Hazen

BAWSCA
Bay Area Water Supply & Conservation Agency

Regional Water Demand and Conservation Projections Study

Final Report
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Table of Contents

List of Tables

List of Figures

List of Appendices

List of Acronyms

Abbreviation	Definition
AB	Assembly Bill
ACS	American Community Survey (US Census)
AFY	Acre-Feet per Year
AMI	Advanced Metering Infrastructure
AWE	Alliance for Water Efficiency
AWE Tracking Tool	Alliance for Water Efficiency Tracking Tool
BAWSCA	Bay Area Water Supply and Conservation Agency
CALGreen	California Green Building Standards Code (Title 24, Part 11)
CEC	California Energy Commission
CII	Commercial, Industrial, and Institutional
CMIP5/CMIP6	Coupled Model Intercomparison Project Phase 5/6
COVID	Coronavirus Disease (context: pandemic indicator)
DIM	Dedicated Irrigation Meter
DOF	California Department of Finance
DWR	Department of Water Resources (California)
EPACT	Energy Policy Act (US federal law)
FRED	Federal Reserve Economic Data
GCM	Global Climate Model
GDP	Gross Domestic Product
GIS	Geographic Information System
HET	High-Efficiency Toilet
HOA	Homeowners' Association
INR	Indoor Residential (context: water use)
KAF	Thousand Acre-Feet
LAM	Landscape Area Measurement
LEF	Landscape Efficiency Factor
LEHD	Longitudinal Employer-Household Dynamics
LODES	Origin-Destination Employment Statistics
MF	Multifamily (housing units or residential sector)
MG	Million Gallons
MGD	Million Gallons per Day
NAICS	North American Industry Classification System
Net ETo	Net Reference Evapotranspiration
NRW	Non-Revenue Water
OUTR	Outdoor Residential (context: water use)
PG&E	Pacific Gas and Electric Company
PPH	Persons per Household
PRISM	Parameter-elevation Regressions on Independent Slopes Model
QWEL	Qualified Water Efficient Landscaper
RCP	Representative Concentration Pathway (climate scenario)
RLA	Residential Landscape Area
RSAT	Residential Self-Audit Tool

Abbreviation	Definition
SB	Senate Bill
SB X7-7	Senate Bill X7-7 (California Water Conservation Act)
SF	Single Family (housing units or residential sector)
SLA	Special Landscape Area
SMUD	Sacramento Municipal Utility District
SSP	Shared Socioeconomic Pathway (climate scenario)
SVP	Silicon Valley Power
TAZ	Traffic Analysis Zone
Title 20	California Appliance Efficiency Regulations
UHET	Ultra-High-Efficiency Toilet
ULFT	Ultra-Low-Flush Toilet
UWMP	Urban Water Management Plan
UWUO	Urban Water Use Objective
WF	Water Factor (for appliances)
WUE	Water Usage Effectiveness

Executive Summary

The Bay Area Water Supply and Conservation Agency (BAWSCA) and its 26 member agencies face a dynamic and challenging water future, shaped by population growth, climate change, regulatory requirements, and evolving patterns of water use. This report presents a comprehensive regional water demand and conservation analysis, providing a robust foundation for long-term planning and strategic decision-making through 2050.

The primary objective of the Regional Water Demand and Conservation Projections Study (2025 Demand Study or Project) was to deliver updated, agency-specific water demand forecasts and conservation assessments to support the 2025 Urban Water Management Plan (UWMP) cycle and align with BAWSCA's Long-Term Water Supply Reliability Strategy (Strategy 2050) initiative. The effort integrated socioeconomic and demographic data collection, econometric modeling, and conservation program evaluation to forecast water demand across major water use sectors and customer classifications.

The demand projections presented in this report were developed for the specific purpose of this Project, utilizing a single, standardized set of planning assumptions. These assumptions were collaboratively agreed upon by the member agencies solely for the uniform analysis conducted herein.

It is important to note that as individual member agencies develop their own unique, official planning documents for their own purposes, including regulatory compliance (e.g., UWMPs), their internal decision-making processes may necessitate the use of different assumptions, methodologies, or policy considerations, which may differ from the illustrative estimates unique to this specific project.

Furthermore, agencies often do not consider any demand projections finalized until they have been formally reviewed and adopted by their respective Council or Board. For the most current and officially adopted demand projections, please consult the corresponding member agency's planning documents.

Demand Projection Approach

The Project employed a hybrid water demand modeling framework (illustrated in Figure ES-1) that integrates econometric regression techniques with end-use conservation accounting. This approach allows for a clear separation between the structural factors influencing water demand – such as demographic changes, climate variability, and economic trends – and the impacts resulting from policy decisions and conservation programs.

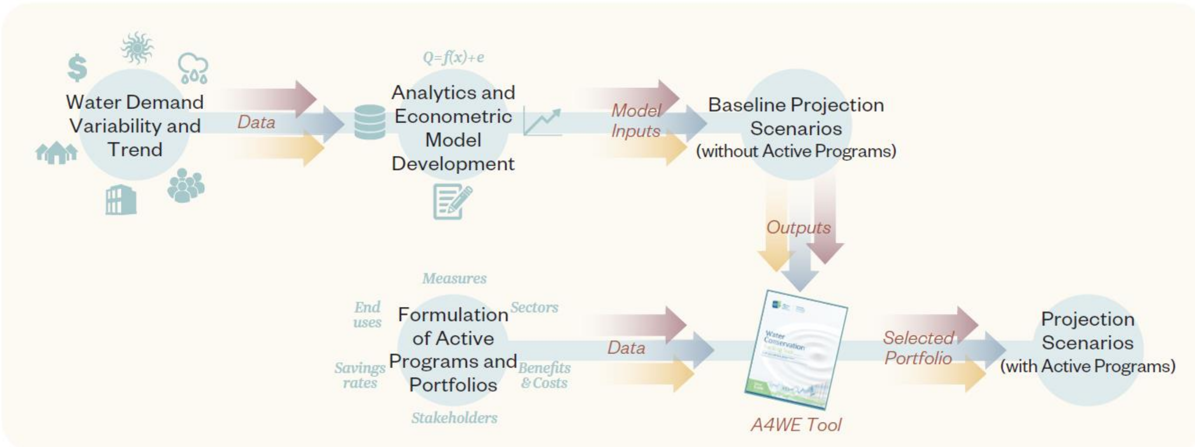

Figure ES-1: Overview of Water Demand Projection Framework

The econometric models describe the influence of key explanatory variables on historical water demand; these explanatory variables include weather conditions, the price of water, regional macroeconomic conditions, socioeconomic factors, long-term trends in passive conservation savings, and historical drought restrictions. The models forecast future water demand based on projected scenarios that define the values of the same explanatory variables. The baseline water demand scenario as well as additional scenarios that help bound future uncertainty are further described below.

Separate to econometric modeling, the Project explicitly quantified both passive conservation impacts, driven by codes and regulations, and future active conservation impacts, resulting from programmatic initiatives and behavioral changes. Passive and active conservation savings were estimated using an end use accounting framework via the Alliance for Water Efficiency Tracking Tool (AWE Tracking Tool).

The Project concluded with scenario analyses to address uncertainties inherent in long-term planning. The scenarios examined demographic shifts different from those presented in the baseline, unforeseen economic fluctuations, climate variability, and the prevalence of demand sectors with highly uncertain growth and water use rates (e.g., data centers). These scenario analyses provide valuable insights into the range of possible future outcomes and support informed decision-making for regional water supply planning. Five scenarios in addition to the baseline were considered, establishing both "high" and "low" bookends of projected water demand based on differences in underlying model assumptions.

Baseline Scenario Water Demand Projections

The baseline scenario was developed through close collaboration with BAWSCA member agencies and is grounded in the following key assumptions:

- **Demographics:** Future population, housing units, and jobs were based on Plan Bay Area 2050 growth rates, with adjustments from member agency planning departments to reflect local realities.
- **Climate:** Future temperatures were adjusted using annual average projections from CalAdapt CMIP5 RCP 8.5 modeling, while precipitation was held at historical averages.

- **Economy:** The mix of industries, regional rates of change in GDP, and unemployment rates were assumed to remain constant at recent historical levels.
- **Conservation:** Passive conservation (fixture and appliance turnover, new construction standards) was assumed to continue steadily into the future, while active conservation programs were assumed to be implemented based on plans discussed and reviewed by member agencies.
- **Water Pricing:** Water rates are assumed to keep pace with inflation, resulting in no real change in price over the planning horizon, except for agencies that provided approved future rate increases.
- **Non-Revenue Water and Other Uses:** Held constant at recent observed levels.

Under these conditions, regional water demand is projected to increase gradually over the planning period, moderated by ongoing conservation efforts and efficiency improvements. The forecasted total demand (all sectors, including passive and active conservation) is presented in Table ES-1 below.

Table ES-1: Summary of Baseline Regional Water Demand Forecast

Assumption	2025	2030	2035	2040	2045	2050
Regional Demand without Additional Conservation (mgd)	192	205	214	222	229	238
Passive and Active Conservation (mgd)	1	6	10	12	14	16
Total Regional Demand	**191**	**198**	**204**	**210**	**215**	**222**

The projections reflect a modest but steady increase in demand, primarily driven by demographic growth, with conservation programs offsetting what would otherwise be higher increases.

Alignment with Expected Urban Water Use Objectives

The Project also evaluated each member agency's baseline projected water use, including passive and active conservation, against the State's Urban Water Use Objective (UWUO) regulatory standards through 2050. The results illustrate that the majority of BAWSCA member agencies are expected to remain in compliance with their UWUOs throughout the planning period. With both passive and active conservation in place, only 4 out of 23 agencies are projected to exceed their UWUO at any point between 2025 and 2050. This demonstrates that, under baseline assumptions, the region is generally well-positioned to meet regulatory efficiency requirements, though a small number of agencies may need to consider additional measures or targeted strategies in future years.

Addressing Uncertainty

The Project attempted to address future uncertainty in water demands through a scenario analysis informed through coordination with member agency representatives, external stakeholders, and the San Francisco Public Utilities Commission (SFPUC). The scenario analysis aimed to demonstrate how variations in demographic, economic, climate, pricing, and conservation assumptions influence regional water demand trajectories through 2050. Five scenarios were developed that reflected a range of plausible regional narratives. Key findings from the analysis included the following:

- Demographics are the dominant factor shaping long-term demand.
- Pricing and conservation assumptions, particularly rate increases over inflation and additional conservation programming can exert off-setting (downward) pressures on demand.
- High-water-use customers (e.g., data centers) can introduce localized risk under high-growth futures.

By 2050, volumetric demand differences between High and Low scenarios exceed 30% (266 mgd on the high end and 157 mgd on the low end), underscoring the potential impact of uncertainties in planning assumptions.

Future Analyses and Next Steps

The report identifies several recommendations to improve monitoring, tracking, and understanding water demands as key drivers evolve in the future, including:

- **Monitor Emerging High-Use Sectors:** Establish ongoing tracking of data centers and other large water users and explore incorporating energy consumption as a driver in future econometric models.
- **Consider Future Droughts in Scenario Planning:** Expand scenario analysis to include severe drought conditions and test rebounds from future droughts, integrating lessons from recent events.
- **Consider Optimization of Conservation Measures:** Conservation modeling suggests that member agencies could further optimize their active conservation programming by prioritizing investment in lower cost-per-gallon-saved programs.
- **Continuous Model Improvements:** Maintain clear documentation, continue annual data collection from member agencies, and regularly refine model structure and assumptions to reflect new trends in development and other drivers.

1. Introduction

Background and Context

The Bay Area Water Supply and Conservation Agency (BAWSCA) plays a critical role in ensuring reliable, high-quality water supply for 26 member agencies serving over 1.8 million residents, businesses, and communities throughout the San Francisco Bay Area. BAWSCA's represents the collective interests of its member agencies in regional water planning, supply reliability, and conservation, while supporting local agencies' efforts to meet both current and future water needs. As the region faces increasing pressures from population growth, climate change, regulatory requirements, and evolving water use patterns, proactive and data-driven planning has become increasingly essential.

Project Scope

This report presents the results of the Regional Water Demand and Conservation Projections Project (Project) conducted for BAWSCA and its member agencies. The Project encompasses the development of updated, agency-specific water demand forecasts through 2050, using a robust modeling framework that integrates socioeconomic and demographic data collection, econometric analysis, and conservation program evaluation. The analysis covers the major customer sectors that make up municipal water demands—single family, multifamily, commercial/industrial/institutional, irrigation, and recycled water—and explicitly quantifies both passive (code-driven) and active (programmatic) conservation impacts.

The demand projections presented herein are based on a single, standardized set of assumptions developed exclusively for the analytical scope of this Project. These figures are not the official planning forecasts for any individual member agency, which may differ from the illustrative estimates unique to this specific project.

Agencies maintain the authority to develop and adopt their own distinct projections (e.g., in their UWMPs) based on independent internal processes and assumptions. Final, official demand projections must be obtained directly from the corresponding member agency's adopted planning documents.

Project Objectives and Alignment with Regional Planning Efforts

The primary objectives of the Project were to:

- Provide scenario-ready forecasts of regional and agency-level water demand through 2050;
- Quantify the impacts of ongoing and planned conservation measures;
- Support member agencies in meeting the requirements of the 2025 Urban Water Management Plan (UWMP) cycle, including compliance with new regulatory standards such as the Urban Water Use Objective (UWUO); and

- Align demand forecasting and conservation planning with BAWSCA's Long-Term Reliable Water Supply Strategy (Strategy 2050) initiative, which is conducting parallel scenario analyses to assess long-term water supply reliability and inform regional investment decisions.

By integrating demand-side analysis with the broader Strategy 2050 effort, the Project ensures that BAWSCA and its member agencies are equipped to evaluate a range of plausible futures, identify potential risks and opportunities, and make informed, adaptive decisions to secure the region's water future.

Structure of the Report

The report is organized in the following main sections:

- **Historical Data Collection and Review:** Overview of data sources, coordination with member agencies, and data processing methods.
- **Water Demand Forecasting Approach and Model Development:** Description of the modeling framework, particularly the econometric methods.
- **Water Conservation Analysis and Projection:** Overview of the Project's conservation modeling, analysis, and projections.
- **Baseline 2050 Water Demand Projection Scenario:** Presentation of baseline assumptions, forecast results, and sectoral/regional breakdowns.
- **Urban Water Use Objective (UWUO):** Description of the methodology for projecting member agencies' UWUO out to 2050 and summary of expected compliance under the baseline scenario.
- **Analysis of Alternative Forecast Scenarios:** Exploration of alternative futures, including demographic, economic, climate, and policy uncertainties.
- **Summary and Recommendations:** Summary of findings, recommendations for future analyses, and strategic linkages to ongoing initiatives.
- **Appendices:** Supporting data, technical details, and additional documentation.

2. Historical Data Collection and Review

This section documents the historical data collection process for the Project, including coordination with the member agencies, and overview of the data collected, and a review of key data processing exercises. This section also documents historical demographic and water consumption trends for the region. Future demographic projections, which are key drivers of future water demand, are further documented in Section 5, which describes baseline assumptions of future conditions, and Section 7, which presents alternative scenario assumptions.

2.1 Data Sources and Collection Process

Development of econometric and end-use accounting models is a highly data intensive process that requires a robust historical dataset consisting of water consumption, demographic data, and explanatory variables used to explain variability in water use. This section summarizes the data sources collected in support of the Project's modeling effort.

2.1.1 Data Collected from Member Agencies, BAWCSA, and Santa Clara Valley Water District

Historical records of billed consumption and accounts are perhaps the most important data for developing water demand models. In support of this effort, member agency-specific billing and consumption records from 1980 to 2020 were made available from prior demand studies. This historical data was supplemented with an additional request from member agencies to collect updated data for the years 2020-2023. Additional data, including historical water rates, water shortage history, and conservation program information were also provided by member agencies and supplemented with additional context and data from BAWSCA and Santa Clara Valley Water District (Valley Water).

Following this initial data collection, the project team reviewed member agency data and identified inconsistencies (e.g., billing records agencies reported monthly that appeared to be bimonthly) and coordinated with agency staff through emails and phone calls regarding the data.

2.1.2 Collection of External Data Sets

Additional data gathered for the Project encompassed a comprehensive array of demographic, socioeconomic, and climatic information relevant to the region. Table 2-1 presents a summary of the primary external data sources, which are not directly produced by BAWSCA or its member agencies. These data mainly served as explanatory variables, either directly or through derivation, in the Project's econometric models.

Table 2-1: Summary of Historical Data Collected for Model Development

Explanatory Variable	Years Collected	Data Sources
Population	2000-2023	California Department of Finance (DOF) annual jurisdictional dataset[1] and US Census American Community Survey (ACS)[2]
Single Family (SF) housing units[3]		DOF and member agency account data
Multifamily (MF) housing units[4]		
Employment by North American Industry Classification System (NAICS) Sector	2002-2022	U.S. Census Bureau Longitudinal Employer-Household Dynamics (LEHD) Origin-Destination Employment Statistics (LODES) dataset[5]. The LODES dataset provides annual, geographically detailed estimates of where people work and live, including job counts by industry sector at the census block or tract level, enabling analysis of employment patterns and economic activity within specific service areas.
Observed weather (monthly precipitation, monthly maximum temperature)	2000-2023	Gridded historical climate data from the Parameter-elevation Regressions on Independent Slopes Model (PRISM)[6]
Regional real Gross Domestic Product (GDP)	2002-2021	Federal Reserve Economic Data (FRED) database[7]
Regional unemployment rate		
Median income	2000-2023	US Census ACS
Land use and zoned area measurements	2023	California Geoportal General Plan Landuse Dataset[8]

2.2 Data Processing and Standardization

Prior to utilizing demographic and water use data for modeling and analysis, the data were subjected to multiple processing and standardization procedures. This section outlines the reasons for these steps and describes the general methods applied.

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[1] California Department of Finance (DOF). *Population and Housing Estimates for California Cities, Counties, and the State: E-8 Historical Estimates (1990–2000; 2000–2010; 2010–2020) and E-1 Annual Estimates (2021–2023).* Sacramento, CA: DOF, 2001, 2012, 2023, and May 2024.

[2] U.S. Census Bureau. "American Community Survey 5-Year Estimates 2009–2022." ACS 5-Year Summary File, December 2024 edition.

[3] SF housing units are generally equivalent in number to single-family accounts.

[4] Differences between member agency single-family account data and DOF single-family housing units were reallocated to multi-family housing units to preserve the total housing units.

[5] U.S. Census Bureau, Longitudinal-Employer Household Dynamics (LEHD) Program. (2024). *LEHD Origin-Destination Employment Statistics (LODES), 2002–2022* [Dataset]. Retrieved from https://lehd.ces.census.gov/data/#lodes

[6] PRISM Climate Group, Oregon State University. (2025). *PRISM climate data: maximum temperature (Tmax) and precipitation, 2000–2023* [Dataset]. https://prism.oregonstate.edu

[7] U.S. Bureau of Economic Analysis & U.S. Bureau of Labor Statistics. (2022). *Real gross domestic product (GDPC1) and civilian unemployment rate (UNRATE), 2000–2021* [Data sets]. FRED, Federal Reserve Bank of St. Louis. Retrieved from https://fred.stlouisfed.org

[8] California Office of Planning and Research (OPR). (2025). *California General Plan Land Use* [GIS dataset]. State of California Geoportal. Retrieved from https://gis.data.ca.gov/datasets/Gov-OPR::california-general-plan-land-use

2.2.1 Geographical Processing of Demographic Data

Key demographic information necessary for water demand forecasting—such as population, employment figures, and housing units—must align with the boundaries of each member agency's service area. Historical and projected records for these data (via DOF and Plan Bay Area 2050) are available at jurisdictional, census tract, and/or Traffic Analysis Zone (TAZ) geographical boundaries, which often do not directly align with member agency service area boundaries. This concept is illustrated in Figure 2-1 below. All demographic data utilized in the Project was reprojected to member agency service area boundaries using a GIS-based allocation procedure, further documented in Appendix A.

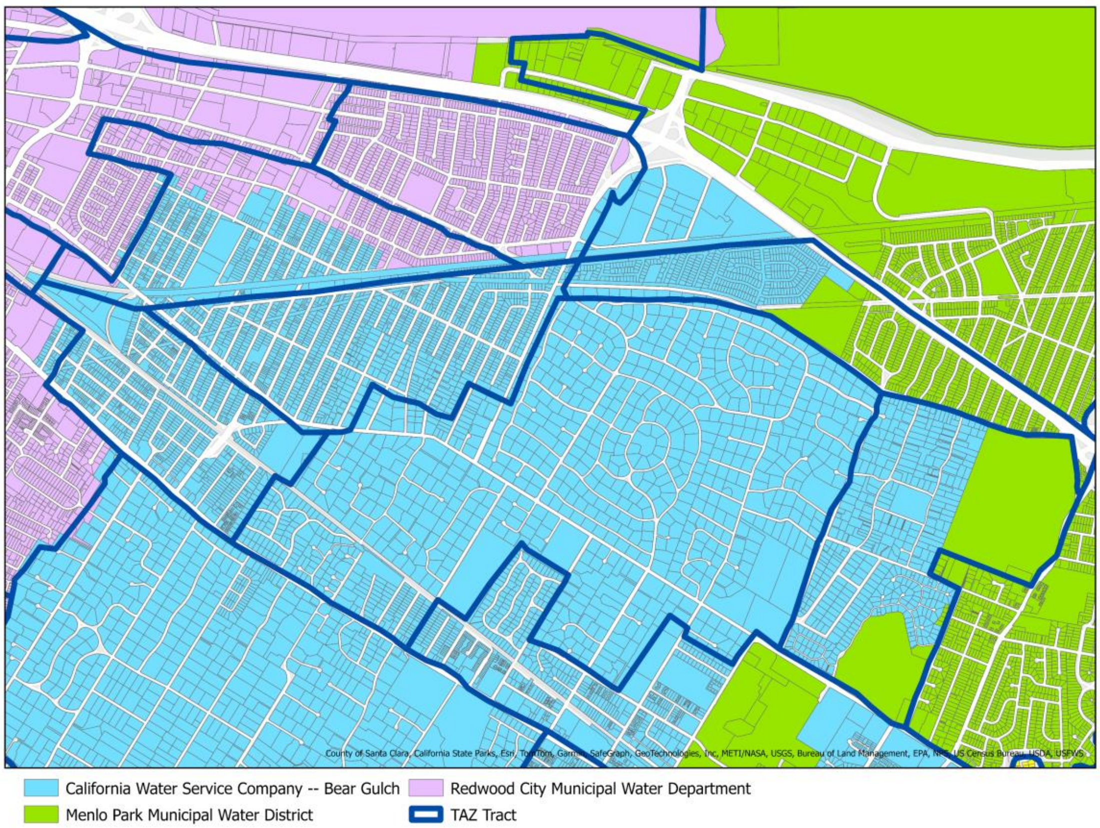

Figure 2-1: Example of TAZ Tract Overlapping an Adjacent Member Agency Service Areas

2.2.2 Characterization and Standardization of Water Demand Sectors

Member agencies provided billing and account data organized by their internal billing classifications. There were 93 unique billing classifications across all member agencies. Residential billing classifications (SF and MF) were generally consistent across member agencies. The City of East Palo Alto, City of San Bruno, and the Town of Hillsborough were the only agencies with a single residential billing classification. Non-residential billing classifications were less consistent across member agencies. While most agencies defined a commercial billing classification, the distinction and definition of industrial, institutional, and irrigation (i.e., landscape) classes were inconsistent across the member agencies.

In order to develop consistent water demand models across the region and to align with water conservation program categories defined in the AWE Tracking Tool (see Section 4), it was necessary to standardize member agency classifications to a consolidated set of water demand sectors. Table 2-2 summarizes the consolidated water use sectors used for model development and projection.

Table 2-2: Summary of Standardized Water Use Sectors Used for Demand Model Development

Model Sector	Description
SF	Water use associated with SF residential homes.
MF	Water use associated with MF residential properties.
Commercial, Industrial, and Institutional (CII)	Water use associated with all CII activity.
Dedicated irrigation (potable)	Water use associated with separately metered outdoor irrigation. Typically non-residential, but occasionally inclusive of common multifamily landscaped area and/or Homeowners' Associations (HOAs).
Recycled and raw water	Water use associated with current recycled and raw water use. Typically non-residential irrigation, but occasionally inclusive of some CII process water consumption, and common multifamily landscaped area and/or Homeowners' Associations (HOAs).
Other	Other water use, often categorized as "other" by retail agencies, but also inclusive of classifications not well represented by the standardized water use sectors above (e.g., construction, fire line, miscellaneous). Other water use does not include nonrevenue water (NRW).

In addition to standardizing water use sectors, member agency consumption data needed to be "smoothed" in order to standardize for consumption billed on monthly and bimonthly cycles. This exercise is necessary prior to statistical analysis and econometric model fitting to ensure that actual monthly consumption is accurately represented. Appendix B provides more detailed mathematical documentation of the smoothing approach applied.

2.2.3 Derived Demographic Variables

Several additional demographic explanatory variables were derived from the datasets identified in Table 2-2. These data are summarized in Table 2-3 below.

Table 2-3: Summary of Derived Demographic Explanatory Variables

Derived Explanatory Variable	Description
Persons per household (PPH)	Calculated as the total population by housing type (SF or MF) divided by the total number of households. Unique PPH values were calculated for each member agency annually between 2000-2023.
Housing density	Derived from housing units (SF and MF) estimated for each member agency divided by zoned SF or MF residential area obtained from the California Geoportal General Plan Landuse Dataset.
Mix of industries / economic activity	Reflects the proportional number of jobs in each NACIS sector documented within the LODES dataset relative to overall employment. Calculated for each NACIS sector and member agency service area.
Housing units and jobs per account	• SF accounts reflect a 1-1 ratio with housing units. • MF housing units per account were calculated by dividing the number of housing units by recorded number of accounts. • CII jobs per account were calculated by dividing the number of jobs within a service area by the total number of CII accounts.

2.3 Summary of Historical Demographic and Water Use Trends

This section provides a summary of the historical demographic and water use trends within the overall BAWSCA region.

2.3.1 Historical Demographic Data

Figures 2-2 through 2-4 illustrate regional historical trends in population, housing unit development, and job growth from 2000-2023. These data reflect historical jurisdictional DOF data, reprojected to member agency service area boundaries using the approach defined in Section 2.2.1, and aggregated to the overall BAWSCA service area. Historical population, housing units, and job data were validated by comparing to prior BAWSCA water demand study estimates, member agencies 2020 UWMPs, and through discussions with member agency representatives.

Between 2000 and 2023, the BAWSCA service area experienced steady population growth, moderate housing expansion, and employment increases, reflecting broader regional economic and urbanization trends. Population rose from approximately 1.57 million in 2000 to about 1.80 million in 2023, an increase of roughly 14%, with most growth occurring after 2010 following a period of relative stability in the early 2000s. Housing units also expanded, with single-family units increasing from about 317,000 in 2000 to roughly 360,000 by 2023, though growth was uneven, with notable acceleration during the mid-2010s. The trend illustrates a gradual shift toward higher-density development, as multifamily housing grew at a faster rate than single-family units in recent years. Employment trends tend to mirror population growth, with job counts rising steadily across the period, driven by technology and service sectors, although the data indicate some volatility during economic downturns such as the 2008 recession and the COVID-19 pandemic.

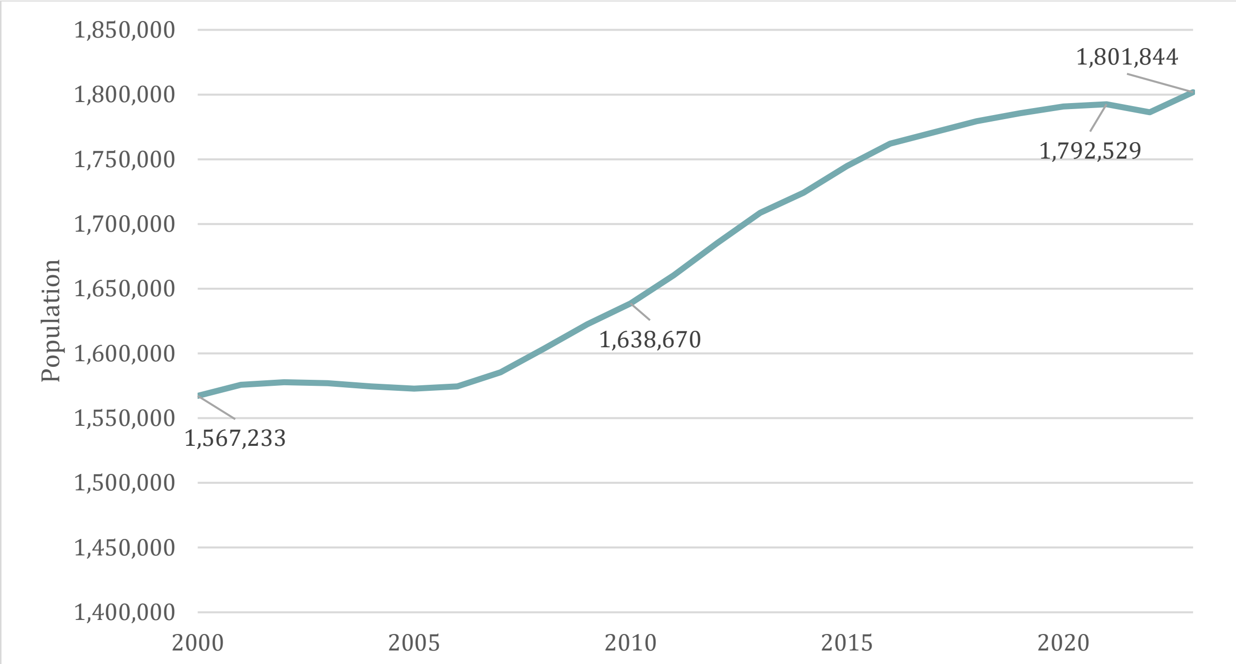

Figure 2-2: Historical Regional Population

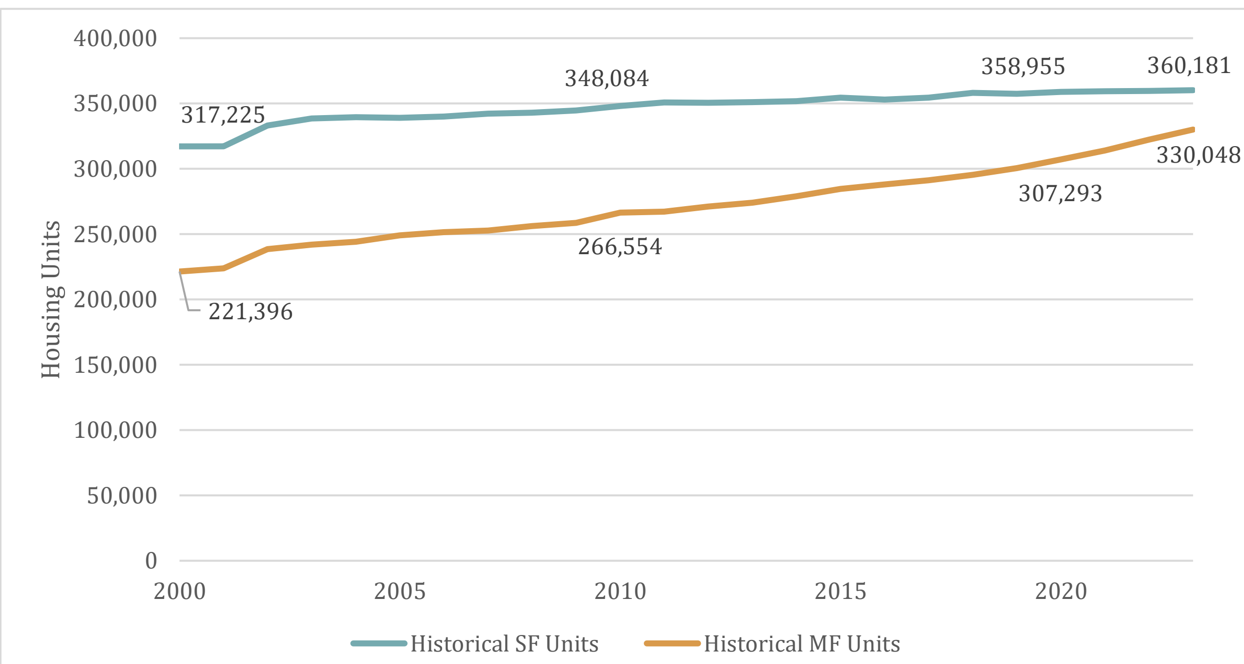

Figure 2-3: Historical Regional SF and MF Housing Units

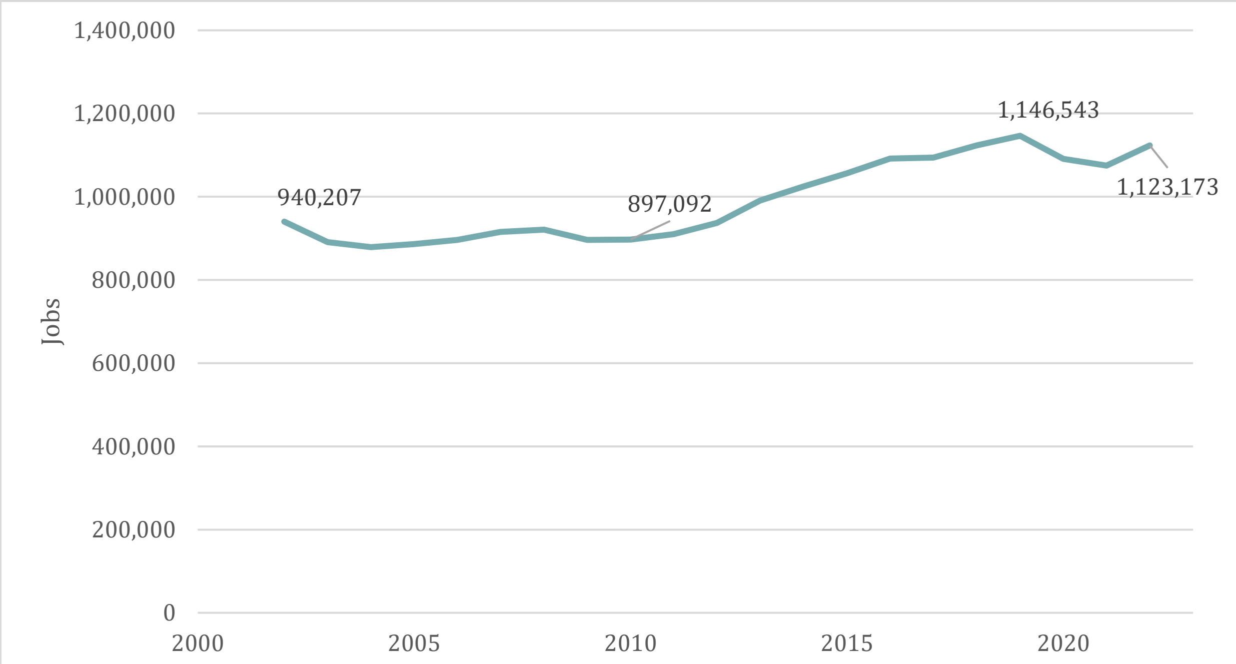

Figure 2-4: Historical Regional Job Totals

2.3.2 Historical Water Use Data

Historical water consumption[9] in the region for the primary water use sectors identified in Table 2-2 are presented in Figure 2-5 on the following page. Figure 2-5 illustrates that total water use across the BAWSCA service area has fluctuated significantly from 2000 through 2023, shaped by economic cycles, conservation programs, and climatic conditions. Demand peaked in the mid-2000s before declining during the 2008–2010 recession and again during the 2014–2016 drought, when mandatory restrictions and heightened conservation awareness drove sharp reductions in use. Following these events, water demand rebounded modestly but remained below early-2000s levels, signaling a structural shift toward lower per-capita consumption due to ongoing efficiency improvements and potential behavioral changes. The COVID-19 pandemic in 2020 introduced a temporary shift in water use patterns: residential demand increased as more people stayed home, while CII use declined due to widespread closures. Effects of the COVID-19 pandemic overlapped with the most recent drought and resulted in a net decrease in overall demand, reinforcing the sensitivity of water use to socio-economic disruptions and temporary water use restrictions.

[9] Consumption excludes NRW.

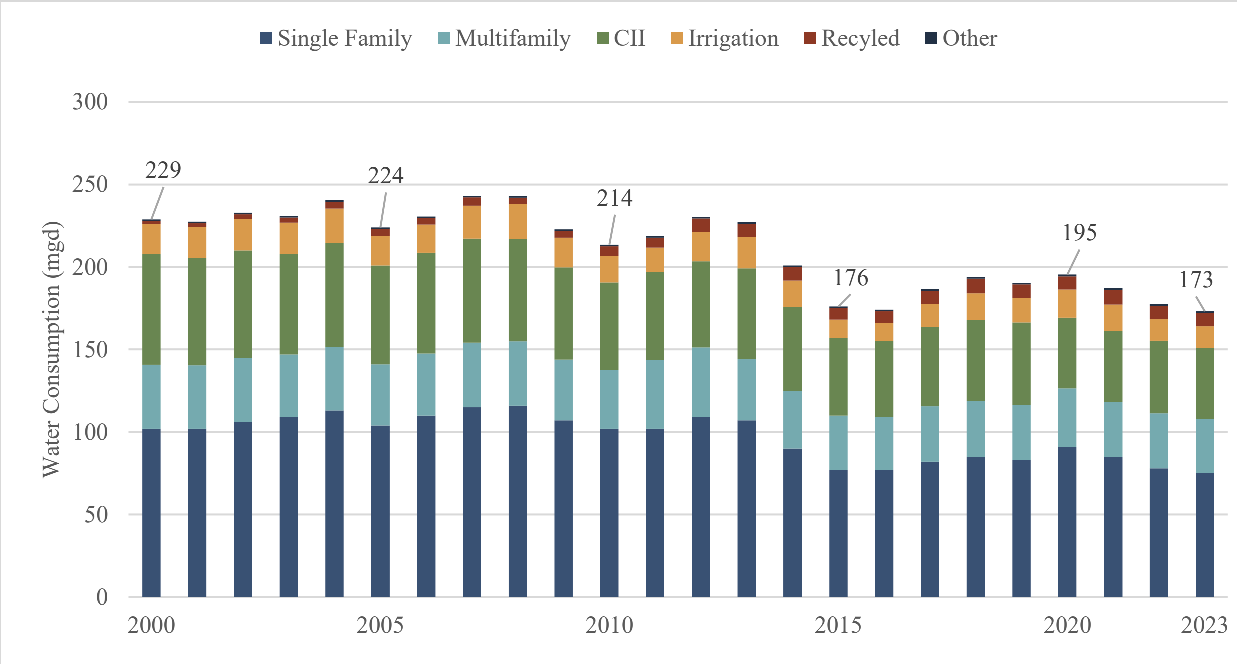

Figure 2-5: Historical Water Consumption (Excludes NRW)

3. Water Demand Forecasting Approach and Model Development

BAWSCA's updated water demand forecasting framework produces agency-specific, monthly projections of water demand by explicitly linking drivers (households, accounts, jobs) and explanatory variables (weather, price, demographics, economy) to observed water use. The generalized approach (Figure 3-1) is a "hybrid" methodology that combines econometric regression for representing historical variability in water demand with an end-use conservation toolset to reflect passive code-driven efficiency and evaluate future active conservation programming. The approach was designed to be "scenario ready" as model inputs and assumptions are straightforward to change to reflect alternate future conditions. This section provides a brief overview of the econometric model approach. The end use accounting conservation module is further discussed in Section 4.

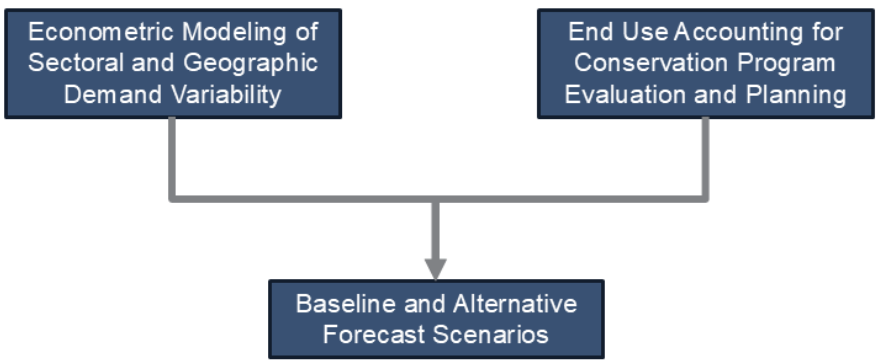

Figure 3-1: Overall Water Demand Modeling Approach

3.1 Econometric Model Design

Member agency demand for any sector is calculated as the product of "driver units" and a corresponding rate of use. Driver units reflect the scale of growth over time while the rate of use reflects the intensity of water use. The rate of use framework is an important concept in water demand forecasting because it decouples growth in customers from behavioral/technology effects on per-unit use. Equation 3-1 below provides a mathematical representation of this concept:

$$Q_{a,s,m} = N_{a,s,m} * q_{a,s,m} \quad \textbf{(3-1)}$$

Where Q is total consumption for agency a, water use sector s, and month m; N are the driver units (e.g., accounts); and q is the rate of use per account. For this analysis, an econometric approach is used to estimate the rate of use per account, q, using a set of linear regression equations that explain historical rates of water use as a function of several weather, socioeconomic, and other explanatory variables. Linear regression produces the coefficients applied to each explanatory variable to closely reproduce the historical rate of use per driver unit. Equation 3-2 shows an example linear regression for single family water use, where the price of water and temperatures are example, and only a subset of possible, explanatory variables.

$$\frac{Historical\ Single\ Family\ Use}{Single\ Family\ Account} = C_{Intercept} + C_R \times Historical\ Price\ of\ Water + C_T \times Historical\ Temperatures + \ \dots \quad \textbf{(3-2)}$$

A key feature of the econometric approach applied to the Project was to implement a "panel" regression methodology to model the rate of water use. Panel regression is a statistical method for analyzing data that combines both cross-sectional data (e.g., geographical data specific to member agencies, such as weather or housing density) and time-series data (e.g., observations of water consumption over multiple time periods). Panel regression is generally preferred to fitting independent models for each agency in isolation, as the approach improves statistical power, supports agencies with shorter or noisier billing records, and allows inclusion of important explanatory variables that vary more across geography than time (e.g., persons-per-household, housing density).

A key feature of the econometric approach is a "panel" regression methodology that models the rate of water use (q). Panel regression is a statistical method for analyzing data that combines both cross-sectional data (e.g., geographical data specific to member agencies, such as weather or housing density) and time-series data (e.g., observations of water consumption over multiple time periods). Panel regression is generally preferred to fitting independent models for each agency in isolation, as the approach improves statistical power, supports agencies with shorter or noisier billing records, and allows inclusion of important explanatory variables that vary more across geography than time (e.g., persons-per-household, housing density). A prerequisite of applying a panel regression approach was to have consistent definitions of water use types across member agencies, which were established in Table 2-2. Note that other water uses (defined in Table 2-2) were not modeled econometrically and were projected using a recent average of historical consumption.

Econometric models of historical per account water use were developed using a set of explanatory variables that meet the following set of criteria and are further defined in Table 3-1:

- Logical causal relationship with historical changes in water consumption (note the relevance and relationships articulated in Table 3-1, Column 2):
- Available historical record consistent with the time series of observed water consumption and accounts; and
- Availability of future projections consistent with the Project forecast horizon (i.e., 2025-2050) or a reasonable basis for deriving or assuming future projected values.

Table 3-1: Summary of Collected Explanatory Variables

Explanatory Variable	Relevance to Water Consumption
Monthly / Seasonal Pattern	Reflects average fluctuations of water consumption consistent with the seasons (e.g., water use tends to be larger in the summer than in the winter).
Temperature[10]	Higher temperatures are associated with higher demands.
Precipitation[11]	Higher precipitation is associated with lower demands.
Price of Water	Economic theory suggests that demand for water decreases as price increases.
Regional GDP	Water demand is positively correlated with regional economic output. An index reflecting departures in Regional GDP from long-term trend was considered in this study.
Average Unemployment Rate	Higher rates of unemployment are associated with lower rates of consumption independent of GDP, which includes the integration of labor, capital, and technology.
Housing Density	Housing density is negatively correlated with demand. Residences with smaller lot sizes tend to use less water for outdoor uses.
Persons per Household	Residences with more people tend to use larger amounts of water.
Mix of Industries / Economic Activity	CII sector water use is linked to the distribution of industries and economic activity in a region.
Jobs or Housing Units per Account[12]	Reflects the intensity of housing development and employment per account for each member agency. Generally positively correlated with water demand.
Historical Passive Efficiency	Reflects long-term historical implementation of plumbing code and fixture replacement. Negatively correlated with water demand. Historical estimates were derived from AWE Tracking Tool (see Section 4).
Drought Restrictions	Short term drought restrictions tend to decrease the amount of water consumed by customers.
COVID	Billing records indicate different water use patterns during the COVID pandemic (Assumed active from March 2020 – May 2023), conceptually related to stay-at-home orders and the increased prevalence of remote work.

3.2 Summary of Econometric Model Fitting Process

Development of econometric models was an iterative process, reflected in the following Figure 3-2 and summarized in more detail in Table 3-2. Models were fit using monthly records of the rate of water consumption, generally over the 2000-2023 time period, though this range varied based on individual member agency data availability. Data utilized for the dedicated irrigation and recycled/raw water models tended to be shorter in length, as the prevalence of these customer classes tended to be newer relative to more established classes such as single family residential.[13]

[10] The econometric model was developed using historical weather data specific to each member agency's service area boundaries. Future weather conditions used for projections are further discussed in Sections 5 and 7.

[11] Ibid.

[12] SF accounts reflect a 1-1 ratio with housing unit. MF housing units per account were calculated by dividing the number of housing units by recorded number of accounts. CII jobs per account were calculated by dividing the number of jobs within a service area by the total number of CII accounts.

[13] To ensure data quality and consistency in model calibration, all irrigation and recycled water use data were restricted to post-2005. Additional agency-specific restrictions were applied where historical patterns or anomalies warranted tighter controls. Specifically, irrigation data for North Coast CWD were limited to post-2020, and Purissima Hills WD irrigation data were

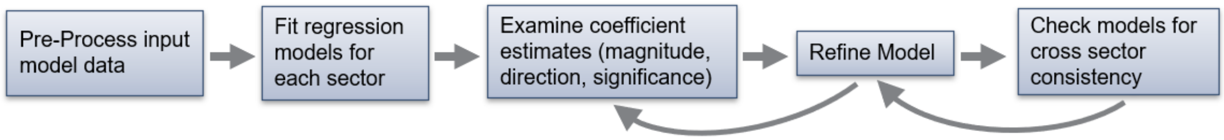

Figure 3-2: General Iterative Process for Developing Econometric Models

Table 3-2: Summary of Econometric Model Fitting Process

Model Fitting Procedure	Description
Collect and pre-process model input data	Conduct necessary pre-processing calculations prior to model fitting, e.g.: • Collaborative development of historical demographic data (e.g., housing units, jobs, and population) with member agencies. • Calculate rate of use (e.g., gallons per account per day). • Calculate natural logarithms of sectoral rate of use and appropriate predictors. • Calculate departures from normal conditions for appropriate predictors (i.e., economic trend and weather). • Calculate any index, “dummy,” or interacted parameters (e.g., seasonal cycle, geography, drought severity). • Smoothing monthly and bimonthly data to adjust for irregular billing cycles.
Fit regression models for each sector	Use statistical estimation software (e.g., R, EViews) to fit linear regression equations to per unit use with the selected explanatory variables.
Examine coefficient estimates and measure of fit	Review measures of fit (e.g., R^2) and coefficient estimates for reasonable magnitude, direction/sign, and significance.
Refine model to improve measures of fit and coefficient estimates	If the model fit is poor or if coefficient estimates are illogical or insignificant, several actions can be taken, including but not limited to: • Identifying and removing outlier data points that have significant leverage on coefficient estimates. • Remove predictors with insignificant or illogical coefficient estimates from the regression equation. • Testing alternate specifications of explanatory variables.
Check models for cross-sector consistency	Model fits and predictors are compared across sectors to judge estimates relative to prior expectations; e.g., testing if the relative effects of price and socioeconomic variables vary by sector in a logical way based on past experience.

Consistent with the panel regression process, several model coefficients are unique to each member agency, while others are shared across all agencies. Model coefficient ranges for each of the econometric models are documented in Appendix C.

restricted to post-2011. For recycled water, City of Redwood City and City of Palo Alto data were limited to post-2020, City of Mountain View to post-2013, and San Jose Muni to post-2015.

3.3 Historical Model Performance

Overall, the econometric models showed strong performance over the historical dataset and are of sufficient strength to be useful in forecasting future water demand. Figures 3-3 through 3-11 on the following pages illustrate timeseries plots overlaying regional average per-account water use compared to the econometric model fits as well as scatter plots illustrating all monthly observations and model predictions for all member agencies. Visual inspection indicates that on a regional scale the econometric models well represent both seasonal trends as well as the long-term historical trend in declining per-account use. Note that SF and MF models tend to show the strongest statistical performance. The CII model is less accurate on a monthly basis relative to the SF and MF models, but faithfully reflects long-term trends in per-account water consumption. Regionally, the irrigation and recycled water models show strong correlation with seasonal water use patterns, which is expected for sectors that are dominated by outdoor water use. Note that a regional timeseries plot for the recycled water model is not shown, as the differences in the available billed data between member agencies makes a regional average difficult to interpret.[14]

Appendix D provides additional statistics demonstrating the strength of the statistical model fits, including ranges of values across the member agencies models.

[14] Ibid.

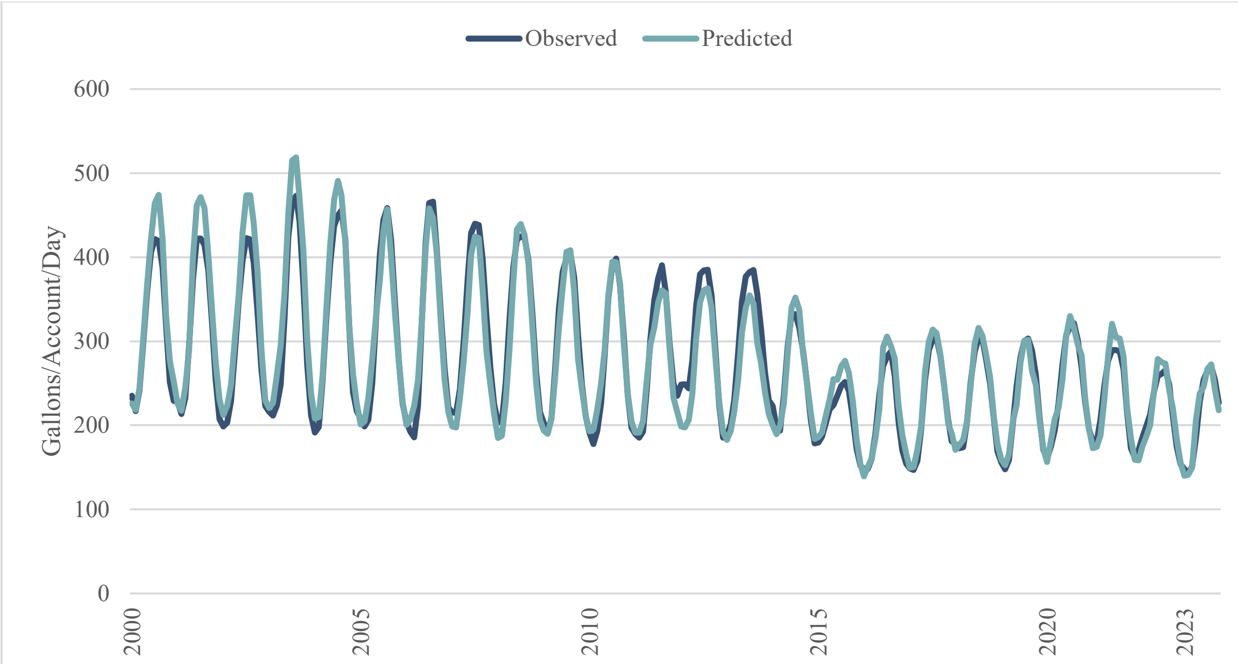

Figure 3-3: Regional Average SF Observed and Predicted Rate of Use

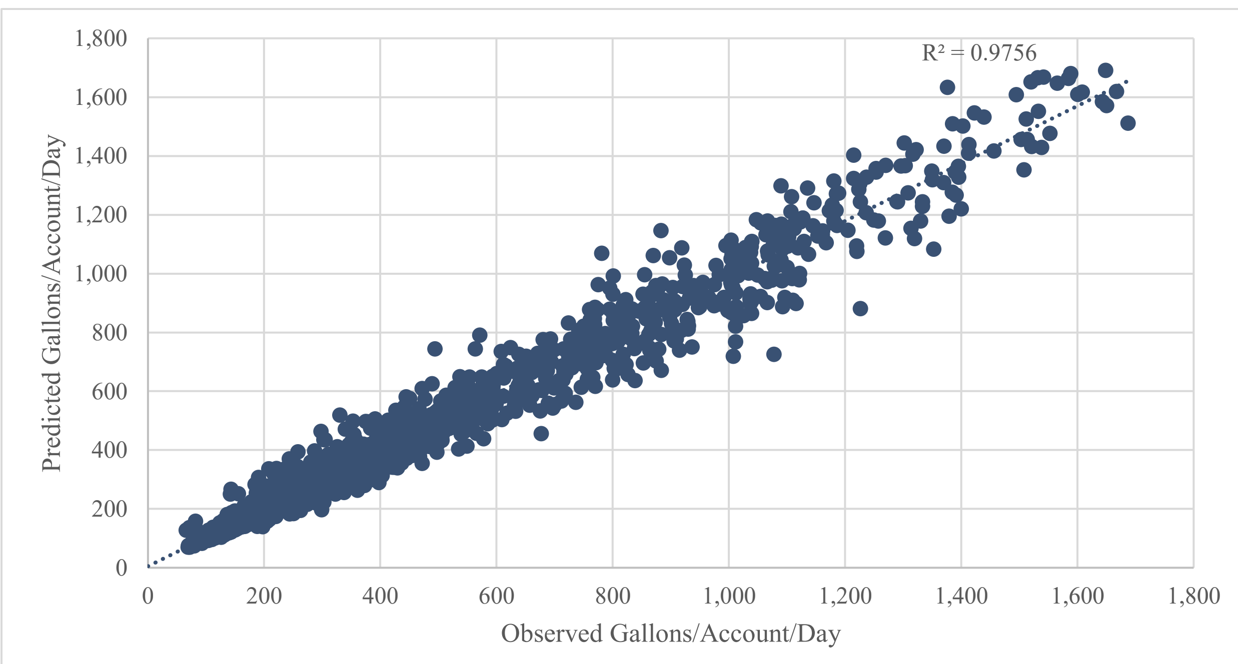

Figure 3-4: Scatterplot Illustrating Monthly Observed SF Water Use vs. Historical Model Predictions

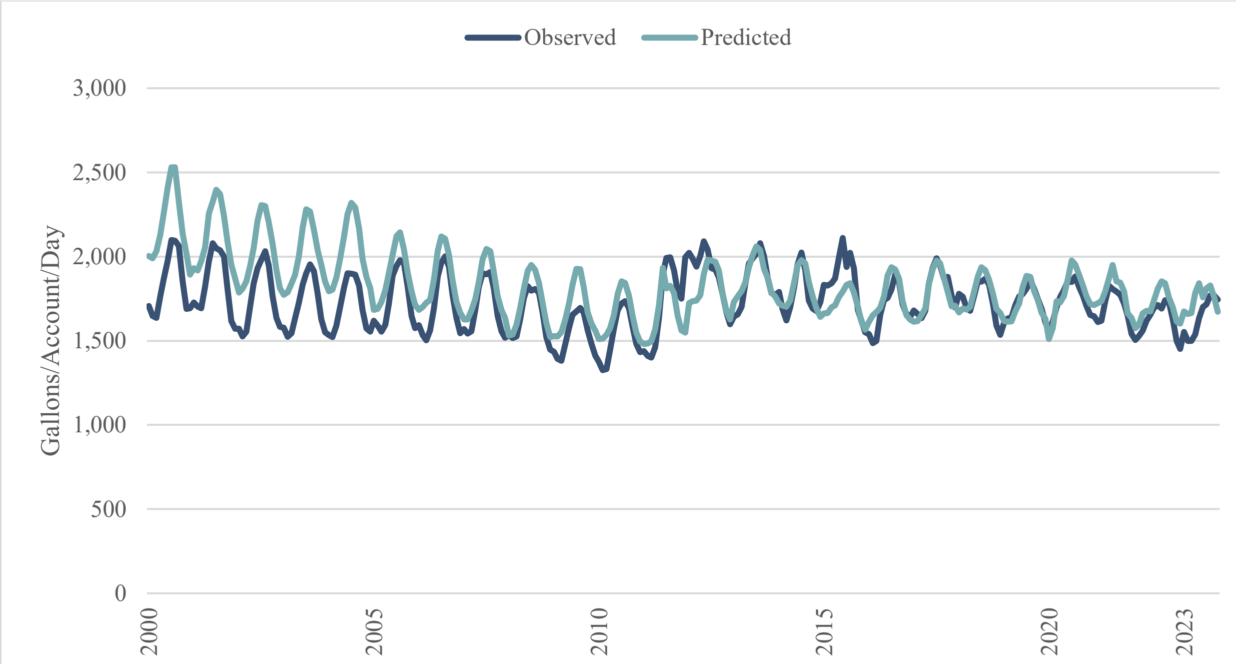

Figure 3-5: Regional Average MF Observed and Predicted Rate of Use

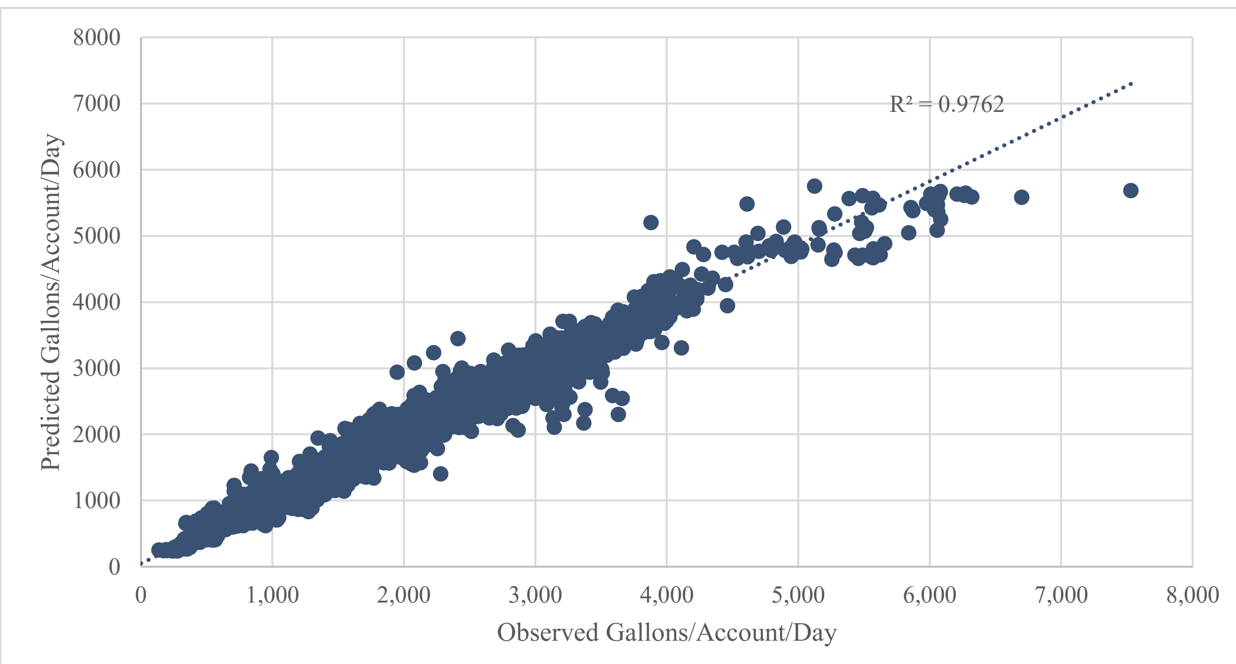

Figure 3-6: Scatterplot Illustrating Monthly Observed MF Water Use vs. Historical Model Predictions

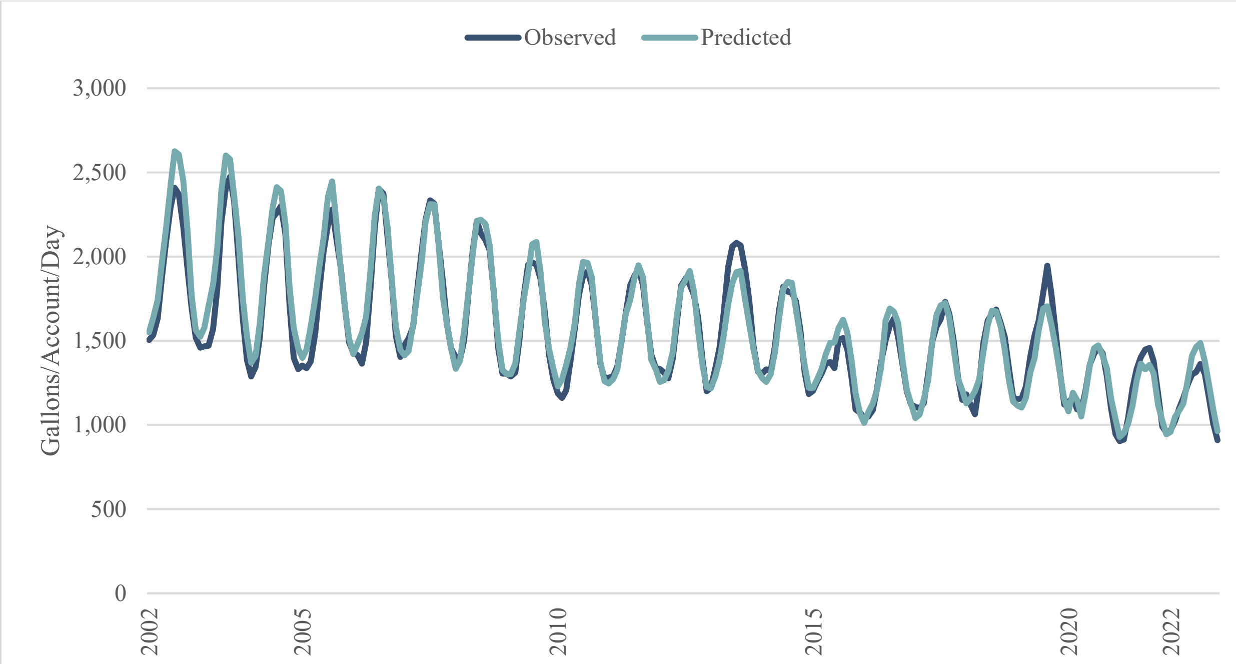

Figure 3-7: Regional Average CII Observed and Predicted Rate of Use

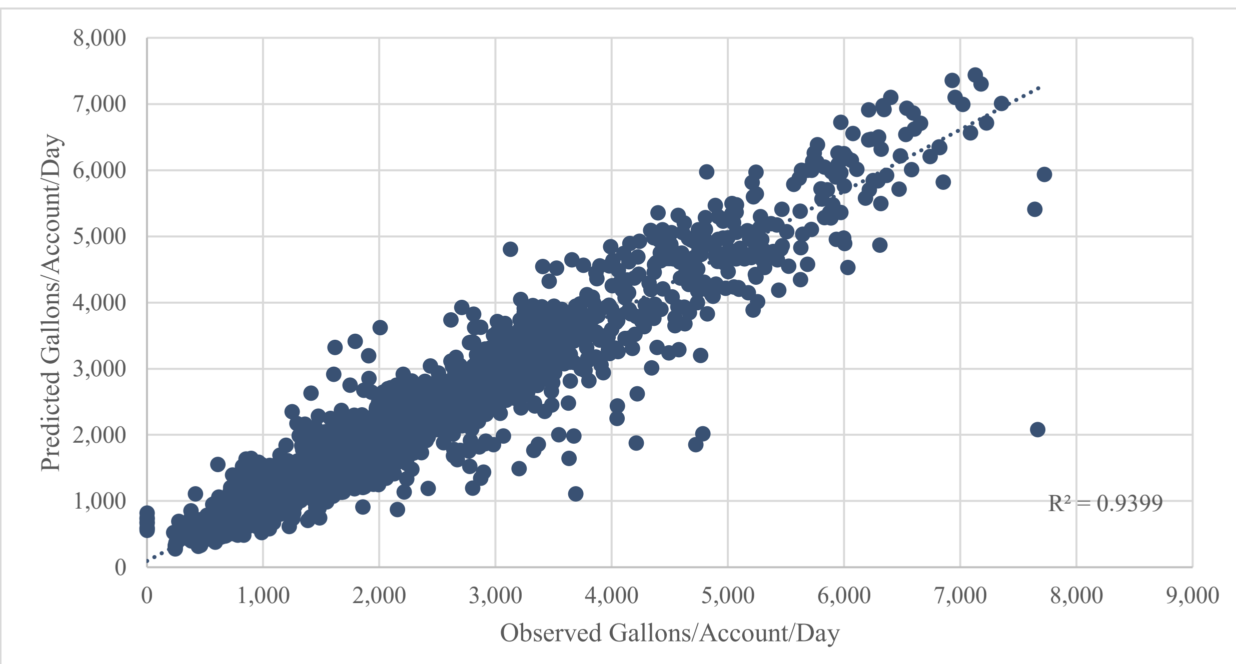

Figure 3-8: Scatterplot Illustrating Monthly Observed CII Water Use vs. Historical Model Predictions

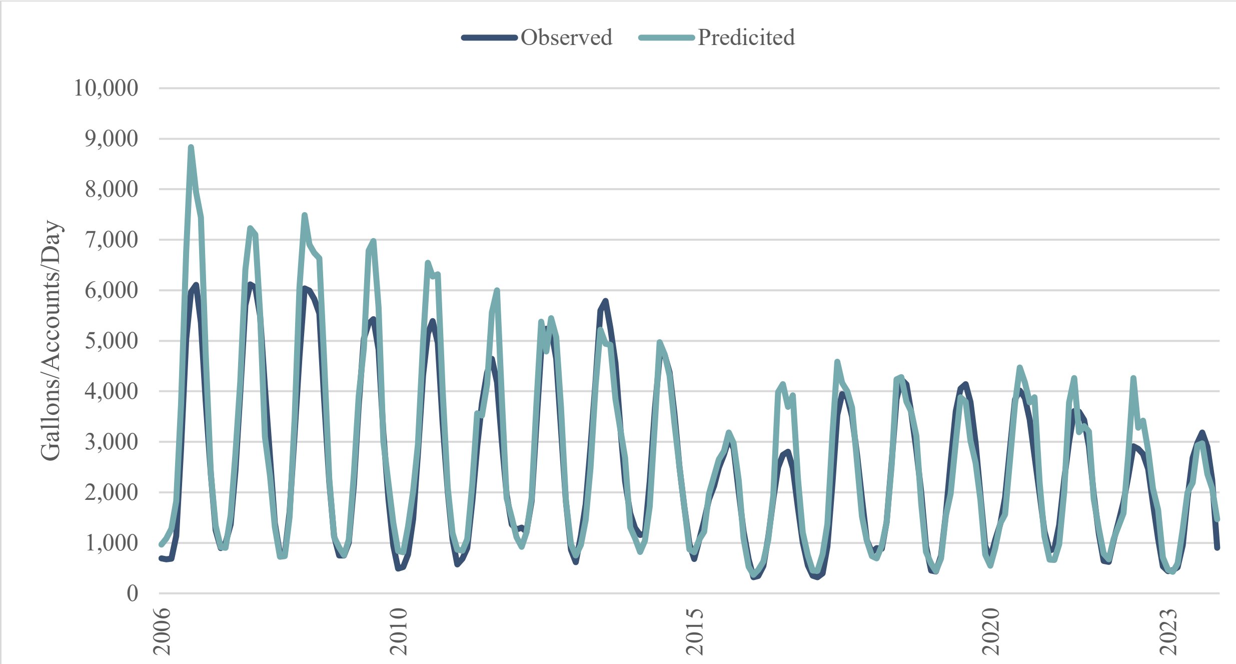

Figure 3-9: Regional Average Irrigation Observed and Predicted Rate of Use

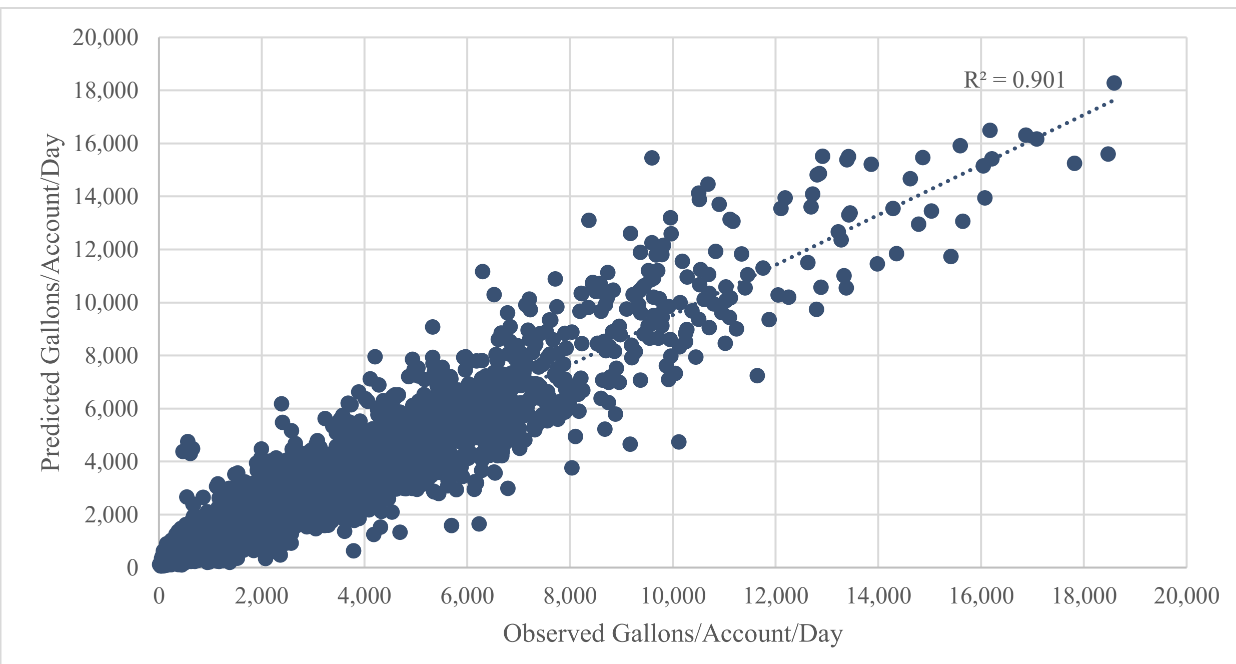

Figure 3-10: Scatterplot Illustrating Monthly Observed Irrigation Water Use vs. Historical Model Predictions

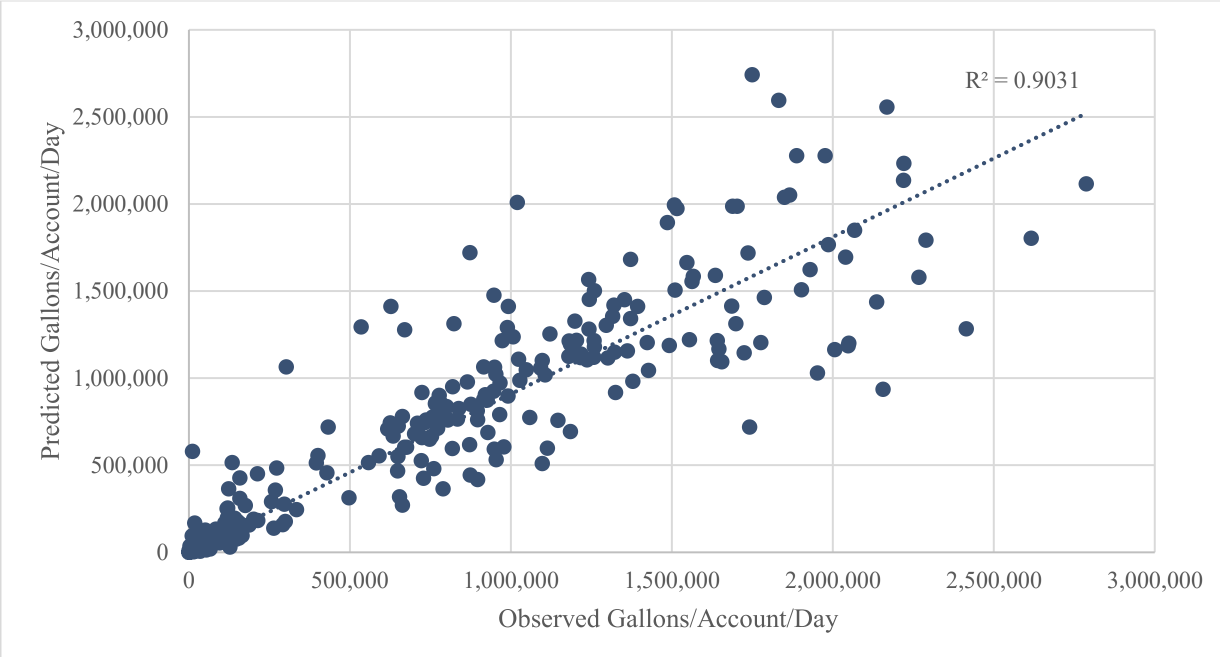

Figure 3-11: Scatterplot Illustrating Monthly Observed Recycled Water Use vs. Historical Model Predictions

4. Water Conservation Analysis and Projection

BAWSCA's conservation analysis is anchored by the AWE Tracking Tool, a Microsoft Excel–based platform designed to help utilities assess technological efficiency, estimate water savings, and evaluate the cost-effectiveness of conservation measures. The tool supports long-term planning by modeling both passive and active efficiency improvements across the SF, MF, CII, and Irrigation sectors.

The analysis uses detailed inputs, including housing units, population, water demand, and historical program installations, to model current fixture stocks and project future efficiency gains. Savings are categorized as passive (code-driven, naturally occurring replacement) or active (utility-sponsored interventions). Together, these components define remaining conservation potential and inform the development of regional program portfolios.

4.1 Passive Water Savings Assessment

Passive water savings represent the efficiency gains expected to occur naturally as fixtures and appliances reach the end of their useful lives and are replaced with models that comply with the Energy Policy Act (EPACT), CALGreen, and Title 20 standards:[15]

- **EPACT:** A U.S. federal law establishing national water efficiency standards for plumbing fixtures and appliances (e.g., toilets, faucets, showerheads).
- **CALGreen**: California's mandatory green building code (Title 24, Part 11) requiring sustainable practices, including indoor and outdoor water efficiency measures.
- **Title 20**: California Appliance Efficiency Regulations setting minimum energy and water performance standards for appliances sold in the state.

The AWE stock model simulates these changes using expected useful lives, housing and population growth, and code-based installation requirements. This establishes both a long-term indoor efficiency trajectory and the baseline against which active program savings are evaluated.

Passive turnover defines remaining retrofit potential for active programs. Several high-efficiency technologies, most notably 0.8 gallons per flush (gpf) Ultra-High-Efficiency Toilets (UHETs), cannot be achieved through passive replacement alone, as codes plateau at higher flush volumes. Similarly, outdoor uses experience no passive turnover, making them a central focus of active conservation.

4.1.1 Baseline Fixture Stock and Efficiency Trends

Understanding the distribution of residential fixture stock, such as toilets, showerheads, faucets, clothes washers, and dishwashers, is critical for accurately estimating both passive and active water savings potential. This section analyzes the current and projected efficiency levels of these fixtures, categorized

[15] https://www.energy.ca.gov/rules-and-regulations/appliance-efficiency-regulations-title-20; https://www.dgs.ca.gov/bsc/calgreen; https://www.congress.gov/bill/102nd-congress/house-bill/776

by regulatory standards (EPACT, Title 20) and market-driven ultra-high-efficiency technologies, to inform conservation planning and program targeting.

Baseline fixture stock distributions for SF, MF, and CII customers were developed using the AWE stock models. These distributions incorporate:

- Historical adoption of efficient technologies;
- Participation in BAWSCA, Valley Water, and Cal Water programs;
- Housing age, population and natural replacement rates;
- Federal and California efficiency standards; and
- Market adoption of WaterSense and ENERGY STAR technologies.

Tables 4-1 through 4-3 present the distribution of fixture and appliance stock by technology tier for 2025 and 2050. Detailed five-year incremental projections in Appendix E (Tables E-3 and E-4) show a continued decline in pre-EPACT fixtures, increasing penetration of ultra-efficient technologies, and remaining opportunities in multifamily shared laundry facilities and specific CII equipment categories not fully captured by passive modeling.

Single-Family Fixture Stock

In the SF sector, passive savings occur primarily through replacement of toilets, clothes washers, dishwashers, and showerheads as homes age, remodel, or change ownership. The model assumes a steady rate of stock turnover based on each fixture's expected useful life and the efficiency level required by current California standards.

Key Findings:

- Pre-EPACT toilets are projected to decline sharply by 2050, nearly disappearing from the stock.
- Ultra-high-efficiency toilets (UHET/WaterSense) are expected to become predominant, especially in new construction.
- The market for showerheads and aerators is expected to reach near-universal efficiency where most products in the market meet or exceed the highest efficiency standards.
- Clothes washers still present significant turnover potential, with many older models expected to remain in use.
- ENERGY STAR dishwashers are projected to dominate the market by 2050.

Multifamily Fixture Stock

The MF sector presents a more complex profile due to wide variation in building configurations, age, occupancy patterns, and management practices. Water use and conservation potential are influenced by factors such as whether units are individually sub-metered, whether landscape irrigation is tenant- or owner-managed, and the presence of shared laundry facilities. These factors create greater variability in passive efficiency trends compared to SF housing.

Key Findings:

- MF toilets are transitioning toward high-efficiency (HET) and UHET models by 2050.
- High-flow showerheads are expected to nearly disappear.
- Shared laundry facilities remain a significant opportunity for efficiency improvements, even in 2050.
- ENERGY STAR and ENERGY STAR Most Efficient clothes washers are gaining substantial market share.
- Overall, MF stock remains less efficient than SF stock across most end uses.

Additional characteristics of multifamily buildings further influence this trajectory. Multifamily properties often retain a higher proportion of inefficient fixtures and adopt efficient appliances more slowly, due to factors such as cost-sharing, building age, and limited incentives for property owners. Shared-laundry facilities commonly rely on older, high-water-use machines, underscoring significant remaining market potential for both passive and active savings.

CII Fixture Stock

CII fixture stock varies widely across business types. The baseline assessment focuses on commercial toilets and urinals, which are the only CII indoor end uses for which the AWE Tracking Tool provides stock-turnover-based passive savings modeling. Passive efficiency gains in this sector tend to occur more gradually due to longer equipment life spans, slower renovation cycles and diversity of facility types and uses.

Other CII equipment types, such as pre-rinse spray valves, commercial dishwashers, steamers, combination ovens, and laundry systems are not modeled through AWE's stock module. These technologies are incorporated only through active conservation measures where applicable and are not included in passive turnover estimates. Turnover occurs through renovations, tenant improvements, equipment failure, and business transitions.

Key Findings include:

- CII turnover is slower than residential turnover, but deep efficiency shifts occur by 2050.
- High-efficiency urinals (0.5 gpf) become the dominant urinal technology.
- Ultra-high-efficiency and waterless urinals grow steadily.
- Pre-EPACT toilets largely disappear but remain a retrofit opportunity in the near term.
- Shares of ULFT toilets shrink but remain substantial due to long commercial fixture lifespans.

Understanding the existing fixture stock and its efficiency levels provides the foundation for estimating passive savings. As older, less efficient fixtures are naturally replaced over time with code-compliant models, these stock changes drive ongoing reductions in water use without additional program intervention. The following section quantifies these passive savings.

Table 4-1: SF Fixture Stock Distribution by Technology Tier (2025 and 2050)

Fixture Type	Technology Tier	Efficiency Level	Share (2025)	Share (2050)
Toilets	Pre-EPACT	3.5–5.0 gpf	10%	2%
	ULFT (EPACT Standard)	1.6 gpf	40%	18%
	HET	1.28 gpf	45%	55%
	UHET/WaterSense	≤1.1 gpf	5%	25%
Showerheads	Legacy	>2.5 gpm	5%	1%
	EPACT	2.5 gpm	10%	4%
	Title 20	2.0 gpm	50%	40%
	Market Trend	1.8 gpm	35%	55%
Faucet Aerators	Legacy	>2.2 gpm	<5%	0%
	EPACT	2.2 gpm	20%	8%
	Title 20 / WaterSense	1.5–1.2 gpm	75%	92%
Clothes Washers	Legacy Top-Loader	High WF	30%	8%
	Standard Efficiency	Medium WF	30%	17%
	ENERGY STAR	Low WF	30%	45%
	ENERGY STAR Most Efficient	Very Low WF	10%	30%
Dishwashers	Legacy	Non-rated	20%	5%
	Standard Efficiency	Mid-efficiency	40%	25%
	ENERGY STAR	High efficiency	40%	70%

Table 4-2: MF Fixture Stock Distribution by Technology Tier (2025 and 2050)

Fixture Type	Technology Tier	Efficiency Level	Share (2025)	Share (2050)
Toilets	Pre-EPACT	3.5–5.0 gpf	20%	5%
	ULFT (EPACT Standard)	1.6 gpf	45%	25%
	HET	1.28 gpf	30%	45%
	UHET/WaterSense	≤1.1 gpf	5%	25%
Showerheads	Legacy	>2.5 gpm	10%	2%
	EPACT	2.5 gpm	15%	6%
	Title 20	2.0 gpm	45%	38%
	Market Trend	1.8 gpm	30%	54%
Shared Laundry Washers	Legacy	High WF	55%	15%
	Standard	Medium WF	25%	20%
	ENERGY STAR	Low WF	15%	40%
	ENERGY STAR Most Efficient	Very Low WF	5%	25%
In-Unit Washers	Legacy	High WF	35%	10%
	Standard	Medium WF	30%	20%
	ENERGY STAR	Low WF	30%	45%
	ENERGY STAR Most Efficient	Very Low WF	5%	25%

Table 4-3: CII Toilet & Urinal Efficiency Distribution by Technology Tier (2025 and 2050)

Fixture Type	Technology Tier	Efficiency Level	Share (2025)	Share (2050)
Toilets	Pre-EPACT	3.5 gpf	20%	5%
	ULFT (EPACT Standard)	1.6 gpf	47%	25%
	HET	1.28 gpf	28%	45%
	UHET/WaterSense	≤1.1 gpf	5%	25%
Urinals	Legacy	>1.5 gpf	15%	2%
	Standard Efficiency	1.0–1.5 gpf	40%	25%
	High-Efficiency (HEU)	0.5 gpf	35%	50%
	Ultra-High-Efficiency	≤0.125 gpf	10%	23%

4.1.2 Passive Water Savings Summary

The passive savings estimates presented in Table 4-4 illustrate projected water use reductions resulting from natural fixture turnover and compliance with plumbing codes over the planning horizon. Passive savings were evaluated in five-year increments using the AWE stock model. Results show regional passive indoor savings increasing from 3.97 mgd in 2030 to 12.15 mgd in 2050.

Key observations include:

- **Steady Growth in Savings:** Passive savings increase gradually each year as older fixtures are replaced, creating a compounding effect over time.
- **Residential Sector Dominance:** Single-family and multifamily accounts contribute the largest share of passive savings, driven primarily by toilet and clothes washer replacements.
- **CII Contribution:** While smaller in absolute terms, CII savings are significant for fixtures like urinals and commercial washers, reinforcing the importance of turnover in nonresidential settings.
- **Baseline Impact:** These savings occur without active program investment, forming a critical foundation for demand management and reducing the burden on active conservation programs.

Table 4-4: Additional Annual Passive Savings Estimates by Sector, MGD

Utility	2025	2030	2035	2040	2045	2050	Total (2025-2050)
Single-Family	0	2	3	4	5	5	89
Multi-Family	0	1	3	3	4	5	73
CII	0	1	1	1	2	2	28
Regional Total	**0**	**4**	**7**	**9**	**11**	**12**	**190**

The average rate of use for each end use technology was rebased to 2025 to ensure that only new or additional passive efficiency gains are captured in the projections. The econometric model is fit to historical water use data, which already reflects the effects of passive efficiency improvements that occurred prior to 2025, such as fixture and appliance turnover and code-driven efficiency gains. Rebasing to 2025 prevents double-counting of efficiency improvements that are already embedded in historical consumption rates. As a result, only incremental passive savings, those resulting from future fixture turnover and new code requirements not yet reflected in the historical data, are included in the projections. This approach provides a more accurate estimate of additional water savings over the planning horizon and ensures that demand forecasts are not artificially reduced by efficiency gains that have already occurred.

4.2 Active Water Conservation Program Development

BAWSCA's active conservation program portfolio was developed through a structured process ensuring that selected measures are technically applicable, cost-effective, and aligned with regional needs. The process included compiling historical program data, reviewing end uses and measure applicability, incorporating member agency input, and evaluating each program using consistent assumptions. The active conservation component reflects the implementation of utility-sponsored programs designed to accelerate or expand efficiency improvements beyond natural replacement trends. These measures address both indoor and outdoor end uses across the SF, MF, and CII sectors.

4.2.1 Compilation of Existing Program Information

BAWSCA manages a Regional Water Conservation Program consisting of multiple initiatives available to all member agencies. Ten agencies also participate in other regional programs—City of Milpitas, City of Mountain View, City of Palo Alto, City of San Jose Municipal Water, City of Santa Clara, Stanford University, and City of Sunnyvale participate in Valley Water programs, while California Water Service (Cal Water) administers programs within its districts, including Bear Gulch, Mid-Peninsula, and South San Francisco. Additionally, some agencies operate their own programs as advertised on their websites.

Historical program data were compiled from BAWSCA archives, Valley Water, Cal Water, and member agency documentation, including participation histories, budgets, and measure descriptions. Conservation measures and cost information published on agency websites were also incorporated into the regional database. These data were consolidated and used to pre-populate assumptions in the utility survey.

To validate and refine this information, an Excel-based survey was developed to present the regional program database and collect feedback on program status, costs, savings, and annual participation. Distributed in January 2025, the workbook included program lists, assumptions, and participation history. Member agencies reviewed and completed the survey in February 2025, confirming measure applicability, refining cost and savings assumptions, and providing planned participation from 2025–2050. This process ensured regional consistency while allowing flexibility to reflect local conditions.

With program data validated and future participation plans established, the next step was to identify the full set of technically applicable measures across all sectors. This analysis ensures that conservation planning considers both existing programs and emerging opportunities for efficiency improvements.

4.2.2 Identification of Technically Applicable Measures

A comprehensive review of indoor and outdoor end uses identified the full set of efficiency measures applicable to each sector. Reviewed technologies included plumbing fixtures, appliances, irrigation hardware, CII process equipment, leak detection tools, landscape transformation programs, and education and outreach initiatives. Potentially applicable measures considered for program development target indoor and outdoor use within single-family, multifamily, and CII sectors.

As discussed in Section 4.1, the passive analysis established the baseline indoor efficiency trajectory. Subsequent integration of both passive and active components ensured that:

- Passive savings are not double counted;
- Active programs focus on meaningful remaining potential;
- High-efficiency technologies not achieved through passive turnover are prioritized through active programs; and
- Outdoor measures receive emphasis due to the absence of passive turnover.

This integration revealed that there are significant remaining opportunities on a regional-level, particularly UHET retrofits and substantial additional outdoor savings potential. To support effective implementation, maintaining up-to-date estimates of fixture and appliance stock by sector and efficiency level is essential. Participation assumptions for active programs should be revisited annually, incorporating observed uptake and feedback from member agencies. Targeted outreach and incentives, especially for multifamily properties and shared-laundry facilities, should be adjusted based on participation trends to accelerate adoption. Tailored communication strategies for property owners and managers can help overcome barriers to upgrading inefficient fixtures in multifamily buildings.

4.2.3 Addressing Uncertainty and Adaptive Management

Uncertainty in participation rates, technology adoption, and cost projections underscores the need for adaptive management. Programs should be periodically reassessed in light of new data, regulatory changes, or emerging technologies to ensure continued effectiveness.

Robust data collection and transparent resolution of gaps are critical for validating savings estimates and refining program assumptions over time. Member agencies should continue providing detailed program implementation data, costs, and savings, while documenting any assumptions or interpolations used in the analysis. This approach supports adaptive planning and ensures confidence in reported outcomes.

4.2.4 Program Water Savings

The AWE Tracking Tool was used to estimate per-unit savings, measure life, retrofit potential, program costs, and cumulative savings through 2050 for all active programs. This uniform framework enables transparent comparison across sectors and supports portfolio development.

Table 4-5 through Table 4-9 present program-level results, including:

- Lifetime units installed;
- Total and annual savings;
- Cumulative savings through 2050;
- Regional program costs;
- Cost-effectiveness ($/1,000 gallons saved); and

- Share of sector savings (%).

Appendix E (Tables E-5 and E-6) present annual active savings and regional program costs by program.

For each measure, the total gallons saved reflect cumulative savings over the useful life of the technology, which varies by end use, implementation assumptions, and participation rates.[16] The tables illustrate how active programs complement passive savings by accelerating efficiency gains beyond natural fixture turnover.

Key observations include:

- **Active programs deliver incremental savings to passive conservation**, with irrigation measures providing the largest overall impact on outdoor water use.
- **Residential and multifamily retrofits contribute significant indoor savings**, particularly through high-efficiency toilets and clothes washers.
- **Commercial and institutional programs**, such as audits and direct-install kits, offer targeted opportunities for cost-effective savings in high-use facilities.
- **Savings projections,** reflect cumulative impacts through 2050, emphasizing the importance of sustained participation and adaptive management to achieve long-term goals.

The following section builds on these results by examining cost-effectiveness, enabling agencies to prioritize programs that deliver the greatest water savings per dollar invested.

4.2.5 Cost-Effectiveness and Key Drivers

Cost-effectiveness was evaluated using the AWE Tracking Tool, incorporating both utility and participant costs. For each measure, the total gallons saved reflect cumulative savings over the useful life of the technology, which varies by end use, implementation assumptions, and participation rates. This structure provides agencies with a consistent analytical foundation while allowing flexibility to select programs that best fit local priorities, customer demographics, and resource objectives.

Table 4-5 through Table 4-9 present the program water savings and unit costs used to estimate program cost-effectiveness, measured in cost per 1,000 gallons, for the single family, multi-family, non-residential (CII), and irrigation sectors, respectively.[17]

For context, programs with a unit cost below $3–$5 per 1,000 gallons saved are generally considered highly cost-effective based on regional and industry benchmarks. Measures exceeding $10 per 1,000 gallons may still warrant inclusion if they deliver significant total savings or support compliance objectives.

[16] Assumptions for unit savings rates, and useful life of the technology are default values associated with programs included in the AWE Tracking Tool.
[17] Cost-effectiveness values shown in this Tables 4-5 through Table 4-9 reflect regional costs and savings aggregated across all participating utilities over the full planning horizon. These results do not represent the cost-effectiveness of individual programs. Detailed program-level cost-effectiveness is provided separately in Appendix E. Higher cost-effectiveness values may reflect uncertainty in savings projections, participation rates, or program costs at the planning level.

Cost-effectiveness varies significantly by sector and technology, reflecting differences in retrofit potential, measure life, and implementation costs:

- **Single-Family:** Indoor conservation kits (~$2 per 1,000 gallons) and smart irrigation controllers (~$3 per 1,000 gallons) rank among the most cost-effective measures. Inline drip conversions and AMI leak alerts also fall below the $5 benchmark, while turf replacement often exceeds $10 but delivers large total savings.
- **Multifamily:** Irrigation controllers (~$3–$4 per 1,000 gallons) and UHET retrofits (~$4–$5) offer strong returns. Efficient clothes washer rebates average $8–$9 per 1,000 gallons, above the benchmark but still valuable for high-density properties.
- **CII:** Spray valves and aerators typically cost less than $3 per 1,000 gallons, making them among the most cost-effective measures. Restroom fixture upgrades and commercial laundry technologies generally fall in the $4–$6 range.
- **Irrigation:** Large landscape controllers and inline drip conversions often achieve costs near $3–$4 per 1,000 gallons, while water budgets and audits remain under $5. Turf conversion programs exceed $10 but provide significant regional impact.
- **Education & Outreach:** While not quantified in cost-effectiveness terms, these efforts are essential for driving participation and supporting compliance with the UWUO.

These findings underscore the importance of prioritizing programs that maximize water savings per dollar invested while maintaining a balanced portfolio that addresses all sectors. Utilities should incorporate cost-effectiveness metrics into future planning cycles to ensure resources are directed toward measures with the greatest impact. Programs with high total savings but moderate unit costs, such as large-scale irrigation retrofits, may still warrant inclusion for their regional impact and compliance objectives.

4.2.6 Distribution of Program Savings by Sector

Understanding how savings are distributed across programs provides the foundation for strategic decision-making. The Share of Sector Savings (%) metric presented in Table 4-5 through Table 4-9 highlights some implications for prioritizing investments.

Key observations include:

- **Irrigation:** Controllers, audits, inline drip conversions, and turf replacement dominate outdoor savings.
- **Residential Indoor:** UHET retrofits, conservation kits, and AMI leak alerts provide significant indoor savings.
- **CII:** Spray valves, aerators, restroom upgrades, and ozone laundry systems deliver strong savings in high-use facilities.

Strategic implications include:

- Focus resources on programs that represent the highest percentage of sector savings relative to program costs.
- Use distribution analysis to identify "high-leverage" measures that accelerate conservation savings.

Building on these patterns, the next section translates this analysis into actionable priorities, linking program selection to cost-effectiveness, sector-specific strategies, and long-term compliance objectives

4.2.7 Implications for Program Prioritization

The combined passive and active assessment supports several key planning decisions and provides a roadmap for cost-effective, strategically targeted conservation investments across the BAWSCA region.

Current Priorities

- Emphasize irrigation and AMI measures for long-term impact.
- Maintain strong indoor offerings, especially UHETs and fixture retrofits.
- Incorporate education programs to enable participation in high-impact measures.

While these priorities provide a solid foundation, the analysis also reveals opportunities to improve program selection. As agencies seek to maximize water savings and ensure long-term compliance with regulatory objectives, it becomes increasingly important to move beyond a "one-size-fits-all" approach. Enhanced prioritization, grounded in cost-effectiveness, a tiered implementation framework, and sector-specific strategies, enables agencies to focus resources where they will have the greatest impact.

Opportunities for Enhanced Prioritization

1. **Link to Cost-Effectiveness:** Programs with the lowest cost per 1,000 gallons saved and highest cumulative savings should form the core portfolio.
2. **Adopt a Tiered Framework for Program Implementation:**
    - **Tier 1:** High savings + high cost-effectiveness (e.g., irrigation controllers, UHET retrofits, AMI leak alerts).
    - **Tier 2:** Moderate savings or higher cost but strategic importance (e.g., turf replacement for drought resilience).
    - **Tier 3:** Supportive programs (education/outreach) that enable participation and compliance.
3. **Sector-Specific Strategies**
    - **Multifamily**: Target incentives for shared laundry facilities and tailored outreach for property managers.
    - **CII**: Focus on audits and high-use fixture upgrades in commercial kitchens and laundries.

4. **Integrate Regulatory Compliance:** Align prioritization with need to meet UWUO targets and long-term reliability objectives.

5. **Dynamic Monitoring:** Review participation and savings annually; adjust priorities based on performance and emerging technologies.

Agencies exceeding or nearing the UWUO should prioritize regulatory compliance in their planning. Those close to the UWUO threshold should strongly consider implementing the outlined recommendations to ensure compliance and avoid potential penalties. This caveat ensures that resources are directed where regulatory risk is highest, while still encouraging proactive planning for others.

Table 4-5: Portfolio of Single-Family Program Active Water Savings and Unit Costs (2050)

Program ID	Program Name	Units	Program Cost Parameters				
			Life of Savings (Years)	Cumulative Program Costs ($K)	Cumulative Program Savings (MG)	Share of Sector Savings	Cost Effectiveness ($/1000 gal)[(a)]
1	Toilets - Conventional (>=3.5 gpf) to HET (1.28 gpf)	Toilet	25	$212.05	392	2.7%	$0.54
4	Toilets - ULFT (>=1.6 gpf) to HET (1.28 gpf)	Toilet	25	$0.00	0	0.0%	-
7	Toilets - HET (1.28 gpf) to HET+ (<=1.0 gpf)	Toilet	25	$0.00	0	0.0%	-
11	SFR Washer Rebate (WF <=4)	Washer	15	$614.30	204	1.4%	$3.01
13	Water Conservation Kits - Indoor	Kit	10	$1,800.64	2,640	18.3%	$0.68
14	Water Conservation Kits - Outdoor	Kit	10	$404.05	427	3.0%	$0.95
15	Water Conservation Kits - LivingWise	Kit	10	$1,069.48	692	4.8%	$1.54
19	SFR Turf Replacement	Square-foot	10	$23,882.21	2,123	14.7%	$11.25
22	Rain Garden Addition	Square-foot	10	$640.36	75	0.5%	$8.56
23	SFR In-Line Drip Irrigation Conversion	Square-foot	10	$187.65	2,563	17.8%	$0.07
26	SFR Smart Irrigation Controller Rebate	Device	10	$1,530.24	1,189	8.3%	$1.29
29	SFR Irrigation Nozzle Replacement	Device	10	$203.90	167	1.2%	$1.22
32	Rainwater Capture - Rain Barrel <200	Barrel	5	$20,747.17	414	2.9%	$50.16
35	SFR Graywater Laundry to Landscape Rebate	Household	10	$106.54	30	0.2%	$3.50
38	SFR Water Use Audit	Household	5	$1,870.12	578	4.0%	$3.24
41	SFR Wireless Flow Monitor	Monitor	5	$42,668.36	1,947	13.5%	$21.91
42	SFR AMI Leak Alert	Household	1	$3,702.66	809	5.6%	$4.58
62	Showerhead Replacement (<= 1.8 gpm)	Showerhead	10	$99.00	79	0.5%	$1.26
64	Bathroom Direct Install	Toilet	25	$0.00	0	0.0%	-
66	Irrigation System Flow Sensor Rebate	Controller	10	$5.00	1	0.0%	$7.05
68	SFR Medium Cistern (501-999 gal) Rebate	Barrel	5	$150.00	40	0.3%	$3.75
69	SFR Large Cistern (1000+ gal) Rebate	Barrel	5	$132.00	43	0.3%	$3.10
	SINGLE-FAMILY TOTAL			**$100,027**	**14,413**	**100%**	**$6.94**

Table 4-6: Portfolio of Multifamily Program Active Water Savings and Unit Costs (2050)

Program ID	Program Name	Units	Program Cost Parameters				
			Life of Savings (Years)	Cumulative Program Costs ($K)	Cumulative Program Savings (MG)	Share of Sector Savings	Cost Effectiveness ($/1000 gal)
2	Toilets - Conventional (>=3.5 gpf) to HET (1.28 gpf)	Toilet	25	$27.64	40	0.7%	$0.69
5	Toilets - ULFT (>=1.6 gpf) to HET (1.28 gpf)	Toilet	25	$131.67	229	3.9%	$0.58
8	Toilets - HET (1.28 gpf) to HET+ (<=1.0 gpf)	Toilet	25	$10.50	11	0.2%	$1.00
12	MFR In-Unit Washer Rebate (WF <=4)	Washer	15	$0.00	0	0.0%	-
20	MFR Turf Replacement	Square-foot	10	$4,949.58	545	9.3%	$9.08
24	MFR In-Line Drip Irrigation Conversion	Square-foot	10	$553.87	366	6.3%	$1.51
27	MFR Large Landscape Smart Irrigation Controller Rebate	Device	10	$724.31	2,212	37.8%	$0.33
30	MFR Irrigation Nozzle Replacement	Device	10	$758.86	287	4.9%	$2.65
33	Rainwater Capture - Cistern >=200	Barrel	5	$420.14	70	1.2%	$6.01
36	Submetering - Other	Meter	20	$119.20	29	0.5%	$4.07
37	SFR Unmetered to Metered	Meter	20	$25.19	38	0.6%	$0.67
39	MFR Water Use Audit	Property	5	$157.72	15	0.3%	$10.57
43	MFR (4 or fewer units) AMI Leak Alert	Property	1	$92.72	1,924	32.9%	$0.05
63	Showerhead Replacement (<= 1.8 gpm)	Showerhead	10	$62.48	48	0.8%	$1.31
65	Bathroom Direct Install	Toilet	25	$52.85	38	0.6%	$1.39
67	Irrigation System Flow Sensor Rebate	Controller	10	$4.94	2	0.0%	$2.33
	MULTIFAMILY TOTAL			**$8,092**	**5,853**	**100%**	**$1.38**

Table 4-7: Portfolio of CII Program Active Water Savings and Unit Costs (2050)

Program ID	Program Name	Units	Program Cost Parameters				
			Life of Savings (Years)	Cumulative Program Costs ($K)	Cumulative Program Savings (MG)	Share of Sector Savings	Cost Effectiveness ($/1000 gal)
3	Toilets - Conventional (>=3.5 gpf) to HET (1.28 gpf)	Toilet	25	$27.29	49	3.8%	$0.56
6	Toilets - ULFT (>=1.6 gpf) to HET (1.28 gpf)	Toilet	25	$368.69	310	24.1%	$1.19
9	Toilets - HET (1.28 gpf) to HET+ (<=1.0 gpf)	Toilet	25	$10.50	13	1.0%	$0.80
10	CII Urinal (1/8 gpf) Replacement	Urinal	25	$68.69	40	3.1%	$1.70
16	Water Conservation Kits - Spray Valves	Kit	10	$83.04	568	44.1%	$0.15
17	Water Conservation Kits - Aerators/Showerheads	Kit	10	$309.47	167	13.0%	$1.85
34	Rainwater Capture - Cistern >=200	Barrel	5	$220.21	35	2.8%	$6.20
57	Certification - Green Business	Certification	0	$259.60	0	0.0%	-
61	Building Efficiency Program	CII Establishment	0	$0.00	0	0.0%	-
70	CII Ozone Laundry Washer Rebate	Washer	15	$54.60	73	5.7%	$0.75
71	CII Commercial Kitchen Dishwasher Rebate	Dishwasher	20	$0.00	0	0.0%	-
72	CII Commercial Kitchen Spray Rinse Valve Rebate	Spray Valve	10	$10.40	10	0.8%	$1.07
73	CII Commercial Kitchen Food Steamer Rebate	Food Steamer	10	$39.65	21	1.6%	$1.93
74	CII Restaurant Dipper Well Rebate	Dipper Well	10	$0.00	0	0.0%	-
76	Acoustic Hydrant Cap	Hydrant Cap	0	$0.00	0	0.0%	-
	CII TOTAL			**$1,452**	**1,286**	**100.0%**	**$1.13**

Table 4-8: Portfolio of Irrigation Program Active Water Savings and Unit Costs (2050)

Program ID	Program Name	Units	Program Cost Parameters				
			Life of Savings (Years)	Cumulative Program Costs ($K)	Cumulative Program Savings (MG)	Share of Sector Savings	Cost Effectiveness ($/1000 gal)
18	CII Technologies	CCF	10	$570.20	845	5.5%	$0.67
21	CII Large Landscape Turf Replacement	Square-foot	10	$13,536.34	1,128	7.3%	$12.00
25	CII In-Line Drip Irrigation Conversion	Square-foot	10	$1,570.07	1,100	7.1%	$1.43
28	CII Large Landscape Irrigation Controller	Station	10	$956.84	1,793	11.6%	$0.53
31	CII Large Landscape Irrigation Nozzle Replacement	Station	10	$208.72	143	0.9%	$1.46
40	CII Large Landscape Water Audit	Property	5	$2,760.57	2,947	19.0%	$0.94
75	CII Large Landscape Water Budget	Site	1	$1,079.39	7,548	48.7%	$0.08
	IRRIGATION TOTAL			**$20,682**	**15,504**	**100.0%**	**$1.33**

Table 4-9: Portfolio of Education Program Water Savings and Unit Costs (2050)

Program ID	Program Name	Units	Program Cost Parameters				
			Life of Savings (Years)	Cumulative Program Costs ($K)	Cumulative Program Savings (MG)	Share of Sector Savings	Cost Effectiveness ($/1000 gal)
44	Water Use Monitoring - Water Calculator	Household	0	$0.00	0	0.0%	-
45	Water Use Monitoring - Footprint Calculator	Household	0	$0.00	0	0.0%	-
46	Water Use Monitoring - RSAT Kit/Home Survey Kit	Household	0	$61,779.00	0	0.0%	-
47	In-School Education - Poster Contest	Household	0	$693,500.00	0	0.0%	-
48	In-School Education - EarthCapades	Performance	0	$66,108,606.00	0	0.0%	-
49	In-School Education - Water-Wise	Kit	10	$9,685,010.00	0	0.0%	-
50	In-School Education - Classroom Visit	Household	0	$1,377,000.00	0	0.0%	-
51	In-School Education - Teacher Training	Household	0	$25,500.00	0	0.0%	-
52	Public Outreach	Household	0	$9,437,771.00	0	0.0%	-
53	Water Efficient Landscaping - Conservation Garden	Household	0	$0.00	0	0.0%	-
54	Water Efficient Landscaping - Education Classes	Household	0	$474,566.00	0	0.0%	-
55	Water Efficient Landscaping - Garden Tours	Household	0	$36,480.00	0	0.0%	-
56	Water Efficient Landscaping - Water-Wise Tool	Household	0	$0.00	0	0.0%	-
58	Certification - QWEL	Certification	0	$0.00	0	0.0%	-
59	Affordability/Equity - Grants	Grant	0	$0.00	0	0.0%	-
60	Affordability/Equity - Assistance Program	Grant	0	$2,812,840.00	0	0.0%	-
	EDUCATION TOTAL			**$90,713,052**	**$0**	**0.0%**	**-**

4.3 Water Conservation Summary

Section 4 has provided a comprehensive evaluation of conservation program options for BAWSCA and its member agencies. The analysis quantifies both the ongoing impact of code-driven fixture turnover and the additional savings achievable through targeted utility programs. The use of the AWE Tracking Tool, combined with agency feedback and cost-effectiveness analysis, ensures that program selection is grounded in real-world data and tailored to local needs.

This approach also highlights the importance of adaptive management as regulatory requirements and water use patterns evolve. The findings underscore the need for ongoing monitoring, transparent documentation, and regular updates to program assumptions to maximize water savings and cost efficiency across the region.

With these insights as a foundation, the following recommendations are offered to help member agencies translate analysis into effective action, ensuring that conservation efforts remain responsive and aligned with both regional goals and state regulations.

Key findings include:

- **Passive conservation** will continue to deliver steady, compounding savings, especially in the residential sector.
- **High-impact indoor measures**, including spray valves, aerators, showerheads, and UHET toilets, remain essential contributors.
- **Active programs** generate the majority of long-term savings, particularly through irrigation measures, but they require sustained investment and adaptive management to remain effective.
- **Cost-effectiveness** varies widely across programs, with some measures delivering much greater savings per dollar.
- **Education and outreach** support awareness, enhance participation, and strengthen long-term efficiency behavior.

A balanced regional conservation strategy, combining high-impact irrigation with AMI measures, targeted indoor upgrades and strong education and engagement, ensures sustained long-term water savings and supports compliance with evolving state and local efficiency requirements.

5. Baseline 2050 Water Demand Projection Scenario

The baseline scenario serves as the foundation for BAWSCA's regional water demand projections, providing a consistent set of assumptions for demographic growth, climate, economic conditions, and efficiency trends across all member agencies. BAWSCA worked closely with member agency representatives to adjust published regional assumptions for the baseline scenario, that are agency-approved forecasts for housing units, population, and jobs to 2050. This section provides a summary of the baseline scenario assumptions and reviews the resulting water demand and conservation forecast regionally and by member agency.

5.1 Selection of Base Period and Econometric Model Calibration

Calibration refers to adjustments for residual biases in the output of fitted econometric models to establish an historical point in time to anchor projections of the future to a recent, representative historical period for each agency and sector. The calibration approach implemented a simple scalar calibration at the per-account (rate-of-use) level for each agency and sector. The use of simple scalar (i.e., a constant multiplicative factor) preserves the econometric relationships (e.g., weather and price elasticities) while removing differences/errors in the statistical model predictions for the selected calibration period. The 2022–2023 time frame was selected as the base period for SF and MF sectors and 2021–2022 for CII. These windows align the model to the most recent billed records provided by each member agency for which model predictions were available and not subject to drought restrictions.

For each member agency and model sector a calibration factor was calculated as the ratio needed to make the model's average predicted per-unit use equal the observed per-unit use over the selected calibration period. Calculated factors were then applied multiplicatively to all forward-looking monthly rate-of-use predictions. The initial calibrated forecast point, 2025, was checked against FY23-24 volumetric data reflected in BAWSCA's most recent Annual Survey and member agency profiles. Across member agencies, the initial calibrated 2025 forecast point closely aligned with FY23-24 volumetric data. A handful of member agencies[18] were able to provide preliminary FY24-25 volumetric data to further refine the calibration factors. Table 5-1 provides a summary of the final calibration factors developed for the econometric models. Since each member agency and sector has a unique calibration factor, Table 5-1 illustrates the range for each model sector.

Table 5-1: Summary of Calibration Factors

Model Sector	Calibration Factor Range
SF	0.900 to 1.300
MF	0.920 to 2.000
CII	0.800 to 1.250
Dedicated Irrigation (potable)	0.400 to 1.400
Recycled & Raw Water	0.681 to 1.270

[18] ACWD, City of Palo Alto, City of Redwood City, City of Hayward, City of Sunnyvale, and the City of Milpitas.

5.2 Scenario Definition and Assumptions

Over the course of two Water Management Representative (WMR) meetings[19] and individual comments from member agency representatives over a four-month period, BAWSCA reviewed and solicited feedback on the baseline forecast assumptions. Table 5-2 below provides a summary of key assumptions for the baseline future water demand scenario. Additional discussion of demographic, weather and climate, economic, conservation and pricing, and losses are included in the following subsections.

Table 5-2: Summary of Baseline Scenario Assumptions

Explanatory Variable	Future Assumption and Data Sources
Demographic Variables	
Housing Units	• Based on growth rates from Plan Bay Area 2050, reviewed and adjusted by member agencies' planning departments and cities (see Figure 5-1, Figure 5-2, Figure 5-3).
Population	
Total Jobs	
Persons Per Household (PPH)	• Derived from projected housing units and population identified above.
Housing Density	• Derived from projected housing units and residential land use processed from the California General Plan Land Use dataset published by the California State Geoportal.
Jobs per Account	• Assumed to be consistent with 2023 averages.
MF Housing Units per Account	
SF, MF, CII Accounts	• Grows proportionally to housing units and jobs projections using jobs and MF housing units per account factors.
Irrigation and Recycled Water Accounts	• Held constant into future unless specific account growth specified from member agency representatives.[20]
Weather and Climate Variables	
Monthly Maximum Temperature	• Climate change adjusted temperature from 2025-2050 from CalAdapt CMIP-5 downscaled projections.
Monthly Total Precipitation	• Consistent with historical normal values.
Economic Variables	
Mix of Industries / Economic Activity	• Consistent with 2022 sectoral jobs reports from LODES dataset. • Assumed to hold constant into the future.
Regional GDP and Unemployment Rate	• Consistent with long-term trend in historical data. • Assumed to hold constant into the future.
Conservation and Pricing	
Passive Savings	• Consistent with AWE Tracking Tool projections given projected demographic data (housing units, population, jobs).
Active Savings	• Consistent with projected savings from annual measures described in Section 3.
Price of Water	• Member agencies with known rate increases provided expected changes in prices. • Otherwise, prices held constant in real terms (i.e., assumed to keep pace with inflation).
Losses and Other Assumptions	
Non-Revenue Water	• Non-revenue water volumes consistent with 2023 AWWA water loss audits. • Assumed constant into the future.
Other Water Uses	• Held constant at average of billed consumption for years 2000-2023.

[19] May 29, 2025 and July 8, 2025.

[20] ACWD, City of Brisbane, City of Hayward, and the City of Redwood City provided specific account growth for irrigation and recycled water accounts.

5.3 Demographic Assumptions

Future demographic projections for housing units, population, and jobs are foundational inputs for both the econometric water demand model and a conservation planning tool (i.e., AWE Tracking Tool). These projections drive estimates of future water use, passive savings, and the capacity for conservation programs across BAWSCA member agencies.

Future demographic projections for population, SF housing units, MF housing units, and jobs were extrapolated from the historical values used to develop the econometric models as defined in Section 2.3.1.

Future projections of these explanatory variables were primarily based on the Plan Bay Area 2050 TAZ dataset,[21] which provides modeled demographic data for 2015, 2035, and 2050. TAZ geographies, which are similar in size and shape to census tracts, were aggregated and reprojected to align with member agency service areas using the procedure described in Section 2.2.1. Rather than using absolute values from Plan Bay Area (which may not align with historical estimates), the rate of change (slope) between projection years was applied to the most recent historical estimates for each agency. Application of the rate of change based on Plan Bay Area, as opposed to the actual Plan Bay Area values, avoids unrealistic jumps and ensures continuity between historical and projected data. The rate of change was applied to the most recent historical values in two steps, that reflect the two disparate growth rates in the Plan Bay Area forecasts:

- An initial "Slope A" reflecting 2015–2035 Plan Bay Area projections was calculated for population, SF/MF housing units, and jobs and imposed on 2023 historical data to generate annual projections.
- A second "Slope B" reflecting 2035–2050 Plan Bay Area projections was calculated for population, SF/MF housing units, and jobs and imposed on the 2035 projection.

As an additional validation step, the resulting demographic projections were compared to member agency Regional Housing Needs Assessment (RHNA) targets and were reviewed by member agency representatives. Adjustments to make the Plan Bay Area projections consistent with RHNA requirements were made as needed to reflect local planning realities as communicated by member agency representatives.

Demographic projections illustrated in Figures 5-1 through 5-3 on the following pages indicate steady growth across all key drivers—population, housing units, and employment—through 2050, consistent with regional planning assumptions from Plan Bay Area 2050 and local agency inputs. Regional population is expected to grow 37% over the planning horizon. Housing unit growth closely tracks population trends, with a notable shift toward higher-density multifamily development, reflecting urbanization and land-use constraints. This shift has implications for per-capita water use, as multifamily units typically exhibit lower indoor consumption but may increase outdoor irrigation demand in shared

[21] Association of Bay Area Governments (ABAG) and Metropolitan Transportation Commission (MTC). *Plan Bay Area 2050: Traffic Analysis Zone (TAZ) Dataset*. San Francisco, CA, 2021. Plan Bay Area, https://planbayarea.org/. Accessed 2024.

landscapes. Regional employment projections show a similar growth rate to population, which is likely to influence growth in CII water use.

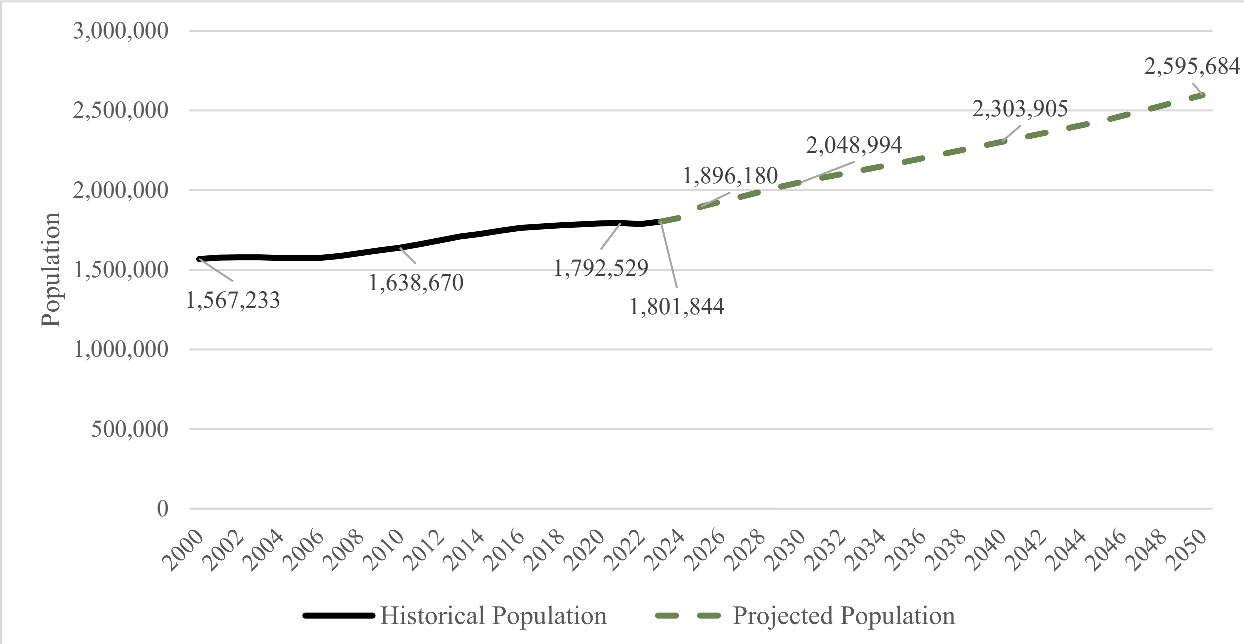

Figure 5-1: Historical and Projected Regional Population

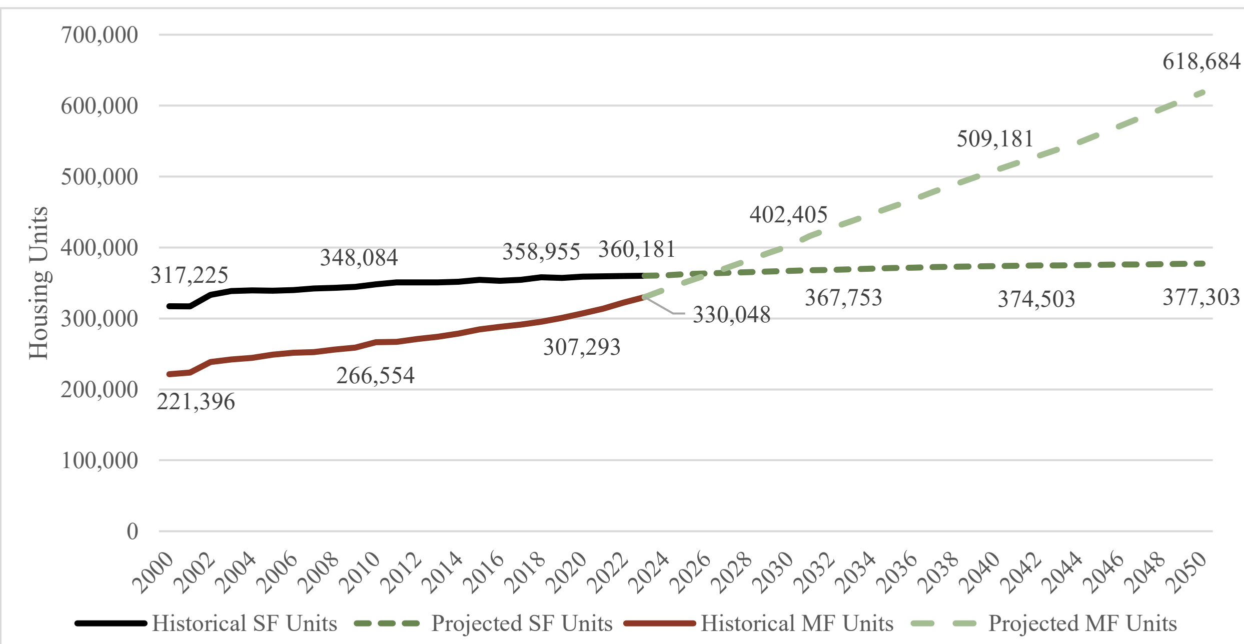

Figure 5-2: Historical and Projected Regional Housing Units

Figure 5-3: Historical and Projected Regional Jobs[22]

As discussed in Table 5-2, all additional future demographic variables, including future accounts, PPH, and housing density were derived from the projected population, housing units, and job projections illustrated in Figures 5-1 through 5-3.

5.4 Weather and Climate Assumptions

Based on discussions with member agency representatives, inclusion of climate change adjusted future weather conditions was considered appropriate to include as a part of the baseline scenario assumptions. Downscaled CMIP5 data[23] were obtained from CalAdapt's Local Climate Change Snapshot tool.[24] Climate projection data, including annual precipitation and maximum temperature, was collected for the three counties that overlay BAWSCA's member agencies, including Alameda, San Mateo, and Santa Clara counties. Data were collected for two Representative Concentration Pathways (RCP), RCP 4.5 and RCP 8.5[25] for the multi-ensemble means[26] of the CalAdapt CMIP5 projections.

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[22] Note that historical jobs data from the LODES dataset start in 2002.

[23] Note that at the time climate change data were obtained for this study, only CMIP5 data were available in a post-processed form from CalAdapt. CMIP6 data have since been released.

[24] https://cmip5.cal-adapt.org/tools/local-climate-change-snapshot

[25] RCP 4.5 represents a moderate climate change scenario where greenhouse gas emissions peak around 2040 and then decline, assuming significant mitigation efforts. In contrast, RCP 8.5 assumes continued high emissions throughout the century, leading to more severe warming and climate impacts due to minimal mitigation.

[26] The multi-ensemble mean refers to the average output derived from multiple climate model simulations, often across different models and scenarios. This approach helps reduce individual model biases and internal variability, providing a more robust and representative projection of future climate conditions—such as temperature, precipitation, or water demand—by capturing the consensus across a range of plausible futures.

Modeled temperatures from the CalAdapt CMIP5 RCP 4.5 and RCP 8.5 datasets were processed annually for 2025 – 2050 and included as potential inputs to the demand model. Table 5-3 summarizes the estimated increases in temperature between 2025 and 2050. Based on conversations with BAWSCA staff and member agency representatives, future changes from historical normal temperatures associated with RCP 8.5 were selected to include in the baseline scenario. Using RCP 8.5 captures the upper-end warming signal from CalAdapt's multi-model ensemble, supporting a conservative (i.e., non-understating) baseline for regional planning.

Table 5-3: Average Annual Maximum Temperature Increases in 2050 (Relative to 2025) Derived from CalAdapt CMIP5 RCP 4.5 and RCP 8.5

County	RCP 4.5	RCP 8.5
Alameda	1.20 °F	2.03 °F
Santa Clara	1.25 °F	2.05 °F
San Mateo	1.06 °F	1.77 °F

Climate change impacts for annual precipitation were also considered for inclusion in the baseline scenario assumptions. Based on the analysis, precipitation impacts were excluded from initial climate change considerations as modeled changes in precipitation in each county did not appear to have a significant change in mean between 2025 and 2050 for either RCP 4.5 or RCP 8.5. An example plot[27] illustrating this concept for Santa Clara County is presented below in Figure 5-4.

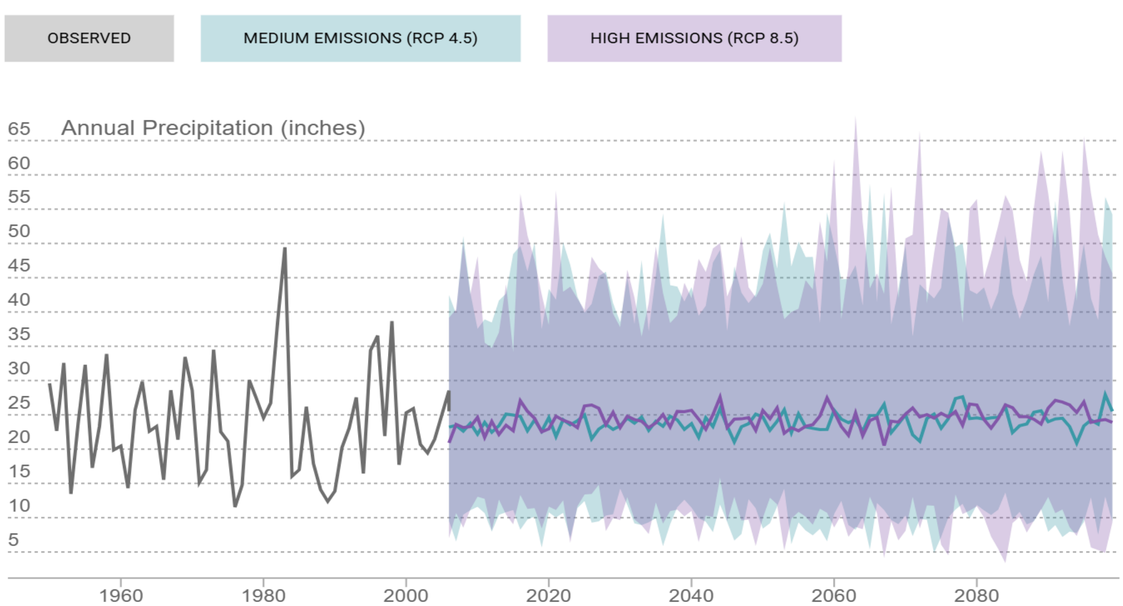

Figure 5-4: Example Modeled Annual Precipitation in Santa Clara County Under Future Climate Change Conditions

[27] Similar trends were observed for Alameda and San Mateo Counties.

5.5 Assumptions for Economic Variables

Three economic explanatory variables were considered as inputs to the CII econometric model including, the future mix of industries in each member agency service area, regional GDP, and county-wide unemployment rate. Future shifts in jobs between industries are highly uncertain (Plan Bay Area did not indicate a significant shift between 2035 and 2050) and therefore the relative percentages were assumed to be constant based on 2022 observations from the LODES dataset.[28] Future evolution of GDP and unemployment are similarly difficult to predict and were elected to remain constant at historical trends in the baseline scenario.

5.6 Conservation and Pricing Assumptions

Future conservation, both passive efficiency gains and active program implementation, moderates projected water demand growth. These savings are applied as annual deductions to sectoral consumption forecasts generated by the econometric models. Detailed methodologies and assumptions related to conservation are provided in Section 4; this section summarizes only the key elements relevant to demand projections.

Passive Savings reflect ongoing fixture and appliance turnover and code-compliant installations in new construction, consistent with California standards (Title 20 and CALGreen). These improvements occur independently of utility programs and are incorporated prospectively using the AWE Tracking Tool to ensure demand forecasts account for gradual efficiency gains.

Although new development contributes to total water demand growth, it also adds only high-efficiency fixtures to the system, thereby reducing average use per housing unit over time. These effects are considered passive because they occur independently of active utility programs and are not captured in the historical water-use data used to estimate average per-unit consumption in the econometric demand models. The AWE Tracking Tool therefore provides a mechanism to incorporate these incremental efficiency gains prospectively, ensuring that future demand projections reflect the ongoing impact of both fixture turnover and efficient new construction. Member agency estimates developed using the AWE Tracking Tool indicate that passive conservation will continue at a steady rate through 2050 driven by both ongoing MF housing growth and plumbing fixture turnover in existing SF homes.

Active Savings represent incremental reductions achieved through utility-sponsored programs beyond natural turnover. Program assumptions draw from the analysis in Section 4.3 and include measures targeting indoor and outdoor use across single-family, multifamily, and CII sectors.

[28] The City of Hayward provided alternate future distribution of jobs by industry based on a Lightcast dataset. These projections were incorporated into the baseline scenario for the City of Hayward but were not applied to other agencies given the geographical specificity of the dataset.

5.6.1 Future Water Prices

In addition to conservation effects, the econometric models explicitly account for changes in the real price of water, allowing the impacts and of pricing and conservation to be evaluated independently. To keep the baseline focused on "business-as-usual conditions" and to avoid making assumptions associated with future policy choices, the baseline scenario generally assumes no real change in customer prices over time with the exception of a handful of agencies[29] that provided approved rate increases for inclusion. More specifically, nominal rates are assumed to change with general inflation so that the real (inflation-adjusted) marginal volumetric price is held constant throughout the forecast horizon. This treatment isolates the effects of demographics, weather/climate, efficiency, and the economy from unapproved or uncertain future pricing actions. This establishes a neutral, defensible baseline for comparing alternative conservation portfolios, without presuming future Board / Council actions on rates.

A review of SFPUC's 10-year financial plan[30] indicates that wholesale rates are expected to rise in *nominal terms* at an annual average of 2.2% over the next 10-years, which is slightly *below* the assumed rate of general inflation of 3% annually. This also suggests that holding prices constant in real terms is a reasonable baseline from which other pricing scenarios can be evaluated.

5.7 NRW and Other Water Use Assumptions

NRW and "Other" water use were handled outside the econometric rate-of-use equations to avoid introducing noise into the modeled sectors and to preserve a transparent link to member-reported data and AWWA water-loss practices.

For each agency, "Other" water use was projected using the latest five-year average, with no applied trend. Meanwhile, NRW was anchored to member agency-reported 2023 AWWA water loss reporting (and/or historical production-vs-consumption series), ensuring consistency with the State reporting framework. For each member agency, NRW was assumed to be constant in percentage terms with the aforementioned historical data. These percentages were multiplied by total projected water use for the total of each modeled sector plus other water uses. The baseline scenario holds NRW at a constant share of total consumption in the future, consistent with each agency's 2023 AWWA water loss reporting (or historically observed production-consumption relationship). As total demand grows or declines, the volumetric NRW moves proportionally, but the percentage remains constant.

5.8 Baseline Forecast Results

This section summarizes the baseline water demand projections for BAWSCA member agencies between 2025-2050. The forecast reflects the combined influence of assumptions articulated in Sections 2, 3, and 4, including demographic growth, passive efficiency improvements, planned active conservation implementation, and expected climate change, while holding general economic conditions and real water rates constant. It serves as the reference point for evaluating conservation strategies and UWUO

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[29] Several agencies, including the City of Redwood City, City of Palo Alto, and Estero MID provided approved increases in water rates, which were incorporated into the baseline assumptions.

[30] https://www.sfpuc.gov/sites/default/files/about-us/policies-reports/FY-2026-10-Year-Plan-Report.pdf

regulatory compliance as developed by the State Water Resources Control Board (see Section 6). Forecasted demand is summarized sectorally without additional conservation, regionally with passive and active conservation, and by member agency.

5.8.1 Sectoral Forecasts without Additional Conservation

Across the region, SF demand remains the largest share of total consumption, but its growth is modest due to near build-out conditions. MF demand shows a stronger upward trajectory, driven by regional housing policies and higher-density development patterns anticipated in Plan Bay Area 2050 projections. The CII sector reflects moderate growth aligned with employment forecasts. Dedicated Irrigation demand remains sensitive to climate assumptions and are generally expected to be stable into the future. Low growth in this sector is consistent with the baseline assumption that Dedicated Irrigation accounts are not expected to significantly increase in the region. Recycled and raw water projections reflect expected use of ***existing*** recycled and raw water accounts.[31] As discussed in Section 3, Other water use and non-revenue water are assumed to remain constant at existing (i.e., 2023) volumes and rates, respectively. The baseline forecast organized by modeled sector is presented in Figure 5-5.

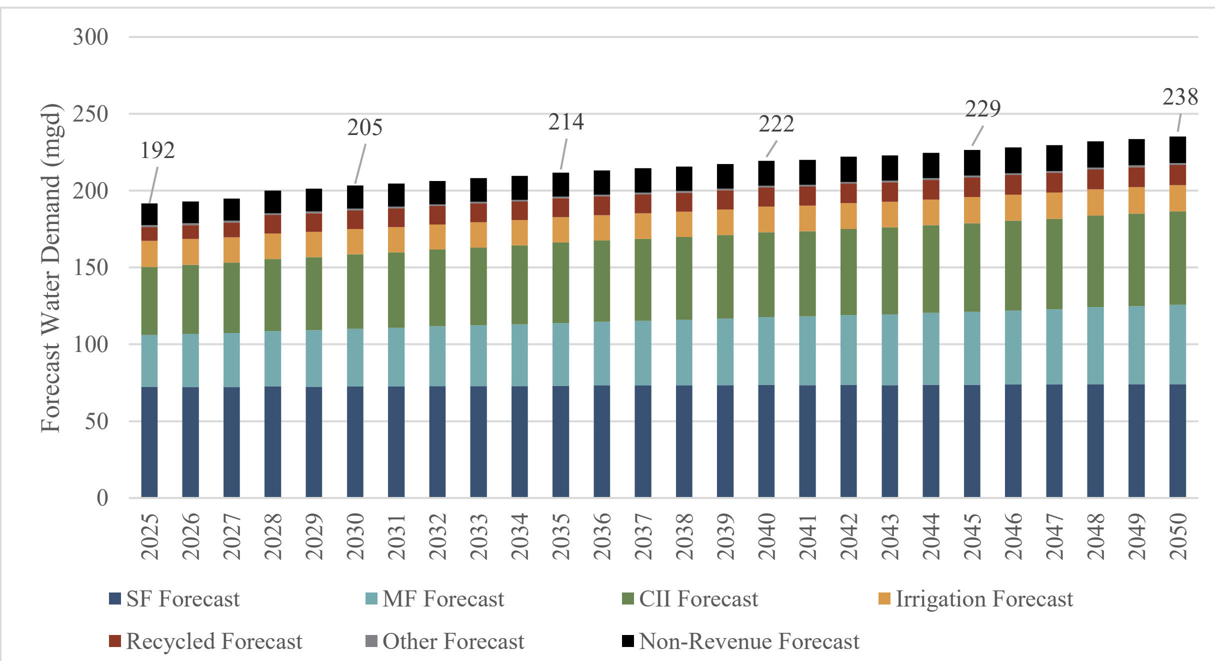

Figure 5-5: Baseline Sectoral Forecast Without Additional Conservation

[31] Several agencies indicated that several existing CII accounts and some MF accounts may switch supply sources to recycled water in the future. These changes in classification are not reflected in the baseline forecast, and should be evaluated as changes in source of supply.

5.8.2 Regional Forecasts Including Conservation

Between 2025 and 2050, passive conservation is expected to deliver a steady, compounding reduction in indoor water use as legacy fixtures and appliances are naturally replaced with code-compliant, higher-efficiency models. This effect is strongest in the SF and MF sectors driven by turnover of toilets, showerheads, faucets, clothes washers, and dishwashers) and remains meaningful for select CII end uses such as urinals). Passive savings trajectories are based on adopted California fixture standards and assumed replacement rates developed through the AWE Tracking Tool.

Building on the underlying passive glidepath, active conservation programs deliver incremental, implementation-dependent water savings. Measure options encompass both indoor and outdoor applications across SF, MF, CII, and irrigation sectors including direct-install and rebate programs, landscape conversions, smart controllers. Unit savings and measure costs taken from member submittals or Valley Water inputs supplemented by AWE Tracking Tool defaults where local data were unavailable.

Because the econometric baseline holds real prices constant and embeds only passive efficiency gains, the water savings attributed to active program portfolios are modeled as additive adjustments to the forecast. This approach supports transparent comparisons among alternative program mixes and budget levels.

In aggregate, the 2025–2050 period is characterized by monotonic increases in passive savings that steadily lower indoor use per unit, with discretionary active savings layered on where and when agencies choose to implement programs. Outdoor savings potential is especially sensitive to active measures such as turf conversion, irrigation system retrofits and smart control adoption), while indoor savings reflect a mix of passive fixture turnover and active program acceleration). Figure 5-6 and Table 5-4 summarize the baseline forecast incorporating estimates of future passive and active conservation effects across all sectors. Between 2025 and 2050, passive conservation is projected to reduce total regional demand by roughly 12 MGD, a 5 percent reduction relative to the baseline forecast. When active conservation measures are included, total demand declines by approximately 16 MGD, or about 7 percent below the baseline by 2050. These reductions equate to roughly 13,500 acre-feet per year (AFY) from passive efficiency improvements alone, and up to 19,000 AFY when active programs are implemented.

While passive savings accrue steadily across all sectors as fixtures turn over and new developments are built to California's stringent efficiency codes, active savings depend on continued program investment and customer participation. Together, these effects moderate long-term demand growth and improve the region's supply reliability, effectively offsetting the equivalent of a small new water supply source by 2050.

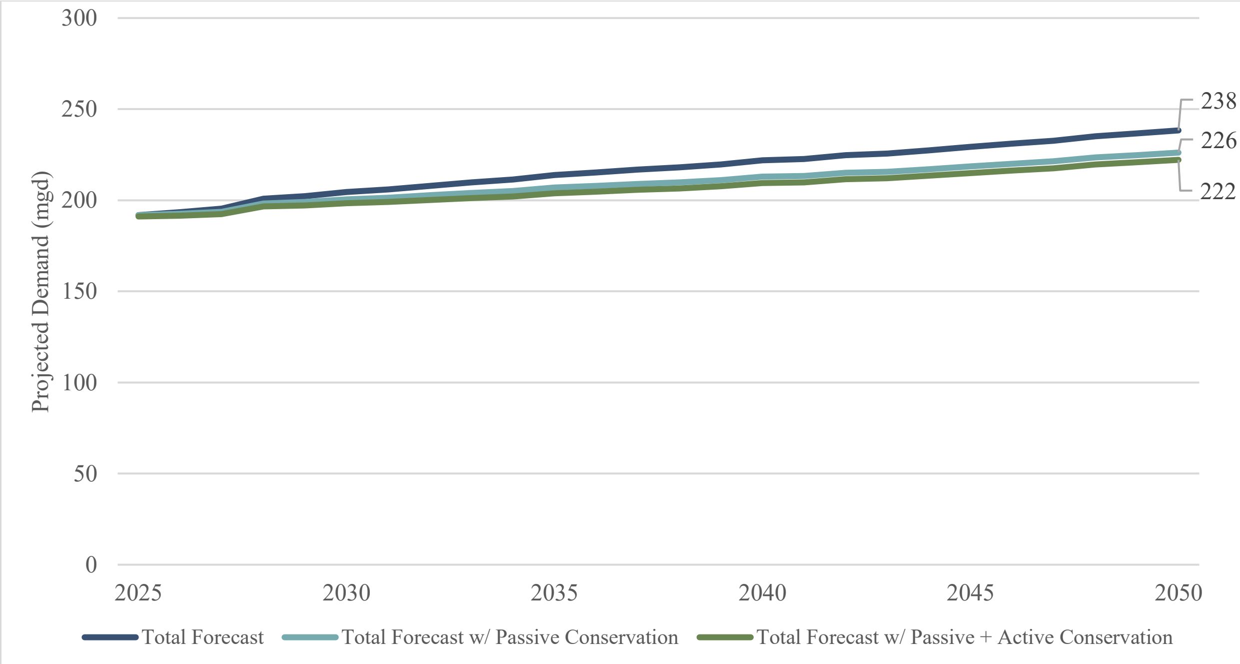

Figure 5-6: Baseline Forecast Including Passive and Active Conservation

Table 5-4: Baseline Forecast Including Passive and Active Conservation (MGD)

Forecast Assumption	2025	2030	2035	2040	2045	2050
Forecast without Additional Conservation	192	205	214	222	229	238
Total Forecast w/ Passive Conservation	192	201	207	213	219	226
Total Forecast w/ Passive + Active Conservation	191	198	204	210	215	222

5.9 Total Forecasts by Member Agency

The total baseline forecast scenario for each member agency with and without conservation is summarized in Tables 5-5 through 5-7 on the following pages. As previously stated, the demand projections presented in this report were developed exclusively for the analytical scope of this Project. Final, official demand projections must be obtained directly from the corresponding member agency's adopted planning documents. Separate to this report each member agency has been provided a water demand projection workbook containing detailed model inputs, econometric model equations, and sectoral summaries of water conservation projections.

Table 5-5: Total Baseline Forecast Without Additional Conservation by Member Agency (MGD)

Member Agency	2025	2030	2035	2040	2045	2050
Alameda County Water District	36.10	37.12	38.23	39.27	40.24	42.60
California Water Service Company -- Bear Gulch	9.01	9.14	9.28	9.33	9.36	9.40
California Water Service Company -- Mid-Peninsula	11.59	11.80	12.02	12.13	12.19	12.27
California Water Service Company -- South San Francisco	5.54	5.89	6.24	6.41	6.54	6.69
City of Brisbane/Guadalupe Municipal Improvement District	0.68	0.95	0.97	1.00	1.01	1.01
City of Burlingame Municipal	3.89	4.01	4.13	4.36	4.56	4.75
City of Daly City	6.34	6.39	6.45	6.65	6.81	6.98
City of East Palo Alto	1.64	1.68	1.73	1.76	1.78	1.80
City of Hayward	13.67	15.73	17.01	18.46	20.06	21.93
City of Menlo Park	2.70	2.80	2.90	2.99	3.07	3.16
City of Millbrae	1.89	2.03	2.17	2.29	2.41	2.52
City of Milpitas	8.76	9.19	9.68	10.11	10.39	10.69
City of Mountain View	9.12	9.96	10.80	11.37	11.89	12.46
City of Palo Alto	10.30	10.23	10.45	10.55	10.62	10.72
City of Redwood City	8.31	8.23	8.42	8.75	9.05	9.36
City of San Bruno	2.90	2.94	2.99	3.08	3.15	3.22
City of San Jose Municipal Water System - North San José - Alviso	4.72	8.41	9.02	10.00	10.91	11.81
City of Santa Clara	19.76	21.28	22.82	23.74	24.58	25.48
City of Sunnyvale	17.52	18.59	19.66	20.28	20.83	21.41
Coastside County Water District	1.57	1.60	1.61	1.63	1.64	1.66
Estero Municipal Improvement District	3.94	4.01	4.12	4.18	4.21	4.25
Mid-Peninsula Water District	2.66	2.89	3.09	3.34	3.57	3.63
North Coast County Water District	2.25	2.37	2.49	2.61	2.62	2.65
Purissima Hills Water District	1.37	1.37	1.38	1.39	1.39	1.40
Stanford University	2.65	2.86	3.08	3.16	3.24	3.32
Town of Hillsborough	2.12	2.12	2.14	2.16	2.17	2.19
Westborough Water District	0.85	0.88	0.91	0.93	0.95	0.98
Regional Total	**192**	**205**	**214**	**222**	**229**	**238**

Table 5-6: Total Baseline Forecast with Passive Conservation by Member Agency (MGD)

Member Agency	2025	2030	2035	2040	2045	2050
Alameda County Water District	36.10	36.44	37.10	37.82	38.54	40.53
California Water Service Company -- Bear Gulch	9.01	9.02	9.08	9.07	9.05	9.05
California Water Service Company -- Mid-Peninsula	11.59	11.51	11.51	11.45	11.38	11.35
California Water Service Company -- South San Francisco	5.54	5.74	5.97	6.05	6.12	6.22
City of Brisbane/Guadalupe Municipal Improvement District	0.68	0.94	0.95	0.97	0.97	0.97
City of Burlingame Municipal	3.89	3.94	4.00	4.17	4.31	4.46
City of Daly City	6.34	6.20	6.13	6.21	6.28	6.38
City of East Palo Alto	1.64	1.62	1.62	1.62	1.61	1.62
City of Hayward	13.67	15.36	16.38	17.65	19.11	20.85
City of Menlo Park	2.70	2.75	2.82	2.89	2.95	3.02
City of Millbrae	1.89	1.97	2.05	2.15	2.24	2.35
City of Milpitas	8.76	9.04	9.40	9.74	9.96	10.21
City of Mountain View	9.12	9.71	10.34	10.82	11.28	11.79
City of Palo Alto	10.30	10.05	10.12	10.15	10.17	10.23
City of Redwood City	8.31	8.05	8.12	8.34	8.55	8.79
City of San Bruno	2.90	2.82	2.79	2.81	2.83	2.86
City of San Jose Municipal Water System - North San José - Alviso	4.72	8.33	8.87	9.76	10.58	11.40
City of Santa Clara	19.76	20.99	22.30	23.07	23.78	24.57
City of Sunnyvale	17.52	18.27	19.11	19.54	19.93	20.39
Coastside County Water District	1.57	1.57	1.55	1.55	1.54	1.55
Estero Municipal Improvement District	3.94	3.93	3.99	4.01	4.02	4.03
Mid-Peninsula Water District	2.66	2.83	2.98	3.19	3.40	3.44
North Coast County Water District	2.25	2.31	2.39	2.46	2.46	2.47
Purissima Hills Water District	1.37	1.36	1.36	1.36	1.36	1.37
Stanford University	2.65	2.84	3.04	3.10	3.16	3.23
Town of Hillsborough	2.12	2.10	2.10	2.11	2.12	2.14
Westborough Water District	0.85	0.85	0.86	0.87	0.87	0.89
Regional Total	**192**	**201**	**207**	**213**	**219**	**226**

Table 5-7: Total Baseline Forecast with Passive and Active Conservation by Member Agency (MGD)

Member Agency	2025	2030	2035	2040	2045	2050
Alameda County Water District	36.02	36.03	36.48	37.12	37.76	39.66
California Water Service Company -- Bear Gulch	9.00	8.99	9.03	9.02	9.00	9.00
California Water Service Company -- Mid-Peninsula	11.58	11.47	11.45	11.38	11.30	11.27
California Water Service Company -- South San Francisco	5.53	5.72	5.94	6.02	6.08	6.17
City of Brisbane/Guadalupe Municipal Improvement District	0.63	0.78	0.78	0.81	0.81	0.81
City of Burlingame Municipal	3.89	3.92	3.99	4.15	4.30	4.44
City of Daly City	6.33	6.18	6.08	6.15	6.21	6.29
City of East Palo Alto	1.64	1.62	1.62	1.62	1.61	1.62
City of Hayward	13.38	14.97	15.92	17.17	18.61	20.33
City of Menlo Park	2.69	2.73	2.79	2.86	2.91	2.98
City of Millbrae	1.88	1.91	1.99	2.09	2.18	2.29
City of Milpitas	8.73	8.92	9.22	9.51	9.69	9.89
City of Mountain View	9.11	9.67	10.28	10.75	11.20	11.71
City of Palo Alto	10.16	9.69	9.61	9.58	9.58	9.63
City of Redwood City	8.29	7.93	7.92	8.13	8.36	8.60
City of San Bruno	2.90	2.82	2.79	2.81	2.83	2.86
City of San Jose Municipal Water System - North San José - Alviso	4.71	8.29	8.79	9.68	10.51	11.33
City of Santa Clara	19.74	20.84	22.02	22.72	23.36	24.09
City of Sunnyvale	17.52	18.26	19.11	19.54	19.93	20.39
Coastside County Water District	1.57	1.56	1.55	1.55	1.54	1.54
Estero Municipal Improvement District	3.93	3.90	3.92	3.93	3.91	3.90
Mid-Peninsula Water District	2.66	2.82	2.97	3.18	3.39	3.43
North Coast County Water District	2.24	2.27	2.33	2.40	2.40	2.40
Purissima Hills Water District	1.37	1.36	1.35	1.36	1.36	1.37
Stanford University	2.65	2.82	3.02	3.08	3.14	3.21
Town of Hillsborough	2.11	2.09	2.08	2.09	2.11	2.12
Westborough Water District	0.85	0.84	0.84	0.84	0.85	0.86
Regional Total	**191**	**198**	**204**	**210**	**215**	**222**

6. Urban Water Use Objective (UWUO)

This section evaluates BAWSCA member agencies' projected compliance with the State's UWUO through 2050. It summarizes the methodology, key assumptions, and high-level results, highlighting where agencies are expected to meet or exceed regulatory efficiency targets under baseline and conservation scenarios.

6.1 Regulatory Context

Passed in 2018, Senate Bill 606 (Hertzberg) and Assembly Bill 1668 (Friedman) established a long-term water use efficiency framework[32] that required the State Water Resources Control Board (SWRCB) to adopt new regulations for indoor and outdoor water use for urban retail water suppliers[33] (URWSs) across the state. A centerpiece of this legislation was the development of UWUOs that would regulate residential indoor and outdoor use, CII irrigation, and real water losses together as an aggregate water use efficiency standard. The SWRCB adopted this regulation mandating UWUO reporting and compliance on July 3rd, 2024.

The regulatory formulation of the UWUO[34] consists of an Indoor Residential Water Use Budget, an Outdoor Residential Water Use Budget, a CII Landscape with dedicated irrigation meters (DIMs) Water Use Budget, a Real Water Loss Budget, and any variance or provision volumes, as well as any allowable "Bonus Incentive Adjustments," as shown in Figure 6-1. Notably, no BAWSCA member agency qualifies for any "Bonus Incentive Adjustments" related to potable recycled water, so no calculations of the Bonus Incentive were required for this study. Although the UWUO is composed of four separate water use budgets, compliance with the UWUO only requires that total UWUO is not exceeded by the sum of the UWUO-regulated sectors of water use in aggregate. In other words, individual UWUO water use budgets can be exceeded as long as the overall UWUO is not.

[32] Also known as the Making Conservation a California Way of Life framework

[33] As defined in the California Water Code section 10608.12, an urban retail water supplier (URWS) is "a water supplier, either publicly or privately owned, that directly provides potable municipal water to more than 3,000 end users or that supplies more than 3,000 acre-feet of potable water annually at retail for municipal purposes."

[34] Final WCL Primer 2018

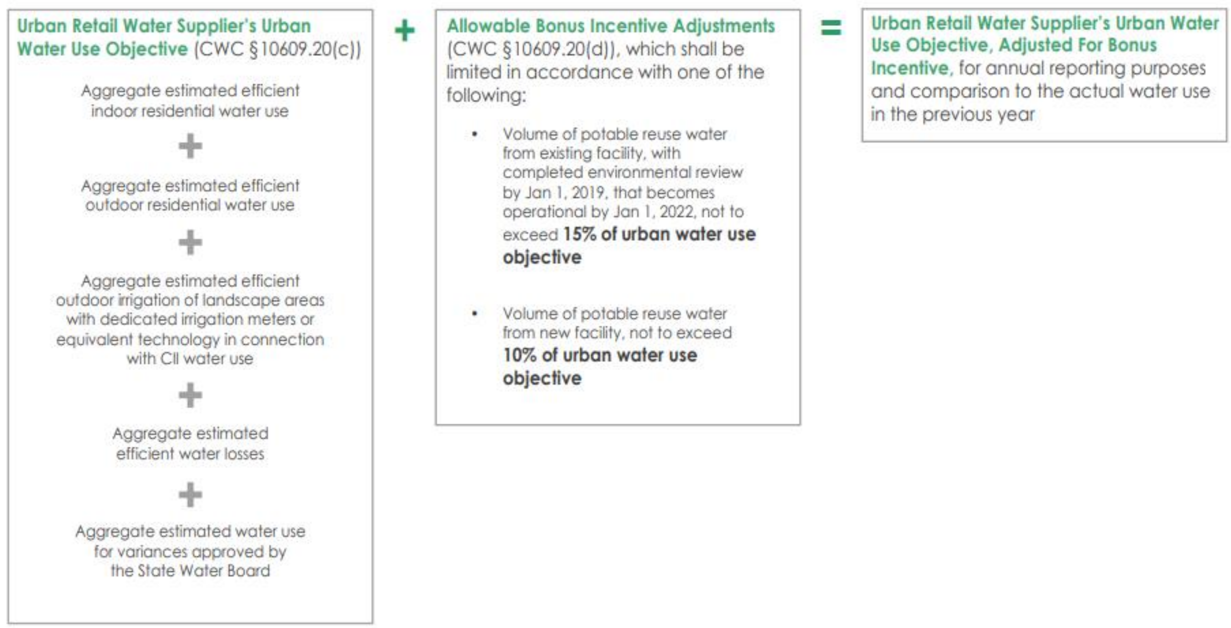

Figure 6-1: Regulatory Formulation of UWUO

As described in the final text of the *Making Conservation a California Way of Life* regulation, compliance with the UWUO regulation requires that *"no later than January 1, 2025, and by January 1 every year thereafter, each urban retail water supplier shall calculate its urban water use objective and, beginning January 1, 2027, annually demonstrate compliance with its objective."* Consequently, all UWRSs must calculate and report their UWUO to the state every year into the future and also demonstrate compliance with their new efficiency standards as soon as January 1, 2027.

Within the UWUO calculation methodology developed by the state, budgets for indoor residential water use, outdoor residential water use, and CII with DIMs water use are all required to become more stringent over time.[35] For indoor residential water use, this is the result of mandatory reductions in gallons per capita per day (gpcd) requirements over time, and for outdoor residential water use, and CII with DIMs water use, it is the result of reductions in landscape efficiency factors (LEFs)[36] over time, as shown in Tables 6-1 through 6-3. As result, UWUO compliance may become increasingly challenging for some agencies in the future.

[35] Water Code section 10609.4
[36] [Final Text of Regulation Making Conservation a Way of Life]

Table 6-1: Residential Indoor Water Use Standards and Compliance Timeline

Compliance Date	Residential Indoor Water Use Standard (gpcd)
Through December 31, 2024	55
January 1, 2025	47
January 1, 2030	42

Table 6-2: Residential Outdoor Landscape Efficiency Factors and Compliance Timeline

Compliance Date	Landscape Efficiency Factors (LEFs) for Residential Outdoor Budget		
	Existing Residential Outdoor Use	Special Landscape Area (SLA)	New Construction
Through June 30, 2035	0.8	1	0.55
July 1, 2035	0.63	1	0.55
July 1, 2040	0.55	1	0.55

Table 6-3: CII with DIMs Landscape Efficiency Factors and Compliance Timeline

Compliance Date	Landscape Efficiency Factors (LEFs) for CII DIMs Budget		
	Existing CII DIMs	Special Landscape Area (SLA)	New Construction
Through June 30, 2028	Actual deliveries associated with landscape irrigation reported to the State Board pursuant to Health and Safety Code section 116530	1	0.45
July 1, 2028	0.8	1	0.45
July 1, 2035	0.63	1	0.45
July 1, 2040	0.45	1	0.45

6.2 Methodology and Assumptions for Estimating UWUO

UWUO projections were developed for all BAWSCA member agencies that qualified as URWSs.[37] To create projections for each agency across the 2025 – 2050 time period, baseline inputs were taken from agencies' January 1, 2025 UWUO regulatory reporting submissions to the state. These regulatory submissions contained the following agency-specific information necessary for UWUO estimation:

[37] The City of Brisbane, Purissima Hills WD, and Stanford University are not URWSs and do not have UWUO estimates as part of this study.

- Landscape area measurements (LAMs) developed by the Department of Water Resources (DWR);
- CII dedicated irrigation meters' (DIMs) actual water use from FY 2023-24;
- Real water loss standards;
- Variance and provision calculation volumes, if any; and
- Senate Bill X7-7 (SB X7-7) water use efficiency targets.

In addition to this baseline data, development of long-term UWUO projections required the following external inputs:

- Annual population projections;[38]
- Net reference evapotranspiration (Net ETo) projections; and
- Existing CII DIMs landscape area measurement (LAM) projections.

6.2.1 Net Reference Evapotranspiration (Net ETo) Projections

Net ETo is defined as the difference between reference evapotranspiration and effective precipitation, in inches per year. As can be inferred from the definition, high Net ETo values occur during hot and dry years while low Net ETo values occur during cool and wet years. This Net ETo parameter acts as a scalar and significantly affects the annual calculation for the Outdoor Residential Water Use Budget as well as the CII DIMs Water Use Budget within the overall UWUO, as shown in the UWUO regulatory equations below:

$$R_{outdoor}\, Budget = S_{outdoor} \times RLA \times \boldsymbol{Net\ ETo} \times 0.62$$

$$CII_{DIM}\, Budget = S_{DIM} \times DIM\ LA \times \boldsymbol{Net\ ETo} \times 0.62$$

Due to overall UWUO sensitivity to this parameter, and because future climatological data is not yet known and the required inputs for reference evapotranspiration and effective precipitation derivations are difficult to estimate, BAWSCA opted to use a DWR-developed historical dataset for Net ETo (the 2017-2021 Provisional Dataset) that was released as part of the *Making Conservation a California Way of Life* proposed regulation. Key benefits of using this DWR dataset were concurrence with the reference evapotranspiration and effective precipitation derivations used in the UWUO Reporting Form, as well as a 5-year dataset that included both a wet and a critically dry hydrologic year. Furthermore, to address the future climatological uncertainty out to 2050, BAWSCA approved an "envelope" approach that calculated an "upper bound" and "lower bound" UWUO projection into the future for each agency, one based on the highest Net ETo value from the 2017-2021 Provisional Dataset, and the other based on the lowest Net ETo value. Figure 6-2 shows an example UWUO projection "envelope" for an anonymized agency.

[38] Annual population projections by agency were developed as part of the Baseline Forecast. Please refer to Section 5 for more information on this projection methodology.

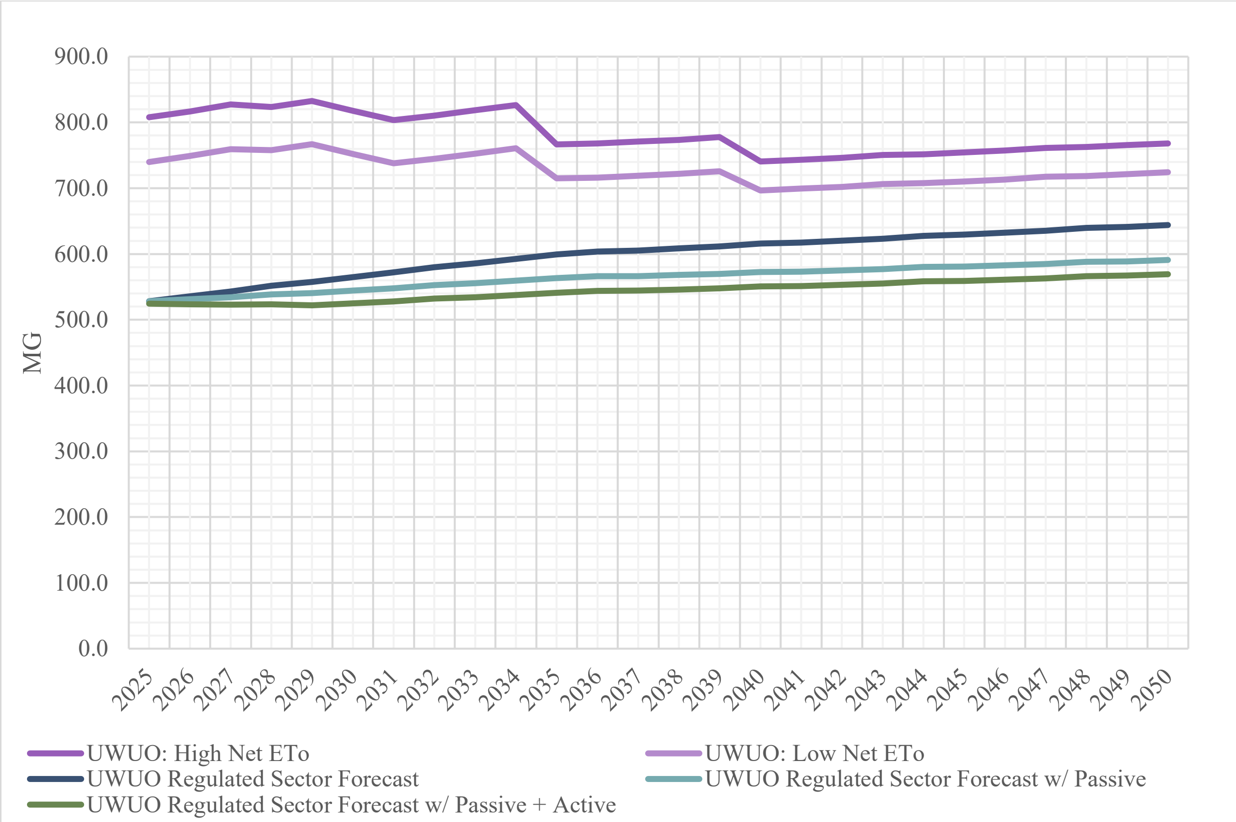

Figure 6-2: Example UWUO Projection Envelope based on High and Low Net ETo values

6.2.2 Existing CII DIMs LAM Projections

While the January 1, 2025 UWUO regulatory submissions included agencies' CII DIMs actual water use from FY 2023-24, long-term UWUO projections required an estimate of existing CII DIMs LAMs to appropriately adjust the CII DIMs Water Use Budget over time. Since DWR had not completed the CII DIMs LAMs dataset prior to this study's development, BAWSCA approved the following methodology for back-calculating CII DIMs LAMs using January 1, 2025 UWUO regulatory submission data as well as the *Making Conservation a California Way of Life* regulatory equation shown below:

$$CII_{DIM}\ Budget = S_{DIM}\ \times DIM\ LA \times Net\ ETo \times 0.62$$

Within this equation, values for $CII_{DIM}\ Budget$ (which DWR equated to the CII DIMs actual water use from fiscal year 2023-24 for this submission) and $Net\ ETo$ were taken from the January 1, 2025 UWUO regulatory submissions by agency. Assuming that S_{DIM} (i.e. the landscape efficiency factor [LEF] standard) equaled 1.0, since compliance with CII DIMs LEFs only begins July 1, 2028 and no efficiency reductions are required before that date, the equation above can be rewritten to solve for $DIM\ LA$:

$$DIM\ LA = \frac{CII_{DIM}\ Budget}{S_{DIM} \times Net\ ETo \times 0.62}$$

Note that this equation also assumes that DIM LA is the sum of both CII DIM LA and CII DIM special landscape area (SLA), since any distinctions between LA and SLA are not captured within actual water use volumes.

Estimation of the existing CII DIMs LAMs by agency was important for the overall UWUO projections because it allowed the CII DIMs Water Use Budget to reduce over time due to changing Landscape Efficiency Factors (LEFs). This approach also allowed for the correct handling of different Net ETo values within the CII DIMs Wate Use Budget projections. Once derived, the back-calculated CII DIMs LAMs values were assumed to be constant across the 2025 – 2050 timeframe unless agency-specific changes were requested.

6.2.3 Other Assumptions and Considerations for UWUO Projections

Various other assumptions and considerations were also required as part of the UWUO estimation methodology, including:

- No changes to residential or CII DIMs LAMs over time[39] unless specifically requested by an agency.
- No inclusion of the 20% Irrigable Not Irrigated (INI) "buffer" component of the UWUO calculation,[40] as it is a temporary measure that will be discontinued once suppliers update/approve the landscape area values in the original dataset provided by DWR.
- As required under the final *Making Conservation a California Way of Life* regulation, and as developed in the UWUO Reporting Form, the UWUO projection methodology incorporates a SB X7-7 cap on the UWUO so that the governing water use efficiency objective will always be the minimum of either the calculated UWUO or the SB X7-7 individual target-based total use less any excluded demands.[41]

Agencies were also able to provide more granular data for incorporation into the UWUO projections if desired, including 1) changes to currently reported landscape areas, 2) future landscape areas for new development (residential outdoor, CII DIMs), and 3) any additional variance and provision volumes. Numerous BAWSCA agencies provided additional information on landscape areas, both existing and planned, but no agency provided any additional variance or provision volumes.

A summary of the UWUO budget components, required budget inputs, regulatory equations, and estimation methodologies used to develop the overall UWUO projections is provided in Table 6-4.

[39] As part of this task, Hazen conducted a sensitivity analysis and determined that updating residential LAM areas over time was unlikely to significantly impact UWUO projections. The sensitivity analysis developed a "typical square footage" per SFR unit and MFR unit, respectively, and then scaled the LAMs over time based on SFR and MFR housing growth projections. Numerically, the most likely scenario (i.e. "typical" based on empirical GIS analysis) in terms of residential LAM adjustments over time increased the UWUO projections of the evaluated agencies by less than 5% compared to the "no LAM adjusted" baseline.

[40] The 20% INI buffer only applies if Actual Water Use exceeds the UWUO.

[41] Excluded demands are defined as values provided by the supplier to the Board pursuant to Health and Safety Code section 116530, for the following delivery categories: other; commercial and institutional; and industrial.

Table 6-4: UWUO Budget Components, Inputs, Regulatory Equations, and Estimation Methodologies

UWUO Budget Component	Regulatory or DWR-provided Inputs	Agency Inputs	Regulatory Equation[42]	Estimation Methodology for UWUO Budget Component
Indoor Residential Water Use Budget	• Indoor Water Use Standards • DWR LAMs • DWR Provisional Dataset for NET ETo	Agency population projections	$Indoor\ Residential\ Budget = S_{indoor} \times P \times days\ in\ year$	Multiplied the appropriate Indoor Residential Water Use standard (Water Code section 10609.4) in gallons per capita per day by the residential service area population projection and by 365 days, accounting for fiscal year reporting.
Outdoor Residential Water Use Budget	• LEFs • DWR LAMs • DWR Provisional Dataset for NET ETo		$Outdoor\ Residential\ Budget = S_{outdoor} \times RLAM \times Net\ ETo \times 0.62$	Multiplied the appropriate LEF standard by DWR's residential LAM in square feet, the Net ETo value as developed from DWR's Provisional Dataset, and the conversion factor of 0.62.
CII with DIMs (or Equivalent Technology) Water Use Budget	• LEFs • DWR LAMs • DWR Provisional Dataset for NET ETo	Back-calculated CII DIMs LAMs	$CII\ DIMs\ Budget = S_{DIM} \times DIM\ LAM \times Net\ ETo \times 0.62$	Multiplied the appropriate LEF standard by the back-calculated CII DIMs LAM in square feet, the Net ETo value as developed from DWR's Provisional Dataset, and the conversion factor of 0.62.
Water Loss Budget	• Agency-specific real water loss standard (gallons per connection per day)	Agency number of account projections	$Water\ Loss\ Budget = S_{water\ loss} \times C \times days\ in\ year$	Multiplied the agency-specific real water loss standard in gallons per connection per day by the total annual agency number of accounts projection and by 365 days.
Variances or Provisions	Variable	Any agency-specific inputs	Variable	None requested, although residential agricultural variance calculations were incorporated in the underlying DWR data populated in the January 1, 2025 UWUO Report submissions and were therefore carried forward for relevant agencies in the UWUO projections.
SB X7-7 Target-based Total Use	• Agency-specific SB X7-7 target		$SB\ X7x7\ Target\ based\ Total\ Use = Agency\ SB\ X7x7\ target \times P \times days\ in\ year$	Multiplied the agency-specific SB X7-7 target in gallons per capita per day by the residential service area population projection and by 365 days.

[42] Where, P = population, S = applicable standard, RLAM = residential landscape area measurement, Net ETo = net reference evapotranspiration, and C = total number of service connections.

6.3 Comparison of Projected Water Demands with the Estimated UWUO

A primary goal of this study was to assess if BAWSCA agencies are anticipated to exceed their UWUOs over the course of 2025 – 2050, given the baseline forecast, and if so, by how much and when. This information can help agencies understand how much time they might have to adopt additional conservation measures to meet their future water use efficiency regulatory requirements. To develop this analysis, agency UWUO projections were compared to the water demand projections of the UWUO-regulated sectors. Within the Demand Study, these UWUO-regulated sectors included the SF Forecast, the MF Forecast, the Irrigation Forecast, the Recycled Forecast (the portion used for residential and/or CII large landscapes), and the real water loss component of the Non-Revenue Forecast.

The results from this comparison demonstrate that the majority of BAWSCA agencies are anticipated to meet their UWUOs across the full time period 2025 – 2050. However, 7 of 23 agencies[43] are anticipated to exceed their UWUOs over the 25-year period with only passive conservation, and 5 of 23 agencies are anticipated to exceed their UWUOs over the 25-year period with both passive and active conservation. If only the High Net ETo UWUO projections (which result in higher objectives) are evaluated, 4 of 23 agencies are anticipated to exceed their UWUOs over the 25-year period with conservation included. The earliest anticipated UWUO exceedance occurs in 2031 with only passive conservation (if evaluating the Low Net ETo projection) and in 2035 with only passive or with both passive and active conservation (if evaluating the High Net ETo projection). Other anticipated exceedances begin between 2035 – 2040.

Due to the step-wise reductions in the indoor residential gpcd standards as well as step-wise reductions in the landscape efficiency factors (LEFs) within the UWUO calculation, some agencies only show a brief window of UWUO exceedance and then again show demand dropping below the UWUO into the future. This is the result of steady and more gradual conservation (passive only or both passive and active) catching up with the UWUOs over time. With conservation included in the forecast (passive only or both passive and active), only 5 of 23 agencies are anticipated to exceed their UWUOs in 2050 (if evaluating the Low Net ETo projection), and only 4 of 23 are anticipated to exceed their UWUOs in 2050 (if evaluating the High Net ETo projection).

[43] The City of San Jose was not included in this metric because its UWUO encompasses geographies that are outside of BAWSCA's service area.

7. Analysis of Alternative Forecast Scenarios

Water demand forecasting is sensitive to uncertainties in assumptions around future conditions. Population growth and demographic shifts introduce variability, as migration patterns and urbanization trends are difficult to predict. Economic development and industrial activity add further complexity, as fluctuations in economic output and changes in water-intensive industries are driven (or derived) by the demand for various goods and services. Technological adoption—such as water-saving devices and reuse systems—depends on uncertain behavioral and policy factors. Finally, data quality and model structure themselves pose risks, as simplifying assumptions may propagate errors over time. Given these layers of uncertainty, scenario analysis offers a practical framework to explore a range of plausible futures, enabling water suppliers to test assumptions and assess the resilience of strategies under varying conditions.

BAWSCA worked with member agency representatives, external stakeholders, and SFPUC to develop five additional water demand scenarios to bracket the baseline forecast summarized in Section 5. This section provides a summary of the scenario development process, a description of the key scenario assumptions, and an overview of the alternative scenario projections on a regional basis.

7.1 Scenario Development Process

Alternative water demand scenarios were developed in concert with member agency representatives, stakeholders, and SFPUC staff with the intent to leverage additional expertise around key uncertainties that may impact future water demands. Aside from member agency representatives, organizations providing input to the scenario development process included:

- Association of Bay Area Governments (ABAG)
- Acterra (formerly Sustainable Silicon Valley)
- City/County Association of Governments of San Mateo County (C/CAG)
- County of San Mateo
- Tuolumne River Conservancy (formerly Friends of the Tuolumne River)
- Sierra Club
- Sustainable San Mateo

During a two-month period, BAWCSA engaged with member agency representatives, SFPUC, and stakeholders through direct discussions, online surveys, and two workshops. The process included determining key explanatory variables affecting water demand, evaluating baseline assumptions and data sources, and assessing uncertainty regarding future conditions—such as identifying alternative projection datasets. Throughout this engagement, assumptions for potential future scenarios for the Bay Area were collaboratively developed and systematically categorized into four general groups that align with water demand model inputs: (1) Demographics and development; (2) Socioeconomic conditions; (3) Conservation and pricing; and (4) Climate and other trends/concerns.

Using this organizational approach, plausible regional scenarios were developed to set reasonable bounds on future water demand predictions. During the workshops, conceptual scenarios were designed to align with both high and low regional water needs, relative to the baseline scenario. The main results from these workshop activities are summarized below according to "High" and "Low" demand scenarios.

Higher Demand Scenarios

Demographic and Development: There was interest in considering alternative data sources for population, housing units, and job projections, with the application of raw Plan Bay Area 2050 projections as the preferred upper bound.[44] Workshop participants noted that while some commercial, industrial, and institutional (CII) land uses could be converted to residential, a less dense future housing scenario was unlikely and there was a preference to keep density constant at 2025 levels to reflect the high scenario.

Socioeconomic Conditions: Workshop participants were interested in scenarios incorporating greater economic growth, anticipating a potential increase in demands associated with the technology industry in the region.

Conservation and Pricing: Workshop participants generally agreed that a decrease in active conservation savings could potentially occur in the future, dependent on societal norms and availability of water. Workshop participants discussed water rates and pricing and concluded that a decrease in real price was not likely given regional trends and infrastructure needs. Workshop participants also discussed the potential for rate structures to change from tiered volumetric rates to uniform volumetric rates. It is unclear what effect this transition may have on price levels and how this may influence price elasticity regionally. Given these observations, it was recommended to keep future pricing constant in real terms for the high scenario.

Climate and Other Trends: Workshop participants wanted to consider hotter and dryer global climate models (GCMs). Workshop participants also expressed strong interest in scenarios with an increase in high water use industries, particularly data centers and biotech applying water for cooling.

Lower Demand Scenarios

Demographic and Development: There was interest in considering alternative data sources for population, housing units, and job projections, with the application of the California Department of Finance (CA DOF) projections as the preferred lower bound.

Socioeconomic Conditions: Workshop participants were interested in scenarios incorporating lower economic growth, with discussion including the potential negative impacts of federal tariff and immigration policies, and how this may influence the job market/economic output in the region.

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[44] Baseline water demand model demographic assumptions are based on Plan Bay Area 2050 projections but included revisions from member agencies' planning departments that in aggregate moderated future demographic growth on a regional level and to align with RHNA numbers as appropriate.

Conservation and Pricing: Workshop participants noted that rate increases may be likely due to future infrastructure investments and showed interest in further water conservation. To prevent overlapping savings from both price hikes and new conservation programs, per capita use was reviewed before adding volumetric conservation in the low scenario. Participants also want to assess how non-functional turf (NFT) bans affect outdoor water consumption.

Climate and Other Trends: Workshop participants wanted to consider GCMs projecting less warming and wetter conditions, or climate models that consider a shift in weather patterns throughout the year.

7.2 Alternate Scenario Assumptions

This section documents the key assumptions and data sources forming the scenario inputs.

7.2.1 Demographic and Development

Three scenarios articulating alternate future demographic and development conditions were developed in response to feedback from member agency representatives, SFPUC, and stakeholders. Key assumptions and data sources are summarized in Table 7-1 on the following page.[45]

Table 7-1: Alternate Scenario Demographic and Development Data Sources and Assumptions

Scenario Name	Data Sources	Assumptions
Adjusted ABAG	• Plan Bay Area 2050 • Member agency approved future demographics	Reflects the maximum of member agency-approved projections and Plan Bay Area 2050.
Historical Trend	• Member agency approved historical demographics	Reflects the continuation (extrapolation) of the long-term trends (2000-2023) in population, housing units, and jobs. This scenario aligns with assumptions articulated in SFPUC's "Scenario B" in their concurrent demand projection update.
DOF	• DOF Population projections[46] • DOF Housing Unit Projections[47]	• Reflects DOF projections for population and housing units. • DOF projects total population, and historical single family/multifamily persons-per-household ratios were used to develop the population split. • Housing units are projected by DOF through 2030; beyond 2030, housing unit growth was projected to 2050 by applying the average annual growth rate from 2020–2030. • Because CA DOF reports only total housing units, the future single family and multifamily split was estimated by applying the historical multifamily share to total units, with single family units calculated as the remainder. • Note that DOF does not project jobs, so jobs were assumed to increase at the same rate as population.

[45] For all Scenarios, Stanford University demographic assumptions were kept consistent with the baseline.

[46] California Department of Finance, Demographic Research Unit. (2025). *State and County Population Projections, 2020–2070 MicrosoftExcelfile*. Sacramento, CA: California Department of Finance. Retrieved September 2025.

[47] California Department of Finance, Demographic Research Unit. (2025). *Household Projections for California Counties: 2020–2030 (P-4) MicrosoftExcelfile*. Sacramento, CA: California Department of Finance. Retrieved September 2025.

Plots illustrating the regional projection scenarios relative to the baseline are summarized in Figures 7-1 through 7-3 below.

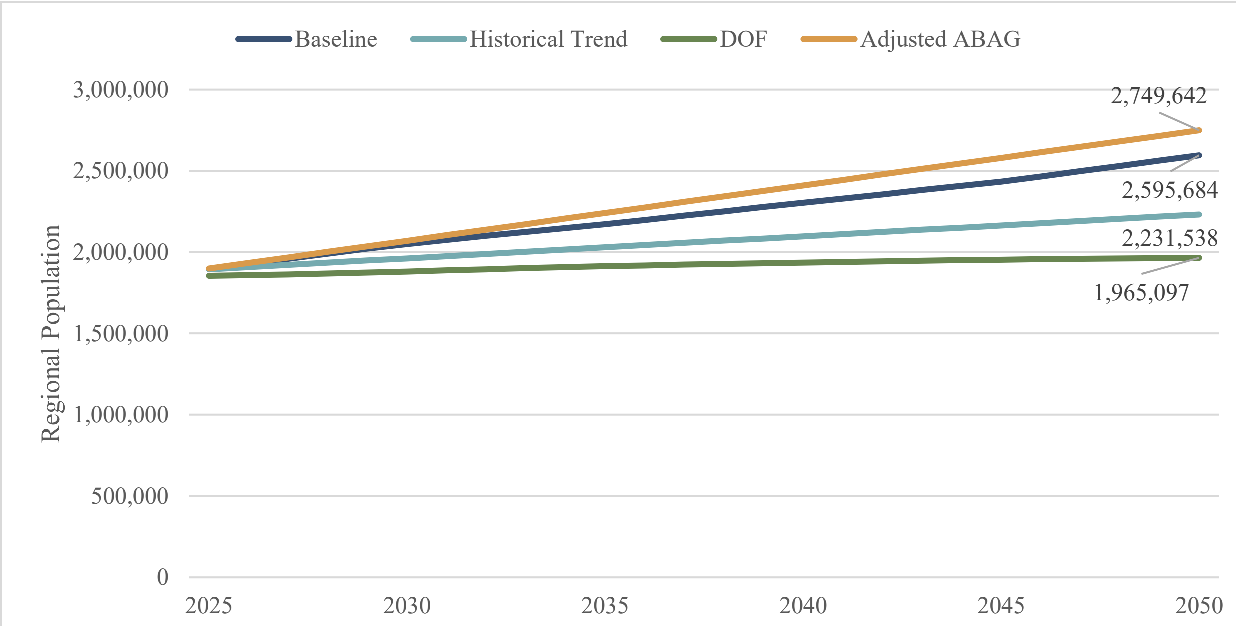

Figure 7-1: Comparison of Regional Population Scenarios

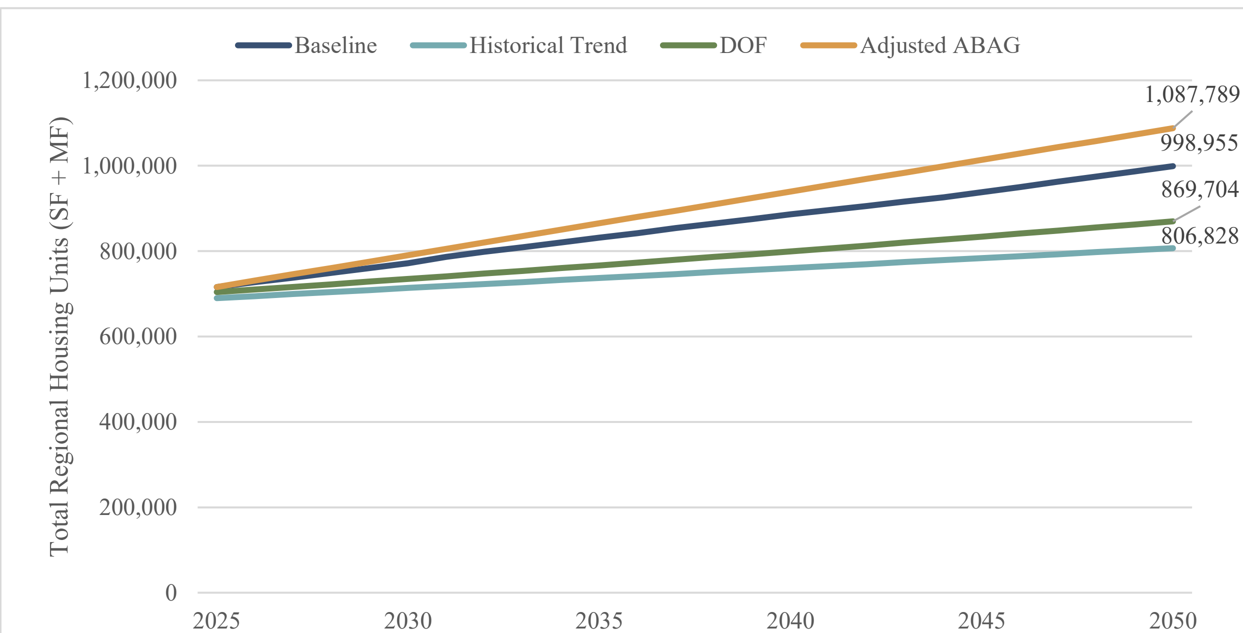

Figure 7-2: Comparison of Regional Housing Units Scenarios

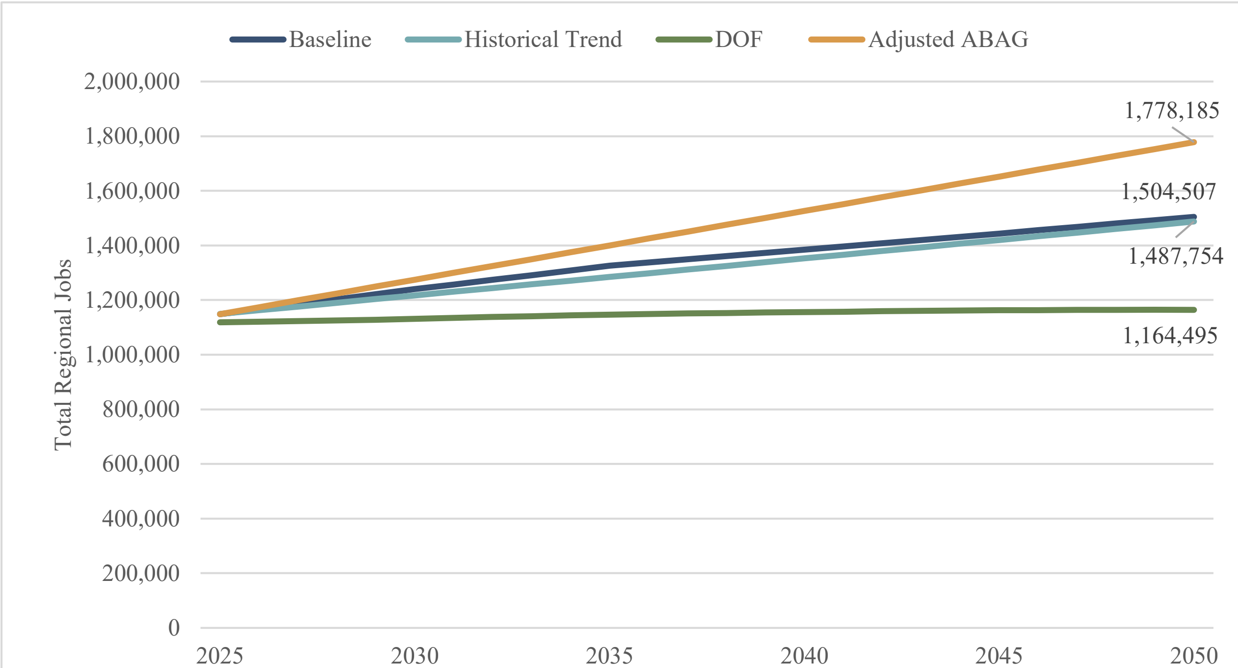

Figure 7-3: Comparison of Regional Job Scenarios

7.2.2 Socioeconomic Conditions

Alternate future socioeconomic conditions were represented by considering different assumptions in future regional real GDP growth and the unemployment rate. Recall that the baseline scenario considers regional real GDP growth and unemployment rate to remain constant at long-term trends. Future scenarios deviating from the long-term trend were selected from the distribution of available historical data. Per discussions in Section 3, higher GDP is associated with higher water demand and higher unemployment rate is associated with lower water demand. Table 7-2 summarizes the regional GDP and unemployment assumptions by scenario.

Table 7-2: Summary of Regional GDP and Unemployment Scenario Assumptions

Scenario Name	Percentile of Historical GDP	Percentile of Historical Unemployment
High	90th	10th
Moderated-High	75th	25th
Moderated-Low	25th	75th
Low	10th	90th

7.2.3 Conservation and Pricing

Conservation and pricing scenarios examine how variations in water rates and efficiency measures influence future demand.

Conservation Assumptions

Passive and active conservation assumptions reflect how demographic trends and policy measures shape long-term efficiency gains. Volumetric passive savings are tied to development, as higher efficiency fixtures are expected to be installed as new development proceeds. This results in higher volumetric savings projected under scenarios using the Adjusted ABAG demographics and lower savings under DOF projections. Figure 7-4 illustrates modeled 2050 passive savings by sector comparing the different demographic scenarios. For example, single-family sectors show modest differences, while multifamily and CII sectors exhibit up to 54% variation in passive savings between high-growth and low-growth demographic cases. Active conservation programs—such as rebates and outreach—were held constant across lower demand scenarios, consistent with member agency plans, meaning no additional active measures are introduced in alternative futures. In response to feedback from workshop participants, additional outdoor conservation reflecting regulatory actions like AB 1572 nonfunctional turf restrictions were considered in the lowest demand scenario. This scenario incorporated additional reductions for combined CII and irrigation seasonal use by an estimated 15% region-wide starting in 2028. Collectively, these assumptions ensure that conservation effects are realistically represented without overstating behavioral change beyond what agencies have committed to implement.

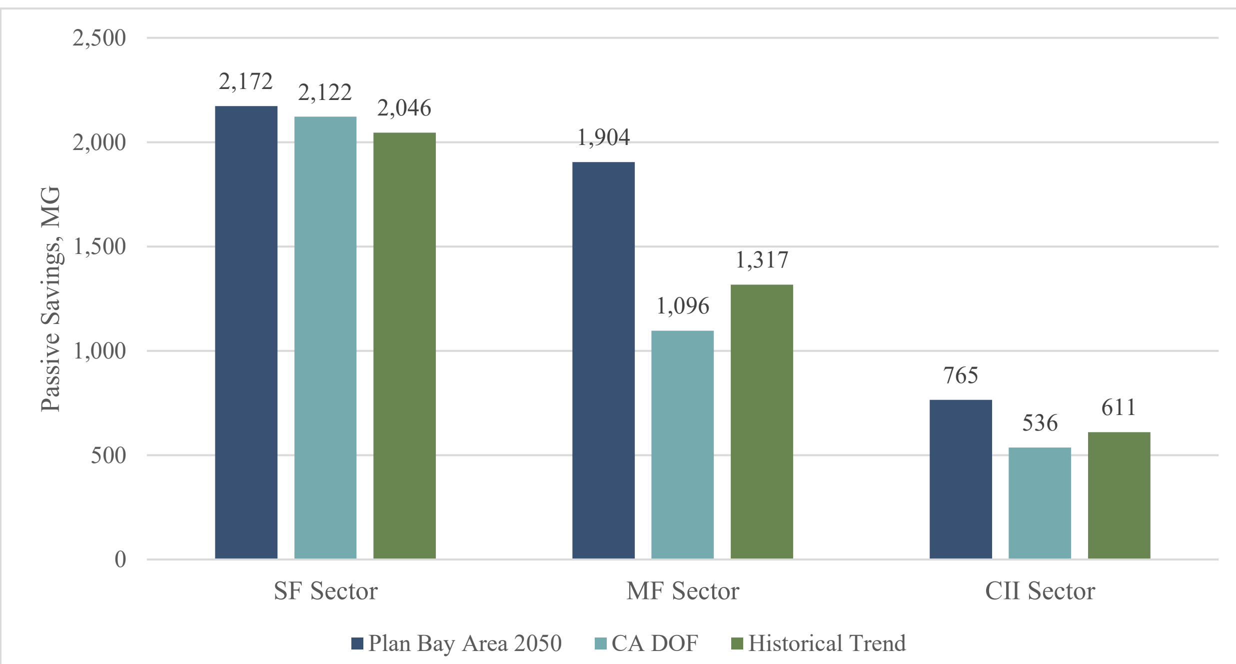

Figure 7-4: 2050 Passive Savings by Sector

Water Pricing

Water pricing assumptions vary across scenarios to reflect different regional pricing conditions. The Baseline, High, and Moderated-High scenarios assume rates remain constant in real terms, meaning nominal increases only offset inflation without altering consumption behavior further. In contrast, the Moderated-Low scenario applies a sustained real price increase of approximately 2.5% annually over the planning horizon, while the Low scenario introduces a steeper adjustment—5% per year for the first decade, followed by 2.5% annually thereafter—to simulate more aggressive long-term real rate increases. The Historical Trend scenario aligns with SFPUC's 10-year financial plan, incorporating planned wholesale rate changes adjusted for inflation. Note that rate increases from the 2025 SFPUC 10-year financial plan reflect *nominal* rates. The SFPUC wholesale rate changes have been reduced by an assumed 3% annual rate of inflation to calculate the implied change in real rates each year. These differentiated water rate paths (plotted together in Figure 7-5) allow the analysis to capture how pricing signals influence demand elasticity.

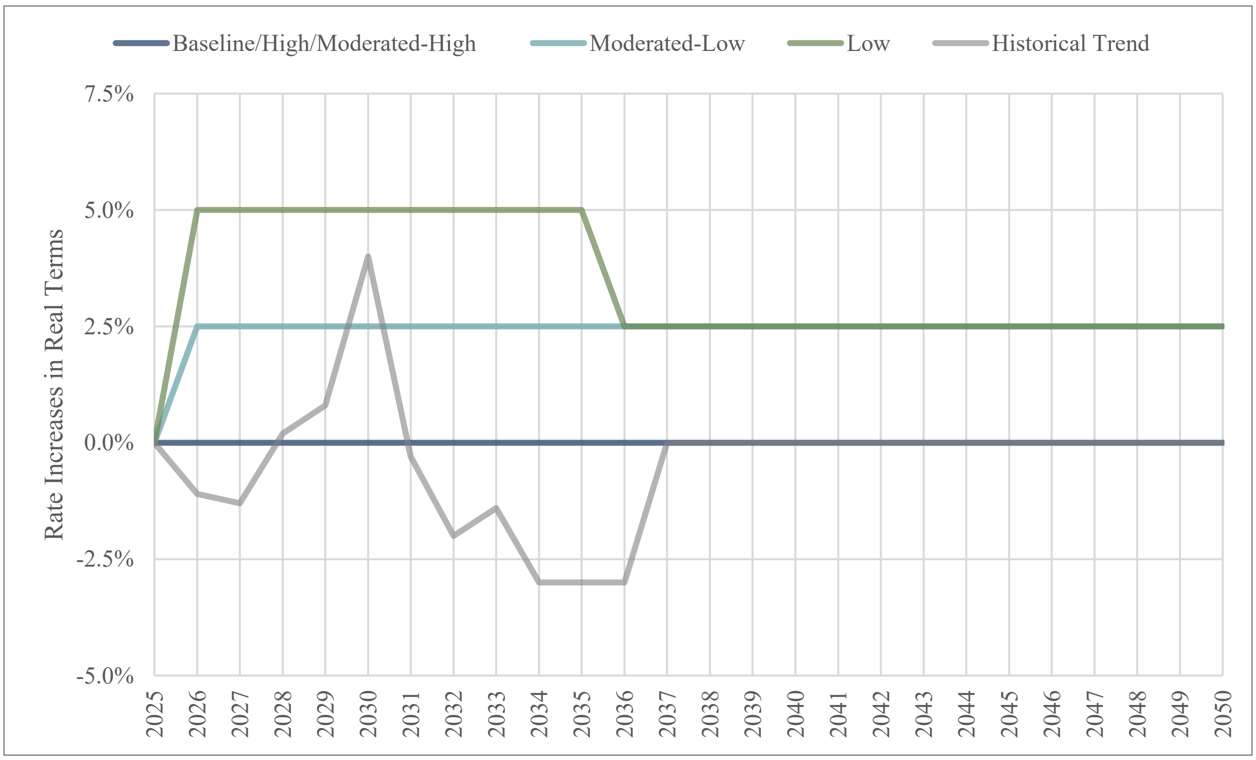

Figure 7-5: Annual Change in Water Rates in Real Terms

7.2.4 Climate Change

Climate change assumptions were incorporated to capture the potential variability in temperature and precipitation patterns that influence outdoor water use and seasonal demand. Each scenario applies a distinct climate projection drawn from widely recognized global climate models (GCMs) and representative concentration pathways (RCPs). At the time scenario analysis was conducted, CMIP6 modeling was released and available for consideration. CMIP6 data was utilized for alternative scenarios although CMIP5 was maintained for the baseline (see Section 5.4).

An analysis was performed for each county in the BAWSCA service area to assess the individual CMIP6 models to select individual models that resulted in both higher and lower temperature and precipitation changes relative to the baseline.

High-demand scenarios adopt the hottest and driest conditions from CMIP6 SSP5-8.5 (KACE-1-0-G), while low-demand scenarios assume cooler and wetter futures using CMIP6 SSP2-4.5 (CNRM-ESM2-1). Moderated scenarios apply intermediate assumptions, such as CMIP5 RCP4.5 for temperature combined with historical precipitation norms. These climate inputs were selected to bracket plausible extremes and mid-range conditions, ensuring that the scenario analysis reflects both the risks of intensified drought and the potential for milder future climates.

7.2.5 New High Water Users – Data Centers

In the scenario analysis workshops and surveys, participants identified a handful of industries that have the potential to significantly expand and increase water use regionally. Data centers received a high degree of interest / concern and were selected to further evaluate.

Data centers represent a unique challenge in water demand forecasting because their consumption patterns are not well captured by traditional employment or account-based model drivers. Instead, water use in these facilities is closely tied to energy consumption and cooling technology choices. With rapid and uncertain growth in cloud computing and AI workloads, the potential for large-scale data center development introduces significant uncertainty into long-term demand projections.

The data center analysis relied on 2024 energy demand projections from the California Energy Commission (CEC), which forecasted peak power demand and annual energy use for data center growth through 2040.[48] Figure 7-6 depicts data center power projections provided by CEC for major power utilities in CA.[49] The analysis selected projections from power utilities within BAWSCA's service area, including Silicon Valley Power (SVP), City of San José, City of Palo Alto, and PG&E. 90% of PG&E's projected data center power demand was included, as the majority of data center growth in the state is expected to occur within the Bay Area.

[48] California Energy Commission. Data Center Forecast. Final Report. March 2025. Available at: https://www.energy.ca.gov/sites/default/files/2025-03/Data_Center_Forecast_Final_ada.pdf.
[49] Ibid.

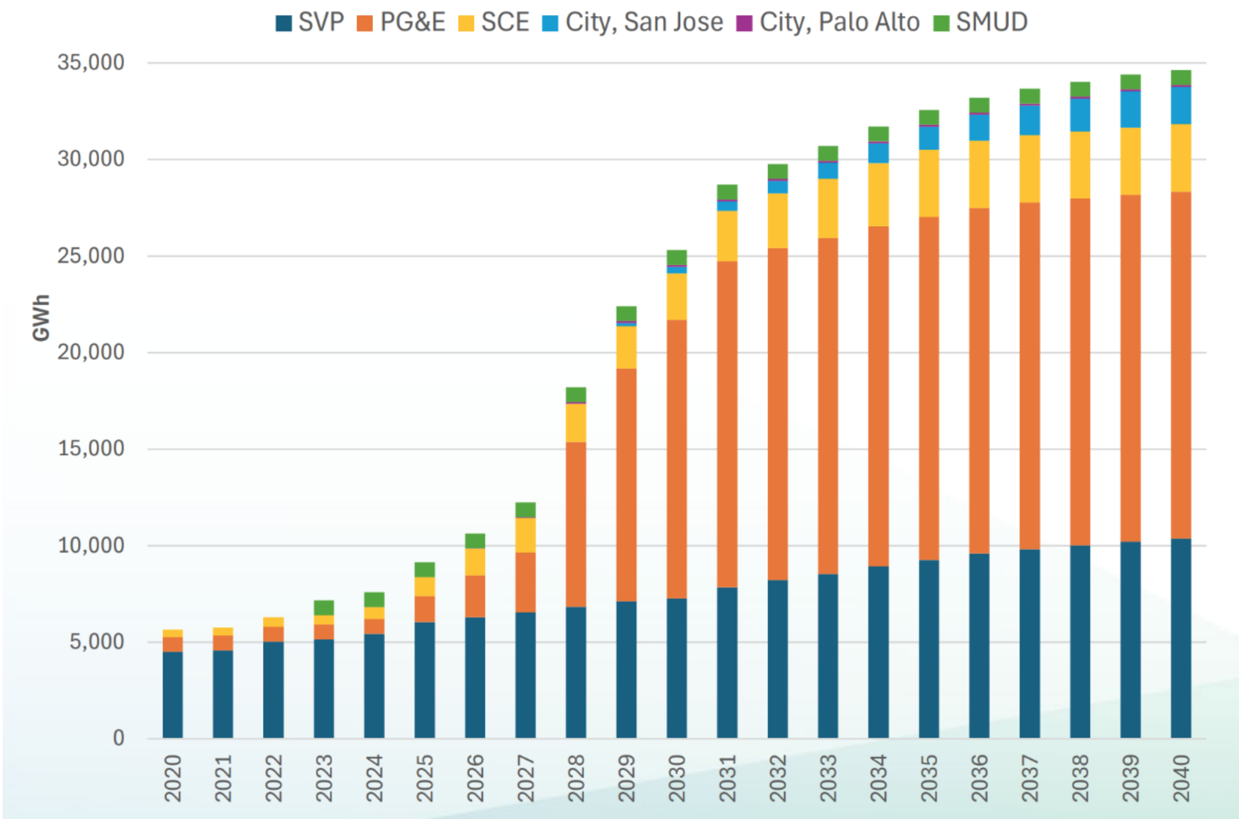

Figure 7-6: CEC Annual Energy Use Projections for Data Centers, Organized by Power Utility

Figure 7-7 illustrates the total annual data center energy demand in BAWSCA's service area consistent with these assumptions. Note that localized ("behind the meter") power production was not included in these projections.

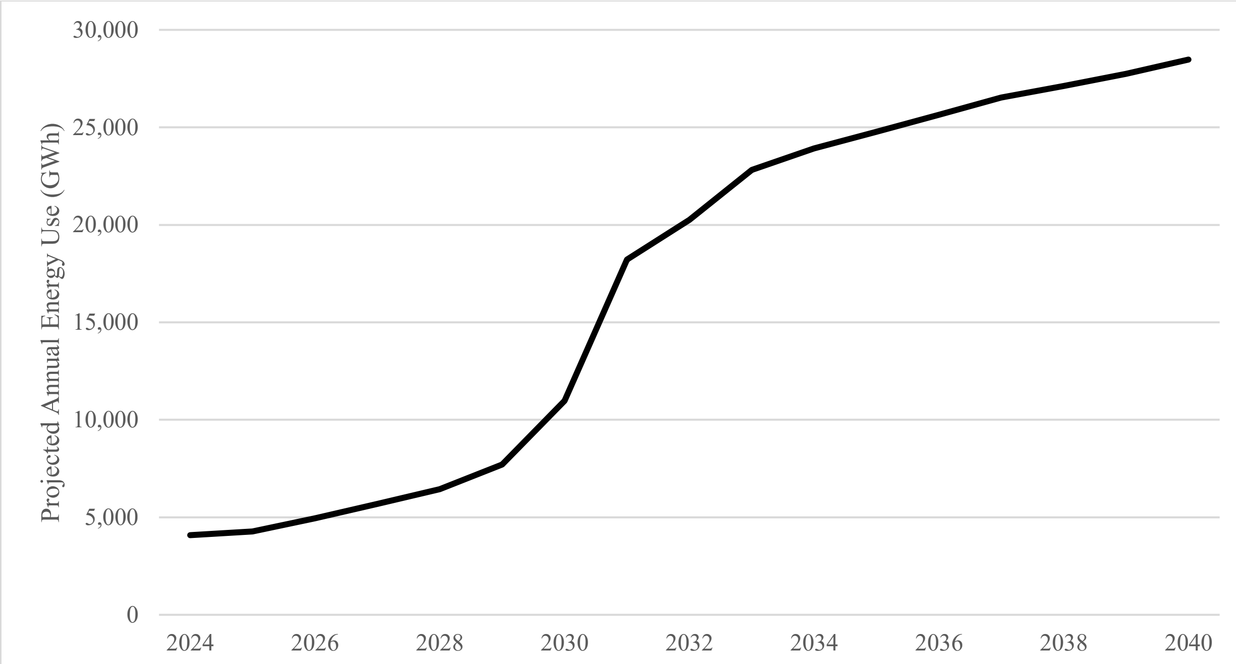

Figure 7-7: Estimated Total Annual Data Center Energy Use in BAWSCA Service Area Inferred from CEC Projections

To translate projected electricity use into water demand, Water Usage Effectiveness (WUE) factors were obtained from Lawrence Berkeley National Laboratory (LBNL) that reflect a range of existing cooling technologies currently used by data centers to cool IT equipment, and, specifically, water used for humidification and water evaporated cooling of the data center and its support systems.[50] Three WUE values were considered from the LBNL study including:

- 0.2 L/kWh for liquid cooling technology using dry coolers with adiabatic assist (air-cooled chillers);[51]
- 1.9 L/kWh for liquid cooling technology using waterside economizers (water-cooled chillers); and
- 1.05 L/kWh reflecting the average of the air-cooled and water-cooled chillers identified above.

Figure 7-8 illustrates projected water use for data centers obtained by multiplying the regional annual energy use (in GWh) by the WUE factors identified above. It is unlikely that liquid cooling technology using waterside economizers (1.9 L/kWh) will be adopted at scale in the Bay Area given broader water supply constraints in the region. In general, data centers being developed in water stressed regions tend to select more water efficient cooling technologies, such as air-cooled chillers. Based on these observations, the 0.2 L/kWh WUE was selected to inform projected data center water use for the scenario analysis.

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[50] Shehabi, Arman, et al. *2024 United States Data Center Energy Usage Report.* Lawrence Berkeley National Laboratory, Dec. 2024. https://eta-publications.lbl.gov/sites/default/files/2024-12/lbnl-2024-united-states-data-center-energy-usage-report_1.pdf.

[51] 0.2 L/kWh reflects annual demands. Note that peak monthly uses for this technology can be significantly higher.

Additional demands for data centers were only considered for the "High" scenario and are tabulated in Table 7-3.

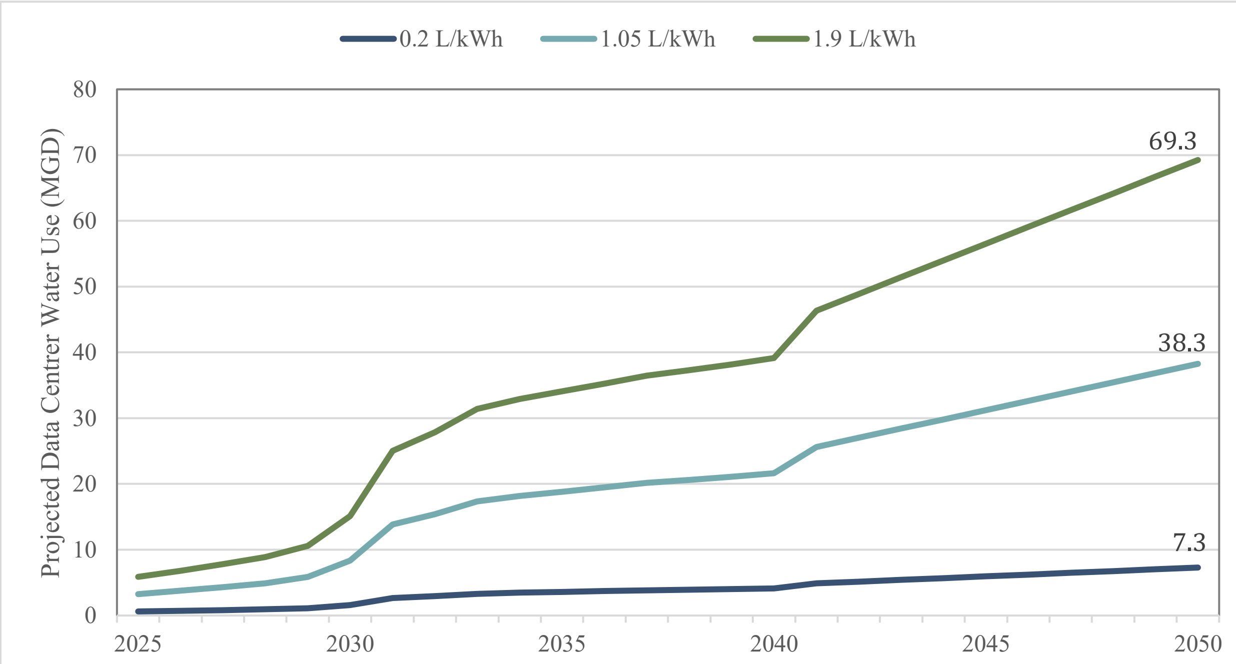

Figure 7-8: Projected Data Center Water Use Organized by Assumed WUE

Table 7-3: Projected Data Center Water Use (MGD) for "High" Scenario Reflecting 0.2 L/kWh WUE

Scenario	2025	2030	2035	2040	2045	2050
"High"	0.6	1.6	3.6	4.1	5.9	7.3

7.2.6 Consolidated Scenario Assumptions

A consolidated summary of scenario assumptions consistent with Sections 7.2.1 through 7.2.5 is presented in Table 7-4 on the following page.

Table 7-4: Consolidated Summary of Scenario Assumptions

Scenario	Temperature and Precipitation	High Water Users	Conservation Assumptions	Water Rates	Demographics	Socioeconomics
Baseline	• CMIP5 RCP8.5 multi-model mean temperature • Historical mean precipitation	• No additional high water users	• Passive savings consistent with demographic growth • Active savings consistent with member agency planned annual measures	• Keeps pace with inflation (constant in real terms) • Planned 5–10-year rate increases for select agencies	• Member agency approved adjustments to Plan Bay Area 2050 • Housing density increases with housing units (as approved by member agencies)	• Historical trend GDP and unemployment rate
Low	*CMIP6 SSP2 4.5 CNRM-ESM2-1* • Lowest temperature GCM • Highest precipitation scenario GCM	• No additional high water users	• Passive savings consistent with demographic growth • Active savings consistent with member agency planned annual measures • Considers lower outdoor use (i.e., approximated NFT ban)	• Initial 10-year real price increase at 5% annually • Annual 2.5% real price increase over remainder of 25-year period	• Reflects DOF projections • Housing density consistent with baseline calculations	• Lower than trend GDP (10th percentile) • Higher than trend unemployment rate (90th percentile)
Moderated-Low	• CMIP5 RCP 4.5 multi-model mean temperature (lower temperature impact from baseline) • Historical mean precipitation	• No additional high water users	• Passive savings consistent with demographic growth • Active savings consistent with member agency planned annual measures	• Annual 2.5% real price increase over entire 25-year period	• Reflects DOF projections • Housing density consistent with baseline calculations	• Lower than trend GDP (25th percentile) • Higher than trend unemployment rate (75th percentile)
High	*CMIP6 SSP5 8.5 KACE-1-0-G* • Highest temperature GCM • Lowest precipitation scenario GCM	• Data center projections consistent with Section 7.2.5	• Passive savings consistent with demographic growth • No implementation of active programs	• Keeps pace with inflation (constant in real terms) • Planned 5–10-year rate increases for select agencies	• Maximum of agency approved demographics and "raw" Plan Bay Area 2050 projections • Housing density remains constant at 2025 levels	• Higher than trend GDP (90th percentile) • Lower than trend unemployment rate (10th percentile)
Moderated-High	• Hottest GCM from CMIP6 (*SSP5 8.5 KACE-1-0-G*) • Historical mean precipitation	• No additional high water users	• Passive savings consistent with demographic growth • No implementation of active programs	• Keeps pace with inflation (constant in real terms) • Planned 5–10-year rate increases for select agencies	• Maximum of agency approved demographics and "raw" Plan Bay Area 2050 projections • Housing density remains constant at 2025 levels	• Higher than trend GDP (75th percentile) • Lower than trend unemployment rate (25th percentile)
Historical Trend	• CMIP5 RCP8.5 multi-model mean temperature • Historical mean precipitation	• No additional high water users	• Passive savings consistent with demographic growth • Active savings consistent with member agency planned annual measures	• Aligns with real rate increases presented in SFPUC 10-year plan (wholesale)	• Historical growth consistent with trend extrapolation from agency-approved historical demographics • Housing density increases with housing units (as approved by member agencies)	• Historical trend GDP and unemployment rate

7.3 Alternate Scenario Results

The scenario analysis demonstrates how variations in demographic, economic, climate, pricing, and conservation assumptions influence regional water demand trajectories through 2050. Figure 7-9 and Table 7-5 provide a comparison of the volumetric demands for each scenario identified in Table 7-4.

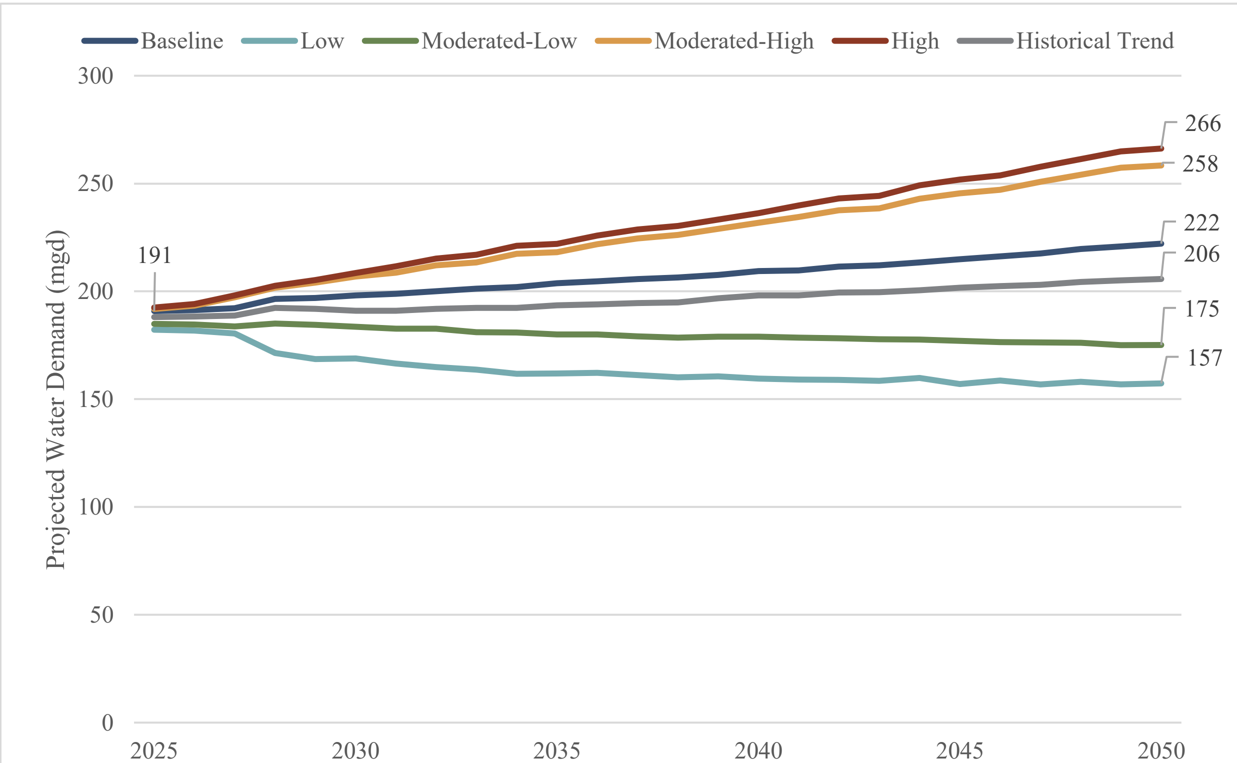

Figure 7-9: Graphical Comparison of Water Demand Scenarios

Table 7-5: Tabular Comparison of Water Demand Scenarios (MGD)

Scenario	2025	2030	2035	2040	2045	2050
Baseline	191	198	204	209	215	222
Low	182	169	162	159	157	157
Moderated-Low	185	184	180	179	177	175
High	193	209	222	236	252	266
Moderated-High	192	207	218	232	245	258
Historical Trend	188	191	194	198	202	206

By the early 2030s, the alternative demand projections begin to separate significantly, with continued widening toward 2050. High and Moderated-High Scenarios show the steepest growth, driven by high demographic projections, hotter/drier climate assumptions, and stable real water rates. The inclusion of potential data center loads in the High Scenario amplifies this effect. Low and Moderated-Low Scenarios exhibit substantial reductions in demand, reflecting CA DOF demographics, cooler/wetter climate conditions, and more aggressive real price increases combined with nonfunctional turf restrictions. Baseline and Historical Trend Scenarios remain near the center of the range, with the Historical Trend Scenario tracking slightly below Baseline due to moderated growth and rate adjustments.

8. Summary and Recommendations

The baseline water demand and conservation projections presented in this report provide a robust foundation for long-term planning across BAWSCA member agencies. Developed through a rigorous process of data collection, econometric modeling, and conservation analysis, these projections are designed to support the 2025 UWMP cycle and inform long-term planning for the region's water future.

Key elements of the study's analysis included:

- **Integrated Modeling Approach.** The Project coupled econometric modeling of sectoral water consumption with detailed end-use conservation accounting. This hybrid framework enables the separation of structural drivers—such as demographic growth, economic trends, and climate impacts—from the effects of conservation programs and pricing policies. The scenario-ready design allows for flexible adaptation as new data, policies, and/or priorities emerge.

- **Transparent and Consensus-Based Assumptions.** The baseline scenario assumptions are grounded in member agency-approved demographic projections, climate-adjusted temperature scenarios, and best-practice efficiency standards. The process incorporated extensive feedback from member agencies, ensuring that the assumptions reflect both regional trends and local planning realities.

- **Explicit Quantification of Conservation:** Both passive (code-driven) and active (programmatic) conservation measures were explicitly modeled. Passive savings, driven by ongoing fixture turnover and new construction standards, are projected to steadily reduce water use across all sectors. Active conservation programs, developed in collaboration with member agencies, offer additional potential for demand reduction, but must be invested in to be fully realized.

- **Sensitivity to Demographic and Economic Uncertainty:** The scenario analysis demonstrates that future water demand is highly sensitive to changes in population, housing, and employment. Scenario analysis highlights the importance of monitoring demographic and development trends and maintaining flexibility in planning to accommodate a range of plausible futures.

- **Alignment with Regulatory and Planning Needs:** The baseline forecast provides a neutral, transparent point of comparison for evaluating future compliance with regulatory requirements. The results from this comparison demonstrate that the majority of BAWSCA agencies are anticipated to meet their UWUOs across the full period from 2025 – 2050. The baseline forecast also provides insights into future water supply reliability needs and the anticipated effectiveness of current regional conservation strategies and investment.

8.1 Recommendations for Future Analyses and Studies

Water demand projections are a critical component on long-range water resource planning for the region. Water managers should consider the following recommendations, to help better monitor, track, and understand water demands as key drivers evolve in the future:

Enhanced Monitoring of High-Uncertainty Sectors (e.g., Data Centers):

- Establish a regular monitoring program for new and existing data centers, including tracking permitting, operational cooling technologies, and actual water use.
- Consider establishment of new customer classifications that encompass data centers and/or other large industrial users.
- Collaborate with local planning departments and utilities to obtain early warning of large-scale developments.
- Update demand models annually to reflect observed trends and incorporate new data center loads as they materialize.
- Consider introducing an additional model that explicitly considers energy consumption as an independent driver unit for data centers and related industries.

Scenario Analysis of Future Drought Impacts:

- Develop and periodically update drought scenarios that simulate the effects of severe and prolonged droughts on both demand and supply.
- Assess the resilience of current and planned conservation programs under drought conditions.
- Integrate lessons learned from recent drought events to refine assumptions and response strategies.
- Revisit participation assumptions for active programs annually, incorporating observed participation rates and, for BAWSCA specifically, feedback from member agencies.

Prioritize High Cost-Effectiveness Water Conservation Programs

- Focus on programs with the lowest cost per 1,000 gallons saved (e.g., high-efficiency toilet and urinal retrofits, smart irrigation controllers, and direct-install kits), as identified in the cost-effectiveness analysis tables.
- Regularly review and update the program portfolio to ensure that investments are directed toward measures with the greatest water savings per dollar spent.

Monitor Water Conservation Program Participation and Adjust Outreach

- Track participation rates and program uptake annually to identify underperforming programs or sectors.

- Adjust outreach and incentive levels as needed to increase participation in priority programs, especially in sectors or agencies lagging behind regional targets.
- Focus active conservation programs on targeted incentives for MF properties, particularly shared laundry facilities, to accelerate the adoption of efficient appliances.
- Develop tailored outreach for property owners and managers to address barriers to upgrading inefficient fixtures in MF buildings.

Coordinate Water Conservation Planning with Regulatory Compliance

- Use conservation program analysis to support compliance with the UWUO and other regulatory requirements.
- Identify regulated sectors at risk of exceeding the established UWUO budget and prioritize additional or targeted conservation measures for those sectors.

Continuous Improvement of Data and Models:

- Continue to maintain clear documentation of all data sources, model parameters, and calibration methods.
- Maintain consistent and comprehensive data collection regarding core indicators such as population, housing, and employment, in addition to conservation-related metrics including program implementation, associated costs, and achieved savings.
- Periodically review and refine model structure and parameters (for both the econometric models and AWE Tracking Tool) to incorporate new data, research, emerging technologies, and regulatory requirements.
- Maintain up-to-date estimates of fixture and appliance stock by sector and efficiency level, using the latest available data and the AWE Tracking Tool.

Lastly, as BAWSCA’s Strategy 2050 effort proceeds, there are several areas for which the new water demand projections and models can directly support. These include:

- Coordination of scenario definitions, assumptions, and timelines between the demand forecasting team and the Strategy 2050 Project to ensure consistency and comparability.
- Assessment of the interplay between demand-side uncertainties (e.g., demographics, conservation, high water users) and supply-side uncertainties (e.g., climate change, regulatory shifts) and concomitant risks.
- Use integrated scenario results to identify potential gaps in supply reliability, inform adaptive management strategies, and prioritize investments in both demand management and new supply options.

Appendix A: Procedure for Reprojecting Demographic Data

Introduction / Purpose

Key demographic information necessary for water demand forecasting—such as population, employment figures, and housing units—must align with the boundaries of each member agency's service area. Historical and projected records for these data (e.g., DOF and Plan Bay Area 2050) are available at jurisdictional, census tract, and/or Traffic Analysis Zone (TAZ) geographical boundaries, which often do not directly align with member agency service area boundaries (see Figure A-1 as an example). These data must be reprojected from their native geographies to member agency service area boundaries in order to be used for statistical modeling and water demand projection. This Appendix documents the data sources and reprojection approach applied in the Project.

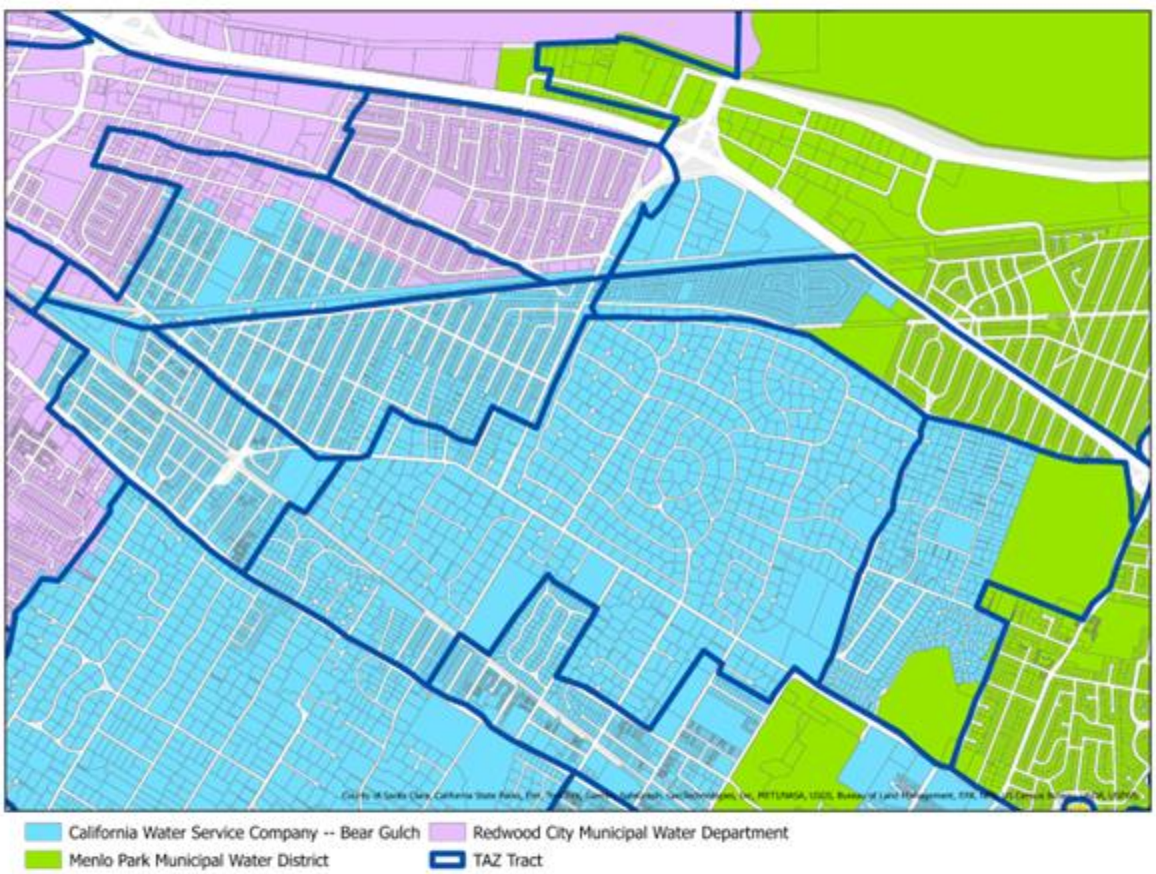

Figure A-1: Example of TAZ Tracts Overlapping an Adjacent Member Agency Service Areas

Data Sources

Demographic data sources used for econometric modeling and demand projection as well as their native geographies are summarized in Table A-1.

Table A-1: Summary of Demographic Data Sources and Native Geographies

Data Source	Use	Native Geography
DOF	Primary data source for determining historical housing units and population	City and county jurisdictional boundaries
ACS	Supplemental data source for housing units, population distribution between SF and MF residences	Census tract
LODES	Primary data source for determining historical jobs and job sectors	Census tract
Plan Bay Area 2050	Primary data source for understanding future growth in housing units, population, and jobs	TAZ

In addition to demographic datasets, several geospatial data sources were obtained including:

- Member agency service area boundaries;
- Census tract boundary dataset from the US Census Bureau;
- Parcel boundaries obtained from the Alameda County, Santa Clara County, and San Mateo County assessor's office;
- Land use classification obtained from California Geoportal, General Plan Land Use dataset; and
- TAZ boundary dataset from Metropolitan Transportation Commission.

General Reprojection Approach

The general reprojection approach applies the following steps:

Step 1: Define Target Geographies

- Identify the boundaries for the member agencies service areas using GIS datasets approved by member agency representatives.
- Ensure all member agency service area boundaries are spatially aligned and compatible (e.g., same projection, no gaps/overlaps).

Step 2: Source Population Forecasts

- Obtain regional population forecasts and historical datasets (e.g., Plan Bay Area 2050) at the finest available granularity (TAZ, census tract, etc.).

Step 3: Reproject Forecasts to Target Boundaries

- **Spatial Overlay:**
  Overlay forecast units (e.g., TAZs) with target member agency service area boundaries.

- **Weighting Factor:**
  Use parcel counts (residential parcel counts for population data, non-residential parcel counts for jobs) within the intersection of each forecast unit and target boundary as the primary weighting factor.
  - For each forecast unit, calculate the proportion of residential parcels within each target boundary.
  - Allocate forecasted population, housing units, or jobs to each target boundary based on these proportions.
- **Fallback:**
  If parcel count data is unavailable, use area-weighting (proportion of land area within the target boundary).

Step 4: Interpolate to Desired Time Increments (If Necessary)

- For projection datasets (i.e., Plan Bay Area 2050) interpolate the demographic estimates for intermediate years using trends from forecasted years.
- Step 4 is not necessary for DOF, LODES, and ACS datasets.

A simple example of the reprojection procedure is illustrated below:

TAZ #2 has 100 residential parcels within its boundary and a projected population of 2,000 people. 10 of the 100 residential parcels fall within Agency A's service area. 90 of the 100 residential parcels fall within Agency B's service area.

- The weighting factor for allocating TAZ #2 population to Agency A equals 10/100 (0.1).
- The projected number of people residing in TAZ #2 allocated to Agency A equals 0.1 x 2,000 (200 people).
- The weighting factor for allocating TAZ #2 population to Agency B equals 90/100 (0.9).
- The projected number of people residing in TAZ #2 allocated to Agency B equals 0.9 x 2,000 (1,800 people).

Appendix B: Monthly and Bimonthly Smoothing Procedure

Member agencies have different billing and meter reading frequencies. Additionally, within each agency, meter reading cycles can vary by customer. Many agencies universally adopt either monthly or bimonthly billing; however, some utilize a combination of the two billing cycles depending on customer class and date. Water use rates for the different agency billing cycles were standardized to a calendar-month to better reflect the actual seasonal timing of water use for each of the four modeled sectors (other uses are applied as a percentage of total use across the SF, MF, CII, and irrigation sectors).

Water use billed at monthly intervals can generally overlap with two consecutive calendar months. A smoothing equation extracts a single calendar-month use from the two monthly billing periods. For example, April water use is equal to the fraction of the April consumption billed in April plus the fraction of the April consumption billed in May, as demonstrated in the equation below.

$$April\ Use = \left(Billed\ April\ Consumption \times \frac{April\ Accounts}{April\ Accounts + May\ Accounts}\right) + \left(Billed\ May\ Consumption \times \frac{May\ Accounts}{April\ Accounts + May\ Accounts}\right)$$

Customers billed at bimonthly intervals are divided into two groups, and each group is billed every second month. Bimonthly meter readings contain water use that occurs over a span of three calendar months. For example, April use equals the fraction of April consumption billed in April and June (billing group 1) plus the fraction of April consumption billed in May (billing group 2), per the equation below:

$$April\ Use = \left(\left(\frac{1}{4} Billed\ April\ Consumption + \frac{1}{4}\ Billed\ June\ Consumption\right) \times \frac{\frac{1}{2} April\ Accounts + \frac{1}{2} June\ Accounts}{\frac{1}{2} April\ Accounts + May\ Accounts + \frac{1}{2} June\ Accounts}\right) + \left(\frac{1}{2} Billed\ May\ Consumption \times \frac{May\ Accounts}{\frac{1}{2} April\ Accounts + May\ Accounts + \frac{1}{2} June\ Accounts}\right)$$

Figure B-1 depicts smoothed water use for an agency whose billing structure changes from bimonthly to monthly in late 2022.

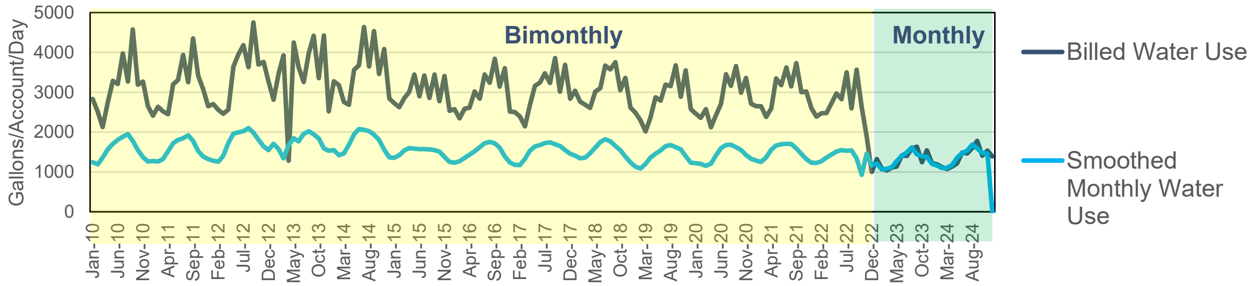

Figure B-1: Example smoothing of consumption for an Agency with a Billing Structure that Changes Over Time

If an agency employs both monthly and bimonthly billing cycles for billing sectors that fall into a single model demand sector, a weighting of smoothed monthly (m) and bimonthly (b) water use (q) is employed to average use ($q_{M,avg}$) over the two cycles, per the equation below:

$$q_{M,avg} = w_m \times q_m + w_b \times q_b$$

The weighting factors (w) are defined in the equations below:

$$w_m = \frac{A_{M,m} + A_{M+1,m}}{\left(A_M + 2A_{M+1,b} + A_{M+2,b}\right) + \left(A_{M,m} + A_{M+1,m}\right)}$$

$$w_b = \frac{A_{M,b} + 2A_{M+1,b} + A_{M+2,b}}{\left(A_M + 2A_{M+1,b} + A_{M+2,b}\right) + \left(A_{M,m} + A_{M+1,m}\right)}$$

Appendix C: Estimated Model Coefficient Ranges

This section provides a summary of the econometric model coefficient values for each of the five common water use sectors modeled in the Project. Each model is summarized in tabular form identifying the predictors used, the expected directional influence (i.e., increasing or decreasing effect on water use) the predictor should have on water use, and the range of fitted coefficient values. Consistent with the panel regression approach, certain model coefficients are shared between agencies while others are unique. Unique coefficients are indicated in the tables below using a range. Note that not all potential model predictors discussed in Section 3 were used in all models.

Table C-1: Single-Family Regression Predictors and Coefficients

Predictor	Expected Directional Influence	Model Coefficient Range
PPH	+	0.200
Housing Density	-	-0.454
Water Rate (per 10 CCF)	-	-0.132 (annual average)
Tmax	+	-0.120 to 1.026
Tmax (lag 1 month)	+	-0.247 to 0.514
Precip	-	-0.060 to 0.001
Precip (lag 1 months)	-	-0.045 to 0.004
Passive Efficiency Index	-	-0.325 to -0.107
COVID Indicator	+	0.023 to 0.174
Tier 2 Percentage	-	-1.213 to -0.022
SFPUC Systemwide Voluntary Rationing	-	-0.997 to 0.389
State Requested Percent Restriction	-	-0.154

Table C-2: Multifamily Regression Predictors and Coefficients

Predictor	Expected Directional Influence	Model Coefficient Range
Units Per Account Mean	+	0.606
Units Per Account 2023	+	0.068
PPH	+	0.407
Housing Density	-	-0.243
Water Rate (per 20 CCF)	-	-0.083 (annual average)
Tmax	+	-0.281 to 0.407
Precip	-	-0.018 to 0.005
Precip (lag 1 month)	-	-0.015 to 0.01
Precip (lag 2 months)	-	-0.009 to 0.011
Passive Efficiency Index	-	-0.358 to 0.131
COVID Indicator	+	-0.157 to 0.537
SFPUC Systemwide Voluntary Rationing	-	-1.528 to 0.255
State Requested Percent Restriction	-	-1.902 to 1.793

Table C-3: CII Regression Predictors and Coefficients

Predictor	Expected Directional Influence	Model Coefficient Range
Total Jobs per Account	+	0.416
GDP	+	0.422
Average Unemployment Rate	-	-0.059
Water Rate (per 20 CCF)	-	-0.212
Tmax	+	-1.135 to 1.113
Tmax (lag 1 month)	+	-0.451 to 0.897
Precip	-	-0.048 to 0.018
Precip (lag 1 month)	-	-0.037 to 0.013
Passive Efficiency Index	-	-1.423 to 0.381
SFPUC Systemwide Voluntary Rationing	-	-2.64 to 0.796
State Requested Percent Restriction	-	-0.624 to 0.386
COVID	-	-0.453 to 0.392

Table C-4: Dedicated Irrigation Regression Predictors and Coefficients

Predictor	Expected Directional Influence	Model Coefficient Range
Precip	-	-0.187 to -0.016
Precip (lag 1 month)	-	-0.129 to -0.043
SFPUC Systemwide Voluntary Rationing	-	-7.265 to 1.783
State Requested Percent Reduction	-	-8.633 to 8.381
Tmax	+	1.617
Water Rate (per 20 CCF)	-	-0.272
COVID	n/a	-0.325 to 0.41

Table C-5: Recycled and Raw Water Regression Predictors and Coefficients

Predictor	Expected Directional Influence	Model Coefficient Range
Precip	-	-0.276 to -0.005
Precip (lag 1 month)	-	-0.58 to -0.006
SFPUC Systemwide Voluntary Rationing	-	-6.037 to 25.271
State Requested Percent Reduction	-	-2.129 to 1.225
Tmax	+	1.617 to 1.621
Water Rate (per 20 CCF)	-	-0.272
COVID	n/a	-2.29 to 0.349

Appendix D: Summary of Econometric Model Fits

Fitted econometric models were evaluated against historical rates of water consumption using both visual inspection of plotted data and evaluation of several statistical measures of goodness-of-fit. Statistical measures examined in the study are summarized in Table D-1 below.

Table D-1: Summary of Statistical Measures of Fit

Statistical Measure	Definition	Example
R^2	Measures how well a model explains the variability of the outcome variable (rate of water use).	A R^2 of 0.5 means that the model explains 50% of the variability in the historical rate of billed water consumption.
Mean Absolute Percent Error	Measures the average absolute percent error of the model prediction across all historical observations.	A mean absolute percent error of 5% indicates that the model's prediction is on average 5% different than the historical rate of water consumption across all monthly billings.
Mean Bias	Measures the average difference between predicted values and observed values. Helps assess whether a model tends to overpredict or underpredict on average.	A mean bias of -2% indicates that on average, the model predicts a 2% lower rate of water consumption than billed records.

Goodness of fit is a holistic exercise requiring simultaneous judgement of several indicators, including the measures of fit summarized in Table D-1, visual inspection of time series plots and scatter plots comparing model predictions to observed data, and as assessment of the reasonableness of model coefficients.

Table D-2 provides a summary of the model historical model performance for each of the statistical measures of fit identified in Table D-1. Overall, the econometric models illustrate strong measures of overall fit, with R^2 values averaging exceeding 0.9 on a regional basis, low percent error, and bias relatively close to 0. The SF models tended to have the strongest measures of fit amongst the sectors, which is typical (and important) given that single family sectors tend to be the highest historical proportional use and most stable. Fit statistics tended to be lower for member agencies and sectors that had less variability on a seasonal basis, however these same agencies also expressed low percent error and bias statistics, indicating acceptable model fits. Error statistics for the irrigation and recycled/raw water models are generally higher than SF, MF, and CII given the smaller sample size, record of historical data, and relatively low number of accounts.

Table D-2: Summary of Historical Model Performance

Model	Statistical Measures of Fit		
	R^2	**Mean Absolute Percent Error**	**Mean Bias**
Regional Pooled Statistics Across All Member Agency Monthly Predictions			
Single Family	.971	6.24%	0.36%
Multi Family	.983	6.35%	0.43%
CII	.973	9.60%	0.98%
Dedicated Irrigation	.901	29.80%	8.18%
Recycled and Raw Water	.903	26.96%	7.40%
Member Agency Range			
Single Family	.526 to .958	3.37% to 11.20%	0.11% to 1.05%
Multi Family	.512 to .961	3.01% to 11.98%	0.07% to 1.19%
CII	.421 to .951	4.47% to 27.20%	0.16% to 6.03%
Dedicated Irrigation	.635 to .917	13.23% to 50.72%	1.83% to 21.20%
Recycled and Raw Water[52]	.593 to .956	7.08% to 93.52%	0.39% to 48.81%

[52] Maximum recycled water percent error and mean bias reflects a single month for a single agency where the historical prediction significantly differs from the observed value. Mean errors are amplified by the relatively small sample size for this sector.

Appendix E: Supplementary Conservation Tables

Table E-1: Conservation Measure Descriptions

Program ID	Program Name	Program Category	Program Class	Units	Program Description
1	Toilets - Conventional (>=3.5 gpf) to HET (1.28 gpf)	HET	Single-Family	Toilet	
2	Toilets - Conventional (>=3.5 gpf) to HET (1.28 gpf)	HET	Multi-Family	Toilet	Replacement of existing conventional, low-efficiency toilets (>=3.5 gpf) with high-efficiency toilets (<=1.28 gpf).
3	Toilets - Conventional (>=3.5 gpf) to HET (1.28 gpf)	HET	CII Common Meter	Toilet	
4	Toilets - ULFT (>=1.6 gpf) to HET (1.28 gpf)	HET	Single-Family	Toilet	
5	Toilets - ULFT (>=1.6 gpf) to HET (1.28 gpf)	HET	Multi-Family	Toilet	Replacement of existing low flush toilets (>= 1.6 gpf) with high-efficiency toilets (<=1.28 gpf).
6	Toilets - ULFT (>=1.6 gpf) to HET (1.28 gpf)	HET	CII Common Meter	Toilet	
7	Toilets - HET (1.28 gpf) to HET+ (<=1.0 gpf)	HET	Single-Family	Toilet	
8	Toilets - HET (1.28 gpf) to HET+ (<=1.0 gpf)	HET	Multi-Family	Toilet	Replacement of existing high-efficiency toilets (1.28 gpf) with high-efficiency plus toilets (<=1.0 gpf).
9	Toilets - HET (1.28 gpf) to HET+ (<=1.0 gpf)	HET	CII Common Meter	Toilet	
10	CII Urinal (1/8 gpf) Replacement	Urinal (0.125 gpf)	CII Common Meter	Urinal	Replacement of existing low-efficiency urinals with high-efficiency urinals (0.125 gpf).
11	SF Washer Rebate (WF <=4)	Clothes Washers (residential in-unit)	Single-Family	Washer	Replacement of traditional clothes washers with high-efficiency clothes washers (< 15 gal/load)
12	MF In-Unit Washer Rebate (WF <=4)	Clothes Washers (residential in-unit)	Multi-Family	Washer	
13	Water Conservation Kits - Indoor	Kits & Giveaways	Single-Family	Kit	The Indoor kit includes a high-efficiency showerhead (1.75 gpm), kitchen aerator (1.5 gpm), bathroom aerator (1.0 gpm), digital thermometer, toilet leak detector tablets, Teflon tape, miniature tape measure, rain/drip gauge, shower timer, natural resources facts slide chart, flow rate test bag, and information material.
14	Water Conservation Kits - Outdoor	Kits & Giveaways	Single-Family	Kit	The outdoor kit includes a garden hose spray nozzle, male and female end garden hose replacement, soil moisture meter, TORO male and female precision 180° nozzle, TORO male and female precision 90° nozzle, rain/drip gauge, natural resources facts slide chart, flow rate test bag, and information material.
15	Water Conservation Kits - LivingWise	Kits & Giveaways	Single-Family	Kit	The LivingWise kit includes a high-efficiency showerhead (1.75 gpm), kitchen aerator (1.5 gpm), bathroom aerator (1.0 gpm), 9 watt LED, LED nightlight, filter tone alarm, digital thermometer, toilet leak detector tablets, miniature tape measure, rain/drip gauge, shower timer, resources fact slide chart, flow rate test bag, Teflon tape, and information material.
16	Water Conservation Kits - Spray Valves	Kits & Giveaways	CII Common Meter	Kit	CII water conservation kits include one pre-rinse spray valve.
17	Water Conservation Kits - Aerators/Showerheads	Kits & Giveaways	CII Common Meter	Kit	CII water conservation kits include the direct installation of one faucet aerator and one showerhead.
18	CII Technologies	Cooling & Heating Systems	CII Irrigation Meter	CCF	Customizable rebate incentive for CII customers to implement projects that result in a reduction of water use per year.
19	SF Turf Replacement	Turf Replacement	Single-Family	Square-foot	
20	MF Turf Replacement	Turf Replacement	Multi-Family	Square-foot	Replacement of high-water use lawns with low-water use, water-efficient landscape. Includes Lawn Be Gone!, Large Landscape Lawn to Mulch and Lawn Bust Programs.
21	CII Large Landscape Turf Replacement	Turf Replacement	CII Irrigation Meter	Square-foot	
22	Rain Garden Addition	Rainwater Harvesting	Single-Family	Square-foot	Optional rain garden addition to Lawn Be Gone! Program for water customers under participating agencies.
23	SF In-Line Drip Irrigation Conversion	Irrigation System & Devices	Single-Family	Square-foot	
24	MF In-Line Drip Irrigation Conversion	Irrigation System & Devices	Multi-Family	Square-foot	Convert overhead sprinklers to in-line drip tubing in existing shrubs, perennial, or annual planting beds.
25	CII In-Line Drip Irrigation Conversion	Irrigation System & Devices	CII Irrigation Meter	Square-foot	
26	SF Smart Irrigation Controller Rebate	Irrigation System & Devices	Single-Family	Device	Replacement of existing conventional irrigation controller with a "smart" irrigation controller. Program includes WaterSense certified weather-based irrigation controllers and Rachio 3 Smart Controller.
27	MF Large Landscape Smart Irrigation Controller Rebate	Irrigation System & Devices	Multi-Family	Device	

Program ID	Program Name	Program Category	Program Class	Units	Program Description
28	CII Large Landscape Irrigation Controller	Irrigation System & Devices	CII Irrigation Meter	Station	
29	SF Irrigation Nozzle Replacement	Irrigation System & Devices	Single-Family	Device	Purchase and installation of new technology sprinkler heads that save water by allowing slower water application rates, by improving distribution uniformity, and by reducing the effects of wind-blow overspray. Includes high sprinkler nozzles, spray bodies with integrated pressure regulation and large rotary nozzles.
30	MF Irrigation Nozzle Replacement	Irrigation System & Devices	Multi-Family	Device	
31	CII Large Landscape Irrigation Nozzle Replacement	Irrigation System & Devices	CII Irrigation Meter	Station	
32	Rainwater Capture - Rain Barrel <200	Rainwater Harvesting	Single-Family	Barrel	Purchase of a rain barrel (less than 200 gallons) or a small rain cistern (200 to 500 gallons).
33	Rainwater Capture - Cistern >=200	Rainwater Harvesting	Multi-Family	Barrel	
34	Rainwater Capture - Cistern >=200	Rainwater Harvesting	CII Common Meter	Barrel	
35	SF Graywater Laundry to Landscape Rebate	Graywater	Single-Family	Household	Purchase and installation of graywater systems to recycle laundry rise water from clothes washers directly to landscape areas without filters, tanks or pumps.
36	Submetering - Other	Metering & Submetering	Multi-Family	Meter	Separation of domestic and irrigation meters for HOA or multi-family residential units with combined domestic and irrigation meters.
37	SF Unmetered to Metered	Metering & Submetering	Multi-Family	Meter	New submeter installation at existing water customer sites where they do not currently exist at mobile home parks, apartments, HOA's and condominium complexes.
38	SF Water Use Audit	Audits & Rpts	Single-Family	Household	Residential home surveys include a site visit by a trained personnel who assesses current water use practices and make recommendations for efficiency improvements. The outdoor portion of the survey can range from a brochure on outdoor savings to an intensive outdoor water efficiency study (turf audit, catch can test, and written recommendations for irrigation scheduling or landscape changes). Conservation devices could be directly installed.
39	MF Water Use Audit	Audits & Rpts	Multi-Family	Property	Residential home surveys include a site visit by a trained personnel who assesses current water use practices and makes recommendations for efficiency improvements. For the multi-family sector, these surveys cover indoor use, outdoor landscape, pools, and washing machines. Conservation devices could be directly installed.
40	CII Large Landscape Water Audit	Audits & Rpts	CII Irrigation Meter	Property	A large landscape water audit includes a site visit by a trained personnel who assesses current irrigation practices, measures and inspects landscape areas, inspects and tests irrigation system performance, and makes recommendations for improvements in plant material, irrigation equipment, and irrigation schedule. Conservation devices could be directly installed.
41	SF Wireless Flow Monitor	Audits & Rpts	Single-Family	Monitor	Wireless devices that continuously measure the flow of water volume and provide alerts in the case of detected leaks. These devices can attach to the meter, incoming water pipes, fitted under the sink or be in-line installed directly on the water main. Examples include Flume and WaterSmart (VertexOne). Note devices that sense water on the floor or humidity to indicate a leak are not included.
42	SF AMI Leak Alert	Audits & Rpts	Single-Family	Household	Leak detection alert systems of various sorts that identify leaks on the customer side of the meter, where the metering is Advanced Metering Infrastructure (AMI). Since AMI technology connects customer meters to the utility through a network, it allows storage and analysis of water use patterns, in addition to billing. An AMI Leak Alert Program, thus, is one that uses the data infrastructure to identify customers with leaks, and to send alerts. This activity assumes AMI is utilized with the ability to both identify a leak at a customer site and to alert the customer in a way that allows subsequent repair or resolution (mail, email, text, and/or call). Not included are devices installed on the customer side of the meter.
43	MF (4 or fewer units) AMI Leak Alert	Audits & Rpts	Multi-Family	Property	
44	Water Use Monitoring - Water Calculator	Education	Single-Family	Household	Website available to water customers with advice on how to set irrigation controllers properly and how to manage it thereafter.
45	Water Use Monitoring - Footprint Calculator	Education	Single-Family	Household	An interactive website quiz that calculates a persons water footprint. The website also includes information on what a water footprint is, ways to save water and educational resources.
46	Water Use Monitoring - RSAT Kit/Home Survey Kit	Kits & Giveaways	Single-Family	Household	An at-home self-audit survey that includes a step-by-step guide to check for flow rates, leaks, and general inefficiencies.
47	In-School Education - Poster Contest	Education	Single-Family	Household	Annual contest part of the school education program designed to promote water conservation awareness among students in kindergarten through 5th grade.
48	In-School Education - EarthCapades	Education	Single-Family	Performance	School assemblies designed to increase student awareness of water conservation by combining age-appropriate state science standards with circus skills, juggling, music, storytelling, comedy, and audience participation to teach environmental awareness, water science and conservation.
49	In-School Education - Water-Wise	Kits & Giveaways	Single-Family	Kit	Through the Water-wise School Education Kits Program, kits are distributed to 5th grade students that enable them to install water saving devices and perform a water audit in their home. After the student performs the audit and installs the water and energy savings devices, affidavits signed by the parents are returned to the school, collected by the teacher, and forwarded to Water Wise for program documentation of implementation and resulting savings. The kit includes energy and water savings high-efficiency showerhead, kitchen aerator, flip control bathroom aerator, energy cost calculator, mini-tape measure, flow rate test bag, multi-function drop/rain gauge, water temperature check card, toilet leak detector tablets.
50	In-School Education - Classroom Visit	Education	Single-Family	Household	

Program ID	Program Name	Program Category	Program Class	Units	Program Description
51	In-School Education - Teacher Training	Education	Single-Family	Household	A collection of classroom resources on conservation for teachers.
52	Public Outreach	Education	Single-Family	Household	BAWSCA participates in the Water Conservation Showcase event every year and helped form the Silicon Valley Water Conservation Award Coalition to recognize programs and leadership that has contributed to the advancement of water conservation in Silicon Valley. Other measures taken include collaborations with member agencies for public outreach and community events.
53	Water Efficient Landscaping - Conservation Garden	Education	Single-Family	Household	Water Conservation Garden that demonstrates low water landscaping concepts. Visit the garden to learn how you can incorporate these water conservation concepts into your landscaping project.
54	Water Efficient Landscaping - Education Classes	Education	Single-Family	Household	BAWSCA's Landscape Education Classes are designed to introduce homeowners, commercial property managers, landscape service providers, and others to the concepts of water-efficient and sustainable landscaping.
55	Water Efficient Landscaping - Garden Tours	Education	Single-Family	Household	Garden tours which showcase homes around the Bay Area that have beautiful water conserving gardens comprised primarily of California native plants. These tours are regional throughout the Bay Area and provide homeowners, landscape professionals, and others with ideas for design and implementation of water-efficient landscapes.
56	Water Efficient Landscaping - Water-Wise Tool	Education	Single-Family	Household	A website full of information on how to garden beautifully while saving water.
57	Certification - Green Business	Education	CII Common Meter	Certification	Program designed to encourage businesses follow best practices for energy and water conservation, waste management, and more.
58	Certification - QWEL	Education	Single-Family	Certification	Free or low cost 20-hour training and certification on irrigation and water management to receive an EPA WaterSense labeled professional certification in irrigation system audits.
59	Affordability/Equity - Grants	Grants	Single-Family	Grant	Grants for non-profit, government agencies and schools/universities to test new and innovative water conservation technologies and programs.
60	Affordability/Equity - Assistance Program	Grants	Single-Family	Grant	Qualified water customers receive a free water and energy conservation assessments to residents. Services include indoor and outdoor leak assessments, and if needed, installation of new fixtures such as high-efficiency toilets, bathroom faucets, outdoor hose bibs, and sprinkler heads.
61	Building Efficiency Program	Cooling & Heating Systems	CII Common Meter	CII Establishment	Program designed to address energy and water use in existing buildings to help make them more efficient, thereby saving owners money, improving the safety and comfort of the building stock, and reducing emissions that are driving climate change.
62	Showerhead Replacement (<= 1.8 gpm)	Low Flow Showerhead (<= 1.8 gpm)	Single-Family	Showerhead	Replacement of existing low efficiency showerheads with low-flow showerheads rated 1.8 gpm or less.
63	Showerhead Replacement (<= 1.8 gpm)	Low Flow Showerhead (<= 1.8 gpm)	Multi-Family	Showerhead	
64	Bathroom Direct Install	HET	Single-Family	Toilet	Direct installation of high efficiency toilets, inefficient showerheads and bathroom faucets by a contractor.
65	Bathroom Direct Install	HET	Multi-Family	Toilet	
66	Irrigation System Flow Sensor Rebate	Irrigation System & Devices	Single-Family	Controller	Installation of irrigation flow sensors that measure the flow rate from which the volume of water being delivered to an irrigation system can be inferred.
67	Irrigation System Flow Sensor Rebate	Irrigation System & Devices	Multi-Family	Controller	
68	SFR Medium Cistern (501-999 gal) Rebate	Rainwater Harvesting	Single-Family	Barrel	Purchase of a medium cistern (501 to 999 gallons) or a large cistern (1,000+ gallons) for the purpose of rainwater harvesting.
69	SFR Large Cistern (1000+ gal) Rebate	Rainwater Harvesting	Single-Family	Barrel	
70	CII Ozone Laundry Washer Rebate	Laundries & Laundromats	CII Common Meter	Washer	Ozone laundry systems utilize cold-water, lower amounts of detergent and fewer rinse cycles to conserve water and energy. Applicable to hospitals, nursing homes, hotels/motels, universities and prisons.
71	CII Commercial Kitchen Dishwasher Rebate	Commercial Kitchens & Restaurants	CII Common Meter	Dishwasher	Installation of high efficiency dishwashers in commercial and industrial kitchens.
72	CII Commercial Kitchen Spray Rinse Valve Rebate	Commercial Kitchens & Restaurants	CII Common Meter	Spray Valve	Installation of pre-rinse spray valves that control the water flow in sprayers for rinsing food waste from pots, pans, utensils, and dishware before entering a dishwasher.
73	CII Commercial Kitchen Food Steamer Rebate	Commercial Kitchens & Restaurants	CII Common Meter	Food Steamer	Installation of water efficient food steamers in commercial and industrial kitchens.
74	CII Restaurant Dipper Well Rebate	Commercial Kitchens & Restaurants	CII Common Meter	Dipper Well	Installation of high efficiency dipper wells that utilize automatic shutoffs and other features to reduce water use. Can include replacement of low efficiency dripper wells.
75	CII Large Landscape Water Budget	Audits & Rpts	CII Irrigation Meter	Site	Large landscape, irrigated area greater than 1 acre, where water budgets tied to water rates.
76	Acoustic Hydrant Cap	Leaks and Water Loss	CII Common Meter	Hydrant Cap	Leak detection technology. System water loss is calculated by determining the total water inputs into the system against the total measurable outputs of the system. Inputs are measured at the point of entry into the water network through a meter. Outputs are then calculated at residential or commercial meters where customers purchase the water.

Table E-2: Conservation Cost and Savings Assumptions

Program ID	Program Name	Units	BAWSCA Defined Programs				Valley Water Defined Programs				Other Utility Defined Programs			
			Utility Cost ($/unit)	Utility Unit Cost ($/1000 gal)	Expected Savings (gpd/unit)	Life of Savings (Years)	Utility Cost ($/unit)	Utility Unit Cost ($/1000 gal)	Expected Savings (gpd/unit)	Life of Savings (Years)	Utility Cost ($/unit)	Utility Unit Cost ($/1000 gal)	Expected Savings (gpd/unit)	Life of Savings (Years)
1	Toilets - Conventional (>=3.5 gpf) to HET (1.28 gpf)	Toilet	NA	NA	NA	NA	NA	NA	NA	NA	50 - 70	0.2 - 0.28	28	25
2	Toilets - Conventional (>=3.5 gpf) to HET (1.28 gpf)	Toilet	NA	NA	NA	NA	$150	$0.43	39	25	50 - 150	0.14 - 0.43	39	25
3	Toilets - Conventional (>=3.5 gpf) to HET (1.28 gpf)	Toilet	NA	NA	NA	NA	$150	$0.43	39	25	50 - 150	0.14 - 0.43	39	25
4	Toilets - ULFT (>=1.6 gpf) to HET (1.28 gpf)	Toilet	NA	NA	NA	NA	NA	NA	NA	NA	50	0.26	28	25
5	Toilets - ULFT (>=1.6 gpf) to HET (1.28 gpf)	Toilet	NA	NA	NA	NA	$150	$0.43	39	25	50 - 150	0.19 - 0.57	39	25
6	Toilets - ULFT (>=1.6 gpf) to HET (1.28 gpf)	Toilet	NA	NA	NA	NA	$150	$0.43	39	25	50 - 150	0.19 - 0.57	15	25
7	Toilets - HET (1.28 gpf) to HET+ (<=1.0 gpf)	Toilet	NA	NA	NA	NA	NA	NA	NA	NA	50	0.3	28	25
8	Toilets - HET (1.28 gpf) to HET+ (<=1.0 gpf)	Toilet	NA	NA	NA	NA	NA	NA	NA	NA	50 - 150	0.22 - 0.65	39	25
9	Toilets - HET (1.28 gpf) to HET+ (<=1.0 gpf)	Toilet	NA	NA	NA	NA	NA	NA	NA	NA	50 - 150	0.22 - 0.65	16	25
10	CII Urinal (1/8 gpf) Replacement	Urinal	NA	NA	NA	NA	$150	$0.78	21	25	150 - 150	0.83	20	25
11	SF Washer Rebate (WF <=4)	Washer	NA	NA	NA	NA	NA	NA	NA	NA	100 - 150	1.65 - 2.48	11	15
12	MF In-Unit Washer Rebate (WF <=4)	Washer	NA	NA	NA	NA	NA	NA	NA	NA	100 - 150	2.23 - 3.34	8	15
13	Water Conservation Kits - Indoor	Kit	$40	$1.48	7	10	$40	$1.48	7	10	15	0.56	7	10
14	Water Conservation Kits - Outdoor	Kit	$38	$1.61	6	10	$38	$1.61	6	10	NA	NA	NA	NA
15	Water Conservation Kits - LivingWise	Kit	$55	$2.04	7	10	$55	$2.04	7	10	NA	NA	NA	NA
16	Water Conservation Kits - Spray Valves	Kit	NA	NA	NA	NA	$50	$0.18	77	10	35	0.5	19	10
17	Water Conservation Kits - Aerators/Showerheads	Kit	NA	NA	NA	NA	$60	$3.74	4	10	3.68 - 60	0.23 - 3.74	4	10
18	CII Technologies	CCF	$4	$0.55	2	10	$4	$0.55	2	10	4	0.55	2	10
19	SF Turf Replacement	Square-foot	$2	$5.56	0	10	$5	$13.70	0	10	0.71 - 3	1.97 - 8.34	NA	10
20	MF Turf Replacement	Square-foot	$2	$5.56	0	10	$5	$13.70	0	10	0.71 - 3	1.97 - 8.34	NA	10
21	CII Large Landscape Turf Replacement	Square-foot	$2	$5.56	0	10	$5	$13.70	0	10	0.77 - 1	2.14 - 2.78	NA	10
22	Rain Garden Addition	Square-foot	$1	$3.61	0	10	$3	$8.22	0	10	NA	NA	NA	NA
23	SF In-Line Drip Irrigation Conversion	Square-foot	NA	NA	NA	NA	$0	$1.10	0	10	0.25	1.1	NA	10
24	MF In-Line Drip Irrigation Conversion	Square-foot	NA	NA	NA	NA	$0	$1.10	0	10	0.25	1.1	NA	10

Program ID	Program Name	Units	BAWSCA Defined Programs				Valley Water Defined Programs				Other Utility Defined Programs			
			Utility Cost ($/unit)	Utility Unit Cost ($/1000 gal)	Expected Savings (gpd/unit)	Life of Savings (Years)	Utility Cost ($/unit)	Utility Unit Cost ($/1000 gal)	Expected Savings (gpd/unit)	Life of Savings (Years)	Utility Cost ($/unit)	Utility Unit Cost ($/1000 gal)	Expected Savings (gpd/unit)	Life of Savings (Years)
25	CII In-Line Drip Irrigation Conversion	Square-foot	NA	NA	NA	NA	$0	$1.10	0	10	0.25	1.1	NA	10
26	SF Smart Irrigation Controller Rebate	Device	$82	$0.86	26	10	$82	$0.86	26	10	125	1.31	26	10
27	MF Large Landscape Smart Irrigation Controller Rebate	Device	$125	$0.05	727	10	$1,461	$0.55	727	10	125 - 960	0.05 - 0.36	727	10
28	CII Large Landscape Irrigation Controller	Station	$25	$0.01	727	10	$3,295	$1.24	727	10	25 - 960	0.01 - 0.36	727	10
29	SF Irrigation Nozzle Replacement	Device	$5	$0.86	2	10	$9	$1.48	2	10	4.51 - 5	0.77 - 0.86	2	10
30	MF Irrigation Nozzle Replacement	Device	$5	$0.86	2	10	$11	$1.86	2	10	4.51 - 18	0.77 - 3.08	2	10
31	CII Large Landscape Irrigation Nozzle Replacement	Station	$5	$0.86	2	10	$7	$1.12	2	10	37	6.34	2	10
32	Rainwater Capture - Rain Barrel <200	Barrel	$50	$16.15	2	5	$150	$48.46	2	5	50	16.15	2	5
33	Rainwater Capture - Cistern >=200	Barrel	$200	$16.15	7	5	$200	$16.15	7	5	NA	NA	NA	NA
34	Rainwater Capture - Cistern >=200	Barrel	$200	$16.15	7	5	$200	$16.15	7	5	NA	NA	NA	NA
35	SF Graywater Laundry to Landscape Rebate	Household	NA	NA	NA	NA	$200	$3.04	18	10	200	5.03	11	10
36	Submetering - Other	Meter	NA	NA	NA	NA	$300	$0.68	60	20	302 - 1,950	0.69 - 4.45	60	20
37	SF Unmetered to Metered	Meter	NA	NA	NA	NA	$150	$0.40	51	20	NA	NA	NA	NA
38	SF Water Use Audit	Household	$125	$2.02	34	5	$125	$2.02	34	5	125	2.02	34	5
39	MF Water Use Audit	Property	NA	NA	NA	NA	$75	$3.74	11	5	75	3.74	11	5
40	CII Large Landscape Water Audit	Property	$1,700	$1.04	893	5	$1,400	$0.66	1,160	5	725	0.44	893	5
41	SF Wireless Flow Monitor	Monitor	$200	$4.57	24	5	$200	$4.57	24	5	0 - 200	22.83	24	1
42	SF AMI Leak Alert	Household	NA	NA	NA	NA	NA	NA	NA	NA	0.003 - 301	0.01 - 1,178	1	1
43	MF (4 or fewer units) AMI Leak Alert	Property	NA	NA	NA	NA	NA	NA	NA	NA	0.003 - 20	0 - 27.40	2	1
44	Water Use Monitoring - Water Calculator	Household	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
45	Water Use Monitoring - Footprint Calculator	Household	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
46	Water Use Monitoring - RSAT Kit/Home Survey Kit	Household	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
47	In-School Education - Poster Contest	Household	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
48	In-School Education - EarthCapades	Performance	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
49	In-School Education - Water-Wise	Kit	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
50	In-School Education - Classroom Visit	Household	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Program ID	Program Name	Units	BAWSCA Defined Programs				Valley Water Defined Programs				Other Utility Defined Programs			
			Utility Cost ($/unit)	Utility Unit Cost ($/1000 gal)	Expected Savings (gpd/unit)	Life of Savings (Years)	Utility Cost ($/unit)	Utility Unit Cost ($/1000 gal)	Expected Savings (gpd/unit)	Life of Savings (Years)	Utility Cost ($/unit)	Utility Unit Cost ($/1000 gal)	Expected Savings (gpd/unit)	Life of Savings (Years)
51	In-School Education - Teacher Training	Household	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
52	Public Outreach	Household	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
53	Water Efficient Landscaping - Conservation Garden	Household	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
54	Water Efficient Landscaping - Education Classes	Household	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
55	Water Efficient Landscaping - Garden Tours	Household	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
56	Water Efficient Landscaping - Water-Wise Tool	Household	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
57	Certification - Green Business	Certification	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
58	Certification - QWEL	Certification	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
59	Affordability/Equity - Grants	Grant	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
60	Affordability/Equity - Assistance Program	Grant	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
61	Building Efficiency Program	CII Establishment	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
62	Showerhead Replacement (<= 1.8 gpm)	Showerhead	$4	$0.50	2	10	$10	$1.14	2	10	4.26 - 10	0.49 - 1.14	2	10
63	Showerhead Replacement (<= 1.8 gpm)	Showerhead	$4	$0.50	2	10	$10	$1.14	2	10	4.26 - 10	0.49 - 1.14	2	10
64	Bathroom Direct Install	Toilet	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
65	Bathroom Direct Install	Toilet	NA	NA	NA	NA	NA	NA	NA	NA	350	0.73	53	25
66	Irrigation System Flow Sensor Rebate	Controller	NA	NA	NA	NA	$190	$5.78	9	10	190	5.78	9	10
67	Irrigation System Flow Sensor Rebate	Controller	NA	NA	NA	NA	$190	$1.93	27	10	190	1.93	27	10
68	SF Medium Cistern (501-999 gal) Rebate	Barrel	$50	$3.26	8	5	$300	$19.57	8	5	350	22.85	8	5
69	SF Large Cistern (1000+ gal) Rebate	Barrel	$50	$2.84	10	5	$300	$17.12	10	5	400	22.73	10	5
70	CII Ozone Laundry Washer Rebate	Washer	NA	NA	NA	NA	NA	NA	NA	NA	2,100	0.54	704	15
71	CII Commercial Kitchen Dishwasher Rebate	Dishwasher	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
72	CII Commercial Kitchen Spray Rinse Valve Rebate	Spray Valve	NA	NA	NA	NA	$50	$0.71	19	10	50	0.71	19	10
73	CII Commercial Kitchen Food Steamer Rebate	Food Steamer	NA	NA	NA	NA	NA	NA	NA	NA	1,250 - 1,400	1.54 - 1.72	223	10
74	CII Restaurant Dipper Well Rebate	Dipper Well	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
75	CII Large Landscape Water Budget	Site	$44	$0.10	1,160	1	$0	$0.00	1,160	1	NA	NA	NA	NA
76	Acoustic Hydrant Cap	Hydrant Cap	NA	NA	NA	NA	NA	NA	NA	NA	1,189	NA	165	NA

Table E-3: Residential End Uses by Technological Efficiency Level

Class	End Use Technology	Mechanical Efficiency	Projections						2025-2050	
			2025	2030	2035	2040	2045	2050	Change	% Change
SF	Toilets	Pre-ULFT	151,442	113,341	84,668	63,085	46,838	34,611	-116,831	-77.15%
		ULFT	350,144	276,937	219,042	173,255	137,043	108,403	-241,741	-69.04%
		HET	437,464	566,933	670,738	747,887	808,391	857,304	419,840	95.97%
		% Pre-ULFT	16.13%	11.84%	8.69%	6.41%	4.72%	3.46%	-	-
SF	Showerheads	>2.5 gpm	15,998	8,085	3,643	2,046	1,149	645	-15,353	-95.97%
		(1.8, 2.5)	293,958	172,598	101,596	59,886	35,328	20,849	-273,108	-92.91%
		<=1.8 gpm	441,284	585,085	674,318	725,450	757,342	778,760	337,476	-247,609
		% >2.5 gpm	2.13%	1.06%	0.47%	0.26%	0.14%	0.08%	-	-
SF	Clothes Washers	Conventional	195,946	193,675	193,394	193,228	193,565	194,423	-1,523	-0.78%
		High-Efficiency	169,031	178,204	185,034	189,295	192,395	194,972	25,942	15.35%
		% Conventional	53.69%	52.08%	51.10%	50.51%	50.15%	49.93%	-	-
SF	Dishwashers	Conventional	84,968	64,128	51,356	43,669	39,227	36,777	-48,191	-56.72%
		High-Efficiency	260,799	288,178	307,155	318,722	326,419	332,124	71,325	27.35%
		% Conventional	24.57%	18.20%	14.32%	12.05%	10.73%	9.97%	-	-
MF	Toilets	Pre-ULFT	78,569	60,818	47,959	37,796	29,776	23,450	-55,119	-70.15%
		ULFT	195,636	154,654	122,259	96,650	76,407	60,404	-135,231	-69.12%
		HET	339,297	487,333	628,848	745,917	854,434	973,556	634,259	186.93%
		% Pre-ULFT	12.81%	8.65%	6.00%	4.29%	3.10%	2.22%	-	-
MF	Showerheads	>2.5 gpm	9,555	5,502	3,168	1,824	1,051	605	-8,950	-93.67%
		(1.8, 2.5)	214,334	126,295	74,488	43,956	25,946	15,318	-199,016	-92.85%
		<=1.8 gpm	372,572	551,486	699,212	810,128	906,936	1,012,115	639,544	171.66%
		% >2.5 gpm	1.60%	0.81%	0.41%	0.21%	0.11%	0.06%	-	-
MF	In-Unit Clothes Washers	Conventional	96,044	106,513	118,683	129,230	139,915	153,072	57,028	59.38%
		High-Efficiency	85,854	100,190	114,759	126,795	138,403	152,133	66,280	77.20%
		% Conventional	52.80%	51.53%	50.84%	50.48%	50.27%	50.15%	-	-
MF	Shared Clothes Washers	Conventional	23,117	26,033	29,280	32,054	34,816	38,164	15,047	65.09%
		High-Efficiency	22,357	25,643	29,080	31,952	34,763	38,137	15,780	70.58%
		% Conventional	50.84%	50.38%	50.17%	50.08%	50.04%	50.02%	-	-
MF	Dishwashers	Conventional	57,447	48,091	43,180	40,664	40,120	41,465	-15,982	-27.82%
		High-Efficiency	197,209	241,293	283,640	317,771	349,525	385,822	188,613	95.64%
		% Conventional	22.56%	16.62%	13.21%	11.34%	10.30%	9.70%	-	-

Table E-4: CII End Uses by Technological Efficiency Level

Class	End Use Technology	Mechanical Efficiency	Projections						2025-2050	
			2025	2030	2035	2040	2045	2050	Change	% Change
CII	Toilets	Pre- ULFT	51,923	40,352	31,727	24,873	19,438	15,132	-36,790	-70.86%
		ULFT	102,789	83,811	68,337	55,720	45,433	37,045	-65,744	-63.96%
		% Pre-ULFT	33.56%	32.50%	31.71%	30.86%	29.96%	29.00%	-	-
CII	Urinals	>=1 gpf	23,376	18,985	15,398	12,472	10,090	8,151	-15,226	-65.13%
		0.5 gpf	2,420	1,973	1,609	1,312	1,070	872	-1,548	-63.96%
		0.25 gpf	0	0	0	0	0	0	0	0
		0.125 gpf	14,977	22,401	28,390	33,661	38,286	42,927	27,951	186.63%
		0 gpf	1,347	1,744	2,063	2,348	2,601	2,863	1,517	112.62%
		% >=1 gpf	55.50%	42.09%	32.45%	25.05%	19.39%	14.87%	-	-

Table E-5: Annual Active Savings by Program[(a)], MG

ID	Program Name	Units	Class	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	Total
1	Toilets - Conventional (>=3.5 gpf) to HET (1.28 gpf)	Toilet	SF	1	3	4	5	6	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	23	24	25	26	27	392
2	Toilets - Conventional (>=3.5 gpf) to HET (1.28 gpf)	Toilet	MF	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	3	3	40
3	Toilets - Conventional (>=3.5 gpf) to HET (1.28 gpf)	Toilet	CII	0	0	0	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	49
4	Toilets - ULFT (>=1.6 gpf) to HET (1.28 gpf)	Toilet	SF	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	0
5	Toilets - ULFT (>=1.6 gpf) to HET (1.28 gpf)	Toilet	MF	2	5	7	9	11	13	12	12	12	11	11	10	10	10	9	9	9	8	8	8	8	7	7	7	7	6	229
6	Toilets - ULFT (>=1.6 gpf) to HET (1.28 gpf)	Toilet	CII	2	4	6	8	10	11	12	12	12	12	13	13	13	13	13	14	14	14	14	14	14	14	15	15	15	15	310
7	Toilets - HET (1.28 gpf) to HET+ (<=1.0 gpf)	Toilet	SF	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	0
8	Toilets - HET (1.28 gpf) to HET+ (<=1.0 gpf)	Toilet	MF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	11
9	Toilets - HET (1.28 gpf) to HET+ (<=1.0 gpf)	Toilet	CII	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	13
10	CII Urinal (1/8 gpf) Replacement	Urinal	CII	0	0	0	0	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	40
11	SFR Washer Rebate (WF <=4)	Washer	SF	1	1	2	3	3	4	5	6	6	7	8	8	9	10	11	11	11	11	11	11	11	11	11	11	11	11	204
12	MFR In-Unit Washer Rebate (WF <=4)	Washer	MF	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	0
13	Water Conservation Kits - Indoor	Kit	SF	8	17	25	33	41	49	56	64	72	79	87	94	100	107	114	121	127	134	141	147	154	161	167	174	181	187	2,640
14	Water Conservation Kits - Outdoor	Kit	SF	1	3	4	5	7	8	9	10	11	13	14	15	16	17	18	20	21	22	23	24	25	26	27	28	29	31	427
15	Water Conservation Kits - LivingWise	Kit	SF	3	5	7	10	12	14	16	18	20	22	24	26	27	29	31	32	33	35	36	38	39	40	42	43	44	46	692
16	Water Conservation Kits - Spray Valves	Kit	CII	2	4	5	7	8	10	12	13	15	16	18	19	21	23	24	26	27	29	30	32	34	35	37	38	40	42	568
17	Water Conservation Kits - Aerators/Showerheads	Kit	CII	1	1	2	2	3	3	4	5	5	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	10	11	167
18	CII Technologies	CCF	Irr.	4	8	12	16	20	24	27	31	35	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	845
19	SFR Turf Replacement	Square-foot	SF	9	18	27	36	46	55	64	74	84	93	94	95	96	97	97	98	99	100	101	103	104	105	106	107	107	108	2,123
20	MFR Turf Replacement	Square-foot	MF	2	4	7	9	11	14	16	19	21	24	24	24	25	25	25	25	26	26	26	27	27	27	28	28	28	28	545
21	CII Large Landscape Turf Replacement	Square-foot	Irr.	3	6	9	12	16	21	27	32	38	43	46	49	52	54	56	57	58	58	59	60	60	61	62	62	63	63	1,128
22	Rain Garden Addition	Square-foot	SF	0	1	1	1	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	75
23	SFR In-Line Drip Irrigation Conversion	Square-foot	SF	12	23	35	47	59	71	83	95	106	118	119	119	120	120	120	120	120	120	120	120	120	120	120	120	120	120	2,563
24	MFR In-Line Drip Irrigation Conversion	Square-foot	MF	1	2	3	5	6	8	10	12	14	15	16	17	18	18	18	18	18	18	18	18	18	18	18	18	19	19	366
25	CII In-Line Drip Irrigation Conversion	Square-foot	Irr.	3	6	10	14	19	24	28	33	38	43	45	47	49	50	51	52	53	55	56	57	58	59	60	61	62	63	1,100
26	SFR Smart Irrigation Controller Rebate	Device	SF	6	12	19	25	31	38	45	52	59	66	64	62	61	59	57	55	53	50	48	46	46	47	47	47	47	47	1,189
27	MFR Large Landscape Smart Irrigation Controller Rebate	Device	MF	8	17	25	35	45	55	65	75	85	95	97	99	102	102	103	104	105	106	107	108	110	111	112	112	113	114	2,212

ID	Program Name	Units	Class	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	Total
28	CII Large Landscape Irrigation Controller	Station	Irr.	8	14	21	29	37	46	54	62	70	78	80	82	83	84	84	85	85	86	86	87	87	88	88	89	89	90	1,793
29	SFR Irrigation Nozzle Replacement	Device	SF	1	1	2	3	3	4	5	6	6	7	7	7	7	8	8	8	8	8	8	8	8	8	9	9	9	9	167
30	MFR Irrigation Nozzle Replacement	Device	MF	1	3	4	5	6	8	9	10	12	13	13	13	13	13	13	13	13	14	14	14	14	14	14	14	14	14	287
31	CII Large Landscape Irrigation Nozzle Replacement	Station	Irr.	1	1	2	2	3	4	4	5	5	6	6	6	6	6	7	7	7	7	7	7	7	7	7	8	8	8	143
32	Rainwater Capture - Rain Barrel <200	Barrel	SF	3	7	10	14	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	414
33	Rainwater Capture - Cistern >=200	Barrel	MF	0	1	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	70
34	Rainwater Capture - Cistern >=200	Barrel	CII	0	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	35
35	SFR Graywater Laundry to Landscape Rebate	Household	SF	1	1	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	30
36	Submetering - Other	Meter	MF	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	29
37	SFR Unmetered to Metered	Meter	MF	0	0	0	0	0	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	3	3	38
38	SFR Water Use Audit	Household	SF	7	12	17	20	23	23	23	23	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	578
39	MFR Water Use Audit	Property	MF	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
40	CII Large Landscape Water Audit	Property	Irr.	32	57	78	96	112	113	116	117	118	119	120	120	121	122	122	123	123	124	125	126	127	127	127	127	127	127	2,947
41	SFR Wireless Flow Monitor	Monitor	SF	49	54	59	65	70	74	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	1,947
42	SFR AMI Leak Alert	Household	SF	30	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	809
43	MFR (4 or fewer units) AMI Leak Alert	Property	MF	73	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	1,924
44	Water Use Monitoring - Water Calculator	Household	SF	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	0
45	Water Use Monitoring - Footprint Calculator	Household	SF	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	0
46	Water Use Monitoring - RSAT Kit/Home Survey Kit	Household	SF	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	0
47	In-School Education - Poster Contest	Household	SF	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	0
48	In-School Education - EarthCapades	Performance	SF	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	0
49	In-School Education - Water-Wise	Kit	SF	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	0
50	In-School Education - Classroom Visit	Household	SF	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	0
51	In-School Education - Teacher Training	Household	SF	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	0
52	Public Outreach	Household	SF	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	0
53	Water Efficient Landscaping - Conservation Garden	Household	SF	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	0
54	Water Efficient Landscaping - Education Classes	Household	SF	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	0
55	Water Efficient Landscaping - Garden Tours	Household	SF	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	0
56	Water Efficient Landscaping - Water-Wise Tool	Household	SF	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	0
57	Certification - Green Business	Certification	CII	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	0
58	Certification - QWEL	Certification	SF	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	0

ID	Program Name	Units	Class	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	Total
59	Affordability/Equity - Grants	Grant	SF	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	0
60	Affordability/Equity - Assistance Program	Grant	SF	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	0
61	Building Efficiency Program	CII Establishment	CII	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	0
62	Showerhead Replacement (<= 1.8 gpm)	Showerhead	SF	0	1	1	1	2	2	2	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	79
63	Showerhead Replacement (<= 1.8 gpm)	Showerhead	MF	0	0	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	48
64	Bathroom Direct Install	Toilet	SF	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	0
65	Bathroom Direct Install	Toilet	MF	0	0	0	0	0	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3	3	3	3	38
66	Irrigation System Flow Sensor Rebate	Controller	SF	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	1
67	Irrigation System Flow Sensor Rebate	Controller	MF	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	2
68	SFR Medium Cistern (501-999 gal) Rebate	Barrel	SF	0	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	40
69	SFR Large Cistern (1000+ gal) Rebate	Barrel	SF	0	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	43
70	CII Ozone Laundry Washer Rebate	Washer	CII	0	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	73
71	CII Commercial Kitchen Dishwasher Rebate	Dishwasher	CII	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	0
72	CII Commercial Kitchen Spray Rinse Valve Rebate	Spray Valve	CII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	10
73	CII Commercial Kitchen Food Steamer Rebate	Food Steamer	CII	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	21
74	CII Restaurant Dipper Well Rebate	Dipper Well	CII	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	0
75	CII Large Landscape Water Budget	Site	Irr.	442	446	450	453	457	461	465	469	473	476	480	483	486	490	85	85	85	85	85	85	85	85	85	85	85	85	7,548
76	Acoustic Hydrant Cap	Hydrant Cap	CII	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	0
	Regional Total			721	848	968	1,090	1,208	1,308	1,403	1,493	1,582	1,672	1,701	1,728	1,756	1,778	1,392	1,408	1,424	1,440	1,457	1,474	1,492	1,510	1,527	1,544	1,559	1,575	37,055
	Regional Total, Single-Family			134	192	248	304	358	406	453	495	538	581	591	602	614	624	635	644	653	662	672	681	693	704	716	727	738	749	14,413
	Regional Total, Multi-Family			90	107	123	142	161	179	195	211	227	243	246	250	253	255	256	257	259	260	262	264	265	267	268	269	270	271	5,853
	Regional Total, CII Common Meter			6	11	16	21	26	31	34	37	40	43	46	48	51	54	56	59	61	63	66	68	70	72	74	76	78	81	1,286
	Regional Total, Irrigation			492	538	580	623	663	692	721	750	778	806	817	827	838	846	445	448	451	454	457	461	464	467	469	471	473	474	15,504

(a) San Jose Municipal Water System - North San José – Alviso active savings cannot be broken out at the program level as the annual measures are applied to the whole San Jose service area. Total active savings for San Jose Municipal Water System - North San José – Alviso is estimated to be 0.08 MGD in 2050 based on the projected water demand relative to the entire San Jose agency demand.

Table E-6: Annual Program Budgets per $K

ID	Program Name	Units	Class	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	Total
1	Toilets - Conventional (>=3.5 gpf) to HET (1.28 gpf)	Toilet	SF	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	212
2	Toilets - Conventional (>=3.5 gpf) to HET (1.28 gpf)	Toilet	MF	2	1	1	2	1	1	2	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	28
3	Toilets - Conventional (>=3.5 gpf) to HET (1.28 gpf)	Toilet	CII	1	1	1	2	1	1	2	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	27
4	Toilets - ULFT (>=1.6 gpf) to HET (1.28 gpf)	Toilet	SF	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	0
5	Toilets - ULFT (>=1.6 gpf) to HET (1.28 gpf)	Toilet	MF	20	19	19	21	19	20	2	0	0	2	0	0	2	0	0	2	0	0	2	0	0	0	0	0	0	0	132
6	Toilets - ULFT (>=1.6 gpf) to HET (1.28 gpf)	Toilet	CII	26	29	29	31	30	30	11	9	9	11	9	9	11	9	9	11	9	9	11	9	9	9	9	9	9	9	369
7	Toilets - HET (1.28 gpf) to HET+ (<=1.0 gpf)	Toilet	SF	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	0
8	Toilets - HET (1.28 gpf) to HET+ (<=1.0 gpf)	Toilet	MF	2	0	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0	0	0	0	0	0	0	11
9	Toilets - HET (1.28 gpf) to HET+ (<=1.0 gpf)	Toilet	CII	2	0	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0	0	0	0	0	0	0	11
10	CII Urinal (1/8 gpf) Replacement	Urinal	CII	2	2	2	3	2	2	3	2	2	3	2	2	3	2	3	3	3	3	3	3	3	3	3	3	3	3	69
11	SFR Washer Rebate (WF <=4)	Washer	SF	23	23	23	23	23	23	23	23	23	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	614
12	MFR In-Unit Washer Rebate (WF <=4)	Washer	MF	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	0
13	Water Conservation Kits - Indoor	Kit	SF	75	75	75	75	75	75	75	75	75	75	75	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	1,801
14	Water Conservation Kits - Outdoor	Kit	SF	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	404
15	Water Conservation Kits - LivingWise	Kit	SF	51	51	51	51	51	46	46	46	46	46	40	40	40	40	40	35	35	35	35	35	35	35	35	35	35	35	1,069
16	Water Conservation Kits - Spray Valves	Kit	CII	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	83
17	Water Conservation Kits - Aerators/Showerheads	Kit	CII	21	15	15	15	15	15	15	15	15	15	11	11	11	10	10	10	10	10	10	10	8	8	8	8	8	8	309
18	CII Technologies	CCF	Irr.	21	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	570
19	SFR Turf Replacement	Square-foot	SF	800	808	816	824	832	840	849	858	868	878	888	899	910	921	933	946	959	972	986	1,001	1,016	1,016	1,016	1,016	1,016	1,016	23,882
20	MFR Turf Replacement	Square-foot	MF	160	165	166	168	174	175	177	179	180	182	184	186	188	190	192	194	201	204	206	209	211	211	211	211	211	211	4,950
21	CII Large Landscape Turf Replacement	Square-foot	Irr.	250	257	272	308	367	491	535	539	544	548	553	557	562	567	573	578	584	590	597	603	610	610	610	610	610	610	13,536
22	Rain Garden Addition	Square-foot	SF	20	27	27	28	28	21	22	22	22	22	23	23	23	24	24	24	25	25	25	26	26	26	26	26	26	26	640
23	SFR In-Line Drip Irrigation Conversion	Square-foot	SF	3	3	3	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	188
24	MFR In-Line Drip Irrigation Conversion	Square-foot	MF	10	12	12	22	22	22	22	22	22	22	22	22	23	23	23	23	23	23	23	23	23	23	23	23	23	23	554

ID	Program Name	Units	Class	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	Total
25	CII In-Line Drip Irrigation Conversion	Square-foot	Irr.	35	37	38	52	53	54	54	55	56	58	59	60	61	62	64	65	66	68	69	71	72	72	72	72	72	72	1,570
26	SFR Smart Irrigation Controller Rebate	Device	SF	66	66	66	67	67	71	71	71	72	72	51	52	52	52	52	52	52	53	53	53	53	53	53	53	53	53	1,530
27	MFR Large Landscape Smart Irrigation Controller Rebate	Device	MF	21	21	21	28	28	29	28	28	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	724
28	CII Large Landscape Irrigation Controller	Station	Irr.	33	26	27	34	34	41	34	35	35	35	42	36	36	36	36	44	37	37	38	38	45	38	38	38	38	45	957
29	SFR Irrigation Nozzle Replacement	Device	SF	7	7	7	7	7	7	7	7	7	7	8	8	8	8	8	8	8	8	8	9	9	9	9	9	9	9	204
30	MFR Irrigation Nozzle Replacement	Device	MF	28	28	29	29	29	29	29	29	29	29	29	29	29	29	29	29	30	30	30	30	30	30	30	30	30	30	759
31	CII Large Landscape Irrigation Nozzle Replacement	Station	Irr.	7	7	7	7	7	7	8	8	8	8	8	8	8	8	8	8	8	9	9	9	9	9	9	9	9	9	209
32	Rainwater Capture - Rain Barrel <200	Barrel	SF	798	796	796	801	796	796	802	796	796	802	796	797	802	797	797	802	797	797	803	797	797	797	797	797	797	797	20,747
33	Rainwater Capture - Cistern >=200	Barrel	MF	13	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	17	17	17	17	17	17	17	17	17	420
34	Rainwater Capture - Cistern >=200	Barrel	CII	10	8	8	8	8	8	8	8	8	8	8	8	8	8	9	9	9	9	9	9	9	9	9	9	9	9	220
35	SFR Graywater Laundry to Landscape Rebate	Household	SF	42	2	2	2	2	2	2	2	2	2	3	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	107
36	Submetering - Other	Meter	MF	7	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	5	5	5	119
37	SFR Unmetered to Metered	Meter	MF	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	25
38	SFR Water Use Audit	Household	SF	70	70	71	71	71	71	72	72	72	72	72	72	72	72	72	72	72	72	73	73	73	73	73	73	73	73	1,870
39	MFR Water Use Audit	Property	MF	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	158
40	CII Large Landscape Water Audit	Property	Irr.	77	92	93	100	101	102	104	104	105	106	107	107	107	108	109	109	110	110	113	114	114	114	114	114	114	114	2,761
41	SFR Wireless Flow Monitor	Monitor	SF	1,118	1,222	1,322	1,422	1,522	1,622	1,722	1,722	1,722	1,722	1,722	1,722	1,722	1,722	1,722	1,722	1,722	1,722	1,722	1,722	1,722	1,722	1,722	1,722	1,722	1,722	42,668
42	SFR AMI Leak Alert	Household	SF	772	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	3,703
43	MFR (4 or fewer units) AMI Leak Alert	Property	MF	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	93
44	Water Use Monitoring - Water Calculator	Household	SF	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	0
45	Water Use Monitoring - Footprint Calculator	Household	SF	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	0
46	Water Use Monitoring - RSAT Kit/Home Survey Kit	Household	SF	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	62
47	In-School Education - Poster Contest	Household	SF	25	25	25	25	25	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	694
48	In-School Education - EarthCapades	Performance	SF	2,543	2,543	2,543	2,543	2,543	2,543	2,543	2,543	2,543	2,543	2,543	2,543	2,543	2,543	2,543	2,543	2,543	2,543	2,543	2,543	2,543	2,543	2,543	2,543	2,543	2,543	66,109
49	In-School Education - Water-Wise	Kit	SF	373	373	373	373	373	373	373	373	373	373	373	373	373	373	373	373	373	373	373	373	373	373	373	373	373	373	9,685

ID	Program Name	Units	Class	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	Total
50	In-School Education - Classroom Visit	Household	SF	49	49	49	49	49	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	1,377
51	In-School Education - Teacher Training	Household	SF	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	26
52	Public Outreach	Household	SF	311	311	311	311	311	311	311	311	311	311	311	311	311	311	311	311	311	1,656	311	311	311	311	311	311	311	311	9,438
53	Water Efficient Landscaping - Conservation Garden	Household	SF	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	0
54	Water Efficient Landscaping - Education Classes	Household	SF	17	17	17	18	18	18	18	18	18	18	18	18	18	18	18	19	19	19	19	19	19	19	19	19	19	19	475
55	Water Efficient Landscaping - Garden Tours	Household	SF	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	36
56	Water Efficient Landscaping - Water-Wise Tool	Household	SF	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	0
57	Certification - Green Business	Certification	CII	9	9	9	9	9	9	9	10	10	10	10	10	10	10	10	10	10	11	11	11	11	11	11	11	11	11	260
58	Certification - QWEL	Certification	SF	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	0
59	Affordability/Equity - Grants	Grant	SF	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	0
60	Affordability/Equity - Assistance Program	Grant	SF	52	152	152	152	152	152	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	2,813
61	Building Efficiency Program	CII Establishment	CII	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	0
62	Showerhead Replacement (<= 1.8 gpm)	Showerhead	SF	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	99
63	Showerhead Replacement (<= 1.8 gpm)	Showerhead	MF	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	3	2	62
64	Bathroom Direct Install	Toilet	SF	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	0
65	Bathroom Direct Install	Toilet	MF	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	53
66	Irrigation System Flow Sensor Rebate	Controller	SF	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	5
67	Irrigation System Flow Sensor Rebate	Controller	MF	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	5
68	SFR Medium Cistern (501-999 gal) Rebate	Barrel	SF	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	150
69	SFR Large Cistern (1000+ gal) Rebate	Barrel	SF	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	132
70	CII Ozone Laundry Washer Rebate	Washer	CII	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	55
71	CII Commercial Kitchen Dishwasher Rebate	Dishwasher	CII	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	0
72	CII Commercial Kitchen Spray Rinse Valve Rebate	Spray Valve	CII	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	10

ID	Program Name	Units	Class	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	Total
73	CII Commercial Kitchen Food Steamer Rebate	Food Steamer	CII	1	1	1	1	1	3	1	1	1	1	3	1	1	1	1	3	1	1	1	1	3	1	1	1	1	3	40
74	CII Restaurant Dipper Well Rebate	Dipper Well	CII	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	0
75	CII Large Landscape Water Budget	Site	Irr.	57	58	58	58	59	59	60	60	60	61	61	62	62	62	20	20	20	20	20	20	20	20	20	20	20	20	1,079
76	Acoustic Hydrant Cap	Hydrant Cap	CII	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	0
Regional Total				8,090	7,630	7,758	7,970	8,136	8,381	8,453	8,458	8,478	8,512	8,498	8,499	8,534	8,543	8,525	8,566	8,573	9,945	8,642	8,657	8,693	8,683	8,683	8,683	8,683	8,693	220,966
Regional Total, Single-Family				7,258	6,779	6,887	7,007	7,111	7,220	7,283	7,288	7,298	7,315	7,296	7,297	7,314	7,321	7,334	7,349	7,357	8,716	7,392	7,402	7,420	7,419	7,419	7,419	7,419	7,420	190,740
Regional Total, Multi-Family				272	281	283	306	309	311	297	295	297	303	301	303	309	308	310	316	320	323	329	329	332	332	332	332	332	332	8,092
Regional Total, CII Common Meter				80	71	71	76	72	74	56	52	53	57	50	49	52	48	48	54	49	50	54	50	49	47	47	47	47	49	1,452
Regional Total, Irrigation				480	499	517	581	644	776	817	823	830	838	851	851	858	866	832	847	848	856	868	876	892	885	885	885	885	892	20,682

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Bay Area Water Supply & Conservation Agency

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