City of Santa Cruz Water Supply Advisory Committee
Phase II -- Technical Summary

Consolidated Alternative 01 - Peak Demand Reduction

Project description: Reduce water demand during peak season by 10%, 25%, or 50% through turf replacement and water use restrictions. Analysis assumes: the total water used for peak use is predominately driven by outdoor water demand, principally landscape and turf irrigation. Reductions are:
10% Level = 70 MG (0.4 MGD over 6 months) saved
25% Level = 170 MG (0.9 MGD over 6 months) saved
50% Level = 340 MG (1.9 MGD over 6 months) saved
Equivalencies to achieve these reductions include:
10%: Replace 1/3 existing turf with low water use material (cost =~ $70 million); or implement the following actions: 1) accelerate Program C Recommended , 2) increase incentives on turf replacement to facilitate turf removal goal, 3) implement seasonal pricing
25%: Remove all single family turf; or replace 84% of all city turf with low water use material (cost=~ $175 million); or implement the following 3 actions: 1) implement permanent water restrictions with enforcement & alternative sources, 2)accelerate Program C Recommended, and 3) Replace 25% of existing turf and/or implement seasonal pricing
50%: Remove 77% of all City turf (cost =~ $ 100 million), or institute permanent water rationing; or implement the following 3 actions: 1) institute permanent water rationing, 2) Implement very high seasonal price for water use above indoor allotment, 3) implement a massive turf removal program.
To accomplish these savings through **turf replacement alone**, the city would need to replace the following portions of city-wide turf with zero water use material (artificial turf, bark, hardscape, etc.): **10% Level** = 15%, **25% Level** = 39%, **50% Level** = 77%; or the following portions of city-wide turf with low water use material: **10% Level** = 34%, **25% Level** = 84%, **50% Level** = 169%.

Description: Peak demand reduction

Applicable WCAs: WCA-69: SCWD: Peak season reductions – 10%, 25% and 50%

Estimated Peak Water Savings in 2030 (million gallons [MG])	10% Level = 70 MG (0.4 MGD) 25% Level = 170 MG (0.9 MGD) 50% Level = 340 MG (1.9 MGD)
PV Cost of Savings per Unit Volume ($/MG)	$35,000 (using 25% level and turf replacement costs)
Water Savings Over Time (Enter "seasonal and inter-annual variability" here if a	Seasonal variability - reductions during peak season

Comments

Key Components (for 50% peak demand reduction)

1 Intensify incentives (like full landscape make-overs	6
2 Continuous enforcement of programs that reduce water use	7
3 Water rationing/allocation pricing schemes	8
4 More ordinance restrictions like retrofit on resale and new codes (e.g., Retrofit landscapes with alternative sources only for landscape)	9
5 Other drought shortage measures	

Implementation Requirements Summary

10% reduction with planned programs is achievable; 25% would be difficult and require a massive turf removal or replacement project; A 50% reduction in peak demand does not appear to be feasible without relying on short-term drought measures, and using the drought tool kit on a long term basis then leaves limited opportunity to further reduce use when another drought comes and water use must again be reduced.

Technical Feasibility

City residents likely to resist big change in type of landscape allowed; would be very expensive (tens of millions to possibly 175 million dollars). A related issue is "who would pay?" Also, could have detrimental impact on property values throughout the community.

Legal Feasibility

City may not have legal authority to mandate a certain type of landscape on private property, after water service has already been granted (existing customers). May require using very high rate blocks to effectively disincentivize outdoor irrigation.

Environmental Considerations

Will change the look of the City. Annual energy savings associated with reduced pumping and treating by SCWD, under the 25% reduction in demand, amounts to 272 MWh.

Related Opportunities

Reducing the peak may be more valuable than reducing the annual volume of use so may justify higher than normal incentives for peak demand measures.

Issues to Resolve

Listed above. Also, economic hardship for landscape maintenance contractors, nurserries, etc.

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Consolidated Alternative 03 - Program C Recommended

Project description: Preliminary recommended program for Water Conservation Master Plan: infuses more budget and staffing to be more aggressive with maximizing annual water savings.
The conservation measures are included in Appendix 1 below.

Note: This Alt is not strictly additive with CA1-peak season demand reduction, as that Alt may include accelerating implementation of this Alt. (i.e., applying both Alts could entail some double counting of water savings and costs).

Description: Program C Recommended (based on draft Conservation Master Plan)

Applicable WCAs: WCA-20: McGilvray (9): Implement Conservation; WCA-22: SCDA: Conservation Education; WCA-65: zNano: Conservation rebate program; WCA-68: SCWD: Program C from Long-Term Water Conservation Master Plan

Estimated Water Savings in 2030 (million gallons [MG])	489
PV Cost of Savings per Unit Volume ($/MG)	$2,400

Water Savings Over Time (Enter "seasonal and inter-annual variability" here if appli: none

Cost benefit comparison	**Best Estimate**	**Likely Range**	**Comments**
Present Value of Water Utility Benefits (Utility's avoided cost of producing water)	$11.2 million	plus or minus 15%	
Present Value of Community Benefits (Customer's avoided cost of purchasing water)	$24.9 million	plus or minus 15%	
Present Value of Water Utility Costs (Cost of utility to implement and run the program)	$15.1 million	plus or minus 15%	
Present Value of Community Costs (Cost to customers to implement the program)	$38.4 million	plus or minus 15%	
Water Utility Benefit to Cost Ratio	0.74	plus or minus 15%	Program was designed to reduce total volume of use cost-effectively and was not designed to emphasize peak demand reduction
Community Benefit to Cost Ratio	0.65	plus or minus 15%	
Five Years of Water Utility Costs 2016 through 2020	$6.4 million	plus or minus 15%	

Key Components

1 See Appendix 1, below	6
2	7
3	8
4	9
5	

Implementation Requirements Summary

Increased staff and budget and adoption of new requirements and codes

Technical Feasibility

Feasible when City is in a position to afford it; relatively high customer cost as City incentives will not cover total cost

Legal Feasibility

No legal barriers known at this time

Environmental Considerations

More efficient use of available natural resources; reduced potable water use results in energy savings and reduced carbon footprint. Energy savings in 2030 associated with SCWD avoiding the need to pump, treat and deliver potable surface water is 782 MWh (based on 1.6 MWh/MG).

Related Opportunities

Issues to Resolve

City financial position

Appendix 1: Summary of Active Elements for Preliminary Recommended Program CREC

General Measures	Residential (Indoor)	Commercial (Indoor)	Irrigation (Outdoor)
Water Loss Control Program	Real Customer Water Loss Reduction – Leak Repair and Plumbing Emergency Assistance	CII MF High-Efficiency Washer Rebate	City Code Requirement for New Landscaping*
Install Advance Metering Infrastructure (AMI)	Single Family Water Surveys*	Promote Restaurant Spray Nozzles	Residential Single Family Landscape Conversion or Turf Removal*
Water Budget Based Billing	High Efficiency Faucet Aerator/Showerhead Giveaway*	High Efficiency Urinal Program*	Residential Multifamily and CII Landscape Conversion or Turf Removal*
Public Information Program Including Various Outreach & Education Approaches*	Residential Ultra High Efficiency Toilet (UHET) Rebates*	School Building Retrofit	Expand Outdoor Water Survey and Water Budgets
Customer Billing Report and Service	Residential Washer Rebate*	Customized Top Users Incentive Program*	Rotating Sprinkler Nozzle Rebates
	Require High Efficiency Clothes Washers in New Development	CII and MF Surveys and Top Water Users Program*	Residential Gray Water Retrofit
	Require Hot Water on Demand/Structured Plumbing in New Developments	Public Restroom Faucet Retrofit	Provide Rain Barrel Incentive*
	Toilet Retrofit at Time of Sale*		

*denotes all 13 measures that are currently being implemented and are in Program A.

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Consolidated Alternative 02 - Water Neutral Development

Project description: This alternative would implement a demand offset program required for new development to offset new demands. Water neutral develop focuses on the development "bringing" new water, for example, by fronting costs for water efficiency retrofits and crediting saved water against new demands for a 1:1 offset. Other water suppliers in NorCal have successfully used development charges to "buy" conservation by other customers. The concept has two parts: (a) developers design a project to use a minimum amount of water, consistent with the developer's goals of creating affordable and livable housing, and (b) offset the amount of water needed in the new development by saving an equivalent amount of water within the existing service area.
Some key issues include (1) this may accelerate rather than necessarily adding to water savings already anticipated under plumbing and building codes, thus may double count savings from other programs; (2) who pays becomes a key question; (3) there is likely to be a cap on how much water savings can be achieved over time, as opportunities for additional water use efficiencies or demand reductions become scarcer; and (4) there may be some high costs imposed on builders -- and home buyers and renters -- as water use offsets become increasingly difficult to achieve (possible impacts on affordable housing for low income resdients).

Description: Water Neutral Development

Applicable WCAs: WCA-03: SCDA: Water-Neutral Development

Estimated Water Savings in 2030 (million gallons [MG])	Up to 300
PV Cost of Savings per Unit Volume ($/MG)	See comment
Water Savings Over Time (Enter "seasonal and inter-annual variability" here if ap	

Comments
While costs are unknown at this time, they are likely to be highly variable and escalate with time as cost-effective opportunities for water savings decrease. Potntila water saving estimates are based on recent demand forecast for new accounts.

Key Components

1 Developers will pay the City to do extra conservation measures to reduce the net new water needed for the development, essentially funding offsets with higher impact fees

2 New development customers will use less water due to high-efficiency fixtures and landscape elements

3 Existing customers will voluntarily save water and participate in developer-funded conservation measures offered by the City

4

5

6

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Implementation Requirements Summary

Requires mandates and perhaps some program to facilitate financing of water saving efforts

Technical Feasibility

Setting the impact fee would need to be worked out so as to be equitable, but high enough to generate needed water savings without making new housing much more expensive.

Legal Feasibility

Environmental Considerations

Related Opportunities

Issues to Resolve

City of Santa Cruz Water Supply Advisory Committee
Phase II -- Technical Summary

Consolidated Alternative 04 - WaterSmart Home Water Reports

Project description: WaterSmart Software's Home Water Reports (HWRs) service. HWRs provide households with periodic information on their current water use and compare it to their past use, the average use of similar households, and the use of the most efficient similar households. This data is coupled with actionable information on ways to use water around the home more efficiently. HWRs aim to motivate households to reduce their water use through changes in behavior or adoption of more water efficient technology. The approach is based on research on social norms marketing coming out of the field of social psychology and for this reason we refer to these type of programs as social-norms-based (SNB) efficiency programs. While SNB efficiency programs have been broadly adopted by energy utilities across the United States in recent years, they are new to water utilities. (text from Mitchell, 2013: Evaluation of East Bay Municipal Utility District's Pilot of WaterSmart Home Water Reports)

Initial Ranking	
to be completed during evaluation	

Description: WaterSmart Home Water Reports

Applicable WCAs: WCA-04: WaterSmart: Home Water Reports; WCA-16: Gratz: Maximize Conservation Behavior

Estimated Water Savings in 2030 (million gallons [MG])	37
PV Cost of Savings per Unit Volume ($/MG)	$896

Water Savings Over Time (Enter "seasonal and inter-annual variability" here if a

Comments

Costs based on EBMUD (Mitchell, 2013): $1,200/MG for each year reports sent out (adjusted to 2015 $). Water savings based on 3% reduction of 2013 use levels for SFR

Key Components

1 See description	6
2	7
3	8
4	9
5	

Implementation Requirements Summary

Install WaterSmart software at the utility level.

Technical Feasibility

Analyses done for EBMUD indicated that low water users saved less water than high users. Since Santa Cruz households have relatively low water use and somewhat limited capacity for additonal cost-effective conservation, the estimated savings associated with this alternative are uncertain. A 3% savings is applied to Santa Cruz (compard to 5% in EBMUD).

Legal Requirements/Issues

N/A

Environmental Considerations

Annual energy savings (and associated carbon footprint reductions) amount to 59 MWh in 2030, due to reduced production and delivery of potable water by SCWD.

Related Opportunities

N/A

Issues to Resolve

See above re: feasibility considerations.

Initial Evaluation

Effectiveness	
Practicality	
Environmental Impacts	
Weighted	

City of Santa Cruz Water Supply Advisory Committee
Phase II -- Technical Summary

Consolidated Alternative 05 - Home Water Recycling

Project description: Several alternatives proposed to use graywater recycling in residential units to reduce potable water demands, especially for flushing toilets and landscape irrigation, including CA Plumbing Code compliant facilities and installation. This alternative would install Nexus eWater Home Water Recycling systems into new single family homes. The is the only current system certified (i.e., certified under NSF standard 350) for on-site residential graywater treatment that can be used for toilet flushing and outdoor irrigation. The system uses floatation, two stages of filtration, and UV disinfection; and is a patent-protected, proprietary process. It is a newly developed system, and is currently still in the piloting phase. This system requires professional installation, but once installed, it is automatic and operates with minimal homeowner management (or a third party management contract for periodic upkeep).
The cost is $5,700 per home ($4,500 for the treatment system and tanks, $1200 for installation in new home under construction), with estimated annual operating costs (including electric power and consumables) under $200 per year (using homeowner time), and higher costs if periodic maintence is contracted to a third party. After the 12 year lifespan, replacement costs are estimated at $2000.
The system can be adapted and installed in multi-family units, but current regulations preclude using graywater for toilet flushing in multi-family setting, thus restricting graywater use to outdoor irrigation. There is also potential to retrofit existing homes, but the process is currently under development and the plumbing and pumping requirements make retrofits considerably more complex and expensive. Thus, this alternative is evaluated here specifically for use in new single family residences.
This evaluation assumes potable water savings of 18,469 gallons per household per year based on data for per household toilet flushing and irrigation use levels in new single family homes, multiplied by number of new SFR homes anticipated added in future years.

Description: Home Water Recycling (Graywater Treatment Systems)

Applicable WCAs: WCA-39: Garges: Residential Gray-Water; WCA-66: zNano: Onsite Water re-use; WCA-70: Home Water Recycling

Estimated Water Savings in 2030 (million gallons [MG])	15.5
PV Cost of Savings per Unit Volume ($/MG)	$22,662
Water Savings Over Time (Enter "seasonal and inter-annual variability" here if a	See number 4, below.

Comments
Assumes capital cost of $5,900 and annual operating costs of $200 per household; lifetime of 12 years, with 75% assumed capital cost to replace filter system elements every 12th year.

Key Components

1 Currently focuses on single family new builds
2 Costs include connection to irrigation system, not irrigation system itself
3 System treats water for use in outdoor irrigation (including spray and drip) and toilet flushing (single family only)
4 During low irrigation season, excess (unused) treated water automatically goes to sewer system
5 System has 12-year lifetime with minimal maintenance
6 Grey water sources include laundry, shower, bath, hand sinks (not kitchen sink, dishwasher, or toilets)
7
8
9

Implementation Requirements Summary
Requires professional installation and duel piping. Focus on new builds rather than retrofit.

Technical Feasibility
Technically feasible, but currently in place in only 3 homes in Southern California, as a pilot demonstration.

Legal Feasibility
Multi-family units are restricted from using the recycled graywater for toilet flushing under existing CA regulations. Water reuse regulations are in a state of flux, and graywater produced by this system may become permitted for toilet flushing in multi-family resdiences within a few years.

Environmental Considerations
Annual energy use savings from reduced SCWD production and delivery of potable water amounts to about 25 MWh in 2030, less energy required to operate graywater treatment system and any associated in-home pumping.

Related Opportunities
Rainwater harvest systems (RHS), such as rain barrels or cisterns, may also be used to cpature and apply on-site water to irrigation (and perhaps other nonpotable) uses at resdiential sites.

Issues to Resolve
Actual potable water savings need to be demonstrated with on-site monitoring (not yet done), or estimated using realistic water use estimates in Santa Cruz for seasonal single family irrigation needs and installation of highly efficient toilets. Estimates shown here of about 18,500 gallons per new household per year reflect these conditions.

Read Me for the March 13, 2015 draft version of the
Summary Templates for the Demand-side Management and Decentralized Alts.

This sheet provides important notes about the basis, format, and limitations of the information provided in this preliminary version of the Template Summaries for those Consolidated Alternatives (CAs) related to conserving water (demand side management, water use efficiencies) and building-scale decentralized systems (e.g., on-site graywater capture and use).

1	As of March 13, 2015, this file contains information covering CA1 - CA5
2	CA6 turned out to be essentially a repeat of CA5, and so it is not included here. CA5/CA6 both address household-scale graywater collection, treatment, and reuse for irrigation and toilet flushing, using largely automated, low maintenance treatment units plus associated plumbing and storage tanks.
3	If there is interest, we can develop a new CA6 that examines simpler, untreated graywater systems for household irrigation uses only. This is a less expensive and more readily applicable graywater approach for existing homes, as it elimantes the need for retrofitting in-home collection and redistribution plumbing or treatment.
4	Energy savings associated with reduced demands for SCWD-provided potable water are estimated at 1.6 MWh/MG, consistent with existing system estimates for the Water Department
5	This is a simple version of the summary template for Alts. The template will be expanded in next iterations to include the Criteria selected for the MCDS exercises.