

Memorandum

To: Water Supply Advisory Committee members
From: Robert Raucher, Carolyn Wagner, and Colleen Donovan, Stratus Consulting Inc.
Date: 4/24/2015
Subject: Communicating assumptions and inputs for the demand management CAs

In this memorandum, we provide an update on the progress the Technical Team has made on the demand management consolidated alternatives (CAs) since the March Water Supply Advisory Committee (WSAC) meeting. Further, we outline the assumptions and inputs for CA-03, CA-04, and CA-05, as well as general assumptions. We highlight the assumptions and inputs for the demand management CAs because these CAs are very different from the supply CAs. We note some of these differences below:

The demand management CAs:

- ▶ Generate water savings rather than create new water
- ▶ Have low capital costs that would not be financed through bonds like the supply CAs
- ▶ Are dependent on assumed household participation rates.

1. Update on what has happened since the March WSAC meeting

Since the March WSAC meeting, we have worked with Brown and Caldwell to ensure consistency in our calculations of costs and benefits across all CAs, modified the demand management CA summary spreadsheet to make it as consistent as possible with the supply CA spreadsheet, worked with Maddaus to better understand their Decision Support System (DSS) model and related inputs and assumptions, and revised the cost and benefit calculations for several demand management CAs. We calculated revised present value estimates for CA-03, CA-04, and CA-05, in which we discounted the water savings (benefits) in addition to the costs in this iteration. This is consistent with best economic practices and provides a more comparable estimate of the cost/million gallons (mg) water saved. Additionally, we used a 2.5% discount rate instead of 2% in order to be consistent with the supply CAs. Updates on the specific CAs are below.

CA-01: Peak Season Reduction: We are in the process of revamping this CA to address concerns expressed by several WSAC members. At this point, we do not have a solid restructuring of this CA to share with WSAC. The Technical Team recognizes this is a WSAC

priority and is working with the Conservation sub-committee to make sure this CA captures new ideas as well as current ones.

CA-02: Water Neutral Development: We have not made changes to this CA other than to modify the project description in the summary spreadsheet. This CA has been the topic of considerable discourse at the Water Commission, and is essentially more about who pays rather than creating additional demand reductions (though it may accelerate some demand reductions). Given these factors, the issue is really more about how the City might restructure how such a program might be designed and implemented (especially in terms of who pays) rather than updating its expected costs or potential demand impacts.

CA-03: Water Conservation Measures (Program CRec): We have worked closely with Maddaus Water Management (MWM) to better understand their DSS model and the relevant inputs for the measures that comprise Program CRec. This work is ongoing and is not presented in the memorandum or accompanying summaries. MWM re-ran their DSS model for Program CRec using a 3% savings rate for WaterSmart Home Water Reports (CA-04, for which they previously had applied a 1% water savings). They provided Stratus Consulting with undiscounted annual savings and costs which were used as inputs in our present value calculations. Administrative costs are now presented separately, rather than embedded within each measure. The reported administrative costs are estimated by MWM; these may be revised with input from the Water Department. We have also netted out water savings and costs for Program A and plumbing codes to avoid double counting with the revised demand forecast, which incorporates both.

CA-04: WaterSmart Home Water Reports: We have updated our calculations using revised cost assumptions from MWM, which are presented as costs per report, rather than cost per water saved.

CA-05: Home Water Recycling: We have not changed any of the assumptions or inputs for this CA that examines a graywater system potentially applicable for new single family homes.

CA-06: Landscaping, Capture, Reuse: We are providing a separate memorandum on the status of graywater and rainwater harvest systems. We have not done any further analysis for this CA in this iteration, and are exploring whether there are reliable data available to recast this CA to reflect graywater or rainwater harvest system use at a commercial building scale (e.g., for hotel applications).

2. Assumptions and inputs

2.1 General Assumptions

Unless stated otherwise in the individual CA assumptions below, we applied the following:

- ▶ For the costs, we use real \$2015 and a 2.5% real discount rate; no escalating
- ▶ For the water savings (benefits), we use a 2.5% real discount rate
- ▶ We aggregated all costs and do not indicate “who pays”
- ▶ We did not include administrative costs
- ▶ We use 2015 as the base year and go out to 2045 (30 years).

2.2 CA-03: Water Conservation Measures (Program Crec)

We do not provide a full description of all inputs and assumptions used in the modeling of Program Crec. As described above, MWM reran the DSS model with assumed savings from Home Smart Water Reports as 3% (previously 1%). MWM provided Stratus with annual water savings and costs for Program Crec, Program A, and annual administrative costs for both programs. We used these estimates to calculate the incremental savings and costs (without administrative costs) for Program Crec. These values represent additional savings provided by Program Crec, and do not include saving (or costs) that can be accomplished with Program A alone. Netting out saving accomplished with Program A and changing the savings/household assumption in Home Smart Water Reports, results in a revised savings in 2030 (undiscounted) of 210 mg (previously 489 mg, which had inadvertently double-counted Program A and plumbing codes).

Time period: unlike the other alternatives, the calculations for Program Crec include the period from **2018 to 2040**. This is consistent with the timeframe used in the draft Conservation Master Plan.

2.3 CA-04: WaterSmart Home Water Reports

For our WaterSmart Home Water Reports, we used the following assumptions and inputs:

Cost: **\$8 per report annually**, based on information provided by MWM from a pilot study in which 5,000 accounts received reports for 6 months for a cost of \$20,000. Note, these costs do not include any additional costs of conservation. The reports inform account holders of their water use compared to other households and may offer suggestions for how they might reduce

their usage. Additional costs may be needed to accomplish the estimated water savings. Applying the \$8 per account cost to all single family accounts in 2013 (used as a representative year), yields a total annual cost of \$151,500.

Savings: **3% average water savings per account.** This is based on best professional judgment after reviewing several studies. Studies have found savings up to 5%, but all studies note that higher water users save more water. Since Santa Cruz is a relatively low-use community (compared to other CA communities), we use a middle-of-the-road estimate. We assume that all single family accounts would receive these reports, and thus water savings as calculated as 3% of annual water use in 2013. This yields estimated water savings of 36.78 mg annually.

2.4 CA-05: Home Water Recycling

In this section, in addition to the assumptions and inputs used in the Home Water Recycling calculations, we provide a detailed description of these calculations. Table 1 provides the input description, assumptions, input value, and source for all inputs used in the cost and water savings calculations for CA-05.

Table 1. Inputs for CA-05: Home Water Recycling

Input description	Assumptions	Input value	Source
Water savings from toilet flushing in new homes	New homes will use HET's that flush at 1.3 gallons and average flushes per day is 5.1 per person	17.5 gallons per day (gpd)/household; 6,387.5 gallons per year/household	Maddaus email dated 3/13/2015
Water savings from irrigation use in new homes		33.1 gpd/household in 2015; 1,2081.5 gallons per year/household	Maddaus email dated 3/13/2015
Total annual water savings	Water savings from toilet flushing plus water savings from irrigation in new, single-family homes	18,469 gallons per year/household	Based on inputs from Maddaus email dated 3/13/2015
Number of new single-family households by 2030	Number of households built evenly distributed over time period	840 new households	2010 Urban Water Management Plan (UWMP)
Installation cost	A one-time cost. Includes \$200 operating cost for year 1.	\$5,900	Bob Hitchner, Chief Sales & Marketing Officer, Nexus eWater, Inc.
Operating cost	An annual cost, starts in first year after installation	\$200	Bob Hitchner, Chief Sales & Marketing Officer, Nexus eWater, Inc.

Maintenance cost	Occur every 12 years	\$2,000	Bob Hitchner, Chief Sales & Marketing Officer, Nexus eWater, Inc.
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We provide the calculations for cost and water savings of this CA in Tables 2 and 3, below. We have also provided a separate Excel spreadsheet for those WSAC members who want to click on individual cells and see what we did.

Table 2. Present value calculations for CA-05

General information	Step 1: Illustration of per HH costs			Step 2: Allocate household build out through 2030, assuming even distribution		Step 3: Discount costs				
	Year	Discount factor	Cost per HH	Disc cost per HH	Number of new HH	Cumulative number of HH	Discounted installation costs	Discounted operating costs	Discounted maintenance costs 1: each cohort pays after 12 years	Discounted maintenance costs 1: each cohort pays after 24 years
2015	1.000	-	-	-	-	-				
2016	0.976	\$5,900	\$5,756	56	56	\$322,341	\$-			
2017	0.952	\$200	\$190	56	112	\$314,479	\$10,660			
2018	0.929	\$200	\$186	56	168	\$306,809	\$20,801			
2019	0.906	\$200	\$181	56	224	\$299,326	\$30,440			
2020	0.884	\$200	\$177	56	280	\$292,025	\$39,597			
2021	0.862	\$200	\$172	56	336	\$284,903	\$48,289			
2022	0.841	\$200	\$168	56	392	\$277,954	\$56,533			
2023	0.821	\$200	\$164	56	448	\$271,175	\$64,347			
2024	0.801	\$200	\$160	56	504	\$264,561	\$71,745			
2025	0.781	\$200	\$156	56	560	\$258,108	\$78,745			
2026	0.762	\$200	\$152	56	616	\$251,813	\$85,360			
2027	0.744	\$200	\$149	56	672	\$245,671	\$91,606			
2028	0.725	\$2,200	\$1,596	56	728	\$239,679	\$97,496	\$81,247		
2029	0.708	\$200	\$142	56	784	\$233,833	\$103,045	\$79,265		
2030	0.690	\$200	\$138	56	840	\$228,130	\$108,265	\$77,332		
2031	0.674	\$200	\$135	0	840	\$-	\$113,169	\$75,446		
2032	0.657	\$200	\$131	0	840	\$-	\$110,409	\$73,606		
2033	0.641	\$200	\$128	0	840	\$-	\$107,716	\$71,811		

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	Year	Discount factor	Cost per HH	Disc cost per HH	Number of new HH	Cumulative number of HH	Discounted installation costs	Discounted operating costs	Discounted maintenance costs 1: each cohort pays after 12 years	Discounted maintenance costs 1: each cohort pays after 24 years
	2034	0.626	\$200	\$125	0	840	\$-	\$105,089	\$70,059	
	2035	0.610	\$200	\$122	0	840	\$-	\$102,526	\$68,350	
	2036	0.595	\$200	\$119	0	840	\$-	\$100,025	\$66,683	
	2037	0.581	\$200	\$116	0	840	\$-	\$97,585	\$65,057	
	2038	0.567	\$200	\$113	0	840	\$-	\$95,205	\$63,470	
	2039	0.553	\$200	\$111	0	840	\$-	\$92,883	\$61,922	
	2040	0.539	\$2,200	\$1,187	0	840	\$-	\$90,618	\$60,412	\$60,411.75
	2041	0.526	\$200	\$105	0	840	\$-	\$88,407	\$58,938	\$58,938.29
	2042	0.513	\$200	\$103	0	840	\$-	\$86,251	\$57,501	\$57,500.77
	2043	0.501	\$200	\$100	0	840	\$-	\$84,147	\$-	\$56,098.31
	2044	0.489	\$200	\$98	0	840	\$-	\$82,095	\$-	\$54,730.06
	2045	0.477	\$200	\$95	0	840	\$-	\$80,093	\$-	\$53,395.18

HH: Household.

Table 3. Water savings calculations for CA-05

Year	General information		Step 4: Illustration of per HH savings		Step 5: Discount cumulative savings		
	Discount factor	Benefit per HH	Discount benefit per HH	Number of new HH	Cumulative number of HH	Benefits for cumulative HH	Discount benefits for cumulative HH
2015	1.000		-	-		-	-
2016	0.976	18469	18,019	56	56	1,034,264	1,009,038
2017	0.952	18469	17,579	56	112	2,068,528	1,968,855
2018	0.929	18469	17,150	56	168	3,102,792	2,881,251
2019	0.906	18469	16,732	56	224	4,137,056	3,747,969
2020	0.884	18469	16,324	56	280	5,171,320	4,570,693
2021	0.862	18469	15,926	56	336	6,205,584	5,351,056
2022	0.841	18469	15,537	56	392	7,239,848	6,090,632
2023	0.821	18469	15,158	56	448	8,274,112	6,790,949
2024	0.801	18469	14,789	56	504	9,308,376	7,453,481
2025	0.781	18469	14,428	56	560	10,342,640	8,079,654
2026	0.762	18469	14,076	56	616	11,376,904	8,670,848
2027	0.744	18469	13,733	56	672	12,411,168	9,228,397
2028	0.725	18469	13,398	56	728	13,445,432	9,753,590
2029	0.708	18469	13,071	56	784	14,479,696	10,247,675
2030	0.690	18469	12,752	56	840	15,513,960	10,711,855
2031	0.674	18469	12,441	0	840	15,513,960	10,450,590
2032	0.657	18469	12,138	0	840	15,513,960	10,195,698
2033	0.641	18469	11,842	0	840	15,513,960	9,947,022
2034	0.626	18469	11,553	0	840	15,513,960	9,704,412
2035	0.610	18469	11,271	0	840	15,513,960	9,467,719
2036	0.595	18469	10,996	0	840	15,513,960	9,236,799

Table 3. Water savings calculations for CA-05

General information		Step 4: Illustration of per HH savings			Step 5: Discount cumulative savings		
Year	Discount factor	Benefit per HH	Discount benefit per HH	Number of new HH	Cumulative number of HH	Benefits for cumulative HH	Discount benefits for cumulative HH
2037	0.581	18469	10,728	0	840	15,513,960	9,011,511
2038	0.567	18469	10,466	0	840	15,513,960	8,791,718
2039	0.553	18469	10,211	0	840	15,513,960	8,577,286
2040	0.539	18469	9,962	0	840	15,513,960	8,368,084
2041	0.526	18469	9,719	0	840	15,513,960	8,163,984
2042	0.513	18469	9,482	0	840	15,513,960	7,964,863
2043	0.501	18469	9,251	0	840	15,513,960	7,770,598
2044	0.489	18469	9,025	0	840	15,513,960	7,581,071
2045	0.477	18469	8,805	0	840	15,513,960	7,396,167

