

APPENDIX S

Water Conservation Plan



City of Oceanside



Water Conservation Master Plan Update

April 29, 2016



*MADDAUS
WATER
MANAGEMENT INC.*

TABLE OF CONTENTS

LIST OF FIGURES.....	4
LIST OF TABLES	4
LIST OF ACRONYMS.....	5
EXECUTIVE SUMMARY	6
Introduction	6
Long-Term Demand and Conservation Program Analysis Results.....	7
1. INTRODUCTION	12
1.1 Overview of Oceanside Water System.....	12
1.2 Purpose and Scope of Plan.....	12
1.3 Content of Report.....	13
2. ANALYSIS OF HISTORICAL WATER DEMAND	14
2.1 Production vs. Consumption.....	14
2.2 Consumption by User Category	14
3. DEMAND PROJECTIONS.....	18
3.1 Demand Methodology Overview	18
3.2 Future Population and Employment Projections.....	19
3.3 Water Use Data Analysis and Key Inputs to the DSS Model.....	20
3.4 Water Use Targets	24
3.5 Water Demand Projections with and without Plumbing Code Savings.....	24
4. CURRENT WATER CONSERVATION PROGRAM	27
4.1 Water Waste Prevention Ordinances	27
4.2 Metering	28
4.3 Conservation Pricing	28
4.4 Public Education and Outreach.....	29
4.5 Programs to Assess and Manage Distribution System Real Loss.....	32
4.6 Water Conservation Program Coordination and Staffing Support.....	32
4.7 Other Demand Management Measures	32
5. COMPARISON OF INDIVIDUAL CONSERVATION MEASURES	34
5.1 Selecting Conservation Measures to be Evaluated (Conservation Measure Screening)	34
5.2 Conservation Measures Evaluated.....	34
5.3 Comparison of Individual Measures	37
6. RESULTS OF CONSERVATION PROGRAM EVALUATION	41
6.1 Selection of Measures for Programs	41
6.2 Results of Program Evaluation	42
7. CONCLUSIONS	45
APPENDIX A - ASSUMPTIONS FOR THE DSS MODEL	46
A.1 DSS Model Overview	46
A.2 Plumbing Codes and Legislation	47

A.3	Water Reduction Methodology	51
A.4	Perspectives on Benefits and Costs.....	52
A.5	Present Value Parameters	52
A.6	Measure Assumptions including Unit Costs and Water Savings	53
A.7	Assumptions about Avoided Costs.....	54
APPENDIX B - WATER USE GRAPHS FOR PRODUCTION AND CUSTOMER CATEGORIES.....		55
APPENDIX C - MEASURE SCREENING PROCESS AND RESULTS		63
APPENDIX D - ASSUMPTIONS FOR WATER CONSERVATION MEASURES EVALUATED IN THE DSS MODEL		64
APPENDIX E - LIST OF CONTACTS.....		86
APPENDIX F - REFERENCES.....		87

LIST OF FIGURES

Figure ES-1. Conservation Measure Program Scenarios.....	9
Figure ES-2. Long Term Demands with Conservation Programs.....	10
Figure 2-1. Water Production and Consumption.....	15
Figure 2-2. Annual Consumption by User Category	15
Figure 2-3. Single Family Residential Water Use: Indoor vs. Outdoor*	16
Figure 3-1. DSS Model Flow Diagram.....	19
Figure 3-2. Historical and Projected Population and Employment.....	20
Figure 3-3. Water Use Projections for City of Oceanside (AFY)	25
Figure 6-1. Conservation Measure Program Scenarios.....	42
Figure 6-2. Long Term Demands with Conservation Programs.....	43
Figure 6-3. Present Value of Utility Costs vs. Cumulative Water Saved.....	44
Figure A-1. DSS Model Overview Used to Make Potable Water Demand Projections.....	50
Figure A-2. Example Toilet Replacement Percentages by Type of Toilet	51

LIST OF TABLES

Table ES-1 Conservation Measures Evaluated.....	8
Table ES-2. Water Use Projections (Acre-Feet/Year)*	9
Table ES-3. Water Demand Program Savings Projections	10
Table ES-4. Economic Analysis of Alternative Programs	11
Table 2-1. City of Oceanside Age of Housing from Census 2011-2013	17
Table 3-1. Historical and Projected Population and Employment.....	20
Table 3-2. Water Use Data Analysis and DSS Model Key Assumptions.....	22
Table 3-3. Water Use Projections (Acre-Feet/Year)*	25
Table 3-4. Demands and Accounts by Customer Category*	26
Table 4-1. Residential Customer Billing Rates	29
Table 4-2. Commercial Customer Billing Rates.....	29
Table 4-3. Residential Water Conservation Rebate.....	30
Table 4-4. Commercial Water Conservation Rebates	31
Table 5-1. Water Use Efficiency Measure Descriptions.....	35
Table 5-2. Conservation Measure Cost and Savings	39
Table 6-1 Water Use Projections (Acre-Feet/Year)*	42
Table 6-2. Water Demand Program Savings Projections (Acre-Feet/Year).....	43
Table 6-3. Comparison of Long-Term Conservation Programs – Utility Costs and Savings	44
Table 7-1. Water Use Projections (Acre-Feet/Year)*	45
Table A-1. 2010 CALGreen Building Code Summary Table.....	48

LIST OF ACRONYMS

AB	Assembly Bill	HE	High Efficiency
AF	acre-foot/acre-feet	HEU	High Efficiency Urinal
AFY	acre-foot/acre-feet per year	HP	horsepower
ag	agricultural	ILI	Infrastructure Leakage Index
AMI	Automated Meter Infrastructure	IRR	Irrigation
AWWA	American Water Works Association	MF	Multifamily
AWWARF	American Water Works Association Research Foundation	MG	million gallons
BMP	Best Management Practice	MOU	Memorandum of Understanding
CII	Commercial, Industrial, and Institutional	MWD	Metropolitan Water District of Southern California
CPI	Consumer Price Index	MWM	Maddaus Water Management, Inc.
CUWCC	California Urban Water Conservation Council	NRW	Non-revenue water
DMM	Demand Management Measure	PV	Present value
DWR	Department of Water Resources	PWSS	Public Water System Statistics
DSS	Decision Support System	SANDAG	San Diego Association of Governments
EPA	Environmental Protection Agency	SB	Senate Bill
FY	Fiscal Year	SB X7-7	2009 Water Conservation Act
GPCD	gallons per capita per day	SDCWA	San Diego County Water Authority
gpd	gallons per day	SF	Single Family
gpf	gallons per flush	UHET	Ultra-High Efficiency Toilet
gpm	gallons per minute	ULF	Ultra-Low Flow
hcf	hundred cubic feet	ULFT	Ultra-Low Flow Toilet
		UWMP	Urban Water Management Plan
		WF	Water factor

EXECUTIVE SUMMARY

Introduction

The purpose of the Executive Summary is to briefly describe the City of Oceanside Water Conservation Master Plan Update (Master Plan Update or Plan). The evaluation process and assumptions used to develop this Master Plan Update and recommendations for future implementation are included in the full report.

The City of Oceanside (City) has a current water conservation program. This report illustrates that expanding existing efforts in a cost-effective way will help meet future water needs and meet State mandated per capita reduction targets according to the 2009 Water Conservation Act (SB X7-7).

Maddaus Water Management Inc. (MWM) was contracted to develop the Plan using a process that included analyzing conservation measures and programs using MWM's proprietary Demand Side Management Least Cost Planning Decision Support System Model (DSS Model). The evaluation included measures directed at existing accounts, as well as new development measures to make new residential and business customers more water efficient. Three programs were developed to evaluate the net effect of running multiple measures together over time. From this analysis, a Recommended Plan was selected in concert with the City's 2015 Urban Water Management Plan (UWMP).

The City selected a plan comprised of aggressive water conservation, smart meters (AMI), and further implementation of recycled water conversions. The elements of the plan are further presented in Table ES-1 and Figure ES-1.

The benefits of the Master Plan Update are as follows:

- Aims to expand existing conservation efforts, along with the use of recycled water, to help meet future water needs and meet State mandated year 2020 per capita reduction targets;
- Is cost-effective and less expensive than continuing to buy water from San Diego County Water Authority;
- Helps the City become more self-sufficient with its water supply; and
- Is environmentally beneficial and helps make the City more sustainable.

Successful implementation of the Master Plan Update will require effort on the part of the City. Six new conservation measures will be employed and will work together, along with increased water recycling, to achieve City goals. Recommendations to assist with implementation include the following:

- Prioritize measures that contribute the most to meeting the per capita use targets as highest priority for implementation;
- Consider working with the largest 100 water using customers to reduce water use;
- Develop annual work plan for each plan year as soon as budget is adopted (or in concert with budget planning process);
- Form partnerships and apply for grants where appropriate;
- Outsource, if needed, to gain enough staff support to administer the expanded program;
- Develop analytical tools to track water use by customer class and overall per capita water use, adjusted for the weather and external factors;
- Set up a database to store and manage measure participation, cost, and other data to gauge successes and failures;
- Use the tools annually to help decide on priorities for the following plan year; and

- Annually update the plan, including actual measure participation, projected water savings, and expected per capita water use reductions, to ensure the City is on track to meet 2020 targets.

Long-Term Demand and Conservation Program Analysis Results

The Master Plan Update included analysis for the City and consisted of two main parts: (1) create a demand and conservation analysis for 2020 to 2040, and (2) evaluate conservation savings potential for the years 2020 to 2040 with a variety of different measures and conservation programs.

The first step in the analysis was to review and analyze historical water use production and billing data. Building on MWM's 2011 Water Conservation Master Plan effort, billing data was provided for the years 2011 to 2015. The data was graphically analyzed and discussed with the City.

The historical water use, selected population and employment projections, plumbing code information, and discussions with the City were used to create a demand forecast for the years 2020 to 2040, as further described in Section 3.

Once the demands were completed, the conservation measures were analyzed for a total of 22 measures shown in Table ES-1. The conservation analysis included all the measures selected by the City. The following important factors about the conservation measures were included in this analysis:

1. The measures reviewed are listed in the following table and described in Section 5.
2. New California state-wide plumbing standards that were adopted in 2015, the Model Water Efficient Landscape Ordinance (MWELO) and the CALGreen building code (as of May 1, 2015). These can be found in Appendix A.

The Master Plan Update presents the water demands and conservation savings determined by this analysis. The Plumbing Code includes the new California State Law (Assembly Bill 715), which requires High Efficiency Toilets and High Efficiency Urinals as of 2014. The Plumbing Code also includes SB 407, which applies to all new construction and replacements as of 2017 for single family and 2019 for multifamily and commercial properties. The increase of projected growth in population and/or jobs will cause water demand to increase. The three conservation program scenarios are organized as follows:

- **Program A:** "Existing Program" option includes measures that the City currently offers.
- **Program B:** "Optimized Program" includes individual measures that were selected by the City. This program includes all the measures included in Program A, plus 6 additional measures: an Automated Metering Infrastructure (AMI) measure; two Commercial, Industrial, and Institutional (CII) targeted measures; a school education measure; a recycled water conversion incentive measure; and an agricultural water audit measure.
- **Program C:** "All Measures Analyzed" presents a scenario where all 22 measures are implemented.

Table ES-1 presents all 22 conservation measures modeled in this analysis sorted by utility, CII, landscape, and residential categories.

Table ES-1 Conservation Measures Evaluated

Utility Measures	CII Measures	Landscape Measures	Residential Measures
Water Loss	High Efficiency Faucet Aerator, Showerhead, and Soil Moisture Sensor Giveaway	Residential Outdoor Water Surveys	Single Family Indoor Water Surveys
AMI	Top Water Users Program (Top customers from each customer category)	Large Landscape Outdoor Water Audit	High Efficiency Faucet Aerator, Showerhead, and Soil Moisture Sensor Giveaway
Pricing	CII Rebates to Replace Inefficient Equipment	Large Landscape Water Budgeting/Monitoring	Hot Water on Demand Pump Systems Rebate
Public Information	Require Plan Review for New CII	Financial Incentives for Irrigation and Landscape Upgrades	Residential Clothes Washer Rebate
School Education	Promote High Efficiency Pre-Rinse Spray Valves	Require Weather Adjusting Smart Irrigation Controllers and / or Rain Sensors in New Development	Incentive for Recycled Water Conversions
	Incentive for Recycled Water Conversions	Rotating Sprinkler Nozzle Rebates	
		Provide Rain Barrel Incentive	

Figure ES-1 presents the City of Oceanside’s conservation measure program scenarios, indicating which measures have been selected for implementation within each program.

Figure ES-1. Conservation Measure Program Scenarios

Program Scenarios				
 Program Scenarios	Measures	Program A	Program B	Program C
	Water Loss	☒	☒	☒
	AMI	☐	☒	☒
	Pricing	☐	☐	☒
	Single Family Indoor Water Surveys	☒	☒	☒
	High Efficiency Faucet Aerator, Showerhead, and Soil Moisture Sensor Giveaway	☒	☒	☒
	Hot Water on Demand Pump Systems Rebate	☐	☐	☒
	Residential Clothes Washer Rebate	☒	☒	☒
	Residential Outdoor Water Surveys	☒	☒	☒
	Large Landscape Outdoor Water Audit	☒	☒	☒
	Large Landscape Water Budgeting/Monitoring	☒	☒	☒
	Financial Incentives for Irrigation and Landscape Upgrades	☐	☐	☒
	Require Weather Adjusting Smart Irrigation Controllers and / or Rain Sensors in New Development	☐	☐	☒
	Rotating Sprinkler Nozzle Rebates	☒	☒	☒
	Provide Rain Barrel Incentive	☒	☒	☒
	Top Water Users Program (Top customers from each customer category)	☒	☒	☒
	CII Rebates to Replace Inefficient Equipment	☒	☒	☒
	Require Plan Review for New CII	☐	☒	☒
	Promote High Efficiency Pre-Rinse Spray Valves	☐	☒	☒
	Public Information	☒	☒	☒
	School Education	☐	☒	☒
	Incentive for Recycled Water Conversions	☐	☒	☒
	Ag Water Audit Program	☐	☒	☒

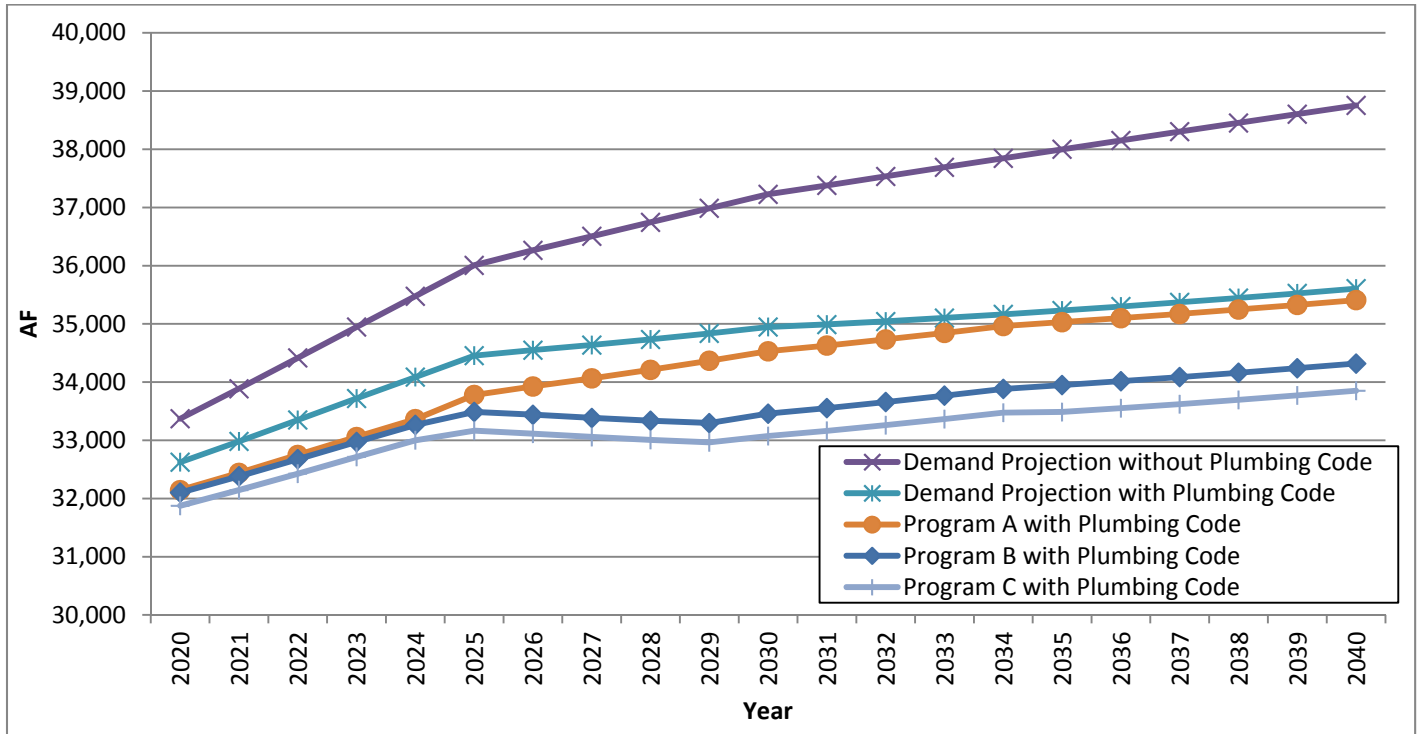
Table ES-2 presents the City of Oceanside's potable water use projections without plumbing code savings, with only plumbing code savings and no active conservation activity, and with plumbing code savings and Program A, Program B, and Program C active conservation program implementation savings.

Table ES-2. Water Use Projections (Acre-Feet/Year)*

	2020	2025	2030	2035	2040
Demand without Plumbing Code	33,371	36,006	37,227	38,001	38,754
Demand with Plumbing Code	32,624	34,454	34,947	35,231	35,606
Demand with Plumbing Code and Program A	32,145	33,779	34,531	35,031	35,408
Demand with Plumbing Code and Program B	32,102	33,487	33,458	33,949	34,319
Demand with Plumbing Code and Program C	31,875	33,164	33,073	33,485	33,851

*Data is not weather normalized. Total water use includes agricultural and recycled water use, as well as non-revenue water (NRW).

Figure ES-2 exhibits the same information as Table ES-2, but in graphic form.

Figure ES-2. Long Term Demands with Conservation Programs**Notes:**

1. All line types shown in the legend are presented in the graph. The following demand scenarios, Program A, Program B, and Program C, are close in value and therefore may be indistinguishable in the figure. Note the axis is “zoomed” in.
2. Data is not weather normalized. Total water use includes agricultural and recycled water use, as well as NRW.

Table ES-3 shows the annual water savings for plumbing code savings only, as well as plumbing code savings with Program A, Program B, and Program C implementation in five-year increments.

The benefit to cost ratio for each conservation program from the perspective of the City of Oceanside (water utility) and the combined perspective of the City plus the customers (community) is also presented.

Table ES-3. Water Demand Program Savings Projections

Conservation Program Water Savings (AFY)	2020	2025	2030	2035	2040	Water Utility Benefit to Cost Ratio	Community Benefit to Cost Ratio
Plumbing Code	747	1,552	2,280	2,770	3,148	N/A	N/A
Program A with Plumbing Code	1,226	2,227	2,696	2,970	3,346	3.86	2.89
Program B with Plumbing Code	1,269	2,519	3,768	4,052	4,435	6.70	3.45
Program C with Plumbing Code	1,496	2,842	4,154	4,516	4,902	7.11	3.51

Table ES-4 shows the year 2040 indoor and outdoor water savings for the three conservation programs modeled; the present value of water savings and the present value of costs to the utility and community are also displayed. The cost of utility savings per unit volume of water is shown in the far-right column.

Table ES-4. Economic Analysis of Alternative Programs

	2040 Indoor Water Savings (AFY)	2040 Outdoor Water Savings (AFY)	2040 Total Water Savings (AFY)	Present Value of Utility Water Savings (\$)	Present Value of Utility Costs (\$)	Present Value of Community Costs (\$)	Cost of Utility Savings per Unit Volume (\$/AF)*
Program A with Plumbing Code	3,235	110	3,346	\$10,830,774	\$2,809,068	\$4,551,358	\$279
Program B with Plumbing code	3,971	463	4,435	\$26,009,636	\$3,879,261	\$9,954,456	\$150
Program C with Plumbing Code	3,988	914	4,902	\$33,562,045	\$4,718,559	\$12,096,745	\$139

*Utility Cost of Water Saved per Unit Volume (\$/AF) = Present Value (PV) of Utility Costs over 25 years divided by the 25-Year Water Savings. This value is compared to the utility's avoided cost of water as one indicator of the cost effectiveness of conservation efforts. It should be noted that the Utility Cost of Water Saved per Unit Volume somewhat undervalues the cost of savings because program costs are discounted to present value and the water benefit is not.

Program B is the selected program for this plan update, which has an estimated budget and associated water savings. However, the program is intended to be flexible and structured as “menu/toolbox” format to allow individual measures to change as necessary.

This flexible format will allow adaptation to new or best available technology. It will also enable the City to select or change measures for implementation as needed to reach their conservation goals.

1. INTRODUCTION

This section provides an overview of the issues facing the City of Oceanside water system, describes the purpose and scope of the Master Plan Update, and provides a project history of the steps used to complete the Plan.

In this report, “demand management” and “water conservation” are used interchangeably. The evaluation includes measures directed at existing accounts, as well as new development measures that mandate that new residential and business customers be water efficient. Three program scenarios were provided to help evaluate the net effect of running multiple measures together over time. Assumptions and results for each of the 22 individual measures and three programs are described in detail in this report.

1.1 Overview of Oceanside Water System

The City of Oceanside Water Utilities operates and maintains the City’s water treatment, distribution, and metering systems. Approximately 86% of the City’s water is purchased from the San Diego County Water Authority (SDCWA). The City purchases raw water and treats it at the Robert A. Weese Filtration Plant. Approximately 13.5% of the City’s water comes from the Mission Basin. Brackish groundwater is extracted and becomes potable water through a desalting process at the Mission Basin Groundwater Purification Facility. The City also reclaims wastewater at the San Luis Rey Wastewater Treatment Plant and uses it to irrigate the Oceanside Municipal Golf Course, which comprises about 0.5% of total water use. The City’s Water Division operates and maintains over 500 miles of waterlines that distribute water throughout the City and 12 reservoirs with a capacity of 50.5 million gallons.

As a result of the decreasing reliability and increasing cost of these imported supplies, the City and other water suppliers in the region are examining the development of alternative supplies, such as ocean water desalination and increased recycled water use.

On the demand side, the City has completed a demand assessment for the 2015 UWMP and Water Conservation Master Plan Update that will be instrumental in meeting SB X7-7 regulations that require the reporting of baseline demand and conservation targets. As part of the 2015 UWMP, the City is planning to use a combination of recycled water and water conservation to achieve the potable demand reduction targets while maintaining a high-quality, reliable, and cost-effective supply for its customers.

Significant changes in the cost and availability of water supplies within the region, as well as increasing conservation requirements, have occurred in the City in the last few years.

1.2 Purpose and Scope of Plan

The purpose of this project is to evaluate water conservation demand management alternatives, general and type of customer-specific (single family, multifamily, commercial, etc.) conservation programs, and other water efficiency measures suggested by the City of Oceanside and Maddaus Water Management. These were evaluated in terms of their water savings, costs, and cost effectiveness from various perspectives, their acceptability, and their ability to be implemented. Working with the City staff, the best measures have been incorporated into the 2015 UWMP for the period of 2020 to 2040.

1.2.1 Objective of Plan

Oceanside’s stated objective is to develop a Water Conservation Master Plan Update to attain the water efficiency goals in a cost-effective manner that is feasible to implement by City staff. Key components of the plan include:

- Updating and further examining the current water use by the City of Oceanside to identify the best method of achieving additional savings and the timing of achieving those savings; and
- A short-term plan for complying with SB X7-7 and meeting per capita use targets by 2020.

1.2.2 Conservation Savings Goals

The City is committed to implementing a water demand reduction through conservation savings and water recycling. At this time, the future goal is to implement Program B.

1.2.3 Structure and Basis of Existing Oceanside Conservation Program

The City has been a member of the California Urban Water Conservation Council (CUWCC) since 1997. Currently, Oceanside partners with SDCWA and Metropolitan Water District of Southern California (MWD) for most of its current offering of programs, such as landscape site surveys. Over 25 separate rebate programs have been historically offered to the City's customers through MWD and SDCWA. They range from toilet and washing machine rebates for residential and business customers to "Smart" irrigation controller rebates. The City is fortunate that their water wholesalers offer aggressive programs. Not many utilities in the United States have such a wealth of resources available to its customers. However, just having these programs available does not mean that the City can expect large water savings with minimal effort. The actual uptake of these programs by City customers determines how much water is being saved by the current program. This will require that the City be proactive in marketing and educating customers as to the benefits of installing water efficient devices and changing water use habits. It is anticipated that in the future many of these programs will no longer be sponsored or run by the water wholesalers and that the City will need to consider directly administering and funding these programs.



1.3 Content of Report

The following information is included in this report and is discussed in individual sections below:

- Section 2 – Analysis of Historical Water Demand
- Section 3 - Demand Projections
- Section 4 – Current Water Conservation Program
- Section 5 – Comparison of Individual Conservation Measures
- Section 6 – Results of Conservation Program Evaluation
- Section 7 - Conclusions
- Appendix A - Assumptions for the DSS Model
- Appendix B - Water Use Graphs for Production and Customer Categories
- Appendix C - Measure Screening Process and Results
- Appendix D - Assumptions for Water Conservation Measures Evaluated in the DSS Model
- Appendix E – List of Contacts
- Appendix F – References

2. ANALYSIS OF HISTORICAL WATER DEMAND

The City's water use patterns were analyzed based on water production and consumption data from City staff; water loss was examined as well. Historical monthly water use data was analyzed and data from five years (2007 to 2011) was used to derive typical average water use per account per day. It was determined that more recent (years 2012-2015) data was affected by drought and recession. Data from each customer category was analyzed separately. Based on the City's water billing system, residential water use was broken down into single family and multifamily categories. Historical data was segregated into indoor and outdoor water use by customer type using the monthly billing data.

From the billing data, residential per capita water use values were calculated for water use inside the home and outside the home. These values were compared with other sources of municipal water use data applicable to the area. Other nonresidential categories of use were analyzed separately. Average daily commercial/industrial and public water use was expressed on a gallons-per-account or gallons-per-employee basis.

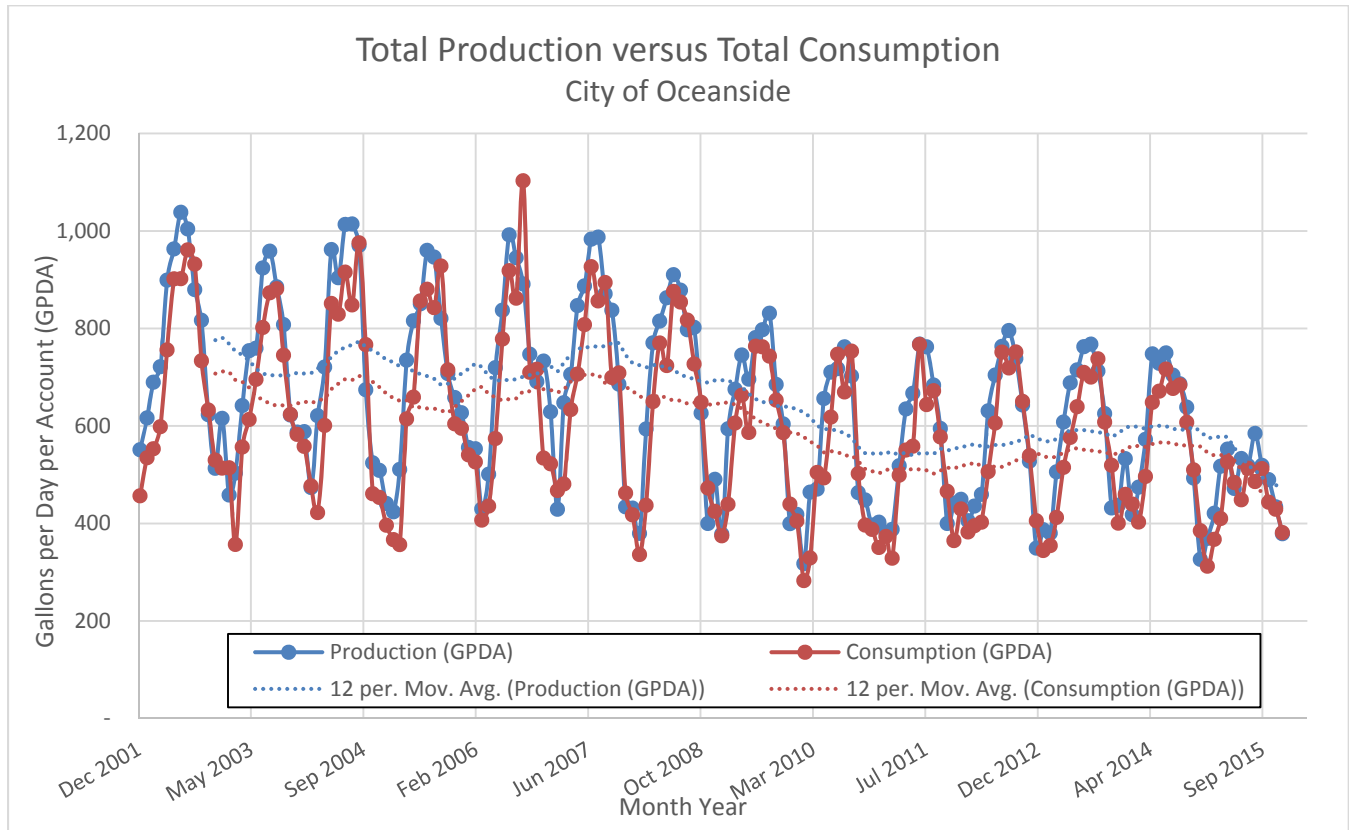
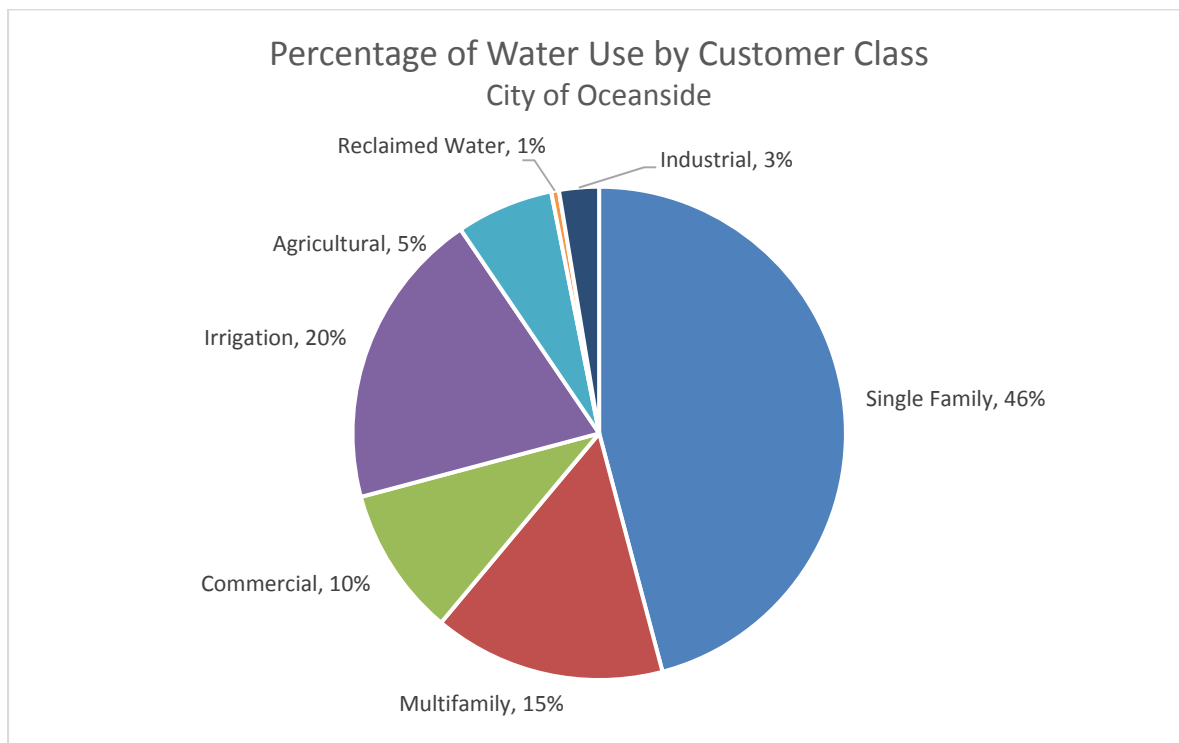
2.1 Production vs. Consumption

Historical water production data for the City was analyzed on a monthly basis and shown in Figure 2-1, which illustrates the total production versus total consumption for the City. Water production data was measured at the respective sources. Water consumption data was measured at the customer meters. As can be seen from the figure, the City does not experience significant losses of water in its system between the sources and the customer.

The difference between the amount of water produced and the amount of water billed is termed the non-revenue water (NRW). The City has elected to use an average 2010-2014 NRW value of 6.3% in their NRW projection estimates presented in the Section 3.

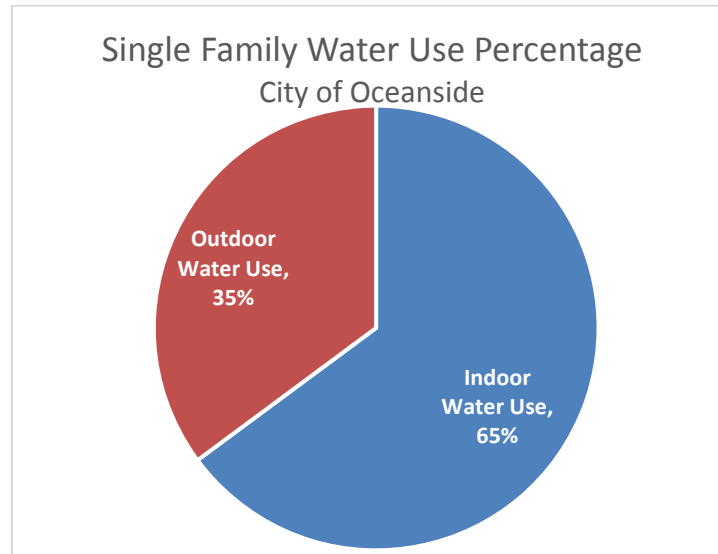
2.2 Consumption by User Category

The City has several different types of water users. The current and projected user categories in the City may be generally classified as single family residential, multifamily residential, commercial, irrigation, industrial, agricultural, and reclaimed. In the past, there was also a governmental customer category, but that stopped being used as of 2015. The City is a mostly residential community, with some agriculture, and light commercial and industry. Therefore, the largest category of users of water in the City is the single family residential users who consume almost half of the water sold. Shown in Figure 2-2 is the average annual consumption of the various user categories, based on average historical monthly water use and account data for years 2007 to 2011 for all customer categories, used to derive typical average per account per day water use. Five years (2010-2015) of water use and accounts were analyzed for the industrial category since it did not become active as a consistent customer category with reliable billing data until 2010.

Figure 2-1. Water Production and Consumption**Figure 2-2. Annual Consumption by User Category**

Residential use is approximately 61% of the total, typical of a city without significant commercial industrial uses. Since the single family residential use category formed the major portion of the City's water use (46%), it was analyzed further. Figure 2-3 shows the breakdown of single family residential use as indoor and outdoor based on the assumption that indoor use is approximately equal to the minimum use in the winter. Recent rainfall has been below normal, so an average of years 2007-2011 was selected for this profile as it was evident that there was little, if any, winter watering of landscape in these years. The goal of the analysis by customer sector, shown in Figure 2-2, and the breakdown of indoor and outdoor water use, shown in Figure 2-3, were provided to help the water conservation planning staff to design conservation programs and marketing messages to obtain the highest water savings. As seen in Figure 2-3, 65% of the average single family water use is indoors.

Figure 2-3. Single Family Residential Water Use: Indoor vs. Outdoor*



* Average 2007-2011 Single Family indoor and outdoor water use.

Appendix B presents historical customer category water use graphs which show the average monthly usage per account per day for the seven types of customers including reclaimed water. All categories exhibit a strong seasonal pattern where water use is higher in the summer.

Growth in accounts from 2010-2015 are as follows:

- Single Family ~0.4 percent/year
- Multifamily ~0.14 percent/year
- Commercial ~0.6 percent/year
- Irrigation - Potable ~7.5 percent/year
- Agricultural ~negative 0.9 percent/year
- Reclaimed Water ~0.0 percent/year (remained the same)

Several observations can be made when looking at the figures in Appendix B:

- On January 17, 2014, Governor Edmund G. Brown, Jr. declared a drought state of emergency and directed state officials to take all necessary actions in response. Statewide mandated drought restrictions began in 2014 and are still in effect in the year 2016 at the time this Master Plan Update is being written. Therefore, some of the decrease in water use is not actually a true long-term reduction in water use, but only a reflection of the drought restrictions.

- The residential growth that did occur has mainly been in the single family category. Single family accounts have only grown 0.4% per year over the last five years. Commercial accounts are also growing slowly at 0.6% per year. Single family per account water use has decreased over the past 5 years, most likely due to a combination of the drought and economic recession and conservation activities.
- Multifamily water use also has a downward trend that suggests that newer accounts have been of the smaller size units or have separate irrigation meters and/or conservation programs are driving lower per account use.
- Commercial water use also has a very downward trend, suggesting smaller new accounts are being added, or commercial accounts are conserving, replacing turf, etc.
- Though the number of irrigation accounts has increased 7.5% per year over the past five years, as shown in Appendix B, irrigation account water use exhibits a significant downward trend due to the current restrictions on outdoor irrigation.

The age of housing was analyzed for the City from the 2011 to 2013 Census data and provided in Table 2-1. The table shows that the age of the City homes is mostly older, with about 43% of the homes built before 1980 and 73% built before 1990. Typically, older homes have older fixtures and more leaks and therefore have higher indoor usage. We would expect commercial and governmental/institutional buildings to be of a similar age. Building age is important in determining what types of plumbing fixtures were installed in the buildings when constructed. California began modifying plumbing codes in 1977. Prior to 1977, toilets flushed with 4.5-7.0 gallons and no requirement on shower heads and faucets existed. More information about plumbing codes can be found in Appendix A.

However, note that the age of a building is not the only indicator of its water usage. Additional analysis is required to determine the number of homes that have been remodeled or upgraded with more water efficient fixtures. This often occurs at the rate of 3-5% of fixture replacements per year. In addition, the City has sponsored rebates on fixtures and given away conservation kits. Although the buildings may have started out inefficient by today's standards, the exact stock of more efficient fixtures is unknown.

Table 2-1. City of Oceanside Age of Housing from Census 2011-2013

Year Structure Built	# of Structures	Percentage of Structures	Cumulative Percentage of Structures Built
Built 2010 or later	376	1%	100%
Built 2000 to 2009	6,250	10%	99%
Built 1990 to 1999	11,088	17%	90%
Built 1980 to 1989	19,464	30%	73%
Built 1970 to 1979	17,012	26%	43%
Built 1960 to 1969	5,826	9%	17%
Built 1950 to 1959	2,786	4%	8%
Built 1940 to 1949	1,267	2%	4%
Built 1939 or earlier	1,094	2%	2%
Total Housing Units	65,163	100%	N/A

Source: U.S Census. City of Oceanside. American Community Survey 2011-2013 Table DP04.

The breakdown of indoor versus outdoor use taken into account along with the age of buildings indicates that further conservation efforts of City staff focused towards the indoor uses of water may be warranted. However, further research is needed to determine saturation of water efficient fixtures due to rebates, replacements, and remodels. Subsequent sections of this Master Plan Update describe the conservation programs already being run by the City, MWD, or SDCWA and recommend further programs that the City could consider to reduce its water use.

3. DEMAND PROJECTIONS

The purpose of Section 3 is to document the demand projections developed for the Plan. This section presents:

- Demand methodology overview;
- Population and employment projections;
- Water use data analysis inputs and key assumptions for the DSS Model;
- Water use targets; and
- Water demand projections with and without the plumbing code savings through 2040 (this is the demand before incorporating planned water savings from future active conservation efforts).

3.1 Demand Methodology Overview

The City's water demand (i.e., average year demand before additional active conservation savings were incorporated) was forecasted through 2040 using the DSS Model. The demand analysis process included forecasting future water demand (2020-2040) by customer category based upon forecasted increases in population and employment. Historical average monthly water use per customer category account was analyzed between 2002 and 2015. Average annual consumption of the various user categories is based on average historical monthly water use and account data for years 2007 to 2011 for all customer categories used to derive typical average per account per day water use. Five years (2010-2015) of water use and accounts were analyzed for the industrial category since it did not come online as a consistent customer category with reliable billing data until 2010.

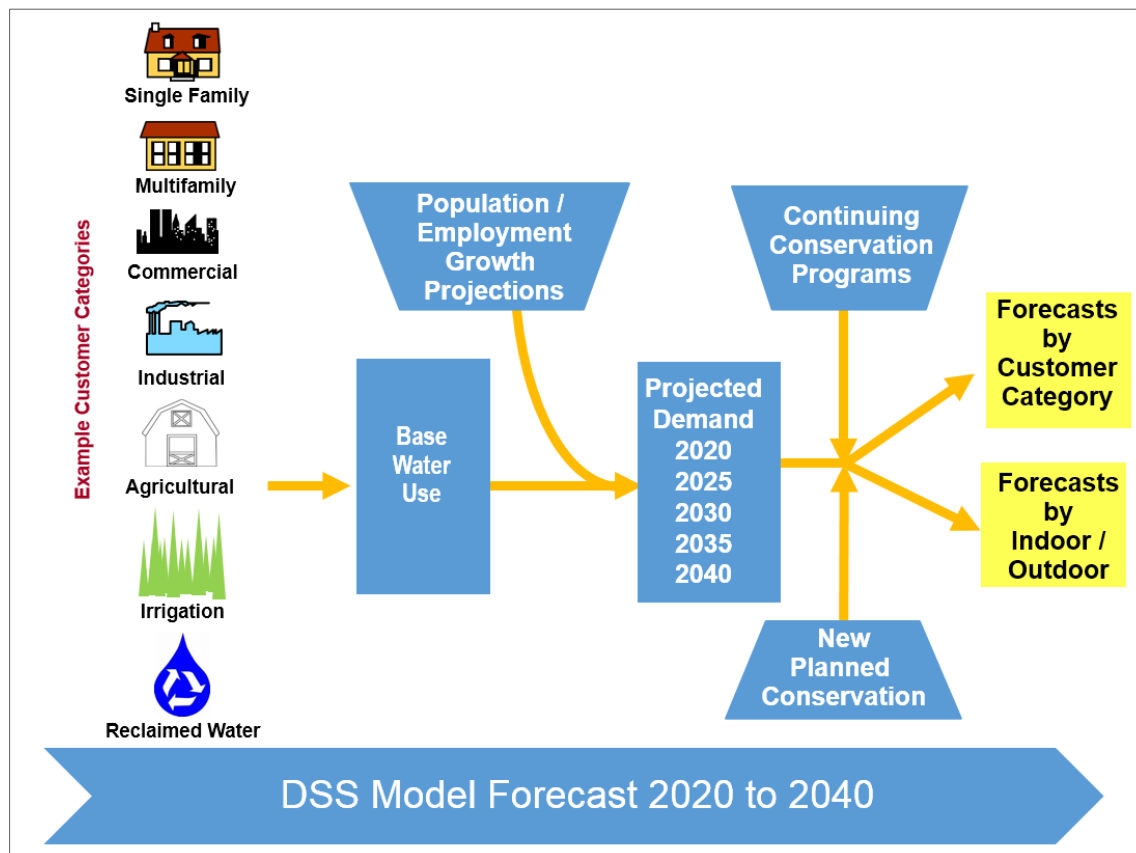
To forecast water demands, the DSS Model relies on demographic and employment projections, combined with the effects of natural fixture replacement due to the implementation of plumbing codes, which is passive conservation savings. Passive conservation refers to water savings resulting from actions and activities that do not depend on direct financial assistance or educational programs from the City. These savings result primarily from (1) the natural replacement of existing plumbing fixtures with water-efficient models required under current plumbing code standards, and (2) the installation of water-efficient fixtures and equipment in new buildings and retrofits as required under CALGreen Building Code Standards. The DSS Model evaluated water savings associated with these codes and standards to project passive conservation savings. Section 3 presents the DSS Model's demand estimates taking into account savings only from passive conservation.

3.1.1 DSS Model Methodology

The DSS Model's conservation component covers the entire forecast period, 2020-2040. Quantification of water savings potential from active conservation programs is presented in Section 4 and Section 5.

The DSS Model prepares long-range, water demand and conservation water savings projections. The DSS Model is an end-use model that breaks down total water production (i.e., water demand in the service area) into specific water end uses, such as toilets, faucets, irrigation, etc. This "bottom-up" approach allows for detailed criteria to be considered when estimating future demands, such as the effects of natural fixture replacement, plumbing codes, and conservation efforts. The purpose of using end-use data is to enable a more accurate assessment of the impact of water efficiency programs on demand and to provide a rigorous and defensible modeling approach necessary for projects subject to regulatory or environmental review.

Figure 3-1. DSS Model Flow Diagram



Note: The Governmental/Institutional category was discontinued as of January 1, 2015.

As shown in Figure 3-1, the first step for forecasting water demands using the DSS Model was to gather customer category billing data from the City. The next step was to check the model by comparing water use data with available demographic data to characterize water usage for each customer category (single family, multifamily, commercial, industrial, agricultural, irrigation, and reclaimed water) in terms of number of users per account and per capita water use. During the model calibration process data was further analyzed to approximate the indoor/outdoor split by customer category. The indoor/outdoor water usage was also further divided into typical end uses for each customer category. Published data on average per-capita indoor water use and average per-capita end use was combined with the number of water users to verify that the volume of water allocated to specific end uses in each customer category is consistent with social norms from end-use studies on water use behavior (e.g., for flushes per person per day).

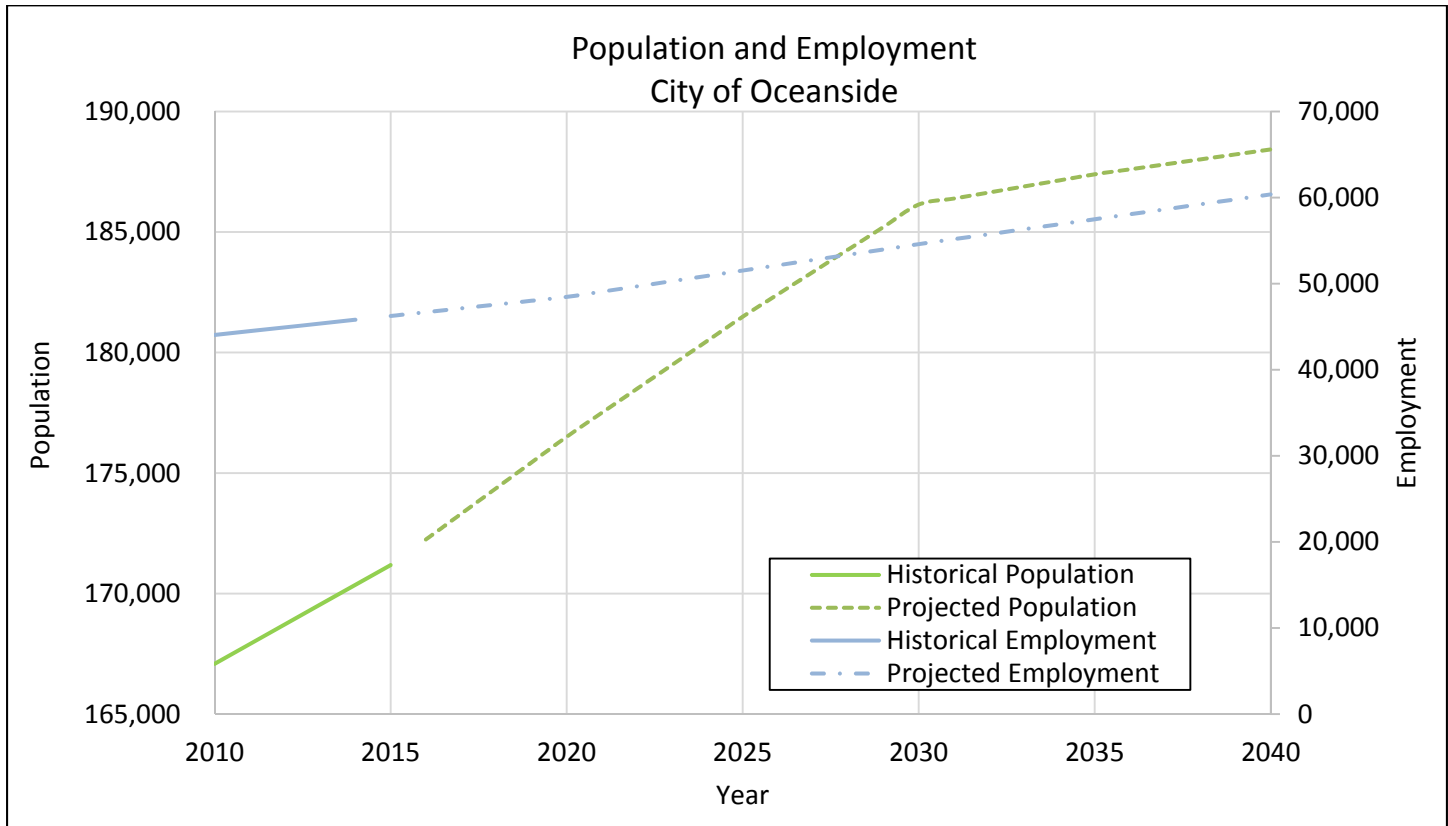
3.2 Future Population and Employment Projections

The main source of population and employment projections used to generate future water demands for the Conservation Master Plans is:

- *San Diego Association of Governments (SANDAG) (population and employment)* – SANDAG published projection estimates in 2013 and 2015 that include employment and population estimates, respectively, for each city in the San Diego region. These reports provide estimates for years 2020, 2035, and 2050.

Included in the following tables and graphs are the population and employment projections for the City. Population projections are based on the 2020-2045 population from SANDAG Series 13 Growth Forecast as reported in the 2015 UWMP. Employment projections are based on October 15, 2013 Series 13: 2050 Regional Growth Forecast by SANDAG.

The population and employment projections are shown in the following Figure 3-2 and Table 3-1.

Figure 3-2. Historical and Projected Population and Employment

Note: Population and employment projections for the City of Oceanside are based on SANDAG projections.

Table 3-1. Historical and Projected Population and Employment

Year	Population	Employment
2010	167,086	44,037
2015	171,183	46,251
2020	176,510	48,464
2025	181,489	51,531
2030	186,140	54,597
2035	187,397	57,487
2040	188,428	60,377

Note: Population and employment projections for the City of Oceanside are based on SANDAG projections.

3.3 Water Use Data Analysis and Key Inputs to the DSS Model

The demand analysis process includes using baseline average water use per customer to forecast water demands by customer category based upon forecasted increases in population and employment to predict customer category account growth. Average water use per customer category account was based on a water use data analysis investigating historical and current water use data and demographic data. This analysis includes the following elements:

- **Model Start Year** – This is the starting year for the analysis. For this project, the start year for the model is 2015. The DSS Model includes 25 years of data projecting information until the year 2040.
- **Base Year for Future Water Factors** – Based on an analysis of historical water billing data, the City selected years that are representative of current water use and used as a base year demand factor for developing future water

use projections. An average of five years 2007-2011 was used for all customer categories except for the industrial customer category, which used years 2010-2015 since it didn't come online as a consistent customer category with reliable billing data until 2010. These years were chosen by the City for the following reasons:

- Note that it is recognized that the years 2008-2011 show a dip in water demand in many areas due to reduction in economic activity.
 - The years selected had relatively “normal” climate conditions (i.e., not a drought or excessively wet year), so no significant weather adjustments were necessary. More recent years (2012-2015) were affected by drought conditions. The water billing or production data shown in Appendix B was not weather normalized for this analysis.
 - Appendix B presents historical customer category water use graphs. Historical water use was provided by the City, taken from DWR's annual Public Water System Statistics (PWSS) reports, or taken from previous modeling efforts conducted by MWM. The data was reviewed and confirmed by the City. Units shown are average gallons of water per account per day. These graphs were reviewed to better identify outlier data points and years so that a representative baseline water use value (of average account water use by category) could be determined. The effects of drought, economic recessions, service line failures, and meter inaccuracies are typically evident in these figures.
- *Average gal/day/acct* – This is the amount of water in gallons that is used per day, per account.
 - *Indoor/outdoor Water Use* – This is the amount of water per account split into the percent that is used indoors and outdoors.
 - *Consumption by Customer Class* – This shows the annual amount of water used for an entire calendar year, broken down by customer class (Single Family, Multifamily, Commercial, Irrigation, etc.).
 - *Non-Revenue Water (NRW)* – This is the sum of all water input to the system that is not billed (metered and unmetered), including apparent (metering accuracy) and real losses. The values were calculated by taking the difference between the amount of water produced and the amount of water sold. Data provided by the City was used unless another more accurate value from the AWWA M36 Water Loss reports was provided.
 - *Census Data* – The 2011-2013 Census data was used as a general reference when determining household sizes for the City.
 - *Current Service Area Population* – Recent SANDAG projection estimates was selected by the City for future population projections as shown in Table 3-1.
 - *Employment Data* – Recent SANDAG projection estimates was selected by the City for future employment projections as shown in Table 3-1.

Table 3-2 shows the key inputs and assumptions used in the model. The assumptions having the most dramatic effect on future demands were the natural replacement rate of fixtures, how residential or commercial future use is projected, and the percent of estimated non-revenue water. More details on these assumptions, including screenshots of where they are incorporated into the DSS Model, can be found in Appendix A.

Table 3-2. Water Use Data Analysis and DSS Model Key Assumptions

Parameter	Model Input Value, Assumptions, and Key References					
Model Start Year	2015					
Non-Revenue Water in Start Year	6.3%					
	This is based on 2010-2014 historical NRW and can be found in the green NRW section of the DSS Model.					
Population Projection Source	Final Technical Memorandum Updated Population Forecasts for 2015 UWMP, Jan 21, 2016. 2015 population from Department of Finance; 2020-2045 population from SANDAG Series 13 Growth Forecast.					
Employment Projection Source	October 15, 2013 Series 13: 2050 Regional Growth Forecast by SANDAG.					
Avoided Cost of Water	\$1,401/AF (\$4,299/MG) This value can be found in the “Avoided Costs” red section of the City’s DSS Model.					
Base year Water Use Profile						
Customer Categories	Start Year Accounts	Total Water Use Distribution	Demand Factors (gpd/acct)	Indoor Use %	Water Demand Factor Year (Base Year)	Residential Indoor Water Use (GPCD)
Single family	38,471	45.9%	316	65%	2007-2011	71
Multifamily	2,026	15.2%	1,992	81%	2007-2011	54
Commercial	1,642	9.8%	1,579	77%	2007-2011	N/A
Irrigation	1,482	19.6%	3,518	0%	2007-2011	N/A
Agricultural	134	6.4%	12,648	0%	2007-2011	N/A
Reclaimed Water	1	0.5%	133,533	0%	2007-2011	N/A
Industrial	11	2.6%	63,205	88%	2010-2015	N/A
Total	43,768	100%	N/A	N/A	N/A	N/A
Residential End Uses	Key Reference: CA DWR Report "California Single Family Water Use Efficiency Study," (DeOreo, 2011 – Page 28, Figure 3: Comparison of household end-uses) and AWWA Research Foundation (AWWARF) Report “Residential End Uses of Water, Version 2 - 4309” (DeOreo, 2016). Table 2-A. Water Consumption by Water-Using Plumbing Products and Appliances - 1980-2012. PERC Phase 1 Report. Plumbing Efficiency Research Coalition. 2013. http://www.map-testing.com/content/info/menu/perc.html Model Input Values are found in the “End Uses” section of the DSS Model on the “Breakdown” worksheet.					
Non-Residential End Uses, %	Key Reference: AWWARF Report "Commercial and Institutional End Uses of Water" (Dziegielewski, 2000 – Appendix D: Details of Commercial and Industrial Assumptions, by End Use). Santa Clara Valley Water District Water Use Efficiency Unit. "SCVWD CII Water Use and Baseline Study." February 2008. Model Input Values are found in the “End Uses” section of the DSS Model on the “Breakdown” worksheet.					
Efficiency Residential Fixture Current Installation Rates	U.S. Census, Housing age by type of dwelling plus natural replacement plus rebate program (if any). Key Reference: California Urban Water Conservation Council Potential Best Management Practice Report "High Efficiency Plumbing Fixtures – Toilets and Urinals" (Koeller, 2005 – Page 42, Table 8 and Table 9: Residential toilet installation rates in California). Key Reference: Consortium for Efficient Energy (www.cee1.org). Model Input Values are found in the “Codes and Standards” green section of the DSS Model by customer category fixtures.					

Parameter	Model Input Value, Assumptions, and Key References
Water Savings for Fixtures, gal/capita/day	Key Reference: AWWARF Report "Residential End Uses of Water, Version 2 - 4309" (DeOreo, 2016). Key Reference: CA DWR Report "California Single Family Water Use Efficiency Study" (DeOreo, 2011 – Page 28, Figure 3: Comparison of household end-uses). WCWCD supplied data on costs and savings; professional judgment was made where no published data was available. Key Reference: California Energy Commission, Staff Analysis of Toilets, Urinals and Faucets, Report # CEC-400-2014-007-SD, 2014. Model Input Values are found in the "Codes and Standards" green section on the "Fixtures" worksheet of the DSS Model.
Non-Residential Fixture Efficiency Current Installation Rates	Key Reference: 2010 U.S. Census, Housing age by type of dwelling plus natural replacement plus rebate program (if any). Assume commercial establishments built at same rate as housing, plus natural replacement. California Energy Commission, Staff Analysis of Toilets, Urinals and Faucets, Report # CEC-400-2014-007-SD, 2014. Santa Clara Valley Water District Water Use Efficiency Unit. "SCVWD CII Water Use and Baseline Study." February 2008. Model Input Values are found in the "Codes and Standards" green section of the DSS Model by customer category fixtures.
Residential Frequency of Use Data, Toilets, Showers, Faucets, Washers, Uses/user/day	Key Reference: AWWARF Report "Residential End Uses of Water, Version 2 - 4309" (DeOreo, 2016). Summary values of the report can be found in the following presentation: http://watersmartinnovations.com/documents/pdf/2014/sessions/2014-T-1458.pdf Key Reference: California Energy Commission, Staff Analysis of Toilets, Urinals and Faucets, Report # CEC-400-2014-007-SD, 2014. Key Reference: Alliance for Water Efficiency, The Status of Legislation, Regulation, Codes & Standards on Indoor Plumbing Water Efficiency, January 2016. Model Input Values are found in the "Codes and Standards" green section on the "Fixtures" worksheet of the DSS Model and confirmed in each "Service Area Calibration End Use" worksheet by customer category.
Non-Residential Frequency of Use Data, Toilets, Urinals, and Faucets, Uses/user/day	Key References: Estimated based on AWWARF Report "Commercial and Institutional End Uses of Water" (Dziegielewski, 2000 – Appendix D: Details of Commercial and Industrial Assumptions, by End Use). Key Reference: California Energy Commission, Staff Analysis of Toilets, Urinals and Faucets, Report # CEC-400-2014-007-SD, 2014. Based on three studies of office buildings in which the numbers varied from 2.0 to 3.45 toilet flushes per employee per day: Darell Rogers cited in Schultz Communications (1999); Konen Plumbing Engineer July/August 1986); and Eva Opitz cited in PMCL (1996). Fixture uses over a 5-day work week are prorated to 7 days. Non-residential 0.5gpm faucet standards per Table 2-A. Water Consumption by Water-Using Plumbing Products and Appliances - 1980-2012. PERC Phase 1 Report. Plumbing Efficiency Research Coalition. 2013. http://www.map-testing.com/content/info/menu/perc.html Model Input Values are found in the "Codes and Standards" green section on the "Fixtures" worksheet of the DSS Model, and confirmed in each "Service Area Calibration End Use" worksheet by customer category.
Natural Replacement Rate of Fixtures (% per year)	Residential Toilets 2% (1.28 gpf and lower), 3% (1.6 gpf toilets), 4% (3.5 gpf and higher toilets).
	Non-Residential Toilets 2% (1.6 gpf and lower), 3% (3.5 gpf and higher toilets).
	Residential Showers 4% (corresponds to 25-year life of a new fixture).

Parameter	Model Input Value, Assumptions, and Key References
	Residential Clothes Washers 10% (based on 10-year washer life). Key References: “Residential End Uses of Water” (DeOreo, 2016) and “Bern Clothes Washer Study, Final Report” (Oak Ridge National Laboratory, 1998).
	Residential Faucets 10% and Non-Residential Faucets 6.7% (every 15 years). CEC uses an average life of 10 years for faucet accessories (aerators). A similar assumption can be made for public lavatories, though no hard data exists and since CII fixtures are typically replaced less frequently than residential, 15 years is assumed. CEC, Analysis of Standards Proposal for Residential Faucets and Faucet Accessories, a report prepared under CEC’s Codes and Standards Enhancement Initiative, Docket #12-AAER-2C, August 6, 2013.
	Model Input Value is found in the “Codes and Standards” green section on the “Fixtures” worksheet of the DSS Model.
Residential Future Water Use	Increases Based on Population Growth and Demographic Forecast.
Non-Residential Future Water Use	Increases Based on Employment Growth and Demographic Forecast.

3.4 Water Use Targets

SB X7-7, or “The Water Conservation Act of 2009,” was enacted to ensure California continues to have reliable water supplies, requiring urban water agencies to collectively reduce statewide per capita water use by 20% before December 31, 2020. The law establishes that the base daily per capita use be based on total gross water use divided by the service area population.

In tracking per capita water use, which is measured in gallons per capita per day (GPCD), the primary project driver is the SB X7-7 compliance requirements that require tracking of baseline GPCD, a 2015 target, and a 2020 target. The City’s service area population estimates were updated in developing the 2015 UWMP using the 2010 U.S. Census data to provide correct annual GPCD calculations. A Geographic Information System (GIS) analysis found that the City provides 95% of its service area with water services, which allows it to use California Department of Finance (DOF) population projections for its service area data. The year 2020 GPCD target for the City of Oceanside is 137 and is based on Method 1. The Method 1 methodology is based on a per capita water use by 2020 that is 80% of the urban retail water supplier’s baseline per capita daily water use. The City’s baseline is 171 GPCD. The resulting per capita demand target for 2020 is 137 GPCD, with an interim 2015 target of 154 GPCD. Additional background information about the calculation of the water use targets can be found in the 2015 UWMP.

3.5 Water Demand Projections with and without Plumbing Code Savings

Water demand projections were developed to the year 2040 using the DSS Model. Table 3-3 shows projected demands in 5-year increments with and without plumbing codes and appliance standards. Information and assumptions about plumbing code and appliance standards can be found in Appendix A.

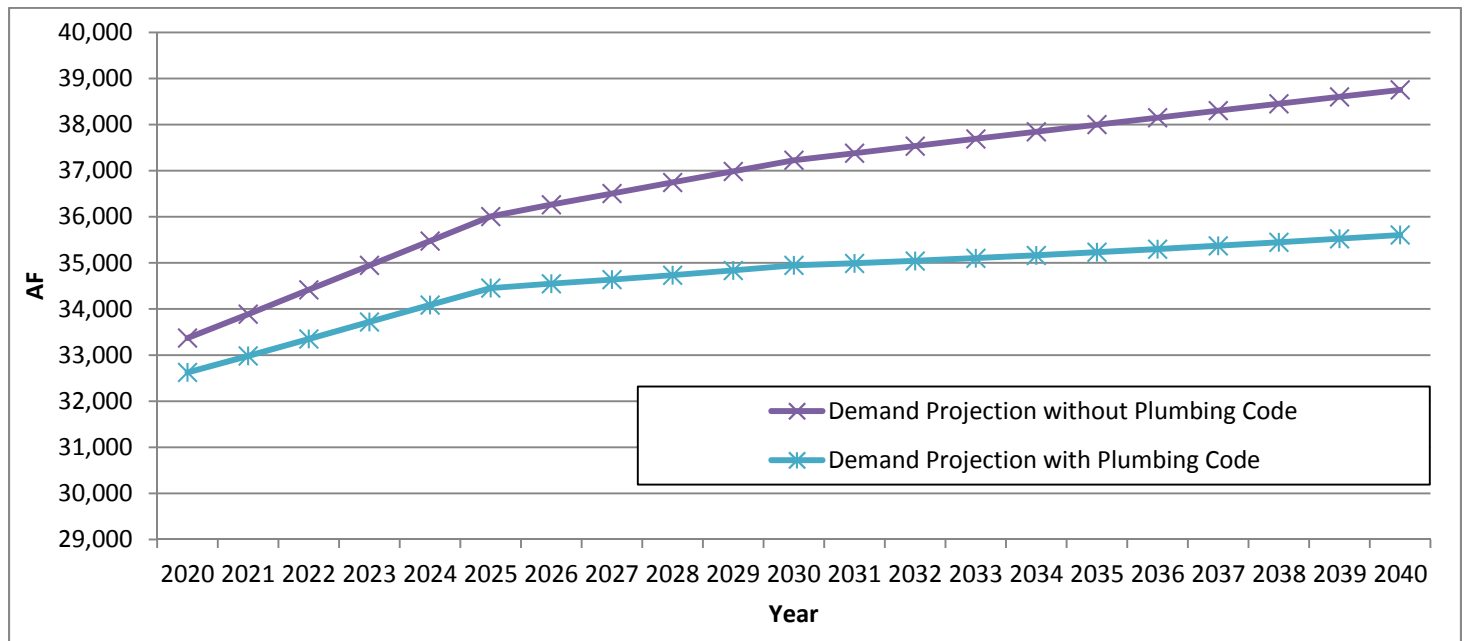
The demand projections reflect average water use assuming average weather conditions and do not reflect drier and hotter drought conditions. Likewise, climate change (which might alter weather patterns), increased or decreased rainfall, and possibly increased irrigation demand in the spring and fall due to a warmer climate have not been addressed in this analysis.

Table 3-3. Water Use Projections (Acre-Feet/Year)*

	2020	2025	2030	2035	2040
Demand without Plumbing Code (AFY)	33,371	36,006	37,227	38,001	38,754
Demand with Plumbing Code (AFY)	32,624	34,454	34,947	35,231	35,606
Plumbing Code Savings (AFY)	747	1,552	2,280	2,770	3,148

*Data is not weather normalized. Total water use includes agricultural and recycled water use. Values include NRW.

Figure 3-3 shows the water demand projections with and without the plumbing code through 2040.

Figure 3-3. Water Use Projections for City of Oceanside (AFY)

*Data is not weather normalized. Total water use includes agricultural and recycled water use. Values include NRW.

The current and projected number of connections and deliveries to the City's water distribution system, by sector, are identified in the following table. Note that total deliveries include plumbing code savings, recycled water deliveries, agricultural water deliveries, and NRW.

Table 3-4. Demands and Accounts by Customer Category*

		Single family	Multi-family	Commercial	Irrigation	Agricultural	Reclaimed Water	Industrial	NRW	Total
2020	# of accounts	39,669	2,089	1,721	1,617	134	3	12	N/A	45,243
	Deliveries AF/Y	13,638	4,459	2,970	6,374	1,895	400	817	2,071	32,624
2025	# of accounts	40,788	2,148	1,830	1,720	134	11	12	N/A	46,643
	Deliveries AF/Y	13,577	4,365	3,091	6,783	1,895	1,700	868	2,174	34,454
2030	# of accounts	41,833	2,203	1,939	1,514	134	19	13	N/A	47,655
	Deliveries AF/Y	13,536	4,284	3,221	5,970	1,895	2,900	920	2,221	34,947
2035	# of accounts	42,115	2,218	2,041	1,566	134	20	14	N/A	48,109
	Deliveries AF/Y	13,366	4,185	3,348	6,175	1,895	3,060	969	2,233	35,231
2040	# of accounts	42,347	2,230	2,144	1,547	134	23	14	N/A	48,440
	Deliveries AF/Y	13,245	4,113	3,480	6,100	1,895	3,500	1,017	2,256	35,606

*Demands include plumbing code savings.

4. CURRENT WATER CONSERVATION PROGRAM

The purpose of this section is to present the City's existing water conservation program.

The City has been a member of the California Urban Water Conservation Council (CUWCC) since 1997. The City's current water conservation program is a combination of the City's commitment to carrying out the CUWCC Best Management Practices (BMPs) and the City's desire to be water efficient. Since July 2008 the City has been participating in three regional programs that focus on offering services and hardware according to many of the 14 CUWCC BMPs created in 1997. These 14 BMPs were required of the CUWCC signatories until the end of 2008. Currently the CUWCC members are expected to comply with the new and revised CUWCC BMPs which went into effect with the last Memorandum of Understanding revision on January 4, 2016. Exhibit 1 of the MOU Contains the five Best Management Practices, which include:

- BMP 1.1: Utility Operations Programs
- BMP 1.2: Water Loss Control
- BMP 1.3: Metering with Commodity Rates for All New Connections and Retrofit of Existing Connections
- BMP 1.4: Retail Conservation Pricing
- BMP 2.1: Public Information Programs
- BMP 2.2: School Education Programs
- BMP 3: Residential Programs
- BMP 4: CII Programs
- BMP 5: Landscape Programs

With the submittal and approval of their 2013 and 2014 BMP annual reports, the City is in full compliance with the Memorandum of Understanding (MOU).

The following sections describe the BMPs or demand management measures (DMMs) that have been implemented by the City of Oceanside over the past 5 years, along with planned implementation to achieve water use targets.

4.1 Water Waste Prevention Ordinances

The City has three ordinances in place to give the City the authority to prohibit water waste and encourage water use efficiency within the service area. Each ordinance is updated as needed to stay current with State regulations. The three ordinances are listed and described in further detail below.

- Updates to Water Conservation Program and Drought Response Conservation Measures (Ordinance No. 15-OR0276-1)
- Water Efficient Landscaping (Ordinance No. 10-OR0412-1)
- Recycled Water (Ordinance No. 14-OR0565-1)

4.1.1 Updates to Water Conservation Program and Drought Response Conservation Measures (Ordinance No. 15-OR0276-1)

The most recent amendments to the City's "Drought Ordinance" occurred in 2015 to incorporate Governor Brown's 2014 state of emergency proclamation for drought and the 2015 Executive Order for 25% reduction of water use statewide. This ordinance clarifies the four drought response levels and describes the water use restrictions and required reductions for each stage. A copy of the ordinance is included in Appendix E of the City's 2015 UWMP.

4.1.2 Water Efficient Landscaping (Ordinance No. 10-OR0412-1)

To ensure compliance with the State's Water Conservation in Landscaping Act, this ordinance was implemented to include 2006 development landscape design requirements and is written to be as effective as the State's Model Water Efficient Landscape Ordinance. This ordinance is currently in the process of being updated. A copy of the ordinance is included in Appendix F of the 2015 UWMP.

4.1.3 Recycled Water (Ordinance No. 14-OR0565-1)

The ordinance establishes the authority for the City to enforce connection to and use of recycled water where applicable. A copy of the ordinance is included in Appendix G of the 2015 UWMP.

4.1.4 Planned Implementation to Achieve Water Use Targets

The City will maintain and expand its water waste prevention ordinances as needed to meet demand management goals established in this 2015 Plan.

4.2 Metering

All water service connections are metered and billed according to water consumed. The City does have Commercial/Industrial mixed-use meters and, after a preliminary in-house feasibility study was performed, concluded that the potential water savings to separate out the irrigation water usage with an additional meter would be small, unnoticeable, and cost prohibitive. Therefore, the project has not been pursued further.

The City has an active water meter replacement program in place to continually change out older meters based on staff availability each month.

4.2.1 Planned Implementation to Achieve Water Use Targets

The City is planning to implement an advanced metering infrastructure (AMI) program, initially for its dedicated irrigation customers, with potential for future expansion. AMI, in concert with a web-based interface software (WaterSmart), will provide real-time consumption data to facilitate early identification of water loss, allow customers to track daily water use, and provide a mechanism for ongoing outreach and communication between the City and its customers. It will also allow the City to notify customers of overwatering throughout the month rather than only once month.

4.3 Conservation Pricing

The City has and will continue to utilize a combination of uniform and increasing block or tiered rate conservation rate structures. Residential customers comprised of single family, master-metered residential, and multifamily customer classes are billed in increasing block structures where the water rate increases with additional water units consumed. Table 4-1 shows the proposed residential customer billing rates for 2016. Commercial, agricultural (ag), and irrigation customer classes are billed using uniform rate structures where a flat rate is billed for every unit consumed. Table 4-2 shows the proposed billing rates for commercial customers.

Table 4-1. Residential Customer Billing Rates

Tier	Block Structure	Cost per Unit
Single Family and Master – Metered (per dwelling unit)		
Tier 1	0 – 13 units	\$2.21/unit
Tier 2	14 units and above	\$2.76/unit
Multiple Family (per dwelling unit)		
Tier 1	0 – 7 units	\$2.21/unit
Tier 2	8 units and above	\$2.69/unit

Table 4-2. Commercial Customer Billing Rates

Tier	Cost per Unit
Commercial Ag rate	\$2.43/unit
Special Ag Rate	\$1.76/unit
Irrigation rate	\$2.44/unit
Commercial rate	\$2.36/unit

4.3.1 Planned Implementation to Achieve Water Use Targets

The City will maintain and expand its conservation pricing as needed to meet demand management goals established in this 2015 Plan.

4.4 Public Education and Outreach

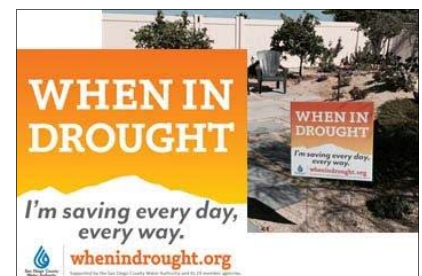
The City engages in a variety of public education and outreach efforts to improve water use management, education, and efficiency. These programs are described herein.

4.4.1 Outreach Activities

The City provides water conservation messaging to customers through their dedicated water conservation website www.SaveWaterOceanside.com which contains water conservation tips, rebate program information, water saving videos, and important links to other water conservation websites and regional partners.

The City staffs a “Save Water Oceanside” booth dedicated to promoting water conservation at several events throughout the year. Displayed are brochure handouts containing indoor and outdoor water saving information and conservation tools as free giveaways. Giveaway items include toilet leak dye tabs, water saving buckets, hose nozzles, soil moisture meters, shower timers, shower gauge bags, and San Diego Gas & Electric Water and Energy Saving kits.

In order to reach a wide range of audiences, the City has brochures and handouts available at various community centers and City offices. Bill inserts are included with utility bills to announce available programs and important water conservation reminders. The City has consistently reached out to customers using various methods every quarter within the last five years. In coordination with SDCWA, the City promotes opportunities for residents to participate in regional programs such as Green Oceanside Business Network certification, California-Friendly landscape contest, Speaker Bureaus, and Citizens Water Academy.



4.4.2 Workshops

The City, in coordination with SDCWA, provides workshops on water related themes geared to the residential user. Workshop topics provided in the past include California Friendly Landscape Training and Fix-a-Leak. Workshops are offered for free and held at different locations through the county, with at least two workshops held in a City of Oceanside facility.

Marketing for workshops occurs by the City through strategically placed poster notices at various public locations such as libraries, community centers, and garden centers, and through email blasts or bi-monthly bill stuffer notifications.

4.4.3 School Education

The City offers two school education programs for local schools as well as education materials to teachers upon request through SDCWA. The Splash Lab offers assembly presentations available to grades K-6 to educate students on water science. For Grades 4-6, students can participate in a mobile water lab for a hands-on experience learning water-related topics.

The City holds a poster contest for 4th graders to compete for inclusion in the City's annual water conservation calendar. The top posters are incorporated into the calendar that includes conservation tips and reminders. The poster is provided as a giveaway item to customers.

4.4.4 Residential Customer Rebates

In combination with SoCal WaterSmart program managed by MWD, rebates are available to upgrade water fixtures to be more water efficient. Table 4-3 provides a list of all rebates available and associated rebate amounts for residential customers.

A popular program that exhausted funds in 2015 was the turf removal rebate program designed to encourage the replacement of water thirsty turf with drought tolerant plants. The program has gathered about 900 participants since it began in 2014. Rebates for clothes washers and high efficiency (HE) toilets continue to be popular programs gathering participation of just over 2,000 fixtures replaced for each rebate program.

Table 4-3. Residential Water Conservation Rebate

Rebate Program Name	Rebate Amount
Indoor Fixtures	
Turf removal rebate	\$2/sq. ft. up to \$6,000
Clothes washer rebate	\$135
HE toilets	\$100
Outdoor Fixtures	
Irrigation controllers	\$80
Irrigation nozzles	\$4/nozzle - minimum is 15
Rain barrels	\$75
Soil moisture sensors	\$35/controller station

4.4.5 Commercial Customer Rebates

The City, in combination with SoCal WaterSmart Program managed by MWD, provides rebates geared towards commercial customers to promote water efficiency. Table 4-4 displays the rebates available grouped into market sectors with associated amounts available per rebate for commercial customers. Within the last five years the most applied for

rebates programs by commercial customers include HE toilets, with about 160 toilets replaced, and turf removal rebates, with 62 sites applying for the program.

Table 4-4. Commercial Water Conservation Rebates

Rebate Name	Rebate Amount
Indoor Fixtures	
HE toilet	\$100 or \$145 (for more efficient 4-liter)
Flush meters	\$100
ULF Urinal	\$200
Zero Water urinal	\$200
Flow valve restrictions	\$5/valve
Outdoor Fixtures	
Turf removal	\$2/sq. ft. up to \$6,000
Irrigation controllers	\$35/controller station
Irrigation heads	\$4/nozzle
Flow regulators	\$1
Soil moisture sensors	\$35/station
Restaurant Fixtures	
Connectionless food steamers	\$485
Air-cooled ice machines	\$1,000
Commercial Industrial	
Cooling tower conductivity controllers	\$625
Cooling tower pH controllers	\$1,750
Dry vacuum pump	\$125
Laminar flow restrictors	\$10/restrictor

4.4.6 Water Smart Check-up Program

The City has offered, and will continue to offer, the WaterSmart Check-up program in coordination with SDCWA, where a WaterSmart representative visits a property upon request to provide water saving tips and perform a water audit, which includes an inventory of water fixtures used indoors and outdoors, replacing high use water fixtures, evaluating toilets for leaks, and performing a landscape water audit, turning on stations to evaluate for inefficiencies and adjusting water schedules where appropriate. A summary report with additional conservation advertising is left with the customer at the end of the appointment.

4.4.7 Planned Implementation to Achieve Water Use Targets

The City will continue to support numerous public outreach, education, and rebate programs to support demand management. The City's WCMP Update identifies the following suite of activities in the City's "toolbox" of conservation programs to be implemented to achieve water use targets:

- Single Family Indoor Water Surveys
- High Efficiency Faucet Aerator, Showerhead, and Soil Moisture Sensor Giveaway
- Residential Clothes Washer Rebate
- Residential Outdoor Water Surveys

- Large Landscape Outdoor Water Audit
- Large Landscape Water Budgeting/Monitoring
- Rotating Sprinkler Nozzle Rebates
- Provide Rain Barrel Incentive
- Top Water Users Program (Top Customers from Each Customer Category)
- CII Rebates to Replace Inefficient Equipment
- Require Plan Review for New CII
- Promote High Efficiency Pre-Rinse Spray Valves
- Public Information
- School Education
- Incentive for Recycled Water Conversions
- Agricultural Water Audit Program

4.5 Programs to Assess and Manage Distribution System Real Loss

The City has completed the AWWA M36 Water Loss Audit Software program and has determined that water losses are within the acceptable industry standard range. The City is proactive in reducing unaccounted-for water by ensuring water meters are regularly maintained, evaluated for functionality, and replaced at industry standards.

Reported leaks are investigated and recorded in a tracking database that collects the time of report, leak location, and type of leaking pipe or fitting. Leaks are repaired to the extent that is cost-effective and prioritized based on potential water loss.

The City will continue to survey and correct its own infrastructure system and processes to reduce system real loss.

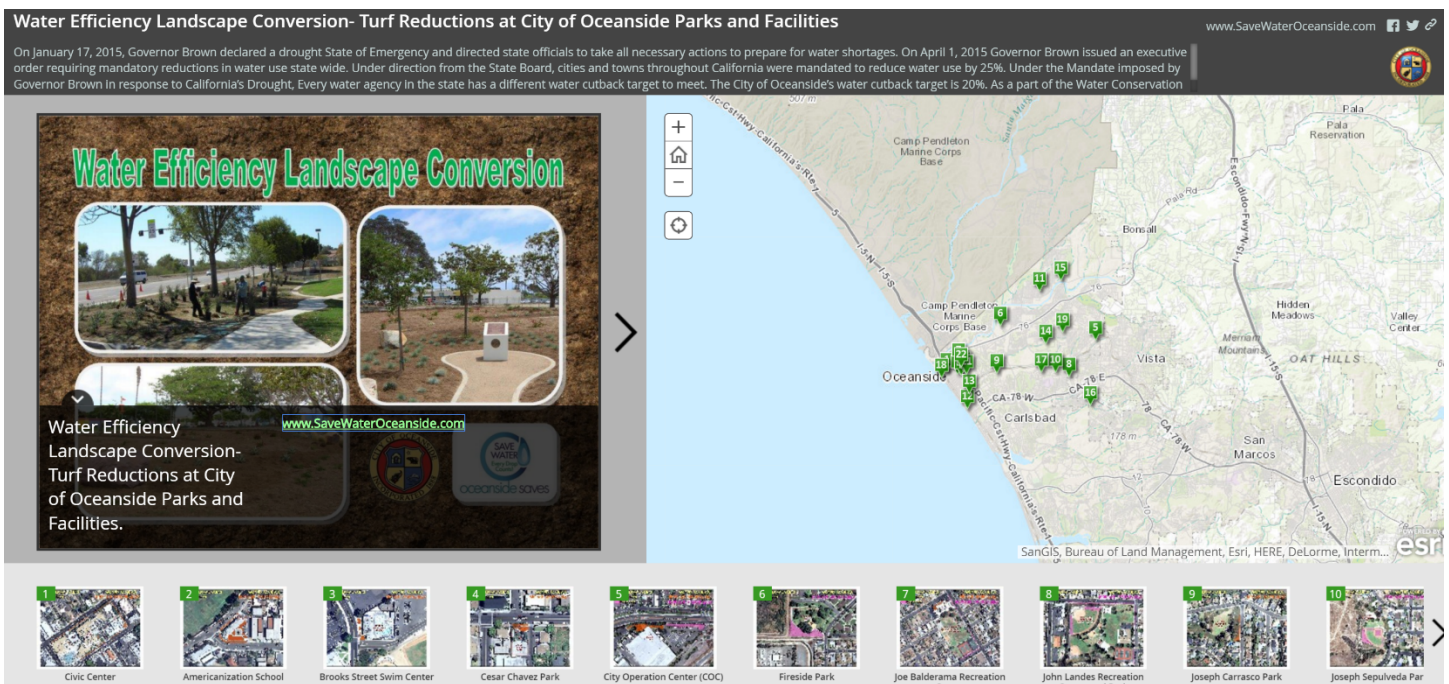
4.6 Water Conservation Program Coordination and Staffing Support

Water conservation staffing is performed by a full-time Professional Assistant and supervised by the Senior Management Analyst appointed as the Water Conservation Coordinator. The City's conservation coordinator is Ms. Teresa Gomez, (760) 435-5815, tkgomez@ci.oceanside.ca.us.

The City will maintain its Water Conservation Coordinator to serve as a program manager and point of contact for demand management activities.

4.7 Other Demand Management Measures

To reduce water use, promote the turf rebate program, and create demonstration gardens, the City has reduced turf at City Parks and Facilities. To date the City has reduced turf at 22 City parks and facilities. Information regarding each renovated site is available on the City web site and includes before and after pictures, square footage of turf replaced, and anticipated water savings.



4.7.1 Drought Efforts

Drought restrictions began in June 2015 with the goal to achieve the state-mandated 20% reduction in water use. The City announced through direct mailing to all customers that the City was initiating a Stage 2 Drought Alert Condition Response which incorporates a mandatory 2-day watering limit to all customers for outdoor irrigation (see Section 8, Water Shortage Contingency Planning, 2015 UWMP). Restaurants were offered table tent cards announcing water will be served upon request; hotels were offered door hangers encouraging the reusing of towels; and free shutoff nozzles were offered to slip renters at the harbor to reduce water use for boat wash-down. The City created signs to be placed in prominent areas around town providing conservation messages, including resident's yards to announce their commitment for saving water.

To facilitate enforcement, the City initiated a water waste reporting online form to allow customers to report observations of water waste. The City followed up on the reports of water waste through drought violation door hangers and fines for repeat offenders.

The City will continue to implement drought management conditions as needed, including water waste reporting and investigations.

5. COMPARISON OF INDIVIDUAL CONSERVATION MEASURES

This section presents the conservation measure screening process, a description of the measures selected to be analyzed in the City's DSS Model, measure design assumptions and modeling methodology, and a comparison of the individual conservation measure costs and savings.

5.1 Selecting Conservation Measures to be Evaluated (Conservation Measure Screening)

An important step in updating the water conservation program is the review and screening of new water conservation measures. New measures were designed with an implementation schedule reflecting dates sometime in the future when the City might begin such programs. The first step in the conservation analysis was to review historical water conservation activity and savings. The purpose of this review was to look at historically successful programs, past penetration rates (activity levels) for individual measures, and the types of programs that were implemented (and for which customers – single family, multifamily, commercial, etc.) by the City since the 2010 UWMP and 2011 WCMP.

Following the review of the historical conservation efforts, a list of over 100 potential conservation measures was provided to the City to be considered for further evaluation in the DSS Model. This list of measures was then screened by City staff to identify those measures with the highest level of interest and potential for implementation within the region. The result of this process was a short list of 22 measures that were selected for further evaluation (water savings analysis and benefit-cost analysis using the City's DSS Model). This evaluation was specific to the water use characteristics, economies of scale, demographics, and other factors that are unique to the San Diego region and the City.

Appendix C contains a more detailed description of the screening process and results. The tables in Appendix C include devices or programs (e.g., a new high efficiency toilet that would save water if installed by a water retailer, contractor, or customer) that can be used to achieve water conservation, methods through which the device or program will be implemented, and what distribution method or mechanism can be used to activate the device or program. The list of potential measures was drawn from MWM and the City's general experience and review of what other water agencies with conservation programs are currently implementing.

5.2 Conservation Measures Evaluated

Table 5-1 includes the 22 water use efficiency measures that were included in the DSS Model analysis. The table includes measures, devices, and programs (e.g., direct install high efficiency toilets) that can be used to achieve water use efficiency; methods through which the device or program will be implemented; and what distribution method or mechanism can be used to activate the device or program.

Water use efficiency savings due to plumbing codes such as CALGreen (California Statewide New Development Building Code), SB 407 (Plumbing Fixture Retrofit on Resale or Remodel), and any new development ordinances are included in the DSS Model and presented in Appendix A.

Table 5-1. Water Use Efficiency Measure Descriptions

No.	Measure Name	Measure Description
1	Water Loss	Maintain a thorough annual accounting of water production, sales by customer class and quantity of water produced but not sold (non-revenue water). In conjunction with system accounting, include audits that identify and quantify known legitimate uses of non-revenue water in order to determine remaining potential for reducing water losses. Goal would be to lower the Infrastructure Leakage Index (ILI) and non-revenue water every year by a pre-determined amount based on cost effectiveness. These programs typically pay for themselves based on savings in operational costs (and saved rate revenue can be directed more to system repairs/replacement and other costs). Continuously analyze billing data for system errors and under-registering meters. Run a monthly report to check on outliers. Identify and quickly notify customers of apparent leaks. Address meter testing and repair/replacement to insure more accurate meter reads and revenue collection. Actions could include meter calibration and accelerated meter replacement. Measure covers efforts to find and repair leaks in the distribution system to reduce real water loss. More aggressive actions could include installation of data loggers and proactive leak detection. Leak repairs would be handled by existing crews at no extra cost. May include accelerated main and service line replacement. Enhanced real loss reduction may include more ambitious main replacement and active leak detection. Capture water from water main flushing and hydrant flow testing for reuse.
2	AMI	Require that new customers install such AMI meters as described above and possibly purchase means of viewing daily consumption inside their home/business either through the internet or separate device. The AMI system would, on demand, indicate to the customer and Utility where and how their water is used, facilitating water use reduction and prompt leak identification. Also require that larger or irrigation customers install such AMI meters as described above and possibly purchase means of viewing daily consumption by landscape/property managers, or business, either through the Internet (if available) or separate device. This would require Utility to install an AMI system.
3	Pricing	Develop individualized monthly water budgets. Water budgets are linked to a rate schedule where rates per unit of water increase when a customer goes above their budget, or decreases if they are below their budget. Budgets typically are based on such factors as the size of the irrigated area and often vary seasonally to reflect weather during the billing period. These rates have been shown to be effective in reducing landscape irrigation demand (AWWARF reports). This measure would require rate study and capable billing software.
4	Single Family Indoor Water Surveys	Indoor water surveys for existing single family residential customers. Target those with high water use and provide a customized report to owner.
5	High Efficiency Faucet Aerator, Showerhead, and Soil Moisture Sensor Giveaway	Utility would buy showerheads, kitchen and bathroom faucet aerators, and soil moisture sensors in bulk and give them away at Utility office or community events.
6	Hot Water on Demand Pump Systems Rebate	Provide a rebate to equip homes with efficient hot water on demand systems. These systems use a pump placed under the sink to recycle water sitting in the hot water pipes to reduce hot water waiting times by having an on-demand pump on a recirculation line. Can be installed on kitchen sink or master bath, wherever hot water waiting times are

No.	Measure Name	Measure Description
		more than 1/2 minute. Requires an electrical outlet under the sink, which is not common on older home bathrooms but is on kitchen sinks.
7	Residential Clothes Washer Rebate	Provide a rebate for efficient washing machines to single family homes and apartment complexes that have common laundry rooms. It is assumed that the rebates would remain consistent with relevant state and federal regulations (Department of Energy, Energy Star) and only offer the best available technology. Partner with MWD, with measure administration by MWD.
8	Residential Outdoor Water Surveys	Outdoor water surveys offered for existing customers. Those with high water use are targeted and provided a customized report on how to save water.
9	Large Landscape Outdoor Water Audit	Outdoor water audits offered for existing large landscape customers. Those with high water use are targeted and provided a customized report on how to save water. All large multifamily residential, CII, and public irrigators of large landscapes would be eligible for free landscape water audits upon request.
10	Large Landscape Water Budgeting/Monitoring	Website that provides feedback on irrigation water use (budget vs. actual).
11	Financial Incentives for Irrigation and Landscape Upgrades	For SF, MF, CII, and IRR customers with landscape, provide a Smart Landscape Rebate for substantive landscape retrofits or installation of water efficient upgrades; rebates contribute towards the purchase and installation of water-wise plants, compost, mulch and selected types of irrigation equipment upgrades.
12	Require Weather Adjusting Smart Irrigation Controllers and / or Rain Sensors in New Development	Require developers for all properties of greater than four residential units and all commercial development to install the weather-based irrigation controllers. May require landscaper training.
13	Rotating Sprinkler Nozzle Rebates	Provide rebates to replace standard spray sprinkler nozzles with rotating nozzles that have lower application rates. Nozzles cost about \$6 and the current MWD rebate is \$2 per nozzle. Eligible rebate applications must contain a minimum of 30 rotating nozzles.
14	Provide Rain Barrel Incentive	Provide incentive for installation of residential rain barrels. Rebates start at \$75 per barrel or \$300 per cistern.
15	Top Water Users Program (Top customers from each customer category)	Top water customers from each category would be offered a professional water survey that would evaluate ways for the business to save water and money. The surveys would be for large accounts (i.e., accounts that use more than 5,000 gallons of water per day), such as hotels, restaurants, stores, and schools. Emphasis will be on supporting the top users for each customer category.
16	CII Rebates to Replace Inefficient Equipment	Program to provide rebates for a standard list of water efficient equipment. Included per current SoCal WaterSmart program are the following devices and base rebate amounts: Premium High-Efficiency Toilets (\$100), Ultra Low and Zero Water Urinals (\$200), Plumbing Flow Control Valves (\$5/valve, minimum of 20), Connectionless Food Steamers (\$485/compartments), Air-cooled Ice Machines (\$1,000), Cooling Tower Conductivity Controllers (\$625), Cooling Tower pH Controllers (\$1,750), Dry Vacuum Pumps (\$125/0.5HP), and Laminar Flow Restrictors (\$10/restrictor, minimum of 10).

No.	Measure Name	Measure Description
17	Require Plan Review for New CII	Require plan reviews for water use efficiency for all new business customers.
18	Promote High Efficiency Pre-Rinse Spray Valves	Provide free 1.15 gpm spray rinse valves and possibly free installation operation in restaurants, commercial kitchens, grocery stores, and other locations. EPA WaterSense spray valves are 1.28 gpm valves. Food Service Technology Center recommends 1.15 gpm valves. This program would promote the more efficient 1.15gpm valves.
19	Public Information	Public information includes the following: conservation print media; electronic conservation options/web site/social media; speakers bureau/event participation; billing report educational tools; media campaigns, such as "Take Control of your Controller;" recognition programs for water savings by residences, apartments, businesses program; outdoor residential focused public awareness information program and efficient outdoor use education and training programs; training for landscape maintenance workers, networking with landscaping industry, landscape water calculator, and climate appropriate demonstration gardens.
20	School Education	Work with local school districts to develop classroom programs to promote water use efficiency education. Consider poster contests, etc. Some programs would require dedicated utility staff to assist and present.
21	Incentive for Recycled Water Conversions	Provide incentives for recycled water conversion.
22	Ag Water Audit Program	Water audit offered for existing agricultural customers. Those with high water use are targeted, offered a survey, and provided a customized report on how to save water.

Additional detail on the DSS Model, including water reductions methodology, benefits and costs perspectives, avoided costs, present value parameters, and measure assumptions can be found in Appendix A.

5.3 Comparison of Individual Measures

Table 5-2 presents how much water the measures will save through 2040, how much they will cost, and what the cost of saved water will be per unit volume *if the measures are implemented on a stand-alone basis (i.e. without interaction or overlap from other measures that might address the same end use(s))*. Thus, savings from measures which address the same end use(s) are not additive. The model uses impact factors to avoid double counting in estimating the water savings from programs of measures. For example, if two measures are planned to address the same end use and both save 10% of the prior water use then the net effect is not the simple sum (20%). Rather it is the cumulative impact of the first measure reducing the use to 90% of what it was without the first measure in place and then reducing the use another 10% to result in the use being 81% of what it was originally. In this example, the net savings is 19%, not 20%. Using impact factors, the model computes the reduction as follows, $0.9 \times 0.9 = 0.81$ or 19% water savings.

Since interaction between measures has **not** been accounted for in Table 5-2, it is **not** appropriate to include totals at the bottom of the table. However, the table is useful to give a close approximation of the cost effectiveness of each individual measure.

Cost categories are defined below:

- Utility Costs – those costs that the City as a water utility will incur to operate the measure including administrative costs.
- Utility Benefits – the avoided cost of producing water.
- Customer Costs – those costs customers will incur to implement a measure in the City's service area and maintain its effectiveness over the life of the measure.

- Customer Benefits – the savings other than from reduced water/sewer utility bills, such as energy savings resulting from reduced use of hot water.
- Community Costs and Benefits – Community Costs and Benefits include Utility Costs plus Customer Costs, and Utility Benefits plus Customer Benefits, respectively.

The column headings in Table 5-2 are defined as follows:

- Present Value (PV) of Utility and Community Costs and Benefits (\$) = the present value of the 25-year time stream of annual costs or benefits, discounted to the base year.
- Utility Benefit-Cost Ratio = PV of Utility Costs divided by PV of Utility Benefits over 25 years.
- Community Benefit-Cost Ratio = (PV of Utility Benefits plus PV of Customer Energy Savings) divided by (sum of PV of Utility Costs plus PV of Customer Costs), over 25 years.
- Five Years Total Cost to Utility (\$) = the sum of the annual Utility Costs for years 2020 through 2025. Only those measures that are run between 2020 and 2025 will have a cost. The measures start in the years as specified for each measure shown in Appendix D.
- Water Savings in 2020 (AFY) = water saved in acre-feet per year. The year 2020 is provided as this information is helpful as relates to the statewide SB X7-7 legislation.
- Utility Cost of Water Saved per Unit Volume (\$/AF) = PV of Utility Costs over 25 years divided by the 25-Year Water Savings. This value is compared to the utility's avoided cost of water as one indicator of the cost effectiveness of conservation efforts. It should be noted that the Utility Cost of Water Saved per Unit Volume somewhat undervalues the cost of savings because program costs are discounted to present value and the water benefit is not.

Table 5-2. Conservation Measure Cost and Savings

Measure	Present Value of Water Utility Benefits	Present Value of Community Benefits	Present Value of Water Utility Costs	Present Value of Community Costs	Water Utility Benefit to Cost Ratio	Community Benefit to Cost Ratio	Five Years of Water Utility Costs 2020-2025*	Water Savings in 2020 (AFY)	Cost of Savings per Unit Volume (\$/AF)
Water Loss	\$1,045,453	\$1,045,453	\$919,716	\$919,716	1.14	1.14	\$250,000	40	\$866
AMI	\$14,017,675	\$19,367,192	\$666,373	\$3,555,269	21.04	5.45	\$0	-	\$46
Pricing	\$408,985	\$408,985	\$214,514	\$214,514	1.91	1.91	\$50,000	153	\$40
Single Family Indoor Water Surveys	\$111,688	\$199,795	\$20,044	\$63,382	5.57	3.15	\$11,596	7	\$253
High Efficiency Faucet Aerator, Showerhead, and Soil Moisture Sensor Giveaway	\$924,753	\$1,662,123	\$272,553	\$396,440	3.39	4.19	\$157,986	25	\$319
Hot Water on Demand Pump Systems Rebate	\$486,134	\$1,051,101	\$188,169	\$496,081	2.58	2.12	\$131,645	13	\$445
Residential Clothes Washer Rebate	\$337,705	\$836,837	\$105,688	\$778,246	3.20	1.08	\$0	12	\$395
Residential Outdoor Water Surveys	\$47,909	\$47,909	\$24,621	\$45,458	1.95	1.05	\$13,099	3	\$570
Large Landscape Outdoor Water Audit	\$178,510	\$178,510	\$30,313	\$77,707	5.89	2.30	\$17,740	10	\$183
Large Landscape Water Budgeting/Monitoring	\$5,798,547	\$5,798,547	\$953,800	\$953,800	6.08	6.08	\$558,198	314	\$177
Financial Incentives for Irrigation and Landscape Upgrades	\$250,260	\$250,260	\$391,931	\$748,232	0.64	0.33	\$122,989	5	\$1,372
Require Weather Adjusting Smart Irrigation Controllers and/or Rain Sensors in New Development	\$2,268,759	\$2,268,759	\$44,684	\$683,462	50.77	3.32	\$15,363	63	\$18
Rotating Sprinkler Nozzle Rebates	\$477,935	\$477,935	\$43,998	\$123,994	10.86	3.85	\$25,706	14	\$85

Measure	Present Value of Water Utility Benefits	Present Value of Community Benefits	Present Value of Water Utility Costs	Present Value of Community Costs	Water Utility Benefit to Cost Ratio	Community Benefit to Cost Ratio	Five Years of Water Utility Costs 2020-2025*	Water Savings in 2020 (AFY)	Cost of Savings per Unit Volume (\$/AF)
Provide Rain Barrel Incentive	\$54,795	\$54,795	\$37,658	\$47,580	1.46	1.15	\$20,034	2	\$632
Top Water Users Program (Top customers from each customer category)	\$132,919	\$215,465	\$32,762	\$82,402	4.06	2.61	\$0	5	\$284
CII Rebates to Replace Inefficient Equipment	\$340,769	\$340,769	\$152,838	\$847,555	2.23	0.40	\$48,848	6	\$482
Require Plan Review for New CII	\$611,999	\$1,040,131	\$67,490	\$427,438	9.07	2.43	\$19,281	9	\$113
Promote High Efficiency Pre-Rinse Spray Valves	\$143,868	\$580,337	\$18,559	\$18,559	7.75	31.27	\$3,407	5	\$153
Public Information	\$2,094,959	\$3,204,028	\$215,077	\$215,077	9.74	14.90	\$57,667	73	\$117
School Education	\$418,992	\$640,806	\$46,756	\$46,756	8.96	13.71	\$12,536	15	\$127
Incentive for Recycled Water Conversions	\$1,040,403	\$1,040,403	\$260,201	\$1,301,005	4.00	0.80	\$320,068	12	\$221
Ag Water Audit Program	\$78,469	\$78,469	\$10,814	\$54,070	7.26	1.45	\$7,519	6	\$153

*Some measures have no Water Utility Costs from 2020 to 2025, indicated by \$0 in the table. This means that there are no costs for these five years only, from 2020, inclusive, up to 2025, exclusive. It is not indicative of any activity before 2020 or during and/or after 2025. This column is meant to be helpful for budgeting purposes only.

6. RESULTS OF CONSERVATION PROGRAM EVALUATION

This section describes the process of selecting conservation measures for developing alternative conservation program scenarios and various cost, savings, and target results.

6.1 Selection of Measures for Programs

The 22 conservation measures were incorporated into the City of Oceanside's DSS Model for benefit-cost analysis and selection of a conservation program to meet the City's goals. Included in the City's DSS Model was a list of measures in each of three alternative conservation programs (Programs A, B, and C), which were designed to illustrate a range of various measure combinations and resulting water savings. Four key items were taken into consideration during measure selection for Programs A, B, and C:

- Existing water use efficiency measures
- Programs run by MWD and SDCWA
- Measures focused on Programmatic BMP defined by the CUWCC's MOU if the City had reported on a measure
- New and innovative measures

These programs are not intended to be rigid frameworks, but rather to demonstrate the range in savings that could be generated if selected measures were run together. The three program scenarios are organized as follows:

- **Program A:** "Existing Program" option includes measures that the City currently offers.
- **Program B:** "Optimized Program" includes individual measures that were selected by the City. This program includes all the measures included in Program A, plus an Automated Metering Infrastructure (AMI) measure in addition to 2 CII targeted measures, a school education measure, a recycled water conversion measure, and an agricultural water audit measure.
- **Program C:** "All Measures Analyzed" presents a scenario where all 22 measures are implemented.

The City's DSS Model presents estimated average per capita per day savings with plumbing codes and each of the alternative programs (Program A, B, and C). Plumbing code includes current state and federal standards (including CALGreen, Senate Bill 407, and Assembly Bill 715) for items such as toilets, showerheads, faucets, and pre-rinse spray valve savings. SB 407 and AB 715 require the replacement of non-water conserving plumbing fixtures with water-conserving fixtures. More information about plumbing codes can be found in Appendix A.

The City staff was provided a copy of the DSS Model to review the conservation program options, tailor the programs to meet its needs, and select the program that fit its individual water savings goals and budgets. The City selected a particular suite of measures based on varied reasons which included the following considerations:

- Measure cost effectiveness
- Applicability to service area
- Amount of water savings generated
- Cost to the City
- Ease of implementation and staffing required
- Whether the measure was being run by MWD
- Local preferences

The following figure displays which measures are in each program.

Figure 6-1. Conservation Measure Program Scenarios

Program Scenarios				
 Program Scenarios	Measures	Program A	Program B	Program C
	Water Loss	☒	☒	☒
	AMI	☐	☒	☒
	Pricing	☐	☐	☒
	Single Family Indoor Water Surveys	☒	☒	☒
	High Efficiency Faucet Aerator, Showerhead, and Soil Moisture Sensor Giveaway	☒	☒	☒
	Hot Water on Demand Pump Systems Rebate	☐	☐	☒
	Residential Clothes Washer Rebate	☒	☒	☒
	Residential Outdoor Water Surveys	☒	☒	☒
	Large Landscape Outdoor Water Audit	☒	☒	☒
	Large Landscape Water Budgeting/Monitoring	☒	☒	☒
	Financial Incentives for Irrigation and Landscape Upgrades	☐	☐	☒
	Require Weather Adjusting Smart Irrigation Controllers and / or Rain Sensors in New Development	☐	☐	☒
	Rotating Sprinkler Nozzle Rebates	☒	☒	☒
	Provide Rain Barrel Incentive	☒	☒	☒
	Top Water Users Program (Top customers from each customer category)	☒	☒	☒
	CII Rebates to Replace Inefficient Equipment	☒	☒	☒
	Require Plan Review for New CII	☐	☒	☒
	Promote High Efficiency Pre-Rinse Spray Valves	☐	☒	☒
	Public Information	☒	☒	☒
	School Education	☐	☒	☒
	Incentive for Recycled Water Conversions	☐	☒	☒
	Ag Water Audit Program	☐	☒	☒

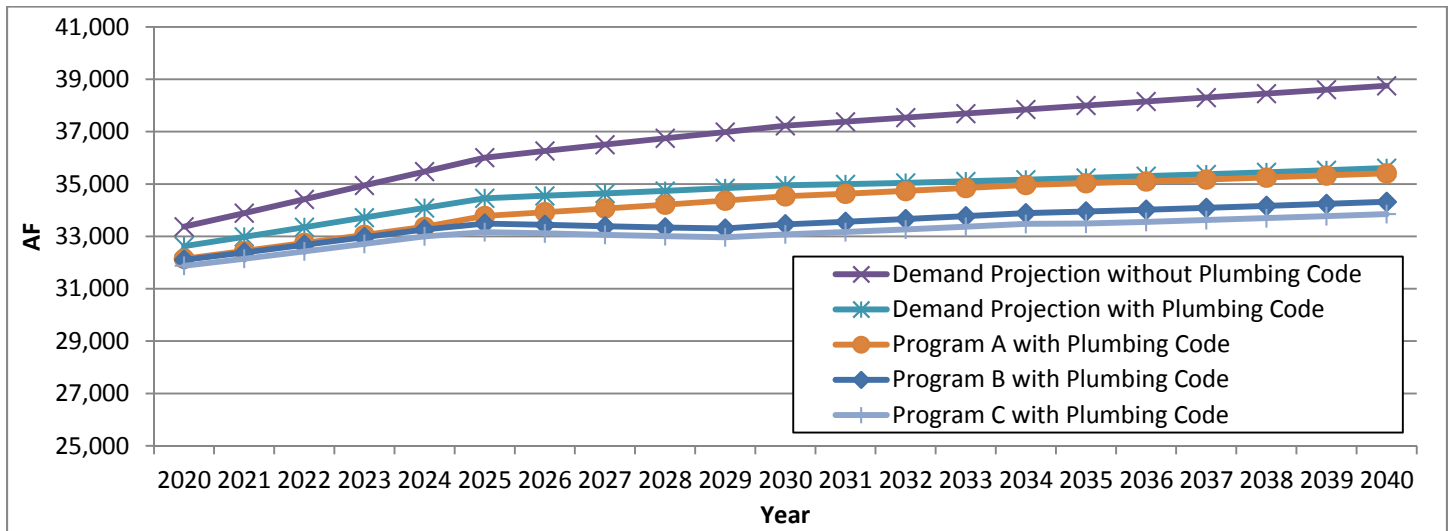
6.2 Results of Program Evaluation

Table 6-1 and Figure 6-2 show annual water demand with no conservation (plumbing code only) and the three conservation programs.

Table 6-1 Water Use Projections (Acre-Feet/Year)*

	2020	2025	2030	2035	2040
Demand without Plumbing Code	33,371	36,006	37,227	38,001	38,754
Demand with Plumbing Code	32,624	34,454	34,947	35,231	35,606
Demand with Plumbing Code and Program A	32,145	33,779	34,531	35,031	35,408
Demand with Plumbing Code and Program B	32,102	33,487	33,458	33,949	34,319
Demand with Plumbing Code and Program C	31,875	33,164	33,073	33,485	33,851

*Data is not weather normalized. Total water use includes agricultural and recycled water use. NRW is included.

Figure 6-2. Long Term Demands with Conservation Programs**Notes:**

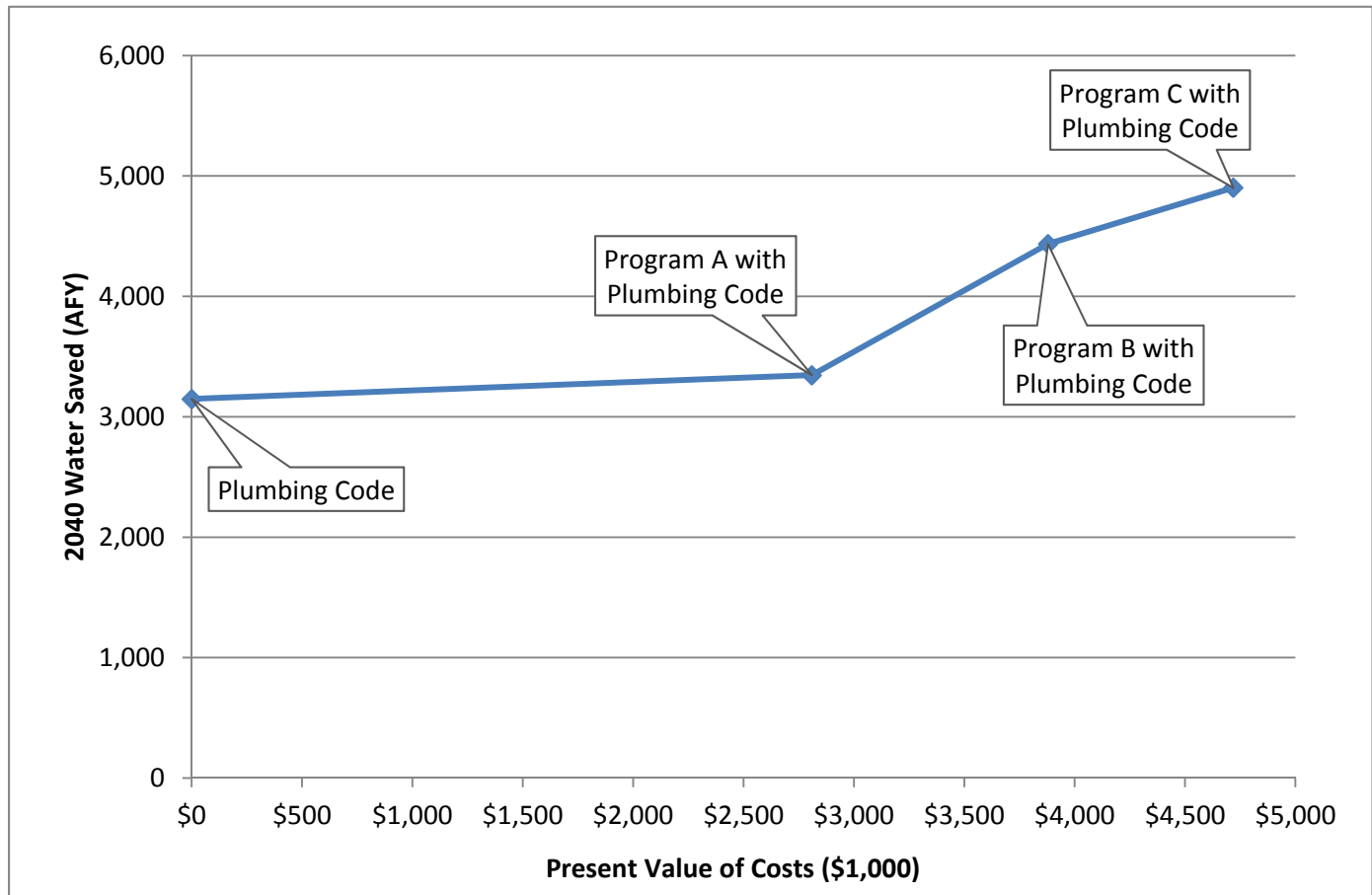
1. All line types shown in the legend are presented in the graph. The following demand scenarios, Program A, Program B, and Program C are close in value and therefore may be indistinguishable in the figure. Note “zoomed in” y-axis.
2. Data is not weather normalized. Total water use includes agricultural and recycled water use. NRW is included.

Table 6-2 shows the savings in 5-year increments for all three conservation programs; these are from the conservation programs alone and include the plumbing code savings. Assuming each program’s measures are successfully implemented, projected indoor, outdoor, and total water savings for 2040 in AFY are also shown. The separate starting points for the demand with and without the plumbing code versus the conservation programs are directly correlated to the variation in individual measures selected for each individual Program A, B, and C.

Table 6-2. Water Demand Program Savings Projections (Acre-Feet/Year)

	2020	2025	2030	2035	2040	2040 Indoor	2040 Outdoor
Program A with Plumbing Code	1,226	2,227	2,696	2,970	3,346	3,235	110
Program B with Plumbing Code	1,269	2,519	3,768	4,052	4,435	3,971	463
Program C with Plumbing Code	1,496	2,842	4,154	4,516	4,902	3,988	914

Figure 6-3 shows how marginal returns change as more money is spent to achieve savings. Most recently, it may be impacted by the goals set forth by SB X7-7, which calls for a reduction in per capita water use by 2020 (this is independent of the economic analysis).

Figure 6-3. Present Value of Utility Costs vs. Cumulative Water Saved

Note: The scenarios above for Program A, Program B, and Program C have different measures included in each program with recommended Program B more streamlined for fewer measures that are estimated to save more water as part of the optimized program design.

Table 6-3 presents key evaluation statistics compiled from the DSS Model. Savings and costs in the following table are a result of each program's conservation measures and plumbing codes. Total present value costs and savings are estimated over the 25-year analysis period using an interest rate of 3%. The cost of water saved is presented for the utility. These cost parameters are derived from the annual time stream of utility, customer, and community costs.

Table 6-3. Comparison of Long-Term Conservation Programs – Utility Costs and Savings

	Present Value of Utility Water Savings (\$)	Present Value of Utility Costs (\$)	Present Value of Community Costs (\$)	Cost of Utility Savings per Unit Volume (\$/AF)	Water Utility Benefit to Cost Ratio (AFY)	Community Benefit to Cost Ratio (AFY)
Program A with Plumbing Code	\$10,830,774	\$2,809,068	\$4,551,358	\$279	3.86	2.89
Program B with Plumbing Code	\$26,009,636	\$3,879,261	\$9,954,456	\$150	6.70	3.45
Program C with Plumbing Code	\$33,562,045	\$4,718,559	\$12,096,745	\$139	7.11	3.51

*Utility Cost of Water Saved per Unit Volume (\$/AF) = PV of Utility Costs over 25 years divided by the 25-Year Water Savings. This value is compared to the utility's avoided cost of water as one indicator of the cost effectiveness of conservation efforts. It should be noted that the Utility Cost of Water Saved per Unit Volume somewhat undervalues the cost of savings because program costs are discounted to present value and the water benefit is not.

7. CONCLUSIONS

This section presents a discussion of the relative savings and cost effectiveness of the City of Oceanside’s alternative conservation programs.

The City’s service area has a relatively high portion of residential water use and a significant amount of outdoor water use. Consequently, residential and irrigation conservation programs produce the most savings. The City’s service area is not a heavy industrial or manufacturing sector, so the conservation potential in the commercial sector is relatively low. Based on the assumed avoided cost of water, water conservation programs are cost-effective. Overall conclusions are as follows:

- The change in water demands from years 2020 to 2040 are provided in Table 7-1. Five projected demand scenarios have been analyzed for the 20-year study period.
- Water savings from implementation of Program A, Program B, and Program C conservation programs would reduce water needs in 2040 by approximately 1%, 4%, and 5% respectively when compared to 2040 water demands *with* plumbing code savings. The Plumbing Code by itself achieves an 8% savings (year 2040).
- For Program A, Program B, and Program C, the active conservation water savings potential in 2040 of reducing outdoor use is approximately 3%, 10%, and 19%, respectively; the rest is indoor use reduction potential due to passive and active measures.
- The average cost of water saved over 25 years (from future year 2040) is lower than the current price of water (as of year 2015). Thus, measures that are cost-effective at today’s water rates will be more so if water rates rise in the future.
- Water savings contributed by Program A measures alone are 198 acre-feet in 2040 (active program savings only).
- Water savings contributed by Program B measures alone are 1,287 acre-feet in 2040 (active program savings only).
- Water savings contributed by Program C measures alone are 1,755 acre-feet in 2040 (active program savings only).
- Water Utility Benefit-Cost Ratios of Program A, Program B, and Program C conservation alternatives are 3.86, 6.70, and 7.11 respectively, indicating that all program combinations are cost-effective from the utility standpoint.

Table 7-1. Water Use Projections (Acre-Feet/Year)*

	2020	2025	2030	2035	2040
Demand without Plumbing Code	33,371	36,006	37,227	38,001	38,754
Demand with Plumbing Code	32,624	34,454	34,947	35,231	35,606
Demand with Plumbing Code and Program A	32,145	33,779	34,531	35,031	35,408
Demand with Plumbing Code and Program B	32,102	33,487	33,458	33,949	34,319
Demand with Plumbing Code and Program C	31,875	33,164	33,073	33,485	33,851

*Data is not weather normalized. Total water use includes agricultural and recycled water use. NRW is included.

Program B is the selected program for this plan update, which has an estimated budget and associated water savings. However, the program is intended to be flexible and structured as “menu/toolbox” format to allow individual measures to change as necessary.

This flexible format will allow adaptation to new or best available technology. It will also enable the City to select or change measures for implementation as needed to reach their conservation goals.

APPENDIX A - ASSUMPTIONS FOR THE DSS MODEL

Plumbing codes and appliance standards for toilets, urinals, faucets, clothes washers, and showerheads will continue to reduce indoor residential and non-residential water demands in the future. This reduction in demand is accounted for in Maddaus Water Management (MWM) Decision Support System (DSS) Model. Background on the DSS Model, as well as details on the method of determining plumbing code savings is presented in the following sections.

A.1 DSS Model Overview

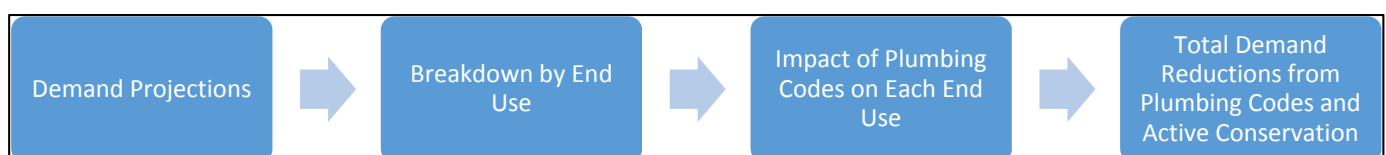
The DSS Model prepares long-range, detailed demand projections. The purpose of the extra detail is to enable a more accurate assessment of the impact of water efficiency programs on demand. A rigorous modeling approach is especially important if the project will be subject to regulatory or environmental review.

The DSS Model is an end-use model that breaks down total water production (water demand in the service area) to specific water end-uses. The model uses a bottom-up approach that allows for multiple criteria to be considered when estimating future demands, such as the effects of natural fixture replacement, plumbing codes, and conservation efforts. The DSS Model may also use a top-down approach with a utility prepared water demand forecast.

To forecast urban water demands using the DSS Model, customer demand data are obtained from the water agency being modeled. The demand data are reconciled with available demographic data to characterize the water usage for each customer category in terms of number of users per account and per capita water use. The data are further analyzed to approximate the split of indoor and outdoor water usage in each customer category. The indoor/outdoor water usage is further divided into typical end uses for each customer category. Published data on average per-capita indoor water use and average per-capita end use are combined with the number of water users to calibrate the volume of water allocated to specific end uses in each customer category. In other words, the DSS Model checks that social norms from end studies on water use behavior (e.g., for flushes per person per day) are not exceeded.

The DSS Model evaluates conservation measures using benefit cost analysis with the present value of the cost of water saved (\$/Acre-Foot). Benefits are based on savings in water and wastewater facility operations and maintenance (O&M). The figure below illustrates the process for forecasting conservation water savings, including the impacts of fixture replacement due to plumbing codes and standards already in place.

The DSS Model has been used for practical applications of conservation planning in over 250 service areas representing 20 million people including extensive efforts nationally in California, Colorado, Hawaii, Idaho, Utah, Georgia, Florida, North Carolina, Tennessee, Oregon, Texas, Ohio, and internationally in Australia, New Zealand and Canada. The California Urban Water Conservation Council (CUWCC) did a peer review and has endorsed the model since 2006. The model is offered to all of their members for use to estimate water demand, plumbing code and conservation program savings. For more information please see the CUWCC Website: <https://www.cuwcc.org/Resources/Planning-Tools-and-Models?folderId=776&view=gridview&pageSize=10>



The DSS Model forecasts service area water fixture use. In the codes and standards part of the DSS Model, specific fixture end use type (point of use fixture or appliance), average water use, and lifetime are compiled. Additionally, state and national plumbing codes and appliance standards for toilets, urinals, showers, and clothes washers are modeled by customer category. These fixtures and plumbing codes can be added to, edited, or deleted by the user. This yields two demand forecasts: 1) with plumbing codes, and 2) without plumbing codes.

Plumbing code measures are independent of any conservation program; they are based on customers following applicable current local, state and federal laws, building codes, and ordinances.

A.2 Plumbing Codes and Legislation

The DSS Model incorporates the following items as a “code” meaning that the savings are assumed to occur and are therefore “passive” savings.

- National Plumbing Code
- CALGreen
- AB 715
- AB 407
- CA Code of Regulations Title 20 Sections 1601-1608 2015 Appliance Efficiency Rulemaking New Standards

National Plumbing Code

The Federal Energy Policy Act of 1992, as amended in 2005, mandates that only fixtures meeting the following standards can be installed in new buildings:

- Toilet – 1.6 gal/flush maximum
- Urinals – 1.0 gal/flush maximum
- Showerhead – 2.5 gal/min at 80 psi
- Residential faucets – 2.2 gal/min at 60 psi
- Public restroom faucets – 0.5 gal/min at 60 psi
- Dishwashing pre-rinse spray valves – 1.6 gal/min at 60 psi

Replacement of fixtures in existing buildings is also governed by the Federal Energy Policy Act, which mandates that only devices with the specified level of efficiency (as shown above) can be sold as of 2006. The net result of the plumbing code is that new buildings will have more efficient fixtures and old inefficient fixtures will slowly be replaced with new, more efficient models. The national plumbing code is an important piece of legislation and must be carefully taken into consideration when analyzing the overall water efficiency of a service area.

In addition to the plumbing code, the U.S. Department of Energy regulates appliances, such as residential clothes washers, further reducing indoor water demands. Regulations to make these appliances more energy efficient have driven manufactures to dramatically reduce the amount of water these machines use. Generally, front loading washing machines use 30-50% less water than conventional models (which are still available). In a typical analysis, the DSS Model forecasts a gradual transition to high efficiency clothes washers (using 12 gallons or less) so that by the year 2025 that will be the only type of machines available for purchase. In addition to the industry becoming more efficient, rebate programs for washers have been successful in encouraging customers to buy more water efficient models. Given that machines last about 10 years, eventually all machines on the market will be the more water efficient models. Energy Star washing machines have a water factor (WF) of 6.0 or less - the equivalent of using 3.1 cubic feet (or 23.2 gallons) of water per load. The maximum water factor for residential clothes washers under current federal standards is 9.5. The water factor equals the number of gallons used per cycle per cubic foot of capacity. Prior to year 2000, the water factor

for a typical new residential clothes washer was about 12. In March 2015, the federal standard reduced the maximum water factor for top- and front-loading machines to 8.4 and 4.7, respectively. In 2018, the maximum water factor for top-loading machines will be further reduced to 6.5. For commercial washers, the maximum water factors were reduced in 2010 to 8.5 and 5.5 for top- and front-loading machines, respectively. Beginning in 2015, the maximum water factor for Energy Star certified washers was 3.7 for front-loading and 4.3 for top-loading machines. In 2011, the Environmental Protection Agency (EPA) estimated that Energy Star washers comprised more than 60% of the residential market and 30% of the commercial market (Energy Star 2011). A new Energy Star compliant washer uses about two-thirds less water per cycle than washers manufactured in the 1990s.

State Building Code – 2010 CALGreen

The 2010 CALGreen requirements effect all new development in the State of California after January 1, 2011. The new development requirements under CALGreen are listed in the following figure. The DSS Model includes the CALGreen requirements that effect all new development in the State of California after January 1, 2011. The DSS Model modeled water savings from the CALGreen building code by adding Multifamily and Commercial customer categories as appropriate to applicable conservation measures.

Table A-1. 2010 CALGreen Building Code Summary Table

Building Class	Component	Effective Date*	Indoor Fixtures Included	Indoor Requirement	Landscaping & Irrigation Requirements	Are the Requirements Mandatory?
Residential	Indoor	1/1/2011	Toilets, Showers, Lavatory & Kitchen Faucets, Urinals	Achieve 20% savings overall below baseline		Yes
	Outdoor	1/1/2011			Provide weather adjusting controllers	Yes
Non Residential	Indoor	1/1/2011	Submeter leased spaces	Only if building >50,000 sq. ft. & leased space uses >100 gallons/day		Yes
			Toilets, Showers, Lavatory & Kitchen Faucets, Wash Fountains, Metering Faucets, Urinals	Achieve 20% savings overall below baseline		Yes
	Outdoor	1/1/2011			Provide water budget	> 1,000 sq. ft. landscaped area
					Separate meter	As per Local or DWR ordinance
					Prescriptive landscaping requirements	> 1,000 sq. ft. landscaped area
					Weather adjusting irrigation controller	Yes

* Effective date is 7/1/2011 for toilets.

State Plumbing Code – AB 715

Plumbing codes for toilets, urinals, showerheads, and faucets were initially adopted by California in 1991, mandating the sale and use of ultra-low flush 1.6 gallon per flush (gpf) toilets (ULFTs), 1 gpf urinals, and low-flow showerheads and faucets. California Code of Regulations Title 20 California State Law (AB 715) required High Efficiency Toilets and High Efficiency Urinals be exclusively sold in the state by 2014. Effective January 1, 2014, Assembly Bill (AB) 715 (enacted in 2007) required that toilets and urinals sold and installed in California cannot have flush ratings exceeding 1.28 and 0.5 gallons per flush, respectively.

California State Law – SB 407

SB 407 addresses plumbing fixture retrofits on resale or remodel. The DSS Model carefully takes into account the overlap with SB 407, the plumbing code (natural replacement), CALGreen, AB 715 and rebate programs (such as toilet rebates). SB 407 (enacted in 2009) requires that properties built prior to 1994 be fully retrofitted with water conserving fixtures by the year 2017 for single-family residential houses and 2019 for multifamily and commercial properties. SB 407 program length is variable and continues until all the older high flush toilets have been replaced the service area. The number of accounts with high flow fixtures is tracked to make sure that the situation of replacing more high flow fixtures than actually exist does not occur. SB 837 (enacted in 2011) requires that sellers of real property disclose on their Real Estate Transfer Disclosure Statement whether their property complies with these requirements. Additionally, SB 407 conditions issuance of building permits for major improvements and renovations upon retrofit of non-compliant plumbing fixtures. Each of these laws is intended to accelerate the replacement of older, low efficiency plumbing fixtures, and ensure that only high-efficiency fixtures are installed in new residential and commercial buildings.

2015 CALGreen and 2015 CA Code of Regulations Title 20 Appliance Efficiency Regulations

Fixture characteristics in the DSS Model are tracked in new accounts, which are subject to the requirements of the 2015 California Green Building Code and 2015 California Code of Regulations Title 20 Appliance Efficiency Regulations adopted by the California Energy Commission (CEC) on September 1, 2015. The CEC 2015 appliance efficiency standards applies to the following new appliances, if they are sold in California: showerheads, lavatory faucets, kitchen faucets, metering faucets, replacement aerators, wash fountains, tub spout diverters, public lavatory faucets, commercial pre-rinse spray valves, urinals, and toilets. The DSS Model accounts for plumbing code savings due to these standards effects on showerheads, faucets and aerators, urinals, and toilets.

- Showerheads: July 2016: 2.0 gpm; July 2018: 1.8 gpm
- Wall Mounted Urinals: 2016: 0.125 (pint) gpf
- Lavatory Faucets and Aerator: July 2016: 1.2 gpm at 60 psi
- Kitchen Faucets and Aerator: July 2016: 1.8 gpm with optional temporary flow of 2.2 gpm at 60 psi
- Public Lavatory Faucets: July 2016: 0.5 gpm at 60 psi

In summary, the controlling law for **toilets** is Assembly Bill (AB) 715. This bill requires high efficiency toilets (1.28 gpf) to be exclusively sold in California beginning January 1, 2014. The controlling law for wall-mounted urinals is the 2015 CEC efficiency regulations requiring that ultra-high efficiency pint **urinals** (0.125 gpf) be exclusively sold in California beginning January 1, 2016. This is an efficiency progression for urinals from AB 715's requirement of high-efficiency (0.5 gpf) urinals starting in 2014.

Standards for **residential clothes washers** fall under the regulations of the U.S. Department of Energy. In March 2015, the federal standard reduced the maximum water factor for non-Energy Star certified top- and front-loading washing machines to 8.4 and 4.7, respectively. In 2018, the maximum water factor for standard top-loading machines will be further reduced to 6.5.

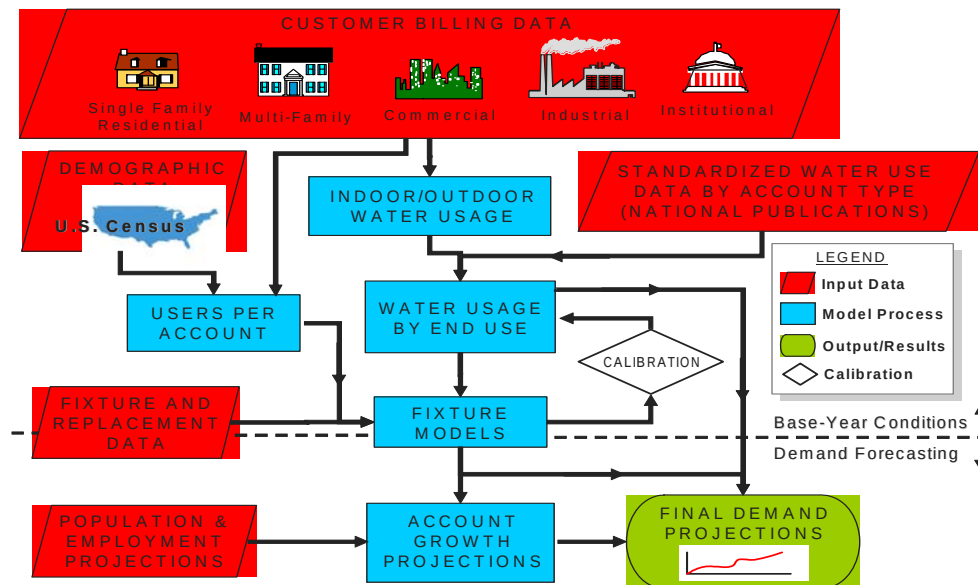
Showerhead flow rates are newly regulated under the 2015 California Code of Regulations Title 20 Appliance Efficiency Regulations adopted by the CEC, which requires the exclusive sale in California of 2.0 gpm showerheads at 80 psi as of July 1, 2016 and 1.8 gpm showerheads at 80 psi as of July 1, 2018. The WaterSense specification applies to showerheads that have a maximum flow rate of 2.0 gallons per minute (gpm) or less. This represents a 20% reduction in showerhead flow rate over the current federal standard of 2.5 gpm, as specified by the Energy Policy Act of 1992.

Faucet flow rates have likewise been recently regulated by the 2015 CEC Title 20 regulations. This standard requires that the residential faucets and aerators manufactured on or after July 1, 2016 be exclusively sold in California at 1.2 gpm at 60 psi; and public lavatory and kitchen faucet/aerators sold or offered for sale on or after July 1, 2016 be 0.5 gpm at 60 psi, and 1.8 gpm at 60 psi (with optional temporary flow of 2.2 gpm), respectively. Previously, all faucets had been regulated by the 2010 California Green Building Code at 2.2 gpm at 60 psi.

Plumbing code related water savings are considered reliable, long-term savings, and can be counted on over time to help reduce the City's overall system water demand. The demand projections including plumbing code savings further assumes no active involvement by the water utility, and that the costs of purchasing and installing replacement equipment (and new equipment in new construction) are borne solely by the customers, occurring at no direct utility expense. The inverse of the Fixture Life is the natural replacement rate, expressed as a percent (i.e., 10 years is a rate of 10% per year).

The following figure conceptually describes how plumbing codes are incorporated into the flow of information in the DSS Model.

Figure A-1. DSS Model Overview Used to Make Potable Water Demand Projections



DSS Model Fixture Replacement

The DSS Model is capable of modeling multiple types of fixtures, including fixtures with slightly different design standards. For example, currently toilets can be purchased that flush at a rate of 0.8 gallons per flush (gpf), 1.0 gallon per flush or 1.28 gallons per flush. The 1.6 gpf and higher gallons per flush toilets still exist but can no longer be purchased in California. Therefore, they cannot be used for replacement or new installation of a toilet. So, the DSS Model utilizes a fixture replacement table to decide what type of fixture should be installed when a fixture is replaced or a new fixture is installed. The replacement of the fixtures is listed as a percentage, as shown in the following figure. A value of 100% would indicate that all the toilets sold would be of one particular flush volume. A value of 75% means that three out of every four toilets installed would be of that particular flush volume type. The DSS Model contains a pair of replacement tables for each fixture type and customer category combination (i.e., Residential Single Family toilets,

Residential Multifamily toilets, Commercial toilets, Residential clothes washing machines, Commercial washing machines, etc.).

In the following example, the DSS Model includes the effects of the Federal Policy Act and AB 715 on each toilet fixture type. This DSS Model feature determines the “saturation” of 1.6 gpf toilets as the Federal Policy Act was in effect from 1992-2014 for 1.6 gpf toilet replacements.

Figure A-2. Example Toilet Replacement Percentages by Type of Toilet

Replacement Appliance Market Shares					
Year	High Use Toilet Residential	1.6 gpf ULFT Residential	1.28 gpf HET Residential	<1.0 gpf Toilet Residential	Total
2015	0%	0%	100%	0%	100%
2020	0%	0%	90%	10%	100%
2025	0%	0%	75%	25%	100%
2030	0%	0%	65%	35%	100%
2040	0%	0%	50%	50%	100%
New Appliance Market Shares					
Year	High Use Toilet Residential	1.6 gpf ULFT Residential	1.28 gpf HET Residential	<1.0 gpf Toilet Residential	Total
2015	0%	0%	100%	0%	100%
2020	0%	0%	90%	10%	100%
2025	0%	0%	75%	25%	100%
2030	0%	0%	65%	35%	100%
2040	0%	0%	50%	50%	100%

A.3 Water Reduction Methodology

Each conservation measure targets a particular water use such as indoor single family water use. Targeted water uses are categorized by water user group and by end use. Targeted water user groups include single family residential, multifamily residential, commercial, industrial, and institutional (CII), etc. Measures may apply to more than one water user group. Targeted end uses include indoor and outdoor use. The targeted water use is important to identify because the water savings are generated from reductions in water use for the targeted end use. For example, a residential retrofit conservation measure targets single family and multifamily residential indoor use, and in some cases specifically shower use. When considering the water savings potential generated by a residential retrofit one considers the water saved by installing low-flow showerheads in single family and multifamily homes.

The market penetration goal for a measure is the extent to which the product or service related to the conservation measure occupies the potential market. In essence, the market penetration goal identifies how many fixtures, rebates, surveys, etc. the wholesale customer would have to offer or conduct over a period of time to reach its water savings goal for that conservation measure. This is often expressed in terms of the number of fixtures, rebates, surveys, etc. offered or conducted per year.

The potential for errors in market penetration goal estimates for each measure can be significant because they are based on previous experience, chosen implementation methods, projected utility effort, and funds allocated to implement the measure. The potential error can be corrected through re-evaluation of the measure as the implementation of the measure progresses. For example, if the market penetration required to achieve specific water savings turns out to be more or less than predicted, adjustments to the implementation efforts can be made. Larger rebates or additional promotions are often used to increase the market penetration. The process is iterative to reflect actual conditions and helps to ensure that market penetration and needed savings are achieved regardless of future variances between estimates and actual conditions.

In contrast, market penetration for mandatory ordinances can be more predictable with the greatest potential for error occurring in implementing the ordinance change. For example, requiring dedicated irrigation meters for new accounts through an ordinance can assure an almost 100% market penetration for affected properties.

Water utilities are constantly looking at when a measure reaches saturation. Baseline surveys are the best approach to having the most accurate information on market saturation. This was taken into account when analyzing individual conservation measures where best estimates were made. MWM was not provided with any baseline surveys for this analysis, but discussions were held with the City staff regarding what their best estimates were for saturation for their service area.

A.4 Perspectives on Benefits and Costs

The determination of the economic feasibility of water conservation programs involves comparing the costs of the programs to the benefits provided. This analysis was performed using the DSS Model developed by MWM. The DSS Model has received the endorsement of the California Urban Water Conservation Council, and calculates cost effectiveness of conservation measure savings at the end-use level; for example, the model determines the amount of water a toilet rebate program saves in daily toilet use for each single family account.

A.5 Present Value Parameters

Present value analysis using constant FY 2015 dollars and a real discount rate of 3% is used to discount costs and benefits to the base year. From this analysis, benefit-cost ratios of each measure are computed. When measures are put together in programs, the model is set up to avoid double counting savings from multiple measures that act on the same end use of water. For example, multiple measures in a program may target toilet replacements. The model includes assumptions to apportion water savings between the multiple measures.

Economic analysis can be performed from several different perspectives, based on which party is affected. For planning water use efficiency programs for utilities, the perspectives most commonly used for benefit-cost analyses are the “utility” perspective and the “community” perspective. The Utility Benefit-Cost Analysis is based on the benefits and costs to the water provider. The Community Benefit-Cost Analysis includes the utility benefit and costs together with account owner/customer benefits and costs. These include customer energy and other capital or operating cost benefits plus costs of implementing the measure, beyond what the utility pays.

The utility perspective offers two advantages. First, it considers only the program costs that will be directly borne by the utility. This enables the utility to fairly compare potential investments for saving versus supplying increased quantities of water. Second, revenue shifts are treated as transfer payments, which means program participants will have lower water bills and non-participants will have slightly higher water bills so that the utility’s revenue needs continue to be met. Therefore, the analysis is not complicated with uncertainties associated with long-term rate projections and retail rate design assumptions. It should be noted that there is a significant difference between the utility’s savings from the avoided cost of procurement and delivery of water and the reduction in retail revenue that results from reduced water sales due to water use efficiency. This budget impact occurs slowly, and can be accounted for in water rate planning. Because it is the water provider’s role in developing a water use efficiency plan that is vital in this study, the utility perspective was primarily used to evaluate elements of this report.

The community perspective is defined to include the utility and the customer costs and benefits. Costs incurred by customers striving to save water while participating in water use efficiency programs are considered, as well as the benefits received in terms of reduced energy bills (from water heating costs) and wastewater savings, among others. Water bill savings are not a customer benefit in the aggregate for reasons described above. Other factors external to the utility, such as environmental effects, are often difficult to quantify or are not necessarily under the control of the utility. They are therefore frequently excluded from economic analyses, including this one.

The time value of money is explicitly considered. Typically, the costs to save water occur early in the planning period whereas the benefits usually extend to the end of the planning period. A long planning period of 30-40 years is typically

used because costs and benefits that occur beyond 2050 years have very little influence on the total present value of the costs and benefits. The value of all future costs and benefits is discounted to the first year in the DSS Model (the base year, which in this case is 2015), at the real interest rate of 3.01%. The DSS Model calculates this real interest rate, adjusting the current nominal interest rate (assumed to be approximately 6.1%) by the assumed rate of inflation (3.0%). The formula to calculate the real interest rate is: $(\text{nominal interest rate} - \text{assumed rate of inflation}) / (1 + \text{assumed rate of inflation})$. Cash flows discounted in this manner are herein referred to as “Present Value” sums.

A.6 Measure Assumptions including Unit Costs and Water Savings

Appendix D presents the assumptions and inputs used in the City’s DSS Model to evaluate each water conservation measure. Assumptions regarding the following variables were made for each measure:

- Targeted Water User Group End Use – Water user group (e.g., single family residential) and end use (e.g., indoor or outdoor water use).
- Utility Unit Cost – Cost of rebates, incentives, and contractors hired to implement measures. The assumed dollar values for the measure unit costs were closely reviewed by staff and are found to be adequate for each individual measure. The values in the majority of cases are in the range of what is currently offered by other water utilities in the region.
- Retail Customer Unit Cost – Cost for implementing measures that is paid by retail customers (i.e., the remainder of a measure’s cost that is not covered by a utility rebate or incentive).
- Utility Administration and Marketing Cost – The cost to the utility for administering the measure, including consultant contract administration, marketing, and participant tracking. The mark-up is sufficient (in total) to cover conservation staff time and general expenses and overhead.

Costs are determined for each of the measures based on industry knowledge, past experience and data provided by the City. Costs may include incentive costs, usually determined on a per-participant basis; fixed costs, such as marketing; variable costs, such as the costs to staff the measures and to obtain and maintain equipment; and a one-time set-up cost. The set-up cost is for measure design by staff or consultants, any required pilot testing, and preparation of materials that are used in marketing the measure. The model was run for 25 years (each year between FY 2015 and FY 2040). Costs are spread over the time period depending on the length of the implementation period for the measure and estimated voluntary customer participation levels.

Lost revenue due to reduced water sales is not included as a cost because the conservation measures evaluated herein generally take effect over a long span of time that is sufficient to enable timely rate adjustments as necessary to meet fixed cost obligations and savings on variable costs such as energy and chemicals.

The unit costs vary according to the type of customer account and implementation method being addressed. For example, a measure might cost a different amount for a residential single family account than a residential multifamily account, and for a rebate versus an ordinance requirement or a direct installation implementation method. Typically water utilities have found there are increased costs associated with achieving higher market saturation, such as more surveys per year. The DSS Model calculates the annual costs based on the number of participants each year. The general formula for calculating annual utility costs is:

- Annual Utility Cost = Annual market penetration rate x total accounts in category x unit cost per account x (1+administration and marketing markup percentage)
- Annual Customer Cost = Annual number of participants x unit customer cost
- Annual Community Cost = Annual utility cost + annual customer cost

Data necessary to forecast water savings of measures include specific data on water use, demographics, market penetration, and unit water savings. Savings normally develop at a measured and predetermined pace, reaching full maturity after full market penetration is achieved. For example, this may occur three to ten years after the start of implementation, depending upon the implementation schedule.

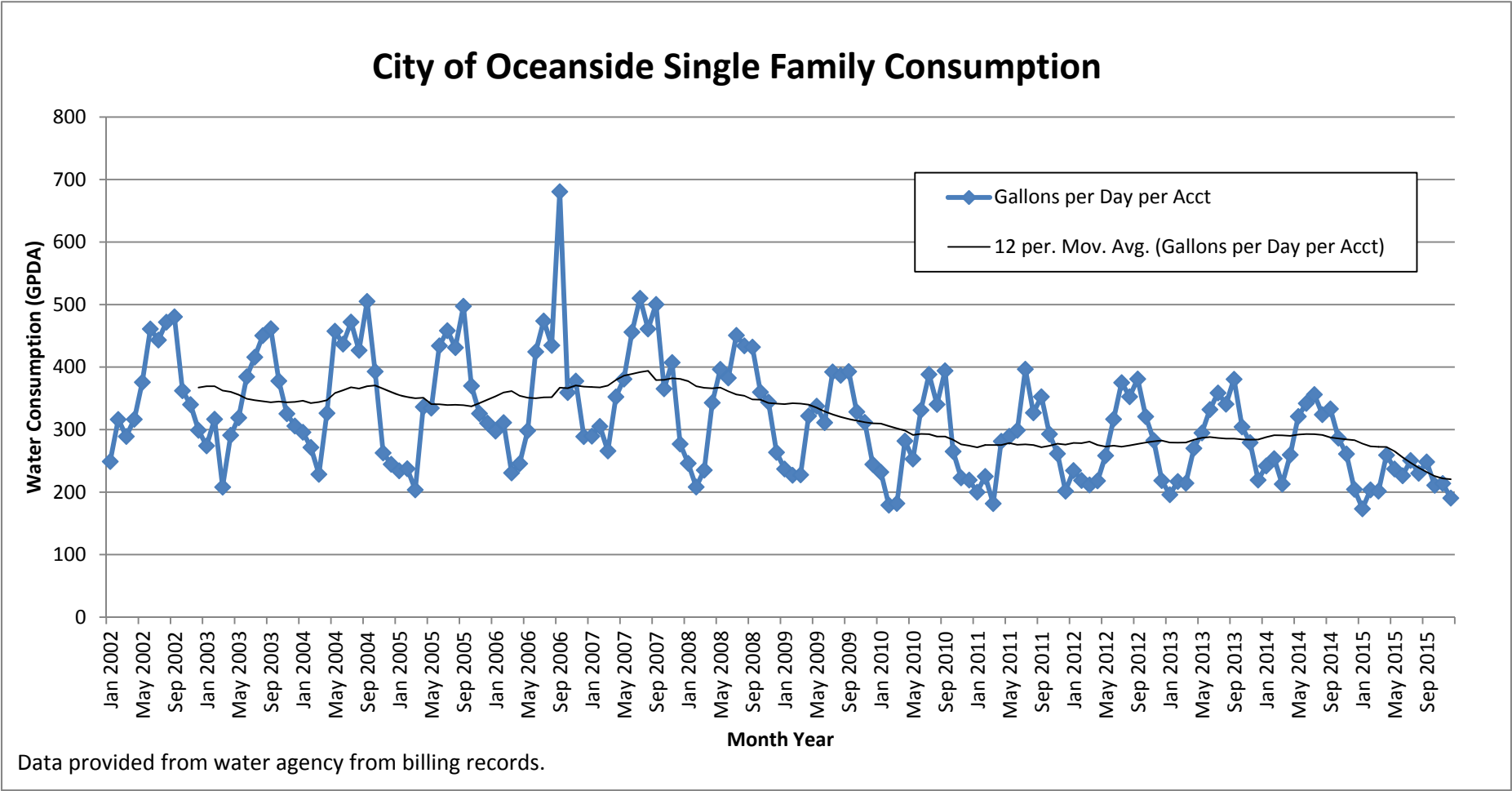
For every water use efficiency activity or replacement with more efficient devices, there is a useful life. The useful life is called the “Measure Life” and is defined to be how long water use efficiency measures stay in place and continue to save water. It is assumed that measures implemented because of codes, standards or ordinances (e.g., toilets) would be “permanent” and not revert to an old inefficient level of water use if the device needed to be replaced. However, some measures that are primarily behavioral based, such as residential surveys, are assumed to need to be repeated on an ongoing basis to retain the water savings (e.g., homeowners move away and new homeowners may have less efficient water using practices around the home). Surveys typically have a measure life on the order of five years.

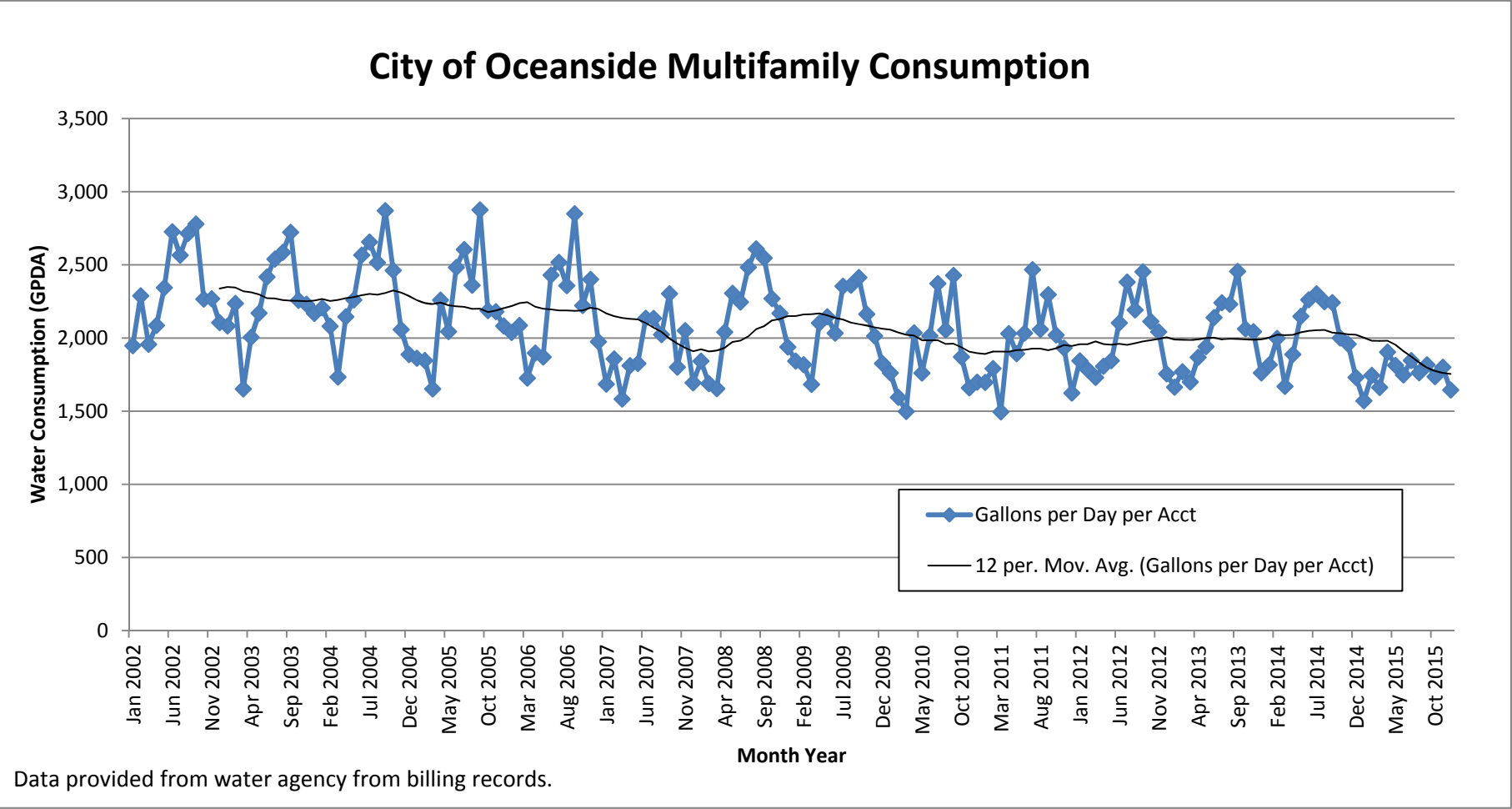
A.7 Assumptions about Avoided Costs

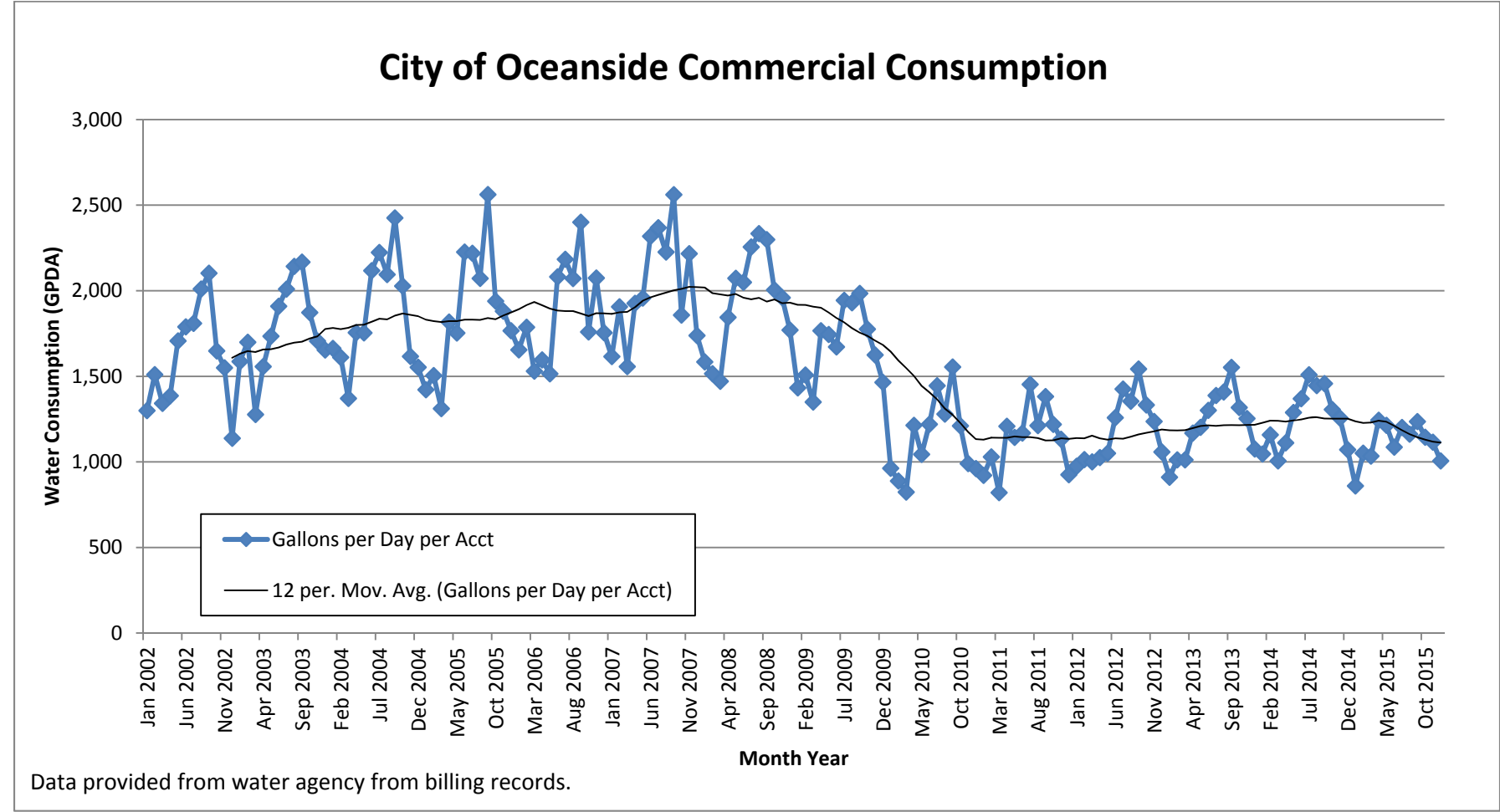
The main source of water for the City is SDCWA imported water. The price of the water to the City is set by SDCWA every year and varies by agency location. For this evaluation the avoided costs were taken from the average SDCWA cost of treated water of \$1,401/AF (\$4,299/MG) for years 2015 and 2016. It is recommended in the future that this cost be updated when new cost information from SDCWA becomes available.

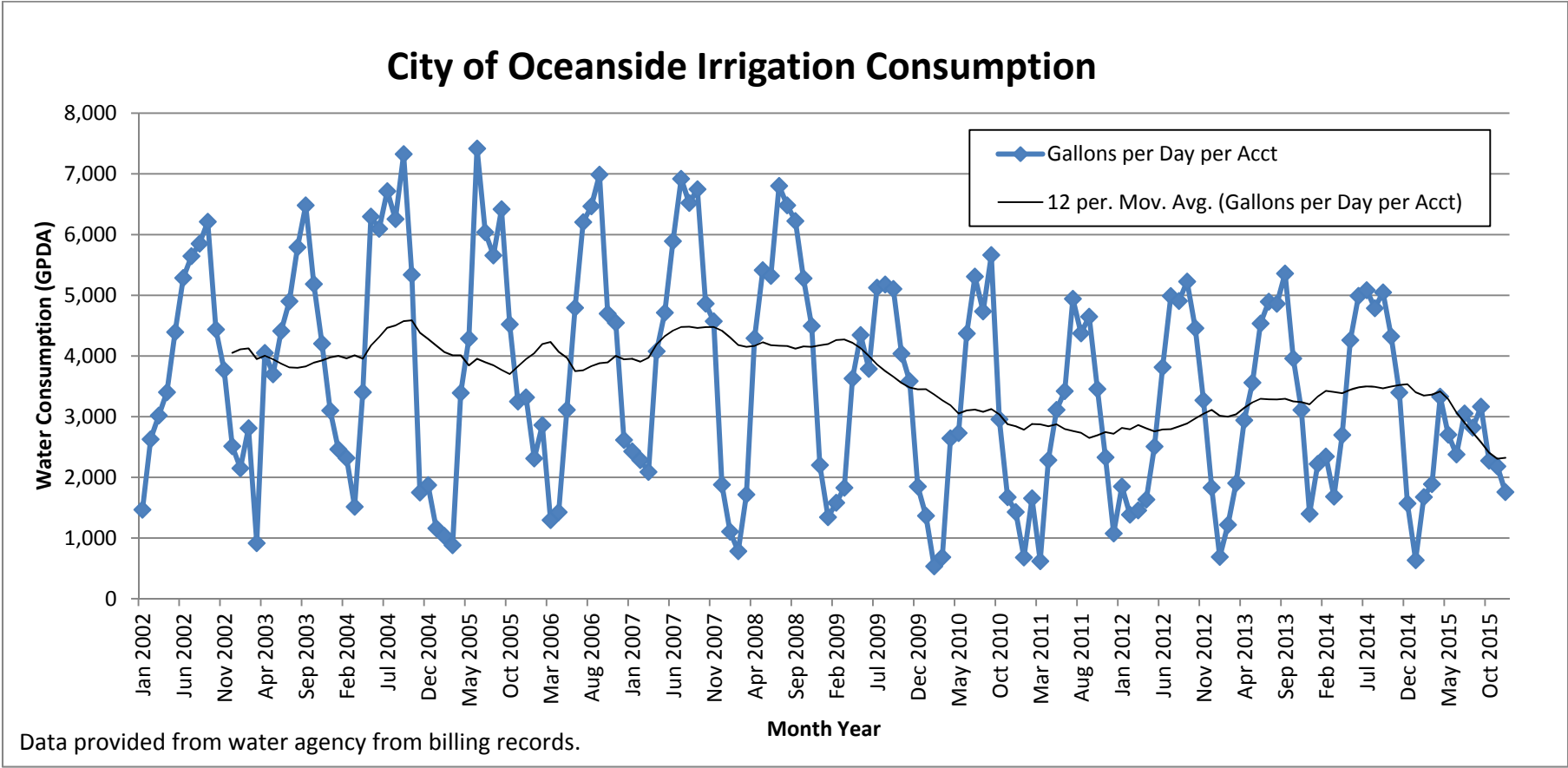
APPENDIX B - WATER USE GRAPHS FOR PRODUCTION AND CUSTOMER CATEGORIES

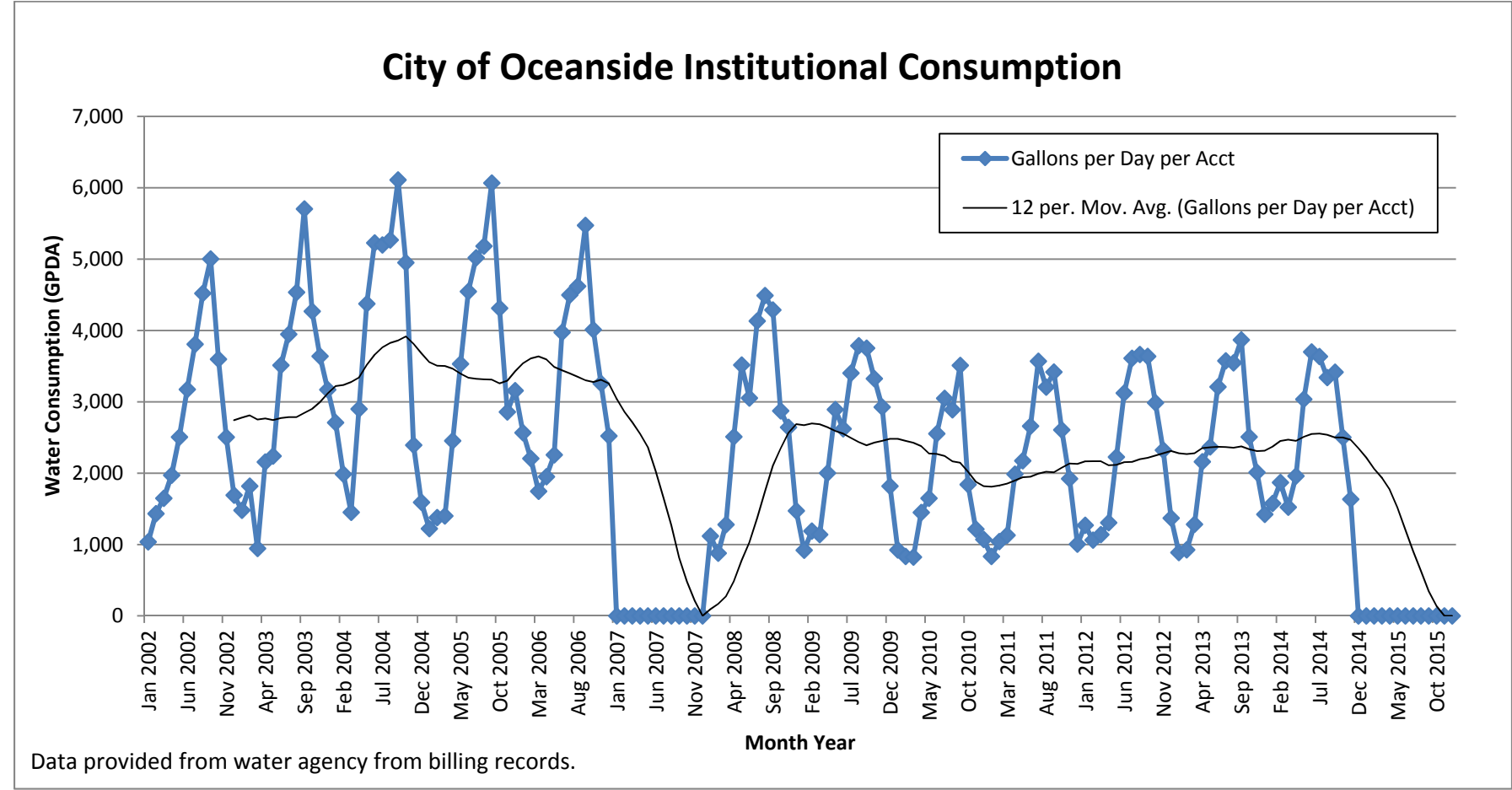
As presented in Section 2 of this report, this appendix presents historical customer category water use graphs. Units shown are average gallons of water per account per day. These graphs were reviewed to better identify outlier data points and years so that a representative baseline water use value (of average account water use by category) could be determined. The effects of drought, economic recessions, service line failures, and meter inaccuracies are typically evident in these figures.



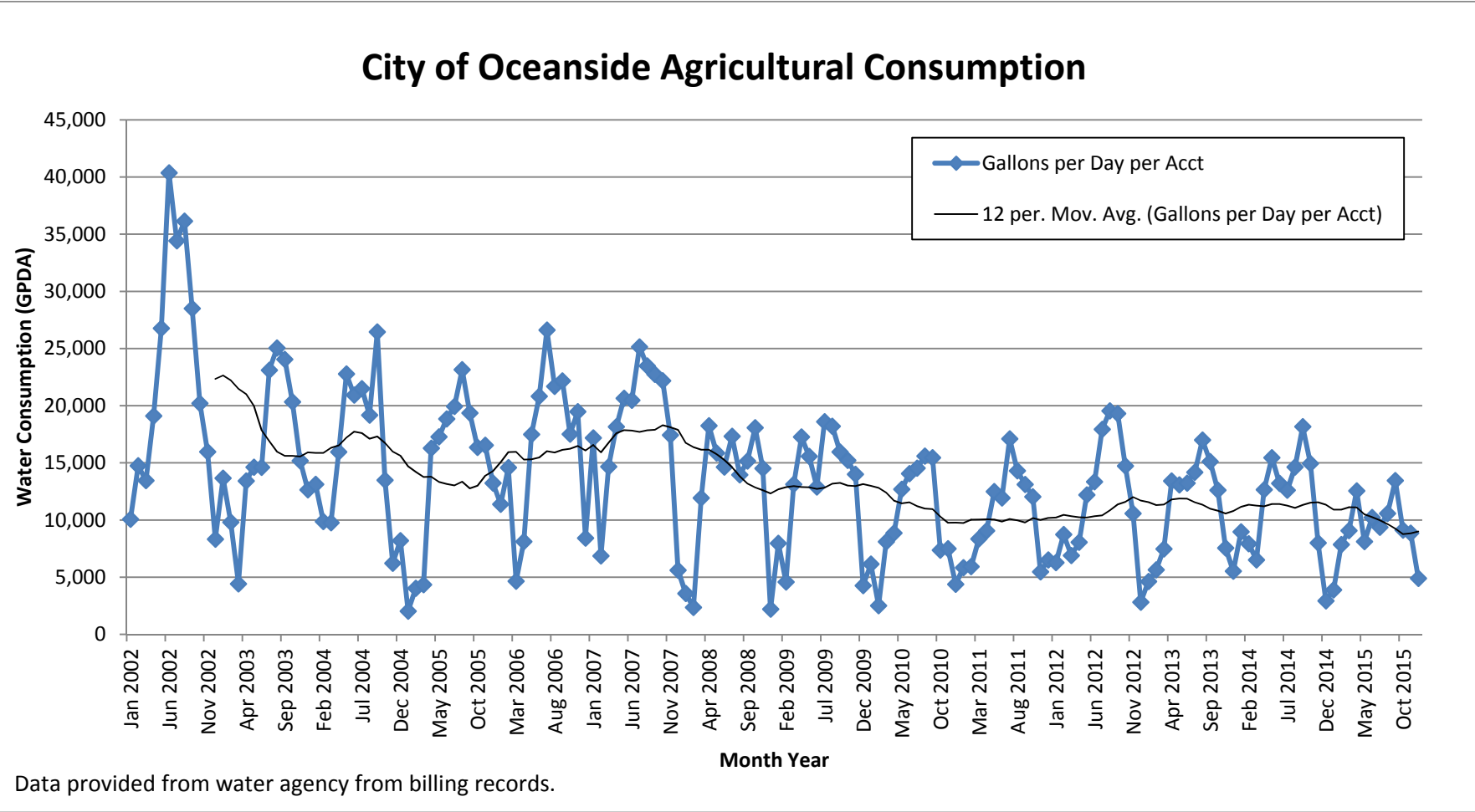


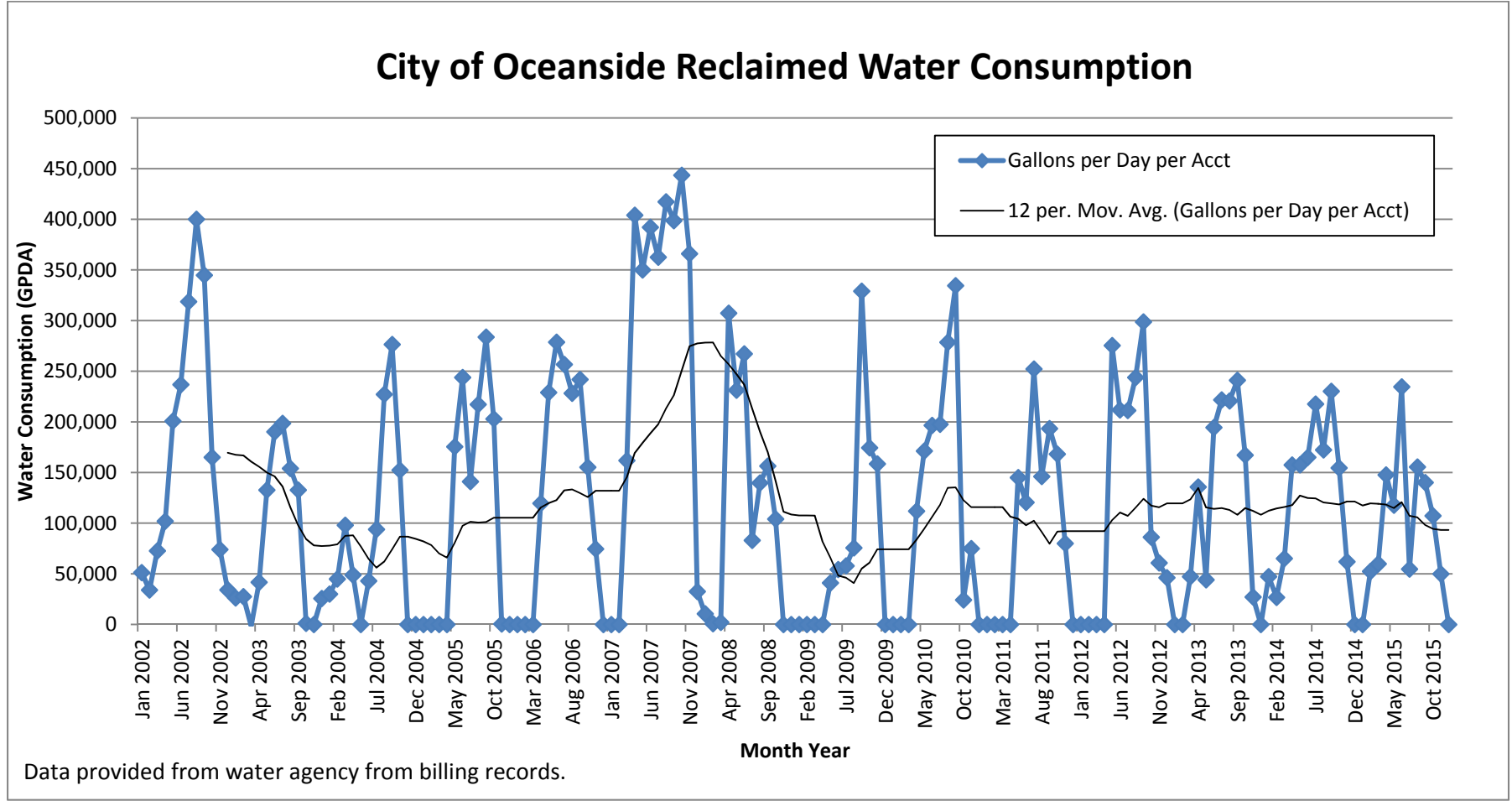


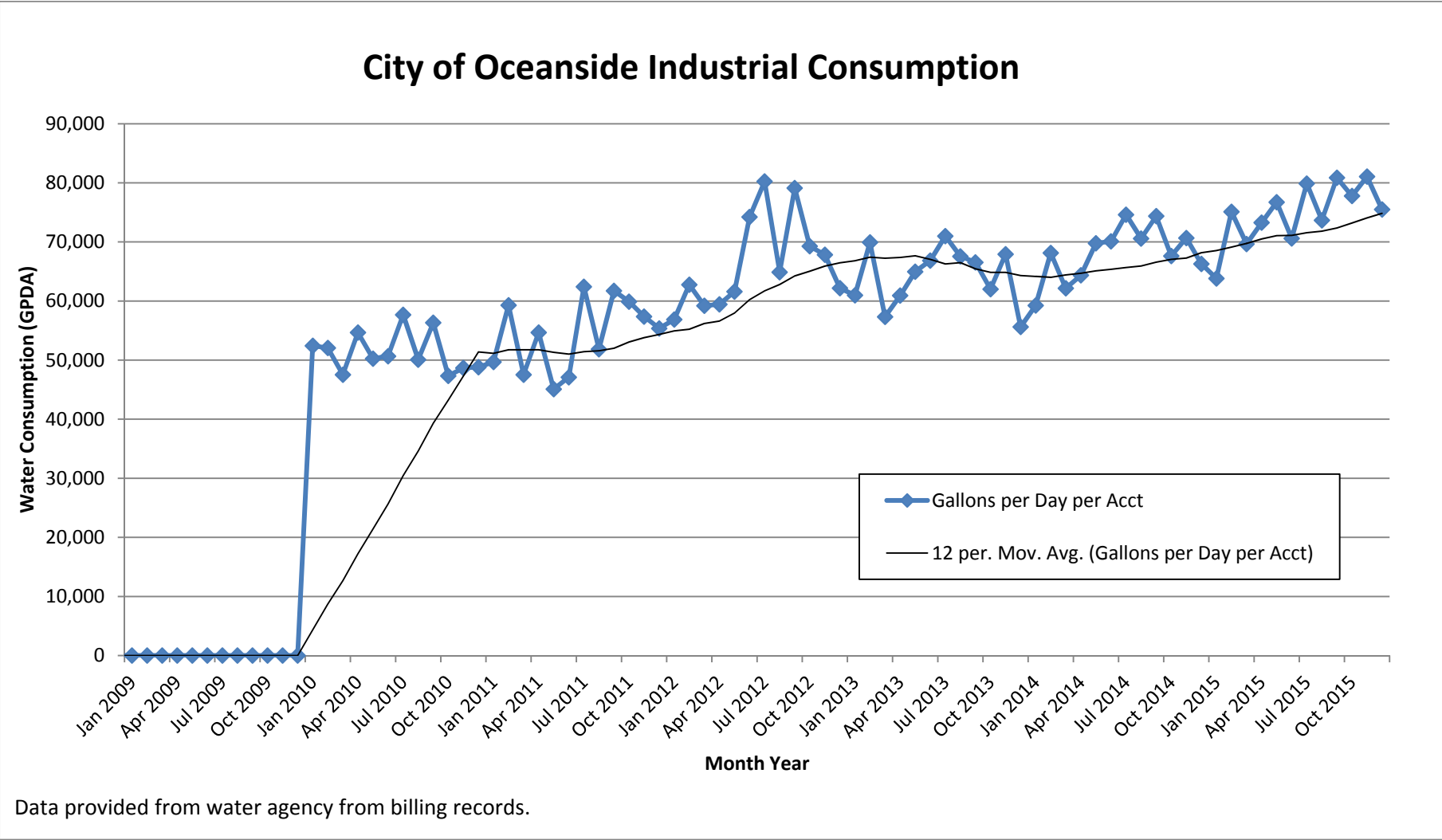




Note: The Governmental/Institutional category was discontinued as of January 1, 2015.







APPENDIX C - MEASURE SCREENING PROCESS AND RESULTS

In order to start the cost-effectiveness analysis and build a water use efficiency model for the City of Oceanside, City staff decided on the list of conservation measures to be analyzed that, once modeled, would serve as the menu to build conservation program scenarios. To this end, two web-based webinars were conducted in February and March 2016 to review and select conservation measures together with staff representatives from the City. The library of conservation measure opportunities had more than 100 measures and various implementation strategies (having different unit costs, participation levels, and/or unit water savings which must be modeled individually).

Once finalized, the selected measures were inserted into the City's DSS Model, along with the standard utility operations (e.g., water loss control programs) and education measures in order to have a complete standard menu of 22 measures in the DSS Model. Next, the MWM Project Team worked with the City to more specifically analyze measures (participation rates, net costs and unit water savings, etc.) and build conservation program scenarios. The number of measures, 22, was derived from past experience relative to (a) building program scenarios that are able to meet SB X7-7 water use targets, and (b) still being feasible to be successfully implemented by the City.

The general discussion screening criteria included:

- **Technology/Market Maturity** – Refers to whether the technology needed to implement the water use efficiency measure, such as an irrigation control device, is commercially available and supported by the local service industry. A measure was more likely to be included if the technology was widely available in the service area and less likely to be included if the technology was not commercially available or not supported by the local service industry.
- **Service Area Match** – Refers to whether the measure or related technology is appropriate for the area's climate, building stock, and lifestyle. For example, promoting native and/or water efficient landscaping may not be appropriate where water use analysis indicates little outdoor irrigation. Thus, a measure was not included if it was not well suited for the area's characteristics and could not save water, and was more highly considered to be included if it was well suited for the area and could save water.
- **Customer Acceptance/Equity** – Refers to whether retail customers within the service area would be willing to implement and accept the water use efficiency measures. For example, would retail customers attend homeowner irrigation classes and implement lessons learned from these classes? If not, then the water savings associated with this measure would not be achieved and a measure with this characteristic would score low for this criterion. This criterion also considers retail customer equity where one category of retail customers receives benefit while another pays the costs without receiving benefits. Retail customer acceptance may be based on convenience, economics, perceived fairness, and/or aesthetics.

Based on the previously listed criteria, City staff decided if a measure was a "Yes" or "No." Measures with a "No" were eliminated from further consideration, while those with a "Yes" passed into the next evaluation phase: cost-effectiveness analysis using the DSS Model.

Upon inspection of the overall list of over 100 conservation measures selected for evaluation, it became apparent that some measures could be combined and others could be separated into two categories as follows:

- Measures that were voluntary and incentive based
- Measures that were regulatory and applied to new development only

APPENDIX D - ASSUMPTIONS FOR WATER CONSERVATION MEASURES EVALUATED IN THE DSS MODEL

This appendix presents various parameter inputs as well as cost and savings results for the conservation measures evaluated in the City of Oceanside's DSS Model. Annual utility costs, targets, and water savings were provided for each individual measure for the first 5 years to the year 2020. The actual DSS Model runs measures to the year 2040.



Water Loss

Overview	
Name	Water Loss
Abbr	O1
Category	Default
Measure Type	Water Loss Measure
Time Period	
First Year	2015
Backlog Costs	
Total Backlog Work Costs	\$0
Years to Complete Backlog	0
Maintenance Costs	
Annual Maintenance Costs	\$50,000
Target	
Total GPCD Reduction	0.2

Description

Maintain a thorough annual accounting of water production, sales by customer class and quantity of water produced but not sold (non-revenue water). In conjunction with system accounting, include audits that identify and quantify known legitimate uses of non-revenue water in order to determine remaining potential for reducing water losses. Goal would be to lower the Infrastructure Leakage Index (ILI) and non-revenue water every year by a pre-determined amount based on cost-effectiveness. These programs typically pay for themselves based on savings in operational costs (and saved rate revenue can be directed more to system repairs/replacement and other costs). Continuously analyze billing data for system errors and under-registering meters. Run a monthly report to check on outliers. Identify and quickly notify customers of apparent leaks. Address meter testing and repair/replacement to insure more accurate meter reads and revenue collection. Actions could include meter calibration and accelerated meter replacement. Measure covers efforts to find and repair leaks in the distribution system to reduce real water loss. More aggressive actions could include installation of data loggers and proactive leak detection. Leak repairs would be handled by existing crews at no extra cost. May include accelerated main and service line replacement. Enhanced real loss reduction may include more ambitious main replacement and active leak detection. Capture water from water main flushing and hydrant flow testing for reuse.

Results	
Average Water Savings (mgd)	
0.036435	
Lifetime Savings - Present Value (\$)	
Utility	\$1,045,453
Community	\$1,045,453
Lifetime Costs - Present Value (\$)	
Utility	\$919,716
Community	\$919,716
Benefit to Cost Ratio	
Utility	1.14
Community	1.14
Cost of Savings per Unit Volume (\$/mg)	
Utility	\$2,658
Comments	
Did NOT include distribution system regulation which would directly affect fire flow calculations for any buildings with fire sprinklers. 90% of all homes in our service area already have pressure regulators. Costs and target need to be updated. Michelle and Teresa discussed this on 3/14/16. Confirm backlog costs (\$0). Confirm annual maintenance costs (\$50K). Confirm target total GPCD reduction of 0.2 GPCD. Confirm Program A because this is required by CUWCC.	

Costs	
	Utility
2015	\$50,000
2016	\$50,000
2017	\$50,000
2018	\$50,000
2019	\$50,000
2020	\$50,000

Targets	
	Projected NRW Percent
2015	6.2%
2016	6.2%
2017	6.2%
2018	6.2%
2019	6.2%
2020	6.2%

Water Savings	
	Total Savings
2015	0.034237
2016	0.034450
2017	0.034663
2018	0.034876
2019	0.035089
2020	0.035302



AMI

Overview	
Name	AMI
Abbr	O2
Category	Default
Measure Type	Standard Measure

Time Period	Measure Life
First Year	2025
Last Year	2029
Measure Length	5

Fixture Costs			
	Utility	Customer	Fix/Acct
SF	\$15.00	\$75.00	1
MF	\$25.00	\$150.00	1
COM	\$25.00	\$200.00	1
IRR	\$25.00	\$200.00	1
GOV	\$25.00	\$200.00	1
IND	\$25.00	\$200.00	1

Administration Costs	
Markup Percentage	25%

Description
Require that new customers install such AMI meters as described above and possibly purchase means of viewing daily consumption inside their home/business either through the internet or separate device. The AMI system would, on demand, indicate to the customer and Utility where and how their water is used, facilitating water use reduction and prompt leak identification. Also require that larger or irrigation customers install such AMI meters as described above and possibly purchase means of viewing daily consumption by landscape/property managers, or business either through the Internet (if available) or separate device. This would require Utility to install an AMI system.

Customer Classes							
	SF	MF	COM	IRR	GOV	AG	REC
	☐	☐	☐	☐	☐	☐	☐

End Uses							
	SF	MF	COM	IRR	GOV	AG	REC
Toilets	☐	☐	☐	☐	☐	☐	☐
Urinals	☐	☐	☐	☐	☐	☐	☐
Lavatory Faucets	☐	☐	☐	☐	☐	☐	☐
Showers	☐	☐	☐	☐	☐	☐	☐
Dishwashers	☐	☐	☐	☐	☐	☐	☐
Clothes Washers	☐	☐	☐	☐	☐	☐	☐
Process	☐	☐	☐	☐	☐	☐	☐
Kitchen Spray Rinse	☐	☐	☐	☐	☐	☐	☐
Internal Leakage	☒	☒	☒	☒	☒	☒	☒
Baths	☐	☐	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐	☐	☐
Irrigation	☐	☐	☐	☐	☐	☐	☐
Pools	☐	☐	☐	☐	☐	☐	☐
Wash Down	☐	☐	☐	☐	☐	☐	☐
Cooling	☐	☐	☐	☐	☐	☐	☐
Car Washing	☐	☐	☐	☐	☐	☐	☐
External Leakage	☒	☒	☒	☒	☒	☒	☒
Outdoor	☐	☐	☐	☐	☐	☐	☐
tory/Kitchen Faucets	☐	☐	☐	☐	☐	☐	☐

Comments
Allocated part of AMI cost to Conservation program; costs per account cover part of installation and part of customer notification and follow up. Total cost is \$13 million capital cost + est. \$11 million meters, assign 25% to conservation or \$6 million. Measure savings may NOT be permanent. Costs, savings and targets based on 2010 measure design.

Results	
Average Water Savings (mgd)	0.500718
Lifetime Savings - Present Value (\$)	
Utility	\$14,017,675
Community	\$19,367,192
Lifetime Costs - Present Value (\$)	
Utility	\$666,373
Community	\$3,555,269
Benefit to Cost Ratio	
Utility	21.04
Community	5.45
Cost of Savings per Unit Volume (\$/mg)	
Utility	\$140

End Use Savings Per Replacement	
	% Savings per Account
SF Internal Leakage	30.0%
MF Internal Leakage	30.0%
COM Internal Leakage	30.0%
GOV Internal Leakage	30.0%
IND Internal Leakage	30.0%
SF External Leakage	30.0%
MF External Leakage	30.0%
COM External Leakage	30.0%
IRR External Leakage	30.0%
GOV External Leakage	30.0%
IND External Leakage	30.0%

Targets	
Target Method	Percentage
% of Accts Targeted / yr	20.000%
Only Effects New Accts	☐

Costs			
View:	Utility	Customer	Total
2023	\$0	\$0	\$0
2024	\$0	\$0	\$0
2025	\$188,645	\$818,754	\$1,007,398
2026	\$189,377	\$821,448	\$1,010,825
2027	\$190,109	\$824,142	\$1,014,251
2028	\$190,841	\$826,837	\$1,017,678
2029	\$191,573	\$829,531	\$1,021,104
2030	\$0	\$0	\$0

Targets							
View:	SF	MF	COM	IRR	GOV	IND	Total
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	8,158	430	366	344	0	2	9,300
2026	8,199	432	370	336	0	2	9,340
2027	8,241	434	375	328	0	3	9,380
2028	8,283	436	379	319	0	3	9,420
2029	8,325	438	383	311	0	3	9,460
2030	0	0	0	0	0	0	0

Water Savings (mgd)	
	Total Savings (mgd)
2023	0.000000
2024	0.000000
2025	0.185387
2026	0.371093
2027	0.557120
2028	0.743467
2029	0.930133
2030	0.930133

Yellow highlighting indicates that this measure starts in the year 2025-2029 which is a later start date than the other measures provided in this Appendix.



Pricing

Overview	
Name	Pricing
Abbr	O3
Category	Default
Measure Type	Pricing Measure

Customer Class	
Customer Class	Single family

Time Period	
First Year	2016

Description
Develop individualized monthly water budgets. Water budgets are linked to a rate schedule where rates per unit of water increase when a customer goes above their budget, or decreases if they are below their budget. Budgets typically are based on such factors as the size of the irrigated area and often vary seasonally to reflect weather during the billing period. These rates have been shown to be effective in reducing landscape irrigation demand (AWWARF Reports). This measure would require rate study and capable billing software.

Comments
Might change this measure from a pricing measure to a "Water Budget Based Billing" measure with selected customer categories targeted. Elasticity and costs based on SCWD: SCWD conducted a comprehensive rate study in 2008 costing \$100,000. An update was completed in 2013 for ~\$25,000. The 2008 rate study states that "long-term elasticity of demand for water services is -0.16." SCWD reports no annual costs associated with maintaining rates.

Planned Rate Increases			
Add Rate Increase			
Change Year	Price Incr (%)	Price Incr Adjusting for Inflation	
2016	7.5%	4.5%	Delete
2017	3.0%	0.0%	Delete
2020	5.0%	2.0%	Delete
2025	5.0%	2.0%	Delete
2030	5.0%	2.0%	Delete
2035	5.0%	2.0%	Delete

Results	
Average Water Savings (mgd)	
0.182759	
Lifetime Savings - Present Value (\$)	
Utility	\$408,985
Community	\$408,985
Lifetime Costs - Present Value (\$)	
Utility	\$214,514
Community	\$214,514
Benefit to Cost Ratio	
Utility	1.91
Community	1.91
Cost of Savings per Unit Volume (\$/mg)	
Utility	\$124

Price Elasticity		
Overall	Indoor	Outdoor
-0.16	-0.05	-0.36

Utility Costs	
Rate Study Cost	\$50,000
Rate Study Frequency (every # yrs)	4
First Year of Rate Study	2017
Annual Maintenance Cost	\$0

Consumer Price Index	
First Year Index	100.0
Annual Increase	3%

Costs			
	Utility	Customer	Total (Community)
2015	\$0	\$0	\$0
2016	\$0	\$0	\$0
2017	\$50,000	\$0	\$50,000
2018	\$0	\$0	\$0
2019	\$0	\$0	\$0
2020	\$0	\$0	\$0

Projected Price Index		
	Price Index	Cumulative Index Increase
2015	0.0	0%
2016	100.0	0%
2017	103.0	3%
2018	106.1	6%
2019	109.3	9%
2020	112.6	13%

Water Savings	
	Total Savings (mgd)
2015	0.000000
2016	0.094102
2017	0.094102
2018	0.094102
2019	0.094102
2020	0.136823



**Single Family
Indoor Water
Surveys**

Overview			
Name	Single Family Indoor Water Survey		
Abbr	O4		
Category	Default		
Measure Type	Standard Measure		

Time Period	
First Year	2015
Last Year	2024
Measure Length	10

Measure Life	
Permanent	☐
Years	7
Repeat	☐

Fixture Costs			
	Utility	Customer	Fix/Acct
SF	\$18.50	\$50.00	1

Administration Costs	
Markup Percentage	25%

Description
Indoor water surveys for existing single family residential customers. Target those with high water use and provide a customized report to owner.

Customer Classes							
	SF	MF	COM	IRR	GOV	AG	REC
	☒	☐	☐	☐	☐	☐	☐

End Uses							
	SF	MF	COM	IRR	GOV	AG	REC
Toilets	☒						
Urinals							
Lavatory Faucets	☒						
Showers	☒						
Dishwashers	☒						
Clothes Washers	☒						
Process							
Kitchen Spray Rinse							
Internal Leakage	☒						
Baths	☒						
Other	☒						
Irrigation	☐						
Pools	☐						
Wash Down	☐						
Cooling							
Car Washing	☐						
External Leakage	☐						
Outdoor							
Lavatory/Kitchen Faucets	☒						

Comments
Assume NO outdoor. Outdoor surveys are included in measure 9 Residential Outdoor Audits. Utility costs per file: "2017 AttachE_final.docx" agency share of service. Customer costs represent follow-up device and installation costs. Giveaway of devices are NOT included in cost and savings. Target based on recent indoor audit activity.

Results	
Average Water Savings (mgd)	0.002721
Lifetime Savings - Present Value (\$)	
Utility	\$111,688
Community	\$199,795
Lifetime Costs - Present Value (\$)	
Utility	\$20,044
Community	\$63,382
Benefit to Cost Ratio	
Utility	5.57
Community	3.15
Cost of Savings per Unit Volume (\$/mg)	
Utility	\$776

End Use Savings Per Replacement	
	% Savings per Account
SF Toilets	5.0%
SF Lavatory Faucets	5.0%
SF Showers	5.0%
SF Dishwashers	5.0%
SF Clothes Washers	5.0%
SF Internal Leakage	5.0%
SF Baths	5.0%
SF Other	5.0%
on-Lavatory/Kitchen Fat	5.0%

Targets	
Target Method	Percentage
% of Accts Targeted / yr	0.250%
Only Effects New Accts	☐

Costs			
View:	Summary		
	Utility	Customer	Total
2015	\$2,224	\$4,809	\$7,033
2016	\$2,238	\$4,839	\$7,077
2017	\$2,252	\$4,869	\$7,121
2018	\$2,266	\$4,899	\$7,164
2019	\$2,279	\$4,929	\$7,208
2020	\$2,293	\$4,959	\$7,252

Targets		
View	Accounts	
	SF	Total
2015	96	96
2016	97	97
2017	97	97
2018	98	98
2019	99	99
2020	99	99

Water Savings (mgd)	
	Total Savings (mgd)
2015	0.001053
2016	0.002096
2017	0.003125
2018	0.004142
2019	0.005146
2020	0.006137



High Efficiency Faucet Aerator, Showerhead, and Soil Moisture Sensor Giveaway

Overview	
Name	High Efficiency Faucet Aerator, Showerhead, and Soil Moisture Sensor
Abbr	OS
Category	Default
Measure Type	Standard Measure

Time Period	Measure Life
First Year 2015	Permanent ☒
Last Year 2024	
Measure Length 10	

Fixture Costs			
	Utility	Customer	Fix/Acct
SF	\$50.00	\$25.00	2
MF	\$50.00	\$25.00	8
COM	\$50.00	\$25.00	10
GOV	\$50.00	\$25.00	10
IND	\$50.00	\$25.00	10

Administration Costs	
Markup Percentage	10%

Description
Utility would buy showerheads, kitchen and bathroom faucet aerators and soil moisture sensors in bulk and give them away at Utility office or community events.

Customer Classes									
	SF	MF	COM	GOV	IND				

End Uses									
Toilets	☐	☐	☐	☐	☐	☐	☐	☐	☐
Urinals	☐	☐	☐	☐	☐	☐	☐	☐	☐
Lavatory Faucets	☒	☒	☒	☒	☒	☒	☒	☒	☒
Showers	☒	☒	☒	☒	☒	☒	☒	☒	☒
Dishwashers	☐	☐	☐	☐	☐	☐	☐	☐	☐
Clothes Washers	☐	☐	☐	☐	☐	☐	☐	☐	☐
Process	☐	☐	☐	☐	☐	☐	☐	☐	☐
Kitchen Spray Rinse	☐	☐	☐	☐	☐	☐	☐	☐	☐
Internal Leakage	☐	☐	☐	☐	☐	☐	☐	☐	☐
Baths	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐	☐	☐	☐	☐
Irrigation	☒	☒	☒	☒	☒	☒	☒	☒	☒
Pools	☐	☐	☐	☐	☐	☐	☐	☐	☐
Wash Down	☐	☐	☐	☐	☐	☐	☐	☐	☐
Cooling	☐	☐	☐	☐	☐	☐	☐	☐	☐
Car Washing	☐	☐	☐	☐	☐	☐	☐	☐	☐
External Leakage	☐	☐	☐	☐	☐	☐	☐	☐	☐
Outdoor	☐	☐	☐	☐	☐	☐	☐	☐	☐
Laundry/Kitchen Faucets	☒	☒	☒	☒	☒	☒	☒	☒	☒

Comments
A giveaway package includes one 1.5 gpm kitchen faucet aerator, one 1.0 bathroom faucet aerator, one 1.5 gpm showerhead and one soil moisture sensor. Assume an average of 2 packages per SF account, 8 packages per MF account, and 10 packages per CII account.
>Utility costs for 1 package is approximately \$50 when fixtures are bought in bulk - showerheads \$10, bathroom and kitchen aerators \$5, and soil sensor \$25. Customer cost is for installation, to repair leaks or other minor costs.
>Conservatively assume 1.5 gpm showerhead is replacing 2.5 gpm device yielding 40% savings. Conservatively assume 1.0 gpm bathroom aerator replaces 2.2 gpm aerator yielding 55% savings. Conservatively assume 1.8 gpm kitchen aerator replaces a 2.5 gpm aerator saving 28%. Assume only 25% of distributed packages are actually installed/used - so only 25% of possible savings are achieved.
According to Baum-Haley, 2013 "Evaluation of Potential Best Management Practices - Soil Moisture Sensors" report prepared for the CUWCC, studies indicate an enormous savings range potential from 4.3% to 72% with lower savings indicated in the "real world" investigations versus pilot study results. Conservatively assume 5% (accounting for some giveaways NOT being installed).
>File "CII Fully Funded Forms.pdf" notes an approx. 10% administrative fee per device.

Results	
Average Water Savings (mgd)	0.029333
Lifetime Savings - Present Value (\$)	
Utility	\$924,753
Community	\$1,662,123
Lifetime Costs - Present Value (\$)	
Utility	\$272,553
Community	\$396,440
Benefit to Cost Ratio	
Utility	3.39
Community	4.19
Cost of Savings per Unit Volume (\$/mg)	
Utility	\$978

End Use Savings Per Replacement	
	% Savings per Account
SF Lavatory Faucets	13.8%
MF Lavatory Faucets	13.8%
COM Lavatory Faucets	13.8%
GOV Lavatory Faucets	13.8%
IND Lavatory Faucets	13.8%
SF Showers	10.0%
MF Showers	10.0%
COM Showers	10.0%
GOV Showers	10.0%
IND Showers	10.0%
SF Irrigation	5.0%
MF Irrigation	5.0%
COM Irrigation	5.0%
GOV Irrigation	5.0%
IND Irrigation	5.0%
Non-Lavatory/Kitchen Faucets	7.0%
Non-Lavatory/Kitchen Faucets	7.0%
Non-Lavatory/Kitchen Faucets	7.0%
Non-Lavatory/Kitchen Faucets	7.0%

Targets	
Target Method	Percentage
% of Accts Targeted / yr	0.500%
Only Effects New Accts	☐

Costs			
View:	Summary		
	Utility	Customer	Total
2015	\$30,164	\$13,711	\$43,875
2016	\$30,367	\$13,803	\$44,170
2017	\$30,570	\$13,895	\$44,465
2018	\$30,773	\$13,988	\$44,760
2019	\$30,976	\$14,080	\$45,056
2020	\$31,179	\$14,172	\$45,351

Targets						
View:	Fixtures					
	SF	MF	COM	GOV	IND	Total
2015	385	81	82	0	1	548
2016	387	82	83	0	1	552
2017	390	82	84	0	1	556
2018	392	83	84	0	1	560
2019	394	83	85	0	1	563
2020	397	84	86	0	1	567

Water Savings (mgd)	
Total Savings (mgd)	
2015	0.003940
2016	0.007821
2017	0.011627
2018	0.015365
2019	0.019034
2020	0.022651



Hot Water on Demand Pump Systems Rebate

Overview			
Name	Hot Water on Demand Pump System		
Abbr	O6		
Category	Default		
Measure Type	Standard Measure		

Time Period		Measure Life	
First Year	2018	Permanent	☒
Last Year	2022		
Measure Length	5		

Fixture Costs			
	Utility	Customer	Fix/Acct
SF	\$100.00	\$180.00	1

Administration Costs	
Markup Percentage	10%

Description

Provide a rebate to equip homes with efficient hot water on demand systems. These systems use a pump placed under the sink to recycle water sitting in the hot water pipes to reduce hot water waiting times by having an on-demand pump on a recirculation line. Can be installed on kitchen sink or master bath, wherever hot water waiting times are more than 1/2 minute. Requires an electrical outlet under the sink, which is not common on older home bathrooms but is on kitchen sinks.

Customer Classes							
	SF	MF	COM	IRR	GOV	AG	REC
	☒	☐	☐	☐	☐	☐	☐

End Uses							
	SF	MF	COM	IRR	GOV	AG	REC
Toilets	☐						
Urinals	☐						
Lavatory Faucets	☒						
Showers	☒						
Dishwashers	☐						
Clothes Washers	☐						
Process							
Kitchen Spray Rinse							
Internal Leakage	☐						
Baths	☒						
Other	☐						
Irrigation	☐						
Pools	☐						
Wash Down	☐						
Cooling	☐						
Car Washing	☐						
External Leakage	☐						
Outdoor	☐						
Lavatory/Kitchen Faucets	☒						

Comments

Target based on 2010 measure target for existing accounts. Assume include SF accounts only. Water savings based on Jim Lutz paper and information from Gary Klein and David Grieshop. See spreadsheet titled "Hot Water On Demand Water Savings Estimate_2013" includes 1750 sq ft house saves 1571 gallons per year or 4.3 gpd/acct and a total of 99.5 gpd per SF home, equates to ~4.3% savings per home. Based on a SF indoor water use this results in an equivalent savings of approximately 7.45 gpd savings or 11.6% on shower and faucet end uses. For more information on ACT go to www.gothotwater.com. >File "CII Fully Funded Forms.pdf" notes an approx. 10% administrative fee per device.

Results	
Average Water Savings (mgd)	0.014495
Lifetime Savings - Present Value (\$)	
Utility	\$486,134
Community	\$1,051,101
Lifetime Costs - Present Value (\$)	
Utility	\$188,169
Community	\$496,081
Benefit to Cost Ratio	
Utility	2.58
Community	2.12
Cost of Savings per Unit Volume (\$/mg)	
Utility	\$1,367

End Use Savings Per Replacement	
	% Savings per Account
SF Lavatory Faucets	11.6%
SF Showers	11.6%
SF Baths	11.6%
on-Lavatory/Kitchen Fa	11.6%

Targets	
Target Method	Percentage
% of Accts Targeted / yr	1.000%
Only Effects New Accts	☐

Costs			
View:	Summary		
	Utility	Customer	Total
2015	\$0	\$0	\$0
2016	\$0	\$0	\$0
2017	\$0	\$0	\$0
2018	\$43,109	\$70,542	\$113,650
2019	\$43,372	\$70,972	\$114,345
2020	\$43,635	\$71,403	\$115,039

Targets		
View:	Accounts	
	SF	Total
2015	0	0
2016	0	0
2017	0	0
2018	392	392
2019	394	394
2020	397	397

Water Savings (mgd)	
	Total Savings (mgd)
2015	0.000000
2016	0.000000
2017	0.000000
2018	0.004062
2019	0.008016
2020	0.011877



Residential Clothes Washer Rebate

Overview			
Name	Residential Clothes Washer Rebat		
Abbr	O7		
Category	Default		
Measure Type	Standard Measure		

Time Period	
First Year	2015
Last Year	2016
Measure Length	2

Measure Life	
Permanent	☒

Fixture Costs			
	Utility	Customer	Fix/Acct
SF	\$100.00	\$700.00	1
MF	\$100.00	\$700.00	5

Administration Costs	
Markup Percentage	10%

Description

Provide a rebate for efficient washing machines to single family homes and apartment complexes that have common laundry rooms. It is assumed that the rebates would remain consistent with relevant state and federal regulations (Department of Energy, Energy Star) and only offer the best available technology. Partner with MWD with measure administration by MWD.

Customer Classes							
	SF	MF	COM	IRR	GOV	AG	REC
	☒	☒	☐	☐	☐	☐	☐

End Uses							
	SF	MF	COM	IRR	GOV	AG	REC
Toilets	☐	☐	☐	☐	☐	☐	☐
Urinals	☐	☐	☐	☐	☐	☐	☐
Lavatory Faucets	☐	☐	☐	☐	☐	☐	☐
Showers	☐	☐	☐	☐	☐	☐	☐
Dishwashers	☐	☐	☐	☐	☐	☐	☐
Clothes Washers	☒	☒	☐	☐	☐	☐	☐
Process	☐	☐	☐	☐	☐	☐	☐
Kitchen Spray Rinse	☐	☐	☐	☐	☐	☐	☐
Internal Leakage	☐	☐	☐	☐	☐	☐	☐
Baths	☐	☐	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐	☐	☐
Irrigation	☐	☐	☐	☐	☐	☐	☐
Pools	☐	☐	☐	☐	☐	☐	☐
Wash Down	☐	☐	☐	☐	☐	☐	☐
Cooling	☐	☐	☐	☐	☐	☐	☐
Car Washing	☐	☐	☐	☐	☐	☐	☐
External Leakage	☐	☐	☐	☐	☐	☐	☐
Outdoor	☐	☐	☐	☐	☐	☐	☐
Laundry/Kitchen Faucets	☐	☐	☐	☐	☐	☐	☐

Comments

Per socialwatersmart.com high-efficiency clothes washers can use 55% less water than standard clothes washers. Less water means less energy needed for water heating, lowering your energy bill too. Rebates start at \$85. Assume average rebate value of \$100. Customer costs represents incremental purchase cost of typical device (\$700) and installation (\$100). Target based on 2010 measure design 1% target; the intensive version of this measure had a 3% annual target. Clothes washer water savings between conventional and Energy Star machines is 37% from Energy Star website appliance savings calculator downloaded on September 20, 2013.

> File "CII Fully Funded Forms.pdf" notes an approx. 10% administrative fee per device. The program duration is assumed to end in 2016 as MWD plans to discontinue this program in the near future.

Results	
Average Water Savings (mgd)	0.009192
Lifetime Savings - Present Value (\$)	
Utility	\$337,705
Community	\$836,837
Lifetime Costs - Present Value (\$)	
Utility	\$105,688
Community	\$778,246
Benefit to Cost Ratio	
Utility	3.20
Community	1.08
Cost of Savings per Unit Volume (\$/mg)	
Utility	\$1,211

End Use Savings Per Replacement	
	% Savings per Account
SF Clothes Washers	37.0%
MF Clothes Washers	37.0%

Targets	
Target Method	Percentage
% of Accts Targeted / yr	1.000%
Only Effects New Accts	☐

Costs			
View:	Summary		
	Utility	Customer	Total
2015	\$53,463	\$340,222	\$393,685
2016	\$53,796	\$342,339	\$396,135
2017	\$0	\$0	\$0
2018	\$0	\$0	\$0
2019	\$0	\$0	\$0
2020	\$0	\$0	\$0

Targets			
View:	Accounts		
	SF	MF	Total
2015	385	20	405
2016	387	20	407
2017	0	0	0
2018	0	0	0
2019	0	0	0
2020	0	0	0

Water Savings (mgd)	
	Total Savings (mgd)
2015	0.005555
2016	0.011124
2017	0.011100
2018	0.011072
2019	0.011041
2020	0.010951



**Residential
Outdoor Water
Surveys**

Overview			
Name	Residential Outdoor Water Survey		
Abbr	O8		
Category	Default		
Measure Type	Standard Measure		

Time Period		Measure Life	
First Year	2015	Permanent	☐
Last Year	2025	Years	7
Measure Length	11	Repeat	☐

Fixture Costs			
	Utility	Customer	Fix/Acct
SF	\$44.00	\$50.00	1
MF	\$156.50	\$100.00	1

Administration Costs	
Markup Percentage	25%

Description
Outdoor water surveys offered for existing customers. Those with high water use are targeted and provided a customized report on how to save water.

Customer Classes								
	SF	MF	COM	IRR	GOV	AG	REC	IND
	☒	☒	☐	☐	☐	☐	☐	☐

End Uses								
	SF	MF	COM	IRR	GOV	AG	REC	IND
Toilets	☐	☐						
Urinals	☐	☐						
Lavatory Faucets	☐	☐						
Showers	☐	☐						
Dishwashers	☐	☐						
Clothes Washers	☐	☐						
Process								
Kitchen Spray Rinse								
Internal Leakage	☐	☐						
Baths	☐	☐						
Other	☐	☐						
Irrigation	☒	☒						
Pools	☐	☐						
Wash Down	☐	☐						
Cooling	☐	☐						
Car Washing	☐	☐						
External Leakage	☒	☒						
Outdoor	☐	☐						
tory/Kitchen Faucets	☐	☐						

Comments
Current measure. Assume NO indoor. Indoor SF surveys are included in measure 4 Residential Indoor Surveys. Utility costs per file "2017 Attach E_final.docx" for SF elected service agency share for "Home Water Use Evaluation - Landscape only" and for MF elected service agency share "Irrigation Checkup". Customer costs represent follow-up device and installation costs. Adjust savings and costs if giveaway devices are distributed or installed.

Results	
Average Water Savings (mgd)	0.001481
Lifetime Savings - Present Value (\$)	
Utility	\$47,909
Community	\$47,909
Lifetime Costs - Present Value (\$)	
Utility	\$24,621
Community	\$45,458
Benefit to Cost Ratio	
Utility	1.95
Community	1.05
Cost of Savings per Unit Volume (\$/mg)	
Utility	\$1,751

End Use Savings Per Replacement	
	% Savings per Account
SF Irrigation	10.0%
MF Irrigation	10.0%
SF External Leakage	10.0%
MF External Leakage	10.0%

Targets	
Target Method	Percentage
% of Accts Targeted / yr	0.100%
Only Effects New Accts	☐

Costs			
View:	Summary		
	Utility	Customer	Total
2015	\$2,512	\$2,126	\$4,639
2016	\$2,528	\$2,139	\$4,667
2017	\$2,544	\$2,153	\$4,696
2018	\$2,559	\$2,166	\$4,725
2019	\$2,575	\$2,179	\$4,754
2020	\$2,591	\$2,192	\$4,783

Targets			
View:	Accounts		
	SF	MF	Total
2015	38	2	40
2016	39	2	41
2017	39	2	41
2018	39	2	41
2019	39	2	42
2020	40	2	42

Water Savings (mgd)	
Total Savings (mgd)	
2015	0.000485
2016	0.000974
2017	0.001465
2018	0.001959
2019	0.002456
2020	0.002957



Large Landscape Outdoor Water Audit

Overview			
Name	Large Landscape Outdoor Water Audit		
Abbr	O9		
Category	Default		
Measure Type	Standard Measure		

Time Period	
First Year	2015
Last Year	2024
Measure Length	10

Measure Life	
Permanent	☐
Years	10
Repeat	☐

Fixture Costs			
	Utility	Customer	Fix/Acct
MF	\$492.00	\$1,000.00	1
COM	\$492.00	\$1,000.00	1
IRR	\$492.00	\$1,000.00	1
GOV	\$492.00	\$1,000.00	1
IND	\$492.00	\$1,000.00	1

Administration Costs	
Markup Percentage	30%

Description
Outdoor water audits offered for existing large landscape customers. Those with high water use are targeted and provided a customized report on how to save water. All large multi-family residential, CII, and public irrigators of large landscapes would be eligible for free landscape water audits upon request.

Customer Classes									
	SF	MF	COM	IRR	GOV	AG	REC	IND	
☐	☐	☐	☐	☐	☐	☐	☐	☐	

End Uses									
	SF	MF	COM	IRR	GOV	AG	REC	IND	
Toilets	☐	☐	☐	☐	☐	☐	☐	☐	
Urinals	☐	☐	☐	☐	☐	☐	☐	☐	
Lavatory Faucets	☐	☐	☐	☐	☐	☐	☐	☐	
Showers	☐	☐	☐	☐	☐	☐	☐	☐	
Dishwashers	☐	☐	☐	☐	☐	☐	☐	☐	
Clothes Washers	☐	☐	☐	☐	☐	☐	☐	☐	
Process	☐	☐	☐	☐	☐	☐	☐	☐	
Kitchen Spray Rinse	☐	☐	☐	☐	☐	☐	☐	☐	
Internal Leakage	☐	☐	☐	☐	☐	☐	☐	☐	
Baths	☐	☐	☐	☐	☐	☐	☐	☐	
Other	☐	☐	☐	☐	☐	☐	☐	☐	
Irrigation	☒	☒	☒	☒	☒	☒	☒	☒	
Pools	☐	☐	☐	☐	☐	☐	☐	☐	
Wash Down	☐	☐	☐	☐	☐	☐	☐	☐	
Cooling	☐	☐	☐	☐	☐	☐	☐	☐	
Car Washing	☐	☐	☐	☐	☐	☐	☐	☐	
External Leakage	☒	☒	☒	☒	☒	☒	☒	☒	
Outdoor	☐	☐	☐	☐	☐	☐	☐	☐	
tory/Kitchen Faucets	☐	☐	☐	☐	☐	☐	☐	☐	

Comments
Current measure. Utility costs based on file: "2017 Attach E_Final.docx" agency share of elected service "Full Audit - Four or more acres." Consider any overlap with measure 9.
Water savings based on:
1. Western Policy Research (The World's Water – Biennial Report on Fresh Water Sources (2004-2005) – Turf maintenance, irrigation system maintenance, irrigation scheduling, Potential Savings = 20%
2. VWC Landscape Assessment Review (Targeted Outreach Scoring Algorithm) – average landscape irrigation efficiency of .5, or 2:1 gallon per gallon need ratio, compared to irrigation efficiency of .625 (Water Smart Allocation Target) with a 1.6:1 ration. Therefore, 2-1.6 = .4, .4/2 = .02, or 20%.
3. CUWCC R&E Committee Revised Numbers 2012) = Residential Landscape Surveys Potential Savings = 20%.

Results	
Average Water Savings (mgd)	0.005688
Lifetime Savings - Present Value (\$)	
Utility	\$178,510
Community	\$178,510
Lifetime Costs - Present Value (\$)	
Utility	\$30,313
Community	\$77,707
Benefit to Cost Ratio	
Utility	5.89
Community	2.30
Cost of Savings per Unit Volume (\$/mg)	
Utility	\$561

End Use Savings Per Replacement	
	% Savings per Account
MF Irrigation	20.0%
COM Irrigation	20.0%
IRR Irrigation	20.0%
GOV Irrigation	20.0%
IND Irrigation	20.0%
MF External Leakage	20.0%
COM External Leakage	20.0%
IRR External Leakage	20.0%
GOV External Leakage	20.0%
IND External Leakage	20.0%

Targets	
Target Method	Percentage
% of Accts Targeted / yr	0.100%
Only Effects New Accts	☐

Costs			
View:	Summary		
	Utility	Customer	Total
2015	\$3,301	\$5,161	\$8,463
2016	\$3,337	\$5,217	\$8,554
2017	\$3,372	\$5,272	\$8,644
2018	\$3,408	\$5,328	\$8,735
2019	\$3,443	\$5,383	\$8,826
2020	\$3,478	\$5,438	\$8,917

Targets						
View:	Accounts					
	MF	COM	IRR	GOV	IND	Total
2015	2	2	1	0	0	5
2016	2	2	2	0	0	5
2017	2	2	2	0	0	5
2018	2	2	2	0	0	5
2019	2	2	2	0	0	5
2020	2	2	2	0	0	5

Water Savings (mgd)	
	Total Savings (mgd)
2015	0.001383
2016	0.002787
2017	0.004215
2018	0.005664
2019	0.007136
2020	0.008630



Large Landscape Water Budgeting/Monitoring

Overview			
Name	Large Landscape Water Budgeting/Monitoring		
Abbr	O10		
Category	Default		
Measure Type	Standard Measure		

Time Period	
First Year	2015
Last Year	2024
Measure Length	10

Measure Life	
Permanent	☐
Years	10
Repeat	☐

Fixture Costs			
	Utility	Customer	Fix/Acct
MF	\$500.00	\$0.00	1
COM	\$500.00	\$0.00	1
IRR	\$500.00	\$0.00	1
GOV	\$500.00	\$0.00	1
IND	\$500.00	\$0.00	1

Administration Costs	
Markup Percentage	15%

Description
Website that provides feedback on irrigation water use (budget vs. actual).

Customer Classes							
SF	MF	COM	IRR	GOV	AG	REC	IND
☐	☐	☐	☐	☐	☐	☐	☐

End Uses								
	SF	MF	COM	IRR	GOV	AG	REC	IND
Toilets	☐	☐	☐	☐	☐	☐	☐	☐
Urinals	☐	☐	☐	☐	☐	☐	☐	☐
Lavatory Faucets	☐	☐	☐	☐	☐	☐	☐	☐
Showers	☐	☐	☐	☐	☐	☐	☐	☐
Dishwashers	☐	☐	☐	☐	☐	☐	☐	☐
Clothes Washers	☐	☐	☐	☐	☐	☐	☐	☐
Process	☐	☐	☐	☐	☐	☐	☐	☐
Kitchen Spray Rinse	☐	☐	☐	☐	☐	☐	☐	☐
Internal Leakage	☐	☐	☐	☐	☐	☐	☐	☐
Baths	☐	☐	☐	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐	☐	☐	☐
Irrigation	☒	☒	☒	☒	☒	☒	☒	☒
Pools	☐	☐	☐	☐	☐	☐	☐	☐
Wash Down	☐	☐	☐	☐	☐	☐	☐	☐
Cooling	☐	☐	☐	☐	☐	☐	☐	☐
Car Washing	☐	☐	☐	☐	☐	☐	☐	☐
External Leakage	☐	☐	☐	☐	☐	☐	☐	☐
Outdoor	☐	☐	☐	☐	☐	☐	☐	☐
atory/Kitchen Faucets	☐	☐	☐	☐	☐	☐	☐	☐

Comments
Water savings based on: 1. Western Policy Research (The World's Water – Biennial Report on Fresh Water Sources (2004-2005) – Turf maintenance, irrigation system maintenance, irrigation scheduling, Potential Savings = 20% 2. VWC Landscape Assessment Review (Targeted Outreach Scoring Algorithm) – average landscape irrigation efficiency of .5, or 2:1 gallon per gallon need ratio, compared to irrigation efficiency of .625 (Water Smart Allocation Target) with a 1.6:1 ration. Therefore, 2-1.6 = .4, .4/2 = .02, or 20%. 3. California Urban Water Conservation Council Research&Evaluation Committee Revised Numbers 2012 = Residential Landscape Surveys Potential Savings = 20%.

Results	
Average Water Savings (mgd)	0.184750
Lifetime Savings - Present Value (\$)	
Utility	\$5,798,547
Community	\$5,798,547
Lifetime Costs - Present Value (\$)	
Utility	\$953,800
Community	\$953,800
Benefit to Cost Ratio	
Utility	6.08
Community	6.08
Cost of Savings per Unit Volume (\$/mg)	
Utility	\$544

End Use Savings Per Replacement	
	% Savings per Account
MF Irrigation	20.0%
COM Irrigation	20.0%
IRR Irrigation	20.0%
GOV Irrigation	20.0%
IND Irrigation	20.0%

Targets	
Target Method	Percentage
% of Accts Targeted / yr	3.500%
Only Effects New Accts	☐

Costs			
View:	Summary		
	Utility	Customer	Total
2015	\$103,874	\$0	\$103,874
2016	\$104,989	\$0	\$104,989
2017	\$106,104	\$0	\$106,104
2018	\$107,219	\$0	\$107,219
2019	\$108,334	\$0	\$108,334
2020	\$109,449	\$0	\$109,449

Targets						
View:	Accounts					
	MF	COM	IRR	GOV	IND	Total
2015	71	57	52	0	0	181
2016	71	58	53	0	0	183
2017	72	59	54	0	0	185
2018	72	59	55	0	0	186
2019	73	60	56	0	0	188
2020	73	60	57	0	0	190

Water Savings (mgd)	
	Total Savings (mgd)
2015	0.044906
2016	0.090539
2017	0.136899
2018	0.183984
2019	0.231797
2020	0.280336



Financial Incentives for Irrigation and Landscape Upgrades

Overview	
Name	Financial Incentives for Irrigation and Landscape Upgrades
Abbr	O11
Category	Default
Measure Type	Standard Measure

Time Period	
First Year	2015
Last Year	2035
Measure Length	21

Measure Life	
Permanent	☒

Fixture Costs			
	Utility	Customer	Fix/Acct
SF	\$350.00	\$350.00	1
MF	\$1,500.00	\$1,500.00	1
COM	\$1,500.00	\$1,500.00	1
IRR	\$1,500.00	\$1,500.00	1
GOV	\$1,500.00	\$1,500.00	1
IND	\$1,500.00	\$1,500.00	1

Administration Costs	
Markup Percentage	10%

Description	
For SF, MF, CII, and IRR customers with landscape, provide a Smart Landscape Rebate for substantive landscape retrofits or installation of water efficient upgrades; Rebates contribute towards the purchase and installation of water-wise plants, compost, mulch and selected types of irrigation equipment upgrades.	

Customer Classes									
	SF	MF	COM	IRR	GOV	AG	REC	IND	
	☒	☒	☒	☒	☒	☒	☒	☒	

End Uses									
	SF	MF	COM	IRR	GOV	AG	REC	IND	
Toilets	☒	☒	☒	☒	☒	☒	☒	☒	
Urinals	☒	☒	☒	☒	☒	☒	☒	☒	
Lavatory Faucets	☒	☒	☒	☒	☒	☒	☒	☒	
Showers	☒	☒	☒	☒	☒	☒	☒	☒	
Dishwashers	☒	☒	☒	☒	☒	☒	☒	☒	
Clothes Washers	☒	☒	☒	☒	☒	☒	☒	☒	
Process	☒	☒	☒	☒	☒	☒	☒	☒	
Kitchen Spray Rinse	☒	☒	☒	☒	☒	☒	☒	☒	
Internal Leakage	☒	☒	☒	☒	☒	☒	☒	☒	
Baths	☒	☒	☒	☒	☒	☒	☒	☒	
Other	☒	☒	☒	☒	☒	☒	☒	☒	
Irrigation	☒	☒	☒	☒	☒	☒	☒	☒	
Pools	☒	☒	☒	☒	☒	☒	☒	☒	
Wash Down	☒	☒	☒	☒	☒	☒	☒	☒	
Cooling	☒	☒	☒	☒	☒	☒	☒	☒	
Car Washing	☒	☒	☒	☒	☒	☒	☒	☒	
External Leakage	☒	☒	☒	☒	☒	☒	☒	☒	
Outdoor	☒	☒	☒	☒	☒	☒	☒	☒	
tory/Kitchen Faucets	☒	☒	☒	☒	☒	☒	☒	☒	

Comments	
Rebate for residential accounts and up to 50% more for commercial customers. Could be costly and administration would be labor intensive. Assume average rebate to be \$300 for single family accounts and \$1,500 for multifamily and non-Residential accounts. Current SoCal WaterSmart commercial rebate program includes the following devices and base rebate amounts: Irrigation Controllers (\$35/Station), Rotating Nozzles for Pop-up Spray Heads (\$2/Nozzle or \$4/set - minimum 15/site), Large Rotary Nozzles (\$13/Set), In-stem Flow Regulators (\$1/Regulator), and Soil Moisture Sensor Systems (\$35/Irrigation controller station). MWD base incentives are consistent with website and file "CII Fully Funded Forms.pdf". This file also notes an approx. 10% administrative fee per device. Measure repetitive with other measures. Savings for each kind of equipment will range from 3%-20%.	

Results	
Average Water Savings (mgd)	
0.009803	
Lifetime Savings - Present Value (\$)	
Utility	\$250,260
Community	\$250,260
Lifetime Costs - Present Value (\$)	
Utility	\$391,931
Community	\$748,232
Benefit to Cost Ratio	
Utility	0.64
Community	0.33
Cost of Savings per Unit Volume (\$/mg)	
Utility	\$4,210

End Use Savings Per Replacement	
	% Savings per Account
SF Irrigation	7.0%
MF Irrigation	7.0%
COM Irrigation	7.0%
IRR Irrigation	7.0%
GOV Irrigation	7.0%
IND Irrigation	7.0%

Targets	
Target Method	Percentage
% of Accts Targeted / yr	0.100%
Only Effects New Accts	☐

Costs			
View:	Summary		
	Utility	Customer	Total
2015	\$23,328	\$21,207	\$44,535
2016	\$23,511	\$21,374	\$44,885
2017	\$23,695	\$21,541	\$45,236
2018	\$23,879	\$21,708	\$45,587
2019	\$24,062	\$21,875	\$45,937
2020	\$24,246	\$22,042	\$46,288

Targets							
View:	Accounts						
	SF	MF	COM	IRR	GOV	IND	Total
2015	38	2	2	1	0	0	44
2016	39	2	2	2	0	0	44
2017	39	2	2	2	0	0	44
2018	39	2	2	2	0	0	45
2019	39	2	2	2	0	0	45
2020	40	2	2	2	0	0	45

Water Savings (mgd)	
	Total Savings (mgd)
2015	0.000714
2016	0.001438
2017	0.002170
2018	0.002911
2019	0.003661
2020	0.004420



Require Weather Adjusting Smart Irrigation Controllers and /or Rain Sensors in New Development

Overview	
Name	Require Weather Adjusting Smart Irrigation Controllers
Abbr	O12
Category	Default
Measure Type	Standard Measure

Time Period	
First Year	2015
Last Year	2040
Measure Length	26

Measure Life	
Permanent	☒

Fixture Costs			
	Utility	Customer	Fix/Acct
MF	\$50.00	\$500.00	1
COM	\$50.00	\$1,000.00	1
IRR	\$50.00	\$1,000.00	1
GOV	\$50.00	\$1,000.00	1
IND	\$50.00	\$1,000.00	1

Administration Costs	
Markup Percentage	25%

Description
Require developers for all properties of greater than four residential units and all commercial development to install the weather based irrigation controllers. May require landscaper training.

Customer Classes							
	SF	MF	COM	IRR	GOV	AG	REC
	☒	☒	☒	☒	☒	☒	☒

End Uses							
	SF	MF	COM	IRR	GOV	AG	REC
Toilets	☒	☒	☒	☒	☒	☒	☒
Urinals	☒	☒	☒	☒	☒	☒	☒
Lavatory Faucets	☒	☒	☒	☒	☒	☒	☒
Showers	☒	☒	☒	☒	☒	☒	☒
Dishwashers	☒	☒	☒	☒	☒	☒	☒
Clothes Washers	☒	☒	☒	☒	☒	☒	☒
Process	☒	☒	☒	☒	☒	☒	☒
Kitchen Spray Rinse	☒	☒	☒	☒	☒	☒	☒
Internal Leakage	☒	☒	☒	☒	☒	☒	☒
Baths	☒	☒	☒	☒	☒	☒	☒
Other	☒	☒	☒	☒	☒	☒	☒
Irrigation	☒	☒	☒	☒	☒	☒	☒
Pools	☒	☒	☒	☒	☒	☒	☒
Wash Down	☒	☒	☒	☒	☒	☒	☒
Cooling	☒	☒	☒	☒	☒	☒	☒
Car Washing	☒	☒	☒	☒	☒	☒	☒
External Leakage	☒	☒	☒	☒	☒	☒	☒
Outdoor	☒	☒	☒	☒	☒	☒	☒
toilet/Kitchen Faucets	☒	☒	☒	☒	☒	☒	☒

Comments
This is a new development ordinance. Cal Green building code that requires this on all new buildings with an irrigation system. Costs represent targeting 90% of new accounts. Water savings based on Valencia Water Company recent experience. Castaic Lake Water Agency (CLWA service area is in north Los Angeles area) retailers assume \$3,000 total cost for WBIC stations, controllers, and installation. CLWA retailer fixture costs assume 1 station per MF account with 1 controller, and 25 stations with 3 controllers each per CII account.

Results	
Average Water Savings (mgd)	0.085753
Lifetime Savings - Present Value (\$)	
Utility	\$2,268,759
Community	\$2,268,759
Lifetime Costs - Present Value (\$)	
Utility	\$44,684
Community	\$683,462
Benefit to Cost Ratio	
Utility	50.77
Community	3.32
Cost of Savings per Unit Volume (\$/mg)	
Utility	\$55

End Use Savings Per Replacement	
	% Savings per Account
MF Irrigation	10.0%
COM Irrigation	10.0%
IRR Irrigation	10.0%
GOV Irrigation	10.0%
IND Irrigation	10.0%

Targets	
Target Method	Percentage
% of Accts Targeted / yr	90.000%
Only Effects New Accts	☒

Costs			
View:	Summary		
	Utility	Customer	Total
2015	\$3,117	\$44,193	\$47,310
2016	\$3,117	\$44,193	\$47,310
2017	\$3,117	\$44,193	\$47,310
2018	\$3,117	\$44,193	\$47,310
2019	\$3,117	\$44,193	\$47,310
2020	\$3,117	\$44,193	\$47,310

Targets						
View:	Accounts					
	MF	COM	IRR	GOV	IND	Total
2015	11	14	24	0	0	50
2016	11	14	24	0	0	50
2017	11	14	24	0	0	50
2018	11	14	24	0	0	50
2019	11	14	24	0	0	50
2020	11	14	24	0	0	50

Water Savings (mgd)	
	Total Savings (mgd)
2015	0.009341
2016	0.018681
2017	0.028022
2018	0.037363
2019	0.046703
2020	0.056044



Rotating Sprinkler Nozzle Rebates

Overview	
Name	Rotating Sprinkler Nozzle Rebates
Abbr	O13
Category	Default
Measure Type	Standard Measure

Time Period	
First Year	2015
Last Year	2024
Measure Length	10

Measure Life	
Permanent	☒

Customer Classes								
	SF	MF	COM	IRR	GOV	AG	REC	IND

End Uses								
	SF	MF	COM	IRR	GOV	AG	REC	IND
Toilets	☐	☐	☐	☐	☐	☐	☐	☐
Urinals	☐	☐	☐	☐	☐	☐	☐	☐
Lavatory Faucets	☐	☐	☐	☐	☐	☐	☐	☐
Showers	☐	☐	☐	☐	☐	☐	☐	☐
Dishwashers	☐	☐	☐	☐	☐	☐	☐	☐
Clothes Washers	☐	☐	☐	☐	☐	☐	☐	☐
Process	☐	☐	☐	☐	☐	☐	☐	☐
Kitchen Spray Rinse	☐	☐	☐	☐	☐	☐	☐	☐
Internal Leakage	☐	☐	☐	☐	☐	☐	☐	☐
Baths	☐	☐	☐	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐	☐	☐	☐
Irrigation	☒	☒	☒	☒	☒	☒	☒	☒
Pools	☐	☐	☐	☐	☐	☐	☐	☐
Wash Down	☐	☐	☐	☐	☐	☐	☐	☐
Cooling	☐	☐	☐	☐	☐	☐	☐	☐
Car Washing	☐	☐	☐	☐	☐	☐	☐	☐
External Leakage	☐	☐	☐	☐	☐	☐	☐	☐
Outdoor	☐	☐	☐	☐	☐	☐	☐	☐
Story/Kitchen Faucets	☐	☐	☐	☐	☐	☐	☐	☐

Fixture Costs			
	Utility	Customer	Fix/Acct
SF	\$2.00	\$4.00	30
MF	\$2.00	\$4.00	60
COM	\$2.00	\$4.00	100
IRR	\$2.00	\$4.00	500
GOV	\$2.00	\$4.00	100
IND	\$2.00	\$4.00	100

Administration Costs	
Markup Percentage	10%

Description	
Provide rebates to replace standard spray sprinkler nozzles with rotating nozzles that have lower application rates. Nozzles cost about \$6 and the current MWD rebate is \$2 per nozzle. Eligible rebate applications must contain a minimum of 30 rotating nozzles.	

Comments							
Per SoCal Water Smart: socialwatersmart.com/commercial/?page_id=4859 "Independent water audits have documented water savings of 20% or more when conventional sprinklers are replaced with rotating nozzles. Additional water-saving advantages include better wind resistance, less misting and virtually no runoff." > Costs based on file "CII Fully Funded Forms.pdf" with minimum of 15 units per site. There is an approx. 10% administrative fee per device.							

Results	
Average Water Savings (mgd)	
0.017715	
Lifetime Savings - Present Value (\$)	
Utility	\$477,935
Community	\$477,935
Lifetime Costs - Present Value (\$)	
Utility	\$43,998
Community	\$123,994
Benefit to Cost Ratio	
Utility	10.86
Community	3.85
Cost of Savings per Unit Volume (\$/mg)	
Utility	\$262

End Use Savings Per Replacement	
	% Savings per Account
SF Irrigation	20.0%
MF Irrigation	20.0%
COM Irrigation	20.0%
IRR Irrigation	20.0%
GOV Irrigation	20.0%
IND Irrigation	20.0%

Targets	
Target Method	Percentage
% of Accts Targeted / yr	0.100%
Only Effects New Accts	☐

Costs			
View:	Summary		
	Utility	Customer	Total
2015	\$4,800	\$8,728	\$13,528
2016	\$4,851	\$8,820	\$13,671
2017	\$4,901	\$8,912	\$13,813
2018	\$4,952	\$9,004	\$13,956
2019	\$5,003	\$9,096	\$14,099
2020	\$5,053	\$9,188	\$14,241

Targets							
View:	Fixtures						
	SF	MF	COM	IRR	GOV	IND	Total
2015	1,154	122	164	741	0	1	2,182
2016	1,161	122	166	754	0	1	2,205
2017	1,169	123	167	768	0	1	2,228
2018	1,176	124	169	781	0	1	2,251
2019	1,183	125	171	795	0	1	2,274
2020	1,190	125	172	808	0	1	2,297

Water Savings (mgd)	
	Total Savings (mgd)
2015	0.002041
2016	0.004108
2017	0.006200
2018	0.008317
2019	0.010460
2020	0.012628



Provide Rain Barrel Incentive

Overview			
Name	Provide Rain Barrel Incentive		
Abbr	O14		
Category	Default		
Measure Type	Standard Measure		

Time Period	
First Year	2015
Last Year	2025
Measure Length	11

Measure Life	
Permanent	☒

Fixture Costs			
	Utility	Customer	Fix/Acct
SF	\$75.00	\$25.00	1
MF	\$300.00	\$25.00	1

Administration Costs	
Markup Percentage	10%

Description	
Provide incentive for installation of residential rain barrels. Rebates Start at \$75 per Barrel or \$300 per Cistern.	

Customer Classes							
	SF	MF	COM	IRR	GOV	AG	REC
	☒	☒	☐	☐	☐	☐	☐

End Uses							
Toilets	☐	☐	☐	☐	☐	☐	☐
Urinals	☐	☐	☐	☐	☐	☐	☐
Lavatory Faucets	☐	☐	☐	☐	☐	☐	☐
Showers	☐	☐	☐	☐	☐	☐	☐
Dishwashers	☐	☐	☐	☐	☐	☐	☐
Clothes Washers	☐	☐	☐	☐	☐	☐	☐
Process	☐	☐	☐	☐	☐	☐	☐
Kitchen Spray Rinse	☐	☐	☐	☐	☐	☐	☐
Internal Leakage	☐	☐	☐	☐	☐	☐	☐
Baths	☐	☐	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐	☐	☐
Irrigation	☒	☒	☐	☐	☐	☐	☐
Pools	☐	☐	☐	☐	☐	☐	☐
Wash Down	☐	☐	☐	☐	☐	☐	☐
Cooling	☐	☐	☐	☐	☐	☐	☐
Car Washing	☐	☐	☐	☐	☐	☐	☐
External Leakage	☐	☐	☐	☐	☐	☐	☐
Outdoor	☐	☐	☐	☐	☐	☐	☐
tory/Kitchen Faucets	☐	☐	☐	☐	☐	☐	☐

Comments	
Current MWD program. http://socialwatersmart.com/?page_id=2973 Need to confirm savings - only as effective as much as it rains. >File "CII Fully Funded Forms.pdf" notes an approx. 10% administrative fee per device.	

Results	
Average Water Savings (mgd)	0.002043
Lifetime Savings - Present Value (\$)	
Utility	\$54,795
Community	\$54,795
Lifetime Costs - Present Value (\$)	
Utility	\$37,658
Community	\$47,580
Benefit to Cost Ratio	
Utility	1.46
Community	1.15
Cost of Savings per Unit Volume (\$/mg)	
Utility	\$1,941

End Use Savings Per Replacement	
	% Savings per Account
SF Irrigation	5.0%
MF Irrigation	5.0%

Targets	
Target Method	Percentage
% of Accts Targeted / yr	0.100%
Only Effects New Accts	☐

Costs			
View:	Summary		
	Utility	Customer	Total
2015	\$3,843	\$1,012	\$4,855
2016	\$3,866	\$1,019	\$4,885
2017	\$3,890	\$1,025	\$4,915
2018	\$3,914	\$1,031	\$4,946
2019	\$3,938	\$1,038	\$4,976
2020	\$3,962	\$1,044	\$5,006

Targets			
View:	Accounts		
	SF	MF	Total
2015	38	2	40
2016	39	2	41
2017	39	2	41
2018	39	2	41
2019	39	2	42
2020	40	2	42

Water Savings (mgd)	
	Total Savings (mgd)
2015	0.000224
2016	0.000449
2017	0.000675
2018	0.000903
2019	0.001133
2020	0.001363



Top Water Users Program (Top customers from each customer category)

Overview			
Name	Top Water Users Program (Top customers from each customer category)		
Abbr	O15		
Category	Default		
Measure Type	Standard Measure		

Time Period		Measure Life
First Year	2015	Permanent ☒
Last Year	2019	
Measure Length	5	

Fixture Costs			
	Utility	Customer	Fix/Acct
COM	\$1,500.00	\$2,500.00	1
GOV	\$1,500.00	\$2,500.00	1
IND	\$1,500.00	\$2,500.00	1

Administration Costs	
Markup Percentage	10%

Description
Top water customers from each category would be offered a professional water survey that would evaluate ways for the business to save water and money. The surveys would be for large accounts (such as, accounts that use more than 5,000 gallons of water per day) such as hotels, restaurants, stores and schools. Emphasis will be on supporting the top users for each customer category.

Customer Classes							
	SF	MF	COM	IRR	GOV	AG	IND
☐	☐	☐	☒	☐	☐	☐	☐

End Uses							
	SF	MF	COM	IRR	GOV	AG	IND
Toilets	☐	☐	☒	☐	☐	☐	☐
Urinals	☐	☐	☒	☐	☐	☐	☐
Lavatory Faucets	☐	☐	☒	☐	☐	☐	☐
Showers	☐	☐	☒	☐	☐	☐	☐
Dishwashers	☐	☐	☒	☐	☐	☐	☐
Clothes Washers	☐	☐	☒	☐	☐	☐	☐
Process	☐	☐	☐	☐	☐	☐	☒
Kitchen Spray Rinse	☐	☐	☒	☐	☐	☐	☐
Internal Leakage	☐	☐	☒	☐	☐	☐	☐
Baths	☐	☐	☐	☐	☐	☐	☐
Other	☐	☐	☒	☐	☐	☐	☐
Irrigation	☐	☐	☐	☒	☐	☐	☐
Pools	☐	☐	☐	☐	☒	☐	☐
Wash Down	☐	☐	☐	☐	☐	☐	☐
Cooling	☐	☒	☐	☐	☐	☐	☐
Car Washing	☐	☐	☐	☐	☐	☐	☐
External Leakage	☐	☐	☒	☐	☐	☐	☐
Outdoor	☐	☐	☐	☐	☐	☐	☐
Laundry/Kitchen Faucets	☐	☐	☒	☐	☐	☐	☐

Comments
Design based on 2010 measure design. Costs assume possible (VWC) contract cost with WaterWise Consulting Contract.
>File "CII Fully Funded Forms.pdf" notes an approx. 10% administrative fee per device.
>File "2017 Attach E_Final" has the agency share of a "Full Audit - Four or more acres" as \$492 - it isn't clear if this is a top water user cost.

Results	
Average Water Savings (mgd)	0.003964
Lifetime Savings - Present Value (\$)	
Utility	\$132,919
Community	\$215,465
Lifetime Costs - Present Value (\$)	
Utility	\$32,762
Community	\$82,402
Benefit to Cost Ratio	
Utility	4.06
Community	2.61
Cost of Savings per Unit Volume (\$/mg)	
Utility	\$870

End Use Savings Per Replacement	
	% Savings per Account
COM Toilets	10.0%
GOV Toilets	10.0%
IND Toilets	10.0%
COM Urinals	10.0%
GOV Urinals	10.0%
IND Urinals	10.0%
COM Lavatory Faucets	10.0%
GOV Lavatory Faucets	10.0%
IND Lavatory Faucets	10.0%
COM Showers	10.0%
GOV Showers	10.0%
IND Showers	10.0%
COM Dishwashers	10.0%
GOV Dishwashers	10.0%
IND Dishwashers	10.0%
COM Clothes Washers	10.0%
GOV Clothes Washers	10.0%
IND Clothes Washers	10.0%
COM Process	10.0%
IND Process	10.0%
COM Kitchen Spray Rins	10.0%
GOV Kitchen Spray Rins	10.0%
COM Internal Leakage	10.0%
GOV Internal Leakage	10.0%
IND Internal Leakage	10.0%
COM Other	10.0%
GOV Other	10.0%
IND Other	10.0%
COM Irrigation	10.0%
GOV Irrigation	10.0%
IND Irrigation	10.0%
GOV Pools	10.0%
COM Cooling	10.0%
GOV Cooling	10.0%
IND Cooling	10.0%
COM External Leakage	10.0%
GOV External Leakage	10.0%
IND External Leakage	10.0%
Non-Lavatory/Kitchen Fa	10.0%
Non-Lavatory/Kitchen Fa	10.0%
Non-Lavatory/Kitchen Fa	10.0%

Targets	
Target Method	Percentage
% of Accts Targeted / yr	0.250%
Only Effects New Accts	☐

Costs			
View:	Summary		
	Utility	Customer	Total
2015	\$6,820	\$10,333	\$17,153
2016	\$6,885	\$10,432	\$17,318
2017	\$6,951	\$10,531	\$17,482
2018	\$7,016	\$10,630	\$17,646
2019	\$7,081	\$10,729	\$17,810
2020	\$0	\$0	\$0

Targets				
View:	Accounts			
	COM	GOV	IND	Total
2015	4	0	0	4
2016	4	0	0	4
2017	4	0	0	4
2018	4	0	0	4
2019	4	0	0	4
2020	0	0	0	0

Water Savings (mgd)	
	Total Savings (mgd)
2015	0.000878
2016	0.001757
2017	0.002638
2018	0.003521
2019	0.004406
2020	0.004391



CII Rebates to Replace Inefficient Equipment

Overview			
Name	CII Rebates to Replace Inefficient		
Abbr	O16		
Category	Default		
Measure Type	Standard Measure		

Time Period	
First Year	2015
Last Year	2034
Measure Length	20

Measure Life	
Permanent	☒

Fixture Costs			
	Utility	Customer	Fix/Acct
COM	\$1,000.00	\$5,000.00	1
GOV	\$1,000.00	\$5,000.00	1
IND	\$1,000.00	\$5,000.00	1

Administration Costs	
Markup Percentage	10%

Description

Program to provide rebates for a standard list of water efficient equipment. Included per current SoCal WaterSmart program are the following devices and base rebate amounts: Premium High-Efficiency Toilets (\$100), Ultra Low and Zero Water Urinals (\$200), Plumbing Flow Control Valves (\$5/Valve (minimum of 20)), Connectionless Food Steamers (\$485/Compartment), Air-cooled Ice Machines (\$1000), Cooling Tower Conductivity Controllers (\$625), Cooling Tower pH Controllers (\$1,750), Dry Vacuum Pumps (\$125/0.5HP), and Laminar Flow Restrictors (\$10/Restrictor (minimum of 10)).

Customer Classes								
	SF	MF	COM	IRR	GOV	AG	REC	IND
	☐	☐	☒	☐	☐	☐	☐	☒

End Uses								
	SF	MF	COM	IRR	GOV	AG	REC	IND
Toilets			☒		☒			☒
Urinals			☒		☒			☒
Lavatory Faucets			☐		☐			☐
Showers			☐		☐			☐
Dishwashers			☐		☐			☐
Clothes Washers			☐		☐			☐
Process			☒					☒
Kitchen Spray Rinse			☐		☐			☐
Internal Leakage			☐		☐			☐
Baths			☐		☐			☐
Other			☐		☐			☐
Irrigation			☐		☐			☐
Pools			☐		☐			☐
Wash Down			☐		☐			☐
Cooling			☒		☒			☒
Car Washing			☐		☐			☐
External Leakage			☐		☐			☐
Outdoor			☐		☐			☐
Laundry/Kitchen Faucets			☐		☐			☐

Comments

Current program. Confirm end uses. Since not every account will replace every listed end use-related device, assume average of 15% savings per end use.

>File "CII Fully Funded Forms.pdf" notes an approx. 10% administrative fee per device.

Results	
Average Water Savings (mgd)	0.010878
Lifetime Savings - Present Value (\$)	
Utility	\$340,769
Community	\$340,769
Lifetime Costs - Present Value (\$)	
Utility	\$152,838
Community	\$847,555
Benefit to Cost Ratio	
Utility	2.23
Community	0.40
Cost of Savings per Unit Volume (\$/mg)	
Utility	\$1,480

End Use Savings Per Replacement	
	% Savings per Account
COM Toilets	15.0%
GOV Toilets	15.0%
IND Toilets	15.0%
COM Urinals	15.0%
GOV Urinals	15.0%
IND Urinals	15.0%
COM Process	15.0%
IND Process	15.0%
COM Cooling	15.0%
GOV Cooling	15.0%
IND Cooling	15.0%

Targets	
Target Method	Percentage
% of Accts Targeted / yr	0.500%
Only Effects New Accts	☐

Costs			
View:	Utility	Customer	Total
2015	\$9,093	\$41,333	\$50,427
2016	\$9,180	\$41,729	\$50,909
2017	\$9,267	\$42,125	\$51,392
2018	\$9,354	\$42,520	\$51,875
2019	\$9,441	\$42,916	\$52,357
2020	\$9,529	\$43,312	\$52,840

Targets				
View:	COM	GOV	IND	Total
2015	8	0	0	8
2016	8	0	0	8
2017	8	0	0	8
2018	8	0	0	9
2019	9	0	0	9
2020	9	0	0	9

Water Savings (mgd)	
	Total Savings (mgd)
2015	0.000864
2016	0.001725
2017	0.002583
2018	0.003439
2019	0.004292
2020	0.005144



Require Plan Review for New CII

Overview			
Name	Require Plan Review for New CII		
Abbr	O17		
Category	Default		
Measure Type	Standard Measure		

Time Period	
First Year	2015
Last Year	2040
Measure Length	26

Measure Life	
Permanent	☒

Fixture Costs			
	Utility	Customer	Fix/Acct
COM	\$150.00	\$1,000.00	1

Administration Costs	
Markup Percentage	25%

Description
Require plan reviews for water use efficiency for all new business customers.

Customer Classes								
	SF	MF	COM	IRR	GOV	AG	REC	IND
	☐	☐	☒	☐	☐	☐	☐	☐

End Uses								
	SF	MF	COM	IRR	GOV	AG	REC	IND
Toilets			☒					
Urinals			☒					
Lavatory Faucets			☒					
Showers			☒					
Dishwashers			☒					
Clothes Washers			☒					
Process			☒					
Kitchen Spray Rinse			☒					
Internal Leakage			☒					
Baths								
Other			☒					
Irrigation			☒					
Pools								
Wash Down								
Cooling			☒					
Car Washing								
External Leakage			☒					
Outdoor								
Lavatory/Kitchen Faucets			☒					

Comments
Confirm customer categories and end uses targeted. Utility cost represents staff time to review plan. Customer cost represents cost to implement water use efficiency practices.

Results	
Average Water Savings (mgd)	0.020485
Lifetime Savings - Present Value (\$)	
Utility	\$611,999
Community	\$1,040,131
Lifetime Costs - Present Value (\$)	
Utility	\$67,490
Community	\$427,438
Benefit to Cost Ratio	
Utility	9.07
Community	2.43
Cost of Savings per Unit Volume (\$/mg)	
Utility	\$347

End Use Savings Per Replacement	
	% Savings per Account
COM Toilets	5.0%
COM Urinals	5.0%
COM Lavatory Faucets	5.0%
COM Showers	5.0%
COM Dishwashers	5.0%
COM Clothes Washers	5.0%
COM Process	5.0%
COM Kitchen Spray Rins	5.0%
COM Internal Leakage	5.0%
COM Other	5.0%
COM Irrigation	5.0%
COM Cooling	5.0%
COM External Leakage	5.0%
Non-Lavatory/Kitchen Fa	5.0%

Targets	
Target Method	Percentage
% of Accts Targeted / yr	100.000%
Only Effects New Accts	☒

Costs			
View:	Summary		
	Utility	Customer	Total
2015	\$2,948	\$15,720	\$18,668
2016	\$2,948	\$15,720	\$18,668
2017	\$2,948	\$15,720	\$18,668
2018	\$2,948	\$15,720	\$18,668
2019	\$2,948	\$15,720	\$18,668
2020	\$2,948	\$15,720	\$18,668

Targets		
View:	Accounts	
	COM	Total
2015	16	16
2016	16	16
2017	16	16
2018	16	16
2019	16	16
2020	16	16

Water Savings (mgd)	
	Total Savings (mgd)
2015	0.001325
2016	0.002637
2017	0.003936
2018	0.005223
2019	0.006499
2020	0.007766



Promote High Efficiency Pre-Rinse Spray Valves

Overview			
Name	Promote High Efficiency Pre-Rinse		
Abbr	O18		
Category	Default		
Measure Type	Standard Measure		

Time Period	
First Year	2015
Last Year	2020
Measure Length	6

Measure Life	
Permanent	☒

Fixture Costs			
	Utility	Customer	Fix/Acct
COM	\$45.00	\$0.00	2

Administration Costs	
Markup Percentage	10%

Description	
Provide free 1.15 gpm spray rinse valves and possibly free installation operation in restaurants, commercial kitchens, grocery stores and other locations. EPA Water Sense spray valves is 1.28 gpm valves. Food Service Technology Center recommends 1.15 gpm valves. This program would promote the more efficient 1.15gpm valves.	

Customer Classes							
SF	MF	COM	IRR	GOV	AG	REC	IND
☐	☐	☒	☐	☐	☐	☐	☐

End Uses								
	SF	MF	COM	IRR	GOV	AG	REC	IND
Toilets			☐					
Urinals			☐					
Lavatory Faucets			☐					
Showers			☐					
Dishwashers			☐					
Clothes Washers			☐					
Process			☐					
Kitchen Spray Rinse			☒					
Internal Leakage			☐					
Baths			☐					
Other			☐					
Irrigation			☐					
Pools			☐					
Wash Down			☐					
Cooling			☐					
Car Washing			☐					
External Leakage			☐					
Outdoor			☐					
Laundry/Kitchen Faucets			☐					

Comments	
Thousands have been replaced in California going door to door, very cost-effective because saves hot water. Cost includes \$45 per valve. Assumes average of 2 valves per site. Conservation savings estimate assumes an average of 2 gpm valves are replaced with 1.3 gpm valves. > File "CII Fully Funded Forms.pdf" notes an approx. 10% administrative fee per device.	

Results	
Average Water Savings (mgd)	0.004157
Lifetime Savings - Present Value (\$)	
Utility	\$143,868
Community	\$580,337
Lifetime Costs - Present Value (\$)	
Utility	\$18,559
Community	\$18,559
Benefit to Cost Ratio	
Utility	7.75
Community	31.27
Cost of Savings per Unit Volume (\$/mg)	
Utility	\$470

End Use Savings Per Replacement	
	% Savings per Account
COM Kitchen Spray Rins	35.0%

Targets	
Target Method	Percentage
% of Accts Targeted / yr	2.000%
Only Effects New Accts	☐

Costs			
View:	Summary		
	Utility	Customer	Total
2015	\$3,252	\$0	\$3,252
2016	\$3,283	\$0	\$3,283
2017	\$3,314	\$0	\$3,314
2018	\$3,345	\$0	\$3,345
2019	\$3,376	\$0	\$3,376
2020	\$3,407	\$0	\$3,407

Targets		
View:	Accounts	
	COM	Total
2015	33	33
2016	33	33
2017	33	33
2018	34	34
2019	34	34
2020	34	34

Water Savings (mgd)	
	Total Savings (mgd)
2015	0.000749
2016	0.001506
2017	0.002270
2018	0.003041
2019	0.003819
2020	0.004605

Public Information		Overview				Customer Classes								Results																															
 Public Information	Name	Public Information												Average Water Savings (mgd)																															
	Abbr	O19												0.063266																															
	Category	Default												Lifetime Savings - Present Value (\$)																															
	Measure Type	Standard Measure												Utility \$2,094,959																															
		Time Period		Measure Life										Community \$3,204,028																															
		First Year	2015	Permanent	☐									Lifetime Costs - Present Value (\$)																															
		Last Year	2040	Years	2									Utility \$215,077																															
		Measure Length	26	Repeat	☐									Community \$215,077																															
		Fixture Costs												Benefit to Cost Ratio																															
		Utility	Customer	Fix/Acct										Utility 9.74																															
		SF	\$0.50	\$0.00	1									Community 14.90																															
		Administration Costs												Cost of Savings per Unit Volume (\$/mg)																															
		Markup Percentage		15%										Utility \$358																															
		Description												End Use Savings Per Replacement																															
		Public information includes the following: conservation print media, electronic conservation options / web site / social media, speakers bureau/ event participation; billing report educational tools, media campaigns such as "Take Control of your Controller," and recognition programs for water savings by residences, apartments, businesses program; outdoor residential focused public awareness information program and efficient outdoor use education and training programs; training for landscape maintenance workers, networking with landscaping industry, landscape water calculator, and climate appropriate demonstration gardens.												<table border="1"> <thead> <tr> <th>End Use</th> <th>% Savings per Account</th> </tr> </thead> <tbody> <tr><td>SF Toilets</td><td>0.5%</td></tr> <tr><td>SF Lavatory Faucets</td><td>0.5%</td></tr> <tr><td>SF Showers</td><td>0.5%</td></tr> <tr><td>SF Dishwashers</td><td>0.5%</td></tr> <tr><td>SF Clothes Washers</td><td>0.5%</td></tr> <tr><td>SF Internal Leakage</td><td>0.5%</td></tr> <tr><td>SF Baths</td><td>0.5%</td></tr> <tr><td>SF Other</td><td>0.5%</td></tr> <tr><td>SF Irrigation</td><td>0.5%</td></tr> <tr><td>SF Pools</td><td>0.5%</td></tr> <tr><td>SF Wash Down</td><td>0.5%</td></tr> <tr><td>SF Car Washing</td><td>0.5%</td></tr> <tr><td>SF External Leakage</td><td>0.5%</td></tr> <tr><td>on-Lavatory/Kitchen Fai</td><td>0.5%</td></tr> </tbody> </table>		End Use	% Savings per Account	SF Toilets	0.5%	SF Lavatory Faucets	0.5%	SF Showers	0.5%	SF Dishwashers	0.5%	SF Clothes Washers	0.5%	SF Internal Leakage	0.5%	SF Baths	0.5%	SF Other	0.5%	SF Irrigation	0.5%	SF Pools	0.5%	SF Wash Down	0.5%	SF Car Washing	0.5%	SF External Leakage	0.5%	on-Lavatory/Kitchen Fai	0.5%
End Use	% Savings per Account																																												
SF Toilets	0.5%																																												
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on-Lavatory/Kitchen Fai	0.5%																																												
														Targets																															
														Target Method Percentage																															
														% of Accts Targeted / yr 50.000%																															
														Only Effects New Accts ☐																															
														Costs																															
		View: Summary												Targets																															
		Utility	Customer	Total										View: Accounts																															
		2015	\$11,061	\$0	\$11,061	SF		Total							Water Savings (mgd)																														
		2016	\$11,129	\$0	\$11,129	2015	19,236	19,236							Total Savings (mgd)																														
		2017	\$11,198	\$0	\$11,198	2016	19,355	19,355							2015 0.032484																														
		2018	\$11,267	\$0	\$11,267	2017	19,475	19,475							2016 0.064821																														
		2019	\$11,336	\$0	\$11,336	2018	19,595	19,595							2017 0.064841																														
		2020	\$11,405	\$0	\$11,405	2019	19,715	19,715							2018 0.064861																														
						2020	19,834	19,834							2019 0.064880																														
														2020 0.064888																															



School Education

Overview			
Name	School Education		
Abbr	O20		
Category	Default		
Measure Type	Standard Measure		

Time Period	
First Year	2015
Last Year	2040
Measure Length	26

Measure Life	
Permanent	☐
Years	2
Repeat	☐

Fixture Costs			
	Utility	Customer	Fix/Acct
SF	\$1.00	\$0.00	1

Administration Costs	
Markup Percentage	25%

Description

Work with local school districts to develop classroom programs to promote water use efficiency education. Consider poster contests, etc. Some programs would require dedicated utility staff to assist & present.

Customer Classes							
	SF	MF	COM	IRR	GOV	AG	REC
	☒	☐	☐	☐	☐	☐	☐

End Uses							
	SF	MF	COM	IRR	GOV	AG	REC
Toilets	☒	☐	☐	☐	☐	☐	☐
Urinals	☐	☐	☐	☐	☐	☐	☐
Lavatory Faucets	☒	☐	☐	☐	☐	☐	☐
Showers	☒	☐	☐	☐	☐	☐	☐
Dishwashers	☒	☐	☐	☐	☐	☐	☐
Clothes Washers	☒	☐	☐	☐	☐	☐	☐
Process	☐	☐	☐	☐	☐	☐	☐
Kitchen Spray Rinse	☐	☐	☐	☐	☐	☐	☐
Internal Leakage	☒	☐	☐	☐	☐	☐	☐
Baths	☒	☐	☐	☐	☐	☐	☐
Other	☒	☐	☐	☐	☐	☐	☐
Irrigation	☒	☐	☐	☐	☐	☐	☐
Pools	☒	☐	☐	☐	☐	☐	☐
Wash Down	☒	☐	☐	☐	☐	☐	☐
Cooling	☐	☐	☐	☐	☐	☐	☐
Car Washing	☒	☐	☐	☐	☐	☐	☐
External Leakage	☒	☐	☐	☐	☐	☐	☐
Outdoor	☐	☐	☐	☐	☐	☐	☐
Laundry/Kitchen Faucets	☒	☐	☐	☐	☐	☐	☐

Comments

Might target a certain number of students per year. Cost represents average cost per student. Assume savings is a result of behavioral modification.

Results	
Average Water Savings (mgd)	0.012653
Lifetime Savings - Present Value (\$)	
Utility	\$418,992
Community	\$640,806
Lifetime Costs - Present Value (\$)	
Utility	\$46,756
Community	\$46,756
Benefit to Cost Ratio	
Utility	8.96
Community	13.71
Cost of Savings per Unit Volume (\$/mg)	
Utility	\$389

End Use Savings Per Replacement	
	% Savings per Account
SF Toilets	1.0%
SF Lavatory Faucets	1.0%
SF Showers	1.0%
SF Dishwashers	1.0%
SF Clothes Washers	1.0%
SF Internal Leakage	1.0%
SF Baths	1.0%
SF Other	1.0%
SF Irrigation	1.0%
SF Pools	1.0%
SF Wash Down	1.0%
SF Car Washing	1.0%
SF External Leakage	1.0%
Laundry/Kitchen Faucets	1.0%

Targets	
Target Method	Percentage
% of Accts Targeted / yr	5.000%
Only Effects New Accts	☐

Costs			
View:	Summary		
	Utility	Customer	Total
2015	\$2,404	\$0	\$2,404
2016	\$2,419	\$0	\$2,419
2017	\$2,434	\$0	\$2,434
2018	\$2,449	\$0	\$2,449
2019	\$2,464	\$0	\$2,464
2020	\$2,479	\$0	\$2,479

Targets		
View:	Accounts	
	SF	Total
2015	1,924	1,924
2016	1,936	1,936
2017	1,948	1,948
2018	1,959	1,959
2019	1,971	1,971
2020	1,983	1,983

Water Savings (mgd)	
	Total Savings (mgd)
2015	0.006497
2016	0.012964
2017	0.012968
2018	0.012972
2019	0.012976
2020	0.012978



Incentive for Recycled Water Conversions

Overview			
Name	Incentive for Recycled Water Conversions		
Abbr	O21		
Category	Default		
Measure Type	Standard Measure		

Time Period		Measure Life	
First Year	2020	Permanent	☒
Last Year	2024		
Measure Length	5		

Fixture Costs			
	Utility	Customer	Fix/Acct
SF	\$1,000.00	\$5,000.00	1
MF	\$2,000.00	\$10,000.00	1
COM	\$2,000.00	\$10,000.00	1
IRR	\$2,000.00	\$10,000.00	1
GOV	\$2,000.00	\$10,000.00	1
IND	\$2,000.00	\$10,000.00	1

Administration Costs	
Markup Percentage	25%

Description
Provide incentives for recycled water conversion.

Customer Classes							
	SF	MF	COM	IRR	GOV	AG	REC
	☐	☐	☐	☐	☐	☐	☐

End Uses							
	SF	MF	COM	IRR	GOV	AG	REC
Toilets	☐	☐	☐	☐	☐	☐	☐
Urinals	☐	☐	☐	☐	☐	☐	☐
Lavatory Faucets	☐	☐	☐	☐	☐	☐	☐
Showers	☐	☐	☐	☐	☐	☐	☐
Dishwashers	☐	☐	☐	☐	☐	☐	☐
Clothes Washers	☐	☐	☐	☐	☐	☐	☐
Process	☐	☐	☐	☐	☐	☐	☐
Kitchen Spray Rinse	☐	☐	☐	☐	☐	☐	☐
Internal Leakage	☐	☐	☐	☐	☐	☐	☐
Baths	☐	☐	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐	☐	☐
Irrigation	☒	☒	☒	☒	☒	☒	☒
Pools	☐	☐	☐	☐	☐	☐	☐
Wash Down	☐	☐	☐	☐	☐	☐	☐
Cooling	☐	☐	☐	☐	☐	☐	☐
Car Washing	☐	☐	☐	☐	☐	☐	☐
External Leakage	☐	☐	☐	☐	☐	☐	☐
Outdoor	☐	☐	☐	☐	☐	☐	☐
tory/Kitchen Faucets	☐	☐	☐	☐	☐	☐	☐

Comments	
Utility (\$1000/SF, \$2000/MF, CII) and customer (\$5000/SF, \$10,000/MF, CII) costs.	
Confirm target. 1% of customers per year	

Results	
Average Water Savings (mgd)	0.040348
Lifetime Savings - Present Value (\$)	
Utility	\$1,040,403
Community	\$1,040,403
Lifetime Costs - Present Value (\$)	
Utility	\$260,201
Community	\$1,301,005
Benefit to Cost Ratio	
Utility	4.00
Community	0.80
Cost of Savings per Unit Volume (\$/mg)	
Utility	\$679

End Use Savings Per Replacement	
	% Savings per Account
SF Irrigation	100.0%
MF Irrigation	100.0%
COM Irrigation	100.0%
IRR Irrigation	100.0%
GOV Irrigation	100.0%
IND Irrigation	100.0%

Targets	
Target Method	Percentage
% of Accts Targeted / yr	0.100%
Only Effects New Accts	☐

Costs			
View:	Summary		
	Utility	Customer	Total
2015	\$0	\$0	\$0
2016	\$0	\$0	\$0
2017	\$0	\$0	\$0
2018	\$0	\$0	\$0
2019	\$0	\$0	\$0
2020	\$63,182	\$252,728	\$315,910

Targets							
View:	Accounts						
	SF	MF	COM	IRR	GOV	IND	Total
2015	0	0	0	0	0	0	0
2016	0	0	0	0	0	0	0
2017	0	0	0	0	0	0	0
2018	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0
2020	40	2	2	2	0	0	45

Water Savings (mgd)	
	Total Savings (mgd)
2015	0.000000
2016	0.000000
2017	0.000000
2018	0.000000
2019	0.000000
2020	0.010842



Ag Water Audit Program

Overview			
Name	Ag Water Audit Program		
Abbr	O22		
Category	Default		
Measure Type	Standard Measure		

Time Period	
First Year	2018
Last Year	2022
Measure Length	5

Measure Life	
Permanent	☐
Years	7
Repeat	☐

Fixture Costs			
	Utility	Customer	Fix/Acct
AG	\$1,500.00	\$7,500.00	1

Administration Costs	
Markup Percentage	25%

Description

Water audit offered for existing agricultural customers. Those with high water use are targeted, offered a survey and provided a customized report on how to save water.

Customer Classes							
	SF	MF	COM	IRR	GOV	AG	IND
	☐	☐	☐	☐	☐	☒	☐

End Uses							
	SF	MF	COM	IRR	GOV	AG	IND
Toilets							
Urinals							
Lavatory Faucets							
Showers							
Dishwashers							
Clothes Washers							
Process							
Kitchen Spray Rinse							
Internal Leakage							
Baths							
Other							
Irrigation						☒	
Pools							
Wash Down							
Cooling							
Car Washing							
External Leakage						☒	
Outdoor							
tory/Kitchen Faucets							

Comments

Assume an average water savings of 10%. Some may save more, some sites may save less but overall savings would be 10%.

Results	
Average Water Savings (mgd)	0.002430
Lifetime Savings - Present Value (\$)	
Utility	\$78,469
Community	\$78,469
Lifetime Costs - Present Value (\$)	
Utility	\$10,814
Community	\$54,070
Benefit to Cost Ratio	
Utility	7.26
Community	1.45
Cost of Savings per Unit Volume (\$/mg)	
Utility	\$469

End Use Savings Per Replacement	
	% Savings per Account
AG Irrigation	10.0%
AG External Leakage	10.0%

Targets	
Target Method	Percentage
% of Accts Targeted / yr	1.000%
Only Effects New Accts	☐

Costs			
View:	Summary		
	Utility	Customer	Total
2015	\$0	\$0	\$0
2016	\$0	\$0	\$0
2017	\$0	\$0	\$0
2018	\$2,506	\$10,025	\$12,531
2019	\$2,506	\$10,025	\$12,531
2020	\$2,506	\$10,025	\$12,531

Targets		
View:	Accounts	
	AG	Total
2015	0	0
2016	0	0
2017	0	0
2018	1	1
2019	1	1
2020	1	1

Water Savings (mgd)	
	Total Savings (mgd)
2015	0.000000
2016	0.000000
2017	0.000000
2018	0.001805
2019	0.003610
2020	0.005415

APPENDIX E - LIST OF CONTACTS

Company	Name	Phone Number	E-mail	Role
City of Oceanside	Teresa Gomez	760-435-5815	TKGomez@ci.oceanside.ca.us	Senior Management Analyst, Water Conservation Department
RMC Water and Environment	Rosalyn Prickett	858-875-7420	rprickett@rmcwater.com	Senior Water Resources Planner/Principal
Maddaus Water Management	Michelle Maddaus	925-831-0194	michelle@maddauswater.com	MWM Project Manager/President

APPENDIX F - REFERENCES

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