CITY OF SANTA CRUZ WATER DEMAND FORECAST

Abstract

This report presents an econometric analysis of water demand and forecasts of class-level customer demands and total system production through 2035. The report was commissioned by the City of Santa Cruz Water Department and the City's Water Supply Advisory Committee to update the Department's existing demand forecast to reflect current information on water usage and to account for effects of conservation, water rates, and other factors expected to impact the future demand for water.

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EXECUTIVE SUMMARY

The City of Santa Cruz is currently undertaking a comprehensive evaluation of its future water supply and infrastructure requirements. The forecast of future water demand is a foundational component to this assessment. In recent years the historical patterns of water demand have been upended by a variety of factors, including the cumulative effects of tighter efficiency standards for appliances and plumbing fixtures, greater investment in conservation, a significant uptick in water rates, an equally significant downturn in economic activity during the Great Recession, and on-going drought. These events have resulted in even more uncertainty than usual regarding future water demand and have placed even greater importance on sorting out the effect each has had on demand in recent years as well as how they are likely to affect demand going forward.

The City of Santa Cruz has appointed a public Water Supply Advisory Committee (WSAC) to examine the City's water supply situation. Its specific charge, as stated in its Charter, is to

> *explore, through an iterative, fact-based process, the City's water profile, including supply, demand and future risks; analyze potential solutions to deliver a safe, adequate, reliable, affordable, and environmentally sustainable water supply and develop recommendations for City Council consideration.*

The Water Department last prepared a formal forecast of water demand as part of its 2010 Urban Water Management Plan (UWMP). That forecast covered the period 2010 to 2030. The forecast reflected average consumption levels circa 2008 and growth projections based on the City's General Plan, UC Santa Cruz's (UCSC) Long Range Development Plan (LRDP) and Association of Monterey Bay Area Governments (AMBAG) population and housing projections. The 2010 UWMP forecast did not account for potential effects of future conservation, higher water rates, or other factors affecting average water use over time. Since the adoption of its 2010 UWMP, actual demand has trended well below forecasted demand. Drought, economic recession, higher water rates, and conservation have been cited as possible reasons for the divergence.

One of the first requests made by the WSAC was for the Water Department to update the demand forecast to reflect current information on water usage and to account for effects of conservation, water rates, and other factors expected to impact the future demand for water.

Statistical Models of Average Demand

This report develops statistically-based models of average water demand. The demand forecasts based on these models cover the period 2020-2035 and incorporate empirical relationships between water use and key explanatory variables, including season, weather, water rates, household income, employment, conservation, and drought restrictions. The approach builds on similar models of water demand developed for the California Urban Water Conservation Council (Western Policy Research, 2011), Bay Area Water Supply and Conservation Agency (Western Policy Research, 2014), California Water Services Company (A&N Technical Services, 2014, M.Cubed 2015), and Contra Costa Water District (M.Cubed 2014).

The statistical models of demand were estimated using historical data on class water use, weather, water price, household income, conservation, and other economic variables driving water demand. The monthly models of average water demand are combined with service and housing growth forecasts to predict future water demands. The average demand models explain 90 to 99% of the observed variation in historical average use over the 14 year estimation period.

The forecasts of average demand by customer class are summarized in Table ES-1. The forecasts include adjustments for future effects of plumbing codes and the City's baseline conservation program[1] and are predicated on average weather and normal economic conditions.

Table ES - 1. Forecasted Average Demand by Customer Class (CCF/Year)

YEAR		2013	2020		2025		2030		2035	
	Per	Actual 1/	Forecast	CI	Forecast	CI	Forecast	CI	Forecast	CI
Single Family	Housing Unit	87	86	± 3	83	± 3	80	± 4	78	± 4
Multi Family	Housing Unit	53	56	± 2	52	± 2	50	± 2	49	± 3
Business	Service	405	400	± 12	389	± 12	382	± 13	377	± 13
Municipal	Service	388	296	± 26	290	± 27	283	± 29	277	± 30
Irrigation	Service	365	286	± 28	271	± 28	257	± 28	244	± 28
Golf	Acre	990	671	± 130	641	± 134	606	± 137	593	± 144

1/ Actual use, unadjusted for weather or economy. Stage 1 drought water use restrictions in effect May - Dec.

CI = 95% confidence interval.

Industrial and UCSC Demand Forecast

Because of their unique characteristics, industrial and UCSC demands were forecasted separately from the other customer categories. In the case of industrial demand, there is a strong relationship between Santa Cruz County manufacturing employment and aggregate industrial water use. This relationship is used to generate the industrial demand forecast shown in Table ES-2.

Table ES - 2. Industrial Demand Forecast

	2013 1/	2020	2025	2030	2035
Mfg Employment Forecast 2/		5,900	6,200	6,400	6,500
Industrial Water Demand (MG)					
Low	56	56	58	59	60
Primary	56	57	59	61	62
High	56	57	60	63	64

Notes

1/ Actual per Water Department billing records.

2/ Caltrans Economic Forecast for Santa Cruz County.

The forecast of future UCSC demand is based on a linear projection of the university's buildout demand in its 2005 LRDP, assuming two alternative buildout dates. In both cases, buildout demand is 349 MGY. In the lower bound forecast, buildout occurs in 2050. In the upper bound forecast it occurs in 2035. The primary forecast is the midpoint between the lower and upper bound forecasts. The forecast of UCSC

[1] The baseline conservation program level is Program A in the City's forthcoming water conservation master plan.

demand is given in Table ES-3. The primary forecast almost exactly replicates a forecast based on projected enrollment and average rates of water use per student.[2]

Table ES - 3. UCSC Water Demand Forecast

	2013 1/	2020	2025	2030	2035
Low	182	186	213	240	268
Primary	182	196	234	271	308
High	182	207	254	302	349

Notes

1/ Actual per Water Department billing records.

Population, Housing, and Non-Residential Connection Forecasts

Forecasts of population, housing units, and non-residential connections are anchored to AMBAG's 2014 Regional Growth Forecast (AMBAG 2014). Projected growth in single- and multi-family housing units are shown in Table ES-4 and projected growth in non-residential services (excluding industrial and UCSC) are summarized in Table ES-5.[3]

Demand Forecasts

The primary, low, and high forecasts of system demand are provided in Tables ES-6, ES-7, and ES-8. Under the primary forecast, total system demand is expected to remain stable at about 3,400 MGY over the forecast period, despite a 13 percent increase in population over the same period. Per capita water use is projected to go from 93 gallons per day in 2020 to 84 gallons per day in 2035, a decrease of approximately 10 percent.

Forecasted demands are significantly lower than the 2010 UWMP forecast, as shown in Figure ES-1. The primary reasons for this are that the 2010 UWMP forecast (1) did not include adjustments for the future effects of passive and active conservation and higher water rates on future water use and (2) assumed higher UCSC demand.

While the econometric demand models were under development, an interim demand forecast was developed for the WSAC by adjusting the 2010 UWMP forecast for future conservation and other economic effects and by adjusting downward the UC demands (M.Cubed, 2015b). Figure ES-2 provides a comparison of the econometric model and WSAC interim demand forecasts. On average, the econometric demand forecast is approximately five and a half percent greater than the WSAC interim forecast. The econometric forecast represented by the dark blue line essentially tracks the upper-bound of the WSAC interim forecast while the WSAC interim forecast represented by the dark yellow line essentially tracks the lower-bound of the corrected econometric forecast. Between these two lines, the forecasts overlap. Future production in the range of 3,200 to 3,400 MGY is consistent with both forecasts.

[2] The enrollment-based approach yields a 2035 demand of 304 MG, which differs from the primary forecast by less than 2%.

[3] The decrease in forecasted golf acreage is due to the intention of Pasatiempo golf course to shift to non-City sources of irrigation water.

Figure ES-3 shows a comparison of historical production and the primary, lower, and upper bound forecasts. It is interesting to see how historical production has been influenced by weather and economic events. The forecast does not exhibit a similar degree of variability because it is based on average weather and normal economic conditions. In other words, it is a forecast of *expected future demand*. Realized future demand will certainly not be smooth like the forecast. It will vary about the expected value depending on year-to-year variation in future weather and economic conditions. The forecast, however, provides the baseline around which this variability is likely to occur.

Figure ES - 1. Comparison of Demand Forecast with 2010 UWMP Forecast

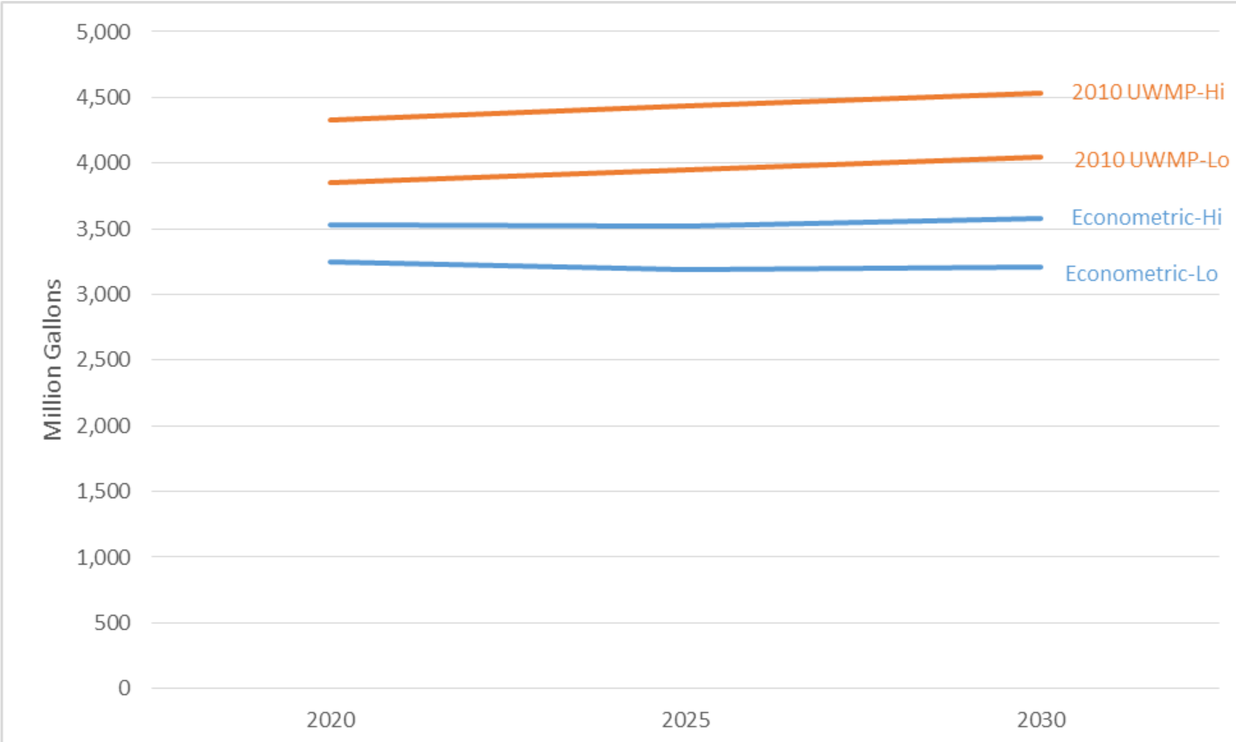

Figure ES - 2. Comparison of Demand Forecast with Interim WSAC Demand Forecast

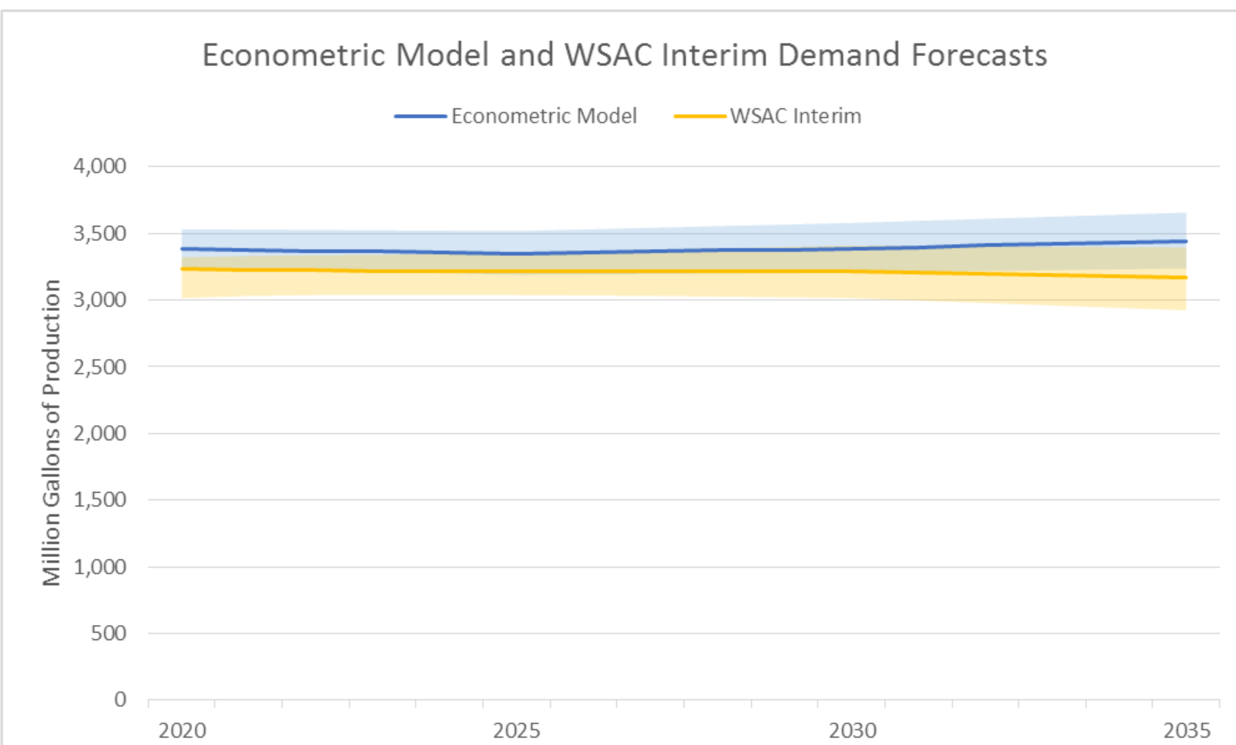

Figure ES - 3. Historical and Forecast Production in Millions of Gallons

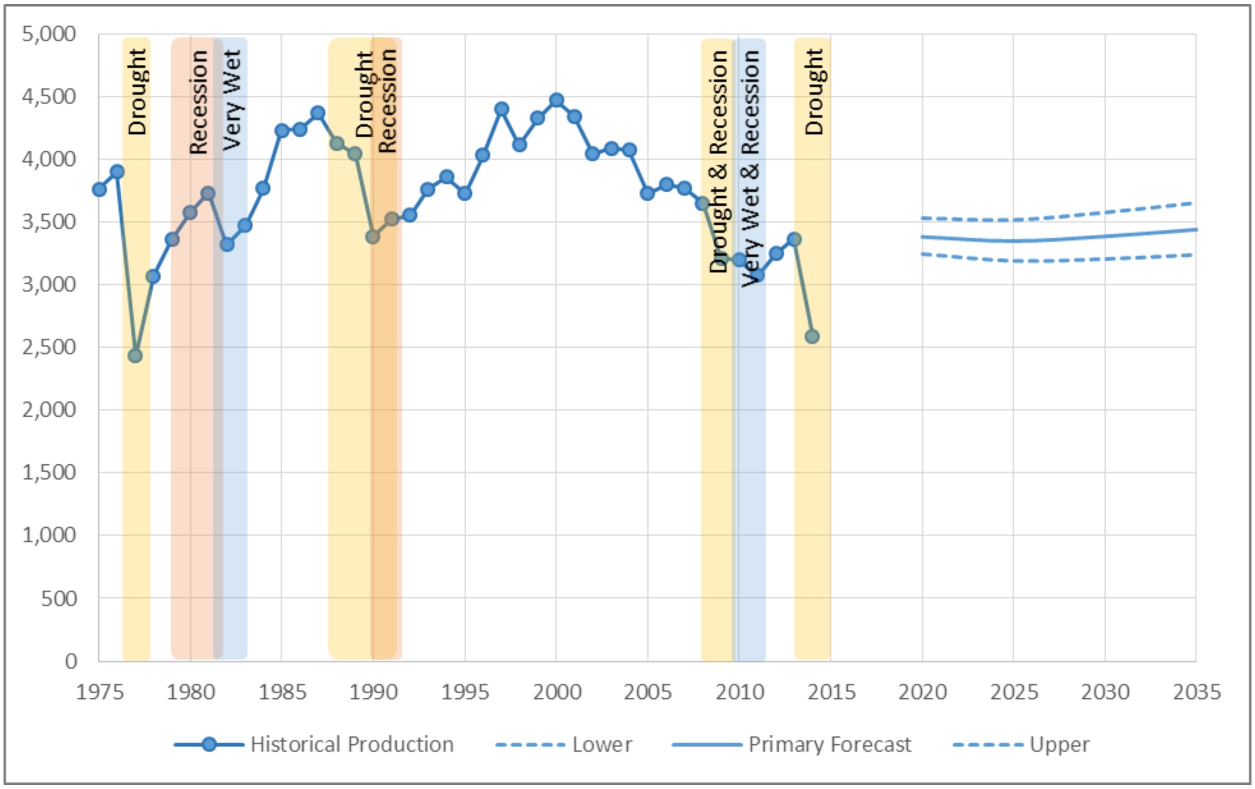

Table ES - 4. Forecast of Occupied Housing Units

	2014 [1/]	2020	2025	2030	2035
Inside-City					
Single Family	12,246	12,534	12,780	13,030	13,246
Multi Family	9,583	10,958	11,398	12,106	12,679
Subtotal	21,829	23,492	24,177	25,136	25,925
Outside-City					
Single Family	6,743	6,922	7,074	7,230	7,390
Multi Family	7,901	7,910	8,033	8,310	8,495
Subtotal	14,644	14,832	15,107	15,540	15,884
Service Area					
Single Family	18,989	19,456	19,854	20,260	20,636
Multi Family	17,484	18,868	19,431	20,416	21,174
Total	36,473	38,324	39,284	40,676	41,809

Notes
1/ Actual per Water Department billing records.

Table ES - 5. Forecast of Non-Residential Services and City-Irrigated Golf Acreage

	2013 [1/]	2020	2025	2030	2035
Business [2/]	1,889	1,948	1,971	2,008	2,055
Municipal [3/]	218	218	218	218	218
Irrigation [4/]	452	651	723	845	951
Golf					
Delaveaga	79	79	79	79	79
Pasatiempo	68	40	30	20	20
Total Golf	146	119	109	99	99

Notes
1/ Actual per Water Department billing records.
2/ Based on ratio of business to residential demand.
3/ No expected growth in number of municipal services.
4/ Based on historical rate of gain in irrigation services per gain in multi-family and business services.

Table ES - 6. Primary Forecast of Class Demands and System Production

YEAR		**2020**	**2025**	**2030**	**2035**
		Forecast	Forecast	Forecast	Forecast
Service Units	**Units**				
SFR	Housing Units	19,456	19,854	20,260	20,636
MFR	Housing Units	18,867	19,430	20,416	21,174
BUS	Services	1,948	1,971	2,008	2,055
IND	NA	NA	NA	NA	NA
MUN	Services	218	218	218	218
IRR	Services	651	723	845	951
GOLF	Acres	119	109	99	99
UC	NA	NA	NA	NA	NA
Avg Demand	**Units**				
SFR	CCF	86	83	80	78
MFR	CCF	56	52	50	49
BUS	CCF	400	389	382	377
IND	NA	NA	NA	NA	NA
MUN	CCF	296	290	283	277
IRR	CCF	286	271	257	244
GOLF	CCF	671	641	606	593
UC	NA	NA	NA	NA	NA
Annual Demand	**Units**				
SFR	MG	1,256	1,228	1,208	1,196
MFR	MG	792	759	766	775
BUS	MG	583	573	575	580
IND	MG	57	59	61	62
MUN	MG	48	47	46	45
IRR	MG	139	147	163	174
GOLF	MG	60	52	45	44
UC	MG	196	234	271	308
Total Demand	**MG**	**3,131**	**3,099**	**3,134**	**3,184**
MISC/LOSS	MG	254	251	254	258
Total Production	**MG**	**3,385**	**3,351**	**3,388**	**3,442**
Rounded	**MG**	**3,400**	**3,400**	**3,400**	**3,400**

Table ES - 7. Lower Bound Forecast of Class Demands and System Production

YEAR		2020	2025	2030	2035
		Forecast	Forecast	Forecast	Forecast
Service Units	**Units**				
SFR	Housing Units	19,456	19,854	20,260	20,636
MFR	Housing Units	18,867	19,430	20,416	21,174
BUS	Services	1,948	1,971	2,008	2,055
IND	NA	NA	NA	NA	NA
MUN	Services	218	218	218	218
IRR	Services	651	723	845	951
GOLF	Acres	119	109	99	99
UC	NA	NA	NA	NA	NA
Avg Demand	**Units**				
SFR	CCF	83	79	76	74
MFR	CCF	54	50	48	46
BUS	CCF	389	377	370	364
IND	NA	NA	NA	NA	NA
MUN	CCF	271	264	256	248
IRR	CCF	260	245	231	218
GOLF	CCF	553	521	485	466
UC	NA	NA	NA	NA	NA
Annual Demand	**Units**				
SFR	MG	1,208	1,178	1,155	1,142
MFR	MG	764	728	731	736
BUS	MG	567	556	556	560
IND	MG	56	58	59	60
MUN	MG	44	43	42	40
IRR	MG	126	133	146	155
GOLF	MG	49	42	36	35
UC	MG	186	213	240	268
Total Demand	**MG**	**3,001**	**2,951**	**2,965**	**2,995**
MISC/LOSS	MG	243	239	240	243
Total Production	**MG**	**3,244**	**3,190**	**3,206**	**3,238**
Rounded	**MG**	**3,200**	**3,200**	**3,200**	**3,200**

Table ES - 8. Upper Bound Forecast of Class Demands and System Production

YEAR		**2020**	**2025**	**2030**	**2035**
		Forecast	Forecast	Forecast	Forecast
Service Units	**Units**				
SFR	Housing Units	19,456	19,854	20,260	20,636
MFR	Housing Units	18,867	19,430	20,416	21,174
BUS	Services	1,948	1,971	2,008	2,055
IND	NA	NA	NA	NA	NA
MUN	Services	218	218	218	218
IRR	Services	651	723	845	951
GOLF	Acres	119	109	99	99
UC	NA	NA	NA	NA	NA
Avg Demand	**Units**				
SFR	CCF	90	86	83	81
MFR	CCF	58	54	53	52
BUS	CCF	412	401	395	391
IND	NA	NA	NA	NA	NA
MUN	CCF	323	318	313	308
IRR	CCF	315	300	287	274
GOLF	CCF	814	790	758	754
UC	NA	NA	NA	NA	NA
Annual Demand	**Units**				
SFR	MG	1,305	1,280	1,262	1,253
MFR	MG	820	792	803	816
BUS	MG	601	591	594	601
IND	MG	57	60	63	64
MUN	MG	53	52	51	50
IRR	MG	153	162	181	195
GOLF	MG	72	64	56	56
UC	MG	207	254	302	349
Total Demand	**MG**	**3,268**	**3,255**	**3,311**	**3,383**
MISC/LOSS	MG	265	264	268	274
Total Production	**MG**	**3,533**	**3,519**	**3,580**	**3,658**
Rounded	**MG**	**3,500**	**3,500**	**3,600**	**3,700**

1 INTRODUCTION

1.1 NEED FOR UPDATED DEMAND FORECAST

The City of Santa Cruz is currently undertaking a comprehensive evaluation of its future water supply and infrastructure requirements. The forecast of future water demand is a foundational component to this assessment. In recent years the historical patterns of water demand have been upended by a variety of factors, including the cumulative effects of tighter efficiency standards for appliances and plumbing fixtures, greater investment in conservation, a significant uptick in water rates, an equally significant downturn in economic activity during the Great Recession, and on-going drought. These events have resulted in even more uncertainty than usual regarding future water demand and have placed even greater importance on sorting out the effect each has had on demand in recent years as well as how they are likely to affect demand going forward.

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One of the first requests made by the WSAC was for the Water Department to update the demand forecast to reflect current information on water usage and to account for effects of conservation, water rates, and other factors expected to impact the future demand for water. Because of timing considerations, it was decided to do this in two steps. First, the Water Department would prepare an interim demand forecast based on the 2010 UWMP forecast. The interim forecast would extend the forecast period to 2035 and include adjustments for conservation and rate effects as well as incorporate new information on economic development and expansion of UCSC. The data and methods used to develop the interim forecast are documented in two Technical Memoranda (M.Cubed 2015a, M.Cubed 2015b). Second, the Water Department would compile data and complete statistical models needed to prepare a new demand forecast. The remainder of this report describes the data and methods used to prepare the new demand forecast that replaces the interim forecast.

1.2 Project Objective

The objective of this project is to develop statistically-based models of water demand that will be used to support WSAC deliberations as well as the 2015 UWMP being developed by the Water Department. Demand forecasts based on these models will cover the period 2020-2035 and will incorporate empirical relationships between water use and key explanatory variables, including season, weather, water rates, household income, employment, and drought restrictions.

1.3 Report Organization

The remainder of this report is organized as follows. In Section 2, the statistical models of average demand are presented, including general approach, data development, model definition, model estimation, and forecasts of average demand by customer class. In Section 3, forecasts of population, housing units, and services are presented. The population and housing unit forecasts are derived from the most recently adopted AMBAG regional forecasts (AMBAG, 2014). Forecasts of non-residential services (e.g. business, irrigation, golf, and municipal) are derived from the residential projections using empirical relationships between the different sectors. In Section 4, forecasts of water demand are developed by combining the forecasts of average demand with the forecasts of housing units and non-residential services. Industrial and UCSC demands, which are treated separately from the other customer categories, are also addressed in this section. In Section 5, a comparison of the new forecast with previous forecasts is presented.

2 Statistical Models of Average Demand

2.1 Approach

The general approach is to statistically estimate class-level conditional expectation functions of water demand using historical data on class water use, weather, water price, household income, conservation, and other economic variables driving water demand. The result for each customer class is a monthly model of average water use per housing unit (for single- and multi-family residential classes), service (for business, municipal, and irrigation classes), or acre (for golf courses), which can then be combined with forecasts of housing units, services, and acres, to forecast future water demands. The conditional expectation functions are used with forecasts of future conservation, water rates, household income, unemployment, and other economic factors to predict the trajectory of average water use over the forecast period. This represents a key departure from the 2010 UWMP forecast methodology, which relied on static average use estimates to forecast future demands.

2.2 Model Definition

The model of expected demand builds on similar models of water demand developed for the California Urban Water Conservation Council (Western Policy Research, 2011), Bay Area Water Supply and Conservation Agency (Western Policy Research, 2014), California Water Services Company (A&N Technical Services, 2014, M.Cubed 2015), and Contra Costa Water District (M.Cubed 2014).

The model of expected demand has several useful features. First, climate and weather effects on demand are decomposed into two distinct components. The climate component measures the seasonal load shape of monthly demand under normal weather conditions. The weather component measures the effect on demand when weather departs from normal conditions. The seasonal and weather components can be interacted to get season-specific weather effects. This is useful if the response to weather is expected to vary by season. For example, the effect of above normal rainfall on demand in winter, when outdoor water uses are lower, may be different than its effect in spring or fall, when outdoor water uses are higher. Second, prior to model estimation, monthly water use is adjusted for historical conservation from plumbing codes. This helps to address the confounding effect of conservation on the estimation of other demand parameters like price, employment, and income. Third, the model includes economic parameters (e.g. price, household income, unemployment) known to influence urban water demand (Renzetti, 2002; Billings and Jones, 1996). Fourth, the model includes drought policy parameters to measure the effect of drought restrictions on demand. Thus, expected demand can be expressed conditional on season, weather, conservation, economic conditions, and drought stage.

The model of expected demand is stated as:

$$ln(\tilde{y}_{it}) = \mu_i + \beta_S Season_t + \beta_W Weather_t + \beta_E Economic_{it} + \beta_D Drought_t + \varepsilon_{it} \quad (1)$$

Where:

$\tilde{y}_{it}$	average use in month t for service region i adjusted to remove the effects of water savings due to plumbing codes and appliance standards
μ_i	model intercept for service region i
$\beta_S Season_t$	seasonal component of average use in month t
$\beta_W Weather_t$	weather component of average use in month t
$\beta_E Economic_{it}$	economic component of average use in month t
$\beta_D Drought_t$	drought component of average use in month t
ε_{it}	stochastic component (error term)

The seasonal component is specified using eleven monthly indicator variables. The monthly indicator variables take the value of one if t = j, and zero otherwise.

$$\beta_S Season_t = \sum_{j=2}^{12} \beta_j \, month_{jt} \quad (2)$$

The eleven monthly parameters plus the model intercept describe the seasonal load shape of average demand. A seasonal index of monthly demand, where January has an index value of one, is easily constructed as shown in Table 1. The eleven seasonal parameters are seen to scale monthly demand relative to January demand.

Table 1. Seasonal Index of Monthly Average Demand

Month	Seasonal Index	Month	Seasonal Index
Jan	1	Jul	e^{β_7}
Feb	e^{β_2}	Aug	e^{β_8}
Mar	e^{β_3}	Sep	e^{β_9}
Apr	e^{β_4}	Oct	$e^{\beta_{10}}$
May	e^{β_5}	Nov	$e^{\beta_{11}}$
Jun	e^{β_6}	Dec	$e^{\beta_{12}}$

The weather component is comprised of weather measures (monthly rainfall, average daily maximum air temperature, monthly ETo) that are transformed logarithmically with their monthly average subtracted away. In the case of rainfall, both contemporaneous and lagged measures are included in the model.

$$\beta_W Weather_t = \beta_{w1} dlR_t + \beta_{w2} dlR_{t-1} + \beta_{w3} dlR_{t-2} + \beta_{w4} dlT_t \ (or\ dlET_t) \quad (3)$$

Where[4]

$$dlR_t = ln(Rain_t + 1) - \overline{ln(Rain_t + 1)} \quad (4)$$

$$dlT_t = ln(Temp_t) - \overline{ln(Temp_t)} \quad (5)$$

$$dlET_t = ln(ET_t) - \overline{ln(ET_t)} \quad (6)$$

For the residential and business customer classes, average daily maximum air temperature is used rather an ET. For the golf, irrigation, and municipal categories, which have greater landscape water uses, ET is used.

The percentage effect on demand due to changes in weather can be calculated from the model parameters and weather observations. Let α be a scalar that expresses the weather measure as a percentage of the observed weather measure. If, for example, α is 1.1, then αR_t would be 110% of observed rainfall. For any αR_t, the expected change in average demand, all else equal, is

$$\%\ change\ in\ average\ demand\ given\ (\alpha - 1)\%\ change\ in\ rain = \left(\frac{\alpha R_t + 1}{R_t + 1}\right)^{\beta_{w1}} - 1 \quad (7)$$

For temperature or ET, which do not have one added to their values prior to transforming them logarithmically, the calculation is even simpler.

$$\%\ change\ in\ average\ demand\ given\ (\alpha - 1)\%\ change\ in\ temp\ or\ ET = \alpha^{\beta_{w4}} - 1 \quad (8)$$

[4] One is added to monthly rain totals to ensure the rainfall measure is defined in months in which total rainfall is zero.

During model estimation, the weather component is interacted with seasonal indicators to estimate separate seasonal weather effects for fall-winter (Nov-Mar), spring (Apr-Jun), and summer-fall (Jul-Oct).[5]

Weather normalization of historical demands can be done in two ways. The first way is to use the predicted model values assuming average weather. In this case the model's weather component simply falls away and we are left with:

$$Weather\ Normalized\ \tilde{y}_{it} = exp(\mu_i + \beta_S Season_t + \beta_E Economic_{it}) \quad (9)$$

The second approach is to rescale observed water use using the estimated weather effects. The ratio of observed to weather normalized demand is

$$WeatherEffect_t = exp\left(\beta_{w1} dlR_t + \beta_{w2} dlR_{t-1} + \beta_{w3} dlR_{t-2} + \beta_{w4} dlT_t\ (or\ dlET_t)\right) \quad (10)$$

Weather normalized observed demand is then given by

$$Weather\ Normalized\ \tilde{y}_{it} = \frac{\tilde{y}_{it}}{WeatherEffect_t} \quad (11)$$

The economic component consists of economic variables that influence average water demand, including water price, household income, vacancy rate, and unemployment rate.

$$\beta_E Economic_{it} = \beta_{E1} lPrice_{it} + \beta_{E2} lInc_{it} + \beta_{E3} dlVac_t + \beta_{E4} dlUnempl_t \quad (12)$$

Where

$$lPrice_{it} = ln(marginal\ price)\ in\ service\ region\ i, period\ t \quad (13)$$

$$lInc_{it} = ln(median\ household\ income)\ in\ service\ region\ i, period\ t \quad (14)$$

$$dlVac_t = ln(housing\ vacancy\ rate) - \overline{ln(housing\ vacancy\ rate)} \quad (15)$$

$$dlUnempl_t = \ln(unemployment\ rate) - \overline{\ln(unemployment\ rate)} \quad (16)$$

The economic variables are logarithmically transformed prior to model estimation. The vacancy rate and unemployment rate variables are expressed as departures from their long-run average values. Each customer class model uses a restricted form of equation 12, as shown in the following table. These restrictions are guided both by economic theory and model diagnostics. For the single family model, the primary economic drivers are marginal water price and household income. For the multi-family model, vacancy rate replaces household income. For the business and municipal class models, marginal price and unemployment measures are used. For golf and irrigation, only marginal price is included in the models.

[5] The seasonal construct follows the CUWCC's GPCD weather normalization methodology (Western Policy Research, 2011).

Table 2. Economic Variable Restrictions in Customer Class Models

Customer Class Model	Economic Variable Restrictions
Single Family	$\beta_{E3} = \beta_{E4} = 0$
Multi Family	$\beta_{E2} = \beta_{E4} = 0$
Business, Municipal	$\beta_{E2} = \beta_{E3} = 0$
Golf, Irrigation	$\beta_{E2} = \beta_{E3} = \beta_{E4} = 0$

2.3 Data Development

2.3.1 Water Consumption

The models were estimated with monthly consumption data for the period January 2000 to November 2014. Class-level aggregated meter read data were obtained from the Water Department. The Water Department data were separated between Inside City and Outside City accounts, and contained aggregated data from both bi-monthly and monthly meter read cycles. Before the data could be used for model estimation, it had to be transformed into estimated aggregate monthly consumption. This was done as follows:

- Aggregated meter read data were allocated to consumption month using the share of total consumption days in each month represented in the aggregated meter read data.
- In the case of aggregated data from bi-monthly meter reads done in month t, the aggregated consumption was allocated approximately 25% to month t-2, 50% to month t-1, and 25% to month t. Thus for data from meters read in March, approximately 25% of the consumption was allocated to January, 50% to February, and 25% to March.
- In the case of aggregated data from monthly meter reads done in month t, the aggregated consumption was allocated approximately 50% to month t-1 and 50% to month t. Thus for data from monthly meters read in March, approximately 50% was allocated to February and 50% to March.
- The allocation percentages cited above are approximate values. To do the actual allocations, seasonal weights were applied to each month to account for the seasonal shape of consumption. The seasonal weights and allocation percentages for each customer class are provided in Attachment 1.
- For Inside City customers, meters were read on a bi-monthly schedule until 2005, when the City started billing customers on a monthly cycle. In the case of Outside City customers, bi-monthly billing was continued until 2014.

Once aggregate monthly consumption was estimated, it was divided by the annual number of housing units (for single and multi-family classes), services (for business, municipal, and irrigation classes), or acres (for golf courses) to get average monthly consumption. Figure 1 illustrates the transformation of the raw aggregated meter read data into its corresponding estimated monthly aggregate and average consumption for the Inside City Single Family customer class. The erratic pattern in the raw meter read data prior to 2005 is primarily due to variability in the number of meters being read in a month and thus total consumption recorded in the aggregate data.[6]

2.3.2 Weather

The weather variables were constructed from monthly data on precipitation, ETo, and average maximum air temperature from October 1990 to April 2015 taken from CIMIS Station 104 (De Laveaga), which is situated within Santa Cruz city limits. Even though model estimation uses monthly data from 2000 to 2014, the average weather values used in equations (4) – (6) are based on the full 1990 to 2015 data series – i.e., they are 25 year normals. The weather data used to estimate the models are provided in Attachment 2.

2.3.3 Economic Variables

The economic data came from multiple sources. The water rate data set was constructed with Water Department records of water rates for each customer class. Annual unemployment rates in Santa Cruz for the period 1990 to 2014 come from the California Employment Development Department. Median and per capita income estimates for Inside City and Outside City customers come from Decennial Census and American Community Survey data. The income data cover estimation years 2000 and 2005-2013. Values for other years were imputed. Average annual residential vacancy rates for City of Santa Cruz for the years 1991-2014 are taken from the California Department of Finance (DOF E-8). These data sets are provided in Attachment 3.

2.3.4 Conservation Adjustment

Prior to estimating the model given by equation (1), average monthly use was adjusted to remove the effect of plumbing codes. That is, if y_{it} is observed average use and c_{it} is estimated average water savings from plumbing codes in month t, then adjusted average monthly use, $\tilde{y}_{it}$, is given by:

$$\tilde{y}_{it} = y_{it} + c_{it} \qquad (17)$$

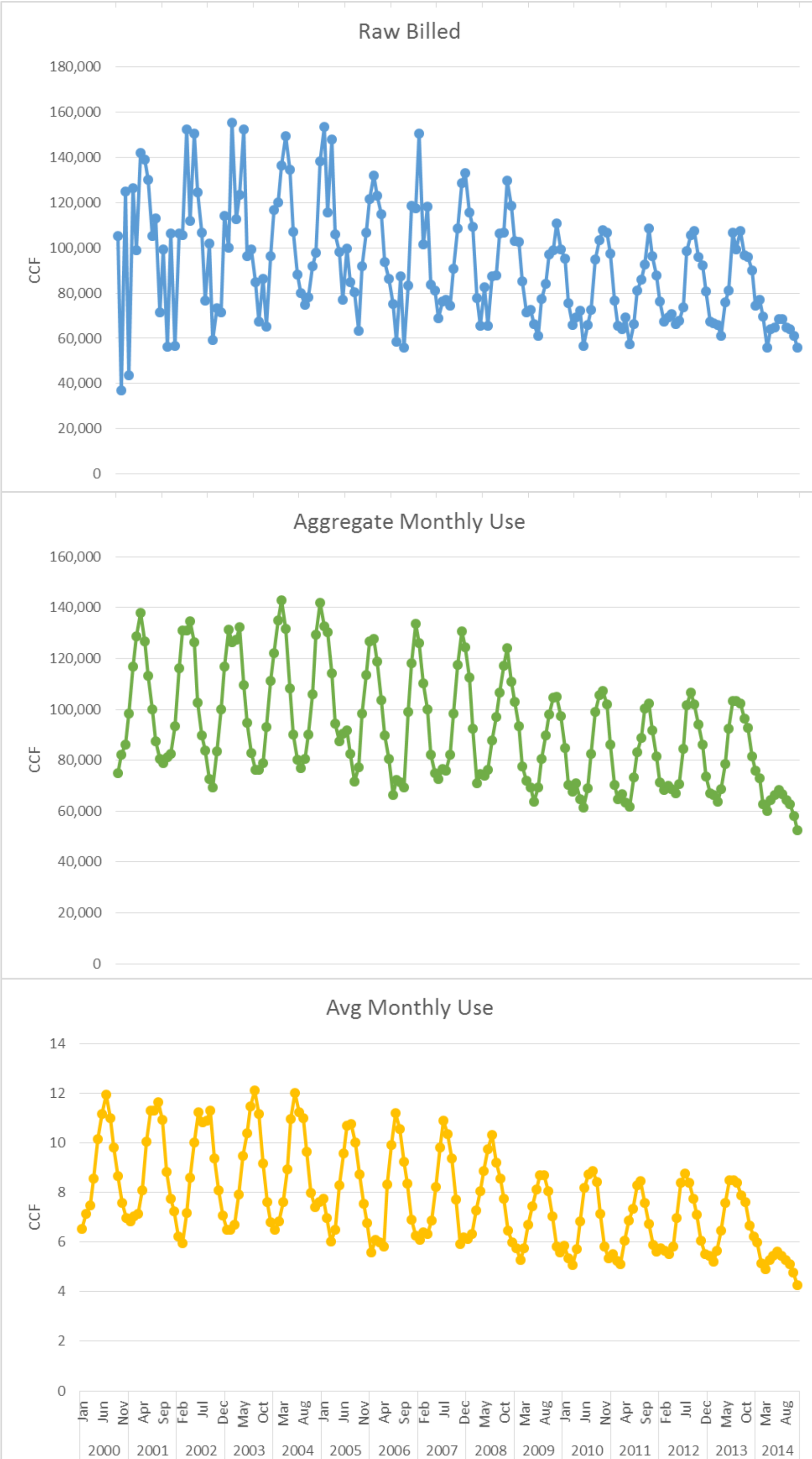
The estimated model yields a predicted value for adjusted monthly use, which we symbolize as $\widehat{\tilde{y}_{it}}$. The predicted value for observed average use, $\hat{y}_{it}$, is then given by:

$$\hat{y}_{it} = \widehat{\tilde{y}_{it}} - c_{it} \qquad (18)$$

This adjustment is made to limit the confounding effect of passive conservation on the estimation of the other economic parameters (e.g. price, income, unemployment). Average monthly passive water savings over the estimation period were estimated using the Alliance for Water Efficiency's Water Conservation Tracking Tool. The conservation adjustment, c_{it}, and adjusted average monthly use from which the models were estimated, $\tilde{y}_{it}$, are given in Attachment 4.

[6] In Jan 2000, for example, 7,823 Inside City Single Family meters were read. In Feb 2000, only 3,004 meters were read. In March 2000, 9,529 meters were read, and so on.

Figure 1. Inside City Single Family Consumption Data



2.4 Model Estimation Results

The average demand models were estimated with R version 3.2 statistical software. Robust regression methods were applied to down-weight outlier consumption data. For customer classes that had both Inside City and Outside City customers (e.g. residential, business, irrigation, and golf) fixed effects models were estimated so that the data could be pooled. Estimation results as summarized by adjusted R-squared are shown in Table 3. Across all classes, the models explain 90% to 99% of the observed variation in the data. All statistically significant model coefficients have the expected signs and magnitudes. Estimation results for each customer class are provided in Attachment 5.

Table 3. Average Demand Model Estimation, Adjusted R-Square

Customer Class	Number of Observations	Adjusted R-Square
Single Family	358	0.917
Multi Family	351	0.900
Business	353	0.942
Municipal	177	0.951
Irrigation	358	0.916
Golf	352	0.988

2.4.1 Seasonal Load Shape

The seasonal load shape describes how monthly average demand changes over the year due to seasonal effects. Average demand is lower in the winter months and peaks in the summer months. However, the degree of difference between these periods varies by customer class depending on the extent of irrigation uses. Table 1 shows how the seasonal parameter estimates can be used to estimate a seasonal index for each customer class. The estimated seasonal indices are given in Table 4.[7] The indices express average monthly demand as a percentage of total annual demand. For example, from Table 4 it is seen that single family average demand in May is about 1.6 times greater than average demand in January. More generally, single family average demand in the summer months is a bit less than double winter average demand. Summer peaking for multi-family is much less pronounced, with summer average demand only about 20% greater than winter average demand. Business average demand mostly falls between single- and multi-family average demands. The municipal and irrigation classes show greater peaking than the residential or business categories, with summer average demand five to eight times greater than winter average demand.[8] Average demands by the two golf courses served by the City are almost entirely in the summer. There is very little golf course demand in the winter months.

[7] These have been expressed as average monthly share of total annual demand. Thus the 12 monthly values sum to 100.

[8] Summer peak demands have been greatly reduced during the current drought so that the differential between winter and summer average use has been almost erased. This is likely to be a transitory response to the drought. However, peak demand may not fully return to its historical pattern if the drought induces more drought-tolerant landscaping or the elimination of landscaped area within the service area.

Table 4. Seasonal Indices of Average Demand

	Inside City Seasonal Index 1/					
Month	**SFR**	**MFR**	**BUS**	**MUN**	**IRR**	**GOLF**
Jan	6.0	7.6	7.0	3.1	2.0	0.0
Feb	5.9	7.7	7.2	3.1	2.1	0.0
Mar	6.1	7.6	7.3	3.5	2.9	0.0
Apr	7.1	7.9	7.8	6.8	6.9	2.2
May	9.5	8.8	8.9	10.6	10.8	8.5
Jun	10.6	9.2	9.7	13.0	13.7	16.6
Jul	11.3	9.3	10.3	14.8	15.0	19.7
Aug	11.1	9.2	10.2	15.2	14.4	21.4
Sep	10.4	8.9	9.1	12.2	13.4	17.1
Oct	8.6	8.5	8.3	9.1	9.9	11.2
Nov	7.0	7.9	7.3	5.3	5.8	2.7
Dec	6.3	7.6	6.9	3.4	3.2	0.7
	Outside City Seasonal Index 1/					
Month	**SFR**	**MFR**	**BUS**	**MUN**	**IRR**	**GOLF**
Jan	6.0	7.4	7.0	NA	2.0	0.2
Feb	5.9	7.3	7.0	NA	2.1	0.3
Mar	6.1	7.4	7.2	NA	2.9	0.4
Apr	7.1	8.1	8.0	NA	6.9	3.9
May	9.5	8.7	8.7	NA	10.8	9.5
Jun	10.6	9.1	9.5	NA	13.7	15.3
Jul	11.3	9.4	9.8	NA	15.0	17.9
Aug	11.1	9.3	9.6	NA	14.4	19.3
Sep	10.4	9.1	9.3	NA	13.4	15.6
Oct	8.6	8.4	8.5	NA	9.9	11.3
Nov	7.0	8.0	7.8	NA	5.8	5.0
Dec	6.3	7.7	7.3	NA	3.2	1.2
1/ Average monthly share of total annual demand.						

2.4.2 Weather Effects

The average demand models include controls for the effects of weather – rainfall and temperature for residential and business classes and rainfall and ETo for municipal, irrigation, and golf classes. During model estimation, the weather component is interacted with seasonal indicators to estimate separate seasonal weather effects for fall-winter (Nov-Mar), spring (Apr-Jun), and summer-fall (Jul-Oct).[9] Estimated weather effects were found to be largest in the spring, when outdoor irrigation can be either accelerated or delayed depending on weather. Spring weather effects are statistically significant in

[9] The seasonal construct follows the CUWCC's GPCD weather normalization methodology (Western Policy Research, 2011).

every class model whereas they are not always statistically significant in the fall-winter or the summer-fall seasons. Table 5 shows the estimated weather parameters for each customer class. As would be expected, average demand is negatively correlated with rainfall and positively correlated with temperature and ETo. With the exception of the multi-family category, average monthly demand is also negatively correlated with lagged rainfall.

Table 5 shows that municipal, irrigation, and golf average demands are more weather sensitive than residential and business average demands. This is expected since outdoor water use makes up a larger share of average demand in these three customer classes. Multi-family demand is the least sensitive to weather.

Table 5. Statistically Significant Weather Parameters in Average Demand Models

Rainfall	**SFR**	**MFR**	**BUS**	**MUN**	**IRR**	**GOLF**
Fall-Winter (Nov-Mar)	-0.016	NS	NS	NS	-0.044 1/	-0.129
Spring (Apr-Jun)	-0.069	-0.020	-0.034	-0.147	-0.116	-0.441
Summer-Fall (Jul-Oct)	-0.040	-0.018	-0.028	NS	-0.085	-0.038 1/
Lagged 1 month	-0.034	NS	-0.017 2/	-0.097	-0.166	-0.546
Lagged 2 months	-0.026	NS	NS	-0.063	-0.090	-0.074 1/
Temperature						
Fall-Winter (Nov-Mar)	0.203	0.100 1/	0.243	NA	NA	NA
Spring (Apr-Jun)	0.422	0.338	0.400	NA	NA	NA
Summer-Fall (Jul-Oct)	0.636	NS	NS	NA	NA	NA
ETo						
Fall-Winter (Nov-Mar)	NA	NA	NA	0.516	0.509	1.135
Spring (Apr-Jun)	NA	NA	NA	0.804	0.660	0.173 1/
Summer-Fall (Jul-Oct)	NA	NA	NA	0.357	0.163	0.792
1/ Correct sign but not statistically significant. 2/ Apr-Jun only. NA = Not applicable. NS= Not statistically different from 0.						

Using equations (7) and (8), the effect of a given change in a weather measure on average demand can be calculated using the parameter estimates in Table 5. An example is provided in Table 6, which shows the percentage effect on average demand in January, April, and July, given weather that is one standard deviation above the average for the month. Note that in Table 6 the percentage effect for each weather measure is being calculated independently of the other weather measures to show their relative impact. When doing weather normalization or forecasting, the weather effects need to be combined. For example, if in April, rainfall was one standard deviation above its average and temperature was one standard deviation below its average (i.e., April is wet and cool), the combined effect on single-family demand would be -5.3%.[10]

The estimated weather parameters in Table 5 can also be used to weather normalize historical average demand using equations (10) and (11). An example is provided in Table 7. It shows the estimated

[10] This presumes average lagged rainfall. In this example and in Table 6 the effect of lagged rainfall is being ignored for sake of simplicity.

monthly weather effects and weather normalization factors for the single family and irrigation classes for water year (WY) 2011. Rainfall in WY 2011 was above average in most months and the spring, in particular, was unusually wet. WY 2011 was also cooler than normal in every month. As shown in the table, above average rainfall and below average temperature (and ETo) had a negative effect on average demand. The effect is more pronounced in the irrigation class than in the single family class, but in both cases the effect is substantial, especially in the May-August period.

Table 6. Percentage Effect on Average Demand if Weather Measure is 1 S.D. above its Average

Rainfall	**SFR**	**MFR**	**BUS**	**MUN**	**IRR**	**GOLF**
Jan	-0.9%	NS	NS	NS	NS	-7.0%
Apr	-3.2%	-0.9%	-1.6%	-6.6%	-5.3%	-18.6%
Jul	-0.5%	-0.2%	-0.4%	NS	-1.1%	-1.6%
Temperature						
Jan	1.1%	NS	1.3%	NA	NA	NA
Apr	2.1%	1.7%	2.0%	NA	NA	NA
Jul	3.7%	NS	NS	NA	NA	NA
ETo						
Jan	NA	NA	NA	10.8%	10.6%	25.3%
Apr	NA	NA	NA	10.1%	8.3%	2.1%
Jul	NA	NA	NA	3.1%	1.4%	6.9%
Note: Rainfall effect is only for change in contemporaneous rainfall. Effects of lagged rainfall are not shown in the table.						

Table 7. Single Family and Irrigation Class Monthly Weather Effects for WY 2011

	Monthly Weather Measures				SFR Weather Parameters				Weather Effect [1/]	Normalization Factor [2/]
WY 2011	dIR_t	dIR_{t-1}	dIR_{t-2}	dIT_t	dIR_t	dIR_{t-1}	dIR_{t-2}	dIT_t		
Oct-10	0.707	-0.142	0.088	-0.042	-0.040	-0.034	-0.026	0.636	0.95	1.05
Nov-10	0.460	0.707	-0.142	-0.021	-0.016	-0.034	-0.026	0.203	0.97	1.03
Dec-10	0.826	0.460	0.707	-0.024	-0.016	-0.034	-0.026	0.203	0.95	1.05
Jan-11	-0.483	0.826	0.460	0.039	-0.016	-0.034	-0.026	0.203	0.98	1.02
Feb-11	0.312	-0.483	0.826	-0.038	-0.016	-0.034	-0.026	0.203	0.98	1.02
Mar-11	1.180	0.312	-0.483	-0.042	-0.016	-0.034	-0.026	0.203	0.97	1.03
Apr-11	-0.400	1.180	0.312	-0.010	-0.069	-0.034	-0.026	0.422	0.98	1.03
May-11	0.481	-0.400	1.180	-0.031	-0.069	-0.034	-0.026	0.422	0.94	1.07
Jun-11	1.028	0.481	-0.400	-0.068	-0.069	-0.034	-0.026	0.422	0.90	1.11
Jul-11	0.080	1.028	0.481	-0.018	-0.040	-0.034	-0.026	0.636	0.94	1.06
Aug-11	-0.027	0.080	1.028	-0.065	-0.040	-0.034	-0.026	0.636	0.93	1.07
Sep-11	-0.056	-0.027	0.080	-0.027	-0.040	-0.034	-0.026	0.636	0.98	1.02
	Monthly Weather Measures				IRR Weather Parameters				Weather Effect	Normalization Factor
WY 2011	dIR_t	dIR_{t-1}	dIR_{t-2}	$dIET_t$	dIR_t	dIR_{t-1}	dIR_{t-2}	$dIET_t$		
Oct-10	0.707	-0.142	0.088	-0.165	-0.085	-0.166	-0.090	0.163	0.93	1.07
Nov-10	0.460	0.707	-0.142	0.048	-0.044	-0.166	-0.090	0.509	0.90	1.11
Dec-10	0.826	0.460	0.707	-0.337	-0.044	-0.166	-0.090	0.509	0.71	1.42
Jan-11	-0.483	0.826	0.460	0.194	-0.044	-0.166	-0.090	0.509	0.94	1.06
Feb-11	0.312	-0.483	0.826	0.156	-0.044	-0.166	-0.090	0.509	1.07	0.93
Mar-11	1.180	0.312	-0.483	-0.120	-0.044	-0.166	-0.090	0.509	0.89	1.13
Apr-11	-0.400	1.180	0.312	0.016	-0.116	-0.166	-0.090	0.660	0.85	1.18
May-11	0.481	-0.400	1.180	0.022	-0.116	-0.166	-0.090	0.660	0.92	1.08
Jun-11	1.028	0.481	-0.400	-0.108	-0.116	-0.166	-0.090	0.660	0.79	1.26
Jul-11	0.080	1.028	0.481	0.057	-0.085	-0.166	-0.090	0.163	0.81	1.24
Aug-11	-0.027	0.080	1.028	-0.149	-0.085	-0.166	-0.090	0.163	0.88	1.14
Sep-11	-0.056	-0.027	0.080	-0.060	-0.085	-0.166	-0.090	0.163	0.99	1.01

1/ Calculated with equation (10). 2/ The inverse of the weather effect, per equation (11).

2.4.3 Economic Effects

The estimated economic parameters are summarized in Table 8. The price and income parameters are elasticities, which measure the percentage change in average demand given a one percent change in price or income. For example, a one percent increase in price would be expected to cause 0.075 and 0.139 percent decreases in winter and summer single family demands, respectively. Similarly, a one percent increase in price would be expected to result in 0.237 and 0.545 percent decreases in municipal and irrigation average demands, respectively.

The estimated price responses for single family are significantly lower than what the interim WSAC forecast assumed: -0.15 versus -0.075 for winter and -0.30 versus -0.139 for summer.[11] However, the estimated price responses for multi-family and business (inside city) are essentially identical to what was assumed in the interim forecast: -0.12 for multi-family and -0.10 for business. Outside city business use showed significantly more price response. As discussed in the next section, it also showed greater response to drought restriction.

[11] In terms of an average annual price response, the interim WSAC forecast assumed an elasticity of -0.24 whereas the econometric analysis indicates the true value is in the neighborhood of -0.11.

The estimated income elasticity for the single family customer class is also very close to the 0.25 assumption used in the interim WSAC forecast. Thus, the econometric analysis mostly confirms the price and income elasticity assumptions used to prepare the interim WSAC demand forecast. Table 8 also confirms the expectation that the magnitude of price response is positively correlated with outdoor irrigation water use. The Pasatiempo golf course is an exception to this general finding. Its price response was not statistically different from zero. Perhaps this is because it is a top tier course and has a substantially higher willingness to pay for water than other irrigators.

Table 8. Economic Parameter Estimates

Parameter	**SFR**	**MFR**	**BUS**	**MUN**	**IRR**	**GOLF**
Price	winter: -0.075 Summer: -0.139	-0.124	Inside City: -0.099 Outside City: -0.262	-0.237	-0.545	-0.358[1/]
Income	0.228					
Vacancy		-0.164				
Unemployment			-0.160	-0.142		
1/Delaveaga price response. Pasatiempo price response not statistically significant.						

The vacancy and unemployment rate parameters measure the effect that deviations from normal have on average demand. That is, how average demand is expected to change if the vacancy or unemployment rate is above or below its long-term average. Both parameters are negative, as expected. A higher rate of vacancy is expected to decrease average multi-family demand. Likewise, a higher rate of unemployment is expected to decrease average business demand. The effect of a departure from normal on average demand can be calculated in the same manner that temperature (or ETo) effects are calculated, per equation (8). For example, a 50% increase in the unemployment rate from its long-term average would be expected to reduce average business demand by approximately 6.4% and municipal demand by approximately 5.6%.[12] Similarly, a vacancy rate that is 20% above its long-term average would be expected to decrease average multi-family demand by about 2.9%.

2.4.4 Drought Effects

The model's drought component uses an indicator variable for each drought stage that takes the value of one if the drought stage was in effect and zero otherwise. The months in which each drought stage was in effect during the model estimation period are shown in Attachment 6. The estimated drought stage parameters are shown in Table 9.

[12] For business, the effect is calculated as $1.5^{-0.16} - 1 = 0.0643$; while for municipal the effect is calculated as $1.5^{-0.142} - 1 = 0.0559$.

Table 9. Estimated Drought Stage Parameters

Parameter	SFR	MFR	BUS	MUN	IRR	GOLF
Stage 1	-0.051	-0.009 [1/]	NS	NS	-0.077 [1/]	NS
Stage 2	-0.071	-0.028	NS	-0.108	-0.250	NS
Stage 3	-0.431	-0.192	Inside City: -0.123 Outside City: -0.191	-0.621	-0.930	-0.319
NS = not statistically different from zero. 1/ correct sign but not statistically different from zero.						

The average percentage effect of a drought stage on average demand is estimated by exponentiating the parameter estimates in Table 9 and subtracting one from the result. Thus, the expected reduction in single family average demand during a Stage 1 drought restriction is $e^{-0.051} - 1 = -0.0497$, or about 5%. Table 10 shows the estimated average change in monthly demand by drought stage and customer class.

Table 10. Percent Reduction in Average Demand by Drought Stage and Customer Class

Stage	SFR	MFR	BUS	MUN	IRR	GOLF
Stage 1	-5%	-1% [1/]	NS	NS	-7% [1/]	NS
Stage 2	-7%	-3%	NS	-10%	-22%	NS
Stage 3	-35%	-17%	Inside City: -12% Outside City: -17%	-46%	-61%	-27%
NS = not statistically different from zero. 1/ correct sign but not statistically different from zero.						

2.5 FORECASTS OF AVERAGE DEMAND BY CUSTOMER CLASS

Class-level forecasts of average demand derived from the econometric models are shown in Table 11. These forecasts are based on the water rate and income growth assumptions developed for the interim WSAC demand forecast and have been adjusted for plumbing code and Program A water savings. The water rate and income growth forecasts are provided in Attachment 7. The plumbing code and Program A water savings forecasts are provided in Attachment 8. The forecasts in Table 11 assume normal weather and economic conditions.[13] The 95% confidence interval for each forecast is shown in the column to the right of the forecast.[14]

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[13] This means the weather, unemployment rate, and housing vacancy rate variables are set to their long-term average values in the forecast.

[14] Given a vector of forecast inputs, $\mathbf{x}_0$, the predicted mean response, y_0, is $y_0 = \mathbf{x}_0{}'\mathbf{b}$, where $\mathbf{b}$ is the vector of estimated model coefficients. The 100(1-α)% confidence interval for the expected value of the mean response is $\pm t_c(\frac{\alpha}{2}, n-p-1)\sqrt{\hat{\sigma}^2\mathbf{x}_0{}'(\mathbf{X'WX})^{-1}\mathbf{x}_0}$, where $\mathbf{X}$ is the n x p design matrix used to estimate the model, $\mathbf{W}$ is the n x n diagonal matrix of estimation weights, $\hat{\sigma}$ is the estimated standard error of the model, n is the number of

The predicted decreases in residential and business average use over the forecast period is due to the combination of plumbing code and Program A water savings and the effects of increasing water rates. Higher water costs are the primary factor in the predicted decreases for municipal and irrigation average uses. The predicted decrease in average golf use reflects both a response to higher water costs and the expected decrease in acreage irrigated with City water at the Pasatiempo golf course.[15]

The 95% confidence intervals are generally in the ± 3 to 10% range. The confidence intervals for golf are an exception. They are wider because of the significant within-month variation in water use over the model estimation period. The increasing width of all the intervals over the forecast horizon is a reflection of the greater uncertainty associated with outer years of the forecast.[16]

Table 11. Forecasted Average Demand by Customer Class (CCF/Year)

YEAR		**2013**	**2020**		**2025**		**2030**		**2035**	
	Per	Actual [1/]	Forecast	CI	Forecast	CI	Forecast	CI	Forecast	CI
Single Family	Housing Unit	87	86	± 3	83	± 3	80	± 4	78	± 4
Multi Family	Housing Unit	53	56	± 2	52	± 2	50	± 2	49	± 3
Business	Service	405	400	± 12	389	± 12	382	± 13	377	± 13
Municipal	Service	388	296	± 26	290	± 27	283	± 29	277	± 30
Irrigation	Service	365	286	± 28	271	± 28	257	± 28	244	± 28
Golf	Acre	990	671	± 130	641	± 134	606	± 137	593	± 144

1/ Actual use, unadjusted for weather or economy. Stage 1 drought water use restrictions in effect May - Dec.

CI = 95% confidence interval.

observations, p is the number of parameter estimates, and t_c is the t-distribution critical value given n-p-1 degrees of freedom.

[15] Average golf use in Table 11 is an acreage-weighted average of the two golf courses the City serves. Historically, Pasatiempo average water use per acre has been greater than Delaveaga. Therefore, as Pasatiempo's share of total golf acreage irrigated with City water decreases over the forecast, average use per acre also decreases.

[16] The confidence intervals only reflect uncertainty in the estimate of adjusted average use, $\widehat{y_{it}}$, which is derived from the econometric models. The DSS model, which generated the forecast of plumbing code and Program A water savings, is not a statistical model and forecast errors cannot be derived from its output. The confidence intervals in Table 11 therefore are implicitly assuming 100% accuracy in the plumbing code and Program A water savings forecasts.

3 Forecasts of Population, Housing, and Services

3.1 Approach

The population and housing unit forecasts are based on the AMBAG 2014 Regional Growth Forecast (AMBAG 2014). The forecasts of business and irrigation services are in turn driven by the residential forecasts. Currently, Water Department staff do not expect appreciable growth in the number of municipal services. Municipal services are therefore assumed to remain at their current number throughout the forecast period.

3.2 Forecast Development

3.2.1 Population

The forecast of service area population is divided into its inside-city and outside-city components. The inside-city component comes directly from the AMBAG 2014 Regional Growth Forecast (AMBAG 2014) and is inclusive of the UCSC population. The outside-city component was derived by Water Department staff using data from the 2014 Regional Growth Forecast. The component population forecasts and total service area population forecast are shown in Table 12.

Table 12. Service Area Population Forecast

	2010 [1/]	2020	2025	2030	2035
Inside-City [2/]	59,946	66,860	70,058	73,375	76,692
Outside-City [3/]	31,342	32,543	33,562	34,614	35,698
Service Area	91,288	99,403	103,620	107,989	112,390

Notes:
1/ Actual per 2010 Census
2/ AMBAG 2014 Regional Growth Forecast (adopted June 11, 2014). Includes UCSC population.
3/ Developed by Water Department Staff from 2014 Regional Growth Forecast data.

3.2.2 Housing Units

The forecast of occupied housing units is calculated by dividing the population in households by average household size. This is the same methodology AMBAG uses, but we use our own forecast of population in households.[17]

For the inside-city portion of the service area, the population in households is the total inside-city population from Table 12 less the UCSC campus population and the off campus population in group quarters. AMBAG's student enrollment forecast is multiplied by the ratio of students living on campus to total enrollment to get the UCSC campus population estimate (see Attachment 9). The ratio of group quarters population to total (non-campus) population is then multiplied by total (non-campus)

[17] We use our own forecast for two reasons. First, the AMBAG forecast only covers the inside-city (i.e. City of Santa Cruz) portion of the service area. Second, AMBAG's City of Santa Cruz housing unit forecast incorrectly equates student enrollment with campus population, causing it to underestimate off-campus housing units.

population to get the group quarters population estimate.[18] The household population is the residual population. These calculations are shown in Table 13 for the inside-city portion of the service area.

The same approach is used to forecast household population for the outside-city portion of the service area, except that no adjustment for campus population is required. Table 14 gives the outside-city household population forecast.

Table 13. Inside-City Household Population Forecast

	2010 1/	2020	2025	2030	2035
Total Population	59,946	66,860	70,058	73,375	76,692
Adjustments					
Campus population 2/	7,331	8,845	9,602	10,359	11,116
Group quarters 3/	1,904	2,099	2,188	2,280	2,373
Non-household population	9,235	10,944	11,790	12,639	13,489
Population In households 4/	50,711	55,916	58,268	60,736	63,203

Notes
1/ Actual per 2010 Census.
2/ See Attachment 9 for calculation.
3/ Ratio of group quarters population to total (non-campus) population from 2010 Census multiplied by total (non-campus) population.

Table 14. Outside-City Household Population Forecast

	2010 1/	2020	2025	2030	2035
Total Population	31,342	32,543	33,562	34,614	35,698
Group quarters adjustment 2/	665	690	712	734	757
Population In households	30,677	31,853	32,850	33,880	34,941

Notes
1/ Actual per 2010 Census
2/ Ratio of group quarters population to total population from 2010 Census multiplied by total population.

Total housing units are then estimated by dividing household population by average household size. Average household size starts with the 2010 Census estimate, which is then scaled to increase at the same rate as average household size in the AMBAG 2014 Regional Growth Forecast. The forecast of total housing units for the inside- and outside-city portions of the service are shown in Table 15.

[18] The ratio of within-city population in group quarters to total population (excluding campus population) is calculated from 2010 Census data. This ratio is approximately 0.0362, or 3.62% of the population.

Table 15. Forecast of Occupied Housing Units

	2010 [1/]	2020	2025	2030	2035
Household Population					
Inside-City	50,711	55,916	58,268	60,736	63,203
Outside-City	30,677	31,853	32,850	33,880	34,941
Average Household Size [2/]					
Inside-City	2.34	2.38	2.41	2.42	2.44
Outside-City	2.39	2.43	2.46	2.46	2.48
Occupied Housing Units					
Inside-City	21,657	23,492	24,177	25,136	25,925
Outside-City	12,856	13,132	13,376	13,759	14,064

Notes
1/ Actual per 2010 Census
2/ Average household size starts with the 2010 Census estimate, which is then scaled to increase at the same rate as average household size in the AMBAG 2014 Regional Growth Forecast.

The last step in the forecast of service area housing units is to allocate total housing units between single-family and multi-family units. This is shown in Table 16. It starts with the Water Department's 2014 estimates of housing units calculated from its billing data. Single-family housing units are then increased at their historical growth rate. In the case of inside-city single-family housing, growth is capped at 1,000 units based on the General Plan's estimate of potential for new single family housing.[19] No cap is applied to the outside-city forecast. Multi-family units are then the difference between the forecast of total units and single-family units. For the inside-city portion of the service area, three-fourths of the gain in housing units is in the multi-family category. For the outside-city portion of the service area, a little less than half of the gain is in the multi-family category. For the whole service area, more than two-thirds of the gain in housing units is in the multi-family category.

Total housing units shown for the inside-city portion of the service area in Table 16 calibrates exactly to the total shown in Table 15. This is not the case for the outside-city total in Table 16. There is a discrepancy between Water Department data on total outside-city housing units in 2014 and the forecast of occupied housing units in Table 15. The Water Department's estimate is higher by several hundred housing units. The water demand forecast uses the housing unit forecasts shown in Table 16.[20]

[19] The General Plan, which extends to 2030, identified a potential for 840 new single family units. This was increased to 1000 units since this forecast runs to 2035.
[20] The outside-city housing unit forecast in Table 16 assumes the same rate of growth in the housing stock as the forecast in Table 15, but starts with the Water Department's higher estimate of housing units in 2014.

Table 16. Service Area Single-Family and Multi-Family Housing Unit Forecast

	2014 [1/]	2020	2025	2030	2035	Gain From 2014	% of Gain
Inside-City							
Single Family	12,246	12,534	12,780	13,030	13,246	1,000	24%
Multi Family	9,583	10,958	11,398	12,106	12,679	3,096	76%
Subtotal	21,829	23,492	24,177	25,136	25,925	4,096	
Outside-City							
Single Family	6,743	6,922	7,074	7,230	7,390	647	52%
Multi Family	7,901	7,910	8,033	8,310	8,495	594	48%
Subtotal	14,644	14,832	15,107	15,540	15,884	1,240	
Service Area							
Single Family	18,989	19,456	19,854	20,260	20,636	1,647	31%
Multi Family	17,484	18,868	19,431	20,416	21,174	3,690	69%
Total	36,473	38,324	39,284	40,676	41,809	5,336	

Notes
1/ Actual per Water Department billing records.

3.2.3 Non Residential Services and City-Irrigated Golf Acreage

The forecast of business services is based on the ratio of business to residential water use. Historically this ratio has averaged about 0.295 with very little variation (see Figure 2). The number of new business services is forecast such that the ratio of business to residential water use is maintained at 0.295 over the forecast period. This results in a gain of 166 new business services between 2013 and 2035.[21]

As seen in Figure 3, there is a strong relationship between growth in irrigation services and growth in multi-family and business services. On average, 0.6 irrigation services are added for each new multi-family or business service. This growth factor is used with the forecast of multi-family and business services to project new irrigation services over the forecast horizon.

The City is currently the sole water sources for the Delaveaga and Pasatiempo golf courses. This is not forecast to change for Delaveaga. However, interviews with Pasatiempo staff indicate it has plans to reduce its reliance of City water starting this year. It expects to irrigate not more than 40 acres with City water by 2020 and not more than 20 acres by 2030. It currently irrigates about 67.5 acres with City water.

[21] As a check on the forecast, it is noted that over the 18 year period 1996-2013, there was a gain of 120 business services. Extending this rate of growth to 22 years to match the length of our forecast would results in 147 new services, which is very close to the forecast of 166 new services for the 22 year period 2013 to 2035.

The forecasts of non-residential services and City-irrigated golf acreage are given in Table 17.

Table 17. Forecast of Non-Residential Services and City-Irrigated Golf Acreage

	2013 [1/]	**2020**	**2025**	**2030**	**2035**	**Gain From 2013**
Business [2/]	1,889	1,948	1,971	2,008	2,055	166
Municipal [3/]	218	218	218	218	218	0
Irrigation [4/]	452	651	723	845	951	499
Golf						
Delaveaga	79	79	79	79	79	0
Pasatiempo	68	40	30	20	20	-48
Total Golf	146	119	109	99	99	-48

Notes

1/ Actual per Water Department billing records.

2/ Based on ratio of business to residential demand.

3/ No expected growth in number of municipal services.

4/ Based on historical rate of gain in irrigation services per gain in multi-family and business services.

Figure 2. Ratio of Business to Residential Water Demand: 1999-2013

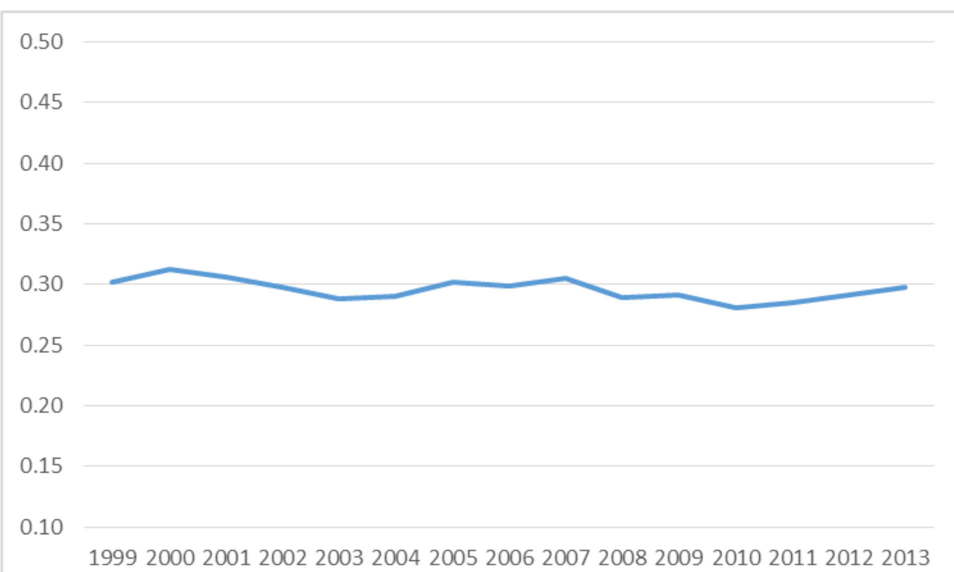
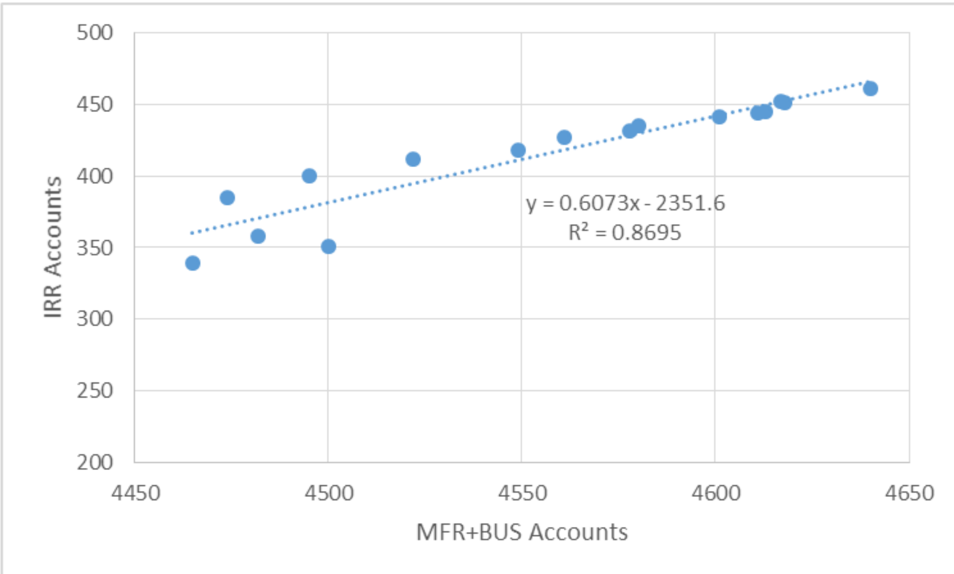


Figure 3. Irrigation vs Multi-Family + Business Accounts: 1999-2013



4 Forecasts of Water Demand

4.1 Approach

4.1.1 Class Demands other than Industrial and UCSC

The approach to the forecast of customer class demands other than industrial and UCSC is straightforward. The class average use forecasts from Table 11 are multiplied by their respective housing unit, service, or acreage forecasts from Tables 16 and 17 to yield the class-level demand forecasts. Lower and upper bounds are put on the forecasts using the confidence intervals in Table 11. In all cases, the forecasts are assuming normal economic conditions, average weather, and no drought or other restrictions on customer water use.

4.1.2 Industrial and UCSC Demands

There is a strong relationship between Santa Cruz County manufacturing employment and industrial water demand. This relationship is illustrated in Figure 4. Prior to the recession, annual industrial demand increased by 11.9 CCF per manufacturing job, on average. Immediately after the recession this increased to about 38.3 CCF per job. We use the pre-recession rate with a forecast of manufacturing employment in Santa Cruz County to project future industrial water demand. The pre-recession rate of water use per job is used because it does not include the transitory effects of the economic recovery. The 95% confidence interval for the water use per job parameter is used to produce the lower and upper bound forecasts.[22] The Caltrans forecast of manufacturing employment for Santa Cruz County is used to forecast industrial water use. The California Employment Development Department also has a forecast of manufacturing employment, but this forecast extends only to 2022. However, the two forecasts are consistent. The forecast of industrial demand is given in Table 18.

Table 18. Industrial Demand Forecast

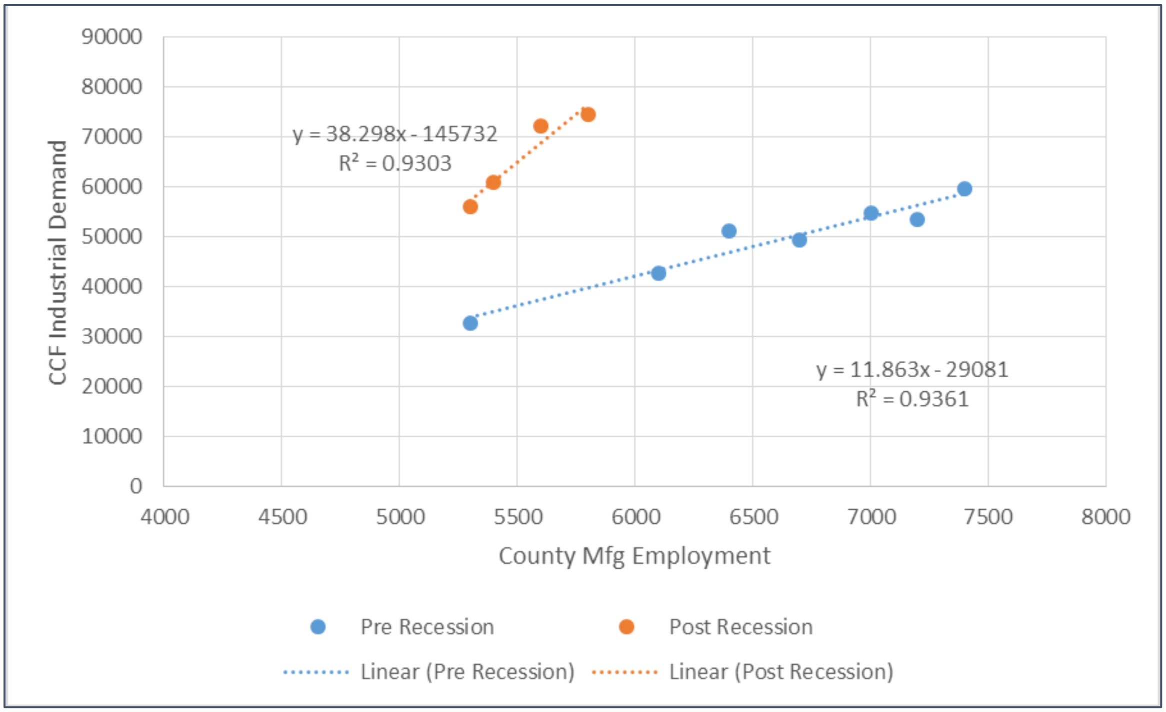
	2013 [1/]	**2020**	**2025**	**2030**	**2035**
Mfg Employment Forecast					
Cal Trans		5,900	6,200	6,400	6,500
Industrial Water Demand (MG)					
Low	56	56	58	59	60
Primary	56	57	59	61	62
High	56	57	60	63	64

Notes

1/ Actual per Water Department billing records.

[22] The 95% confidence interval is [8.4, 15.3]. The data and model output are provided in Attachment 10.

Figure 4. Industrial Demand vs County Manufacturing Employment



The forecast of UCSC demand is the same as in the interim WSAC demand forecast. The interim forecast was based on a linear projection of the UCSC demand requirement under its LRDP, assuming two alternative buildout dates. In both cases, buildout demand is 349 MGY. In the lower bound forecast, buildout occurs in 2050. In the upper bound forecast it occurs in 2035. The primary forecast is the midpoint between the lower and upper bound forecasts. The forecast of UCSC demand is given in Table 19. The primary forecast almost exactly replicates a forecast based on projected enrollment and average rates of water use per student.[23]

Table 19. UCSC Water Demand Forecast

	2013 1/	2020	2025	2030	2035
Low	182	186	213	240	268
Primary	182	196	234	271	308
High	182	207	254	302	349

Notes

1/ Actual per Water Department billing records.

[23] The enrollment-based approach yields a 2035 demand of 304 MG, which differs from the primary forecast by less than 2%.

4.1.3 System Production

System production is calculated as the sum of the demand forecasts plus miscellaneous uses and system losses, which are estimated at 7.5% of total production. The 7.5% rate of system loss and miscellaneous use is based on historical rates of system loss.

4.2 Class Demands and System Production Forecasts

Complete summaries of the primary, lower, and, upper bound forecasts of class demands and system production are provided in Tables 20, 21, and 22, respectively.

Table 20. Primary Forecast of Class Demands and System Production

YEAR		**2020**	**2025**	**2030**	**2035**
		Forecast	Forecast	Forecast	Forecast
Service Units	**Units**				
SFR	Housing Units	19,456	19,854	20,260	20,636
MFR	Housing Units	18,867	19,430	20,416	21,174
BUS	Services	1,948	1,971	2,008	2,055
IND	NA	NA	NA	NA	NA
MUN	Services	218	218	218	218
IRR	Services	651	723	845	951
GOLF	Acres	119	109	99	99
UC	NA	NA	NA	NA	NA
Avg Demand	**Units**				
SFR	CCF	86	83	80	78
MFR	CCF	56	52	50	49
BUS	CCF	400	389	382	377
IND	NA	NA	NA	NA	NA
MUN	CCF	296	290	283	277
IRR	CCF	286	271	257	244
GOLF	CCF	671	641	606	593
UC	NA	NA	NA	NA	NA
Annual Demand	**Units**				
SFR	MG	1,256	1,228	1,208	1,196
MFR	MG	792	759	766	775
BUS	MG	583	573	575	580
IND	MG	57	59	61	62
MUN	MG	48	47	46	45
IRR	MG	139	147	163	174
GOLF	MG	60	52	45	44
UC	MG	196	234	271	308
Total Demand	**MG**	**3,131**	**3,099**	**3,134**	**3,184**
MISC/LOSS	MG	254	251	254	258
Total Production	**MG**	**3,385**	**3,351**	**3,388**	**3,442**
Rounded	**MG**	**3,400**	**3,400**	**3,400**	**3,400**

Table 21. Lower Bound Forecast of Class Demands and System Production

YEAR		**2020**	**2025**	**2030**	**2035**
		Forecast	Forecast	Forecast	Forecast
Service Units	**Units**				
SFR	Housing Units	19,456	19,854	20,260	20,636
MFR	Housing Units	18,867	19,430	20,416	21,174
BUS	Services	1,948	1,971	2,008	2,055
IND	NA	NA	NA	NA	NA
MUN	Services	218	218	218	218
IRR	Services	651	723	845	951
GOLF	Acres	119	109	99	99
UC	NA	NA	NA	NA	NA
Avg Demand	**Units**				
SFR	CCF	83	79	76	74
MFR	CCF	54	50	48	46
BUS	CCF	389	377	370	364
IND	NA	NA	NA	NA	NA
MUN	CCF	271	264	256	248
IRR	CCF	260	245	231	218
GOLF	CCF	553	521	485	466
UC	NA	NA	NA	NA	NA
Annual Demand	**Units**				
SFR	MG	1,208	1,178	1,155	1,142
MFR	MG	764	728	731	736
BUS	MG	567	556	556	560
IND	MG	56	58	59	60
MUN	MG	44	43	42	40
IRR	MG	126	133	146	155
GOLF	MG	49	42	36	35
UC	MG	186	213	240	268
Total Demand	**MG**	**3,001**	**2,951**	**2,965**	**2,995**
MISC/LOSS	MG	243	239	240	243
Total Production	**MG**	**3,244**	**3,190**	**3,206**	**3,238**
Rounded	**MG**	**3,200**	**3,200**	**3,200**	**3,200**

Table 22. Upper Bound Forecast of Class Demands and System Production

YEAR		2020	2025	2030	2035
		Forecast	Forecast	Forecast	Forecast
Service Units	**Units**				
SFR	Housing Units	19,456	19,854	20,260	20,636
MFR	Housing Units	18,867	19,430	20,416	21,174
BUS	Services	1,948	1,971	2,008	2,055
IND	NA	NA	NA	NA	NA
MUN	Services	218	218	218	218
IRR	Services	651	723	845	951
GOLF	Acres	119	109	99	99
UC	NA	NA	NA	NA	NA
Avg Demand	**Units**				
SFR	CCF	90	86	83	81
MFR	CCF	58	54	53	52
BUS	CCF	412	401	395	391
IND	NA	NA	NA	NA	NA
MUN	CCF	323	318	313	308
IRR	CCF	315	300	287	274
GOLF	CCF	814	790	758	754
UC	NA	NA	NA	NA	NA
Annual Demand	**Units**				
SFR	MG	1,305	1,280	1,262	1,253
MFR	MG	820	792	803	816
BUS	MG	601	591	594	601
IND	MG	57	60	63	64
MUN	MG	53	52	51	50
IRR	MG	153	162	181	195
GOLF	MG	72	64	56	56
UC	MG	207	254	302	349
Total Demand	**MG**	**3,268**	**3,255**	**3,311**	**3,383**
MISC/LOSS	MG	265	264	268	274
Total Production	**MG**	**3,533**	**3,519**	**3,580**	**3,658**
Rounded	**MG**	**3,500**	**3,500**	**3,600**	**3,700**

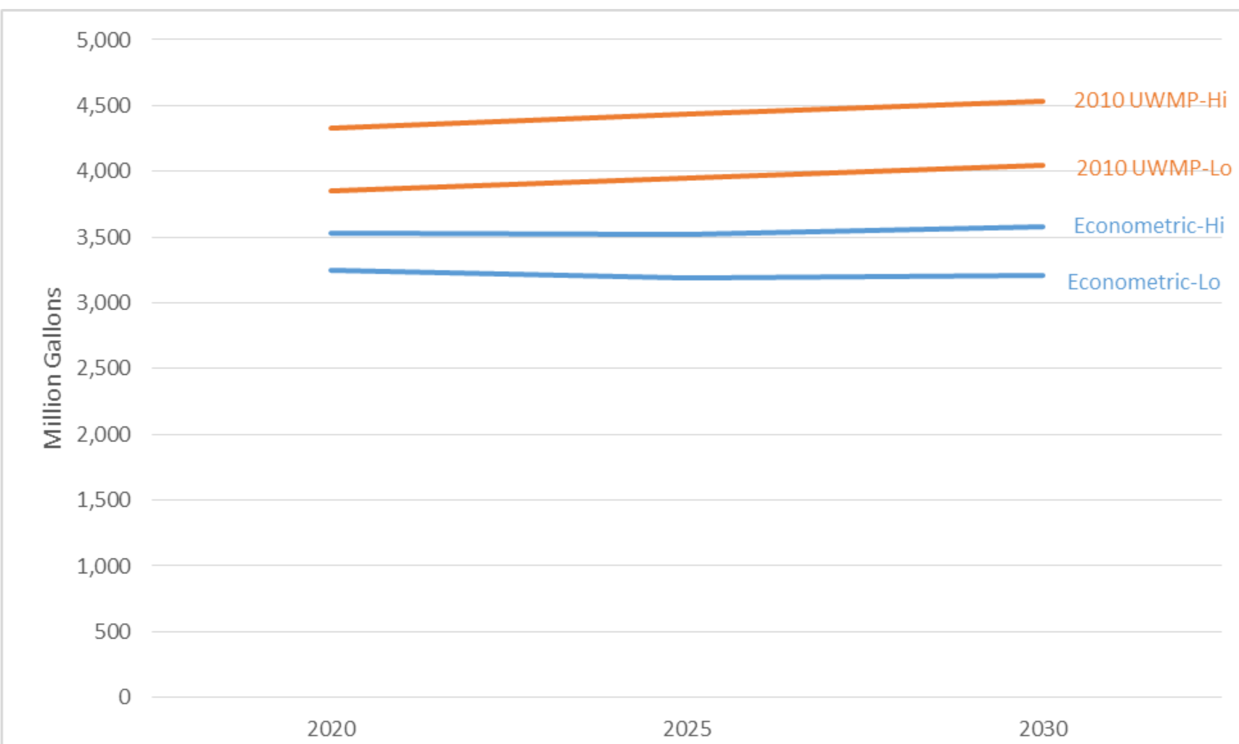
5 Comparison with Previous Forecasts and Historical Production

5.1 2010 UWMP Forecast

The 2010 UWMP included two water demand forecast scenarios that run to 2030. The lower scenario is based on class-level average water use for 2007-08. The higher scenario is based on class-level average water use for 1999-2004. Neither scenario makes adjustments for future effects of conservation or other economic factors on average water use. Each scenario uses the same service growth assumptions, which are tied to the City's General Plan 2030 buildout analysis and AMBAG's regional population forecasts. Importantly, both scenarios assume UCSC demands reach their buildout level of 349 MG by 2030, five years sooner than we assume in the upper bound forecast and 20 years sooner than we assume in the lower bound forecast.

Predicted future demand in both scenarios is significantly higher than the forecast presented in this report, as illustrated in Figure 5. The primary reasons for this are stated above: (1) not including adjustments for the effects of passive and active conservation and higher water rates on future water use and (2) the higher UCSC forecast. As shown in this report, future conservation and price effects are expected to be significant. Indeed, the econometric analysis shows that the effects of conservation and higher water rates have been working to reduce average demand for some time. These trends are predicted to continue. This plus the lower UCSC forecast explain the report's lower forecast compared to the 2010 UWMP forecast.

Figure 5. Comparison of Demand Forecast with 2010 UWMP Forecast

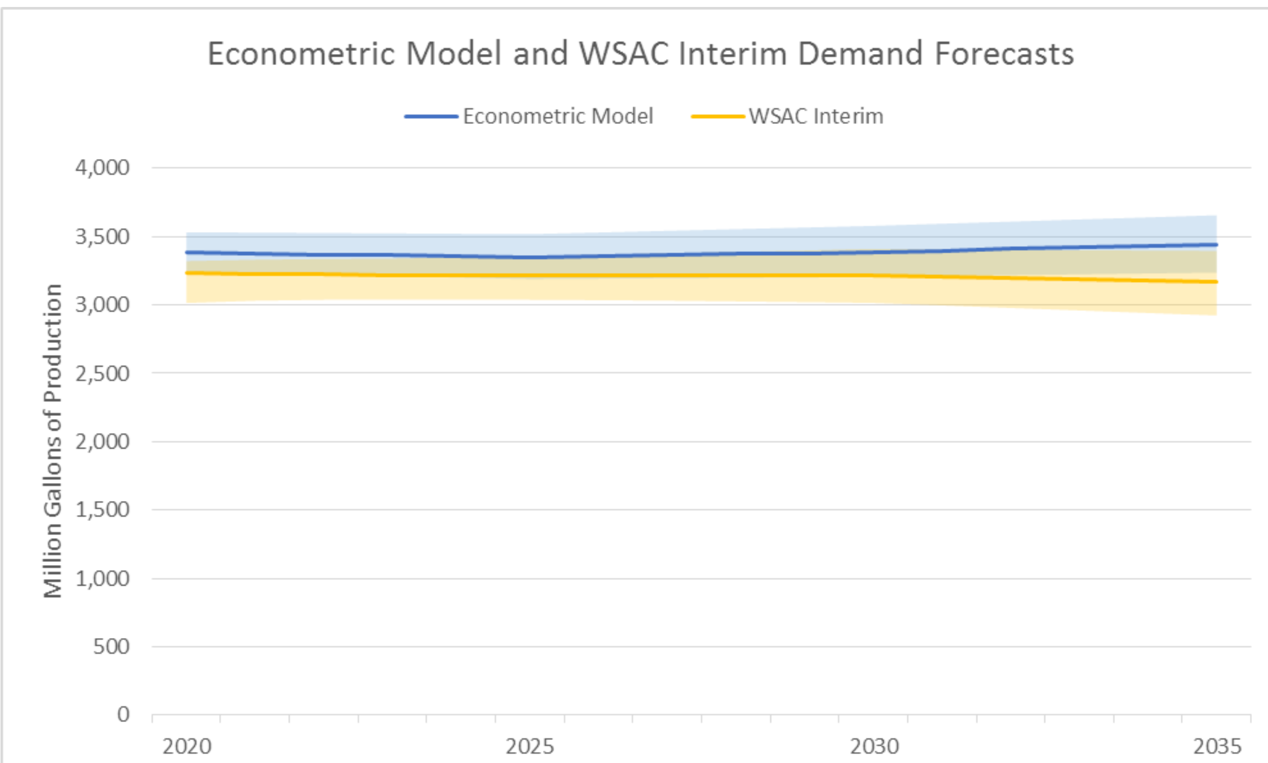


5.2 Interim WSAC Demand Forecast

The WSAC interim demand forecast (M.Cubed, 2015b) was developed from the 2010 UWMP demand forecast by adjusting that forecast for future conservation and other economic effects and by replacing the UCSC demand forecast with the one in Table 19.

The WSAC Interim and econometric demand forecasts are compared in Figure 6. On average, the econometric demand forecast is approximately five and a half percent greater than the WSAC interim forecast. Figure 6 also shows the uncertainty band around each forecast – light blue for the econometric model forecast and light yellow for the WSAC interim forecast. The uncertainty band on the econometric forecast is based on the 95% confidence intervals for the class-level average use per service forecasts developed with the econometric models. The uncertainty band on the WSAC interim forecast is the range between the low and high interim forecasts. From Figure 6 it is seen that the econometric forecast represented by the dark blue line essentially tracks the upper-bound of the WSAC interim forecast while the WSAC interim forecast represented by the dark yellow line essentially tracks the lower-bound of the corrected econometric forecast. Between these two lines, the forecasts overlap. Future production in the range of 3,200 to 3,400 MGY is consistent with both forecasts.[24]

Figure 6. Comparison of Demand Forecast with Interim WSAC Demand Forecast

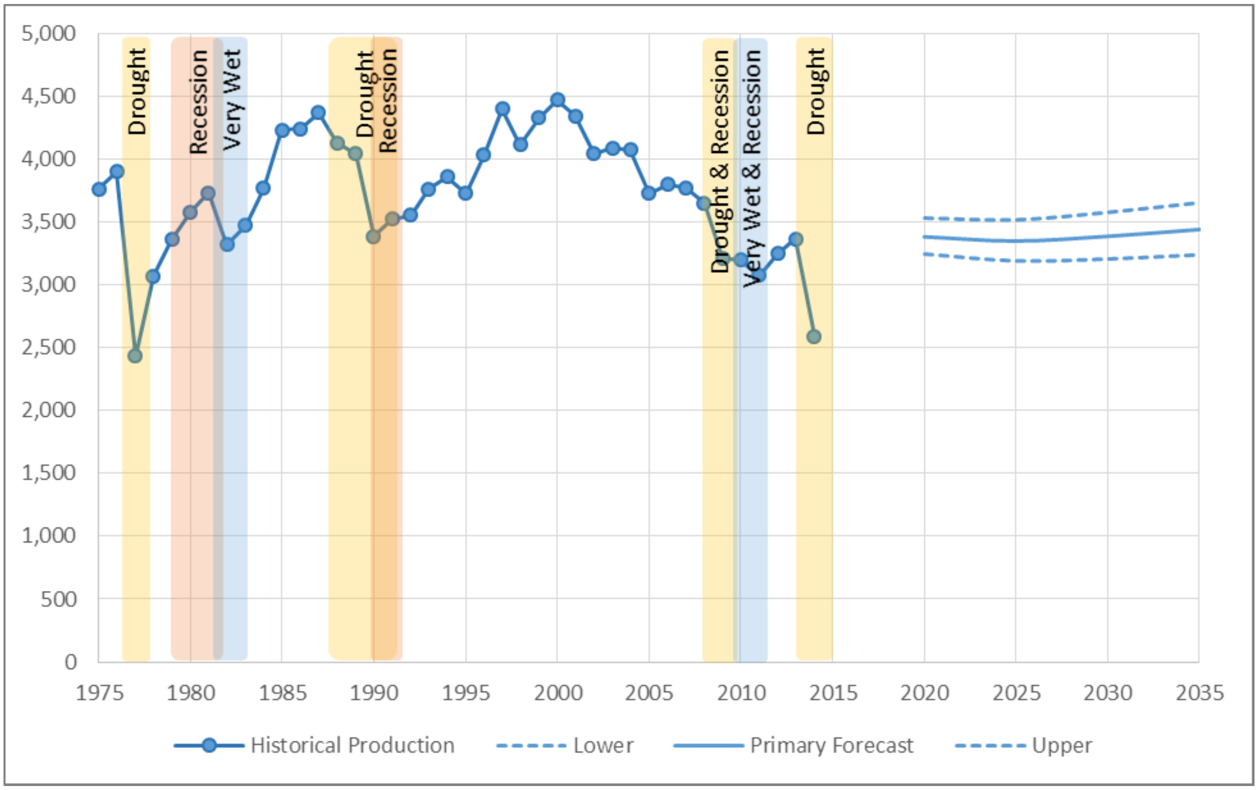


[24] A more conservative uncertainty band obtained by taking the union of the two forecasts suggests future production in the range of 3,000 to 3,500 MGY over most of the forecast period, with a slightly wider band in the last five years of the forecast.

5.3 Historical Production

Figure 7 shows a comparison of historical production and the primary, lower, and upper bound forecasts. It is interesting to see how historical production has been influenced by weather and economic events. The forecast does not exhibit a similar degree of variability because it is based on average weather and normal economic conditions. In other words, it is a forecast of *expected future demand*. Realized future demand will certainly not be smooth like the forecast. It will vary about the expected value depending on year-to-year variation in future weather and economic conditions. The forecast, however, provides the baseline around which this variability is likely to occur.

Figure 7. Historical and Forecast Production in Millions of Gallons



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ATTACHMENT 1 MONTHLY ALLOCATION PERCENTAGES FOR AGGREGATED METER READ DATA

The customer class seasonal use indices in the following table were used to weight the monthly allocation percentages that were used to distribute the aggregated meter read data into consumption months. The season indices were taken from Weber Analytical (2010).

Seaonal Use Indices

Month	SFR	MFR	BUS	IRR/GOLF	MUNI
Jan	0.74	0.90	0.84	0.24	0.34
Feb	0.80	0.97	0.91	0.24	0.31
Mar	0.78	0.92	0.89	0.34	0.39
Apr	0.82	0.92	0.89	0.53	0.65
May	1.05	1.04	1.04	1.21	1.13
Jun	1.25	1.02	1.16	1.57	1.60
Jul	1.28	1.11	1.16	1.80	1.70
Aug	1.29	1.14	1.24	1.83	1.91
Sep	1.22	1.08	1.11	1.65	1.79
Oct	1.07	1.04	1.03	1.35	1.06
Nov	0.89	0.94	0.89	0.71	0.75
Dec	0.81	0.91	0.85	0.53	0.38
Total	12.00	12.00	12.00	12.00	12.00

The next two tables provide the monthly allocation percentages for aggregated meter read data from bi-monthly billing cycles.

	SFR			MFR			BUS		
	% Allocated to Month			% Allocated to Month			% Allocated to Month		
Read Month (t)	t-2	t-1	t	t-2	t-1	t	t-2	t-1	t
Jan	26%	52%	23%	24%	51%	25%	24%	51%	25%
Feb	25%	49%	26%	23%	51%	26%	23%	50%	26%
Mar	27%	48%	25%	27%	48%	24%	27%	48%	25%
Apr	23%	51%	26%	24%	51%	25%	24%	51%	25%
May	22%	47%	30%	24%	48%	27%	24%	48%	28%
Jun	18%	52%	30%	21%	53%	25%	20%	52%	28%
Jul	22%	52%	27%	25%	49%	27%	23%	51%	26%
Aug	23%	52%	25%	22%	52%	26%	23%	51%	26%
Sep	24%	52%	24%	23%	53%	24%	23%	54%	23%
Oct	27%	51%	22%	26%	50%	24%	28%	50%	23%
Nov	27%	52%	21%	25%	52%	23%	26%	52%	22%
Dec	29%	49%	22%	27%	49%	24%	28%	49%	23%

	IRR/GOLF			MUNI		
	% Allocated to Month			% Allocated to Month		
Read Month (t)	t-2	t-1	t	t-2	t-1	t
Jan	33%	55%	12%	38%	43%	19%
Feb	40%	40%	20%	26%	51%	23%
Mar	26%	42%	32%	28%	43%	29%
Apr	15%	49%	36%	17%	46%	37%
May	13%	41%	46%	14%	46%	40%
Jun	11%	55%	34%	13%	52%	35%
Jul	20%	51%	29%	19%	53%	28%
Aug	21%	53%	26%	22%	51%	28%
Sep	24%	53%	23%	22%	54%	24%
Oct	28%	51%	21%	29%	55%	16%
Nov	31%	55%	14%	36%	48%	16%
Dec	41%	43%	16%	36%	51%	13%

The next two tables provide the monthly allocation percentages for aggregated meter read data from monthly billing cycles.

	SFR		MFR		BUS	
Read Month (t)	t-1	t	t-1	t	t-1	t
Jan	52%	48%	50%	50%	50%	50%
Feb	48%	52%	48%	52%	48%	52%
Mar	51%	49%	51%	49%	51%	49%
Apr	49%	51%	50%	50%	50%	50%
May	44%	56%	47%	53%	46%	54%
Jun	46%	54%	51%	49%	47%	53%
Jul	49%	51%	48%	52%	50%	50%
Aug	50%	50%	49%	51%	48%	52%
Sep	51%	49%	51%	49%	53%	47%
Oct	53%	47%	51%	49%	52%	48%
Nov	55%	45%	52%	48%	54%	46%
Dec	52%	48%	51%	49%	51%	49%

	IRR/GOLF		MUNI	
Read Month (t)	t-1	t	t-1	t
Jan	69%	31%	53%	47%
Feb	50%	50%	52%	48%
Mar	41%	59%	45%	55%
Apr	39%	61%	38%	62%
May	30%	70%	36%	64%
Jun	44%	56%	42%	58%
Jul	47%	53%	48%	52%
Aug	50%	50%	47%	53%
Sep	53%	47%	52%	48%
Oct	55%	45%	63%	37%
Nov	66%	34%	59%	41%
Dec	57%	43%	66%	34%

ATTACHMENT 2 WEATHER DATA

The weather data are from CIMIS Station 104 (DeLaveaga)

Average maximum daily air temperature (F)

	Month											
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1990										75.0	67.0	58.0
1991	59.5	65.6	57.0	66.9	66.3	66.9	68.6	74.8	71.0	72.8	68.3	61.3
1992	61.8	63.8	62.9	71.7	69.6	69.3	77.2	75.9	74.6	73.8	67.7	58.1
1993	59.1	59.2	66.2	68.8	69.2	76.0	70.1	74.2	73.9	72.8	66.4	60.9
1994	62.8	58.6	65.8	66.3	67.1	75.3	66.8	74.4	72.8	71.0	58.8	57.7
1995	58.4	63.9	62.2	64.7	64.4	71.4	76.6	75.4	75.2	72.9	70.1	61.0
1996	61.1	64.2	69.5	75.8	78.0	84.5	88.2	93.4	78.3	71.0	63.9	59.9
1997	58.8	63.1	66.2	69.2	76.8	72.5	71.1	77.5	81.4	73.7	65.8	61.4
1998	59.6	58.3	62.1	64.0	64.5	68.8	73.3	76.3	72.7	71.5	62.4	58.5
1999	60.8	58.4	57.9	63.6	65.1	67.8	72.2	74.1	70.1	73.5	63.2	62.5
2000	57.7	60.3	63.2	67.8	71.5	70.5	72.1	72.6	74.9	66.5	61.2	63.7
2001	58.7	57.7	63.9	63.3	73.0	77.0	69.7	73.9	70.6	69.1	63.7	57.3
2002	56.8	63.2	61.3	63.3	68.2	73.4	71.6	72.1	75.4	68.8	68.5	59.0
2003	64.8	61.3	65.0	61.0	70.4	71.6	74.7	76.9	76.8	76.6	61.4	58.1
2004	57.5	58.3	70.4	68.2	72.4	72.4	72.0	74.3	78.2	68.3	61.6	60.5
2005	59.4	61.6	64.2	65.9	69.9	70.4	71.9	71.0	70.3	69.0	65.7	55.2
2006	56.8	63.7	56.1	60.7	68.4	72.9	76.8	70.0	71.4	70.5	64.7	60.2
2007	57.9	59.7	66.9	66.7	68.8	73.3	75.2	75.0	73.9	70.3	66.0	56.6
2008	55.9	60.3	65.5	67.7	68.5	74.8	73.0	73.6	75.0	75.2	66.6	57.9
2009	65.2	58.9	62.9	66.6	68.1	70.2	73.4	74.7	77.2	69.1	66.5	57.5
2010	60.0	60.0	63.2	62.5	67.5	73.2	68.3	70.4	76.6	68.7	63.6	57.9
2011	62.9	58.9	61.1	65.7	67.5	67.5	71.4	69.9	72.4	72.0	62.1	60.3
2012	62.5	62.2	59.4	65.4	69.8	72.5	70.2	73.7	71.2	72.8	66.7	56.6
2013	60.6	61.4	65.4	68.7	73.2	73.1	69.6	75.3	77.6	70.3	67.1	64.2
2014	68.5	61.4	66.5	68.4	75.6	71.5	72.9	72.8	74.3	77.2	66.4	60.1
2015	66.9	66.2	71.7	68.0								
Avg	**60.6**	**61.2**	**63.9**	**66.4**	**69.7**	**72.4**	**72.8**	**74.7**	**74.4**	**71.7**	**65.0**	**59.4**

Monthly total precipitation (in)

	Month											
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1990										4.8	0.6	1.6
1991	0.8	4.9	11.6	0.8	0.1	0.3	0.0	0.1	0.1	2.4	1.5	4.2
1992	3.2	11.3	4.1	0.3	0.0	0.7	0.0	0.5	0.4	1.5	0.3	7.9
1993	14.8	8.7	3.8	1.5	1.5	1.1	0.6	0.5	0.3	0.7	2.0	3.9
1994	2.6	8.0	0.0	2.1	2.3	0.6	0.5	0.6	0.4	1.0	5.1	3.3
1995	18.6	0.5	9.6	5.0	1.2	2.5	0.0	0.0	0.7	1.5	0.0	0.7
1996	10.3	8.6	4.1	2.2	3.5	0.0	0.0	0.0	0.2	2.5	6.8	15.2
1997	10.1	0.3	1.4	0.8	0.1	0.1	0.0	0.5	0.2	0.5	8.9	3.6
1998	15.0	18.7	4.3	3.1	3.3	0.1	0.0	0.0	0.1	0.9	6.0	1.4
1999	7.9	10.3	3.6	2.8	0.0	0.3	0.0	0.0	0.1	0.3	3.7	0.5
2000	11.4	9.9	2.3	1.7	1.4	0.2	0.0	0.2	0.5	4.6	1.2	1.1
2001	5.7	7.0	3.4	1.9	0.0	0.1	0.0	0.0	0.2	0.8	6.2	11.3
2002	3.7	2.3	4.0	0.4	0.8	0.0	0.0	0.0	0.0	0.0	4.4	5.7
2003	2.0	1.9	1.6	0.5	1.1	0.0	0.0	0.0	0.0	0.1	1.8	9.4
2004	3.2	5.9	1.4	0.8	0.1	0.0	0.0	0.0	0.0	5.3	2.9	10.5
2005	5.7	5.9	7.5	2.9	1.0	0.0	0.0	0.0	0.0	0.2	2.0	13.4
2006	6.2	2.7	11.1	6.9	0.8	0.0	0.0	0.0	0.0	0.0	2.0	4.9
2007	0.8	6.2	0.3	1.7	0.6	0.0	0.0	0.0	0.0	1.1	0.6	1.5
2008	12.6	6.5	0.5	0.6	0.1	0.0	0.0	0.0	0.0	1.0	2.1	3.0
2009	1.8	11.3	2.0	0.6	1.7	0.0	0.0	0.0	0.0	4.7	0.3	4.4
2010	9.4	6.5	4.0	4.6	0.8	0.0	0.0	0.2	0.0	3.4	4.2	10.2
2011	2.2	6.3	11.9	0.7	1.8	2.5	0.1	0.1	0.1	2.7	2.6	0.1
2012	3.7	1.0	7.3	3.0	0.1	0.3	0.0	0.0	0.0	0.1	6.0	9.0
2013	0.9	0.3	1.7	0.9	0.0	0.1	0.0	0.1	0.1	0.1	0.3	0.1
2014	0.0	3.2	1.4	0.5	0.0	0.1	0.2	0.0	1.0	0.0	3.2	11.8
2015	0.0	0.0	0.0	0.0								
Avg	**6.1**	**5.9**	**4.1**	**1.8**	**0.9**	**0.4**	**0.1**	**0.1**	**0.2**	**1.6**	**3.0**	**5.5**

Monthly total ETo (in)

	Month											
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1990										3.4	2.2	1.7
1991	1.7	2.1	2.3	4.5	4.6	4.7	4.5	4.3	3.3	2.8	2.1	1.5
1992	1.8	1.9	2.8	4.9	5.1	5.0	5.7	5.1	4.1	2.8	1.9	1.1
1993	1.2	1.6	3.5	4.9	4.9	6.1	4.8	4.8	3.7	2.8	2.1	1.4
1994	1.9	1.9	3.9	4.1	4.7	6.3	4.2	5.2	3.9	2.8	1.3	0.9
1995	0.9	1.9	2.8	3.7	3.0	5.3	5.9	5.3	4.1	3.2	2.0	1.2
1996	1.5	1.7	3.9	4.7	5.4	5.6	5.6	5.3	3.9	3.1	1.5	1.1
1997	1.3	2.7	3.9	5.0	6.1	5.5	4.7	5.1	4.9	3.3	1.6	1.6
1998	1.2	1.4	3.2	4.2	4.2	4.5	5.2	5.3	3.4	3.1	1.6	1.5
1999	1.6	1.9	3.3	4.4	5.1	5.3	5.5	4.8	3.3	3.4	1.6	1.8
2000	1.1	1.6	4.0	4.7	5.4	5.4	5.3	4.7	3.9	2.4	1.8	1.6
2001	1.7	2.1	3.6	4.4	6.0	6.4	4.9	4.9	3.6	2.8	1.5	1.0
2002	1.6	2.4	3.7	3.6	5.4	5.9	5.2	4.5	4.3	2.8	2.1	1.7
2003	1.8	2.2	3.9	3.9	5.3	5.0	5.6	5.3	4.2	3.5	1.6	1.0
2004	1.5	1.9	4.3	4.9	5.9	5.6	4.6	4.6	4.3	2.7	1.8	1.4
2005	1.5	1.9	3.3	4.2	4.7	4.9	4.7	3.9	3.2	2.6	1.9	1.0
2006	1.4	2.2	2.6	2.7	4.9	5.0	5.3	4.1	3.4	2.9	1.6	1.3
2007	2.0	1.7	4.1	4.5	5.4	5.9	5.5	5.3	4.0	3.1	2.0	1.4
2008	1.3	2.3	4.1	5.4	5.6	6.0	5.9	5.6	4.6	3.8	1.9	1.5
2009	2.0	2.0	4.0	4.7	4.7	5.4	5.5	5.1	4.4	3.0	2.0	1.2
2010	1.3	1.7	3.7	3.9	5.2	6.1	4.7	4.6	4.2	2.5	1.9	0.9
2011	1.9	2.3	3.1	4.5	5.3	4.9	5.4	4.2	3.7	2.8	1.8	1.8
2012	2.0	2.6	3.0	4.5	5.6	6.0	5.1	4.8	3.9	2.8	1.7	1.1
2013	2.0	2.5	3.8	4.9	5.9	5.3	5.0	5.0	4.4	3.2	2.1	2.1
2014	2.4	1.9	3.7	4.7	6.2	5.5	5.1	4.6	3.7	2.9	1.7	1.1
2015	2.2	2.4	4.5	4.7								
Avg	**1.6**	**2.0**	**3.6**	**4.4**	**5.2**	**5.5**	**5.2**	**4.8**	**3.9**	**3.0**	**1.8**	**1.4**

ATTACHMENT 3 ECONOMIC DATA

Inside city water rate per unit (100 cubic feet = 748 gallons = 1 billing unit)

			SFR and duplex* customers, In City							
Year	Billing cycle	Effective date	Units 1-4	Units 5-8	Unit 9	Units 10-14	Units 15-18	Units 19-40	Units 40+	MFR and CII
1999	Bi-monthly		0.76	0.76	1.81	1.81	1.81	1.81	3.31	1.81
2000	Bi-monthly		0.76	0.76	1.81	1.81	1.81	1.81	3.31	1.81
2001	Bi-monthly		0.76	0.76	1.81	1.81	1.81	1.81	3.31	1.81
2002	Bi-monthly		0.76	0.76	1.81	1.81	1.81	1.81	3.31	1.81
2003	Bi-monthly		0.76	0.76	1.81	1.81	1.81	1.81	3.31	1.81
2004	Bi-monthly	6/9/2004	0.90	2.30	2.30	2.95	4.05	5.05	5.05	2.30
2005	Monthly	1/1/2005	1.08	2.76	2.76	3.54	4.86	6.06	6.06	2.76
2005	Monthly	9/1/2005	1.05	2.68	2.68	3.44	4.72	5.88	5.88	2.68
2006	Monthly	1/1/2006	1.21	3.08	3.08	3.95	5.43	6.77	6.77	3.08
2007	Monthly	1/1/2007	1.36	3.47	3.47	4.45	6.10	7.61	7.61	3.47
2008	Monthly	1/1/2008	1.49	3.81	3.81	4.89	6.71	8.37	8.37	3.81
2009	Monthly		1.49	3.81	3.81	4.89	6.71	8.37	8.37	3.81
2010	Monthly		1.49	3.81	3.81	4.89	6.71	8.37	8.37	3.81
2011	Monthly	1/1/2011	1.57	4.00	4.00	5.14	7.05	8.79	8.79	4.00
2012	Monthly		1.57	4.00	4.00	5.14	7.05	8.79	8.79	4.00
2013	Monthly		1.57	4.00	4.00	5.14	7.05	8.79	8.79	4.00
2014	Monthly	1/1/2014	1.73	4.40	4.40	5.66	7.76	9.67	9.67	4.40

Outside city water rate per unit (100 cubic feet = 748 gallons = 1 billing unit)

			SFR and duplex* customers							
Year	Billing cycle	Effective date	Units 1-4	Units 5-8	Unit 9	Units 10-14	Units 15-18	Units 19-40	Units 40+	MFR and CII
1999	Bi-monthly		0.97	0.97	2.29	2.29	2.29	2.29	3.79	2.29
2000	Bi-monthly		0.97	0.97	2.29	2.29	2.29	2.29	3.79	2.29
2001	Bi-monthly		0.97	0.97	2.29	2.29	2.29	2.29	3.79	2.29
2002	Bi-monthly		0.97	0.97	2.29	2.29	2.29	2.29	3.79	2.29
2003	Bi-monthly		0.97	0.97	2.29	2.29	2.29	2.29	3.79	2.29
2004	Bi-monthly	6/9/2004	1.15	2.93	2.93	3.76	5.16	6.44	6.44	2.93
2005	Bi-monthly	1/1/2005	1.38	3.52	3.52	4.51	6.19	7.73	7.73	3.52
2005	Bi-monthly	9/1/2005	1.34	3.42	3.42	4.38	6.01	7.50	7.50	3.42
2006	Bi-monthly	1/1/2006	1.54	3.93	3.93	5.04	6.91	8.63	8.63	3.93
2007	Bi-monthly	1/1/2007	1.73	4.42	4.42	5.67	7.78	9.71	9.71	4.42
2008	Bi-monthly	1/1/2008	1.91	4.86	4.86	6.23	8.56	10.68	10.68	4.86
2009	Bi-monthly		1.91	4.86	4.86	6.23	8.56	10.68	10.68	4.86
2010	Bi-monthly		1.91	4.86	4.86	6.23	8.56	10.68	10.68	4.86
2011	Bi-monthly	1/1/2011	2.00	5.10	5.10	6.55	8.98	11.21	11.21	5.10
2012	Bi-monthly		2.00	5.10	5.10	6.55	8.98	11.21	11.21	5.10
2013	Bi-monthly		2.00	5.10	5.10	6.55	8.98	11.21	11.21	5.10
2014	Monthly	1/1/2014	2.20	5.61	5.61	7.21	9.88	12.34	12.34	5.61

Per capita and median household income (2013 dollars)

		Per Capita			Median Household		
Year	**Source**	**County**	**Inside City**	**Outside City**	**County**	**Inside City**	**Outside City**
1999	Census	37,605	36,696	40,980	76,688	71,845	76,369
2000	imputed	42,919	35,797	48,603	87,525	70,681	89,610
2001	imputed	33,542	42,936	50,199	68,402	84,777	92,552
2002	imputed	31,937	33,580	42,814	65,129	66,302	78,936
2003	imputed	32,876	31,349	39,566	67,044	61,898	72,948
2004	imputed	34,384	32,439	40,287	70,120	64,050	74,278
2005	imputed	39,701	35,403	41,088	71,081	69,901	75,755
2006	imputed	37,448	36,600	42,144	73,033	72,265	77,700
2007	imputed	38,394	35,945	44,607	72,534	67,295	82,242
2008	imputed	38,512	37,986	44,979	74,414	69,710	82,928
2009	ACS	32,865	36,359	40,101	67,341	65,474	73,816
2010	ACS	31,390	31,790	40,161	65,969	63,899	73,206
2011	ACS	32,026	29,917	39,611	65,813	62,507	72,032
2012	ACS	34,279	29,949	38,713	69,483	64,215	73,334
2013	ACS	31,609	29,604	37,847	68,630	62,756	68,983
2014	imputed	31,812	29,793	38,090	69,069	63,157	69,425

California Department of Finance Report E-8
Housing Vacancy Rates

Year	Date	Santa Cruz	Capitola	County
1991	1/1/1991	6.3	11.4	3.6
1992	1/1/1992	6.1	11.4	3.4
1993	1/1/1993	6.0	11.5	3.3
1994	1/1/1994	5.8	11.5	3.1
1995	1/1/1995	5.7	11.5	3.0
1996	1/1/1996	5.5	11.5	2.8
1997	1/1/1997	5.4	11.6	2.8
1998	1/1/1998	5.2	11.6	2.6
1999	1/1/1999	5.1	11.6	2.5
2000	1/1/2000	5.0	11.6	2.4
2001	1/1/2001	5.1	12.0	2.5
2002	1/1/2002	5.3	12.5	2.7
2003	1/1/2003	5.4	13.0	2.9
2004	1/1/2004	5.6	13.5	3.1
2005	1/1/2005	6.9	13.9	3.3
2006	1/1/2006	6.6	14.4	3.6
2007	1/1/2007	6.7	14.9	3.8
2008	1/1/2008	6.9	15.3	3.9
2009	1/1/2009	6.9	15.8	4.1
2010	1/1/2010	7.1	16.3	4.3
2011	1/1/2011	7.1	16.4	9.6
2012	1/1/2012	7.0	16.4	9.5
2013	1/1/2013	7.0	16.4	9.4
2014	1/1/2014	6.8	16.3	9.2

California Employment Development Department
Unemployment Rates

Year	County	Santa Cruz
1990	7.2	
1991	8.8	
1992	9.7	
1993	10.4	
1994	9.7	
1995	9.3	
1996	8.5	
1997	7.9	
1998	7.3	
1999	6.4	
2000	5.1	4.2
2001	5.7	4.7
2002	7.3	6.1
2003	7.7	6.4
2004	7	5.8
2005	6.3	5.2
2006	5.6	4.6
2007	5.9	4.9
2008	7.4	6.1
2009	11.1	9.4
2010	13.3	11.9
2011	13.1	11.7
2012	11.8	10.6
2013	10.3	9.2
2014	8.7	7.8

ATTACHMENT 4 CONSERVATION ADJUSTMENT DATA

SFR Inside City Plumbing Code Water Savings Since 2000 (MG)

	Month												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Annual**
2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	8.1
2002	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4	15.7
2003	1.4	1.5	1.6	1.7	1.8	1.9	1.9	2.0	2.1	2.2	2.3	2.4	22.8
2004	2.4	2.4	2.4	2.4	2.4	2.5	2.5	2.5	2.5	2.5	2.5	2.6	29.6
2005	2.6	2.7	2.8	2.8	2.9	3.0	3.0	3.1	3.2	3.2	3.3	3.4	36.0
2006	3.4	3.4	3.4	3.5	3.5	3.5	3.5	3.5	3.5	3.6	3.6	3.6	41.9
2007	3.6	3.7	3.8	3.8	3.9	3.9	4.0	4.0	4.1	4.2	4.2	4.3	47.5
2008	4.3	4.3	4.3	4.4	4.4	4.4	4.4	4.4	4.5	4.5	4.5	4.5	52.8
2009	4.6	4.6	4.7	4.7	4.8	4.8	4.8	4.9	4.9	5.0	5.0	5.1	57.9
2010	5.1	5.1	5.2	5.2	5.2	5.2	5.2	5.3	5.3	5.3	5.3	5.3	62.7
2011	5.4	5.4	5.5	5.5	5.5	5.6	5.6	5.7	5.7	5.8	5.8	5.8	67.3
2012	5.9	5.9	5.9	5.9	5.9	6.0	6.0	6.0	6.0	6.1	6.1	6.1	71.8
2013	6.1	6.2	6.2	6.2	6.3	6.3	6.4	6.4	6.4	6.5	6.5	6.5	76.0
2014	6.6	6.6	6.7	6.7	6.8	6.8	6.9	6.9	7.0	7.0	7.0		74.9

SFR Outside City Plumbing Code Water Savings Since 2000 (MG)

	Month												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Annual**
2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.5	0.5	0.6	0.6	0.7	4.5
2002	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	8.8
2003	0.8	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.2	1.2	1.3	1.3	12.8
2004	1.3	1.3	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	16.7
2005	1.5	1.5	1.6	1.6	1.6	1.7	1.7	1.7	1.8	1.8	1.9	1.9	20.3
2006	1.9	1.9	1.9	1.9	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	23.6
2007	2.1	2.1	2.1	2.1	2.2	2.2	2.2	2.3	2.3	2.3	2.4	2.4	26.7
2008	2.4	2.4	2.4	2.4	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	29.7
2009	2.6	2.6	2.6	2.6	2.7	2.7	2.7	2.8	2.8	2.8	2.8	2.9	32.6
2010	2.9	2.9	2.9	2.9	2.9	2.9	2.9	3.0	3.0	3.0	3.0	3.0	35.3
2011	3.0	3.1	3.1	3.1	3.1	3.1	3.2	3.2	3.2	3.2	3.3	3.3	37.9
2012	3.3	3.3	3.3	3.3	3.3	3.4	3.4	3.4	3.4	3.4	3.4	3.4	40.4
2013	3.5	3.5	3.5	3.5	3.5	3.6	3.6	3.6	3.6	3.6	3.7	3.7	42.7
2014	3.7	3.7	3.8	3.8	3.8	3.8	3.9	3.9	3.9	3.9	4.0		42.1

SFR Inside City Housing Units

	Month											
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2000	11,516	11,519	11,523	11,526	11,530	11,533	11,537	11,540	11,544	11,547	11,551	11,554
2001	11,559	11,564	11,569	11,574	11,579	11,584	11,588	11,593	11,598	11,603	11,608	11,613
2002	11,624	11,634	11,645	11,656	11,666	11,677	11,688	11,698	11,709	11,720	11,730	11,741
2003	11,748	11,755	11,762	11,769	11,776	11,783	11,789	11,796	11,803	11,810	11,817	11,824
2004	11,827	11,829	11,832	11,835	11,837	11,840	11,843	11,845	11,848	11,851	11,853	11,856
2005	11,859	11,862	11,865	11,867	11,870	11,873	11,876	11,879	11,882	11,884	11,887	11,890
2006	11,896	11,903	11,909	11,915	11,922	11,928	11,934	11,941	11,947	11,953	11,960	11,966
2007	11,972	11,978	11,984	11,990	11,996	12,003	12,009	12,015	12,021	12,027	12,033	12,039
2008	12,039	12,039	12,039	12,039	12,039	12,039	12,038	12,038	12,038	12,038	12,038	12,038
2009	12,042	12,045	12,049	12,052	12,056	12,060	12,063	12,067	12,070	12,074	12,077	12,081
2010	12,084	12,088	12,091	12,095	12,098	12,102	12,105	12,108	12,112	12,115	12,119	12,122
2011	12,123	12,125	12,126	12,127	12,129	12,130	12,131	12,133	12,134	12,135	12,137	12,138
2012	12,141	12,144	12,147	12,149	12,152	12,155	12,158	12,161	12,164	12,166	12,169	12,172
2013	12,175	12,178	12,181	12,184	12,187	12,190	12,192	12,195	12,198	12,201	12,204	12,207
2014	12,210	12,214	12,217	12,220	12,223	12,227	12,230	12,233	12,236	12,240	12,243	

SFR Outside City Housing Units

	Month											
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2000	6,257	6,263	6,268	6,273	6,279	6,284	6,289	6,295	6,300	6,305	6,311	6,316
2001	6,321	6,325	6,330	6,334	6,339	6,344	6,348	6,353	6,357	6,362	6,366	6,371
2002	6,377	6,383	6,389	6,394	6,400	6,406	6,412	6,418	6,424	6,429	6,435	6,441
2003	6,443	6,445	6,447	6,449	6,451	6,454	6,456	6,458	6,460	6,462	6,464	6,466
2004	6,469	6,471	6,474	6,476	6,479	6,481	6,484	6,486	6,489	6,491	6,494	6,496
2005	6,501	6,506	6,510	6,515	6,520	6,525	6,529	6,534	6,539	6,544	6,548	6,553
2006	6,557	6,561	6,565	6,569	6,573	6,577	6,580	6,584	6,588	6,592	6,596	6,600
2007	6,609	6,618	6,627	6,636	6,645	6,654	6,662	6,671	6,680	6,689	6,698	6,707
2008	6,708	6,709	6,711	6,712	6,713	6,714	6,715	6,716	6,718	6,719	6,720	6,721
2009	6,722	6,723	6,725	6,726	6,727	6,728	6,729	6,730	6,732	6,733	6,734	6,735
2010	6,735	6,736	6,736	6,737	6,737	6,738	6,738	6,738	6,739	6,739	6,740	6,740
2011	6,741	6,741	6,742	6,742	6,743	6,743	6,744	6,744	6,745	6,745	6,746	6,746
2012	6,747	6,748	6,748	6,749	6,750	6,751	6,751	6,752	6,753	6,754	6,754	6,755
2013	6,754	6,754	6,753	6,752	6,751	6,751	6,750	6,749	6,748	6,748	6,747	6,746
2014	6,746	6,746	6,745	6,745	6,745	6,745	6,744	6,744	6,744	6,744	6,743	

SFR Inside City Plumbing Code Water Savings Since 2000 (CCF/Housing Unit)

	Month												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Annual**
2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.9
2002	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	1.8
2003	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	2.6
2004	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	3.3
2005	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	4.1
2006	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	4.7
2007	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	5.3
2008	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5.9
2009	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	6.4
2010	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	6.9
2011	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	7.4
2012	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	7.9
2013	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	8.3
2014	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8		8.2

SFR Outside City Plumbing Code Water Savings Since 2000 (CCF/Housing Unit)

	Month												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Annual**
2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.0
2002	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.8
2003	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	2.7
2004	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	3.4
2005	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	4.2
2006	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	4.8
2007	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	5.4
2008	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5.9
2009	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	6.5
2010	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	7.0
2011	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	7.5
2012	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	8.0
2013	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	8.5
2014	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8		8.4

SFR Inside City Avg Use (CCF/Housing Unit)

	Month												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Annual**
2000	6.5	7.1	7.5	8.6	10.1	11.2	12.0	11.0	9.8	8.7	7.6	7.0	106.9
2001	6.8	7.0	7.1	8.1	10.1	11.3	11.3	11.6	10.9	8.8	7.7	7.2	108.1
2002	6.2	5.9	7.2	8.6	10.0	11.2	10.8	10.9	11.3	9.4	8.1	7.1	106.7
2003	6.5	6.5	6.7	7.9	9.5	10.4	11.5	12.1	11.2	9.2	7.6	6.8	105.7
2004	6.5	6.8	7.6	8.9	10.9	12.0	11.2	11.0	9.6	8.0	7.4	7.6	107.7
2005	7.7	7.0	6.0	6.5	8.3	9.6	10.7	10.7	10.0	8.7	7.6	6.8	99.6
2006	5.6	6.1	6.0	5.8	8.3	9.9	11.2	10.6	9.2	8.4	6.9	6.3	94.2
2007	6.1	6.4	6.3	6.9	8.2	9.8	10.9	10.4	9.4	7.7	5.9	6.2	94.1
2008	6.1	6.3	7.3	8.0	8.8	9.7	10.3	9.2	8.5	7.8	6.5	6.0	94.6
2009	5.8	5.3	5.8	6.7	7.4	8.1	8.7	8.7	8.1	7.0	5.8	5.6	83.0
2010	5.9	5.4	5.1	5.7	6.8	8.2	8.7	8.9	8.4	7.1	5.8	5.3	81.3
2011	5.5	5.2	5.1	6.1	6.9	7.3	8.3	8.4	7.6	6.7	5.9	5.6	78.6
2012	5.8	5.6	5.5	5.8	7.0	8.4	8.8	8.4	7.7	7.1	6.0	5.5	81.6
2013	5.4	5.2	5.6	6.4	7.6	8.5	8.5	8.4	7.9	7.6	6.7	6.2	84.1
2014	6.0	5.1	4.9	5.3	5.4	5.6	5.5	5.3	5.1	4.8	4.3		57.3

SFR Outside City Avg Use (CCF/Housing Unit)

	Month												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Annual**
2000	7.1	7.2	7.7	9.2	10.4	11.4	12.9	11.9	11.7	9.5	8.4	7.7	115.1
2001	7.4	7.0	6.8	8.8	10.6	11.7	12.8	11.8	11.6	9.9	8.8	7.5	114.6
2002	6.9	6.9	7.1	8.7	10.3	11.6	13.3	12.5	12.6	10.2	8.8	7.6	116.4
2003	7.0	7.1	7.2	8.1	9.0	11.0	13.9	13.0	12.8	10.4	9.0	7.6	116.1
2004	6.9	7.0	7.6	9.6	11.2	12.0	13.3	12.6	12.6	9.9	8.4	7.7	118.8
2005	7.4	6.7	6.1	7.4	8.7	10.2	12.5	11.5	11.3	9.4	8.5	7.2	107.0
2006	6.4	6.2	5.9	7.0	8.3	10.0	12.2	11.3	11.2	9.4	8.3	7.3	103.5
2007	6.8	6.8	6.7	7.9	8.9	10.0	11.5	10.4	10.3	8.6	7.9	7.0	102.9
2008	6.3	6.0	5.9	7.7	11.0	12.7	9.0	8.4	13.0	11.5	7.4	6.5	105.5
2009	6.0	5.6	6.5	7.6	8.6	9.4	9.6	9.8	8.6	7.5	6.4	5.9	91.5
2010	5.6	5.5	5.8	6.4	7.7	9.1	9.5	9.8	8.8	7.4	6.1	5.7	87.6
2011	5.5	5.4	6.0	6.8	7.8	8.6	8.9	9.2	8.0	7.0	6.3	6.2	85.6
2012	5.9	5.7	6.1	6.7	8.1	9.4	9.4	9.3	8.3	7.3	6.2	5.8	88.3
2013	5.6	5.7	6.4	7.4	8.5	9.3	9.3	9.4	8.7	8.1	7.2	6.7	92.2
2014	6.5	6.8	7.1	5.7	6.0	6.3	6.2	5.9	5.5	5.1	4.5		65.6

SFR Inside City Adjusted Avg Use (CCF/Housing Unit)

	Month												
Year	1	2	3	4	5	6	7	8	9	10	11	12	Annual
2000	6.5	7.1	7.5	8.6	10.1	11.2	12.0	11.0	9.8	8.7	7.6	7.0	106.9
2001	6.8	7.0	7.2	8.1	10.1	11.4	11.4	11.7	11.0	9.0	7.9	7.4	109.0
2002	6.4	6.1	7.3	8.7	10.2	11.4	11.0	11.0	11.5	9.5	8.2	7.2	108.5
2003	6.7	6.7	6.9	8.1	9.7	10.6	11.7	12.3	11.4	9.4	7.9	7.1	108.3
2004	6.8	7.1	7.9	9.2	11.2	12.3	11.5	11.3	9.9	8.3	7.7	7.9	111.0
2005	8.0	7.3	6.3	6.8	8.6	9.9	11.0	11.1	10.4	9.1	7.9	7.2	103.6
2006	6.0	6.5	6.4	6.2	8.7	10.3	11.6	11.0	9.6	8.8	7.3	6.7	98.9
2007	6.5	6.8	6.7	7.3	8.6	10.2	11.3	10.8	9.8	8.2	6.4	6.7	99.4
2008	6.6	6.8	7.8	8.5	9.3	10.2	10.8	9.7	9.0	8.2	7.0	6.5	100.5
2009	6.3	5.8	6.3	7.2	8.0	8.7	9.2	9.2	8.6	7.6	6.4	6.2	89.4
2010	6.4	5.9	5.6	6.3	7.4	8.7	9.3	9.4	9.0	7.7	6.4	5.9	88.2
2011	6.1	5.8	5.7	6.7	7.5	7.9	8.9	9.1	8.2	7.4	6.5	6.3	86.0
2012	6.4	6.3	6.2	6.5	7.6	9.0	9.4	9.0	8.4	7.8	6.7	6.2	89.5
2013	6.1	5.9	6.3	7.1	8.3	9.2	9.2	9.1	8.6	8.3	7.4	6.9	92.4
2014	6.7	5.9	5.6	6.0	6.2	6.3	6.2	6.0	5.9	5.5	5.0		65.4

SFR Outside City Adjusted Avg Use (CCF/Housing Unit)

	Month												
Year	1	2	3	4	5	6	7	8	9	10	11	12	Annual
2000	7.1	7.2	7.7	9.2	10.4	11.4	12.9	11.9	11.7	9.5	8.4	7.7	115.1
2001	7.4	7.0	6.8	8.8	10.7	11.7	12.9	11.9	11.8	10.0	8.9	7.6	115.6
2002	7.0	7.0	7.2	8.9	10.4	11.7	13.5	12.7	12.8	10.4	8.9	7.8	118.3
2003	7.2	7.3	7.4	8.3	9.2	11.2	14.1	13.2	13.1	10.7	9.2	7.9	118.7
2004	7.1	7.3	7.9	9.9	11.5	12.3	13.6	12.8	12.9	10.2	8.7	8.0	122.2
2005	7.7	7.0	6.4	7.7	9.1	10.5	12.8	11.9	11.7	9.8	8.9	7.6	111.1
2006	6.8	6.6	6.3	7.4	8.7	10.4	12.6	11.7	11.6	9.8	8.7	7.7	108.3
2007	7.2	7.2	7.2	8.4	9.4	10.4	12.0	10.9	10.7	9.1	8.4	7.5	108.2
2008	6.8	6.5	6.4	8.2	11.5	13.2	9.5	8.9	13.5	12.0	7.9	7.0	111.4
2009	6.5	6.1	7.0	8.1	9.2	10.0	10.1	10.3	9.1	8.0	7.0	6.5	98.0
2010	6.2	6.0	6.4	7.0	8.3	9.7	10.1	10.4	9.4	8.0	6.7	6.3	94.6
2011	6.1	6.0	6.6	7.4	8.4	9.2	9.5	9.8	8.7	7.6	6.9	6.8	93.1
2012	6.6	6.4	6.7	7.4	8.8	10.1	10.1	9.9	9.0	7.9	6.9	6.5	96.3
2013	6.3	6.3	7.1	8.1	9.2	10.0	10.0	10.1	9.4	8.8	7.9	7.5	100.7
2014	7.3	7.5	7.8	6.4	6.7	7.0	7.0	6.7	6.3	5.9	5.3		74.0

MFR Inside City Plumbing Code Water Savings Since 2000 (MG)

	Month												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Annual**
2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.7	0.8	0.9	1.0	6.4
2002	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	12.4
2003	1.1	1.2	1.3	1.3	1.4	1.5	1.5	1.6	1.7	1.7	1.8	1.9	18.2
2004	1.9	1.9	1.9	1.9	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	23.7
2005	2.1	2.2	2.2	2.3	2.3	2.4	2.4	2.5	2.5	2.6	2.7	2.7	28.9
2006	2.7	2.7	2.8	2.8	2.8	2.8	2.8	2.8	2.9	2.9	2.9	2.9	33.8
2007	2.9	3.0	3.0	3.1	3.1	3.2	3.2	3.3	3.3	3.4	3.4	3.5	38.4
2008	3.5	3.5	3.5	3.5	3.5	3.6	3.6	3.6	3.6	3.6	3.7	3.7	42.9
2009	3.7	3.8	3.8	3.8	3.9	3.9	3.9	4.0	4.0	4.1	4.1	4.1	47.2
2010	4.2	4.2	4.2	4.2	4.2	4.3	4.3	4.3	4.3	4.3	4.4	4.4	51.2
2011	4.4	4.5	4.5	4.5	4.6	4.6	4.7	4.7	4.8	4.8	4.8	4.9	55.7
2012	4.9	4.9	4.9	5.0	5.0	5.0	5.0	5.0	5.1	5.1	5.1	5.1	60.1
2013	5.2	5.2	5.2	5.3	5.3	5.3	5.4	5.4	5.4	5.5	5.5	5.6	64.3
2014	5.6	5.6	5.7	5.7	5.8	5.8	5.9	5.9	5.9	6.0	6.0		64.0

MFR Outside City Plumbing Code Water Savings Since 2000 (MG)

	Month												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Annual**
2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	0.1	0.1	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.7	0.8	0.9	5.6
2002	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	11.0
2003	1.0	1.1	1.1	1.2	1.3	1.3	1.4	1.4	1.5	1.6	1.6	1.7	16.1
2004	1.7	1.7	1.7	1.7	1.7	1.7	1.8	1.8	1.8	1.8	1.8	1.8	21.0
2005	1.9	1.9	2.0	2.0	2.1	2.1	2.2	2.2	2.3	2.3	2.4	2.4	25.6
2006	2.4	2.4	2.4	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.6	2.6	30.0
2007	2.6	2.7	2.7	2.7	2.8	2.8	2.9	2.9	2.9	3.0	3.0	3.1	34.1
2008	3.1	3.1	3.1	3.1	3.1	3.2	3.2	3.2	3.2	3.2	3.2	3.3	38.0
2009	3.3	3.3	3.4	3.4	3.4	3.5	3.5	3.5	3.6	3.6	3.6	3.7	41.8
2010	3.7	3.7	3.7	3.7	3.8	3.8	3.8	3.8	3.8	3.8	3.9	3.9	45.4
2011	3.9	4.0	4.0	4.0	4.1	4.1	4.1	4.2	4.2	4.2	4.3	4.3	49.4
2012	4.3	4.4	4.4	4.4	4.4	4.4	4.4	4.5	4.5	4.5	4.5	4.5	53.3
2013	4.6	4.6	4.6	4.7	4.7	4.7	4.8	4.8	4.8	4.9	4.9	4.9	57.0
2014	5.0	5.0	5.0	5.1	5.1	5.2	5.2	5.2	5.3	5.3	5.4		56.8

MFR Inside City Housing Units

	Month											
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2000	8,667	8,668	8,669	8,670	8,671	8,672	8,673	8,674	8,675	8,675	8,676	8,677
2001	8,682	8,686	8,691	8,695	8,699	8,704	8,708	8,713	8,717	8,722	8,726	8,731
2002	8,732	8,733	8,735	8,736	8,737	8,739	8,740	8,741	8,743	8,744	8,745	8,747
2003	8,755	8,763	8,771	8,779	8,787	8,795	8,802	8,810	8,818	8,826	8,834	8,842
2004	8,858	8,873	8,888	8,903	8,918	8,933	8,948	8,963	8,978	8,993	9,009	9,024
2005	9,036	9,048	9,060	9,072	9,084	9,096	9,108	9,120	9,132	9,144	9,156	9,168
2006	9,170	9,172	9,174	9,176	9,179	9,181	9,183	9,185	9,188	9,190	9,192	9,194
2007	9,205	9,216	9,226	9,237	9,248	9,258	9,269	9,280	9,290	9,301	9,312	9,322
2008	9,325	9,328	9,331	9,335	9,338	9,341	9,344	9,347	9,350	9,353	9,356	9,359
2009	9,365	9,371	9,377	9,383	9,388	9,394	9,400	9,406	9,411	9,417	9,423	9,429
2010	9,434	9,439	9,443	9,448	9,453	9,458	9,463	9,468	9,473	9,478	9,483	9,487
2011	9,488	9,488	9,489	9,489	9,490	9,490	9,491	9,491	9,491	9,492	9,492	9,493
2012	9,493	9,493	9,493	9,493	9,493	9,493	9,493	9,493	9,493	9,493	9,493	9,493
2013	9,495	9,496	9,498	9,500	9,502	9,503	9,505	9,507	9,509	9,510	9,512	9,514
2014	9,518	9,523	9,527	9,532	9,536	9,541	9,545	9,550	9,554	9,558	9,563	

MFR Outside City Housing Units

	Month											
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2000	7,940	7,938	7,935	7,932	7,929	7,926	7,924	7,921	7,918	7,915	7,912	7,910
2001	7,910	7,911	7,912	7,912	7,913	7,914	7,915	7,915	7,916	7,917	7,917	7,918
2002	7,915	7,912	7,910	7,907	7,904	7,901	7,898	7,896	7,893	7,890	7,887	7,885
2003	7,885	7,886	7,887	7,887	7,888	7,889	7,889	7,890	7,891	7,892	7,892	7,893
2004	7,893	7,893	7,893	7,893	7,893	7,893	7,893	7,893	7,893	7,893	7,893	7,893
2005	7,896	7,900	7,903	7,907	7,910	7,914	7,917	7,921	7,924	7,928	7,931	7,935
2006	7,936	7,938	7,939	7,940	7,942	7,943	7,945	7,946	7,947	7,949	7,950	7,952
2007	7,950	7,949	7,947	7,946	7,945	7,943	7,942	7,940	7,939	7,938	7,936	7,935
2008	7,933	7,932	7,931	7,929	7,928	7,926	7,925	7,924	7,922	7,921	7,919	7,918
2009	7,917	7,915	7,914	7,912	7,911	7,910	7,908	7,907	7,905	7,904	7,903	7,901
2010	7,903	7,904	7,905	7,907	7,908	7,910	7,911	7,912	7,914	7,915	7,917	7,918
2011	7,915	7,912	7,910	7,907	7,904	7,901	7,898	7,896	7,893	7,890	7,887	7,885
2012	7,885	7,886	7,887	7,887	7,888	7,889	7,889	7,890	7,891	7,892	7,892	7,893
2013	7,893	7,893	7,893	7,893	7,893	7,893	7,893	7,893	7,893	7,893	7,893	7,893
2014	7,894	7,894	7,895	7,896	7,896	7,897	7,898	7,898	7,899	7,900	7,901	

MFR Inside City Plumbing Code Water Savings Since 2000 (CCF/Housing Unit)

	Month												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Annual**
2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	1.0
2002	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.9
2003	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	2.8
2004	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	3.5
2005	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	4.2
2006	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	4.9
2007	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5.5
2008	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	6.1
2009	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	6.7
2010	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	7.2
2011	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	7.9
2012	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	8.5
2013	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	9.0
2014	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8		9.0

MFR Outside City Plumbing Code Water Savings Since 2000 (CCF/Housing Unit)

	Month												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Annual**
2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.0
2002	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.9
2003	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	2.7
2004	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	3.6
2005	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	4.3
2006	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	5.0
2007	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5.7
2008	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	6.4
2009	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	7.1
2010	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	7.7
2011	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	8.4
2012	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	9.0
2013	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	9.7
2014	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9		9.6

MFR Inside City Avg Use (CCF/Housing Unit)

	Month												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Annual**
2000	5.1	5.3	5.3	5.6	6.2	6.5	6.5	6.5	6.1	5.8	5.5	5.2	69.5
2001	5.2	5.3	5.0	5.3	6.1	6.5	6.2	6.2	6.1	5.8	5.4	5.1	68.2
2002	4.5	4.5	5.3	5.7	5.8	6.2	5.7	5.8	5.9	5.5	5.1	4.8	64.8
2003	4.6	4.6	4.7	5.0	5.6	5.8	5.9	6.3	6.0	5.3	4.8	4.7	63.2
2004	4.8	5.4	5.3	5.0	6.0	6.3	5.9	5.6	5.0	4.9	4.8	5.3	64.2
2005	5.9	5.6	4.4	4.3	5.3	5.3	5.6	5.6	5.3	5.0	4.8	4.6	61.6
2006	4.1	4.7	4.2	3.8	5.5	5.3	5.8	5.4	5.1	5.0	4.2	4.4	57.7
2007	4.2	4.7	4.2	4.1	4.7	5.3	6.0	5.6	5.2	4.8	3.8	4.1	56.7
2008	4.6	4.7	5.0	4.8	4.7	5.2	5.6	5.1	4.9	4.7	4.2	3.9	57.5
2009	4.0	3.9	4.0	4.3	4.6	4.7	4.8	4.8	4.6	4.5	4.1	3.9	52.2
2010	4.3	4.0	3.7	4.0	4.5	4.7	4.8	4.9	4.7	4.6	4.1	3.8	52.4
2011	4.0	3.9	3.7	4.2	4.5	4.5	4.7	4.8	4.5	4.2	4.0	3.8	51.0
2012	3.9	4.1	3.9	4.0	4.4	4.8	4.9	4.7	4.4	4.4	4.2	3.9	51.5
2013	3.9	3.7	3.9	4.1	4.5	4.7	4.6	4.6	4.5	4.6	4.3	4.0	51.6
2014	3.9	3.6	3.6	3.7	3.7	3.7	3.6	3.6	3.5	3.4	3.2		39.7

MFR Outside City Avg Use (CCF/Housing Unit)

	Month												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Annual**
2000	5.1	5.2	5.4	5.8	6.1	6.1	6.6	6.5	6.7	6.0	5.8	5.5	70.8
2001	5.3	4.9	4.9	5.8	6.4	6.4	6.6	6.4	6.6	6.0	5.8	5.5	70.5
2002	5.2	4.8	4.9	5.5	5.9	6.1	6.5	6.3	6.6	5.8	5.5	5.1	68.4
2003	4.9	4.9	5.0	5.2	5.5	6.0	6.6	6.3	6.4	5.7	5.3	4.9	66.8
2004	4.7	4.8	4.9	5.5	6.0	5.9	6.2	6.1	6.2	5.5	5.2	5.0	66.0
2005	5.1	4.6	4.3	4.8	5.4	5.6	5.9	5.7	5.9	5.4	5.1	4.7	62.4
2006	4.5	4.3	4.3	4.7	5.0	5.3	5.7	5.5	5.7	5.2	4.9	4.5	59.6
2007	4.3	4.2	4.2	4.6	4.9	5.0	5.3	5.0	5.1	4.7	4.7	4.5	56.6
2008	4.3	4.0	3.9	4.5	6.0	6.0	4.2	4.2	6.6	6.1	4.2	4.2	58.2
2009	4.0	3.9	4.2	4.6	4.9	5.1	5.1	5.2	4.6	4.4	4.1	4.0	54.1
2010	3.9	4.0	4.1	4.2	4.8	5.3	5.3	5.3	4.7	4.5	4.1	4.0	54.2
2011	3.9	3.9	4.2	4.6	4.8	5.0	5.1	5.1	4.5	4.3	4.1	4.2	53.6
2012	4.0	3.9	4.1	4.3	4.8	5.4	5.2	5.1	4.6	4.4	4.2	4.1	54.2
2013	3.9	3.9	4.2	4.5	4.9	5.3	5.2	5.2	4.8	4.7	4.4	4.2	55.3
2014	3.9	4.4	5.0	3.9	3.8	3.9	4.0	3.9	3.8	3.6	3.4		43.5

MFR Inside City Adjusted Avg Use (CCF/Housing Unit)

	Month												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Annual**
2000	5.1	5.3	5.3	5.6	6.2	6.5	6.5	6.5	6.1	5.8	5.5	5.2	69.5
2001	5.2	5.3	5.0	5.3	6.2	6.6	6.3	6.3	6.2	5.9	5.5	5.3	69.1
2002	4.6	4.6	5.4	5.9	6.0	6.3	5.9	6.0	6.1	5.7	5.3	5.0	66.7
2003	4.8	4.8	4.9	5.2	5.8	6.0	6.1	6.5	6.2	5.5	5.1	5.0	66.0
2004	5.1	5.6	5.5	5.3	6.3	6.6	6.2	5.9	5.3	5.2	5.1	5.6	67.8
2005	6.2	5.9	4.7	4.7	5.6	5.6	6.0	6.0	5.6	5.4	5.2	4.9	65.9
2006	4.5	5.1	4.6	4.2	5.9	5.8	6.2	5.8	5.5	5.5	4.7	4.8	62.6
2007	4.6	5.1	4.7	4.5	5.2	5.8	6.5	6.0	5.7	5.3	4.2	4.6	62.3
2008	5.1	5.2	5.5	5.4	5.3	5.7	6.2	5.6	5.4	5.3	4.7	4.5	63.6
2009	4.6	4.4	4.6	4.9	5.1	5.2	5.3	5.4	5.2	5.1	4.7	4.5	58.9
2010	4.9	4.6	4.3	4.6	5.1	5.3	5.4	5.5	5.3	5.2	4.8	4.4	59.6
2011	4.7	4.5	4.4	4.8	5.2	5.2	5.4	5.5	5.2	4.9	4.7	4.5	58.8
2012	4.6	4.8	4.6	4.7	5.1	5.5	5.6	5.4	5.2	5.1	4.9	4.6	60.0
2013	4.6	4.5	4.6	4.9	5.3	5.5	5.4	5.4	5.3	5.4	5.1	4.8	60.7
2014	4.7	4.4	4.4	4.5	4.5	4.5	4.5	4.4	4.3	4.3	4.1		48.7

MFR Outside City Adjusted Avg Use (CCF/Housing Unit)

	Month												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Annual**
2000	5.1	5.2	5.4	5.8	6.1	6.1	6.6	6.5	6.7	6.0	5.8	5.5	70.8
2001	5.3	5.0	4.9	5.8	6.4	6.5	6.7	6.5	6.7	6.1	5.9	5.7	71.5
2002	5.4	5.0	5.1	5.7	6.1	6.3	6.7	6.5	6.7	6.0	5.7	5.3	70.3
2003	5.1	5.1	5.1	5.4	5.7	6.3	6.8	6.6	6.7	6.0	5.6	5.2	69.5
2004	5.0	5.1	5.2	5.8	6.2	6.2	6.5	6.4	6.5	5.8	5.5	5.3	69.6
2005	5.4	4.9	4.6	5.2	5.7	6.0	6.3	6.1	6.2	5.8	5.5	5.1	66.8
2006	4.9	4.7	4.7	5.1	5.4	5.7	6.1	5.9	6.1	5.6	5.3	5.0	64.6
2007	4.8	4.7	4.7	5.0	5.3	5.5	5.8	5.5	5.6	5.3	5.2	5.0	62.3
2008	4.8	4.5	4.4	5.0	6.6	6.5	4.7	4.7	7.2	6.7	4.7	4.8	64.6
2009	4.6	4.4	4.8	5.2	5.4	5.7	5.7	5.8	5.2	5.0	4.7	4.6	61.2
2010	4.5	4.6	4.7	4.9	5.4	5.9	6.0	6.0	5.4	5.2	4.7	4.6	61.9
2011	4.5	4.5	4.9	5.2	5.5	5.7	5.8	5.8	5.2	5.0	4.8	4.9	62.0
2012	4.7	4.7	4.9	5.0	5.6	6.1	6.0	5.9	5.3	5.2	4.9	4.9	63.2
2013	4.7	4.7	5.0	5.3	5.7	6.1	6.0	6.0	5.6	5.6	5.2	5.0	65.0
2014	4.7	5.3	5.8	4.7	4.6	4.8	4.9	4.8	4.7	4.5	4.3		53.1

BUS Inside City Plumbing Code Water Savings Since 2000 (MG)

	Month												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Annual**
2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.4	2.3
2002	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	4.6
2003	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.7	6.8
2004	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	8.9
2005	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	10.9
2006	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	12.8
2007	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	14.6
2008	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	16.4
2009	1.4	1.4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.6	1.6	1.6	18.1
2010	1.6	1.6	1.6	1.6	1.6	1.6	1.7	1.7	1.7	1.7	1.7	1.7	19.8
2011	1.7	1.7	1.7	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.9	1.9	21.5
2012	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	2.0	2.0	2.0	2.0	23.2
2013	2.0	2.0	2.0	2.0	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.2	24.9
2014	2.2	2.2	2.2	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1		23.6

BUS Outside City Plumbing Code Water Savings Since 2000 (MG)

	Month												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Annual**
2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	1.1
2002	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	2.3
2003	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	3.3
2004	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	4.4
2005	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	5.4
2006	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	6.3
2007	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	7.2
2008	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	8.1
2009	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	8.9
2010	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	9.7
2011	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	10.6
2012	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	11.4
2013	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	12.3
2014	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1		11.6

BUS Inside City Services

	Month											
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2000	1,273	1,276	1,278	1,280	1,283	1,285	1,287	1,290	1,292	1,294	1,297	1,299
2001	1,297	1,294	1,292	1,289	1,287	1,285	1,282	1,280	1,277	1,275	1,272	1,270
2002	1,269	1,269	1,268	1,267	1,267	1,266	1,265	1,265	1,264	1,263	1,263	1,262
2003	1,262	1,263	1,263	1,264	1,264	1,265	1,265	1,265	1,266	1,266	1,267	1,267
2004	1,266	1,266	1,265	1,265	1,264	1,264	1,263	1,262	1,262	1,261	1,261	1,260
2005	1,260	1,260	1,260	1,259	1,259	1,259	1,259	1,259	1,259	1,258	1,258	1,258
2006	1,258	1,258	1,258	1,258	1,258	1,258	1,257	1,257	1,257	1,257	1,257	1,257
2007	1,257	1,257	1,257	1,257	1,257	1,258	1,258	1,258	1,258	1,258	1,258	1,258
2008	1,258	1,258	1,258	1,257	1,257	1,257	1,257	1,257	1,257	1,256	1,256	1,256
2009	1,256	1,257	1,257	1,258	1,258	1,259	1,259	1,259	1,260	1,260	1,261	1,261
2010	1,261	1,260	1,260	1,260	1,259	1,259	1,259	1,258	1,258	1,258	1,257	1,257
2011	1,257	1,258	1,258	1,259	1,259	1,260	1,260	1,260	1,261	1,261	1,262	1,262
2012	1,262	1,262	1,262	1,261	1,261	1,261	1,261	1,261	1,261	1,260	1,260	1,260
2013	1,260	1,259	1,259	1,259	1,258	1,258	1,258	1,257	1,257	1,257	1,256	1,256
2014	1,256	1,257	1,257	1,258	1,258	1,259	1,259	1,259	1,260	1,260	1,261	

BUS Outside City Services

	Month											
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2000	620	621	621	622	623	624	624	625	626	627	627	628
2001	628	628	628	628	628	628	628	628	628	628	628	628
2002	628	628	628	628	628	629	629	629	629	629	629	629
2003	629	629	628	628	628	628	627	627	627	627	626	626
2004	626	626	626	626	626	626	626	626	626	626	626	626
2005	626	626	625	625	625	625	624	624	624	624	623	623
2006	624	624	625	625	626	626	627	627	628	628	629	629
2007	629	628	628	627	627	626	626	625	625	624	624	623
2008	623	623	623	623	623	623	622	622	622	622	622	622
2009	622	623	623	624	624	625	625	625	626	626	627	627
2010	627	627	627	627	627	628	628	628	628	628	628	628
2011	628	628	628	628	628	628	628	628	628	628	628	628
2012	629	629	630	630	631	631	632	632	633	633	634	634
2013	634	634	634	634	634	634	633	633	633	633	633	633
2014	634	634	635	635	636	637	637	638	638	639	639	

BUS Inside City Plumbing Code Water Savings Since 2000 (CCF/Service)

	Month												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Annual**
2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	2.4
2002	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	4.8
2003	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	7.2
2004	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	9.4
2005	0.8	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.1	1.1	11.6
2006	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	13.6
2007	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4	15.6
2008	1.4	1.4	1.4	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.5	1.5	17.4
2009	1.5	1.5	1.5	1.6	1.6	1.6	1.6	1.6	1.6	1.7	1.7	1.7	19.2
2010	1.7	1.7	1.7	1.7	1.7	1.7	1.8	1.8	1.8	1.8	1.8	1.8	21.0
2011	1.8	1.8	1.8	1.9	1.9	1.9	1.9	1.9	1.9	2.0	2.0	2.0	22.8
2012	2.0	2.0	2.0	2.0	2.0	2.0	2.1	2.1	2.1	2.1	2.1	2.1	24.6
2013	2.1	2.1	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.3	2.3	2.3	26.5
2014	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3		25.1

BUS Outside City Plumbing Code Water Savings Since 2000 (CCF/Service)

	Month												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Annual**
2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	2.4
2002	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	4.8
2003	0.4	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	7.1
2004	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	9.3
2005	0.8	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.1	1.1	11.5
2006	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	13.5
2007	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4	15.4
2008	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.5	17.3
2009	1.5	1.5	1.5	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.7	1.7	19.1
2010	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.8	1.8	1.8	20.7
2011	1.8	1.8	1.8	1.8	1.9	1.9	1.9	1.9	1.9	1.9	2.0	2.0	22.6
2012	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.1	2.1	24.2
2013	2.1	2.1	2.1	2.1	2.1	2.2	2.2	2.2	2.2	2.2	2.2	2.2	25.9
2014	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2		24.4

BUS Inside City Avg Use (CCF/Service)

	Month												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Annual**
2000	31.0	33.1	34.3	37.3	42.4	45.1	45.7	46.1	41.2	38.6	34.9	32.3	462.1
2001	33.2	33.8	32.5	35.3	44.4	48.1	43.7	43.0	41.1	38.3	32.6	30.3	456.4
2002	26.9	27.8	35.0	39.2	40.5	42.6	40.3	42.0	40.6	37.1	32.5	30.1	434.5
2003	29.6	30.9	31.8	34.6	39.2	40.8	43.8	49.5	43.9	34.1	28.6	28.5	435.2
2004	29.9	35.8	36.0	34.8	42.1	45.0	44.0	40.8	32.8	31.9	30.3	33.1	436.6
2005	38.1	34.8	28.7	29.8	37.7	37.3	44.8	46.5	39.4	35.7	32.6	31.2	436.6
2006	27.4	31.9	27.6	26.0	40.1	40.0	48.3	45.0	37.1	35.0	28.1	29.3	415.8
2007	27.9	33.3	30.4	31.1	36.7	43.4	53.1	48.3	41.0	35.0	24.9	27.1	432.2
2008	30.4	29.8	32.4	32.3	34.3	38.8	43.4	39.9	34.6	32.4	27.4	25.5	401.1
2009	25.6	24.6	27.1	29.6	31.7	34.1	38.1	39.3	34.1	29.7	25.3	23.8	363.0
2010	26.4	24.5	24.4	27.1	30.5	34.5	37.2	37.0	33.3	29.4	25.0	22.2	351.5
2011	24.1	23.4	23.2	27.3	30.1	32.3	36.7	36.4	32.0	28.8	26.2	25.2	345.7
2012	25.1	25.5	26.0	27.0	29.9	35.0	38.4	37.5	34.0	30.7	27.8	25.4	362.4
2013	25.1	24.6	26.9	29.3	33.2	37.3	39.0	38.3	35.0	33.3	30.6	27.9	380.6
2014	27.1	25.1	27.2	29.8	30.8	32.7	34.2	32.5	29.3	27.3	24.2		320.4

BUS Outside City Avg Use (CCF/Service)

	Month												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Annual**
2000	43.5	43.8	45.2	50.3	54.0	56.6	60.2	58.1	59.1	52.0	48.5	45.5	616.6
2001	42.8	40.2	40.1	47.2	52.8	55.0	57.9	56.4	57.9	51.9	48.7	44.6	595.7
2002	41.9	42.7	43.8	47.7	51.2	55.2	59.5	58.3	60.0	51.2	45.1	40.8	597.3
2003	38.0	38.4	39.3	41.4	44.0	51.0	56.9	53.6	53.1	46.1	42.4	39.0	543.2
2004	36.3	37.9	40.8	47.3	51.8	54.3	58.7	57.7	57.7	49.1	44.6	42.8	579.1
2005	41.9	38.1	35.4	41.0	46.8	49.6	52.8	51.4	53.3	47.7	44.7	39.6	542.5
2006	35.3	34.2	34.3	38.4	42.3	47.4	51.8	49.6	51.3	45.5	41.4	37.7	509.2
2007	35.8	36.1	36.8	39.4	42.0	45.8	49.4	46.9	47.6	42.9	41.3	38.1	502.1
2008	34.9	33.3	33.3	39.6	55.9	55.0	36.0	37.9	61.1	56.3	35.7	33.8	512.6
2009	31.8	30.7	34.8	39.3	42.0	43.9	44.2	45.5	38.8	36.1	31.6	29.3	448.0
2010	29.4	30.1	30.8	31.2	36.7	41.9	41.8	42.7	37.3	34.8	29.8	27.4	414.0
2011	27.2	27.7	30.5	33.6	36.4	38.8	41.0	44.0	37.7	34.9	32.0	31.8	415.6
2012	30.7	29.9	31.7	33.8	39.3	43.9	42.5	43.2	38.7	37.1	33.2	31.5	435.4
2013	30.9	31.6	34.9	38.2	41.4	43.2	41.7	42.6	39.6	40.5	36.5	32.7	453.8
2014	30.0	35.0	40.0	31.9	34.2	36.7	36.0	34.8	33.6	31.9	28.3		372.4

BUS Inside City Adjusted Avg Use (CCF/Service)

	Month												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Annual**
2000	31.0	33.1	34.3	37.3	42.4	45.1	45.7	46.1	41.2	38.6	34.9	32.3	462.1
2001	33.2	33.9	32.6	35.5	44.6	48.3	43.9	43.3	41.3	38.6	32.9	30.7	458.9
2002	27.3	28.2	35.4	39.5	40.9	43.0	40.7	42.5	41.0	37.5	32.9	30.5	439.4
2003	30.0	31.4	32.3	35.1	39.8	41.4	44.4	50.1	44.5	34.8	29.3	29.2	442.4
2004	30.7	36.6	36.7	35.5	42.9	45.8	44.8	41.6	33.6	32.7	31.1	33.9	446.0
2005	39.0	35.6	29.6	30.7	38.6	38.2	45.8	47.5	40.5	36.7	33.7	32.3	448.2
2006	28.5	33.0	28.8	27.1	41.2	41.1	49.4	46.2	38.3	36.2	29.3	30.5	429.4
2007	29.1	34.5	31.7	32.4	37.9	44.7	54.4	49.6	42.3	36.3	26.3	28.5	447.8
2008	31.8	31.2	33.8	33.7	35.7	40.3	44.9	41.3	36.1	33.8	28.8	27.0	418.5
2009	27.1	26.1	28.7	31.2	33.3	35.7	39.7	40.9	35.7	31.4	27.0	25.5	382.2
2010	28.1	26.2	26.1	28.8	32.3	36.2	38.9	38.8	35.1	31.1	26.8	24.0	372.5
2011	25.9	25.2	25.0	29.2	31.9	34.2	38.6	38.3	34.0	30.8	28.2	27.2	368.6
2012	27.1	27.6	28.0	29.1	31.9	37.1	40.5	39.6	36.0	32.7	29.9	27.5	387.0
2013	27.3	26.7	29.0	31.5	35.4	39.5	41.2	40.6	37.2	35.6	32.9	30.2	407.0
2014	29.4	27.4	29.5	32.0	33.1	35.0	36.5	34.8	31.6	29.6	26.5		345.5

BUS Outside City Adjusted Avg Use (CCF/Service)

	Month												
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Annual**
2000	43.5	43.8	45.2	50.3	54.0	56.6	60.2	58.1	59.1	52.0	48.5	45.5	616.6
2001	42.9	40.3	40.2	47.3	53.0	55.2	58.2	56.7	58.2	52.2	49.1	44.9	598.1
2002	42.2	43.0	44.2	48.1	51.6	55.6	59.9	58.7	60.4	51.6	45.5	41.3	602.1
2003	38.5	38.9	39.8	41.9	44.6	51.6	57.5	54.2	53.7	46.8	43.2	39.7	550.3
2004	37.1	38.6	41.6	48.0	52.6	55.1	59.5	58.5	58.5	49.9	45.5	43.6	588.5
2005	42.8	39.0	36.3	41.9	47.7	50.5	53.8	52.4	54.4	48.8	45.8	40.7	554.0
2006	36.4	35.3	35.4	39.5	43.4	48.5	52.9	50.8	52.4	46.7	42.5	38.8	522.6
2007	37.0	37.3	38.0	40.6	43.2	47.0	50.7	48.2	48.9	44.3	42.7	39.5	517.5
2008	36.3	34.7	34.7	41.0	57.3	56.4	37.4	39.3	62.6	57.8	37.2	35.3	530.0
2009	33.3	32.2	36.3	40.8	43.6	45.5	45.8	47.1	40.4	37.8	33.3	30.9	467.1
2010	31.1	31.8	32.5	32.9	38.4	43.7	43.6	44.4	39.1	36.6	31.5	29.2	434.8
2011	29.0	29.5	32.4	35.4	38.3	40.7	42.9	45.9	39.7	36.8	34.0	33.8	438.2
2012	32.7	31.9	33.7	35.8	41.4	45.9	44.5	45.2	40.7	39.1	35.3	33.5	459.6
2013	33.0	33.7	37.0	40.3	43.6	45.4	43.9	44.8	41.8	42.7	38.7	35.0	479.7
2014	32.3	37.2	42.2	34.1	36.4	38.9	38.2	37.0	35.8	34.1	30.5		396.8

Attachment 5 Model Estimation Results

Single Family Customer Class Model

Heteroscedastic and auto-correlation consistent standard errors reported in parentheses.

	Dependent variable:
	ln.adj.use
geooutside	0.061 (0.018)***
fmonthFeb	-0.013 (0.010)
fmonthMar	0.014 (0.015)
fmonthApr	0.159 (0.015)***
fmonthMay	0.451 (0.021)***
fmonthJun	0.564 (0.021)***
fmonthJul	0.632 (0.022)***
fmonthAug	0.615 (0.023)***
fmonthSep	0.550 (0.018)***
fmonthOct	0.360 (0.017)***
fmonthNov	0.143 (0.014)***
fmonthDec	0.053 (0.009)***
temp.nov.mar	0.203 (0.091)**
temp.apr.jun	0.422 (0.204)**
temp.jul.oct	0.636 (0.191)***
rain.nov.mar	-0.016 (0.009)*
rain.apr.jun	-0.069 (0.014)***
rain.jul.oct	-0.040 (0.020)**
ln.rain.dev.lag1	-0.034 (0.006)***
ln.rain.dev.lag2	-0.026 (0.007)***
ln.price.winter	-0.075 (0.010)***
ln.price.summer	-0.139 (0.017)***
ln.hh.inc	0.228 (0.076)***
drght.stage1	-0.051 (0.019)***
drght.stage2	-0.071 (0.017)***
drght.stage3	-0.431 (0.019)***
geooutside:ln.price.summer	0.020 (0.009)**
Constant	-0.605 (0.845)
Observations	358
R2	0.923
Adjusted R2	0.917
Residual Std. Error	0.064 (df = 330)
F Statistic	147.089*** (df = 27; 330)
Note:	*p<0.1; **p<0.05; ***p<0.01

Multi Family Customer Class Model

Heteroscedastic and auto-correlation consistent standard errors reported in parentheses.

	Dependent variable: ln.adj.use
geooutside	0.055 (0.012)***
fmonthFeb	0.009 (0.014)
fmonthMar	-0.006 (0.014)
fmonthApr	0.031 (0.014)**
fmonthMay	0.141 (0.013)***
fmonthJun	0.185 (0.012)***
fmonthJul	0.194 (0.015)***
fmonthAug	0.189 (0.013)***
fmonthSep	0.150 (0.012)***
fmonthOct	0.111 (0.011)***
fmonthNov	0.033 (0.015)**
fmonthDec	-0.001 (0.013)
temp.nov.mar	0.100 (0.066)
temp.apr.jun	0.338 (0.099)***
temp.jul.oct	-0.037 (0.089)
rain.nov.mar	0.001 (0.005)
rain.apr.jun	-0.020 (0.009)**
rain.jul.oct	-0.018 (0.008)**
ln.price	-0.124 (0.029)***
ln.vac.cap.dev	-0.164 (0.058)***
drght.stage1	-0.009 (0.010)
drght.stage2	-0.028 (0.008)***
drght.stage3	-0.192 (0.010)***
geooutside:fmonthFeb	-0.030 (0.017)*
geooutside:fmonthMar	0.002 (0.021)
geooutside:fmonthApr	0.051 (0.017)***
geooutside:fmonthMay	0.018 (0.016)
geooutside:fmonthJun	0.022 (0.018)
geooutside:fmonthJul	0.044 (0.017)***
geooutside:fmonthAug	0.031 (0.016)**
geooutside:fmonthSep	0.057 (0.018)***
geooutside:fmonthOct	0.017 (0.014)
geooutside:fmonthNov	0.041 (0.016)**
geooutside:fmonthDec	0.033 (0.014)**
Constant	1.726 (0.035)***
Observations	351
R2	0.909
Adjusted R2	0.900
Residual Std. Error	0.035 (df = 316)
F Statistic	93.266*** (df = 34; 316)
Note:	*p<0.1; **p<0.05; ***p<0.01

Business Customer Class Model

Heteroscedastic and auto-correlation consistent standard errors reported in parentheses.

	Dependent variable: ln.adj.use
geooutside	0.486 (0.048)***
fmonthFeb	0.033 (0.017)*
fmonthMar	0.048 (0.017)***
fmonthApr	0.116 (0.015)***
fmonthMay	0.250 (0.016)***
fmonthJun	0.330 (0.015)***
fmonthJul	0.396 (0.017)***
fmonthAug	0.380 (0.018)***
fmonthSep	0.273 (0.015)***
fmonthOct	0.172 (0.014)***
fmonthNov	0.044 (0.020)**
fmonthDec	-0.005 (0.020)
temp.nov.mar	0.243 (0.103)**
temp.apr.jun	0.400 (0.193)**
temp.jul.oct	-0.135 (0.121)
rain.nov.mar	0.001 (0.007)
rain.apr.jun	-0.034 (0.013)***
rain.jul.oct	-0.028 (0.010)***
rain.lag1.apr.jun	-0.017 (0.008)**
ln.price	-0.099 (0.017)***
ln.unemp.rate.dev.city	-0.160 (0.011)***
drght.stage3	-0.123 (0.008)***
geooutside:fmonthFeb	-0.037 (0.021)*
geooutside:fmonthMar	-0.021 (0.026)
geooutside:fmonthApr	0.010 (0.020)
geooutside:fmonthMay	-0.037 (0.022)*
geooutside:fmonthJun	-0.031 (0.023)
geooutside:fmonthJul	-0.064 (0.022)***
geooutside:fmonthAug	-0.067 (0.024)***
geooutside:fmonthSep	0.007 (0.024)
geooutside:fmonthOct	0.018 (0.020)
geooutside:fmonthNov	0.062 (0.025)**
geooutside:fmonthDec	0.040 (0.022)*
geooutside:ln.price	-0.163 (0.028)***
geooutside:drght.stage3	-0.068 (0.011)***
Constant	3.488 (0.023)***
Observations	353
R2	0.948
Adjusted R2	0.942
Residual Std. Error	0.047 (df = 317)
F Statistic	163.460*** (df = 35; 317)

Municipal Customer Class Model

Heteroscedastic and auto-correlation consistent standard errors reported in parentheses.

	Dependent variable: ln.use
fmonthFeb	-0.025 (0.040)
fmonthMar	0.101 (0.057)*
fmonthApr	0.767 (0.052)***
fmonthMay	1.214 (0.049)***
fmonthJun	1.424 (0.046)***
fmonthJul	1.553 (0.040)***
fmonthAug	1.579 (0.041)***
fmonthSep	1.360 (0.045)***
fmonthOct	1.061 (0.042)***
fmonthNov	0.521 (0.039)***
fmonthDec	0.087 (0.034)**
eto.nov.mar	0.516 (0.138)***
eto.apr.jun	0.804 (0.242)***
eto.jul.oct	0.357 (0.107)***
rain.nov.mar	0.037 (0.036)
rain.apr.jun	-0.147 (0.050)***
rain.jul.oct	0.006 (0.038)
ln.rain.dev.lag1	-0.097 (0.019)***
ln.rain.dev.lag2	-0.063 (0.019)***
ln.price	-0.237 (0.063)***
ln.unemp.rate.dev.city	-0.142 (0.046)***
drght.stage2	-0.108 (0.034)***
drght.stage3	-0.621 (0.035)***
Constant	2.645 (0.076)***
Observations	177
R2	0.957
Adjusted R2	0.951
Residual Std. Error	0.137 (df = 153)
F Statistic	149.772*** (df = 23; 153)
Note:	*p<0.1; **p<0.05; ***p<0.01

Irrigation Customer Class Model

Heteroscedastic and auto-correlation consistent standard errors reported in parentheses.

	Dependent variable:
	ln.use
geooutside	0.150 (0.034)***
fmonthFeb	0.058 (0.039)
fmonthMar	0.380 (0.076)***
fmonthApr	1.256 (0.069)***
fmonthMay	1.697 (0.052)***
fmonthJun	1.938 (0.045)***
fmonthJul	2.028 (0.046)***
fmonthAug	1.992 (0.046)***
fmonthSep	1.920 (0.048)***
fmonthOct	1.614 (0.049)***
fmonthNov	1.073 (0.043)***
fmonthDec	0.479 (0.053)***
eto.nov.mar	0.509 (0.207)**
eto.apr.jun	0.660 (0.243)***
eto.jul.oct	0.163 (0.184)
rain.nov.mar	-0.044 (0.049)
rain.apr.jun	-0.116 (0.065)*
rain.jul.oct	-0.085 (0.040)**
ln.rain.dev.lag1	-0.166 (0.025)***
ln.rain.dev.lag2	-0.090 (0.021)***
ln.price	-0.545 (0.069)***
drght.stage1	-0.077 (0.048)
drght.stage2	-0.250 (0.044)***
drght.stage3	-0.930 (0.081)***
Constant	2.681 (0.080)***
Observations	358
R2	0.922
Adjusted R2	0.916
Residual Std. Error	0.216 (df = 333)
F Statistic	164.036*** (df = 24; 333)
Note:	*p<0.1; **p<0.05; ***p<0.01

Golf Customer Class Model

Heteroscedastic and auto-correlation consistent standard errors reported in parentheses.

	Dependent variable:
	ln.use
geooutside	7.105 (0.201)***
fmonthFeb	-0.242 (0.129)*
fmonthMar	-0.006 (0.100)
fmonthApr	9.812 (0.225)***
fmonthMay	11.174 (0.177)***
fmonthJun	11.845 (0.159)***
fmonthJul	12.018 (0.165)***
fmonthAug	12.098 (0.166)***
fmonthSep	11.876 (0.161)***
fmonthOct	11.448 (0.161)***
fmonthNov	10.043 (0.147)***
fmonthDec	8.628 (0.245)***
ln.eto.nov.mar	1.135 (0.329)***
ln.eto.apr.jun	0.173 (0.452)
ln.eto.jul.oct	0.792 (0.228)***
ln.rain.nov.mar	-0.129 (0.083)
ln.rain.apr.jun	-0.441 (0.140)***
ln.rain.jul.oct	-0.038 (0.055)
ln.rain.dev.lag1	-0.546 (0.060)***
ln.rain.dev.lag2	-0.074 (0.047)
ln.price.summer	-0.358 (0.098)***
drght.stage3	-0.319 (0.064)***
geooutside:fmonthFeb	0.749 (0.255)***
geooutside:fmonthMar	0.896 (0.275)***
geooutside:fmonthApr	-6.721 (0.297)***
geooutside:fmonthMay	-7.186 (0.277)***
geooutside:fmonthJun	-7.384 (0.258)***
geooutside:fmonthJul	-7.400 (0.263)***
geooutside:fmonthAug	-7.408 (0.258)***
geooutside:fmonthSep	-7.397 (0.262)***
geooutside:fmonthOct	-7.287 (0.256)***
geooutside:fmonthNov	-6.698 (0.232)***
geooutside:fmonthDec	-6.703 (0.332)***
geooutside:ln.price.summer	0.364 (0.124)***
Constant	-6.701 (0.103)***
Observations	332
R2	0.989
Adjusted R2	0.988
Residual Std. Error	0.367 (df = 297)
F Statistic	805.493*** (df = 34; 297)
Note:	*p<0.1; **p<0.05; ***p<0.01

ATTACHMENT 6 MONTHS DROUGHT STAGES IN EFFECT

Drought Stage 1: 0 = Not In Effect, 1 = In Effect

	Month											
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	1	1	1	1	1	1	0	0
2008	0	0	0	0	0	0	0	0	0	0	0	0
2009	0	0	0	0	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0	0	0	0	0
2012	0	0	0	0	1	1	1	1	1	1	0	0
2013	0	0	0	0	1	1	1	1	1	1	1	1
2014	1	1	1	1	0	0	0	0	0	0	0	

Drought Stage 2: 0 = Not In Effect, 1 = In Effect

	Month											
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0	0	0	0	0
2009	0	0	0	0	1	1	1	1	1	1	0	0
2010	0	0	0	0	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0	0	0	0	

Drought Stage 3: 0 = Not In Effect, 1 = In Effect

	Month											
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0	0	0	0	0
2009	0	0	0	0	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0	0	0	0
2014	0	0	0	0	1	1	1	1	1	1	1	

ATTACHMENT 7 WATER RATE AND INCOME FORECASTS

Forecasted Increase in Water Rates

Year	Caltrans Inflation Rate Forecast	% Change in Water Rate	% Change Net of Inflation	Real Water Rate Index	% Change from 2014
2014	2.8%			100.0	
2015	3.3%	10.0%	6.7%	106.7	6.7%
2016	3.2%	10.0%	6.8%	114.0	14.0%
2017	2.4%	10.0%	7.6%	122.6	22.6%
2018	2.3%	10.0%	7.7%	132.1	32.1%
2019	2.4%	10.0%	7.6%	142.1	42.1%
2020	2.3%	4.4%	2.1%	145.1	45.1%
2021	2.5%	4.4%	1.9%	148.0	48.0%
2022	2.6%	4.4%	1.8%	150.7	50.7%
2023	2.5%	4.4%	1.9%	153.6	53.6%
2024	2.5%	4.4%	1.9%	156.6	56.6%
2025	2.5%	4.4%	1.9%	159.7	59.7%
2026	2.5%	4.4%	1.9%	162.8	62.8%
2027	2.5%	4.4%	1.9%	166.0	66.0%
2028	2.5%	4.4%	1.9%	169.2	69.2%
2029	2.5%	4.4%	1.9%	172.5	72.5%
2030	2.5%	4.4%	1.9%	175.9	75.9%
2031	2.5%	4.4%	1.9%	179.3	79.3%
2032	2.5%	4.4%	1.9%	182.8	82.8%
2033	2.5%	4.4%	1.9%	186.3	86.3%
2034	2.5%	4.4%	1.9%	190.0	90.0%
2035	2.5%	4.4%	1.9%	193.7	93.7%

The forecasted nominal annual percentage change in water rate for 2014-2019 is from the Water Department. The forecasted nominal annual percentage change in water rate from 2020-2035 is set to the long-term annual rate of increase in the BLS Consumer Price Index for Water, Sewer, and Solid Waste Services (http://data.bls.gov/timeseries/CUSR0000SEHG). The source of the Caltrans inflation rate forecast for Santa Cruz County is: http://www.dot.ca.gov/hq/tpp/offices/eab/socio_economic_files/2014/SantaCruz.pdf#zoom=75

Forecasted Increase in Income

Year	Caltrans Real Per Capita Income Forecast	% Change from 2014
2014	$56,085	
2015	$57,661	2.8%
2016	$59,004	5.2%
2017	$60,267	7.5%
2018	$61,653	9.9%
2019	$62,994	12.3%
2020	$64,379	14.8%
2021	$65,679	17.1%
2022	$66,829	19.2%
2023	$67,986	21.2%
2024	$69,191	23.4%
2025	$70,394	25.5%
2026	$71,482	27.5%
2027	$72,552	29.4%
2028	$73,614	31.3%
2029	$74,679	33.2%
2030	$75,749	35.1%
2031	$76,826	37.0%
2032	$77,844	38.8%
2033	$78,920	40.7%
2034	$80,043	42.7%
2035	$81,138	44.7%

The source of the Caltrans forecasted increase in real per capita income for Santa Cruz County is:

http://www.dot.ca.gov/hq/tpp/offices/eab/socio_economic_files/2014/SantaCruz.pdf#zoom=75

While per capita income is projected to grow over the forecast period, it is less clear that median household income will exhibit similar growth. According to Census data, median household income in Santa Cruz County after adjusting for inflation has been stagnant to declining since 1989. Consequently, the demand forecasts hold median household income constant at the 2013 level in the single family forecast.

Santa Cruz County, CA

Median Household Income

Year	Nominal	CPI	Inflator	2013 $
1989	$37,112	128.000	1.8877	$70,056

1999	$53,998	168.500	1.4340	$77,431
2005	$58,640	202.600	1.1926	$69,935
2009	$64,349	224.110	1.0781	$69,378
2010	$65,253	226.919	1.0648	$69,481
2013	$66,519	241.623	1.0000	$66,519

Source: US Census and ACS

ATTACHMENT 8 PLUMBING CODE AND PROGRAM A SAVINGS FORECASTS

Forecasts of plumbing code water savings, Program A water savings, and allocation of Program A savings to customer classes were produced by Maddaus Water Management's DSS model.

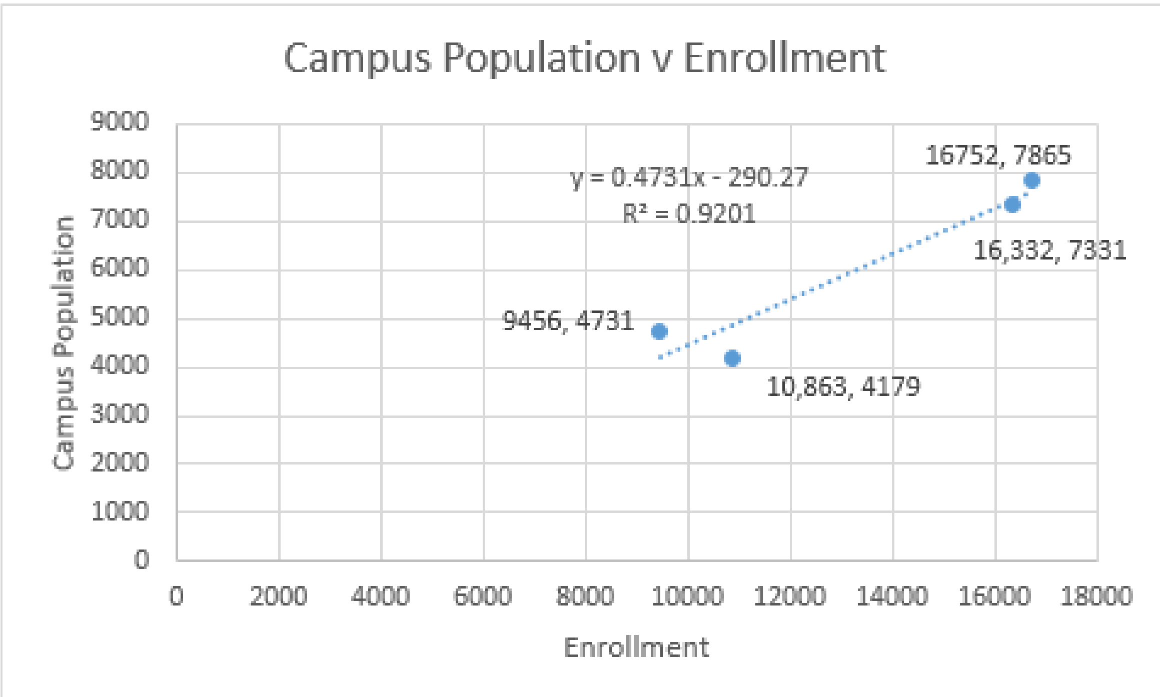
	SFR Code Savings, 2013 Base Year			
Year	MG/Yr	CCF/Yr	Services	CCF/Service
2020	32.7	43,717	19559	2.2
2025	68.0	90,909	19907	4.6
2030	103.3	138,102	20256	6.8
2035	124.7	166,711	20256	8.2
	SFR Prog A Savings, 2013 Base Year			
Year	MG/Yr	CCF/Yr	Services	CCF/Service
2020	55.8	74,663	19559	3.8
2025	61.6	82,393	19907	4.1
2030	59.8	79,932	20256	3.9
2035	57.2	76,533	20256	3.8
	MFR Code Savings, 2013 Base Year			
Year	MG/Yr	CCF/Yr	Services	CCF/Service
2020	29.6	39,544	18867	2.1
2025	58.6	78,394	19430	4.0
2030	87.7	117,286	20416	5.7
2035	103.2	137,991	21174	6.5
	MFR Prog A Savings, 2013 Base Year			
Year	MG/Yr	CCF/Yr	Services	CCF/Service
2020	33.0	44,082	18867	2.3
2025	50.9	68,078	19430	3.5
2030	48.0	64,205	20416	3.1
2035	45.7	61,048	21174	2.9
	BUS Code Savings, 2013 Base Year			
Year	MG/Yr	CCF/Yr	Services	CCF/Service
2020	3.1	4,110	2373	1.7
2025	4.9	6,498	2494	2.6
2030	6.3	8,477	2621	3.2
2035	6.9	9,249	2755	3.4
	BUS Prog A Savings, 2013 Base Year			
Year	MG/Yr	CCF/Yr	Services	CCF/Service
2020	18.4	24,557	2373	10.3
2025	28.1	37,553	2494	15.1
2030	28.5	38,047	2621	14.5
2035	28.3	37,848	2755	13.7

Program A Savings Allocation to Customer Classes

		Class Shares (%)				
Year	Total (MG)	SFR	MFR	BUS	MUN	IND
2020	110	51%	30%	17%	2%	0%
2025	143	43%	36%	20%	1%	0%
2030	139	43%	35%	21%	1%	0%
2035	134	43%	34%	21%	1%	0%

ATTACHMENT 9 UCSC CAMPUS POPULATION FORECAST

Data on enrollment and campus population were collected for 1990, 2000, 2010, and 2013. Enrollment data are from UCSC. Population data are for Census Tract 1004. The enrollment data are from University of California Office of the President. The relationship between enrollment and campus population is shown in the following figure.



The average gain in population per one student gain in enrollment over this period was 0.47. Over the 23 year period considered, campus population has averaged about 45% of total enrollment. According to the UCSC Long Range Development Plan (LRDP, p. 71), future campus development will maintain or possibly increase this ratio. The campus population forecast used for this report assumes the rate of campus population gain is the same as show in the figure above, resulting in the following campus population forecast.

UCSC	2010	2020	2025	2030	2035
AMBAG UCSC Enrollment Projection	16,300	19,500	21,100	22,700	24,300
Gain		3,200	4,800	6,400	8,000
Projected Campus Population	7,331	8,845	9,602	10,359	11,116
Gain		1,514	2,271	3,028	3,785

ATTACHMENT 10 INDUSTRIAL DEMAND FORECAST MODEL

Year	Industrial Water Use (CCF)	County Mfg Empl	Recovery Dummy
2003	54623	7000	0
2004	59656	7400	0
2005	53384	7200	0
2006	49297	6700	0
2007	51018	6400	0
2008	42607	6100	0
2009	32753	5300	0
2010	56145	5300	1
2011	60782	5400	1
2012	72070	5600	1
2013	74451	5800	1

Model: use = constant + recovery.dummy + employment + employment x recovery.dummy

```
===============================================
                        Dependent variable:
                    ---------------------------
                                use
-----------------------------------------------
recovery.dum        -116,651.400 (38,297.110)**
emp                      11.863 (1.451)***
recovery.dum:emp         26.434 (6.861)***
Constant             -29,081.030 (9,608.094)**
-----------------------------------------------
Observations                    11
R2                            0.967
Adjusted R2                   0.953
Residual Std. Error   2,575.436 (df = 7)
F Statistic         69.305*** (df = 3; 7)
===============================================
Note:               *p<0.1; **p<0.05; ***p<0.01
```