories	# of Meters All categories	% AF Savings for All District Categories	Total $ (not NET) Savings	Total$ Costs	Savings: Costs Ratio	Years to Pay off Initial Invest.	Ranking
ULFT	SFR	8.83	3698.743	xxx	0.24%	$456,933.64	$43,595.00	10.9:1	<2.5	n/a**
HotWater on Demand	SFR	0.963	3698.743	xxx	0.03%	$23,615.59	$10,170.46	2.3:1	<5	n/a***
Indoor plumbing retrofit (non-toilet	SFR, MFR	2.044	3698.743	xxx	0.06%	$48,276.47	$14,454.00	3.3:1	<3	2
High-Efficiency Clothes Washer	SFR	127.7	3698.743	xxx	3.45%	$372,019.75	$40,289.50	9.2:1	~2.5	1
WeatherTRAK PILOT program	SFR,.27% (10 homes)	0.91	3698.743	xxx	0.0246%	$34,960.98	$48,407.45	0.7:1	<11	6
WeatherTRAK 5% SFR	SFR, 5% 182 homes	16.64	3698.743	xxx	0.45%	637,513.52	175,084.70	3.6:1	<5	7
Xeriscape turf-replacement PILOT program	SFR, .27% (10 homes)	0.58	3698.743	xxx	0.02%	32,325.83	15,862.98	2.1:1	<10	4
Xeriscape turf-replacement	SFR, 5 177 homes	10.65	3698.743	xxx	0.29%	589,461.59	132,502.36	4.4:1	<5	5
Irrigation efficiency equipment	SFR	Unknown	Unknown							3

**The ULFT retrofit measure would produce significant net savings, and the program measure would be easily planned and carried out. However, San Luis Obispo County is currently considering which water-conservation measures it will recommend for the Nipomo Mesa Management Area as part of their certification of Severity III for water resources. Until the County has made its decision, it is recommended that the District defer further consideration of this measure. If the County elects not to include the ULFT retrofit measure, then it is strongly recommended that the District consider implementing this measure.

***Information regarding success and amount of savings is scant, and there are many variables that impact whether the measure would be successful for a specific household. It is recommended that consideration of this measure be deferred until more information is available.

COMPARISON AND DISCUSION OF NON-CORE WATER CONSERVATION PROGRAM MEASURES

As discussed previously, it is believed that, simply with an intact core measures program, the District's customers could save nearly 11% of its total annual water consumption for all categories.

To achieve the remaining 4% conservation, some of the non-core measures could be added to the core measures program. With this integrated program, it is expected that each measure would support the other, and the sum of the whole would be greater than the sum of the individual components.

For evaluation purposes, comparison and ranking of the proposed non-core water conservation measures was performed using the following criteria:

- Amount of potential water savings.
- Cost to District (savings:cost ratio).
- Years to pay off initial investment in equipment or rebates.
- Ease of designing, promoting and administering the program for the measure.

High-efficiency clothes washer rebates (ranked #1). This measure would provide an anticipated 3.45% water savings of the District's annual water consumption (all categories), which, when combined with the 11% from the core program measures, the savings would be close to the goal water conservation savings of 15%.

As is true for all indoor hardware refit programs, the HEW rebate program would require an initial outlay for rebates, but once those have been processed, further expenditure of staff time and District funds (except for program assessments) would not be needed. These programs are easy to set up and easy to administer. For the high-efficiency clothes-washer rebate program, it is estimated that the savings:cost ratio would be greater than 9:1, and it would take less than 2.5 years to pay off the initial investment in rebates. After that, for the life of the machine, savings would continue to accrue. The District's savings are such that the expenditure on rebates is a good investment, and will stimulate more customer interest in HEWs.

It is recommended that the HEW rebate program be initiated. In addition to the District rebate, information will be provided regarding the rebate program from the So. Ca. Gas Company. The two rebates together will provide a strong stimulus for customers to invest in a more efficient clothes-washer. It is recommended that this program be started in 2008.

Indoor plumbing (non-toilet) retrofit (ranked #2) It is recommended that kits that include a high-quality, low-flow showerhead, a high-quality, low-flow faucet aerator, leak-detection dye tablets, and a shower timer be provided, free, to SFR customers. It is estimated that this kit will provide residential customers the tools they need to decrease indoor water use. Although the anticipated water savings from this measure are small (0.06%), the support of other water-saving measures would provide much more in the way of additional benefits. There is a 3.3:1 savings:cost ratio, and the initial funds would be paid back in water savings in less than three years.

It is recommended that the indoor plumbing kits be provided to SFR and MFR requesting customers (one per account, on a first-come/first-served basis), with an initial purchase of 250 kits, to be provided one to a household, first-come/first-serve basis. The kits can be either provided at the District's office facility, or provided at the time of the water audit. If the kits are provided through the

office, it is recommended that the customer's old showerhead must be exchanged for the kit. This will help ensure that the showerhead (and hopefully the other items) will actually be installed. It is recommended that this program be started in 2008.

Irrigation outdoor efficiency equipment (ranked #3). This kit of several components (soil moisture probe, educational water-wheel, rain gauge, timer for hose-end sprinkler, and automatic shut-off hose nozzle) is designed to educate, increase water-use awareness, and encourage and assist with water use efficiency. Studies for water savings from the use of these items are not available. However, considering the fact that up to 10 gallons of water per minute can come out of a hose, measures that stop unneeded water from exiting the hose will decrease water waste and conserve water. In addition, these items will serve as a support for other water conservation measures, by educating and making customers more aware of water use, especially unintended water use.

It is recommended that an initial order of 250 kits be placed, with provision of these kits to requesting SFR customers, one to a household, on a first-come/first-serve basis.

Xeriscape/turf-replacement, pilot and expanded program (ranked #5,6) There are significant savings reported when turf is replaced by xeriscape plants. Many water suppliers are funding turf-replacement by customers. Since the outlay for the rebates would be high, and because it is anticipated that the program would be more challenging to design and administer, it is strongly recommended that, if this measure is considered, that a pilot program of 10 homes first be accomplished before making the larger investment in an expanded program. If the post-pilot-study analysis warrants it, the program could then be expanded. Because of the staff resources required to initiate and administer the program, it is recommended (if the expanded program is warranted) that the program be expanded in increments, with each increment containing a minimum of 10 residences and a maximum of 30 residences.

The amount of savings, over the years, is predicted to be very large. If this measure is initiated, it is recommended that the pilot program be started in 2008 or 2009.

WeatherTRAK Smart Irrigator program, pilot and expanded program (ranked #8, 9). There are significant savings that have been reported by many sources for Smart irrigation systems. Some of our customers may be reluctant to replace or reduce the amount of their property devoted to lawn. For these customers, it is estimated that the most amount of increased efficiency in water use can occur in landscape irrigation. Turf uses, by far, the largest percentage of water used for most SFR customers. Therefore, ensuring that their landscape irrigation is at maximum efficiency could bring significant savings from these customers and ensure that the water that is dedicated for irrigating their lawns and landscape is not being wasted by unintended usage. Since the outlay for the rebates would be high, and because it is anticipated that the program would be more challenging to design and administer, it is strongly recommended that, if this measure is considered, that a pilot program of 10 homes first be accomplished before making the larger investment in an expanded program. If the post-pilot-study analysis warrants it, the program could then be expanded.

Because of the staff resources required to initiate and administer the program, it is recommended (if the expanded program is warranted) that the program be expanded in increments, with each increment containing a minimum of 10 residences and a maximum of 30 residences.

If this program is selected, it is recommended that the Smart irrigator rebate program be undertaken initially as a pilot program and, if warranted, expansion to a larger program. The amount of savings, over the years, is predicted to be very large. If this measure is initiated, it is recommended that the pilot program be started in 2009 or 2010. This program, out of all those recommended, would take the most staff time for planning, promoting and administering.

X. Comparison of Measures, Discussion and Final Recommendations

A successful water conservation program contains support, incentives and assistance by many means. If the program is designed well, the individual measures of the program support each other, and the sum of the whole is greater than the sum of the individual components.

The proposed water conservation program has two main categories: **core** and **non-core** measures.

The **core** measures are designed to complement each other, and to provide a strong, multi-footed base which supports each of the individual core measures, as well as the non-core measures. The most important element of all of the measures, core and non-core, is the three-tiered, inclining block, conservation-based rate pricing. Studies have repeatedly demonstrated a strong customer response to a rate structure that gives pocketbook incentive to conserve. The best designed, voluntary toilet-replacement rebate measure in the world will be largely unsuccessful if there is no pocketbook incentive for the customer to conserve water.

The other core measures (public education and outreach) are vital to the success of any water conservation program, but not quantifiable individually. However, it seems obvious that a customer who does not know about the need for water conservation, or the rebate measures offered, will not be motivated to save water or take advantage of the rebate measure.

The acceptance of an intact core measures program is estimated to provide nearly 11% savings in the District's annual water usage, for all categories combined. The acceptance of three of the non-core measures, it is estimated, would reach very close to the 15% water conservation goal.

The **non-core** measures include individual measures that may or may not support each other. For instance, the landscape "irrigation efficiency equipment" measure would support the ET-controller rebate and xeriscape/turf-replacement measures, but not the high-efficiency clothes-washer measure (although the argument can be made that conservation of any kind makes the conserver more aware of water use in other situations). The non-core measures range from easy to not-so-easy to design and run, and it is recommended that the easy ones with the greatest potential savings be attempted first before escalating to the measures which require more staff time, effort, and District funding.

For xeriscape/turf-replacement and ET-controller rebate measures, because of the difficulty in designing and running the programs, and the expense involved, it is recommended that small pilot programs of 10 SFR accounts for each measure be performed before expanding to programs with more participants.

Perhaps the most important part of any water conservation program is the customers' willingness to participate. There are many District customers who simply are not willing to conserve water if it is going to be used for new housing and further growth.

Therefore, it is recommended, as a vital part of the water conservation program, that the Board consider enacting an ordinance that guarantees our customers that the water they conserve will not be used to support new housing growth in the District.

It is believe that an approach which provides the District's customers with the pocketbook incentive, education and assistance, technical help, rebates, and other supportive measures, while

guaranteeing that the water they save will not be used for new growth, will be more readily accepted by the District's customers, and will meet with greater success.

FINAL RECOMMENDATIONS

CORE MEASURES PROGRAM: (~11% water savings)

1. **Three-tiered, inclining block, conservation-based rate structure.** It is recommended that a strong conservation-based rate structure be instituted for both residential and nonresidential customers. A three-tiered, inclining block structure is recommended for the SFR category. An incentive-based rate structure is recommended for the multi-family and nonresidential categories, as well.
2. **Public outreach materials and events, NCSD landscape/demonstration garden, technical assistance (water audits, etc.) and other supportive measures.** These measures will complete the core measures program foundation upon which the rest of the program is built.

NON-CORE MEASURES PROGRAM:

1. **High-efficiency clothes washer rebates in increments of 10% (~365).** Each increment is projected to produce 3.45% water savings for the entire District, all categories. This program can be easily accomplished, and has a quick, high-rate return in water savings.
2. **Indoor plumbing (non-toilet) retrofit and leak detection aids, in increments of 250 residences (6.9% of residences in 2008).** This measure will add only 0.06% savings, if estimated on its own, but the savings will be increased when it is considered as part of the water-audit/education and leak-detection program.
3. **Irrigation efficiency equipment in increments of 250 residences (6.9% of residences in 2008)..** Quantifiable savings are not available for this measure. However, especially when provided as part of a water audit/leak-detection program, this measure will serve as incentive to save water in the landscape.

ORDINANCE:

To gain the most customer support possible for the water conservation program, it is recommended that the Board consider enacting an ordinance which guarantees customers that the water they conserve will not be used for new growth.

NOT RECOMMENDED BUT AVAILABLE FOR CONSIDERATION:

- **Ultra-low-flow toilet replacement rebate.** This program would be the #1 choice for non-core measures if SLO County was not considering it as part of its Level of Severity III mitigation program. Should the County not elect to include this in its program, and should additional water conservation be needed, the ULFT replacement program would be a strong candidate.
- **Hot-water on demand.** There is not yet enough in the way of demonstrated savings, and there are too many variables for success in the home, for this measure to be recommended now. However, in the future this measure could be revisited and further search for newer studies could be made.
- **Turf replacement with xeriscape planting rebate.** This measure has repeatedly shown very gratifying return for the funds invested by the program sponsor. However, it is a more complicated program to design, launch, administer and monitor and, unless the core program is not accepted intact, or further water savings are needed, it is recommended that the recommended core and non-core measures be instituted first, with further decision made on the xeriscape program after the recommended measures' returns are demonstrated.

- **Smart ET-controller irrigation rebate.** This measure would be the most complicated and time-consuming to design, launch, administer and monitor. However, the reported returns are huge. If the recommended measures are not sufficient to meet District's water conservation goals, then this measure could be considered.

In Closing

The NCSD and its customers are facing water challenges that can only be met with proper planning and customer support. Water conservation plays a vital role in meeting these challenges. Fortunately, there is a wealth of information and statistics compiled by those who have been down this road before us, and we are now on notice regarding the anticipated impending "permanent drought" that may affect us as early as 2050, the anticipated multi-year drought in the nearer future, and the insecurity of the provision of State water. Throughout the State of California, politicians and managers of water suppliers are taking the lead in initiating plans now for the events predicted to occur in the future.

People in the future will look back on those making water policy decisions at this crucial point, and will view us as either heroes or failures. By moving forward now in a decisive manner, we stand a chance of being regarded as the former and not the latter.

CALIFORNIA URBAN WATER CONSERVATION COUNCIL
BEST MANAGEMENT PRACTICES

1. **Water survey programs for single-family residential and multi-family residential customers.** Survey, including water audit, 15% of residential customers within 10 years.
2. **Residential plumbing retrofit.** Retrofit 75% of residential housing constructed prior to 1992 with low-flow showerheads, toilet displacement devices, toilet flappers, and aerators.
3. **System water audits, leak detection and repair.** Audit the water utility distribution system regularly and repair any identified leaks.
4. **Metering with commodity rates for all new connections and retrofit of existing connections.** Install meters in 100% of existing un-metered accounts within 10 years; bill by volume of water use; assess feasibility of installing dedicated landscape meters.
5. **Large landscape conservation programs and incentives.** Prepare water budgets for 90% of commercial and industrial accounts with dedicated meters; provide irrigation surveys to 15% of mixed-metered customers.
6. **High-efficiency washing machine rebate programs.** Provide cost-effective customer incentives, such as rebates, to encourage purchase of machines that use 40% less water per load.
7. **Public information programs.** Water utilities to provide active public information programs to promote and educate customers about water conservation.
8. **School education programs.** Provide active school education programs to educate students about water conservation and efficient water uses.
9. **Conservation programs for all commercial, industrial and institutional accounts.** Provide a water survey of 10% of these customers within 10 years and identify retrofitting options; OR reduce water use by an amount equal to 10% of the baseline use within 10 years.
10. **Wholesale agency assistance program.** Provide financial incentives to water agencies and cities to encourage implementation of water conservation programs.
11. **Conservation pricing.** Eliminate non-conserving pricing policies and adopt pricing structure such as uniform rates or inclining block rates. Incentives to customers to reduce average or peak use, and surcharges to encourage conservation.
12. **Conservation coordinator.** Designate a water agency staff member to have the responsibility to manage the water conservation programs.
13. **Water waste prohibition.** Adopt water waste ordinances to prohibit gutter flooding, single-pass cooling systems in new connections, non-re-circulating systems in all new car wash and commercial laundry systems, and non-recycling decorative water fountains.
14. **Residential ultra-low flow toilet (ULFT) replacement programs.** Replace older toilets for residential customers at a rate equal to that of an ordinance requiring retrofit upon resale.

XERISCAPE: SEVEN PRINCIPLES

1. Planning and design. Assessing the landscape for exposure, topography, climate, soil, planting zones (hydrozones). A good design is the backbone of a good xeriscape.

- Start the project with a basic scaled drawing of the property, including buildings, walks, and other hardscape.
- Identify sunny and shady areas, slopes and views.
- Include in your design large shrubs and trees that you wish to remain in the landscape. Be sure to draw them to scale so you don't add new plants too close to the existing plants.
- Evaluate the needs of the people, pets and wildlife who will be using the landscape: play areas for children and/or pets, deck for entertaining, herb garden, cutting garden, vegetable garden, hummingbird/butterfly garden, etc., and incorporate these needs into the design.
- Group plants with similar water and exposure needs into zones to make watering easier and more efficient.
- If an herb, vegetable or wildlife garden is desired, place it so it is up-slope and up-wind from any turf or other areas of the landscape that may require pesticide applications. Toxin-laden wind-drift and run-off should not be allowed into areas where food items will be grown (this includes fruit trees) which, for safety's sake, should not be planted in a lawn or garden area which will be treated with chemicals.

2. Improve the soil. Test the soil for nutrient content by collecting a sample and sending it to a soil labMost soils benefit from adding 2 to 3 cubic-yards of organic matter (such as commercial compost or aged manure) for every 1000 square-feet of landscape area. Soil with adequate organic matter absorbs and retains water much better than OM-poor soil, and the reward will be healthy grass and good plant growth, which will require less water. Note that some native plants have evolved to thrive in poor soil. Check for specific plant requirements.

3. Irrigate efficiently. Review the landscape design and choose the most efficient irrigation for the landscape. The new drought-tolerant plantings will require supplemental water in the first year or two, but afterwards will need little irrigation. Select an irrigation system that can be programmed depending on the needs of the plant and climate. Choose appropriate, efficient spray heads and/or emitters. Maintain the system regularly, assessing for distribution uniformity and amount delivered. As the landscape matures, the needs of the plants will change. Once plants have reached the desired size, experiment with decreasing the amount or frequency of irrigation. Any excess growth beyond the size you want is water, money, and maintenance-energy wasted.

4. Limit traditional turf areas. Include only the amount of turf actually needed in the landscape. Replacing all or a portion of an existing lawn area with other attractive landscaping will save money in water costs, maintenance, and chemicals. Consider using a turf alternative, such as *Carex praegracilis,* which is very drought tolerant.

5. Select appropriate plants. A wide selection of plants are available for xeriscaping. Choose plants based on the role they will play in the landscape. Group plants according to water and exposure needs. Place plants grown for eating (fruit trees, herb garden, vegetable garden) up-wind and up-slope from plants, such as turf grass, that may require applications of toxic chemicals. BE SURE TO SELECT PLANTS THAT ARE NOT INVASIVE IN YOUR AREA.

6. Use mulch. Mulch moderates soil temperatures, increases the soil's moisture-holding capacity, increases the soil's fertility (cation-exchange capacity), slows erosion, and suppresses weeds that would compete with landscape plants for nutrients and water.

7. Maintain regularly. All landscapes need some maintenance, even xeriscape landscapes. Maintenance can be decreased, once plants have reached the desired size, by decreasing the amount of irrigation applied. It will save money and energy spent on irrigation and maintenance.

Nipomo Community Services District
148 S. Wilson, P.O. Box 326
Nipomo, CA 93444
Phone: (805) 929-1133

UTILITY SERVICE BILL

Service Address	Billing Date	Due Date	Total Amount Due

TO AVOID PENALTY, PAYMENT MUST BE RECEIVED ON OR BEFORE DUE DATE.

Account Number	Amount Paid

PAYABLE TO: **Nipomo CSD** **MAIL TO:** **P.O. Box 326, Nipomo, CA 93444**

--Detach and return above portion with your payment. Retain lower portion for your records—

NIPOMO COMMUNITY SERVICES DISTRICT • UTILITY SERVICE BILL
148 S. Wilson, P.O. Box 326, Nipomo CA 93444 (805) 929-1133

Service Address	Account No.	From	To	Due Date

Meter Read (In Units)
1 Unit = 100 hundred cubic feet = 748 gallons

Prior Meter Read: xx Current Meter Read: xx

Usage This Period: xx Usage One Yr. Ago: xx

Tiered Rates:
Water charges are based on consumption per tier.

Tier	From, To	Charge/Unit	Charges	% of Charges
1	1-20	$x.xx – x.xx	$xxx.xx	xx%
2	20.5-30	$x.xx – x.xx	$xxx.xx	xx%
3	30.5-40	$x.xx – x.xx	$xxx.xx	xx%
4	40.1 +	$x.xx – x.xx	$xxx.xx	xx%

CHARGES

Previous Balance:

Water Service:

Water Use:

Total Current Charges

TOTAL NOW DUE:

WATER USE IT WISELY

Water Conservation Tip: xxx xxx xxx

Note from NCSD: Your water usage this period was in the top xx% of all customers billed.

WATER USAGE HISTORY

Year	January	February	March	April	May	June	July	August	September	October	November	December
2006												
2007												

APPENDIX IV REFERENCES

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"Based on policies contained in the Water Element of the General Plan, the City has adopted a per capita planning use rate of 145 gallons per person per day (gpcd) for projecting future water supply needs and determine the availability of water for new development. The 145 figures Is not the amount that the average person uses but takes into account all water uses including residential, commercial, industrial, landscape, etc. The city wide water use is monitored to insure that actual use remains below the adopted planning figure so that the City does not exceed our available water resources." Pg. 3

"This last year's per capita water use was approximately 122 gpcd, a decrease from the last year's use of 126 gpcd." Pg. 3

"The non-residential water savings have been achieved through the replacement of pre-rinse spray valves in restaurants, hospitals and grocery stores city-wide, with water conserving hardware. Like the toilet retrofit program, this is a "hard-wired" water conservation measure that will provide reliable, ongoing water savings estimated at 20 acre feet per year." Pg. 6

"The Water Conservation Program is an integral part of the City's overall water management strategy and is now being considered as a new source of supply, contributing to our safe annual yield based on the water saved." Pg. 7

"With the adoption of the UWMP in 1994, toilet retrofitting had been identified as a significant water demand management strategy and integral part of the City's overall water management plan." They replaced "...approximately 83% of all toilets within the City of San Luis Obispo. This represents an annual estimated water savings of over 1,400 acre feet." Pg. 8

"As part of the 2001-03 Financial Plan, a High Efficiency Washing Machine Rebate Program was implemented. A $150 dollar rebate was offered for qualifying machines. The budgeted amount was for 100 machines for each fiscal year. Funding for the 2001-02 and 2002-03 fiscal years was fully utilized by January 2003....It is estimated that about 6 acre feet of water will be saved annually by these water efficient machines with considerable energy savings as a side benefit." Pg. 9

According to table entitled "Washing Machine Rebates," (Pg. 9), a total of 354 rebates have been given, with a total estimated savings of 5.97 afy.

"During 2005, 1,814 HUL were sent to single family residential customers. The program targets residential customers that use more than 50 units of water during a two month billing cycle between April and November. From the November through March, letters are sent to customers using more than 40 units during a billing period. Conservation staff developed a monitoring system in an effort to quantify the water savings resulting from this effort. Based on the data analyzed from 2003 through 2005, the HUL program is conservatively saving an average of 100 acre feet of water per year." Pg. 10

"There are about 450 irrigation only accounts in the City. Of these approximately 80 water budgets have been developed....The goal is to inform customers that they could reduce their water use and associated bills, if their irrigation systems were operated more efficiently." Pg. 11

"The commercial sector program focused on restaurant dishwashing hardware. The City, partnering with the California Urban Water Conservation Council (CUWCC) completed the installation of 100

water/energy efficient pre-rinse spray valves in restaurants, hospitals and grocery stores city-wide. Each valve will save about 50,000 gallons of water and 335 therms of natural gas per year. A majority of the program costs were funded through a California Public Utilities Commission grant which was administered by the CUWCC The City cost was $50.00 per valve. This included the valve, the canvassing and contact with the potential recipients and installation of the valve. The City's cost per acre foot of water saved, based on the life of the valve, is less than $10.00 per acre foot, with an estimated annual savings of about 20 acre feet per year." Pg. 11

"The water saved through Water Conservation Program, historically, has been the least cost option when looking at new sources of supply. The City has implemented numerous programs over the years which have resulted in a dramatic decrease in per capita water use. When evaluating the potential yield from a new conservation measure, it is very important to factor in the reliability of the program to achieve the estimated savings. That is why, in the past, toilet and showerhead replacement had been the cornerstones of the Water Conservation Program. Pg. 11

"As previously stated, numerous studies statewide are currently underway which are evaluating new water conservation technology. Advancements in irrigation technology equipment appears to be the next major source of water savings." Pg. 12

"The third area of focus will be to continue to improve our conservation efforts. Efficient use of our resources stretches the availability of our water supplies and has proven to be very cost effective." Pg. 13

SLO Rates: website

SFR	Inside City	Outside City
1-5 ccf	3.28	6.56
5-25 ccf	4.11	8.22
>25 ccf	5.14	10.28
All Other Customers		
1 to 5 ccf	3.28	6.56
>5 ccf	4.11	8.22

SUMMARY: California could reduce residential outdoor water use by 25% to 40% through landscape management, hardware improvements, and landscape design. Improved efficiency and increased conservation are the cheapest, easiest and least destructive ways to meet CA's future water needs by using technology, economics, smart regulation, information, and integrated water management strategies.
--Gleick, P.H., Haasz, D. Waste not, want not. Pacific Institute. http://www.pacinst.org/reports/. 2003.

SUMMARY: Residential water demand in US averages 26 billion gallons per day, 7.8 billion gallons per day dedicated to outdoor use, primarily lawn watering, (USGS, 1998).
--Vickers, A. Water use and conservation. WaterPlow Press. Amherst, MA. 2001.

SUMMARY: In 1995 Albuquerque adopted the Water Conserving and Water Waste Ordinance that established a 20% turf limit for residences and required all new city properties except parks and golf courses to landscape with 100% low and medium water using plants. Combined with a new conservation-based water rate structure, a public education program, a high-efficiency plumbing program, they successfully slowed down the draw down of the groundwater supply and reduced per

person usage 23% from 250 gallons per person per day (946 liters) in 1995 to 193 gpcd (730 liters) in 2003.
--Albuquerque, New Mexico: Long-range planning to address demand growth. Cases in water conservation: how efficiency programs help water utilities save water and avoid costs. US EPA. July 2002. http://www.epa.gov/owm/water-efficiency/utilityconservation.pdf

SUMMARY: Volusia County has become the first in Florida to pass an ordinance requiring new homes to have less grass: at least 25% of new yards must have landscapes requiring little or no irrigation. According to the Orlando Sentinel, "Florida homeowners now maintain more than 3.8 million acres of lawn with 50,000 acres of new grass planted every year."
--Florida county restricts lawns. WaterWiser, American Water Works Association. http://www.awwa.org/waterwiser/watch/archive.cfm. September 2004.

SUMMARY: New single and multi-family residences will have no more than 50% of the total irrigated landscape dedicated to high irrigation water use zones including turf, annuals, and vegetable gardens. Website includes checklists, diagrams, basic Florida water info, and landscape design and irrigation info.
--Sarasota County (Florida) Water Efficient Landscaping Regulations (Ordinance #2001-081). http://sarasota.extension.ufl.edu/WEL/ord/docs/ord.htm. 2001.

SUMMARY: The comprehensive landscape code adopted in 1991 applies to new multifamily, commercial and industrial development. Limits non-drought tolerant plants to a small 'oasis' areas (less than 5% of total). Requires water-conserving irrigation systems and the use of storm water run-off.
--Tucson, Arizona xeriscape landscaping and screening regulations- ordinance 7522. http://www.tucsonaz.gov/water/ordinances.htm. 1991.

SUMMARY: Ordinance prohibits property associations, both residential and commercial, from requiring mostly high water-use grass in yards. Intends to ensure that all property owners can choose to plant a xeriscape if they wish. Up to 20% can be planted in high water-use grass. Legitimate public interest, avoiding environmental damage caused by over pumping Albuquerque's ground water supply, was justification for this action.
--Albuquerque halts requirements for turf. WaterWiser. American Water Works Association. http://www.awwa.org/waterwiser/watch/. April 2004.

SUMMARY: As part of Castle Rock's ongoing campaign to reduce water consumption, home owner association leaders could face a $1,000 fine and risk arrest if they penalized home owners who want to use less grass and more drought-tolerant plants. Colorado State law prohibits new developments from mandating irrigated turf or banning xeriscaping. Castle Rock's ordinance applies to existing communities as well.
--Bunch, J. Prospects greener for lawn alternatives in Castle Rock. Denver Post. November 9, 2004.

SUMMARY: Recommended water saving features for homeowner controllers: 3 independent programs; station run times from 1-200 minutes; three start times per program; odd/even, weekly and interval program capability up to 30 days; water budgeting from 0-200%; 365 day calendar; non-volatile memory or battery back-up; "Off", "Auto", and "Manual" operation modes without disturbing programming; rain shut-off device capability; diagnostic circuitry to notify homeowner when station is shorted or power failure has occurred.
--Irrigation controllers: timers for the homeowner. US Environmental Protection Agency et al. http://www.epa.gov/owm/water-efficiency/index.htm. July 2003.

SUMMARY: Most irrigation inefficiency occurred during the fall. Sites maintained by contract landscapers were irrigated less efficiently. Sites less than two acres achieved the highest

percentage water savings. Audit water savings diminished over time (20.1%, 7.6%, and 6.5% over three years.)
-- *Whitcomb, J.B. Landscape water audit evaluation. Contra Costa Water District. August 1994*

SUMMARY: Notes Santa Clara Valley Water District's Irrigation Technical Assistance Program: 55% decrease in water use (TriNet example); North Marin study: water conserving landscapes use 54% less water; and Irvine Ranch Water District: pricing, water budgets, rebate and loan program, education and outreach very effective bringing water application to 60% of ET since 1995.
--Gleick, P.H.; Wong, A.K. Sustainable use of water: California success stories. Pacific Institute. http://www.pacinst.org/reports/. January 1999.

SUMMARY: Homeowner associations, schools, commercial sites, and public parks at 25 sites covering 83 acres were retrofitted with weather-based irrigation technologies (WeatherTrak-Hydropoint and Water2save LLC). These technologies reduced water use from 17 to 28 percent. Landscapes with dedicated irrigation meters saved 56 acre-feet per year, those with mixed-use meters saved 26 acre-feet per year. Program success depends upon landscaper participation and support and convincing customers of the dollar benefits they will experience.
--Bamezai, A. Los Angeles Dept. of Water and Power weather-based irrigation controller pilot study. LADWP. http://www.cuwcc.org/uploads/product/LADWP-IrrigationController-Pilot-Study.pdf. August 2004.

SUMMARY: Test controllers were installed in 40 homes. Compared to the reference group, the retrofit group had a 16% reduction in estimated outdoor use, 37 gallons per household per day. Post-trial survey indicated 97% of those with ET controllers found them convenient and improvement or no change to the appearance of the landscape.
--Hunt, T.; Lessick, D. et al. Residential weather-based irrigation scheduling evidence from the Irvine "ET Controller" study. Irvine Ranch Water District. http://www.irwd.com/welcome/FinalETRpt.pdf. June 2001.

SUMMARY: Chapter VII- Residential and Small Commercial Weather-Based Irrigation Controllers summarizes information about weather-based controllers. Irvine Ranch Water District estimated a 10% reduction in total household consumption with outdoor consumption reduced by 24%. Similar studies in Denver, CO, Sonoma, CA and Valley of the Moon, CA estimated 21%, 23%, and 28% declines in outdoor consumption. Programs must include significant levels of outreach and inclusion of green industry. Targeting of high-water users is important. Should tie to rates.
--Koeller, J. A report on potential best management practices. Prepared for California Urban Water Conservation Council. August 2004.

SUMMARY: Weather-based controllers resulted in water savings of 41 gallons per day in typical residential settings and 545 gpd for larger dedicated landscape irrigation accounts. Reduction in runoff was 50% comparing pre-intervention and post-intervention periods and 71% in comparison to the control group. In terms of cost effectiveness, initial targets for program expansion should be large landscapes such as parks and street medians.
--Residential runoff reduction study. Municipal Water District of Orange County and Irvine Ranch Water District. http://www.mwdoc.com (Using Water Wisely). July 2004.

SUMMARY: Best development practices that improve on-site management of storm water runoff include minimizing impervious surfaces, preserving native soil and vegetation, and establishing minimum soil quality and depth standards in landscaped areas. Requires a topsoil layer with a minimum organic matter content of 10 percent with a minimum depth of 8 inches. Subsoils to be scarified (loosened) at least 4 inches.
--Manual 2002 guidelines & resources for implementing soil depth & quality. Washington State. 2002.

SUMMARY: The District initiated the study to determine whether the installation of artificial turf impacts groundwater or surface water quality. Preliminary lab results indicated primary concern regarding heavy metals above secondary drinking water standards (zinc) and above current concentration in the groundwater basins (zinc, copper, barium, and chromium. Collection and treatment of water from sites where artificial turf is installed may decrease the water quality impacts of artificial turf. Other concerns include human health impacts and environmentally safe disposal.
--Ashktorab, H. Artificial turf. Santa Clara Valley Water District. Personal correspondence. 2/1/2005.

SUMMARY: Xeriscape sites used 17% less water than traditionally landscaped single family sites in a study of 382 homes.
--Nelson, J.O.; Kruta, J.C. Water saved by single family xeriscapes. 1994 Annual conference proceedings; American Water Works Association. June 1994.

SUMMARY: Study quantified savings estimates of what a xeriscape conversion facilitation program could yield under real world conditions. The Southern Nevada Water Authority's Water Smart Landscape Program produced a 37% positive return, bringing in $1.58 for each $1.00 spent on rebate incentives, freeing up local water resources for immediate use. The averages savings of 30% (96,000 gallons) annually for those who converted from turf to xeriscape. Residents applied 73 gal/sq ft/year to turf, 17.2 gal/sq ft/yr to xeric landscapes, a per unit area savings of 55.8 gal/sq ft/yr. The savings were most pronounced in summer. Total yearly savings neither eroded or improved across the years. The average cost to convert was $1.55/sq ft, homeowner installed $1.37, contractor installed $1.93. The xeric ETo was about 33% of the ETo of turf. The average savings in landscape management was 2.2 hours per month and $206 per year in maintenance expenditures.
-- Sovocool, Kent A. Xeriscape conversion study final report. Southern Nevada Water Authority. 2005

SUMMARY: In response to severe drought, Clark County School District is considering a plan to remove more than 2 million square feet of existing turf that could save an estimated 60 million gallons of water a year. With 289 schools and 189 acres of landscaping, the sixth-largest school district in the nation is the largest single water user in southern Nevada. Turf is being replaced with desert landscaping or artificial turf.
--Vegas-area schools consider removing turf to save water. WaterWiser, American Water Works Association from US Water News. http://www.awwa.org/waterwiser/watch/archive.cfm. September 2004.

SUMMARY: Metropolitan Water District of Southern California approved another $3.2 million for ongoing campaign to reduce outdoor water use by switching to drought-tolerant plants and setting sprinklers correctly. Outdoor water use can account for 40% to 70% of a home's total water use. The agency set up a website, www.bewaterwise.com, and partnered with The Home Depot and others to highlight drought-tolerant plants and offer classes. Cathedral City initiated a pilot program to offer residents up to $500 to transform front lawns to desert landscapes.
-- Bowles, J. Anti-drought push gets funds. Riverside Press-Enterprise. 10/13/2004.

SUMMARY: SNWA offers a range of free services and rebate programs to help homeowners and businesses become water smart including $1 per square foot for grass converted to xeriscape; irrigation clock upgrade rebates, a landscape awards program, and listing of water smart landscapers.
--Water Smart Rebates and Services. Southern Nevada Water Authority. http://www.lvvwd.com/html/ws_rebates.html. 2003.

SUMMARY: Provides comparative information on California water charges for a typical single family residence monthly water service charge for an assumed average water usage of 1,500 cubic feet (11,000 gallons) per month. Of the 350 water purveyors surveyed, 49% used uniform rate structures, 41% tiered rates, 1% declining block rates, 9% some other rate structure. Down from 24% in 2001,

16% collected additional revenues from various sources such as grants, contributions from other funds, special assessments, general fund transfers and property taxes. The service charge is relatively comparable among the four regions of the state: Northern, Coastal, San Joaquin Valley and Southern, around $11 per month. The commodity charge is the main variant between typical bills in the four regions. Water costs for the San Joaquin Valley are one-fourth of that in the Coastal region and about one-half of that in Northern and Southern California.
-- *California Water Charge Survey 2003. Black and Veatch. 2003.*

SUMMARY: This study ooks at the revenue and rate implications of conservation programs in the short and long term and how water suppliers respond to reduced sales. Water conservation can help utilities avoid both fixed capital and variable operating costs by avoiding investments in unnecessary capacity to meet inflated demand. Conservation should be viewed as a means to lower the long term cost structure and thereby reduce the revenue requirements of the water utility. It is important to communicate benefits to the customers. The revenue effects of water conservation are manageable when viewed from a planning perspective and when planning and ratemaking are integrated.
-- *Chesnutt, T. Beecher, J. Draft white paper: revenue effects of conservation programs: the case of lost revenue. March, 2003.*

SUMMARY: Conservation pricing, separate meters and public education resulted in a 43% water reduction in landscapes. Eighty percent of landscaped acres are served recycled water.
--*Highlights of Irvine Ranch Water District's landscape conservation program. Water Conservation News. July 1997.*

SUMMARY: End use of water consumes more energy than any other part of the urban water conveyance and treatment cycle. By reducing peak demand, water conservation can eliminate or delay the need for expanding treatment facilities or decrease the size of the expansion needed and help avoid power shortages. Peak demand for water coincides with peak seasonal demand experienced by electrical utilities.
--*Cohen, R.; Nelson, B.; Wolff, G. Energy down the drain: the hidden costs of California's water supply. Natural Resources Defense Council and Pacific Institute. August 2004.*

SUMMARY: About 2,000 landscaping jobs in Colorado were lost between 2002 and 2003 because of continuing drought conditions, in the $1.67 billion industry including landscaping, nurseries, garden centers and commercial florists with revenues dropping $60 million. To increase business, some landscapers have added artificial turf to their businesses as well as designing landscapes with drought-tolerant plants and emphasizing more efficient irrigation systems. Sales of container gardens and drought tolerant plants soared. S. Nevada Water Authority banned sod planting in new residential front yards, limited grass to 50% in back yards, and offered rebates of $1 per square foot for turf removal.
-- Shore, S. Landscapers suffer as drought lingers throughout the West, strategies for a water crunch. Associated Press. 5/16/2004.

Sovocal, Kent A. *Xeriscape Conversion Study, Final Report, 2005.* Southern Nevada Water Authority.

"The experimental study involved recruiting hundreds of participants into treatment groups (a Xeric Study and a Turf Study Group and control groups), as well as the installation of submeters to collect per unit area application data. Data on both household consumption and consumption through the submeters was collected, as well as a wealth of other data. In most cases, people in the xeric study group converted from turf to xeriscape, though in some cases recruitment for this group was enhanced by permitting new landscapes with xeric areas suitable for study to be monitored. Portions of xeric areas were then submetered to determine per-unit area water application for xeric

landscapes. The TS Group was composed of more traditional turfgrass-dominated landscapes, and submeters were installed to determine per-unit area application to these areas as well. Submeter installation, data collection, and analysis for a small side-study of multi-family/commercial properties also took place.

"Results show a significant average savings of 30% (96,000 gallons) in total annual residential consumption for those who converted from turf to xeriscape. The per-unit area savings as revealed by the submeter data was found to be 55.8 gallons per square foot (89.6 inches precipitation equivalents) each year. Results showed that savings yielded by xeriscapes were most pronounced in summer. A host of other analyses covering everything from the stability of the savings to important factors influencing consumption, to cost effectiveness of a xeriscape conversion program are contained within the report."..." In the Mojave Desert of the southwestern United States, typically 60 to 90% of potable water drawn by single-family residences in municipalities is used for outdoor irrigation."

Whitcomb, J., Water Price Elasticities for Single-Family Homes in Texas for City of Austin, Stratus Consulting, April 1999.

"Studies done within the region have shown a price elasticity of approximately -0.20. This means that for every 10 percent increase in water prices a resulting 2.0 percent reduction in water use may be anticipated. Increase in average income must be factored in by the utility to determine the actual net impact on consumer perception and response to price. For planning purposes this number may be used."

Urban Water Pricing and Drought Management
Moncur, JET
"In periods of drought, urban water systems commonly rely on nonmarket programs to induce temporary conservation, leaving the marginal price of water unchanged; an alternative is to raise the price. Using pooled cross-sectional and time series observations on single-family residential customers of the Honolulu Board of Water Supply (1982), demand for water is estimated as a function of price, income, household size, rainfall, and a dummy variable denoting a water restrictions program. Short-run elasticities suggest that an increase in marginal price of less than 40% would achieve a 10% reduction in water use, even during a drought episode. An accompanying conservation program would mitigate the necessary price increase , but only slightly."

Water Resources Research WRERAQ Vol. 23, No. 3, p 393-398, March 1987. 2 fig, 4 tab, 19 ref.

Water Conservation Measures. **Municipal Research and Services Center of Washington (http://www.mrsc.org/)**

"One of the most effective tools for water conservation is the rate structure. Rate structures and practices that promote the efficient use of water should be the goal to ensure sufficient resources to meet competing uses."

Vickers, Amy. ***Handbook of Water Use and Conservation.*** **Amherst, MA: 2001.**

"Increased block rate structures, seasonal rate charges, and other pricing strategies may be used to help reduce demand." Pg. 143

"The Irvine Ranch Water District (IRWD) in Irvine, California, has used pricing strategies successfully to discourage excessive outdoor water use. By implementing an increasing block rate structure, the IRWD has reduced outdoor watering among customers by nearly 50%." Pg. 144

"This [water conservation] approach has saved considerable capital and operating costs for utilities and consumers, avoided environmental degradation, and built political bridges instead of walls." (Preface)

Hutchins-Cabibi, Taryn (Western Resource Advocates). *Better Water Rate Structures Can Encourage New Mexicans to Conserve.* February 2006.

"In a new report, *"Water Rate Structures in New Mexico: How New Mexico Cities Compare Using this Important Water Use Efficiency Tool,"* Western Resource Advocates and Professor Denise Fort of The University of New Mexico, School of Law, take a close look at the wide variety of water rate structures in New Mexico cities, ranging from those that promote efficient water use to those that actually encourage wasteful use. Report findings show that, with some adjustment, new water rate designs in New Mexico cities can better protect water resources while meeting urban water supply demands. The clear conclusion: if designed appropriately, increasing block rate structures are most effective at encouraging efficient water use."
-- Hutchins-Cabibi, Taryn (Western Resource Advocates). Better Water Rate Structures Can Encourage New Mexicans to Conserve. February 2006.

***Nipomo Community Services District Water and Sewer Financial Plans, User Rates and Capacity Charges, Final Report.* The Reed Group, 2006. Pg. 36**

"The typical single family residential customer in the Town Division uses an average of 32 HCF per bi-monthly billing period. The typical single family customer in the Blacklake Division uses an average of 38 HCF per billing period." Per table, fiscal year 2006-2007 typical charges are Town $64.18, Blacklake $68.65.

***"Where does my water come from?"* Water Education Foundation (http://www.water-ed.org)**

About 30 percent of California's total annual water supply comes from groundwater in normal years, and up to 60 percent in drought years.

Stallworth, Holly. *Conservation Pricing of Water and Wastewater.* April, 2000. Environmental Protection Agency.

"The most frequent economists' response to the imperatives of environmental protection and resource conservation is to use the price mechanism more strategically. "Full costs" refers to the complete societal costs (environmental, social and actual) that pertain to the production and

consumption of a good or service. Economics shows us that social welfare is maximized when all costs are reflected in prices. This is sometimes referred to as "full cost pricing" or the "polluter pays principle." Only then do our production and consumption decisions take into account all costs to society, resulting in the most appropriate balance of supply and demand. When prices are artificially low, we tend to consume too much. When prices are artificially high, we tend to consume too little...

"...From an environmental economics perspective, pricing can be an extremely valuable public policy tool. Prices can be more than a means of meeting revenue requirements or even turning a profit. Environmental economists have long advocated bringing the price mechanism more fully in line with "full costs" so that "users" might respond to "market signals" – reflecting the true and full costs of production and consumption. Since water is basic to life, and certainly to our quality of life, the pricing of water can be a powerful means of signaling this importance and scarcity to water users, most of whom experience very little connection between their water usage and their total bill. In our current era in which water demands are increasing while water supplies are constant or diminishing, it is important to apply economic tools to communicate the true value of fresh water. Pg. 4, 5

"...Water's importance to our survival renders it, quite literally, "priceless" but this intrinsic value of water is frequently left out under the traditional pricing method -- known as cost-based pricing -- which is an accounting system designed to ensure the financial self-sufficiency of water and wastewater systems.

"This pricing method quantifies the costs of capture, treatment and conveyance. As such, this method can often obscures the larger but less quantifiable societal interests in preserving our water resources. Moreover, given the very high fixed costs associated with water and wastewater facilities, cost-based pricing can predispose rate setting against variable (i.e. commensurate with usage) charges and thus can run counter to conservation goals.

"Cost-based pricing does not to be in conflict with conservation pricing. Supplementing cost-based pricing with incentives for consumers to manage demand is a combination that serves both financial and environmental goals. Another term that is sometimes used is "demand management pricing" to reflect the underlying motivation to lower water demand (or slow the rate of demand growth).

"Water and wastewater demand can be manipulated by price *to some degree*. Water for necessities (sanitation, cleaning and cooking) is far less responsive to price than water for more discretionary uses (lawn watering, car washing, swimming pools).... Pg. 13, 14

"...Clearly, water is "inelastic", meaning that when the price increases, consumption decreases but at a lower rate than the increase in price. Unlike such large factors as the weather, population growth, local geology and hydrology, and the economy; water managers can influence water rates, albeit with an appreciation for the consumers' response. Moreover, utility managers need to consider that price increases will not likely affect the behavior of many middle and upper income groups. For these groups, stiffer price increases or other conservation strategies might be tried.... Pg. 14

"Prices can be used to modify customer behavior to use less water at the tap, stop and prevent leakage and waste, and send less wastewater for treatment. To achieve the efficiency gains that will enable water system managers to postpone the need for new capital outlays, water utilities and local governments will need to expand their toolkit to include the widest array of conservation-oriented initiatives using prices as well as measures like universal metering, water accounting and use audits, retrofitting and public education...Pg. 14

"...In addition to the politics of competing interests that can dominate rate setting, three key issues emerge: the service population's ability to afford higher rates, the effects of conservation rates on a utility's revenues, and their actual effectiveness in reducing water demand....Pg. 16

A&N Technical Services, Inc. ***BMP Costs and Savings Study: A Guide to Data and Methods for Cost-Effectiveness Analysis of Urban Water Conservation Best Management Practices.*** **March 2005.**

"An important step in conservation pricing is accounting for water demand's reponse to charges in the real price of water. A "first-order" estimate of demand response can be obtained by multiplying the scheduled change in price by a price elasticity (assuming Eta_{price} approx.=.09) to produce a predicted change in use. For example, 10 percent increase in price would yield approximately one percent decrease in use (DeltaP x Eta_{price} = .10 x (-.09)).

"The reason why predicting demand response is difficult is obviously not due to the intricate algebra—change in price times the price elasticity. Instead, demand response predictions go wrong because inaccurate values are used in the prediction. The change in price, DeltaP, should be expressed in inflation-adjusted "real" terms. When wastewater costs are recovered through a commodity charge on water use, this adds an additional price to water consumption that needs to be incorporated into the measure of price. The other parameter in the equation (the price elasticity parameter Eta_{price})

"Persistence: There are two applicable estimates of water savings that can result from conservation pricing:

1. Water reductions that can be expected in the long run, and
2. Water reductions that can be expected in the short run.

"Table 2 is an often-cited summary of empirical price elasticity estimates, taken from Dziegielewski, et al. (1991), refers to **long run** price estimates.

Table 2: Summary of Long Run Elasticity Estimates for Planning Purposes	
Single Family Residential Customers	Range of Estimates
Winter season	-.10 to -.30
Summer Season	-.20 to -.50
Multiple Family Residential Customers	
Winter season	-.00 to -.15
Summer season	-.05 to -.20
Source: Dziegielewski, et al. (1991)	

"Analysts should note that these ranges apply to long run price elasticity estimates for the purpose of long run water planning. These are the estimates that would be required for estimates of the long run costs that are avoided by implementation of conservation planning. *They are not sufficient for rate design and financial planning.*

"Revenue prediction for rate design requires a short run price elasticity estimate that would reflect the demand response possible within a one- or two-year period. Most of the published empirical literature on price elasticity focuses on long run estimates. Estimates of short run price elasticities are not as common. Table 3 is from CUWCC's Handbook on *Designing, Evaluating and Implementing Conservation Rate Structures.* It provides the following recommended ranges for short run price response.

Table 2: Summary of Short Run Elasticity Estimates for Planning Purposes	
Single Family Residential Customers	Range of Estimates
Winter season	-.00 to -.10
Summer Season	-.10 to -.20
Multiple Family Residential Customers	
Winter season	-.00 to -.05
Summer season	-.05 to -.10

Source: Designing, Evaluating, and Implementing Conservation Rate Structures, July 1997

"In rate design, it is important not to make the mistake of using long run response estimates developed for planning purposes..."

Cases in Water Conservation. **U.S. Environmental Protection Agency, July 2002.**

Turf Replacemen: "Padilla and Torres (2004) report 398 gallons per day participant-weighted average savings at commercial and residential sites from a turf rebate program. Sovocool and Rosales (2004) report 33% reduction average, and 39% reduction in the summer months in terms of "main meter" overall consumption at single family residences. More relevant for large landscape is the decrease in mean irrigation use only. Irrigation use, in gallons per square foot per year, was 79 at turf sites and 17 at xeriscape sites. The City of Austin (1999) reports average water savings per participant site of 214 gallons per day in the summer compared to preexisting landscapes as a result of their landscape rebate program."
"Goleta established a water efficiency program that emphaxized plumbing retrofits, including high-efficiency toilets, high-efficiency showerheads, and increased rates. The program was highly successful, resulting in a 30% drop in district water use. Goleta was able to delay a wastewater treatment plant expansion."

"IRWD's primary conservation strategy was a new rate structure instituted in 1991. The five-tiered rate structure rewards water-efficiency and identifies when water is being wasted. The goal is to create a long-term water efficiency ethic, while maintaining stabile utility revenues. After the first year of the new rate structure, water use declinded by 19%. Between 1991 and 1997, the district saved an estimated $33.2million in avoided water purchases.
--*Cases in Water Conservation.* U.S. Environmental Protection Agency, July 2002.

"Since 1989, Tampa's water conservation program has included high efficiency plumbing retrofits, an increasing-block rate structure, irrigation restrictions, landscaping measures, and public education. Particular emphasis has been put on efficient landscaping and irrigation. Tampa's landscape evaluation program resulted in a 25% drop in water use. A pilot retrofit program achieve da 15% reduction in water use.
--*Cases in Water Conservation.* U.S. Environmental Protection Agency, July 2002.

HDR Engineering, Inc. **"Utility Billing System Enhancements, City of San Luis Obispo, Volume 1 – Utility Rate Structure Evaluation." March 2006.**

"Today, water conservation is more important due to constrained water resources in the west. In addition, as the cost of wastewater treatment has increased, many utilities have moved away from flat charges for residential sewer customers and have focused more on volumetric sewer rate structures, out of "fairness or equity" concerns on customer bills...."

"The State of California Urban Water Conservation Council (Water Council) was created to increase efficient water use across California. The Water Council's goal is to integrate urban water conservation with Best Management Practices (BMP's) into the planning and management of California's water agencies/utilities...since the early 1990's, there has been a fairly significant amount of research on the response to water demands, as a result of price. The Water Council noted the following "lessons learned" concerning prices and demand in their recently drafted policy statement concerning water rate structures:

Lesson 1: Rates influence demand.

Lesson 2: "Price elasticity" is the percentage change in demand induced by a one percent change in price, all other factors being constant.
Lesson 3: Demand can be thought of as a sum of demand for different end-uses of water.
Lesson 4: Demand for outdoor use is more price elastic than demand for indoor uses.
Lesson 5: Demand for water during peak (summer) periods is greater than demand during off-peak (winter) periods.
Lesson 6: Reidential water demand is relatively inelastic. The response of residential demand to rate changes, though not zero, is relatively small.
Lesson 7: Demand is more elastic in the long-run than in the short-run.
Lesson 8: Demand is influence by forces other than price –including population growth, the economic cycle, weather fluctuation, and income growth.
Lesson 9: The response of demand is more difficult to predict for large changes in price....

"Water pricing in California does not generally reflect the true cost of water, nor the next increment of water supply.
Consumers generally pay relatively low rates for water, especially when compared to other resources such as electricity and gas.
If an individual user or business does not feel a personal responsibility for the amount of water used montly or annually, teghre is very little motivation to conserve.
New landscape water conservation technologies, design and plant alternatives, and metering options will not achieve the potential water savings unless the water customer is motivated personally or economically to reduce water use...
"...The Water Council's draft policies do provide a definition of a conservation-based rate structure. It is as follows:

'A conservation rate structure encourages efficient water use and discourages waste by ensuring that customer bills communicate the full cost of providing water services, including the cost of new water supplies. A conservation rate structure shall: 1) provide a price signal to customers to reduce average or peak use, or both, and financial consequences for inefficient use; and 2) takes into account the long-term marginal cost rate structure options, water agencies should consider the feasibility of incorporating a peak season or excess use surcharge to encourage appropriate use throughout the year, taking into account the range of climatic and other conditions in their service area. Conservation rates shall be designed to recover the cost of providing service and billing shall be based on metered water use. A conservation rate structure shall also be fair and equitable across customer classes/sectors.'...

"...The Water Council encourages utilities to incorporate a customer education process regarding the environmental and resource value of pricing for conservation and efficiency. It is also necessary to provide the customer with education as to how the rate structure works, resolving allocation variances and in remedying high water use....

"...The Calfiornia Urban Water Conervation Council does provide guidelines encouraging the adoption of volumetric-based sewer utilities. The water Council and other conservation experts believe that having volume-based sewer rates, where the billing is based upon water consumption, may encourage water conservation..."

"...The Water Council and other conservation experts believe that having volume-based sewer rates, where the billing is based upon water consumption, may encourage water conservation..."

"...In contrast to the water utility, implementation of the sewer rate structures, particularly for single-family residential customers, will require more thought. It is difficult to transition from a 10)% fixed rate to a 100% volumetric rate. Therefore, the City should consider some transition period where the fixed charge is reduced and the volumetric charge increased over time. The city certainly could implement a 10)% volumetric charge immediately but HDR's sense is that the City would receive a number of customer complaints concerning the change in the size of the bills. Customer education

and information about the change in billing approaches will be an important element of the rate transition plan."

Water Conservation Programs—A Planning Manual (M52). **American Water Works Association. 2006.**

"Conservation-oriented water rate structures by themselves do not constitute an effective water conservation program. Rate structures work best as a conservation tool when coupled with a sustained customer education program. Customer education is important to establish and maintain the link between customer behaviors and their water bill. Utility customers require practical information about water-conserving practices and technologies. Participation in other water conservation programs, such as plumbing-fixture retrofit and replacement programs, can also be enhanced by rate incentives and customer education. Finally, public acceptance of rate structure changes is often enhanced if customers understand the need for and benefits of water conservation."

Wastewater User Charge Survey F.Y 2006-07. **State Water Resources Control Board, California Environmental Protection Agency, May 2007. http://www.swrcb.ca.gov/**

In a State Water Resources Control Board Wastewater User Charge Survey F.Y 2006-07, 926 surveys were sent, 753 agencies submitted completed surveys, 625 (83%) reported a fixed (flat rate) fee for residential customers. For San Luis Obispo County, 67% (12 of 18 agencies) use a flat fee for residential customers. Arroyo Grande, Avila Beach CSD, Cambria CSD, Grover Beach, Morro Bay and San Simeon use commodity-based charges.

What is the Infrastructure Problem, and What are the Solutions? **H2O Coalition. February 2001.**

"Even though water services have generally been under priced in this country relative to other utility and related services, raising rates significantly for water and sewer is at a minimum a major political and marketing challenge for utilities."

"To minimize any future drain on the Treasury, we believe the water industry should move toward becoming self-sustaining, like the electric, gas, and telecommunication utilities. Since this can happen only if utilities charge their customers full cost of service rates, any assistance program for the industry should be structured to assure water utilities, if they are not already doing so, eventually charge rates that cover the full cost of service. An additional benefit of full cost of service rates is they send the proper economic signals to consumers, helping to assure they make appropriate market choices."

Stavins, Robert. ***As Reservoirs Fall, Prices Should Rise, an Economic Perspective.*** **Environmental Law Institute (The Environmental Forum, November/December 2006.**

"...I can refill an eight-ounce glass 2,500 times with water from the tap for less than the cost of a single can of soda. Under these conditions, it is hardly surprising that we have so little incentive to conserve our scarce water supplies. Throughout the United States, water is under-priced. Efficient use of water will take place only when the price reflects the actual additional cost of making water

available. Lest one fear that higher water rates would mean that Americans would go thirsty, take note: On average, each of us uses 183 gallons of water a day...There is plenty of margin for change if people are given the right price signals.

"Fifty years of economic analyses have demonstrated that water demand si responsive to oprice changes, both in the short term, as individuals and firms respond by making do with less, and in the long term, as they adopt more efficient devices in the home and workplace...

"But prices are typically set well below the social costs of the water supplies since historical average costs are employed rather than true additional (marginal) costs of new supplies....Although water scarcity typically develops gradually across seasons of low rainfall and low accumulations of snow pack, pronounced droughts are usually felt in the summer months of greatest demand. The economically sensible approach is to charge more at these times, but such "seasonal pricing" is practiced by less than 2 percent of utilities across the country."

"A reasonable objection to jacking up the price of water is that it would hurt the poort. But we can take a page from the playbook of electric utilities who subsidize the first kilowatt hours of electricity use with very low "life-line" rates. Indeed, the first increment of water use can be made available free of charge. Whatmatters is that the right incentives are provided for higher levels of usage.

"Droughts, like so many public policy dilemmas, present both challenges and opportunities. Inevitably, citizens and businesses do their best to cope with mandatory restrictions. And with equal inevitability, once droughts have passed and the restraints are lifted, they return to their previous habits of water use and abuse.

"....the affected areas can introduce progressive water pricing reforms that send the correct signals to individuals and businesses about the true value of this precious resource."

Simmons, Ann. *Palmdale Water Board Orders Conservation Measures.* Los Angeles Times. 08/30/2007

"The Palmdale water board voted unanimously Wednesday to clamp down on customers who ignore the city's voluntary water conservation policy, but rejected a resolution that would have imposed mandatory rationing -- at least for now... In May, the district asked its 25,000 customers to reduce water usage by 15% by voluntarily adopting many of these conservation policies, said General Manager Dennis LaMoreaux. But only a 5% reduction was achieved. The agency is now demanding that customers reduce their usage by at least 10%..."

Dobuzinskis, Alex. *Court Could Devastate Water Supply: Half of Southland's Imported Resources from North at Risk.* Los Angeles Daily News, 08/30/2007.

"Southern California officials are bracing for a federal judge's ruling that could cut back the local water supply from Northern California by up to 50 percent. U.S. District Judge Oliver Wanger could rule as early as today after hearing evidence this week in a case brought by the Natural Resources Defense Council that, to protect the endangered smelt fish, could force th state to temporarily shut down pumps in San Joaquin-Sacramento River Delta...Two-thirds of the Southland's imported water comes from the delta via the north-south California Aqueduct, up from ore than one-third several years ago. The rest comes from the Colorado River, which used to provide 60 percent of the district's imported water but is now going through an unprecedented dry spell..."

***If the Levees Fail in California.* Business Week (www.businessweek.com), 08/20/2007.**

"If you were to draw up a list of the most worrisome infrastructure risks facing America, the leak-prone network of levees that run east from the San Francisco Bay up to Sacramento would rank

right near the top. This 2,600-mile-long system of berms protects half a million people, 4 million acres of farmland, and the drinking water supply for most of Southern California. Vulnerable to either an earthquake or flooding, it is "like a ticking time bomb," warns Lester Snow, director of the California Water Resources Dept. "

Duarte, Jesse. ***Water shortage hurts Upvalley vineyards; St. Helena's lower reservoir at less than half its capacity.*** **Napa Valley Register, 08/31/2007.**

"Water conservation measures and the threat of rationing have made St. Helena residents aware of the drought's effect on Bell Canyon reservoir. But the city's lower reservoir is hurting even more. Spring Mountain Vineyard and Robert Louis Stevenson Middle School have agreements with the city to use water from the lower reservoir. After the last rainy season yielded little rainfall, Public Works Director Jonathon Goldman told the vineyard and school that 2007 would be a difficult year. Unlike typical years when the lower reservoir spills over, it never got beyond 38 percent of its 160-acre-foot capacity this year, said Ron Rosenbrand, vineyard manager at Spring Mountain Vineyard. According to Rosenbrand, the drought will result in a 10 percent to 15 percent crop reduction at Spring Mountain Vineyard, although quality is not expected to suffer..."

Atagi, Colin. ***New Plans to Curb Water Usage.*** **Desert Sun, 08/31/2007.**

"As drought conditions continue to plague Southern California, Coachella Valley water suppliers have created conservation plans that will change how local developers landscape their projects. A revised Coachella Valley Water District landscaping ordinance, which goes into effect Oct. 1, reduces the amount of water new developments can use to create features within their existing plans. Under the new plan, a project site can have enough water for areas equivalent to 25 percent of the overall project.... It also regulates sprinkler systems, which - under the new plan - need to be 24 inches from curbs and driveways to prevent water from running off into streets. The sprinklers have to be operated by control systems that adjust to climate changes. The revised ordinance is expected to save 1,770 acre feet of water per year... Experts say water conservation in the desert is a top priority because of increased demand due to a combination of drought and development....In addition, the Colorado River's water supply has diminished, and levee problems have affected the Sacramento-San Joaquin river delta, which supplies much of California with water....The agency also is installing water-efficient landscaping outside its building. "You would certainly understand people's disdain if you say, 'Do as we say, not as we do,'" Luker said....Under CVWD's ordinance, golf courses are limited to 4 acres of grass per hole. "For an average golfer, that's what you need," La Quinta Resort and Club Golf Course Superintendent Glenn Miller said. He added golf courses around the valley support water conservation installed sprinkler systems with lower trajectory. Also, many use water-efficient turf. "It is our part. We're on board with it," Miller said.

Curiel, J. ***Forced water conservation could follow dry winter.*** **San Francisco Chronicle. 09/05/2007**

"A federal judge's ruling that limits the amount of water that can be pumped out of the San Joaquin-Sacramento River Delta increases the likelihood of rationing in much of the Bay Area if the coming winter is as dry as the last one, water officials said Tuesday.

Agencies that supply water to millions of customers in Santa Clara County, the Livermore area and other places dependent on the delta described Friday's court decision as the back half of a double whammy that started with last winter's skimpy storm totals.

"We are looking at the potential for mandatory conservation, but we're not going to know until we get into late January or early February," said Susan Siravo, a spokeswoman for the Santa Clara Valley Water District, which serves 1.7 million residents and gets half its water from the delta. "Here in Silicon Valley, people don't connect the delta to the Bay Area. They think, 'What does that have to do with me?' But it does."..."

Rogers, P. *Water rationing could be on horizon; Ruling on delta fish may limit supply pumped to valley.* San Jose Mercury News. 09/05/2007

"Silicon Valley may be heading toward its first mandatory water rationing in 16 years, after a federal judge's decision to protect a tiny endangered fish by reducing the amount of water that can be pumped from San Francisco Bay's delta.

Santa Clara Valley Water District officials said Tuesday that they will produce a range of options - including mandatory rationing - by November for the district's board to consider for 2008. ..."

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1 **Weiser, M. *Less Delta water means dry times; Calls to redesign the estuary follow order to curtail pumping.* Sacramento Bee. 09/06/2007**

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"....Stephen Patricio, chairman of the Western Growers Association, estimated economic effects in the farm sector from the court order could reach $400 million next year -- if the state is blessed with normal rainfall. Zlotnick said his agency may have to reduce the amount of water projected to be available for new housing and commercial development. While some blamed the judge and environmental laws for causing the cutbacks, others said it was only a matter of time. Rep. George Miller, D-Martinez, said California has long relied too heavily on the Delta as a water supply even as danger signs mounted. A longtime Delta advocate, he said the solution involves prioritizing how we use water and adopting aggressive conservation measures....

"We're going to have to call for unprecedented levels of conservation from our 18 million customers," said Roger Patterson, assistant general manager of the Metropolitan Water District of Southern California, the largest urban consumer of Delta water.

Not everyone sees the pumping cutbacks as a calamity. Peter Gleick, president of the Pacific Institute, a nonprofit think tank in Oakland, said the pumping slowdown represents a prime opportunity to reconsider how water is used in California. Gleick said it is critical for urban and agricultural interests to use water more efficiently. "There's enough water for healthy agriculture and a healthy economy, but there's not enough to waste or use inefficiently," he said. He gave numerous examples: Replace 6-gallon-per-flush toilets with 1.6-gallon models and top-loading washing machines with more efficient front-loaders. Use precision sprinklers to irrigate fields and shift from growing crops that use lots of water to those that require less.

Gleick noted that four farming staples -- rice, cotton, alfalfa and irrigated pasture -- use about half of the agricultural water in the state but produce a small fraction of agricultural income.

"I'm not saying, 'Don't grow cotton or alfalfa' " Gleick said, "but it is worth discussing how much we grow. These have been taboo discussions in the past."...'

Dobuzinski, A. *Water shortage ominous; Rationing may surface in Southland next year.* LA Daily News. 09/05/2007

"Southern California water officials are drawing up plans that could force rationing in some cities as early as next year, officials said Wednesday. For now, residents are being asked to voluntarily use

less water, but the Metropolitan Water District of Southern California warned that mandatory rationing could become necessary for the first time since 1991. .... The MWD is preparing an allocation plan that would spell out how much water it might be able to provide the 26 cities and water agencies that it serves in six counties, including Los Angeles and Ventura counties, said Roger Patterson, the district's assistant general manager.

If the district tells its members it has less water to provide them, it would be up to them to decide how to ask residents to cut back. "The question is how soon do we need to go into that kind of decision-making. Do we have to do that in 2008, or do we rely on our reserve account - or (banked water) savings - to not do that in 2008? Those are the policy decisions that will be made." The district imports about 50 percent of the water used by member agencies. About two-thirds of the water comes from the delta and the rest from the Colorado River. The amount of water the district stands to lose from the court decision amounts to more than 10 percent of all the water its members use in a typical year. In the city of Los Angeles, which relies on the district for nearly 70 percent of its water, officials already are asking residents to use 10 percent less water this year. But it's a voluntary program. "If we have rationing in Los Angeles, it won't be the first time that that has happened," said David Nahai, president of the board of the Los Angeles Department of Water and Power Commissioners. "If that is what will be needed in order to safeguard our water supplies, well, so be it. But we'll have to see just what this plan is that Metropolitan Water District will be putting forward." ..."

J. Bowles, J. Miller. *Ruling spurs 'great deal of uncertainty' over water supply.* Riverside Press Enterprise. 09/05/2007

"Another dry winter coupled with a judge's ruling that will severely reduce water supplies coming to the Inland region could lead to mandatory conservation measures in some areas, officials said Wednesday.

But most agencies said they would drill new wells, possibly increase water rates to customers who use large amounts and take other steps before forcing residents to conserve.... Metropolitan Water District, whose customers include suppliers in western Riverside County and southwestern San Bernardino County, said it will create an emergency plan by November for possible cutbacks to its member agencies. The Inland area gets about one-third of its water from the delta. Board members "want to have that tool available in the event we don't see a very good winter and we find ourselves wanting to use it," said Roger Patterson, MWD's assistant general manager. "The bottom line on this is that we moved into an area of tremendous uncertainty as to where we go from here," Patterson said. "It makes it hard for us to provide a reliable water supply to our customers."... John Rossi, general manager of Western Municipal Water District, said a cutback of 20 percent or more will spur the district that serves the western half of western Riverside County to look at some sort of mandatory conservation. He said it's likely to focus on outdoor watering, which can account for 60 percent of a home's water use.... Tim Quinn, president of the Association of California Water Agencies, said that while the judge's order will last a year, "the crisis is indefinite." Randy Van Gelder, general manager of San Bernardino Valley Municipal Water District, which imports delta water for several cities, said unlike a natural drought, this decision can have lasting impacts. "We've had droughts that have lasted one or two or three years, the potential here, though, because you're dealing with saving an endangered species, this could become a permanent way of life, not just a temporary drought," said Van Gelder.... Wanger's ruling "introduces a great deal of uncertainty into the water supply," Snow said. "This won't be the last court case, it won't be the last disaster in the delta, unless we proceed in a very, very comprehensive fashion dealing with conservation, storage, conveyance, wastewater recycling -- the entire package."... Even before the ruling, the Inland region's major water sources were in bad shape. The Colorado River is gripped by an eight-year drought; the water content of the Sierra Nevada snow pack was at its lowest level since 1990; and snowfall in local mountains that feed aquifers was 30 percent of normal. Rainfall this past season in

Riverside was 1.93 inches, making it the driest year since at least 1883. Typically, it averages 10 to 12 inches. If the dire water situation persists, agencies might consider an increase in rates as an incentive to get people to conserve. "You see a number of areas in Southern California where they're talking about adopting a rate structure that if you use more than a certain amount of water, you pay a penalty," Van Gelder said. "We're not looking at that yet."... Susan Lien Longville, director of the Water Resources Institute at Cal State San Bernardino, said Inland agencies have increased their water-conservation activities. But she said it's also hard to talk conservation to residents when they see large parks and other public places irrigating several acres of water-thirsty grass. "We need to set a good example," she said. "I suspect you'll see that more."..."

Valley Farmers May Have To Cut Back With Water Reduction Plan. **ABC Channel 30. 09/05/2007**

"A federal judge's decision to protect the threatened Delta Smelt put a limit on the amount of water released from the reservoir. But farmers in central California worry there won't be enough water for crops next year. Farmers continue to flinch at the news their water supply could be cut considerably next year. 25 million Californians rely on Delta water but maybe none more than local growers.... Stephen Patricio, Western Growers Association, says "When farm workers don't go to work the entire economy feels it."... Meanwhile Beene says he and other farmers have to go back to the drawing board and find ways to stretch out what little water's available. The federal judge has order the water reduction plan to begin in December. Beene says unless the valley receives plenty of rain this winter, he will consider cutting jobs...."

Mandatory water restrictions for San Lorenzo Valley residents. **Associated Press. 09/06/2007.**

"BOULDER CREEK, Calif. -- A dry winter and failure by residents to conserve water have led officials to impose mandatory restrictions that include a ban on daytime outdoor watering. This week's restrictions follow requests by the San Lorenzo Valley Water District that residents voluntarily reduce water usage by 15 percent. Usage by customers in Boulder Creek, Brookdale, Ben Lomond, Zayante and Scotts Valley dropped only 2.5 percent. "Apparently, there's just not enough of the people who are doing their part," water agency director Jim Mueller said. The district sent letters to its 5,900 customers telling them it was necessary to cut water consumption 20 percent, and that the mandatory restrictions were now being imposed.
Mueller said water rationing and fines would come next if the newest conservation effort didn't work. The mandatory restrictions include no outdoor watering between 9 a.m. and 6 p.m., no washing at all of sidewalks, patios, decks, driveways and exterior building walls, and no car washing except with a bucket and hose with a shut-off nozzle..."

Contingency plans drawn up for possible SoCal water rationing. **Associated Press. 09/06/2007**

"LOS ANGELES—Contingency plans currently being drawn up could force Southern California water officials to order rationing next year. .. "If we have rationing in Los Angeles, it won't be the first time that that has happened," said David Nahai, president of Department of Water and Power commissioners. "If that is what will be needed in order to safeguard our water supplies, well, so be it. But we'll have to see just what this plan is that Metropolitan Water District will be putting forward." ..."

DRAFT BUDGET: CONSERVATION AND PUBLIC OUTREACH SPECIALIST, FY 2007 - 2008

WATER CONSERVATION SHARED EXPENSES:

Publications/ Outreach Literature	
Bill Stuffers (6 mailings, $800 ea	$4,800
Brochures/Flyers (in-house print)	$2,000
Brochures/Flyers (out-source print)	$7,000
PrePrinted Materials	$1,000
Postage (2 direct mailings/yr) 8000 @ $0.50 ea	$4,000
WORKSHOPS	
Irrigation x 2	
Stipend x 2	$400
Hospitality x 2	$100
Advertisement	$200
Support Materials	$100
Soil/Compost x 2	
Stipend x 2	$400
Hospitality x 2	$100
Advertisement	$100
Support Materials	$100
Xeriscape, California Natives x 2	
Stipend x 2	$400
Hospitality x 2	$100
Advertisement	$200
Support Materials	$100
Water Conservation x 2	
Stipend x 2	$400
Hospitality x 2	$400
Advertisement	$200
Support Materials	$100
	$22,200
Advertisement	**$4,000**
Customer Promotional/Giveaway Items	**$3,600**
Water Audits	
5% SFR (177 accounts), $100 ea.	**$17,700**
Free Small Area Landscape Designs for Customers	**$1,000**
School Outreach Program	
STUDENT ART	

CONTEST	
Prizes	$600
Publicity/ads	$300
Calendar production from 12 winners	$500
CLASSROOM SUPPORT	
Environthon, Nipomo HS	$500
Science Discovery	$4,000
Student Books, Materials	$500
Educational DVD's for borrowing	$500
	$6,900
Events	
Entry Fees	$1,000
Misc. Supplies	$500
	$1,500
NCSD Landscape Demo Garden	
Phase I (Removal, Install Plants & Irrigation) Front,Side	$11,000
Educational Signage	$1,000
	$12,000
WATER CONSERVATION SHARED EXPENSES TOTAL:	**$68,900**

WATER CONSERVATION REBATES/ GIVEAWAYS:

Rebates/ Giveaways	
Washing machine rebates, $100 ea (50)	$5,000
Outdoor (nozzle, soil moisture probe, rain guage, lawn sprinkler timer, water-drop wheel) 250 sets @ $18.19 ea.	$4,548
*Indoor (showerhead replacement, teflon tape, toilet leak detector, faucet aerator, shower timer) 250 sets @$24.84 ea.)	$6,210
PILOT PROGRAM: SmartController rebates, $200 ea (10)	$2,000
Water audit and installation, $275 ea (10)	$2,750
PILOT PROGRAM: Turf replacement program ($0.48/ft2, max. 1000 ft2=$480), (10)	$4,800
	$25,308
WATER CONSERVATION REBATES/ GIVEAWAYS:	**$34,100**

OTHER:

PROFESSIONAL DEVELOPMENT	
Conferences	
Fees	$1,000
Lodging	$800
Transportation	$500
Water Conservation Practitioner Certification	$500
Books, Magazines	$300
Membership, Professional Organizations	$300
Water Audit Certification Maintenance	$500
	$3,900
PROFESSIONAL DEVELOPMENT TOTAL:	**$3,900**

TOTAL BUDGET FOR PROGRAM:
Pending finalization of program.

PERCENTAGE SHARE OF SHARED EXPENSES

Program	$68,900	%SharedCost	$Amount
ULFT Refitting*		5%	$3,445
High-Efficiency Washer Rebate		5%	$3,445
Outdoor WC Equipment		10%	$6,890
Indoor WC Equipment		10%	$6,890
Hot Water on Demand		10%	$6,890
SmartController Landscape Irrigation		20%	$13,780
Turf Replacement Rebate		10%	$6,890
NCSD Demo Garden		15%	$10,335
Small Item Plumbing Retrofit		10%	$6,890
Landscape Irrigation Efficiency Gadgets		5%	$3,445
		100%	**$65,455**

*This measure is not recommended at this time, pending the Level III Severity mitigation measures determination by SLO County.

Prepared by Celeste Whitlow *Date*

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Volumetric: Rate charged per increment of sewer flow; based on metered volume (water consumption).

Volume Based: Calculated based on average water usage during winter months (flat rate based on average water usage during winter months)..