



DRAFT Technical Memorandum

Date: April 19, 2021

To: Dirk Marks and Rick Vasilopoulos, Santa Clarita Valley Water Agency

From: Lisa Maddaus, Maddaus Water Management Inc.
Anil Bamezai, Western Policy Research

Title: **DRAFT 2021 SCV Demand Study: Land-Use-Based Demand Forecast Analysis**

1. INTRODUCTION

This Demand Study (Study) provides projected demands for the area served by Santa Clarita Valley Water Agency (SCV Water). The purpose of this Technical Memorandum (TM) is to document and present the demand projections for the Santa Clarita Valley, which include the following:

1. Demand projection methodologies
2. Data inputs used in the analysis
3. Demand analysis results including updated Santa Clarita Valley demand projections through buildout (2050)
4. Climate change factors based on similar assumptions used in the Groundwater Sustainability Plan (GSP)
5. Demand analysis results including passive savings¹ and current active conservation program implementation savings² through buildout.

2. BACKGROUND

Since the last demand forecast was prepared and finalized in the March 2016 Demand Study,³ Santa Clarita Valley Water Agency was created on January 1, 2018 by an act of the State Legislature (SB 634) through the merger of several public water agencies in the Santa Clarita Valley. The merger included Castaic Lake Water Agency (CLWA) and three of its four previous water retailers: Santa Clarita Water Division (SCWD), Newhall County Water District (NCWD) and the Valencia Water Company (VWC). The CLWA was originally formed as a wholesale water agency to acquire, treat, and deliver State Water Project water supply throughout the Santa Clarita Valley. SCV Water also provides wholesale water to Los Angeles County Waterworks District #36 (LACWD) Val Verde System. There has been a long history of detailed analyses of water demand and conservation

¹ Passive savings are water use savings due to plumbing codes.

² Active savings are water use savings due to SCV Water's Water Use Efficiency Program activities.

³ CLWA (now SCV Water) Updated Final Technical Memorandum #2 – SCV Demand Study Update: Land-Use Based Demand Forecast Analysis, dated March 3, 2016.

programs in the former CLWA, performed for each of the retailer water agency service areas. This demand analysis served as the basis for the now merged SCV Water service area and sales to LACWD.

This study was commissioned by SCV Water and conducted by Maddaus Water Management, Inc. (MWM) and Western Policy Research (WPR). Several past planning efforts were leveraged for the execution of this analysis. As a result, some past modeling efforts and documentation refer to the former agency naming conventions and, in this document, former “service areas” are now referenced as “Service Divisions.”

This TM is provided to support the 2020 Urban Water Management Plan (UWMP). This TM is necessary to document revised and refined information since the 2015 UWMP, which required an update due to new information on future demand forecast. The most notable changes are the parameters for the West Side Communities Development Project (formerly called Newhall Ranch). The analysis contains the best information currently available related to historical water demands and planned future new development of the updated 2020 UWMP in compliance with the California Water Code associated with the Urban Water Management Planning Act to be completed and submitted to the Department of Water Resources (DWR) by July 1, 2021.

This TM presents the demand forecast for the SCV Water service area since the merger and accounts for its future growth. It is confined to the existing SCV Water’s three Water Divisions service areas, LACWD, and the anticipated annexations into SCV Water. The summary information in this TM is provided for SCV Water; Appendix A and Appendix B present more details specific to future growth for SCV Water and LACWD, respectively.

All planned developments are consistent with the One Valley One Vision (OVOV)) General Plan.⁴ There is some development in the regional OVOV plan that is outside these areas, and where appropriate some future, potential development has been included in these demand projections. The forecasts in this TM are based on planned detailed land use development in compilation with OVOV year 2050 buildout for the purposes of estimating water demand projections. A description of how the demand forecast incorporated information from the OVOV General Plan is presented in Appendix A.

Overall, a higher population projection is now associated with the land-use-based forecasts than the historical estimated projection reported in the 2015 UWMP. The updated 2050 valleywide buildout estimated total population is approximately 432,200, using current developed and undeveloped parcels in the existing SCV Water service area, LACWD, and proposed future annexations into the SCV Water service area. This includes unassigned dwelling units that are not associated with any planned development within the City of Santa Clarita and Los Angeles County. For comparison purposes, the projected demands and population that were reported in SCV’s 2015 UWMP can be found in Appendix C.

3. DEMAND METHODOLOGY

This section presents the demand methodology used in this analysis. This demand analysis incorporates both potable and non-potable water demands while accounting for drought rebound, a partial continuation of work-at-home trends resulting from the current COVID-19 pandemic, the addition of accessory dwelling units not

⁴ More information is available online: [One Valley One Vision – Economic Development Division \(santa-clarita.com\)](https://www.santa-clarita.com/One-Valley-One-Vision-Economic-Development-Division). Reference details published in the OVOV General Plan.

previously planned for, climate change, and potential irrigation practice and device inefficiencies if development policies and/or enforcement protocols are not adopted by the appropriate agencies.

3.1 Summary of Approach

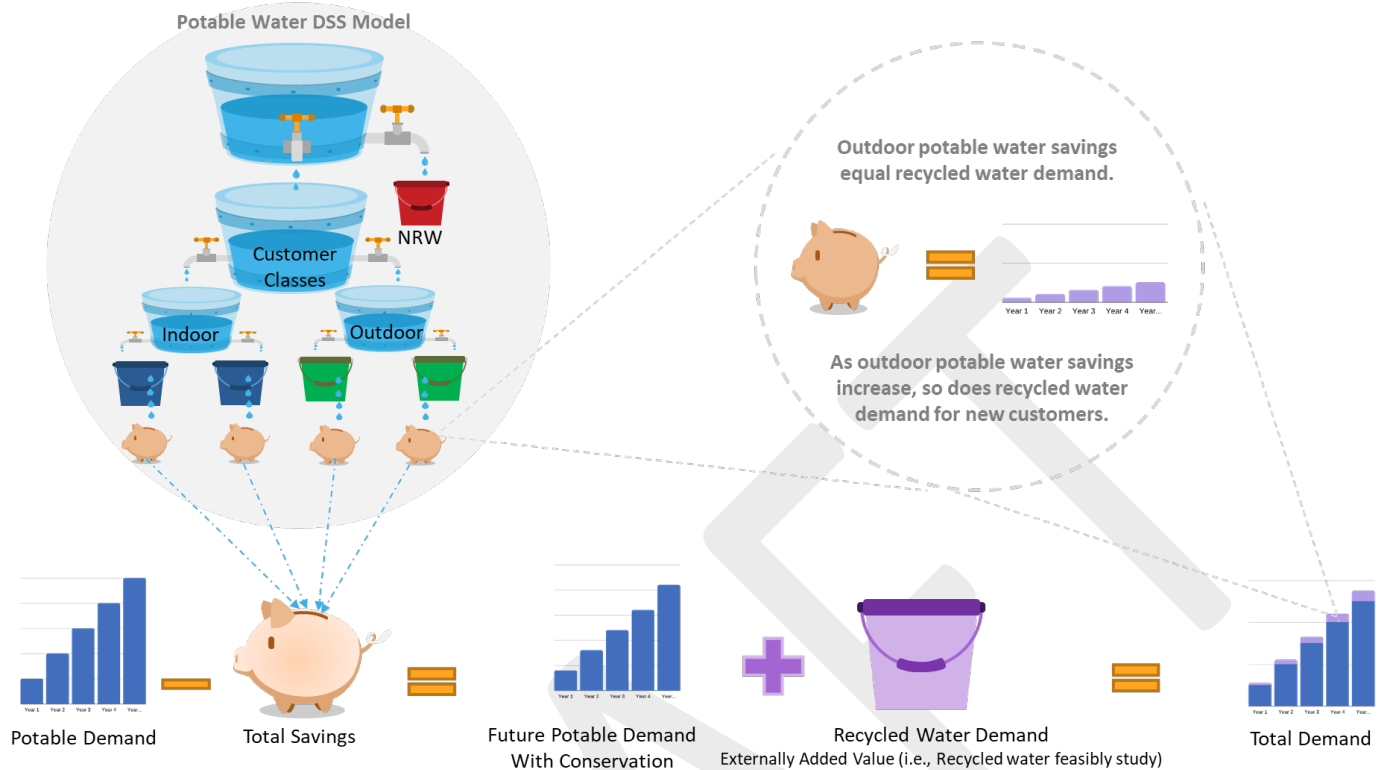
The valleywide demand forecast is a compilation of the following demands as presented in Figures 1 and 2:

1. **SCV Water:** A potable demand forecast determined from land-use-based estimates from 2020 through 2050 (buildout) for SCV Water's three Water Divisions: Newhall Water Division (NWD), Santa Clarita Water Division (SCWD), and Valencia Water Division (VWD). The land-use-based estimates were determined in a land use analysis that compiled data from planned development contracts and the OVOV General Plan.
2. **Los Angeles County Water District 36:** A population-based approach for potable demands using OVOV-based population estimates.
3. **Non-Potable Water:** Demand based on volume and schedule for non-potable use provided by SCV Water.

The potable demand projections for SCV Water and LACWD were developed using the Least Cost Planning Decision Support System Model (DSS Model) and incorporate econometric-based adjustments to better develop an accurate forecast through the year 2050. These adjustments include accounting for climate change, drought rebound, weather normalization, COVID-19 pandemic-prompted work-at-home trends, and overwatering/irrigation equipment efficiency degradation. A more detailed description of the adjustments can be found in Section 3.2.5, more details on the econometric modeling framework are in Appendix D, and climate change adjustment is presented in Appendix E.

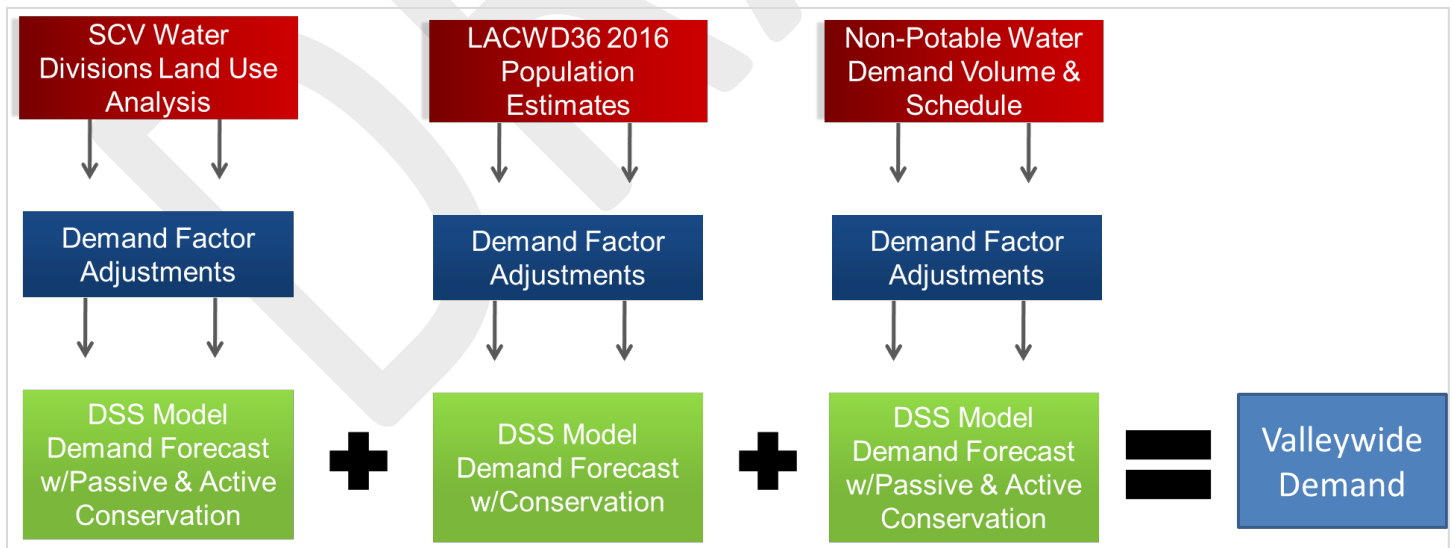
An overview of Figure 1 presents how potable and non-potable demands are accounted for in this analysis. In general, the DSS Model accounts for existing and future potable water consumption by water customers and estimated passive and active water conservation savings. For the non-potable supplies, a simplified estimate was developed building on the existing approximately 450 AF demands. It is estimated that future recycled irrigation demands will be generated from and provided to future developments, including West Side communities. An overall estimate was built between DSS Model potable demands with reductions due to conservation savings then added to the recycled water demands to generate an overall demand forecast for the SCV Water service area.

Figure 1. Accounting for Benefits of Conservation and Recycled Water



Numerous processes were undertaken to build up the estimates using a robust land-use-based analysis as the baseline for both existing customers and new development water demands. The following sections describe the processes in detail. Figure 2 provides an overview of the development of the demand forecast for the overall valleywide demand to be served by SCV Water.

Figure 2. Valleywide Demand Forecast Modeling Approach Flow Diagram

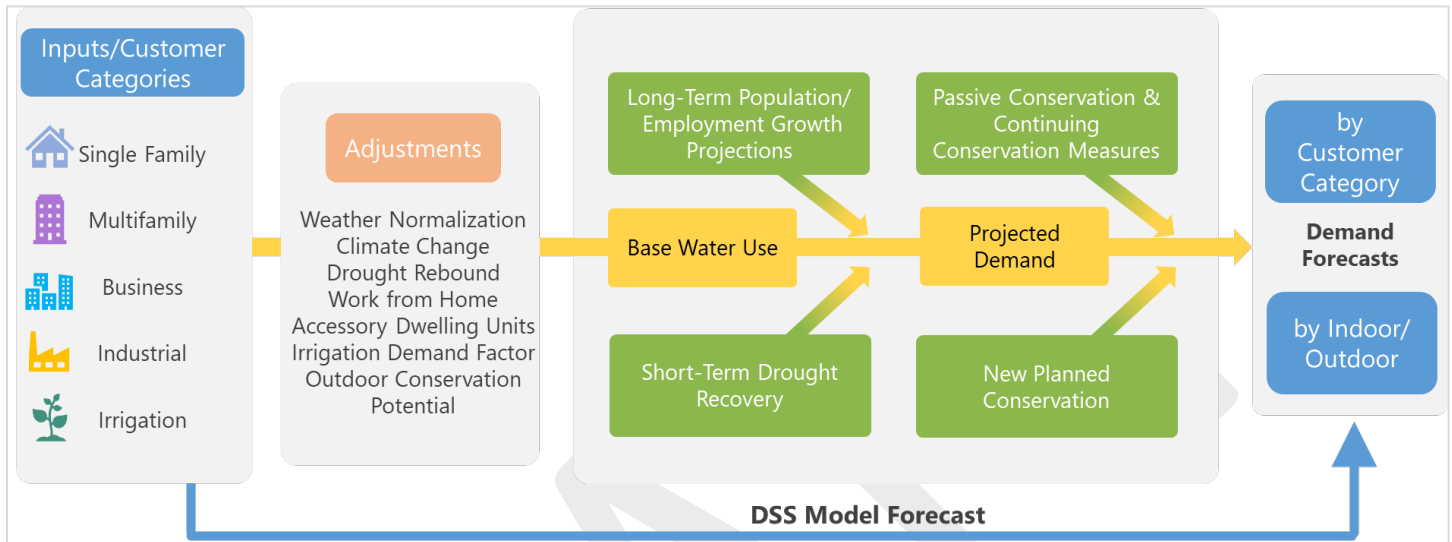


3.1.1 DSS Model Overview

The DSS Model prepares long-range water demand and conservation water savings projections. The model is an end-use model that breaks down total water production (i.e., water demand in the service area) into specific

water end uses (e.g., toilets, faucets, irrigation). This “bottom-up” approach allows for detailed criteria to be considered when estimating future demands, such as the effects of natural fixture replacement, plumbing codes, and conservation efforts. The purpose of using the end-use data is to enable a more accurate assessment of the impact of water efficiency programs on demand and to provide a rigorous and defensible modeling approach necessary for projects subject to regulatory or environmental review.

Figure 3. Potable DSS Model Flow Diagram



As shown in Figure 3, the first step taken in this analysis for forecasting water demands using the DSS Model was to gather customer category billing data. The next step was to calibrate the model by comparing water use data with available demographic data to characterize water usage for each customer category (single family, multifamily, commercial, industrial and institutional) in terms of number of users per account and per capita water use. During the model calibration process, data were further analyzed to approximate the indoor/outdoor split by customer category. The indoor/outdoor water usage was further divided into typical end uses for each customer category. Published data on average per capita indoor water use and average per capita end use were combined with the number of water users to calibrate the volume of water allocated to specific end uses in each customer category. In other words, the DSS Model reflects local trends and social norms from end-use studies on water use behavior (e.g., for flushes per person per day). Additional description and background of the DSS Model and modeling approach is provided in Appendix F and Appendix J.

3.1.2 DSS Model Development

For the 2020 UWMP update, two DSS Models were produced: (1) a combined DSS Model for the Santa Clarita Valley based on SCV Water’s three Water Divisions and (2) an updated DSS Model for LACWD. These DSS Models incorporated historical data for the respective service areas to establish a historic water balance at a monthly resolution. Data analyzed include historical system production between 1995 and 2020,⁵ water rates, weather (rainfall and reference evapotranspiration [ET_o]), population, unemployment rate, and other data as approved and verified by SCV Water. From this historic baseline, the DSS Model forecasts future water demand. The forecast reflects how future service area water use characteristics may differ from the historical patterns, at an annual resolution, including indoor and outdoor water use for each customer category.

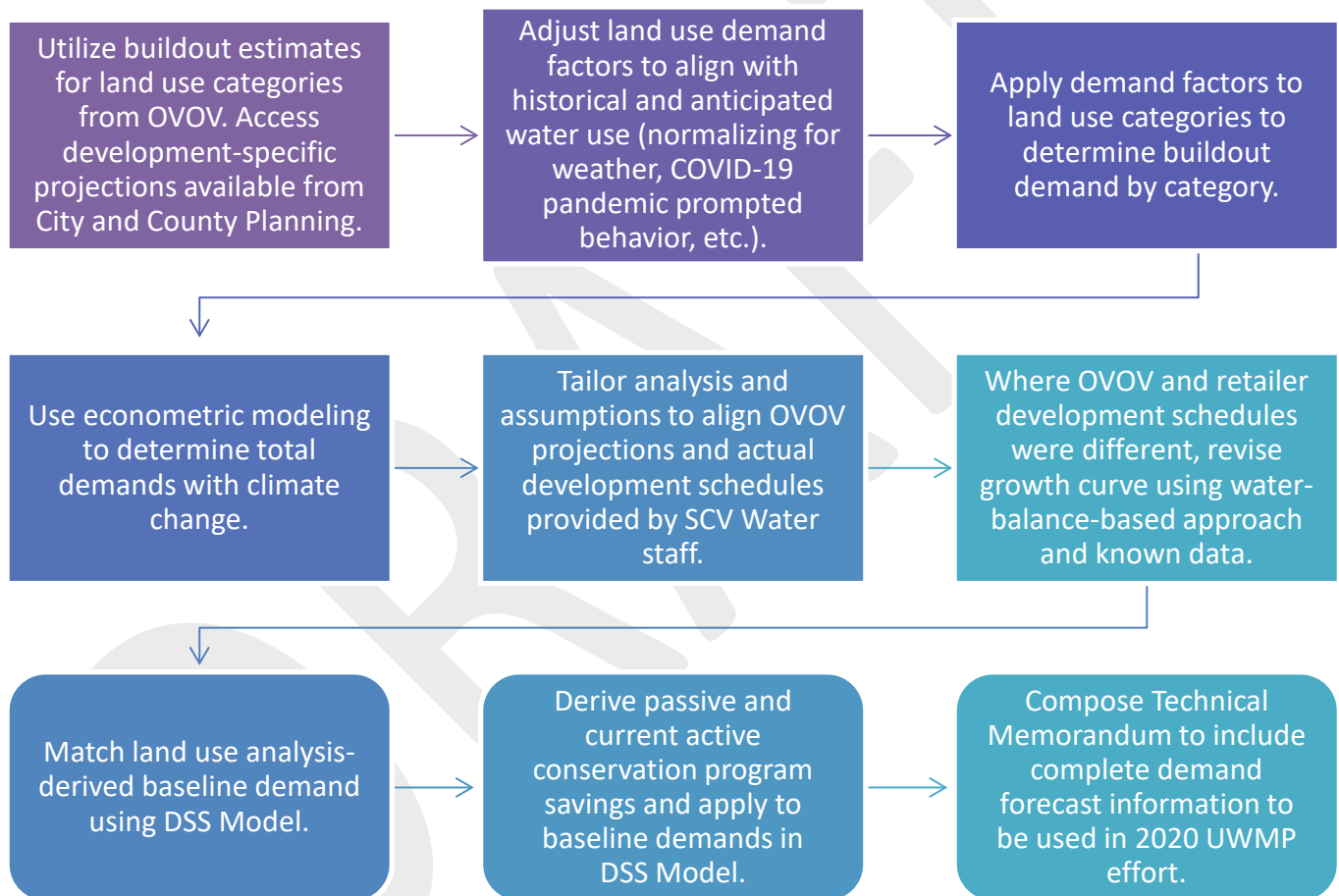
⁵ If a Water Division or retailer was unable to provide complete data going back to 1995, a shorter window was used.

In both DSS Models, estimates of savings from plumbing codes were evaluated. In the SCV Water three Water Divisions DSS Model, current active conservation measures also were analyzed, and savings incorporated. Information about the basis of passive conservation savings can be found in Appendix F. Quantification of savings from SCV Water’s current active conservation program is presented in Appendix G.

3.2 Preparation of Detailed Land-Use-Based Demand Forecast

This section presents the methods used to prepare the SCV Water land use forecast. As introduced previously, the land use analysis conducted for the SCV Water supported the development of land-use-based estimates for input into the DSS Model. Figure 4 illustrates the flow of work and basic steps taken to develop the land-use-based demand forecast.

Figure 4. Flow Chart of Steps for Land-Use-Based Demand Projections



3.2.1 SCV Water Land Use Analysis Methodology

The overall summary basis for this land use analysis was to build future demand forecasts using a “bottom-up” approach for land-use-based anticipated land development. A more detailed description is provided in Appendix A. In general, the approach leveraged the following information:

- Estimated dwelling units provided by City of Santa Clarita and Los Angeles County Planning Department staff. This information was based on the [Santa Clarita Valley Area Plan Update | DRP \(lacounty.gov\)](#) and the OVOV General Plan.

- Land-use-based GIS map shape files provided by the City of Santa Clarita and Los Angeles County planners for determining the appropriate number of dwelling units and non-residential building area:
 - 2012 Traffic Analysis Zone (TAZ) transportation modeling parameters used in the March 2016 land-use-based analysis
 - Buildout (2050) used in the OVOV General Plan and the March 2016 land-use-based analysis
- Queries from GIS maps to determine dwelling units were multiplied by persons per household from the U.S. Census modified for the developments depending on their Water Division customer service area.
 - Information informed the June 2014 Population Assessment and, with no census data available since 2010, was used to inform the existing population basis
- Monthly billing data by customer category (single family, multifamily, non-residential, and non-potable)
- Climate adjustment factors for normalizing demands
- Future demand factors

3.2.2 Summary of Information Provided

This section presents a summary of the information provided from the previous 2016 effort by City of Santa Clarita and Los Angeles County planners and by SCV Water service area new development contractors.

For the nine adjoining communities that collectively comprise the West Side communities in the Santa Clarita Valley in the Valencia Water Division, this land-use-based analysis used information reported in the Draft Technical Memorandum prepared by GSI Water Solutions, Inc. (GSI) in August 2020 (GSI, 2020). Owned by Five Point Holdings, LLC, this Five Point Project includes five villages comprising the master planned West Side communities (formerly Newhall Ranch). The five villages are Landmark Village, Mission Village, Homestead Village South, Homestead Village North, and Potrero Village. The Five Point Project will also include three other future communities: Legacy Village, Entrada Village South, and Entrada Village North, as well as buildout of an ongoing development (Valencia Commerce Center). The Five Point Project Draft Technical Memorandum by GSI (2020 GSI Draft TM) provided the basis for the potable and non-potable demands used in the land-use-based analysis including dwelling unit counts, people per household, non-residential building area, dedicated irrigation acreage, and demand factors.

Since the SCV Water merger and 2016 effort, there were nominal boundary changes for SCV Water's three Water Divisions; therefore, the 2016 Demand Study's determination of the portion of the land use residing in which TAZ was still applicable. The land area located in each Water Division's service area was based on buildout estimates for land use types determined using the GIS TAZ. The historical land use assessment was conducted using land use data by TAZ for year 2012. TAZ data for 2004 and 2012 was ground-truthed in the previous March 2016 land use analysis effort when a water balance was derived to confirm TAZ and water use categories. Additionally, the 2014 SCV Population Assessment provided 2010 census-based baseline estimates for residential dwelling units land use types.

Los Angeles County Department of Regional Planning's online Specific Plan documentation provided information about each new development project in the county including the number of residential units and non-residential square footage. Schedules for each county development project were provided by the County Planning Department and/or SCV Water staff. The City of Santa Clarita Planning Department provided an extensive inventory of approved and pending development with estimated construction time frames for over 90 projects. City planning provided the number of units for Single Family (SF), Multifamily (MF), and Detached Condos, as well as square footage by Retail, Office, Industrial and Other.

Historical and projected residential land use was based on existing dwelling units (DUs) and added DUs by land use type as provided by City Planning, County Planning and/or SCV Water staff, or if not provided, OVOV

estimates. Historical and projected non-residential land use was based on growth provided by City Planning, County Planning and/or SCV Water staff, or if not provided, OVOV estimates. Accessory dwelling units (ADU) on SF properties were added to the development profile as an additional development feature to the OVOV buildout unit numbers at the direction of SCV Water staff based on a recent increase in permit applications for this kind of use. A summary of residential dwelling units, including existing and new development units, is presented in Table 1.

Table 1. Summary of Residential Land Use Type Dwelling Units

Land Use Type	Dwelling Units ¹		
	2030	2035	Buildout ²
Single Family	55,000	60,200	67,400
Multifamily	45,300	51,200	55,200
ADU	2,200	3,200	6,200

¹ Values are rounded to the nearest 100 units.

² Buildout values for Single Family and Multifamily units are based on OVOV General Plan parameters for the service area.

3.2.3 Development of the Population Projection

Future population projections were based on future land use projections that were determined from the OVOV buildout estimates in year 2050 and the interim planned development schedules. Projections were incorporated into the SCV Water Three Water Divisions DSS Model. Historical population from 1994 through 2010 was validated through the Population Assessment project in spring 2014 using 2010 census data. The population was then extended from 2010 through 2013 in the 2016 Demand Study and from 2013-2020 in this current effort based on new account data using the same assumptions developed for the Population Assessment Project.

The land-use-based population projections were founded on dwelling unit projection estimates from specific City of Santa Clarita and Los Angeles County development plans and the total remaining OVOV-based buildout projection. The people per household (PPH) estimates determined for each development and residential land use type varied depending on available data and the development's location. Estimated people per household factors were then applied to dwelling units according to land use type to calculate population.

3.2.4 Development of Baseline Water Demand Factors

Existing residential demand water use factors, and new and existing non-residential demand factors (commercial, industrial, institutional, and other) were based on adjusted 2018 and 2019 outdoor water use and 2017 indoor water use. Historical monthly billing data was reviewed and leveraged to determine that 2018 and 2019 represented the most normal recent year water use profile. For purposes of this analysis, recent non-drought, non-wet year 2017 was established as the base year for indoor water use to be consistent with the recent 2016 Santa Clarita Valley Water Agency Indoor Water Use Estimates technical analysis.⁶

⁶ Technical Memorandum – Santa Clarita Valley Water Agency Indoor Water Use Estimates, dated September 26, 2019.

New residential demand factors were based on 50 indoor gallons per capita per day (GPCD) and align outdoor use with California's Model Water Efficiency Landscape Ordinance⁷. The basis for new development outdoor water use factors are presented in Appendix H. MWM & WPR based the potential outdoor demand for the region on an annual normal ETo of 66.7 inches. In summary, even though the 2015 MWELO specifies an ETo value of 61.5 inches for Santa Clarita, an ETo of 66.7 inches per year was the 10-year average observed at a monitoring station located at SCV Water's Rio Vista water treatment plant. Using the observed ETo value provided a conservative (high) estimate of potential outdoor water demands. These outdoor factors were applied to both potable and non-potable new development residential and non-residential irrigated areas. New residential outdoor demand factors were applied to an estimated residential outdoor irrigated area by residential land use type.

3.2.5 Development of the Water Demand Adjustment Factors

Given that the baseline demand factors were developed using historical consumption data, a review of SCV Water's future community water use necessitated some adjustments to better align with how land use development is planned. As a result, demand factor adjustments addressed the need to account for weather normalization, drought rebound, and COVID-19 pandemic-prompted work-at-home trends. More information about this part of the analysis can be found in Appendix A. The adjustment factors apply to both existing residential use and all non-residential use. The assumptions associated with each factor are described below and presented in Figure 5 and Table 2.

Climate Change: The 2050 customer category demands were increased by 3.77% to capture the effect of climate change. This bump was feathered in linearly starting with a zero increase initially and rising to 3.77% in 2050. More information on the basis of this increase can be found in Appendix E. This climate change increase was not applied to the non-revenue water (NRW) volume directly; however, since NRW was calculated as a percent of production, NRW subsequently increased as well.

Weather Normalization: 2018 and 2019 demands were adjusted to account for 2018 being slightly warmer than normal and 2019 being significantly cooler than normal. More information on the basis of this adjustment can be found in Appendix D.

Drought Rebound: It was estimated that a total drought rebound of 9% occurred by 2019 as compared to year 2015 pre-drought water use. This analysis assumed an additional 2% rebound (increase) in water use on top of the weather normalized average 2018 and 2019 outdoor water use and 2017 indoor water use. This adjustment applied to the water use basis of existing residential and all non-residential accounts. More information on the basis of this adjustment can be found in Appendix D.

Work-at-Home: This analysis assumed a 1% increase in water use due to the continuation of SF and MF population working at home beginning in the COVID-19 pandemic. This adjustment was in addition to the drought rebound and weather normalized adjustments previously presented. This modification applied to existing residential accounts only. The 1% value was a preliminary estimate that SCV Water anticipates adjusting as post-pandemic data becomes available.

Accessory Dwelling Units: Accessory dwelling units were added to the development profile as an additional development feature to the OVOV buildout unit numbers. The city received 80 permit applications for these in 2020. This analysis assumed the number of permit applications for ADUs may more than double to approximately 200 per year through buildout. ADUs were assumed to add approximately 1 person per ADU as

⁷ [Model Water Efficient Landscape Ordinance](#)

well as indoor water use only at 50 GPCD. ADU outdoor demand was assumed to be part of the single family account in which the ADU resides.

Irrigation Demand Factor: This analysis derived an irrigation demand factor for each land use type based on the SCV Water Residential and Non-Residential Outdoor Water Use Study (Outdoor Water Use Study). The irrigation demand factor accounts for baseline irrigation use estimated by land use types for landscaped areas for future customers based on the Model Water Efficient Landscape Ordinance requirements. More details on this can be found in the Outdoor Water Use Study in Appendix H.

Outdoor Conservation Potential/Overwatering Factor: This overwatering factor adjusted the previously presented irrigation demand factor to account for outside water uses beyond irrigation. Using the output from the Outdoor Water Use Study, this factor took into account outside water uses like car washing, in addition to potential overwatering due to irrigation inefficiencies and irrigation device degradation. These landscape inefficiencies and device disrepair have been proven to occur if developers do not design, operate, and install landscapes to standards that account for efficiency losses through time. This overwatering factor was applied to both potable and non-potable new development residential and non-residential irrigated areas and offers additional potential water conservation opportunities. This outdoor overwatering factor was partially derived from the difference between the MWELO/MAWA design standard and what the Outdoor Water Use Study found was actually being applied.

Figure 5. Water Demand Adjustment Factors

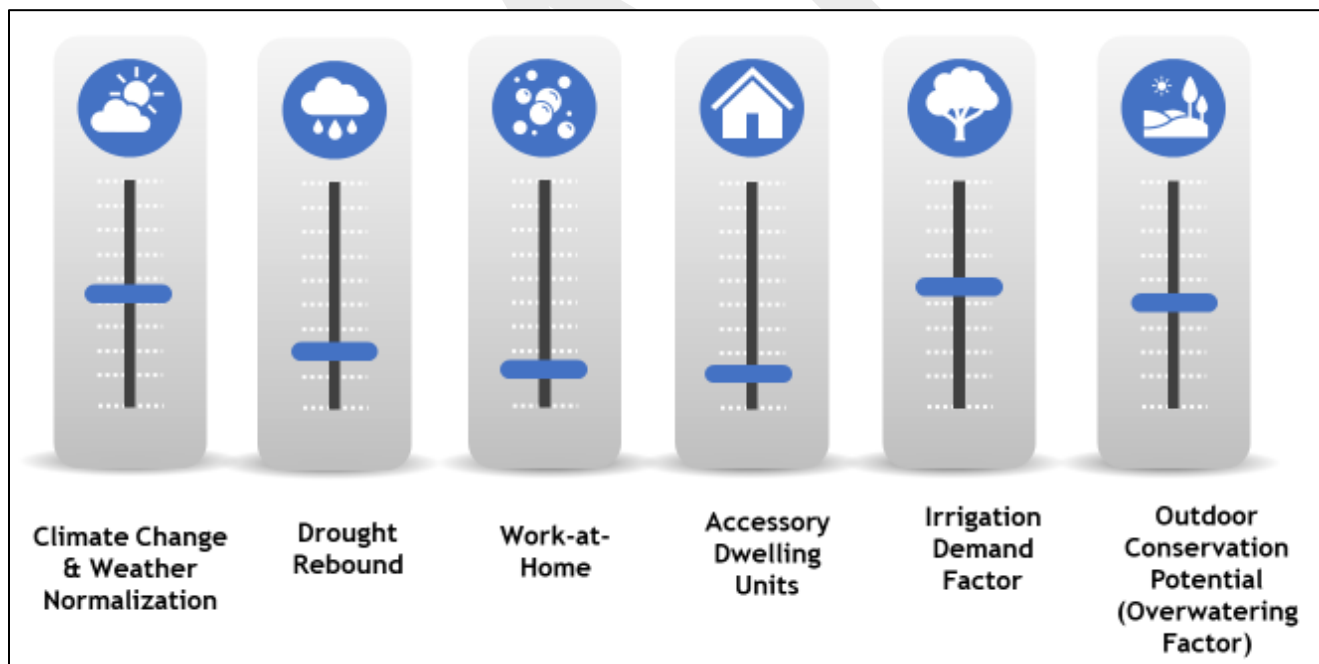


Table 2. Demand Factor Adjustment Values

Adjustment Factors	Value	
	2018	2019
Weather Normalization	-0.78%	5.21%
Adjustment Factors	Value	
Climate Change	3.77%	Percent
Drought Rebound	2.0%	Percent
Work-at-Home	1.0%	Percent
Accessory Dwelling Units	1	People per household
	50	Indoor GPCD
Residential Overwatering Factor	26.5%	Percent
Non-Residential Overwatering Factor	25.6%	Percent

3.2.6 SCV Water Demand Forecast Methodology

New residential indoor demands were derived by applying the 50 GPCD to the annual cumulative population of various residential land use types. New residential outdoor demand factors were applied to an estimated residential outdoor irrigated area by residential land use type. New irrigation account demand was derived by applying the adjusted outdoor demand factor to the derived and compiled residential HOA common area and developed park acreages.

Non-residential demand projections for commercial, industrial, institutional, and other customer categories were based on the adjusted 2018 and 2019 demand factors previously presented, starting with existing category accounts growing annually as each customer category's compiled land use units grow. As explained previously, non-residential land use type units (in thousand square feet of developed land use) were compiled into commercial, industrial, institutional, and other categories for all new development (including the OVOV balance) annually.

West Side communities' projected residential and non-residential total indoor and outdoor potable and non-potable demand was provided in the 2020 GSI Draft TM. The West Side communities estimated development schedule was provided by SCV Water staff. Annual potable demands were tracked for indoor single family, outdoor single family, indoor multifamily, outdoor multifamily, commercial, institutional, industrial, other and irrigation. An additional potable irrigation demand due to potential overwatering from Five Point Project was calculated and included in the total potable irrigation demand; potential irrigation equipment and device deterioration is not currently included in Five Point Project demand estimates per the 2020 GSI Draft TM. The basis for the overwatering factor is presented in Appendix H.

Existing account's potable water use conversion to non-potable supply volume was considered for offsetting projected potable demand for commercial, institutional and irrigation accounts (there are no industrial non-potable accounts). Existing account conversion volume magnitudes were consistent with the 2016 Recycled

Water Master Plan⁸ and confirmed by SCV Water staff. SCV Water staff also provided a revised potable to non-potable conversion schedule for these existing accounts. Potable demand was compiled for the following customer categories: Existing SF, Existing MF, New SF Indoor, New SF Outdoor, New MF Indoor, New MF Outdoor, Commercial, Industrial, Institutional, Other, and Irrigation. This demand does not include those existing accounts' water use that is specifically planned to be served by non-potable.

NRW was estimated to be 8.8% of total production as directed by SCV staff and based on the per weighted average of the three Water Divisions' 2019 and 2020 NRW. Estimated savings from passive conservation (plumbing codes) and SCV Water's current active conservation measures were calculated and applied in the DSS Model.

Los Angeles County Water District 36 did not have detailed enough information (such as specific billing data by lot type) to derive land-use-based demand factors and therefore developed a population-based demand forecast. Future population and demand projections based on OVOV buildout estimates in year 2050 can be found in Appendix B for the LACWD DSS Model.

3.3 Non-Potable Demand Methodology

Existing potable account conversion volume magnitudes reported in the 2016 Recycled Water Master Plan were confirmed by SCV staff and referenced as the volume basis for the development of a non-potable projection. SCV staff provided a revised potable to non-potable conversion schedule for existing accounts including the 2016 Recycled Master Plan phased schedule. Raw water account use conversion to non-potable use volume and schedule was also confirmed by SCV staff.

By 2050 customer category demands were increased by 3.77% to capture the effect of climate change. This bump was feathered in linearly starting with a zero increase and rising to 3.77% in 2050. More information on the basis of this increase can be found in Appendix A.

No NRW was accounted for in the non-potable demand estimate; this might warrant an additional 8-15%.

A table presenting a summary of SCV Water's projected non-potable demand by project or phase is provided in Appendix I.

4. RESULTS

This section presents the overall valleywide demand analysis results for the SCV Water three divisions and LACWD; results are presented for potable demands, non-potable demands and combined total demands. All demands include climate change.

4.1 Potable Demand Projections

The Econometric Model and DSS Model were used to generate water demand projections. As previously described, the Econometric Model generated baseline water demand adjustments that were applied to the baseline land-use-based demand projection for SCV Water's three Water Divisions. The DSS Model determined passive and active savings. Figure 7 presents a summary of potable demand projections through 2050 for the entire service area.

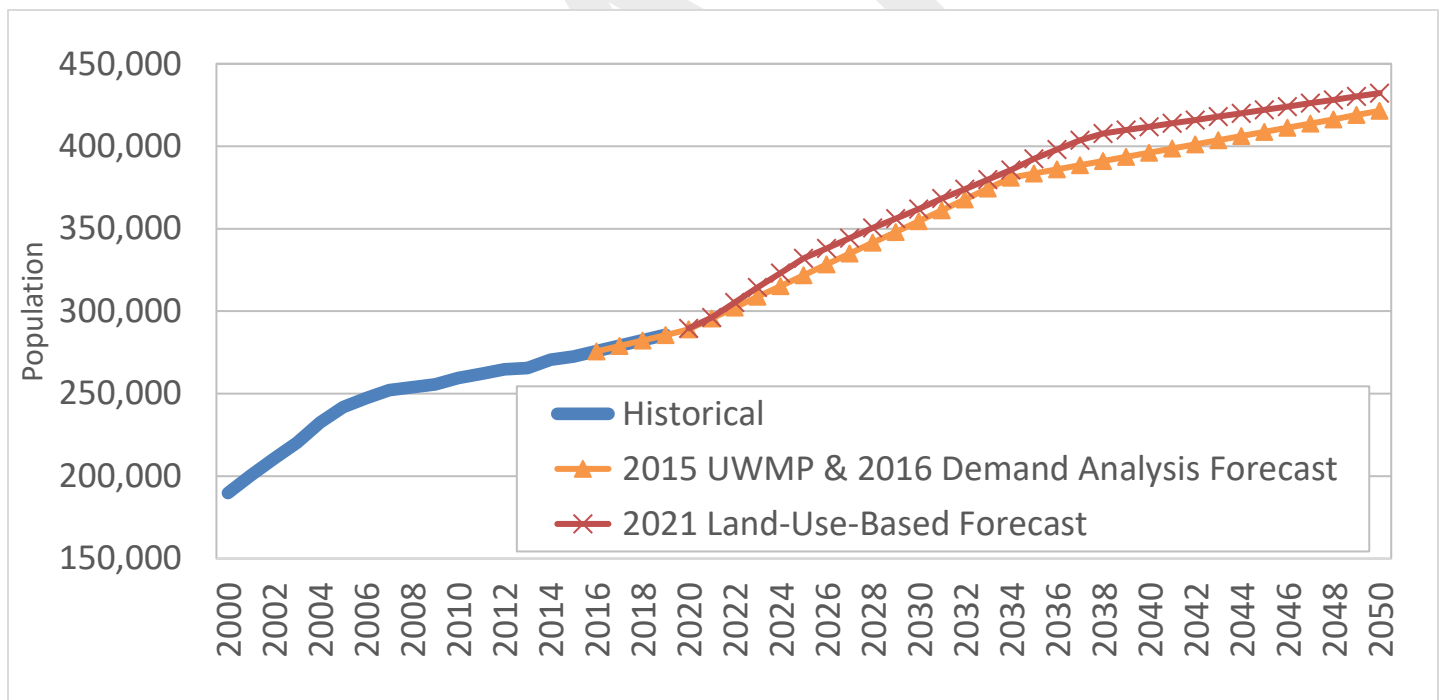
⁸ Castaic Lake Water Agency. (2016). *Recycled Water Master Plan – Final*.

Potable demand and population projections for SCV Water and LACWD can be found in tabular format in Appendix A and Appendix B, respectively, and include the following information:

- **Projected Population.** Population for LACWD specifically and for the combined SCV Water based on land use dwelling unit projections using buildout and PPH estimates.
- **Projected Total Demand with No Plumbing Code Savings.** Potable water demands in five-year increments that do not include the plumbing code.
- **Projected Total Demand with Plumbing Code & Standards Savings.** Potable water demands in five-year increments that includes the effect of plumbing codes.
- **Projected Total Demand with Current Active Conservation Program Including Plumbing Code & Standards Savings.** Potable water demands for SCV Water in five-year increments that includes the effect of projected active conservation program implementation and plumbing codes. A brief summary of active current conservation program measure design and water savings is presented in Appendix G. No active conservation savings are estimated for LACWD in this effort. SCV efforts that target LACWD's customers are included in the SCV active conservation program budget and savings.

The population forecasts are presented in Table 3 and Figure 6, along with the 2015 UWMP population. Appendix C also presents a comparison of the current estimated population and demand projections for LACWD and the SCV Water with the 2015 UWMP (and 2016 Demand Study) estimates.

Figure 6. Valleywide Population Forecast



Note: Population includes both LACWD and SCV Water's three Water Divisions.

Table 3. Valleywide Land-Use-Based Population and Potable Demand Projections

Demand Forecast	2020 ¹	2025	2030	2035	2040	2045	2050
Projected Population ²	289,600	332,100	362,100	392,500	411,900	422,100	432,200
2015 UWMP Population ^{2,5}	289,000	321,900	354,700	383,400	396,100	408,800	421,500
Estimated Total Potable Demand WITH Climate Change and NO Plumbing Code Savings (AFY) ^{2,3}	65,500	78,900	85,200	92,500	99,200	104,900	110,700
Estimated Total Potable Demand WITH Climate Change and Plumbing Code Savings (AFY) ^{2,3}		77,600	82,800	89,200	95,100	100,100	105,300
Estimated Total Potable Demand WITH Climate Change and Active Conservation and Plumbing Code Savings (AFY) ^{2,3,4}		71,900	75,200	80,300	84,400	88,000	91,300

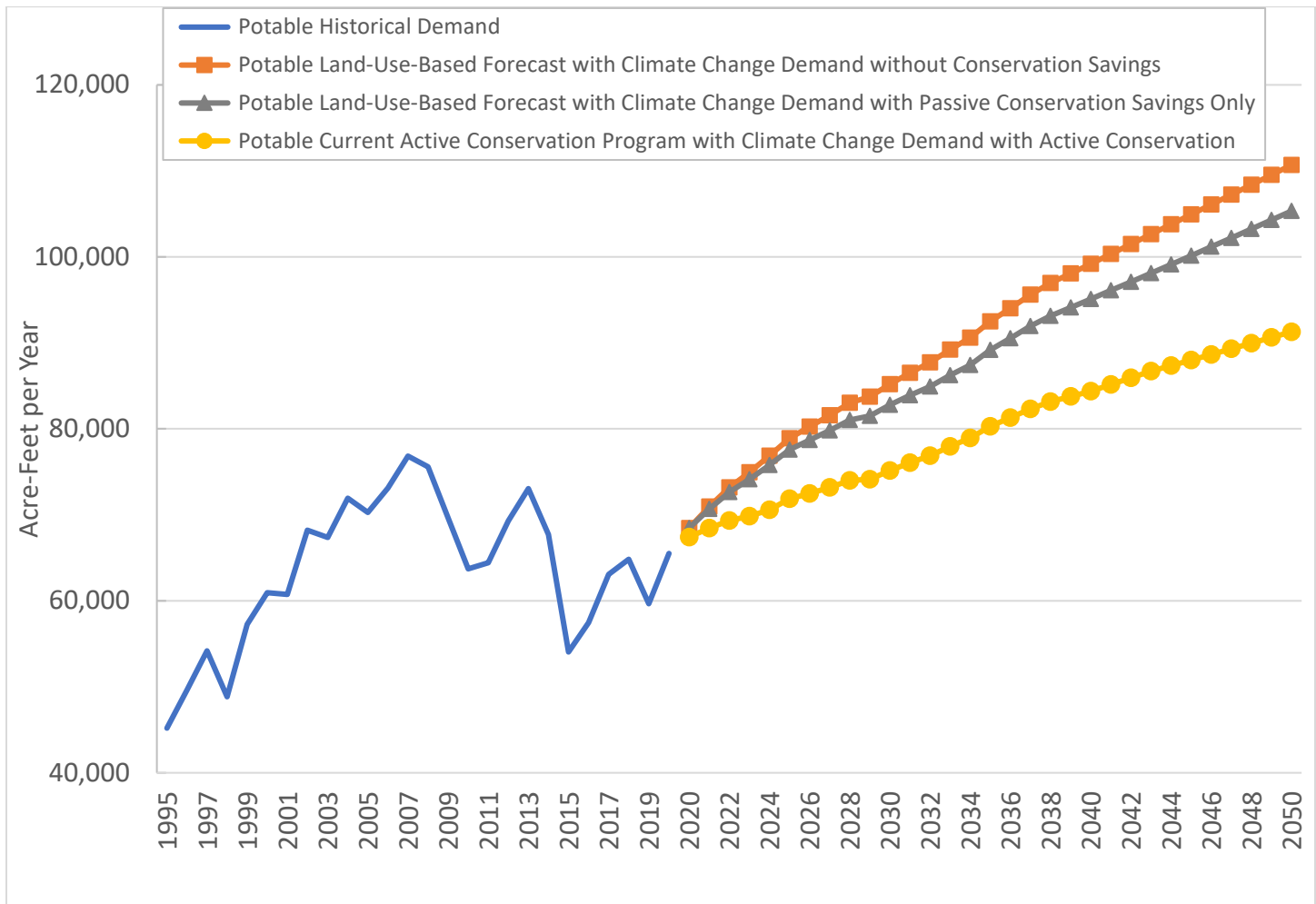
¹ Year 2020 values are actual estimated population and actual water demand for LACWD and SCV Water. No additional adjustment has been made to actual year 2020 demands to account for climate change, plumbing codes, or active conservation.

² Values have been rounded to the nearest 100.

³ Potable demands include climate change and do not include recycled water.

⁴ No active conservation savings are estimated for LACWD in this effort. SCV Water efforts that target LACWD's customers are included in the SCV Water active conservation program budget and savings.

⁵ The 2015 UWMP population forecast is provided for comparison purposes only. Population combines LACWD and SCV Water's three Water Divisions.

Figure 7. Valleywide Land-Use-Based Projected Potable Demands to 2050**Notes:**

1. No active conservation savings are estimated for LACWD in this effort. SCV Water efforts that target LACWD's customers are included in the SCV Water active conservation program budget and savings.
2. Demands include climate change and no recycled water.

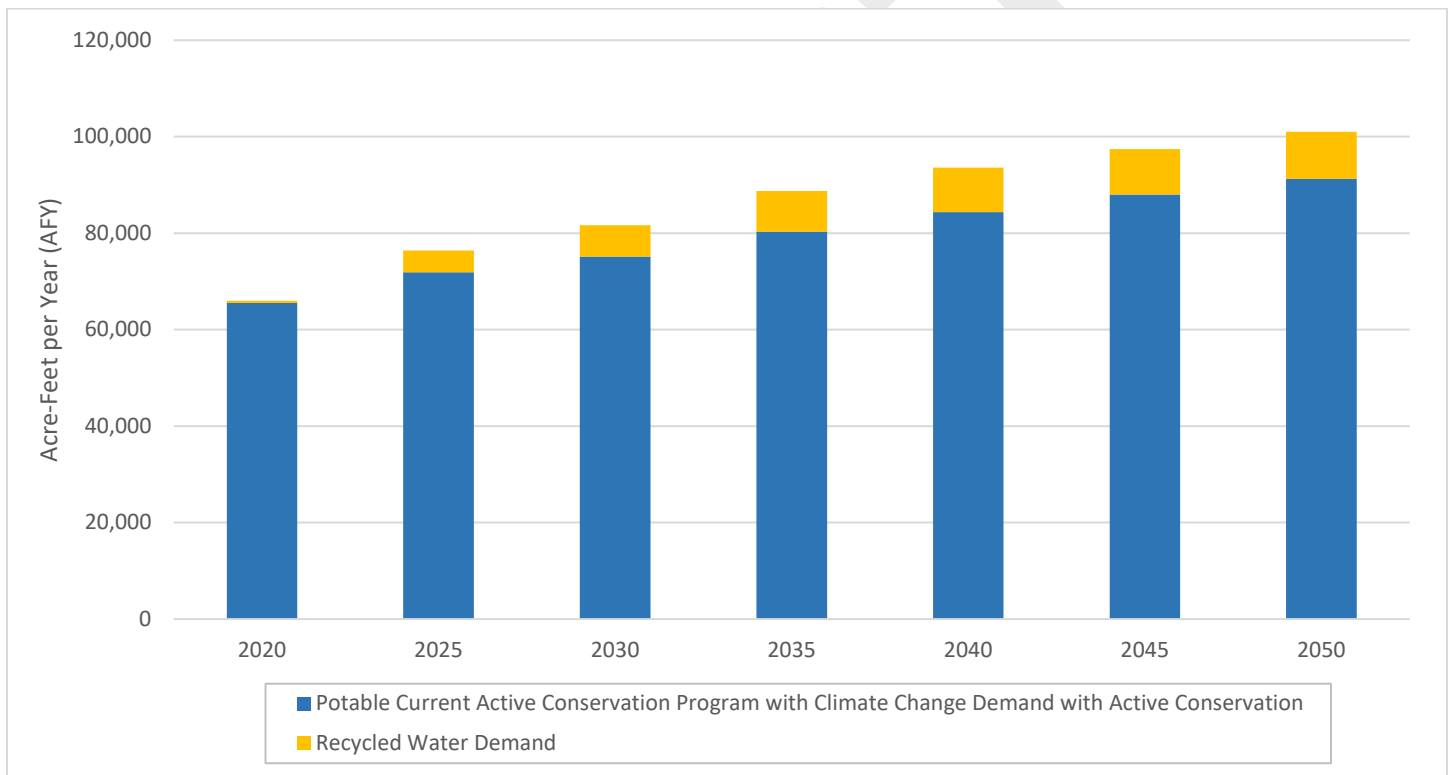
Potable demand projections for SCV Water and LACWD can be found in the graphs in Appendix A and Appendix B, respectively, and include the following curves:

- Actual Demand – This is historical demand as submitted to MWM from SCV Water.
- Estimated Demand – Assumes applicable demand adjustments: 1) 2018 & 2019 base year, 2) drought rebound, 3) COVID-19 pandemic-prompted work-at-home continuation/shift adjustment, 4) weather normalization, 5) overwatering factor (*SCV Water only*), 6) land-use-based analysis projections from available development and OVOV buildout information and PPH estimates determined from recent development data and in the 2014 Population Assessment (*SCV Water only*), 7) climate change considerations (3.77% increase by 2050), and 8) NO plumbing code or passive savings.
- Estimated Demand *with* Plumbing Code – Assumes applicable demand adjustments *WITH* plumbing code/passive savings as described in Appendix F.
- Estimated Demand *with* Current Active Conservation Program Implementation and Plumbing Code – Assumes applicable demand factor adjustments *WITH* plumbing code and a continuation of current active conservation program measure implementation as described in Appendix G.

4.2 Non-Potable Demand Projections

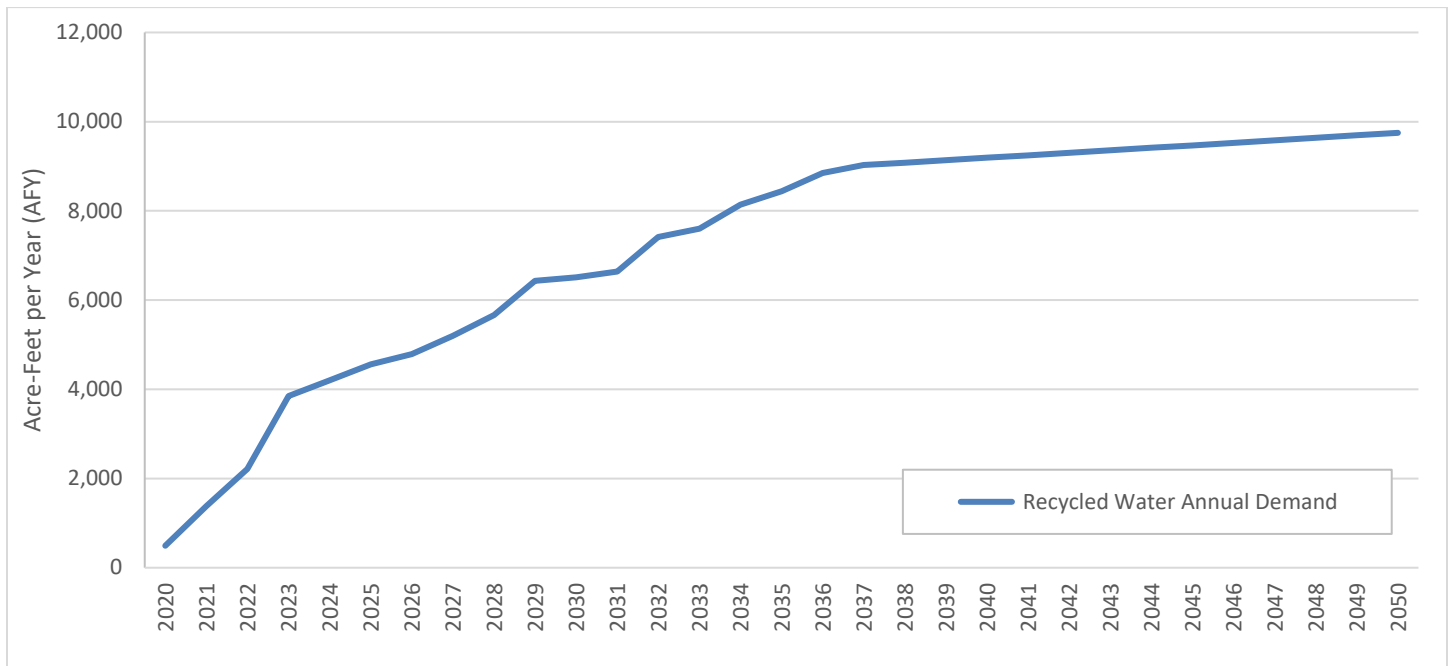
At approximately 450 AF currently, SCV Water’s recycled water demand is estimated to increase to 9,750 AF by buildout. This is based on existing potable account conversion volume magnitudes reported in the Draft 2016 Recycled Water Master Plan and confirmed by SCV Water staff. The projected non-potable demand also includes an additional non-potable irrigation demand due to potential overwatering from irrigation practices and equipment and device efficiency deterioration. Furthermore, by 2050 non-potable customer category demands are increased by 3.77% to capture the effect of climate change. No non-revenue water is accounted for in the total non-potable demand estimate. Non-potable demand is presented with valleywide potable demand with passive and active conservation savings in Figure 8 and valleywide recycled water projection is presented in Figure 9. More information on this non-potable demand can be found in Appendix I.

Figure 8. Valleywide Projected Potable and Recycled Water Demands



Notes:

1. 2020 represents actual potable and non-potable demand for SCV Water and LACWD.
2. This figure presents valleywide potable and non-potable demands including climate change, passive savings, and current active conservation savings.

Figure 9. Valleywide Projected Recycled Water Demands

Note: Projected valleywide non-potable demand only.

Table 4. Valleywide Projected Recycled Water Demands

Demand Forecast	2020 ¹	2025	2030	2035	2040	2045	2050
Recycled Water Annual Demand (AFY) ²	500	4,600	6,500	8,400	9,200	9,500	9,700

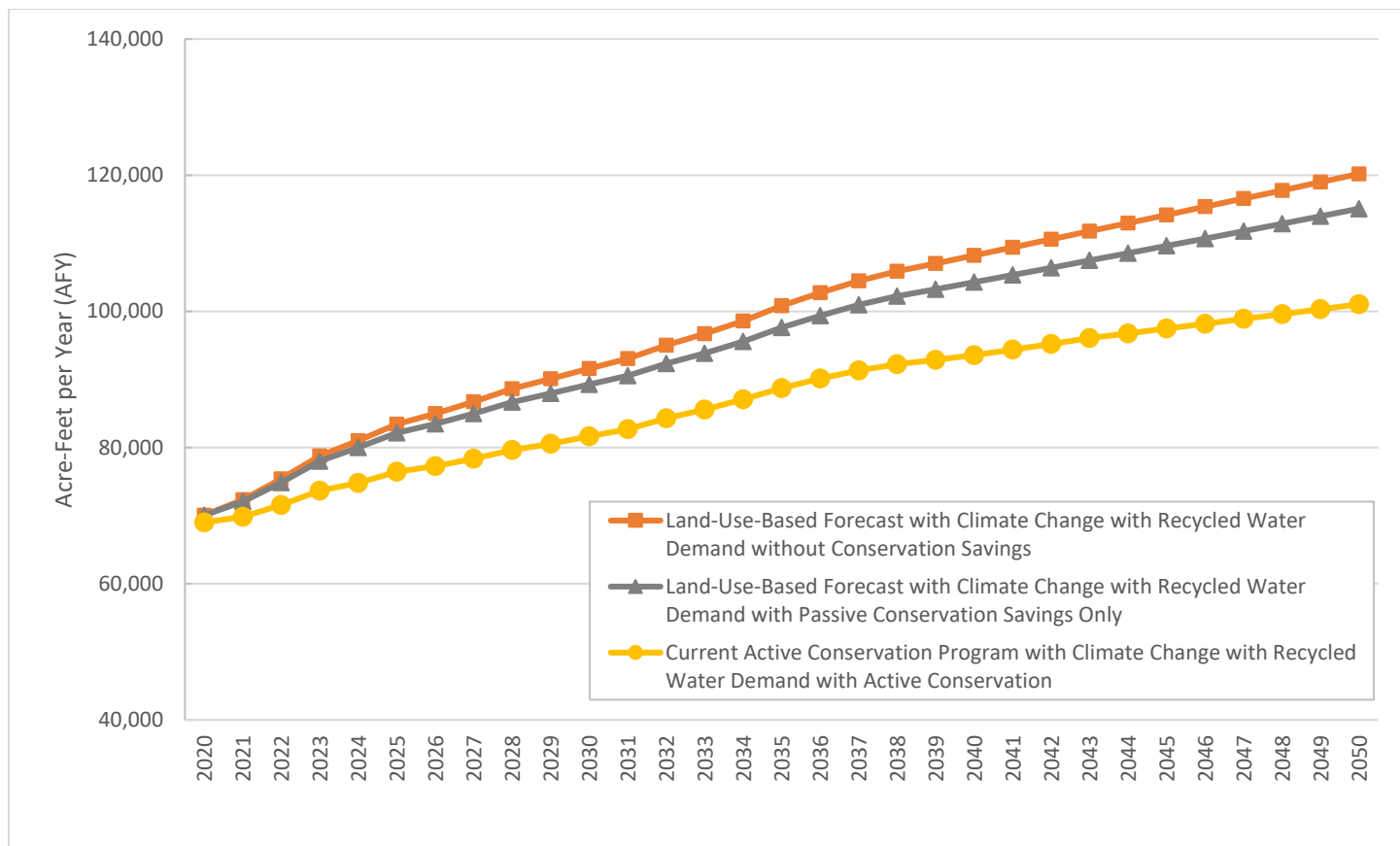
¹ 2020 is actual non-potable water demand.

² Non-potable demands rounded to the nearest 100 AFY.

4.3 Total Demand Projections

Total demand for the SCV Water service area including LACWD retail sales and non-potable demand is presented in Figure 10 and Table 5. Total demand estimates are considered conservative as they include adjustments like potential overwatering. SCV Water anticipates that this estimate may change once state objectives are clarified regarding existing and future irrigation.

Though indoor water use estimates are available, recycled water supply availability will slow the new development schedule as the development builds out to generate the recycled water. It is recognized that there will be a temporary need to use potable water to supply recycled water demands; furthermore, in emergency conditions on the recycled water system, any shortfalls will be met with “make-up” potable water supplies. The volume of this make-up water is based on seasonal recycled water demands, recycled water storage, and indoor water use within the sanitation district.

Figure 10. Valleywide Land-Use-Based Projected Total Demands to 2050

Note: Valleywide demands include LACWD and SCV Water. Demands include climate change and recycled water.

Table 5. Valleywide Land-Use-Based Projected Total Demands to 2050

Demand Forecast	2020	2025	2030	2035	2040	2045	2050
Estimated Total Demand with No Plumbing Code Savings (AFY)	66,100	83,400	91,600	100,800	108,200	114,200	120,200
Estimated Total Demand With Plumbing Code Savings (AFY)		82,100	89,300	97,600	104,300	109,600	115,100
Estimated Total Demand With Active Conservation and Plumbing Code Savings (AFY)		76,400	81,700	88,700	93,600	97,500	101,000

Notes:

1. Valleywide demands include LACWD and SCV Water. Demands include climate change and recycled water.
2. Demands have been rounded to the nearest 100 AFY.

5. CONCLUSIONS

The population and water demand forecasts contained in this technical memorandum reflect a significant enhancement from those used in the 2015 UWMP. Though similar methodologies were employed in this analysis, the more current estimate uses much more refined land use development information provided by City and County planners. This effort also leverages updated results from extended and refined econometric models developed for SCV Water's service area to projected buildout in 2050. In this case, an updated land-use-based approach was used because, as the Santa Clarita Valley approaches buildout, such an approach can further improve upon assumptions regarding how future conditions are estimated to occur (i.e., climate change, etc.), how types of land use are planned in new development, and how water usage patterns might be significantly different than they were in the past, including conservation savings.

Further analysis is planned for the Water Efficiency Program planning when more information becomes available on future regulations from the 2018 "Making Water Conservation a California Way of Life" legislation. Until regulations are finalized, SCV Water is planning to continue with its current conservation program design. Modeling results can be found in Appendix F for passive code based water savings and Appendix G for the active conservation program savings.

For comparison purposes, the projected demands and population that were reported in SCV's 2015 UWMP can be found in Appendix C.

APPENDIX A – SCV WATER RETAIL SERVICE AREA-ONLY DEMAND ANALYSIS METHODOLOGY AND RESULTS

This appendix presents the land use demand analysis methodology steps, Traffic Analysis Zone (TAZ) and land use background data, land use demand factors, and projected land use and land-use-based demand. A TAZ is the unit of geography most commonly used in transportation planning models. Though the size of a TAZ varies, typically a zone of less than 3,000 people is common. The spatial extent of zones varies, ranging from very large areas in undeveloped regions to zones as small as a city block or group of buildings in a central business district. The basis for the TAZ specific data came from the One Valley One Vision (OVOV)) General Plan.

A.1 Land Use Analysis Steps and Inputs

Los Angeles County area developments included Northlake, Spring Canyon, Sloan Canyon, Tapia, Tesoro del Valle, and the Five Point Project. As part of this project, the land use assessment was conducted using the following basic steps/inputs for the service areas of SCV Water's three Water Divisions.

1. MWM used as a basis the 2012 TAZ units by Water Division (not including LACWD) from the March 2016 effort. Kept OVOV buildout by TAZ unit by service division as 2050 general buildout target total. MWM generally followed the OVOV buildout total by specific TAZ unit land use type, however the analysis is aligned by customer category. In some cases, more high-density single-family dwelling units are planned to be constructed than the OVOV land use breakdown originally estimated, even though the overall dwelling unit count did not change.
2. Los Angeles County Planning confirmed no significant added units outside the City of Santa Clarita between 2012 and 2019.
3. The City of Santa Clarita provided a list of built, approved, and pending units with construction time frames included between 2012 and 2050 (buildout). In many cases, land use types were inferred by MWM and SCV Water staff.
4. Homeowner Association (HOA) common area dedicated irrigation acreage was tracked separately from land use types. If not specifically available from the development design, the acreage of this common area was based on an average of available development multifamily and single family common area square footages per dwelling units as provided by SCV Water staff. These average factors were used for the city's pending residential developments, as well as the county's new development areas of Northlake, Spring Canyon, Sloan Canyon, and those units not yet specifically planned for but tracked as the OVOV buildout balance. Tesoro del Valle and Tapia had common area landscape areas available for use.
5. ADUs were added to the development profile as an additional development feature to the OVOV buildout unit numbers. The city received 80 permit applications for these in 2020. This analysis assumed the number of permit applications for ADUs may more than double to approximately 200 per year through buildout. ADUs were assumed to add approximately 1 person per ADU for indoor water use only. (Outdoor demand was assumed to be part of the single family account in which the ADU resides.)
6. Northlake Project assumed residential and non-residential linear growth between 2030 and 2035 within the Newhall Water Division service area.
7. Spring Canyon assumed residential linear growth between 2025 and 2030 in the Newhall Water Division service area.
8. Sloan Canyon assumed residential and non-residential linear growth between 2020 and 2025 in the Newhall Water Division service area.

9. Residential Tapia, located in the Newhall Water Division, assumes 100 units online per year starting in 2025 with 105 units in 2030 (the last year of development). Common area dedicated irrigation square footage was available.
10. Tesoro Del Valle, located in the Newhall Water Division, assumes development is online between 2022 and 2024. Common area dedicated irrigation square footage was available.
11. Five Point Project's projected residential and non-residential development was provided in the 2020 GSI Draft TM. The Five Point Project estimated development schedule was provided by SCV Water staff. This analysis used population as well as potable and non-potable indoor and outdoor residential and non-residential demands as directly reported in the 2020 GSI Draft TM. Five Point's development is expected to occur between 2021 and 2038.
12. In order to determine the balance of development not yet specifically planned for but still accounted for in the OVOV buildout, OVOV buildout units by land use type for SCV Water's three Water Divisions were compiled and compared to the planned city and county development (including West Side communities). In some cases, there were more units of a specific land use type already planned for than outlined in the OVOV buildout total. In these cases, a net balance by customer category (single family, multifamily, commercial, institutional, industrial, etc.) was calculated. The balance of the OVOV development that is not yet approved is assumed to occur between 2035 and 2050 for SCV Water planning purposes.

A.2 Processing TAZ and Land Use Data

This section presents the TAZ land use assessment methodology and the land use data by SCV Water as presented in step 1 in Section A.1. In the 2016 Demand Study, the land use data by TAZ was provided for years 2004, 2012, and 2050 (buildout). The land use assessment was conducted by evaluating the land use types in each TAZ to determine what portion of the land use in that TAZ was located in each Water Division's service area. Furthermore, the 2014 SCV Population Assessment provided 2010 census-based estimates for residential land use types as a basis for comparison and methodology confirmation. Buildout was estimated from the OVOV General Plan.

A.2.1 TAZ Approach Methodology

This analysis leveraged the 2016 Demand Study GIS analysis that was conducted with coordination between Water Division GIS specialists, water resources planners, City of Santa Clarita planners and Los Angeles County planners. More information about the TAZ approach methodology can be found in the 2016 Demand Study TM.

A.2.2 Land Use Types and Estimates

There are 42 types of land uses which include estimates of dwelling units (DU), total square footage (TSF), students (STU), acreage (AC), rooms, and seats by relevant land uses (e.g., the number of seats per movie theater, number of students per school, and number of dwelling units in the category of single family housing with 1-5 DU/AC). A list of the types of unit codes included in the transportation model GIS shape files provided by the City of Santa Clarita and Los Angeles County is presented in Table A-1.

As part of this analysis, where necessary, some land use categories were further consolidated to align with demand factors and water use data. Since the land use data was generated for transportation models, the land use types with special generator (SG) units were applicable only in transportation planning scenarios and not in water resources planning.

Table A-1. City of Santa Clarita and Los Angeles County Transportation Model Land Use Types

Land Use Type	Units
Single Family (<1 du/ac)	DU
Single Family (1-5 du/ac)	DU
Single Family (6-10 du/ac)	DU
Condominium/Townhouse	DU
Apartment	DU
Mobile Homes	DU
Senior (Active)	DU
Commercial Center (>30ac)	TSF
Commercial Center (10-30a)	TSF
Commercial Center (<10ac)	TSF
Commercial Shops	TSF
Hotel	ROOM
Sit-Down Restaurant	TSF
Fast Food Restaurant	TSF
Movie Theater	SEAT
Health Club	TSF
Car Dealership	TSF
Elementary/Middle School	STU
High School	STU
College	STU
Hospital	TSF
Library	TSF
Church	TSF

Land Use Type	Units
Day Care	STU
Industrial Park	TSF
Business Park	TSF
Manufacturing/Warehouse	TSF
Utilities	TSF
Regional Post Office	TSF
Commercial Office	TSF
High-Rise Office	TSF
Medical Office	TSF
Post Office	TSF
Golf Course	AC
Developed Park	AC
Undeveloped Park	AC
Wayside Honor Ranch*	AFY

* Wayside ranch has its own water supply.

A.2.3 Residential Land Uses

The number of dwelling units by land use type were combined into summary groupings that would allow for TAZ-based data to be compared to and checked with other available data. Accessory dwelling units were added to the development profile as an additional development feature to the OVOV buildout unit numbers.

Table A-2. Land Use Units versus Number of Accounts – SCV Water Retail Service Area Only

Land Use Code and Type/Account Customer Category	Units	Projected Future 2030 DUs	Projected Future 2035 DUs	Projected Future Buildout DUs
Single Family	DU	55,000	60,200	67,400
Multifamily	DU	45,300	51,200	55,200
ADU	DU	2,200	3,200	6,200

Notes:

1. Projected units are based on Los Angeles County area developments: Northlake, Spring Canyon, Sloan Canyon, Tapia, Tesoro del Valle, the Five Point Project, and City of Santa Clarita developments provided in an extensive inventory of approved and pending development units.
2. Buildout unit thresholds for single family and multifamily land uses are based on the OVOV General Plan for the service area.
3. The city received 80 permit applications for ADUs in 2020. This analysis assumed the number of permit applications for ADUs may more than double to approximately 200 per year through buildout. ADUs were assumed to add approximately 1 person per ADU for indoor water use only. (Outdoor demand was assumed to be part of the Single Family account in which the ADU resides.)

A.2.4 Non-Residential Land Uses

Non-residential new development land use types were aligned with TAZ land use categories as best as possible with the primary goal of aligning them into the correct non-residential billing categories as follows:

- Commercial – Tracked primarily in thousand square feet. Includes non-residential commercial land use types.
- Institutional – Tracked primarily in thousand square feet. Includes non-residential institutional land use types: Post Office, Regional Post Office, Church, Library, Hospital, Day Care, Elementary/Middle School, High School, and College.
- Industrial – Tracked in thousand square feet. Includes non-residential industrial land use type Industrial Park.
- Other – Tracked in thousand square feet. Includes utility site demands.
- Irrigation – Tracked in acreage. Includes Golf Courses, Developed Parks, and Undeveloped Parks.

An added land use category for residential HOA common areas was included in this analysis with the dedicated irrigation acreage tracked separately from other land use types. Tracked in acreage, HOA irrigation includes SF and MF HOA irrigated common areas.

If not specifically available from the planned development's design, the acreage of the HOA common area was based on an average of available development common area square footages per dwelling units as provided by

SCV Water staff. These average factors, ranging from approximately 2,000 square feet per dwelling unit to 3,650 square feet per DU, were used for the city's pending residential developments as well as Los Angeles County new development areas: Northlake, Spring Canyon, Sloan Canyon, and those units not yet specifically planned for but tracked as the OVOV buildout balance. Tesoro del Valle and Tapia had common area landscape areas available for use. Buildout unit thresholds for each land use category were based on the OVOV General Plan for the service area.

A.3 Population

Historical and existing population was determined in the March 2016 effort (based on the 2010 census and 2014 population assessment) with recent year values ground-truthed by project and SCV staff against new accounts. The land-use-based population was determined through an assessment of future dwelling units based on schedules provided by City and County Planning and SCV Water staff. In order to determine the balance of development not yet approved but still accounted for in planning purposes in the OVOV buildout estimate, OVOV buildout units by land use type for SCV Water's three Water Divisions were compiled and compared to the planned city and county development. To calculate population, estimated people per household factors were applied to dwelling units according to land use type. The range was determined to be between 1 person per household (PPH) for an ADU up to 3.8 PPH in some low-density single-family units. The basis for people per household estimates is presented as follows.

- New development units estimated by the city and calculated in the OVOV balance assumed average PPH values derived for the Santa Clarita Water Division and Newhall Water Division based on the March 2016 analysis (which was based on the 2010 census and 2014 population assessment). A weighted average of the SCWD and NWD PPH was taken using each division's 2015 population.
- Northlake, Sloan Canyon, Spring Canyon, Tapia, and Tesoro del Valle assume NWD PPH as derived in the March 2016 analysis.
- Five Point Project PPH were presented in the 2020 GSI Draft TM and used in this analysis.
- ADUs were assumed to have 1 PPH, however not represented an additional new single family account, given it is assumed that the ADU located within an existing or planned single family account's property.

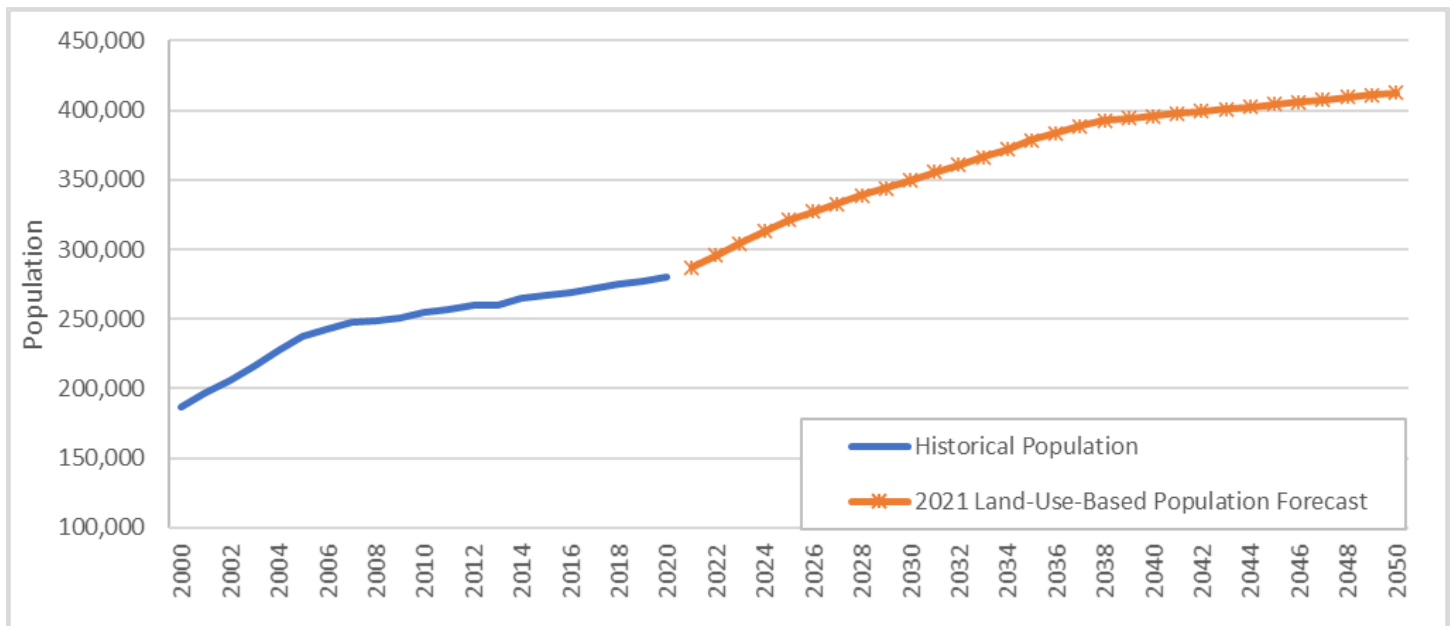
New development population was tracked by single family and multifamily housing categories and associated population. The future population was added to the previous effort's 2016 estimated single family and multifamily population, and was consistent with actual new accounts added to SCV Water based on data provided by customer category.

Table A-3 and Figure A-1 show current and projected population for SCV.

Table A-3. SCV Land-Use-Based Population Forecast

Demand Forecast	2020	2025	2030	2035	2040	2045	2050
Projected Population	280,600	321,300	349,500	378,300	395,900	404,300	412,700

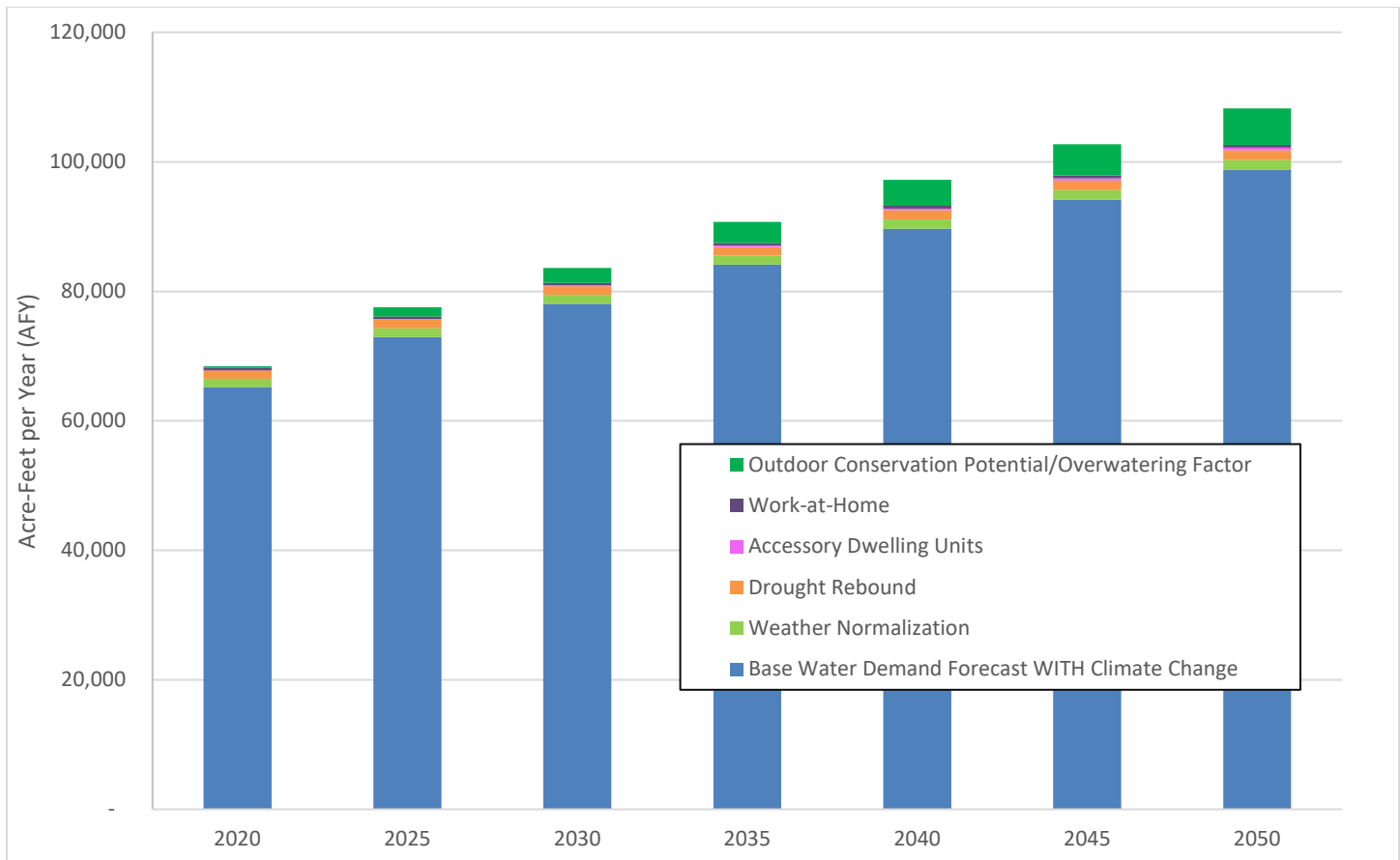
Note: Population values have been rounded to the nearest 100.

Figure A-1. SCV Land-Use-Based Population Forecast

A.4 Demand Factors

Demand factor adjustments address the need to account for weather normalization, drought rebound, and COVID-19 pandemic-prompted work-at-home trends. Figure A-2 presents relative water demand for each demand adjustment.⁹ Due to being designed as a percentage of demand, adjustment savings are not directly additive. It is important to note that baseline demands include climate change, but do not include passive and active savings.

⁹ When an adjustment's percentage is applied to demand, that demand volume changes. Then another adjustment percentage is applied to the adjusted demand volume, then a third is applied. As a result, the volume of savings is different than if the adjustment percentages had been used against total baseline volume.

Figure A-2. Relativity of SCV Water Potable Water Demand Adjustments**Notes:**

1. Due to being designed as a percentage of demand, adjustment savings are not directly additive.
2. Baseline demands do include climate change. Demand is increased by approximately 3.77% by 2050 to capture the effects of climate change.
3. Baseline demands do not include passive savings or active conservation program savings.
4. Baseline demands do not include LACWD demands.
5. Baseline demands do not include recycled water.
6. Weather normalization is based on an adjustment of -0.78% of 2018 data and 5.21% of 2019 data.
7. Drought rebound is based on an increased adjustment of 2% of base year demand.
8. ADUs assume an increase of 1 person for interior water use for ~200 residential accounts per year.
9. Work-at-home assumes a 1% increase in residential water use.
10. Outdoor irrigation inefficiencies are conservatively assumed to be approximately 26% of new development exterior water use.

A.5 Projected Land-Use-Based Demand

New development land use types were aligned with TAZ land use categories as best as possible with the primary goal of aligning them into the correct non-residential billing categories as presented in Table A-4. The table presents projected demand by customer account categories with plumbing code savings and current active conservation program savings. Projected demands also include climate change. Existing customer category account water use projections are a modified projection. This projection was based on 2018 and 2019 actual use adjustments and combined with projected customer category account water use projections, though derived independently as explained previously.

Table A-4. Projected Customer Category Water Demand

Customer Category	Demand (AFY) ¹						
	2020/ Actual ¹⁰	2025	2030	2035	2040	2045	2050/ Buildout
Single Family ²	32,900	32,700	34,700	36,200	37,500	38,400	39,100
Multifamily ³	5,200	8,300	8,900	10,500	11,000	11,200	11,500
Commercial ⁴	3,700	5,100	5,500	5,800	6,300	6,800	7,300
Industrial ⁵	1,100	1,800	1,800	2,100	2,300	2,500	2,700
Institutional ⁶	1,700	1,800	2,100	2,100	2,000	2,000	2,000
Irrigation ⁷	13,300	12,800	12,800	13,400	13,200	13,100	12,900
Other ⁸	400	2,100	2,100	2,400	3,700	5,000	6,300
Subtotal	58,300	64,600	67,900	72,500	76,000	79,000	81,800
Non-Revenue Water ⁹	5,900	6,000	5,800	6,200	6,600	7,000	7,400
Total	64,200	70,600	73,700	78,700	82,600	86,000	89,200

¹ Demands include climate change, plumbing code savings, and current active conservation program savings. All values have been rounded to the nearest 100 AFY.

² Includes SF unit <1/DU/AC, 5-10 DU/ac, 6-10 DU/AC).

³ Includes MF condominiums, townhouses, and apartments.

⁴ Includes non-residential land use types.

⁵ Includes non-residential industrial land use types.

⁶ Includes non-residential institutional land use types.

⁷ Includes golf courses, parks and HOA common area irrigation.

⁸ Includes utility site demands.

⁹ NRW in 2020 is actual SCV Water production minus consumption. NRW is estimated to be 8.8% for projected years.

¹⁰ 2020 is actual consumption by category and NRW. 2020 does not include climate change, plumbing code, or active conservation.

Total demand projections presented in presented in Table A-5 and Figure A-3, account for the total projected potable water production in a service area water system, including NRW, regardless of source. Source may be provided from SCV Water surface water or groundwater supplies.

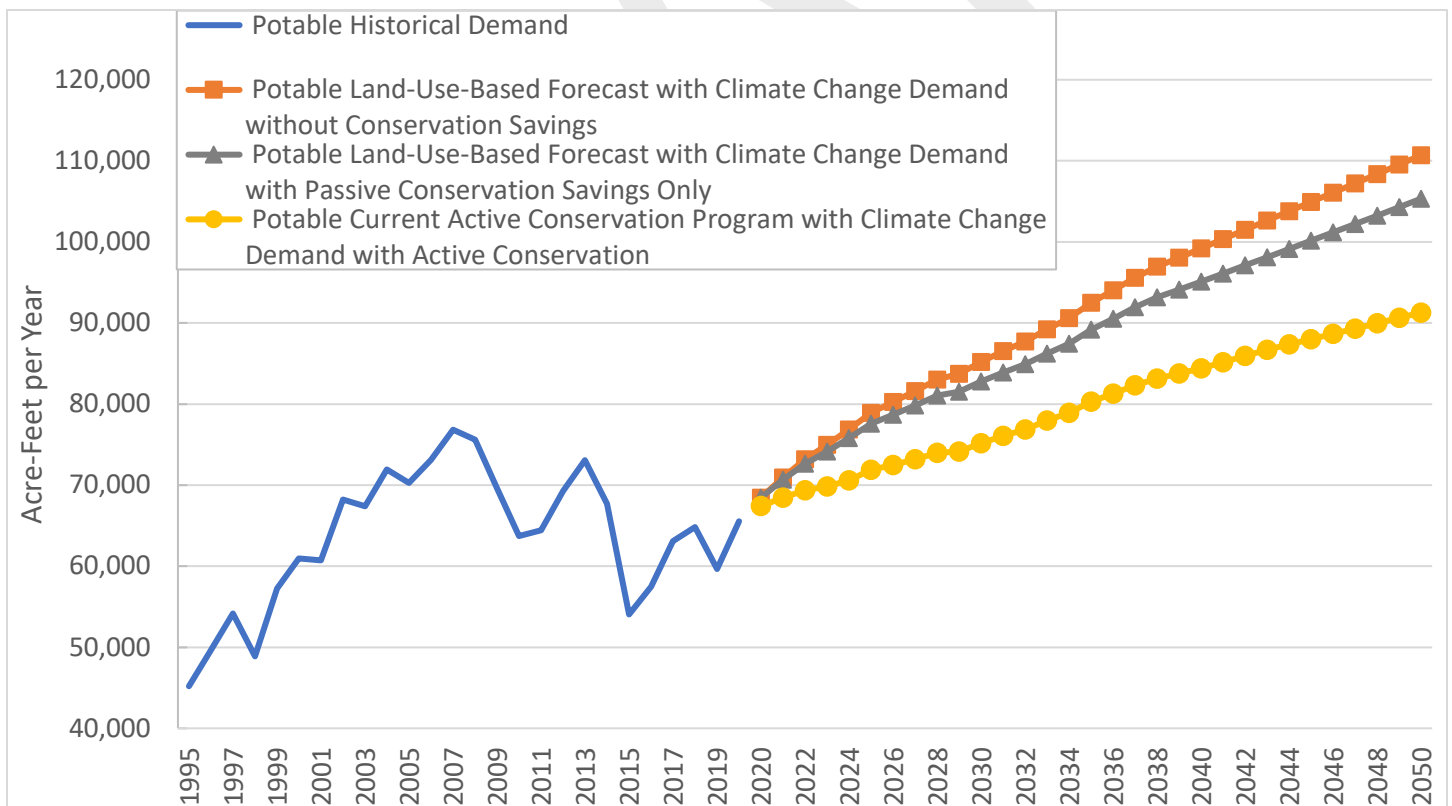
Passive code and standards estimated water savings as well as active current conservation program implementation water savings are presented in Appendix F and Appendix G, respectively.

Table A-5. Land-Use-Based Potable Demand Projections – SCV Water

Demand Forecast	2020	2025	2030	2035	2040	2045	2050
Population (Land-Use-Based)	280,600	321,300	349,500	378,300	395,900	404,300	412,700
Land-Use-Based Total Potable Demand with No Plumbing Code Savings (AFY)	64,300	77,600	83,700	90,700	97,200	102,700	108,200
Land-Use-Based Total Potable Demand With Plumbing Code Savings (AFY)		76,300	81,300	87,500	93,300	98,100	103,100
Land-Use-Based Total Potable Demand With Active Conservation Program and Plumbing Code Savings (AFY)		70,600	73,700	78,700	82,600	86,000	89,200

Notes:

1. Year 2020 demands are actual.
2. Total demand accounts for the total projected potable water demand in a service area water system. Source can be from surface water or groundwater.
3. Water demands include climate change and are rounded to the nearest 100 AFY.

Figure A-3. Land-Use-Based Demand Projection – SCV Water**Notes:**

1. Demand projections include climate change and do not include recycled water.
2. 2020 demand is actual.

APPENDIX B – LACWD DEMAND ANALYSIS METHODOLOGY AND RESULTS

This appendix presents the population and demand projections for Los Angeles County Water District 36. LACWD did not have detailed enough information (such as specific billing data by lot type) to derive land-use-based demand factors and therefore has a population-based demand forecast. Future population projections based on OVOV buildout estimates in year 2050 were used for the LACWD DSS Model.

B.1 LACWD Population

LACWD historical, current, and projected populations were based on the March 2016 effort (which was based on the 2010 census and 2014 population assessment) with recent year values compared to new accounts by project and SCV staff. Projected population continues to be based on OVOV General Plan estimates for the retail service area based on the GIS efforts conducted in the March 2016 effort.

B.2 LACWD Demand

LACWD demands were based on adjusted 2018 and 2019 average per account water use and relatively normal water year 2017 indoor water use. Demand adjustments were applied to address the need to account for weather normalization, drought rebound, and COVID-19 pandemic-prompted work-at-home trends. 2018 and 2019 demands were adjusted to account for slightly warmer and significantly cooler than normal conditions, respectively. More information about this part of the analysis can be found in Appendix B.

Weather normalization and drought rebound adjustment apply to the retailer's total estimated start year water use. It was estimated that a total drought rebound of 9% occurred by 2019 as compared to year 2015 pre-drought water use. This analysis assumed an additional 2% rebound (increase) in water use on top of the weather normalized average 2018 and 2019 water use. It also assumed a 1% increase in water use due to the continuation of the residential population working at home, that began with the COVID-19 pandemic; this is a preliminary estimate that SCV Water anticipates adjusting as post-pandemic data becomes available. This adjustment was in addition to the drought rebound and weather normalized adjustments previously presented. LACWD's water use is over 90% SF water use.

By 2050, customer category demands are increased by 3.77% to capture the effect of climate change. This bump was feathered in linearly starting with a zero increase initially, rising to 3.77% in 2050 (see Appendix E). This climate change increase is not applied to the NRW volume directly. However, since NRW is calculated as a percent of production, NRW subsequently increases as well. This climate change adjustment is applied "post-process" to the demands with passive savings estimate calculated in the DSS Model. NRW is estimated to be 15.5% of total production as directed by SCV staff and based on an average of 2018 and 2019 LACWD NRW calculated as the difference between production and consumption.

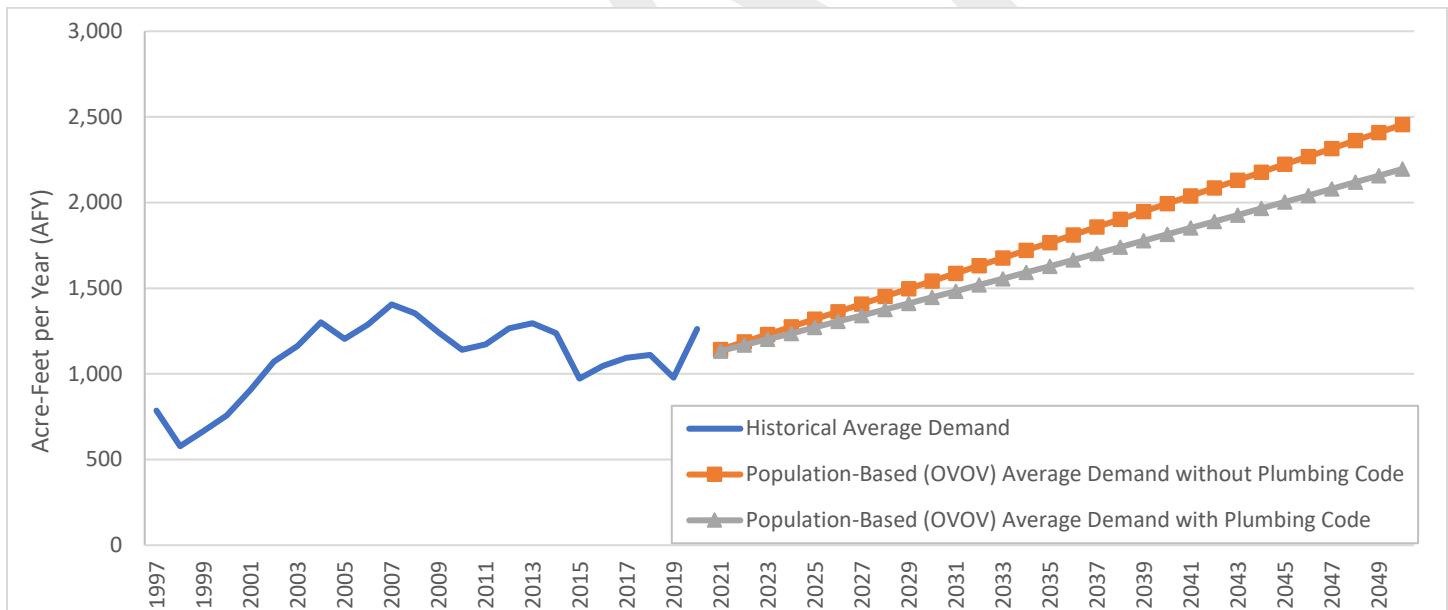
Estimated savings from passive conservation (plumbing codes) were calculated and applied in the DSS Model. No active conservation savings were estimated in this effort for LACWD specifically. SCV efforts that target LACWD's customers were included in the SCV active conservation program budget and savings. Estimated demands with and without passive savings are presented in Table B-1 and Figure B-1. Both demand scenarios include climate change adjustments.

Table B-1. Population-Based Potable Demand Projections – LACWD

Demand Forecast	2020	2025	2030	2035	2040	2045	2050
Population (OVOV Based)	9,000	10,800	12,500	14,300	16,000	17,800	19,500
Population-Based Total Potable Demand with No Plumbing Code Savings (AFY)	1,260	1,320	1,540	1,770	1,990	2,220	2,460
Population-Based Total Potable Demand With Plumbing Code Savings (AFY)		1,270	1,450	1,630	1,810	2,000	2,200

Notes:

1. 2020 is actual demand provided by SCV Water.
2. Total demand accounts for the total projected potable water demand in a service area water system. No active conservation savings were estimated for LACWD in this effort. SCV Water Use Efficiency Program efforts that target LACWD's customers are included in the SCV active conservation program budget and savings.
3. Demand projections include climate change considerations.
4. Population values have been rounded to the nearest 100.
5. Demand values have been rounded to the nearest 10 AFY to better distinguish between scenarios.

Figure B-1. Retailer Demand Projection – LACWD**Notes:**

1. Total demand accounts for the total projected potable water demand in a service area water system. No active conservation savings are estimated for LACWD in this effort. SCV Water Use Efficiency Program efforts that target LACWD's customers are included in the SCV active conservation program budget and savings.
2. Demand projections include climate change considerations.

APPENDIX C – COMPARISON WITH PAST 2015 UWMP DEMAND FORECAST AND POPULATION PROJECTIONS

This appendix presents a comparison of the current estimated population and demand projections with the 2015 UWMP (2016 Demand Study) estimates. Overall, valleywide dwelling units are consistent with the OVOV General Plan, and valleywide population is estimated to be approximately 3% higher and total valleywide demands are 7% higher at buildout from the 2015 UWMP. The comparison includes non-potable demands since these were not isolated in the last effort. Current demand projections are higher at buildout due to 1) the increase in demand from climate change at an estimated 4% by buildout, 2) the 3% increase in population, and 3) an additional 25% increase in future irrigation water use due to anticipated overwatering and equipment inefficiencies.

Table C-1 presents valleywide estimated population and demand projections from the 2015 UWMP and 2016 Demand Study.

Table C-1. 2015 Urban Water Management Plan and 2016 Demand Study Water Demands and Population

Demand Forecast	2015	2020	2025	2030	2035	2040	2045	2050
Projected Population	272,600	289,000	321,900	354,700	383,400	396,100	408,800	421,500
Estimated Total Demand with No Plumbing Code Savings (AFY)	72,000	79,800	90,100	100,400	109,500	113,800	118,200	122,600
Estimated Total Demand With Plumbing Code Savings (AFY)	71,600	76,700	84,800	92,800	100,000	103,300	106,800	110,300
Estimated Total Demand With Active Conservation and Plumbing Code Savings (AFY)	69,100	69,000	74,600	80,800	86,100	88,500	91,000	94,000

Note: Demands and population values are from the 2015 Urban Water Management Plan, include recycled water, and have been rounded to the nearest 100.

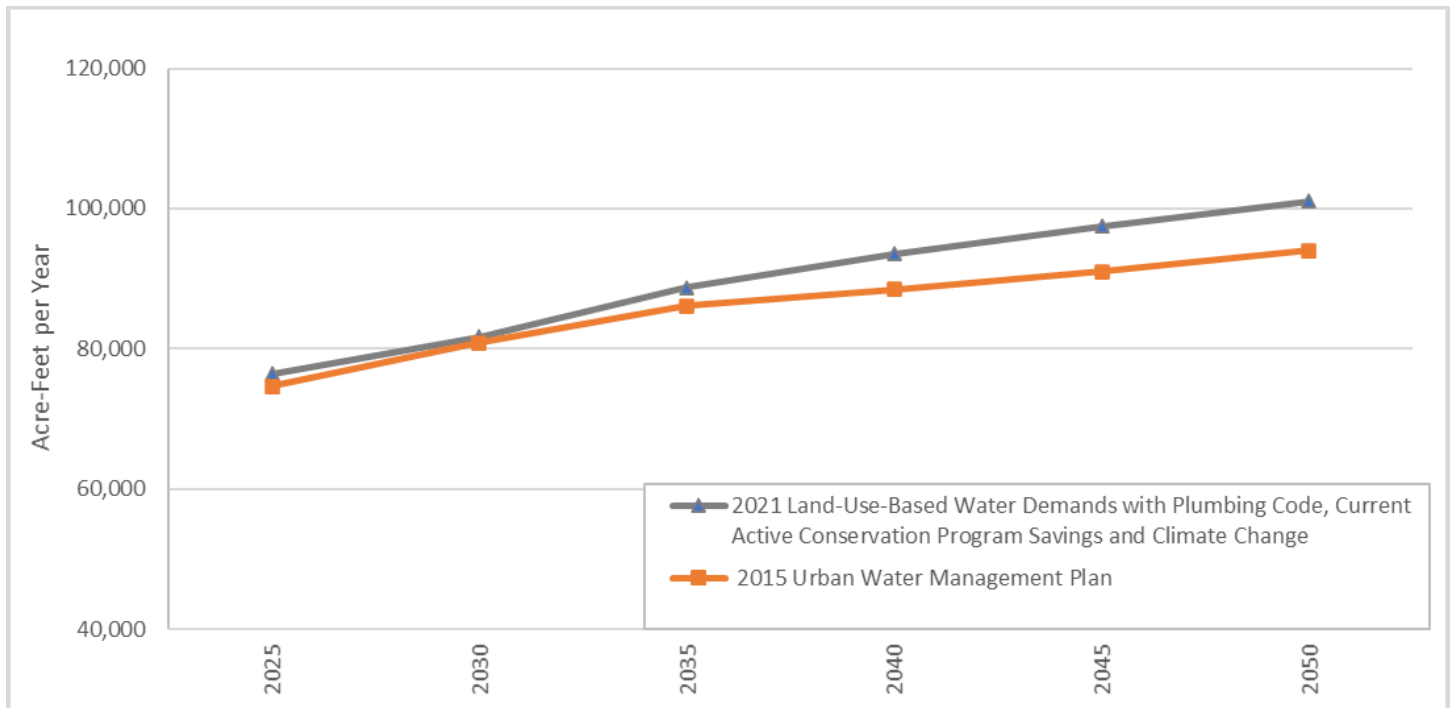
Table C-2 and Figure C-1 present the estimated valleywide population and demand projections.

Table C-2. 2021 Land-Use-Based Projected Water Demands and Population

Demand Forecast	2025	2030	2035	2040	2045	2050
Projected Population	332,100	362,100	392,500	411,900	422,100	432,200
Estimated Total Demand with No Plumbing Code Savings (AFY)	83,400	91,600	100,800	108,200	114,200	120,200
Estimated Total Demand With Plumbing Code Savings (AFY)	82,100	89,300	97,600	104,300	109,600	115,100
Estimated Total Demand With Active Conservation and Plumbing Code Savings (AFY)	76,400	81,700	88,700	93,600	97,500	101,000

Note: Demands include LACWD, recycled water, and climate change and have been rounded to the nearest 100.

Figure C-1. 2021 Land-Use-Based Water Demands versus 2015 Urban Water Management Plan Demands



Notes:

1. Both demand lines include passive savings, active conservation savings and recycled water.
2. The grey 2021 Land-Use-Based demand also includes climate change.

Buildout population is higher primarily due to 1-person ADUs being added to the projected annual estimate at approximately 200 per year. ADUs are located on existing SF properties, increasing SF population and indoor use but not SF accounts or outdoor use.

APPENDIX D – ECONOMETRIC MODEL

This appendix presents the econometric model and related results. Also included is an evaluation of the climate change scenario's impact on demand. The parameters that define the climate change scenario itself are developed and presented in greater detail in Appendix E.

D.1 Introduction

In preparing the 2020 Urban Water Management Plan, SCV Water opted to use the same demand forecasting framework that was previously adopted in 2015. This framework leverages the power of econometric models to generate short-term forecasts, with the power of a land-use-based forecasting methodology for extended years. To establish a valid starting point for a baseline demand forecast, it has become increasingly difficult to identify what might be considered a “normal” or set of “normal” years from which to derive such a starting point. California has experienced few normal years during the last decade or so. There was a deep recession in 2008 with effects on demand lingering through 2010. With quickening economic activity, demand began to rebound. However, California soon found itself facing a severe drought with increasingly stringent water-use restrictions going into effect from 2014 until the drought was declared over in 2017. Once again, demand began to rebound from the low levels reached during 2015 and 2016, only to once again be confounded by the COVID-19 pandemic of 2020 (continuing into 2021).

The purpose of the econometric model is to estimate the impact of these past confounding factors (economic cycles,¹⁰ weather fluctuations, and drought restrictions) on water demand using monthly production data from 1995-2019. No attempt was made to capture the impact of the COVID-19 pandemic since that is still an evolving influence with an unknown long-term impact. In addition to these cyclical confounding factors, the econometric model also is able to capture the impact of past rate increases, which have a cumulative dampening effect on water demand over time. The econometric model can be used to address questions such as, how much more will demand rebound, normalized for weather, as the recent drought fades from memory?

Finally, the econometric model is put to a new purpose for the 2020 UWMP update effort and this land-use based demand analysis. Since a key purpose of building the econometric model is to capture the impact of weather on demand, it can also be used to evaluate the impact of future climate change. Appendix E discusses the development of SCV Water's climate change scenario from data resources made available by DWR. Evaluation of this scenario's impact on demand is undertaken through the econometric model, as discussed below.

The same model specification as the one used in 2015, with a few modifications, was selected for the present round of analysis (Eq. 1):

$$\begin{aligned} \ln(\text{monthly GPCD}) = & \alpha + \beta \text{Trend} + \theta \ln(\text{unemployment rate}) + \delta \ln(\text{marginal price}) + \\ & \vartheta \text{Reference ETo Deviation} + \Omega \text{Rainfall Deviation} + \pi \text{monthly indicators} + \\ & \mu \text{drought restriction indicators} + \varepsilon \dots \dots \dots \text{Eq. 1} \end{aligned}$$

Where,

- Monthly production is measured in GPCD.
- α is a scaling constant.

¹⁰ Economic conditions were captured by the monthly unemployment rate for the City of Santa Clarita obtained from the Bureau of Labor Statistics. The City of Santa Clarita's and Los Angeles County's unemployment rates performed comparably in the models.

- Trend is a variable that takes on a value of 0 in the first year, 1 in the second year, and so on.
- Unemployment rate is captured as an annual percent (for example, 7%).
- Marginal price is for single family customers, measured in dollars per hundred cubic feet.
- Reference ETo deviation is measured in total inches (average monthly ETo minus average for the same month between 1995 and 2019).
- Rainfall deviation is measured in total inches (total rainfall in a given month minus average total rainfall for same month between 1995 and 2019).
- Monthly indicators are binary 0-1 variables, taking on a value of 1 for a given month in question, 0 otherwise.
- Drought restriction timeline indicators are binary 0-1 variables, taking on a value of 1 for when a restriction was in effect, 0 otherwise.
- ϵ denotes random statistical error.

The variable on the left-hand side of the equation is known as the dependent variable, while the right-hand side variable is the independent variable. Each independent variable is preceded by a coefficient (i.e., β , etc.) that measures the strength of the impact of an independent variable on monthly demand. A positive coefficient implies that increases in an independent variable will be associated with an increase in the dependent variable; a negative coefficient implies the opposite. The purpose of model development is both to select the elements of the equation, as well as to estimate each independent variable's coefficient. Continuous variables such as the marginal price and the unemployment rate are logarithmically transformed so that their respective coefficients can be given a proportional interpretation. So, for example, the coefficient on logarithmically transformed marginal price becomes the price elasticity, and so on. The trend variable captures changes in GPCD over time not accounted for by price, unemployment rate, or weather. It was included and tested in the model, but found to be unnecessary.

The basic model specification (Eq. 1) includes several features. First, SCV Water's Water Division-specific production data are modeled at a monthly, not annual level. The reason for estimating monthly level models is to allow for the impact of weather to vary by time of year. Prior research strongly indicates that abnormal weather does not have the same effect in January as, say, in May.¹¹ Working with monthly production data allows for the incorporation of time-varying weather effects. Second, metrics used to capture weather (reference ETo and rainfall¹²) enter the model as deviations from their respective monthly averages, capturing directly how demand reacts to weather as it deviates from average. Normal seasonality in monthly demand (i.e., July demand being much higher than January demand) is captured by the monthly indicator variables. It is necessary to capture the impact of weather using reference ETo and rainfall instead of temperature and rainfall because DWR's climate change tool defines climate change scenarios only in former terms.

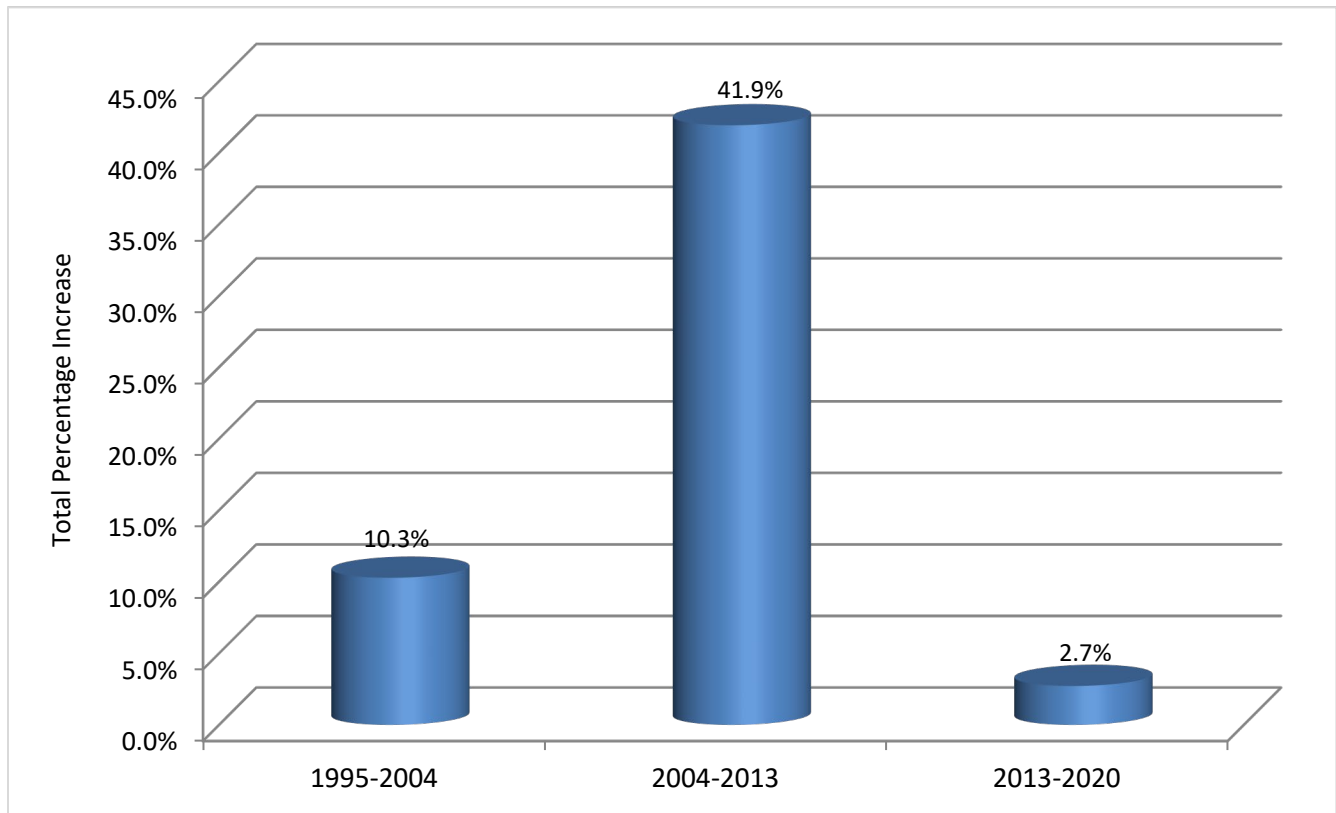
Finally, the model also includes a measure of the marginal price of water in real terms (i.e., price deflated by the consumer price index published by the Bureau of Labor Statistics). The marginal price of water faced by the average single family customer in a Water Division is used to depict price variation over time. By and large, CII

¹¹ Bamezai, A. (2011). *GPCD Weather Normalization Methodology*, final report submitted to the California Urban Water Conservation Council.

¹² Reference ETo and rainfall data were obtained from the CIMIS station in Santa Clarita. This station offers monthly data from 2007 onward. For the 1995-2006 period, rainfall histories were reconstructed using National Oceanic and Atmospheric Administration weather stations located in Santa Clarita Valley, and reference ETo was reconstructed using DWR resources (PRISM and Spatial CIMIS).

and single family price trends appear similar. Figure D-1 shows price escalation faced by single family customers in SCV Water’s service area overall, calculated as a weighted average of each Water Division’s price data. The period between 2004 and 2013 saw sharp increases in water rates, rising a total of 41.9% in real terms during that 10-year period.

Figure D-1. Trends in the Single Family Real Price of Water for SCV Water’s Three Water Divisions



D.2 Econometric Model Results

A single model was developed using data from each of SCV Water’s three Water Divisions to characterize the impact of various drivers on monthly demand (Table D-1). This type of model is known as a time-series, cross-sectional model.¹³ Treating each Water Division as a separate cross-section allows for rate histories to vary across Water Divisions. This three-piece model incorporates Water Division-level fixed effects, a correction for autocorrelation in the error term, and population weighting to account for the different Water Division sizes. The fixed effects capture the impact of Water Division characteristics that do not vary much over time, such as average household income and lot size, leading to a much more robust model specification than one without these fixed effects. In other words, implicitly through these fixed effects the model captures the impact on GPCD of income, lot size, and other unobservable time-invariant differences across Water Divisions.

¹³ The time series part refers to the length of time that is modeled (i.e., monthly data from 1995-2019). The cross-section part refers to SCV Water’s three Water Divisions that comprise SCV Water’s service area.

Table D-1. SCV Water Model Results

Independent Variable	Coefficient	Std. Error	t-statistic
Ln(Marginal Price)	-0.304	0.038	-8.1
Ln(Unemployment Rate)	-0.081	0.015	-5.4
Reference ETo Dev. (Apr-Jun)	0.078	0.008	9.8
Reference ETo Dev. (Jul-Oct)	0.059	0.009	6.8
Reference ETo Dev. (Nov-Mar)	0.128	0.009	14.5
Rain Dev. (Apr-Jun)	-0.064	0.008	-8.4
Rain Dev. (Jul-Oct)	-0.024	0.007	-3.6
Rain Dev. (Nov-Mar)	-0.020	0.002	-10.2
Feb Indicator	-0.070	0.011	-6.2
Mar	0.086	0.015	5.8
Apr	0.330	0.018	18.7
May	0.596	0.019	31.9
Jun	0.751	0.019	39.3
Jul	0.879	0.019	45.7
Aug	0.891	0.019	46.6
Sep	0.778	0.019	42.0
Oct	0.562	0.018	32.1
Nov	0.330	0.015	21.4
Dec	0.070	0.013	5.6
Drought Indicator (May-Dec of 2014)	-0.066	0.031	-2.2
Drought Indicator (2015)	-0.058	0.030	-2.0
Drought Indicator (June-Sep of 2015)	-0.215	0.039	-5.5
Drought Indicator (2016)	-0.141	0.030	-4.7
Drought Indicator (June-Sep of 2016)	-0.058	0.039	-1.5
Drought Indicator (Jan-Sep of 2017)	-0.185	0.030	-6.1
Constant	5.200	0.032	161.8
Water Division interactions with monthly dummies	Included		
R-Square	0.89		

Notes:

1. Model includes SCV Water's three Water Divisions.
2. Dependent Variable: Ln(Monthly Baseline GPCD)
3. The large number of coefficients associated with the Water Division fixed effects and Water Division interactions with monthly dummies are not shown for the sake of brevity.

In addition to the fixed effects, each Water Division is allowed to have its own time trend to capture the impact of service area dynamics that influence water use but are not fully captured either by price, unemployment rate, or weather. The normal seasonality in water use is also allowed to vary across retailers.

The estimated three-Water Division model (Table D-1) has three columns, including one for the estimated coefficient, one for the likely band of error surrounding this coefficient (referred to as standard error), and one for the t-statistic. An independent variable's t-statistic is the ratio of the coefficient over its standard error. A t-

statistic of 2 or greater indicates a statistically significant relationship between the dependent and independent variable; less than 2 indicates that the data are not able to conclusively demonstrate a relationship. The latter finding may reflect the lack of any relationship. Or, it may occur because of data errors or other problems, such as two or more independent variables being highly correlated with one another. The model's R-square is indicative of the overall explanatory power of a statistical model. It can vary between zero and 1, with higher numbers indicating greater explanatory power.

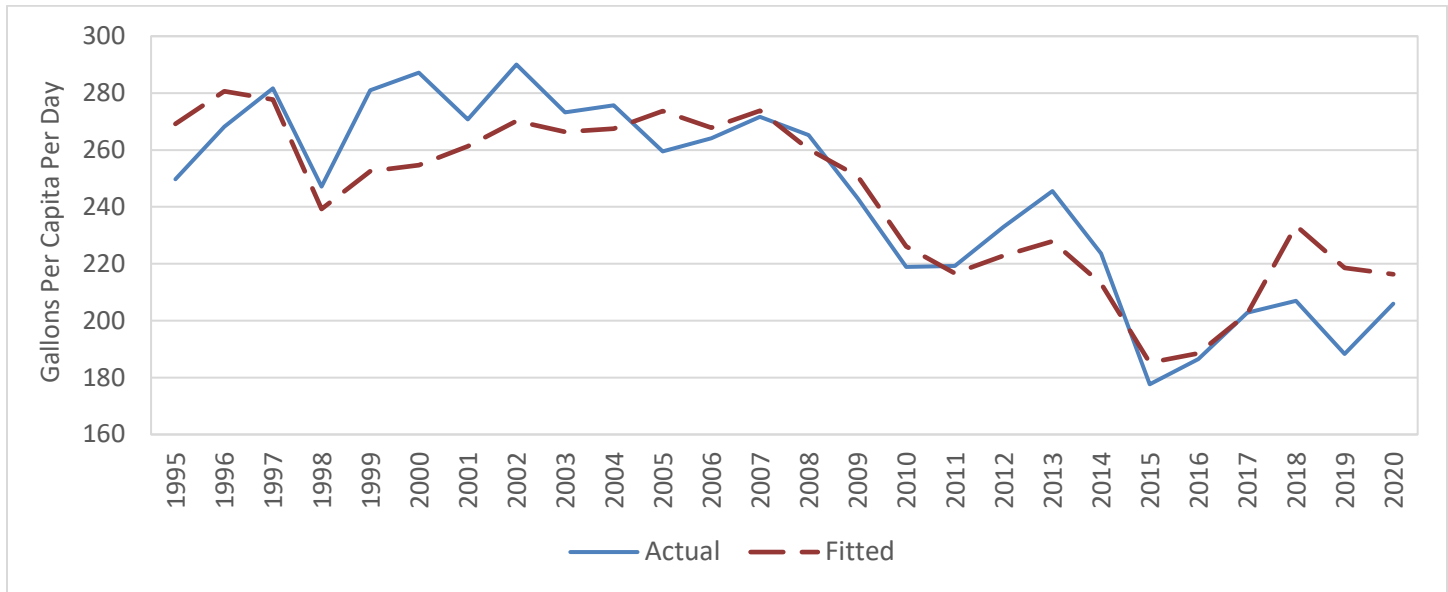
Table D-1's coefficients have the following interpretation:

- A price elasticity of -0.3 indicates that a 10% real increase in the marginal price of water can be expected to reduce demand by 3%. This estimate of price elasticity compares well with the published literature on this topic.
- A 10% increase in the annual unemployment rate is likely to depress water demand by 0.8%. Both the impact of price and economic conditions on demand are statistically significant.
- The weather coefficients are all significant and behave in expected ways. An extra inch of rainfall per month during the spring season reduces monthly demand by roughly 6.1%, while the same extra inch during the winter months only depresses monthly demand by 2.0%.
- On the reference ETo dimension, if monthly ETo is one inch greater than normal, this is likely to raise monthly water demand by 8.0% during the spring season, 6.0% during the summer season, and 13.2% during late fall and winter seasons. Lower than average reference ETo would have the opposite effect.

The monthly indicator variables also exhibit the expected pattern with July and August exhibiting the largest coefficients, indicating that July and August demand is greatest during the year, reaching a minimum during February.

To capture the impact of drought messaging in 2014 and subsequent irrigation restrictions in 2015 and 2016, the model also includes time-period indicator variables. For example, the model suggests that drought messaging that began in May of 2014 and remained in effect until the end of the year caused monthly demand to fall by approximately 6.6% during the May-December period. The effect of messaging in 2015 was comparable to 2014, but irrigation restrictions caused summer demand in 2015 to further drop by an additional 21.5%. By 2016 and 2017, conservation behavior had been internalized by customers and reduced demand exhibits itself as an all-year phenomenon instead of a largely summer phenomenon, as was the case during 2015.

Figure D-2 shows how the model's fitted values compare with SCV Water's GPCD trend at an annual level (the monthly model's fitted values are aggregated to an annual level). The resulting R-square value of 0.89 shows that there is a good match between actual and fitted values. The model captures the downturn in demand experienced during the 2008-2011 period, a result of the recession and its aftereffects. Then, from 2014 onward, demand once again drops due to drought messaging initially then eventually due to implementation of irrigation restrictions in 2015.

Figure D-2. SCV Water Econometric Model Fit

The model's fitted values in 2018 and 2019 exceed actual demand in these two post-drought years. Year 2020 data is also shown for illustration purposes, but was not used for model estimation because of the COVID-19 pandemic. One interpretation of fitted values exceeding actual 2018 and 2019 demand is that the gap illustrates likely remaining demand rebound that will resurface as lingering drought behaviors fade. However, by 2020, the model's fitted value was approaching 2020 actual demand. This suggests while there may exist remaining increased demand normalization for post-drought demand to rebound, it is assumed the rebound will likely remain relatively small and as result was represented by a net 2% increase in future base year demands. The data suggest that 2018 was a slightly warmer than normal year and 2019 was the reverse, cooler than normal. The weather normalization corrections work out to -0.78% for 2018 and 5.21% for 2019. Weather normalized demand in 2018 and 2019 are very close to one another. The starting point for the baseline demand forecast is derived using the average of 2018 and 2019 weather-normalized demands, increased by 2% to account for yet-to-be-realized drought rebound.

D.3 Climate Change Assessment

Appendix E shows the development of a climate change scenario for Santa Clarita Valley in 2050, the horizon year for this land-use-based demand analysis planning effort. The climate scenario is defined in terms of monthly change factors in reference ETo and precipitation relative to baseline normal weather. The econometric demand model was constructed in a way so as to easily accommodate these types of climate change simulation inputs. First, a demand model is constructed at a monthly time step using reference ETo and precipitation to capture weather fluctuation. The model specification evaluates the impact of weather deviations from normal. It is straightforward to take the estimated model coefficients and simulate how much demand would be higher if weather deviations from normal are set to what the 2050 climate scenario suggests.

The difference works out to a projected net increase of 3.77%. In other words, if 2050 weather were present in 2018 and 2019, on average demand would have been 3.77% higher across the two years compared to normal weather. This increase, however, is expected to arrive gradually over time, essentially starting with a 0% impact in 2020 and rising to 3.77% annually in 2050. Between these two bracketing years (2020 and 2050) the impact of climate change is layered linearly onto the baseline demand forecast.

APPENDIX E – CLIMATE CHANGE SCENARIO DEVELOPMENT

The 2020 UWMP land use demand forecast extends to the year 2050 buildout. To factor in the effect of climate change requires an estimate of how 2050 climate is likely to differ compared to baseline normal climate. These estimates are obtained from the climate change scenarios and supporting data that DWR has made available for assessing groundwater basin sustainability to support implementation of the Sustainable Groundwater Management Act (SGMA). GSI Water Solutions recently completed a groundwater basin sustainability study for SCV Water utilizing these data resources. To remain consistent with climate change scenarios used for evaluating supply impacts, the same set of assumptions are used for evaluating the impact of climate change on future demand.¹⁴

More specifically, DWR provides downscaled, gridded information about expected percentage changes in reference ETo and precipitation for two different time horizons (i.e., year 2030 and 2070).¹⁵ Each grid is roughly 6 kilometers by 6 kilometers in area, allowing for a granular assessment of local groundwater conditions. These change factors are derived as the average of 20 climate model predictions for each horizon year. These 20 climate models were selected by DWR's *Climate Change Technical Advisory Group* in 2015 as best representing California.¹⁶

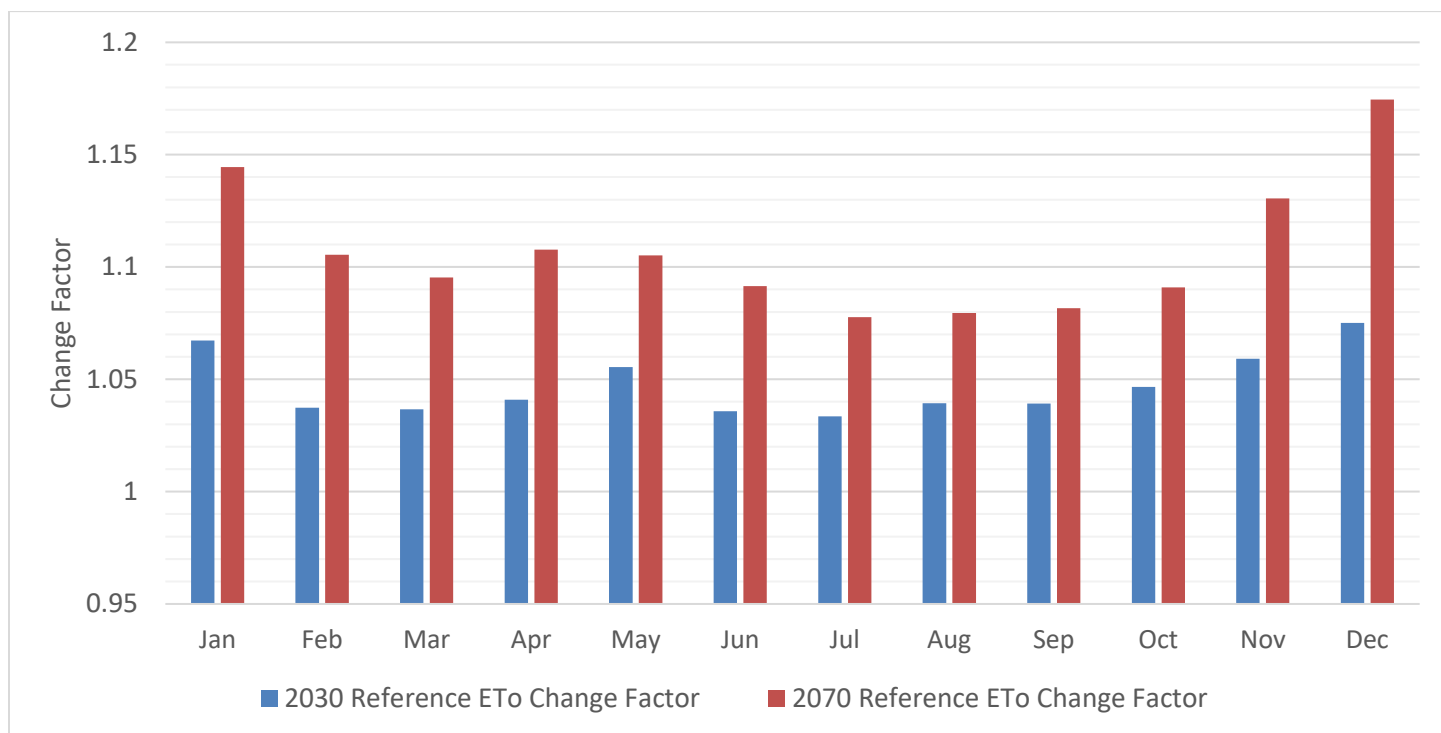
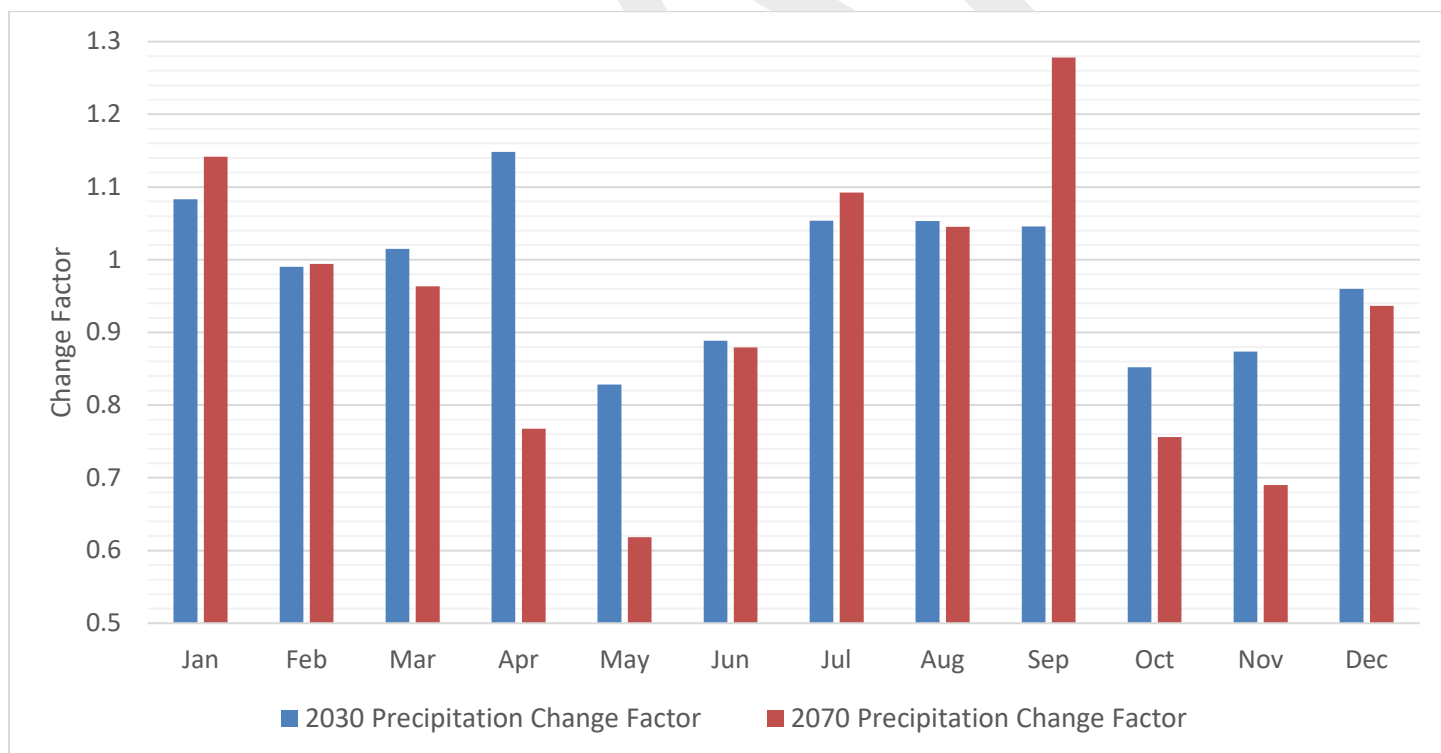
The gridded change factors are provided as a climatological time series by month and year between 1915 and 2011. It is meant to capture how historical weather during the 1915-2011 period in a grid would have been different under expected climate conditions in 2030 and 2070. This format allows groundwater modelers to simulate water budgets under alternative scenarios, such as actual historical weather, or historical weather modified by the change factors to reflect expected 2030 or 2070 weather conditions. This simulation approach preserves historical inter-annual weather variability, allowing for an apples-to-apples comparison across the simulation of alternative scenarios.

To capture expected future weather conditions in the Santa Clarita Valley, change factors for reference ETo and precipitation were downloaded for the two grids that cover the SCV Water service area (Grid ID# 10052 & Grid ID# 10134) and averaged. With the goal of demand forecasting at a future point in time instead of simulating the impact of inter-year variability on a groundwater budget, the change factors were averaged by month across the 1980-2010 period which worked out to 1995, the beginning of the demand modeling period. Figure E-1 shows monthly factors by which reference ETo is expected to be higher relative to 1995 in both year 2030 and year 2070. Figure E-2 shows the same for precipitation. Change factors are multipliers; thus, a factor of 1.0 would mean no change.

¹⁴ GSI Water Solutions, Inc. (2020). *Development of a Numerical Groundwater Flow Model for the Santa Clara River Valley East Groundwater Subbasin*, Draft Report prepared for SCV Water.

¹⁵ The SGMA data viewer and download tool is available at [SGMA Data Viewer \(ca.gov\)](https://sgma.ca.gov/). A detailed description of these data resources and how to use them is included in the following report: Department of Water Resources (2018). *Guidance for Climate Change Data Use During Groundwater Sustainability Plan Development*.

¹⁶ Department of Water Resources and Climate Change Technical Advisory Group. (2015). *Perspectives and Guidance for Climate Change Analysis*.

Figure E-1. Monthly Reference ETo Change Factors**Figure E-2. Monthly Precipitation Change Factors**

These climate change factors suggest that the monthly reference ETo in the Santa Clarita Valley is expected to be higher by approximately 5% in 2030, and 10% in 2070. Although by 2070, winter months would have experienced sharper warming than other months. With respect to precipitation, climate change is not expected to have much effect on the primary rainy months in the Santa Clarita Valley (December-March) and summer

months may actually see a mild increase in precipitation. Overall, climate change is expected to have a more material impact on reference ETo than precipitation.

To develop a climate change scenario that represents the land-use analysis' end-point of 2050, the change factors for 2030 and 2070 were averaged since the midpoint of this period coincided with 2050. This exercise yielded 12 monthly change factors each for reference ETo and precipitation. The econometric demand model was constructed at a monthly time step and used reference ETo and precipitation to model the impact of weather. So, incorporating these change factors was straightforward.

These change factors were fed into the econometric model to forecast what demand would have been in 2018 and 2019 under projected 2050 weather conditions. The model also was used to forecast what demand would have been in 2018 and 2019 under baseline normal weather conditions. The starting point of the baseline demand forecast was estimated from the weather normalized average of 2018 and 2019 demand.

The difference worked out to a projected increase of 3.77% on total production. In other words, if 2050 weather were present in 2018 and 2019, on average demand would have been 3.77% higher across the two years as compared to normal weather. As described in Appendix D, this increase, however, is expected to arrive gradually over time, essentially starting with a 0% impact in 2020 rising to 3.77% in 2050. Between these two bracketing years (2020 and 2050) the impact of climate change is layered linearly on to the baseline demand forecast.

APPENDIX F – PASSIVE CONSERVATION SAVINGS BASIS

This appendix presents the methodology used to determine passive water savings in the SCV Water Three Water Divisions DSS Model and in the LACWD DSS Model, information regarding national and state plumbing codes, and key inputs and assumptions used in the DSS Model including fixture replacement and estimates. Note that the DSS Model does not assess passive water savings for outdoor use. It focuses on plumbing code change impacts on indoor fixtures. However, the DSS Model does incorporate impacts of outdoor code changes, such as MWELO updates, into active conservation savings analyses.

F.1 Plumbing Code Savings Summary

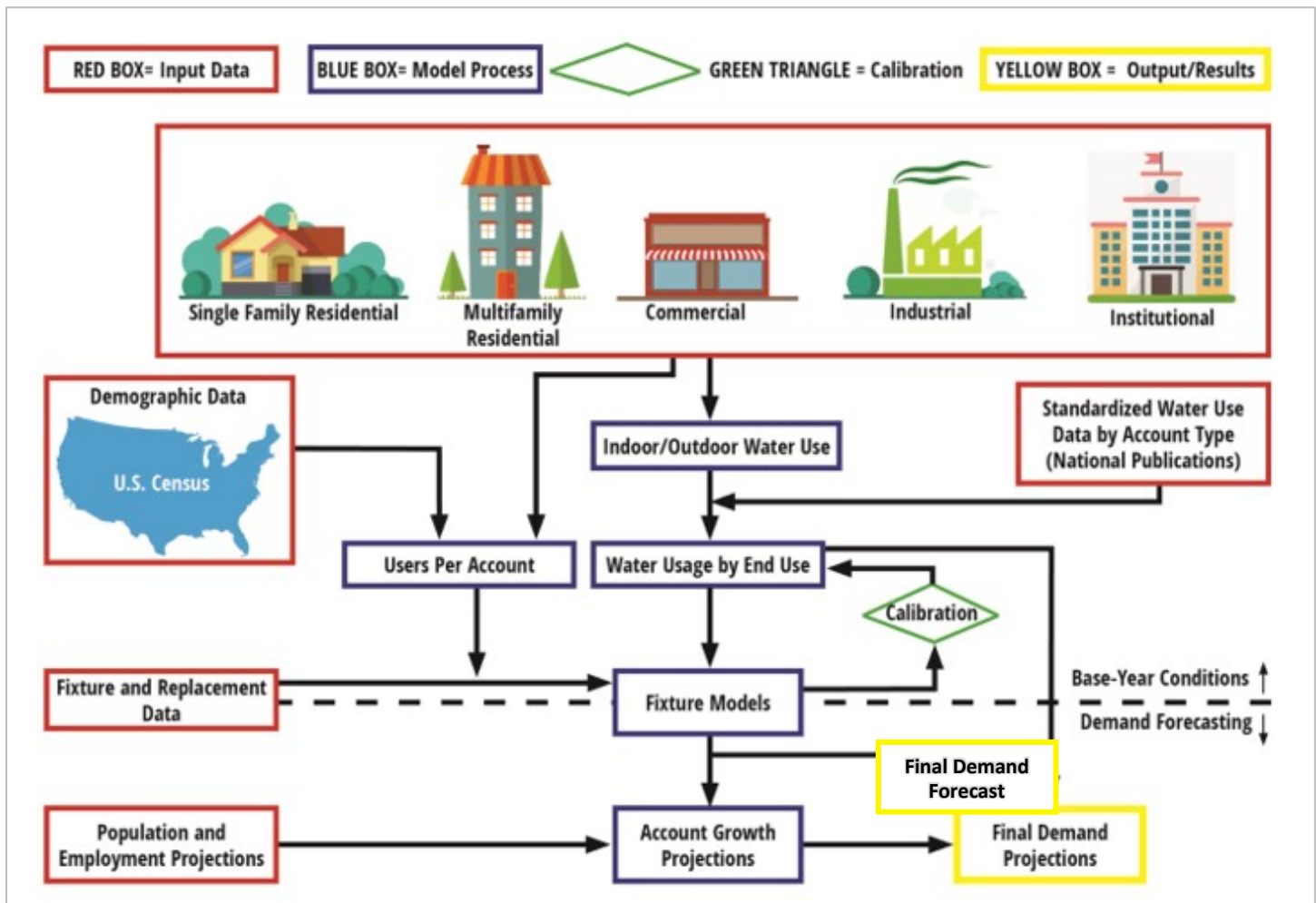
In the codes and standards portion of the DSS Model, specific fixture end-use type (point of use fixture or appliance), average water use, and lifetime are compiled to forecast service area water fixture use. Additionally, state and national plumbing codes and appliance standards for toilets, urinals, showers, and clothes washers are modeled by customer category. This approach yields two distinct demand forecasts related to plumbing code savings: 1) with plumbing codes and 2) without plumbing codes. Plumbing code measures are independent of any water use efficiency program and are based on customers following applicable local, state, and federal laws, building codes, and ordinances.

Plumbing code-related water savings are considered “passive” and reliable long-term savings and can be depended upon over time to help reduce overall system water demand. In contrast, water savings are considered “active” if a specific action unrelated to the implementation of codes and standards is taken by SCV Water to accomplish water use efficiency measure savings (e.g., offering turf removal rebates). The DSS Model incorporates the following items as a “code,” meaning that the savings are assumed to occur and therefore are “passive” savings:

- The Federal Energy Policy Act of 1992 (amended in 2005)
- California Code of Regulations Title 20 California State Law (Assembly Bill 715)
- California State Law Senate Bill 407
- 2015 California Code of Regulations Title 20 Appliance Efficiency Regulations
- 2019 CALGreen Code (effective January 1, 2020)

Figure F-1 conceptually describes how plumbing codes using “fixture models” are incorporated into the flow of information in the DSS Model. The demand forecast, including plumbing code savings, further assumes no active involvement by SCV Water, and that the costs of purchasing and installing replacement equipment (and new equipment in new construction) are borne solely by the customers, occurring at no SCV Water expense.

Figure F-1. DSS Model Overview Used to Make Water Demand Forecast



The inverse of the fixture life is the natural replacement rate expressed as a percent (i.e., 10 years is a rate of 10% per year).

F.2 National Plumbing Code

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

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

Replacement of fixtures in existing buildings is also governed by the Federal Energy Policy Act, which mandates that only devices with the specified level of efficiency (as shown above) can be sold as of 2006. The net result of the plumbing code is that new buildings will have more efficient fixtures and old inefficient fixtures will slowly be replaced with new, more efficient models. The national



plumbing code is an important piece of legislation and must be carefully taken into consideration when analyzing the overall water efficiency of a service area.

In addition to the plumbing code, the U.S. Department of Energy regulates appliances, such as residential clothes washers, further reducing indoor water demands. Regulations to make these appliances more energy efficient have driven manufactures to dramatically reduce the amount of water these machines use. Generally, front-loading washing machines use 30-50% less water than conventional (top-loading) models, which are still available but are becoming more water efficient.

In this analysis, the DSS Model forecasts a gradual transition to high efficiency clothes washers (using 12 gallons or less) so that by the year 2025 that will be the only type of machine available for purchase. In addition to the industry becoming more efficient, rebate programs for washers have been successful in encouraging customers to buy more water efficient models. Given that machines last about 10 years, eventually all machines on the market will be the more water efficient models. Energy Star washing machines have a water factor of 6.0 or less – the equivalent of using 3.1 cubic feet (or 23.2 gallons) of water per load. The maximum water factor for residential clothes washers under current federal standards is 6.5 (equates to approximately 19 gallons per load based on an average 2.9 cubic ft. tub). The water factor equals the number of gallons used per cycle per cubic foot of capacity.

Water Factor (WF) = gallons per load/tub volume

OR

washer capacity (cubic ft.)/average tub volume

Prior to the year 2000, the water factor for a typical new residential clothes washer was around 12 (equates to approximately 35 gallons per load based on an average 2.9 cubic ft. tub). In March 2015, the federal standard reduced the maximum water factor for top- and front-loading machines to 8.4 and 4.7, respectively. In 2018, the maximum water factor for top-loading machines was further reduced to 6.5. For commercial washers, the maximum water factors were



reduced in 2010 to 8.5 and 5.5 for top- and front-loading machines, respectively. Beginning in 2015, the maximum water factor for Energy Star certified washers was 3.7 for front-loading and 4.3 for top-loading machines. In 2011, the U.S. Environmental Protection Agency estimated that Energy Star washers comprised more than 60% of the residential market and 30% of the commercial market (Energy Star, 2011). A new Energy Star compliant washer uses about two-thirds less water per cycle than washers manufactured in the 1990s.

F.3 State Plumbing Code

This section describes California state codes applicable to SCV Water's water use.

F.3.1 California State Law – AB 715

Plumbing codes for toilets, urinals, showerheads, and faucets were initially adopted by California in 1991, mandating the sale and use of ultra-low flush toilets (ULFTs) using 1.6 gpf, urinals using 1 gpf, and low-flow showerheads and faucets. AB 715 led to an update to California Code of Regulations Title 20 (see Section F.3.3) mandating that all toilets and urinals sold and installed in California as of January 1, 2014 must be high efficiency versions having flush ratings that do not exceed 1.28 gpf (toilets) and 0.5 gpf (urinals).

F.3.2 California State Laws – SB 407 and SB 837

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

F.3.3 2019 CALGreen and 2015 CA Code of Regulations Title 20 Appliance Efficiency Regulations

Fixture characteristics in the DSS Model are tracked in new accounts, which are subject to the requirements of the 2019 California Green Building Code and 2015 California Code of Regulations Title 20 Appliance Efficiency Regulations adopted by the California Energy Commission (CEC) on September 1, 2015. The CEC 2015 appliance efficiency standards apply to the following new appliances, if they are sold in California: showerheads, lavatory faucets, kitchen faucets, metering faucets, replacement aerators, wash fountains, tub spout diverters, public lavatory faucets, commercial pre-rinse spray valves, urinals, and toilets. The DSS Model accounts for plumbing code savings due to the effects these standards have on showerheads, faucet aerators, urinals, toilets, and clothes washers.

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



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

Standards for **residential clothes washers** fall under the regulations of the U.S. Department of Energy. In 2018, the maximum water factor for standard top-loading machines was reduced to 6.5.

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

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

F.4 Key Baseline Potable Demand Inputs, Passive Savings Assumptions, and Resources

The following tables present the key assumptions and references that are used in the DSS Model in determining projected demands with plumbing code savings. The assumptions having the most dramatic effect on future demands are the natural replacement rate of fixtures, how residential or commercial future use is projected, and the percent of estimated real water losses.

Table F-1. List of Key Assumptions

Parameter	Model Input Value, Assumptions, and Key References			
	SCV3		LACWD	
Model Start Year for Analysis	2020		2020	
Water Demand Factor Year (Base Year)	2018 & 2019 (adjusted)		2018 & 2019 (adjusted)	
Population Projection Source	Land-use-based analysis including specific development plans provided by City and County Planning and OVOV		OVOV	
Potable Water System Base Year Water Use Profile – SCV Water’s Three Water Divisions				
Customer Categories	Start Year Accounts	Total Water Use Distribution	Demand Factors (gpd/acct)	Indoor Use %
	SCV Water	SCV Water	SCV Water	SCV Water
Single Family Existing	60,767	52.4%	480	46%
Multifamily Existing	5,403	8.7%	894	83%
Commercial	2,034	7.8%	2,125	59%
Industrial	406	2.0%	2,735	43%
Institutional	253	3.0%	6,573	25%
Dedicated Irrigation	2,739	22.0%	4,482	0%

Other	672	3.4%	2,811	0%
New Single Family Indoor	174	0.1%	237	100%
New Single Family Outdoor	174	0.1%	362	0%
New Multifamily Indoor	858	0.2%	143	100%
New Multifamily Outdoor	858	0.4%	230	0%
Total/Avg	73,306	100%	N/A	N/A
Potable Water System Base Year Water Use Profile – LACWD				
Customer Categories	Start Year Accounts	Total Water Use Distribution	Demand Factors (gpd/acct)	Indoor Use %
	LACWD	LACWD	LACWD	LACWD
Single Family	1,332	92.0%	572	53%
Multifamily	1	1.9%	15,516	89%
Commercial	9	0.4%	362	54%
Institutional	9	5.4%	4,937	22%
Other	5	0.3%	0	0%
Total/Avg	1,356	100%	N/A	N/A

Table F-2. Key Assumptions Resources

Parameter	Resource
Residential End Uses	Key Reference: CA DWR Report "California Single Family Water Use Efficiency Study," (DeOreo, 2011 – Page 28, Figure 3: Comparison of household end uses) and AWWA Research Foundation (AWWARF) Report "Residential End Uses of Water, Version 2 - 4309" (DeOreo, 2016). Table 2-A. Water Consumption by Water-Using Plumbing Products and Appliances - 1980-2012. PERC Phase 1 Report. Plumbing Efficiency Research Coalition. 2013. http://www.map-testing.com/content/info/menu/perc.html Model Input Values are found in the "End Uses" section of the DSS Model on the "Breakdown" worksheet.

Parameter	Resource
Non-Residential End Uses, percent	Key Reference: AWWARF Report "Commercial and Institutional End Uses of Water" (Dziegielewski, 2000 – Appendix D: Details of Commercial and Industrial Assumptions, by End Use). Santa Clara Valley Water District Water Use Efficiency Unit. "SCVWD CII Water Use and Baseline Study." February 2008. Model Input Values are found in the "End Uses" section of the DSS Model on the "Breakdown" worksheet.
Efficiency Residential Fixture Current Installation Rates	U.S. Census, Housing age by type of dwelling plus natural replacement plus rebate program (if any). Key Reference: GMP Research, Inc. (2019). 2019 U.S. WaterSense Market Penetration Industry Report. Key Reference: Consortium for Efficient Energy (www.cee1.org). Model Input Values are found in the "Codes and Standards" green section of the DSS Model by customer category fixtures.
Water Savings for Fixtures, gal/capita/day	Key Reference: AWWARF Report "Residential End Uses of Water, Version 2 - 4309" (DeOreo, 2016). Key Reference: CA DWR Report "California Single Family Water Use Efficiency Study" (DeOreo, 2011 – Page 28, Figure 3: Comparison of household end uses). Key Reference: California Energy Commission, Staff Analysis of Toilets, Urinals and Faucets, Report # CEC-400-2014-007-SD, 2014. Model Input Values are found in the "Codes and Standards" green section on the "Fixtures" worksheet of the DSS Model.
Non-Residential Fixture Efficiency Current Installation Rates	Key Reference: 2010 U.S. Census, Housing age by type of dwelling plus natural replacement plus rebate program (if any). Assume commercial establishments built at same rate as housing, plus natural replacement. California Energy Commission, Staff Analysis of Toilets, Urinals and Faucets, Report # CEC-400-2014-007-SD, 2014. Santa Clara Valley Water District Water Use Efficiency Unit. "SCVWD CII Water Use and Baseline Study." February 2008. Model Input Values are found in the "Codes and Standards" green section of the DSS Model by customer category fixtures.
Residential Frequency of Use Data, Toilets, Showers, Faucets, Washers, Uses/user/day	Key Reference: AWWARF Report "Residential End Uses of Water, Version 2 - 4309" (DeOreo, 2016). Summary values can be found in the full report: http://www.waterrf.org/Pages/Projects.aspx?PID=4309 Key Reference: California Energy Commission, Staff Analysis of Toilets, Urinals and Faucets, Report # CEC-400-2014-007-SD, 2014. Key Reference: Alliance for Water Efficiency, The Status of Legislation, Regulation, Codes & Standards on Indoor Plumbing Water Efficiency, January 2016. Model Input Values are found in the "Codes and Standards" green section on the "Fixtures" worksheet of the DSS Model and confirmed in each "Service Area Calibration End Use" worksheet by customer category.

Parameter	Resource
Non-Residential Frequency of Use Data, Toilets, Urinals, and Faucets, Uses/user/day	Key References: Estimated based on AWWARF Report "Commercial and Institutional End Uses of Water" (Dziegielewski, 2000 – Appendix D: Details of Commercial and Industrial Assumptions, by End Use). Key Reference: California Energy Commission, Staff Analysis of Toilets, Urinals and Faucets, Report # CEC-400-2014-007-SD, 2014. Fixture uses over a 5-day work week are prorated to 7 days. Non-residential 0.5gpm faucet standards per Table 2-A. Water Consumption by Water-Using Plumbing Products and Appliances - 1980-2012. PERC Phase 1 Report. Plumbing Efficiency Research Coalition, 2012. http://www.map-testing.com/content/info/menu/perc.html Model Input Values are found in the "Codes and Standards" green section on the "Fixtures" worksheet of the DSS Model and confirmed in each "Service Area Calibration End Use" worksheet by customer category.
Natural Replacement Rate of Fixtures (percent per year)	Residential Toilets 2%-4%
	Non-Residential Toilets 2%-3%
	Residential Showers 4% (corresponds to 25-year life of a new fixture)
	Residential Clothes Washers 10% (based on 10-year washer life). Key References: "Residential End Uses of Water" (DeOreo, 2016) and "Bern Clothes Washer Study, Final Report" (Oak Ridge National Laboratory, 1998).
	Residential Faucets 10% and Non-Residential Faucets 6.7% (every 15 years). CEC uses an average life of 10 years for faucet accessories (aerators). A similar assumption can be made for public lavatories, though no hard data exists and since CII fixtures are typically replaced less frequently than residential, 15 years is assumed. CEC, Analysis of Standards Proposal for Residential Faucets and Faucet Accessories, a report prepared under CEC's Codes and Standards Enhancement Initiative, Docket #12-AAER-2C, August 2013. Model Input Value is found in the "Codes and Standards" green section on the "Fixtures" worksheet of the DSS Model.
Residential Future Water Use	Increases Based on Population Growth and Demographic Forecast
Non-Residential Future Water Use	Increases Based on Employment Growth and Demographic Forecast

F.4.1 Fixture Estimates

Determining the current level of efficient fixtures in a service area while evaluating the passive savings in the DSS Model is part of the standard process and is called "initial fixture proportions." As described earlier, MWM reconciled water efficient fixtures and devices installed within the service area and estimated the number of outstanding inefficient fixtures.

MWM used the DSS Model to perform a saturation analysis for toilets, urinals, showerheads, faucets, and clothes washers. The process included a review of age of buildings from census data, number of rebates per device, and assumed natural replacement rates. MWM presumed the fixtures that were nearing saturation and worth analysis would include residential toilets and residential clothes washers, as both have been included in recommended water use efficiency practices for over two decades.

In 2014, the Water Research Foundation updated its 1999 Residential End Uses of Water Study (REUWS). Water utilities, industry regulators, and government planning agencies consider it the industry benchmark for single family home indoor water use. This Plan incorporates recent study results that reflect the change to the water use profile in residential homes including adoption of more water efficient fixtures over the 15 years that transpired from 1999 to 2014. REUWS results were combined with SCV Water's historical rebate and billing data to enhance and verify assumptions made for all customer accounts, including saturation levels on the above-mentioned plumbing fixtures.

The DSS Model presents the estimated current and projected proportions of these fixtures by efficiency level within SCV Water's service area. These proportions were calculated by:

- Using standards in place at the time of building construction,
- Taking the initial proportions of homes by age (corresponding to fixture efficiency levels),
- Adding the net change due to natural replacement, and
- Adding the change due to rebate measure minus the "free rider effect."

Further adjustments were made to initial proportions to account for the reduction in fixture use due to lower occupancy and based on field observations. The projected fixture proportions do not include any future active water use efficiency measures implemented by SCV Water. More information about the development of initial and projected fixture proportions can be found in the DSS Model "Codes and Standards" section.

The DSS Model is capable of modeling multiple types of fixtures, including fixtures with different designs. For example, currently toilets can be purchased that flush at a rate of 0.8 gpf, 1.0 gpf or 1.28 gpf. The 1.6 gpf and higher toilets still exist but can no longer be purchased in California. Therefore, they cannot be used for replacement or new installation of a toilet. So, the DSS Model utilizes fixture replacement rates to determine what type of fixture should be used for a new construction installation or replacement. The replacement of the fixtures is listed as a percentage within the DSS Model. A value of 100% would indicate that all the toilets installed would be of one particular flush volume. A value of 75% means that three out of every four toilets installed would be of that particular flush volume. All the Fixture Model information and assumptions were carefully reviewed and accepted by SCV Water staff.

The DSS Model provides inputs and analysis of the number, type, and replacement rates of fixtures for each customer category (e.g., single family toilets, commercial toilets, residential clothes washing machines.). For example, the DSS Model incorporates the effects of the 1992 Federal Energy Policy Act and AB 715 on toilet fixtures. A DSS Model feature determines the "saturation" of 1.6 gpf toilets as the 1992 Federal Energy Policy Act was in effect from 1992-2014 for 1.6 gpf toilet replacements. AB 715 now applies for the replacement of toilets at 1.28 gpf. Further consideration and adjustments were made to replacement rates to account for the reduction in fixture use and wear, due to lower occupancy and based on field observations.

APPENDIX G – ACTIVE CONSERVATION SAVINGS BASIS

This analysis included SCV Water’s current active water conservation measures. There are 3 codes and 17 measures included in the active conservation portion of the DSS Model, adding savings to the indoor plumbing code measures included in the passive savings section of the modeling. Depending on the measure analyzed, different customer classes are selected. For example, the DSS Model tracks both new and existing SF and MF customer categories separately, and not every measure that targets existing SF would apply to new SF. New residential accounts are assumed to be efficient and not targeted for indoor efficiency measures. Measure participation/activity and costs were developed to align with SCV Water recent participation and budgets. The active conservation measures take into consideration targeted water user group end uses (e.g., single family toilets), utility unit code (e.g., cost of rebate, cost of out-of-house service), retail customer cost (i.e., the remainder of any cost after rebate), and utility admin and marketing costs. Current measures were only analyzed for SCV Water; no active conservation savings are estimated for LACWD in this effort. SCV efforts that target LACWD's customers are included in the SCV active conservation program budget and savings. See Table G-1 for a breakdown of savings and costs.

Table G-1. Current Active Conservation Program Analysis Results

Savings/Costs	Total
Average Water Savings*	8,800 AFY
Cost of Savings per Unit Volume	\$550/AF
2021 Utility Cost	\$8,607,000
2021 Utility Cost (excluding admin cost)	\$7,742,000
2021 Water Savings	2,200 AFY
2050 Water Savings	14,100 AFY

Notes:

1. Values are based on current active conservation program.
2. Values are rounded to the nearest 100 AFY and \$50.

Included in the current active conservation program are the following measures (*indicates a code):

- Fixture Retrofit on Resale or Water Account Change*
- New Development Submetering*
- Landscape & Irrigation Codes*
- Water Waste Implementation
- AMI
- Real Water Loss Reduction
- Education
- Water Smart Workshop Credit
- Landscape Transformation Incentives
- Smart Controller Rebates
- Irrigation Incentives
- Irrigation Check-Ups
- Pool Cover Rebates
- Residential Check-Ups
- Hot Water on Demand Rebate
- CII Check-Ups
- CII HET and HEU Rebates
- High Efficiency Fixture Giveaway
- Schools Retrofits

The active conservation methodology is an update from SCV Water’s 2016 Water Use Efficiency Strategic Plan. LACWD participation rates are included. SCV Water is looking to track and monitor production data along with consumption by customer category and overall alignment with the upcoming regulations for the 2018 Water Conservation Legislation entitled “Making Water Conservation a California Way of Life.”

APPENDIX H – RESIDENTIAL AND NON-RESIDENTIAL OUTDOOR WATER USE STUDY – DRAFT TECHNICAL MEMORANDUM



WESTERN
POLICY
RESEARCH



MADDAUS
WATER
MANAGEMENT INC.

Technical Memorandum – DRAFT

Date: April 15, 2021
To: Dirk Marks and Rick Vasilopoulos, Santa Clarita Valley Water Agency
From: Anil Bamezai, Western Policy Research
Lisa Maddaus, Maddaus Water Management Inc.
Title: Draft Residential and Non-Residential Outdoor Water Use Research Study

1. INTRODUCTION

Western Policy Research (WPR) and Maddaus Water Management Inc. (MWM) worked together as the project team to provide research and modeling assistance for this Outdoor Water Use Research Study (Study). The goal of the Study was to determine if actual irrigation water use in permitted landscapes is consistent with projected Model Water Efficient Landscape Ordinance (MWELO)¹ water budgets in the Santa Clarita Valley. The Study was undertaken to better understand the outdoor water use of existing residential and non-residential accounts in order to refine future outdoor water demand of planned dwelling units and non-residential developments.

Santa Clarita Valley Water Agency (SCV Water) is responsible for meeting current and future water demands. To estimate water demands, SCV Water collects planning information from developers operating in the Santa Clarita Valley including expected lot size and landscape area of new single family homes. The responsibility of ensuring permitted landscapes (parcel) adhere to the California MWELO requirements belongs to the land use authority for the parcel. In this case, a parcel's landscape must be approved by either the City of Santa Clarita or Los Angeles County Planning Department.

The planning data in recent years have indicated a trend toward increased densification of single family housing development in the future. Increased densification results in smaller lot sizes, smaller landscaped areas, and reduced use of turf. Due to this change in trend, SCV Water wanted to confirm the accuracy of establishing future water demand through a linear extrapolation of per-account single family historical water demand.

For non-residential accounts, there was interest in determining outdoor water use relative to landscaped area in Commercial, Industrial, and Institutional (CII) categories that include numerous small accounts. Large CII customers (i.e., hospitals, schools, universities, etc.) were not included in the Study because, at the time of permitting new large CII customers, it is possible to project baseline water demand using historical usage of similar large CII customers, with suitable adjustments. Multifamily housing was also excluded from this study because, while multifamily housing may become a larger portion of the total housing stock in the future, it is not expected to increase in density. Therefore, baseline demand for future multifamily housing or large CII customers can be established by extrapolating historical trends in a more reliable way for potentially applicable new policy guidelines.

WPR and MWM collaborated with SCV Water's Water Resources, Water Use Efficiency, and Geographic Information Systems (GIS) staff to design and implement the technical analysis based on best available

¹ More information on the MWELO is published on the California Department of Water Resources website:
<https://water.ca.gov/Programs/Water-Use-And-Efficiency/Urban-Water-Use-Efficiency/Model-Water-Efficient-Landscape-Ordinance>

information. The benefit of this Study is to determine more accurate outdoor water use estimates by factoring in reduced landscape area and increased landscape efficiency required by the currently mandated 2015 MWELo guidelines.

To summarize, this Study attempts to address the following questions:

1. How much water is being used outdoors relative to landscape and reference ETo by existing single family residential and small CII accounts?
2. Is there a difference in applied irrigation for single family accounts that were built when different MWELo guidelines were in place?

2. BACKGROUND

MWELo was created by the California Department of Water Resources (DWR) to promote water efficiency in landscape irrigation. It is a model for local agencies to enforce minimum standards in landscape design, providing a path to design, install, manage, and maintain landscapes that conserve water. MWELo aims to achieve this through specific requirements related to soil, plants, irrigation, stormwater, and non-potable water supplies. It sets an upper limit for the water budgets of landscape projects, thereby driving water efficiency through the thoughtful selection of climate-appropriate plants, organic soil amendments, water-saving irrigation devices, and the use of alternative water supplies. MWELo requires land use authorities to only permit landscapes of a certain size depending on land use type (i.e., 500 square feet and larger) as a policy to encourage less water use than the upper limit of the permitted, designed water budget. It also encourages the innovation of landscaping equipment, products, and materials that use resources as efficiently as possible. The actual water use by the customer once the landscape is installed and maintained has yet to be studied in the SCV Water service area.

MWELo guidelines have been revised over for the past several decades as documented in the DWR Guidelines for MWELo.² The original MWELo was adopted in 1992 as Assembly Bill 325 and allowed landscapes to be built with a maximum water allowance (MAWA) of 80% of reference ETo. This level of reference ETo was heavily lobbied by the turf industry and, at that time, was essentially the same ETo as cool season turfgrass. This created a policy with a generous water budget and enforcement was thought to be inconsistent around the state. The MWELo guidelines were studied by a task force established with Assembly Bill 2717 and revised by Assembly Bill 2515. This led to a revised MWELo post-drought in 2009 then again in 2015 during California's most recent and more severe drought. Between 2009 and 2015, MAWA was reduced to 70% of reference ETo for residential and CII landscapes. After 2015, MWELo applied to smaller permitted, irrigated landscape areas and MAWA was reduced to 55% of reference ETo for residential landscapes and 45% for non-residential landscapes.

In addition to refining outdoor water demand of planned construction, the Study was designed to determine if, and to what extent, the increasing specification in landscape design guidelines had influenced outdoor use in existing single family housing and non-residential properties.

With over 65% of total SCV water used outdoors in 2020, this effort was undertaken to better understand the outdoor water use of existing residential and non-residential accounts in order to refine future outdoor water demand of planned dwelling units and non-residential developments. Furthermore, there is a need to assess

² DWR. (2015). *Model Water Efficient Landscape Ordinance Guidebook*. <https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Water-Use-And-Efficiency/Urban-Water-Use-Efficiency/MWELo-Files/MWELo-Guidebook/1-Model-Water-Efficient-Landscape-Ordinance-Guidebook.pdf>

future outdoor water use demand factors for new development impact fees. This effort also provides useful context for understanding the legacy residential and non-residential benefits from MWELo and can determine if higher outdoor demands should be considered due to changes in landscape demand over time as irrigation systems age and landscape practices and plant choices shift.

3. ANALYTICAL APPROACH

A representative sample of existing accounts were studied for both residential and non-residential sectors, and were selected for landscape measurement designed to produce statistically significant results. The effort was focused on randomly selecting parcels, measuring their landscape area by plant type from aerial imagery, then matching these accounts with their respective billing histories to yield estimates of outdoor water use in applied inches. These findings were then compared to maximum allowable water use per the most recent 2015 MWELo guidelines. The end result is to then understand consistency and compliance with MWELo projections and regulations, and better inform future SCV Water Outdoor Water Demand planning and policy.

Data Inventory and Collection

SCV Water staff provided an existing parcel database that was compiled during an earlier project. This database included lot size, construction year, and land use category for all SCV Water parcels. Using this database, the project team isolated the land use categories of interest including single family accounts, detached condominiums, and CII categories with small accounts. From the target land use categories, a subset of developed parcels was selected for landscape measurement using a stratified sampling approach because landscape area exhibits a skewed statistical distribution. When a small portion of all parcels account for most of the total landscape area in that category, stratification can help to reduce overall sample size requirements and study costs.

Residential Accounts Sample Size Design

In the residential sector, stratification by Traffic Analysis Zone (TAZ) land use categories implicitly amounts to stratification by lot size, with the larger lot size categories being oversampled relative to their proportion in the population of all residential parcels. The distribution of landscape area is skewed with the larger lots accounting for a disproportionate share of landscape area in the residential sector. In such a situation, stratified sampling makes the study design more cost effective.

The single family (sf) and detached condominium (detcondo) land use categories were stratified based on lot size and construction year. Land use categories were aligned with TAZ land use types in order to derive landscape areas and irrigation factors to apply in the Land-Use-Based Water Demand Study,³ which sorts and tracks new development by TAZ land use area. The TAZ land use types also align with the scheme developers use to report development plans. This alignment ensured the results generated by this Study could be directly associated with developer planning and reporting data provided to SCV Water. For example, a developer may report a plan to build 300 single family units at a density of 10 units per acre and 5 units at a density of 1 unit per acre. This nomenclature was operationalized using lot size cutoffs as shown in Table 1. The construction year stratification was undertaken to evaluate the impact on outdoor water use of tightening MWELo requirements over time. The construction year age bands were defined as follows: those built prior to 2009,

³ SCV Water Draft Technical Memorandum – SCV Demand Study: Land-Use-Based Demand Forecast Analysis, dated April 13, 2021.

those built between 2009 and 2015; and those built after 2015. Table 1 identifies the number of parcels that align into each stratification band for SCV Water's service area and the study sample set.

Table 1. Residential Data Sample Summary

Parcel Size Stratification Categories	Stratification in Terms of Density (Units/Acre)	Stratification in Terms of Parcel Square Footage	Construction Age Stratification	Number of Parcels in SCV Water's Service Area	Number of Parcels with Landscape Measurements	Number of Parcels with Landscape Measurements & Water Use Data
Detached Condo (detcondo1)	>10 units/acre	<4,356 sqft	2009-2015	397	17	2
			post-2015	315	20	2
			pre-2009	1,798	38	17
Detached Condo (detcondo2)	6-10 units/acre	4,356-7,260 sqft	2009-2015	217	26	4
			post-2015	176	22	8
			pre-2009	1,786	32	11
Detached Condo (detcondo3)	<=5 units/acre	>7,260 sqft	2009-2015	60	21	3
			post-2015	71	18	5
			pre-2009	1,386	32	22
Single Family (sf1)	>10 units/acre	<4,356 sqft	2009-2015	129	10	9
			post-2015	8	6	6
			pre-2009	3,194	10	7
Single Family (sf2)	6-10 units/acre	4,356-7,260 sqft	2009-2015	1,174	100	81
			post-2015	300	31	22
			pre-2009	24,009	99	84
Single Family (sf3)	2-5 units/acre	7,260-43,560 sqft	2009-2015	771	118	97
			post-2015	181	39	31
			pre-2009	21,548	99	89
Single Family (sf4)	1 unit/acre	>43,560 sqft	2009-2015	34	13	9
			post-2015	4	4	3
			pre-2009	1930	112	87
Totals				59,488	867	599

Non-Residential Accounts Sample Size Design

A skewed pattern similar to residential land use categories also exists among the non-residential land use categories. Therefore, to address this pattern in CII categories, an 80-20 stratification by lot size was undertaken. Parcels falling in the top 20% of the lot-size distribution were over-sampled; those falling in the bottom 80% were under-sampled. Table 2 details the number of samples included in the study calculations including commercial (comm), industrial (ind), institutional (inst), and dedicated irrigation meter (lmd) accounts.

It became very difficult to align county assessor parcel boundaries with dedicated irrigation landscapes and billing history data since it required detailed fieldwork to determine what area an irrigation meter actually covered. For these reasons, the final sample set in the dedicated irrigation category ended up being very small even though 20 parcels were sampled at random from the bottom 80% and 20 from the top 20% coded as "lmd"

parcels. None of the parcels selected from the bottom 80% of dedicated irrigation meter accounts could be aligned with meters, so the applied inches estimate for the top 20% of the dedicated irrigation meter accounts was applied to the entire “lmd” sector. The age-based stratification was not feasible for the CII strata because most of these properties were constructed prior to 2009.

Table 2. Non-Residential Data Sample Summary

Parcel Size Stratification Categories	Number of Parcels in SCV Water’s Service Area	Number of Parcels With Landscape Measurements	Number of Parcels With Landscape Measurements & Water Use Data
Commercial – Bottom 80% (commbot)	867	29	19
Commercial – Top 20% (commtop)	289	29	20
Industrial – Bottom 80% (indbot)	741	22	17
Industrial – Top 20% (indtop)	247	38	29
Institutional – Bottom 80% (instbot)	51	16	10
Institutional – Top 20% (insttop)	17	8	6
Dedicated Landscape Meter – Bottom 80% (lmdbottom)*	182	1	0
Dedicated Landscape Meter – Top 20% (lmdtop)	60	5	2
Totals	2,454	148	103

*Assumed AI for “lmdtop” also applies to “lmdbottom” sector.

Preparation of Landscape Area Measurements

To ensure any errors in customer classification or parcel boundaries were identified and corrected, selected parcels were pre-screened by SCV Water staff before landscape area measurements were undertaken to ensure efficient use of staff time. Parcels rejected during the pre-screening were replaced with similar randomly selected parcels. As is common practice, parcel boundary rectification is an ongoing internal exercise at SCV Water to remove errors from the Los Angeles County parcel base map and to identify and separate common-area landscapes in HOAs from landscapes tied to individual property water meters.

Comparison to Historical Billing Consumption

Parcels with measured landscape area were matched with their historical billing data for years 2018 and 2019. Not all parcels with measured landscape area had clean and complete billing histories because of occupant turnover, mismatches between assessor parcel numbers and billing system account numbers, or data outliers. Estimation of average landscape area in a stratum is based on all parcels with landscape area measurements that fall into a given strata. However, estimation of outdoor demand factors is based on the subset where both landscape area and billing data are available.

Estimating Residential Outdoor Water Use

For single family accounts, residential indoor water use was calculated based on the people per household (PPH) and indoor gallon per capita per day water use (GPCD).

$$PPH \times GPCD \times 365 \frac{\text{days}}{\text{year}} = \text{Estimated Indoor Water Use Per Parcel Per Year (gal)}$$

A PPH estimate for each water division was compiled from the 2014 Population Assessment and GPCD Review.⁴ The estimate of 63 GPCD for the entire service area was compiled from the DSS Model. Outdoor water use was then calculated by subtracting the estimated indoor water use from the total annual water consumption. The annual outdoor water use was then divided by the parcel measured landscape to calculate the outdoor water use in gallons per square foot and the applied inches of irrigation (AI). This AI estimate was used as the basis for identifying and removing outliers in the data set.

Estimating Non-Residential Outdoor Water Use

For CII accounts, minimum month usage in a year was used as the best estimate of indoor use. Annual outdoor use was estimated by subtracting from annual consumption twelve times the consumption in the minimum month. Factoring in the measured landscape area, outdoor use in gallons was converted to AI.

After the AI was calculated for all parcels in the study and outliers were removed, weighted averages of outdoor water use and landscape area by strata were calculated to derive strata-specific AI values. These strata-specific AI values were compared to the post-2015 MAWA values for residential (55% of ETo⁵) and commercial (45% ETo) categories. Average annual ETo is estimated to be 66.7 inches per year in the Santa Clarita Valley. For the residential and non-residential sectors, post-2015 MAWA works out to roughly 36.7 inches/year and 30 inches/year, respectively.

4. STUDY RESULTS

Table 3 shows estimates of current (i.e., average of 2018 and 2019) irrigation demand in applied inches across the various strata combinations included in this study. The first seven rows of Table 3 show estimates of applied inches by the single family and detached condominium categories, including all years of construction. The next row shows the average of applied inches when all single family homes and detached condominiums are combined into a single category, including all years of construction. This is followed by five rows showing the variation in applied inches by age of construction, but with data pooled across single family and detached condominiums that fall within an age band. The effect of age of construction was designed to be discernible across single family and detached condominium categories pooled together. To design a study where differences by age of construction would be discernible within each single family lot size category and each detached condominium category would have greatly inflated sample size requirements and with it the landscape measurement effort. All the AI estimates were weighted to account for the stratified sampling design.

There was no significant difference observed in outdoor water use between the various strata combinations except for land use category sf3 (2-5 units/acre) constructed after 2015. This specific stratum displayed a significantly lower outside water use of 27.7 applied inches. In discussions with SCV Water staff, it was learned

⁴ CLWA (now SCV Water) Population Assessment and GPCD Review, dated November 20, 2014.

⁵ The 2015 MWELO specifies an ETo value of 61.5 inches for Santa Clarita Valley. However, an ETo of 66.7 inches per year was the 10-year average observed at a monitoring station located at SCV Water's Rio Vista water treatment plant.

that much of the post-2015 construction in this land use category includes the installation of artificial turf in front yards. Installation of artificial turf is not a requirement or initiative of SCV Water and may reflect a construction trend that may or may not continue into the future. Therefore, this stratum was excluded for estimating the existing single family housing stock's current level of applied irrigation.

The weighted average of AI in the residential sector among post-2015 properties (excluding sf3, 2-5 units per acre SF properties) was calculated as 46.4 inches/year (95% confidence interval around this estimate is $\pm 6\%$), or 26.5% over the expected MAWA AI of 36.7 inches per year. This, then, is the best estimate of how much water is presently being used outdoors given current irrigation practices in SCV Water's service area among single family homes and detached condominiums. Table 3 also shows outdoor demand factors in gallons/account/day calculated using strata-specific estimates of AI as well as the overall best estimate of AI (46.4 inches).

Actual estimated irrigation exceeding post-2015 MAWA can have many explanations (e.g., inefficient irrigation practices, deterioration in irrigation equipment over time such as broken and misaligned sprinkler heads or improper pressure regulation, landscape modifications over time relative to what was initially permitted, etc.). The gap between actual applied irrigation and MAWA also represents a conservation opportunity, to be reclaimed through appropriate programs and regulations.

The weighted average of AI in the non-residential sector was calculated as 37.7 inches/year (95% confidence interval around this estimate is $\pm 16\%$ because of the smaller non-residential sample size) or 25.6% over the expected MAWA AI of 30 inches/year (Table 4).

Baseline outdoor water demand forecasts are generated from demand factors that are estimated from overall average residential and non-residential estimates of applied irrigation (last column of Table 3 and Table 4 labeled MAWA PLUS). These demand factors implicitly include the 26.5% and 25.6% difference between expected outside water use, based on 2015 MWELO MAWA, and the observed outside water use as determined in this study.

Table 3. Residential Land Use Category Outdoor Demand Factor Inputs

Land Use Category	Land Use in Terms of Density (units/acre)	Average Observed Landscape per parcel (sqft)	Post-2015 MAWA, 55% of ETo (inches/year)	Observed Applied Inches in 2018/2019 (inches/year)	Post-2015 MAWA, 55% of ETo + additional Observed Use Factor	Annual Outdoor Demand (gallons/account/day)	MAWA PLUS Annual Outdoor Demand (gallons/account/day)
sf4	1 unit/acre	16,240	36.7	42.6	46.4	1,182	1,287
sf3	2-5 units/acre	4,538	36.7	41.3	46.4	320	360
sf2	6-10 units/acre	2,446	36.7	51.2	46.4	214	194
sf1	>10 units/acre	1,341	36.7	51.2	46.4	117	106
detcondo3	<=5 units/acre	1,682	36.7	38.7	46.4	111	133
detcondo2	6-10 units/acre	933	36.7	46.6	46.4	74	74
detcondo1	>10 units/acre	729	36.7	48.2	46.4	60	58
All sf + detcondo	–	3,467	36.7	44.8	46.4	265	275
All sf + detcondo: pre-2009	–	3,553	36.7	44.7	46.4	271	282
All sf + detcondo: 2009-2015	–	2,579	36.7	49.1	46.4	216	204
All sf + detcondo: post-2015	–	1,583	36.7	39.4	46.4	107	125
Only sf3: post-2015	–	3,952	–	27.7*	–	187	0
All sf + detcondo without sf3: post-2015	–	–	–	46.4 (+26.5%)	–	–	–

Table 4. Non-Residential Land Use Category Outdoor Demand Factor Inputs

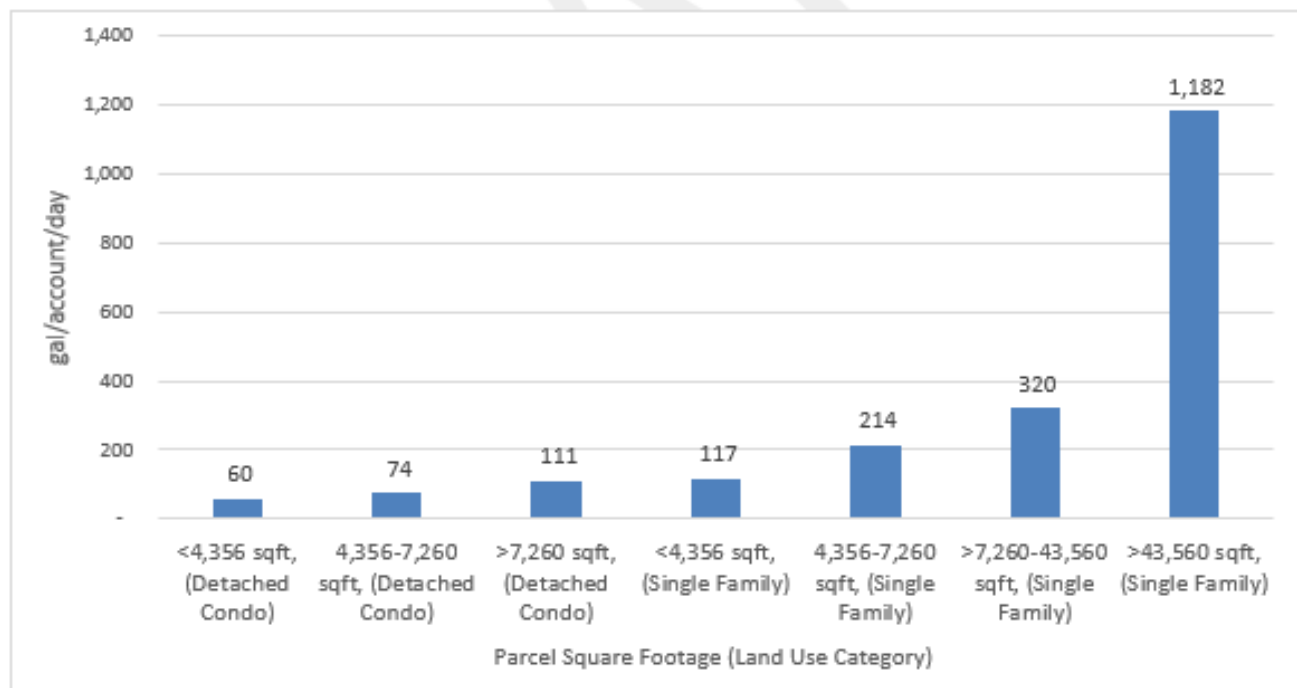
Land Use Category	Land Use in Terms of Density (units/acre)	Average Observed Landscape per Parcel (sqft)	Post-2015 MAWA, 45% of ETo (inches/year)	Observed Applied Inches in 2018/2019 (inches/year)	Post-2015 MAWA, 45% of ETo + Overwatering Factor	Annual Outdoor Demand (gallons/account/day)	MAWA PLUS Annual Outdoor Demand (gallons/account/day)
COMM	–	13,690	30	33.0	37.7	772	881
IND	–	16,164	30	41.0	37.7	1,132	1,040
INST	–	38,607	30	42.7	37.7	2,815	2,484
LMD	–	41,595	30	35.1	37.7	2,496	2,677
All CII	–	–	–	37.7 (+25.6%)	–	–	–

The framework described previously in this section produced a baseline outdoor demand forecast that was more realistic since it accounted for potential overwatering due to irrigation inefficiencies and irrigation device degradation (if developers do not design and install landscapes to standards that account for efficiency losses over time). This overwatering factor was applied to both potable and non-potable new development residential and non-residential irrigated areas. However, the demand and conservation analysis did not stop at this point because the overwatering factor implicitly built into the baseline forecast also offers potential water conservation opportunities. The overwatering could be prevented and converted into conservation savings if a series of explicit programs and regulations are undertaken. Ongoing and future water efficiency program management and planning will consider the steps needed to be undertaken to convert this conservation opportunity into realized savings in the future. Further analysis is planned for the Water Efficiency Program when more information becomes available on future regulations for the 2018 "Making Water Conservation a California Way of Life" legislation.

Until regulations are finalized, SCV Water is planning to continue with its current conservation program design. Conservation modeling results can be found in the Land-Use-Based Water Demand Study TM. The active conservation program will continue to evolve and ultimately provide an update from SCV Water's 2016 Water Use Efficiency Strategic Plan. SCV Water is looking to track and monitor production data along with consumption by customer category and overall alignment with upcoming legislative regulations.

Part of this monitoring and tracking effort will be tracking water use by different land use types, such as water use by lot sizes. Figure 1 illustrates the quantified results showing smaller lots using less water.

Figure 1. Residential Annual Outdoor Demand Factors



5. APPLICATION OF RESEARCH FINDINGS

The findings in this study supported the SCV Water Land-Use-Based Demand Forecast Analysis insofar as providing the fundamental basis for new development outdoor water use. This study provided the following two inputs, as previously explained:

- (1) Average landscape per parcel (sqft) by residential land use types
 - o Values were applied to each new residential development unit land use type and number of units to generate an outdoor landscaped area by residential land use type.
- (2) Applied irrigation in inches (post-2015 MAWA, 55% [or 45%] of ETo + overwatering factor) for all land use types
 - o Values were applied to each new development land use type area to generate an outdoor water use volume by land use type.

In the Land-Use-Based Demand Forecast Analysis, the MAWA PLUS outdoor water use factors were applied to both potable and non-potable new development residential and non-residential irrigated areas.

Again, new residential outdoor demand factors were applied to an estimated residential outdoor irrigated area by residential land use type. New irrigation account demand was derived by applying the adjusted outdoor demand factor from this study to the derived and compiled residential HOA common area and developed park acreages. An additional non-potable irrigation demand, due to potential overwatering from planned recycled water use in new developments because of irrigation equipment device deterioration, was calculated to be included in the total non-potable irrigation demand.

6. CONCLUSIONS AND FUTURE RECOMMENDATIONS

The City of Santa Clarita and Los Angeles County are required to ensure that developers' plans conform to MWELO requirements. In collaboration with SCVWA, it should be confirmed that new developments are designed and constructed to MWELO standards and that actual water use is consistent with design MAWA.

The Study results indicate a need to improve enforcement to the MWELO requirements in new developments and for conducting long term monitoring of water use by SCVWA. To support this, as well as SCV Water's responsibility to maintain reliable water supplies for existing and future developments, a couple questions needed addressing to benchmark existing water use in residential and non-residential landscapes. These questions were successfully addressed through this Study:

1. How much water is being used outdoors relative to landscape and reference ETo by existing single family residential and small CII accounts?
2. Is there a difference in applied irrigation for single family accounts that were built when different MWELO guidelines were in place?

Current irrigation practices in SCV Water's service area indicate that, in general, all residential customer categories use more water than designed permit limits for MAWA provided in the MWELO, including homes built after 2015 to the existing MWELO. The only exception to this finding is the post-2015 single family homes built at a density of 2-5 units per acre; this stratum's outdoor demand falls significantly below the 2015 MAWA, presumed to be due to greater use of artificial turf. Use of artificial turf, however, is not a requirement in SCV

Water's service area or the landscape transformation incentive program. Excluding this stratum, it appears the residential sector uses 26.5% more water, on average, than permitted by the 2015 MAWA.

In addition, this Study confirmed the expected correlation between residential parcel size and quantified outdoor water use insofar as smaller lots use less water. This relates to the development trend toward densification, which has implications for future water demand. The Study provided empirical estimates for forecasting the impact of this expected densification on residential water demand.

Current irrigation practices in the nonresidential sector also indicate that applied water exceeds the MAWA from the 2015 MWELO by roughly the same proportion (25.6%). Actual estimated irrigation exceeding post-2015 MAWA can have many explanations (e.g., inefficient irrigation practices, deterioration in irrigation equipment over time such as broken and misaligned sprinkler heads or improper pressure regulation, landscape modifications over time relative to what was initially permitted, etc.). The gap between actual applied irrigation and MAWA also represents a conservation opportunity, to be reclaimed through appropriate programs and regulations.

Additional research into the outdoor water end use profile would be valuable to determine how much of observed high water use above MAWA is due to irrigation overwatering compared to other outdoor uses. Furthermore, a subsequent study to complement and/or expand upon the research herein might be useful to develop this Study for multifamily as well as to continue work on the SCV Water GIS databases. These research opportunities could serve to align water efficiency policies and further refine information for future planning purposes.

APPENDIX I – NON-POTABLE DEMAND ANALYSIS

SCV Water staff confirmed non-potable demand projections based on the 2016 Recycled Master Plan. Five Point Project non-potable demand by customer category is available in the 2020 GSI Draft TM with the estimated schedule provided by SCV Water staff, which is consistent with the Five Point potable demand development schedule.

An additional non-potable irrigation demand due to potential overwatering from planned recycled water use in new developments for irrigation equipment device deterioration is calculated to be included in the total non-potable irrigation demand. The basis for the overwatering factor is presented in the Outdoor Water Use Study (Appendix H).

An estimated 600 AF of raw water account use conversion to non-potable use volume for the Big V golf course is included. Five Point Project's non-potable demand by customer category is included per the 2020 GSI Draft TM. No NRW is accounted for in the total non-potable demand estimate.

The following table presents a summary of SCV Water's projected non-potable demand.

Table I-1. Recycled Water Demand

	Schedule	Total Annual Demand by 2050 (AF)	Notes
Existing Recycled Water Demand	Ongoing	500	Based on 2019 use. Assumes 450 AF for planning purposes per SCV Water staff.
2016 Recycled Water Master Plan Phase 2C Raw Water	Online 2023	600	Irrigation use for Big V golf course currently served by raw water will be converted to recycled water.
2016 Recycled Water Master Plan Phase 2A	Online 2029	600	Volume does <u>not</u> overlap with Five Point Project.
2016 Recycled Water Master Plan Phases 2D, 2B, and 2C	Online 2021-2023	1,300	Volume does <u>not</u> overlap with Five Point Project.
Five Point Project Recycled Demand	Online 2021-2043	5,200	Per 2020 GSI Draft TM.
Additional Demand due to Overwatering at New Development	Online 2021-2050	1,300	Approximately 43 AF added demand annually. Based on residential and non-residential overwatering factors of ~25%.
Total Demand (AF)	2050	9,400	
Total Demand WITH Climate Change (AF)	2050	9,700	Climate change effect feathered in linearly starting with a 0% increase initially and rising to 3.77% in 2050.

Note: Values rounded to nearest 100 AF.

APPENDIX J – DSS MODEL OVERVIEW



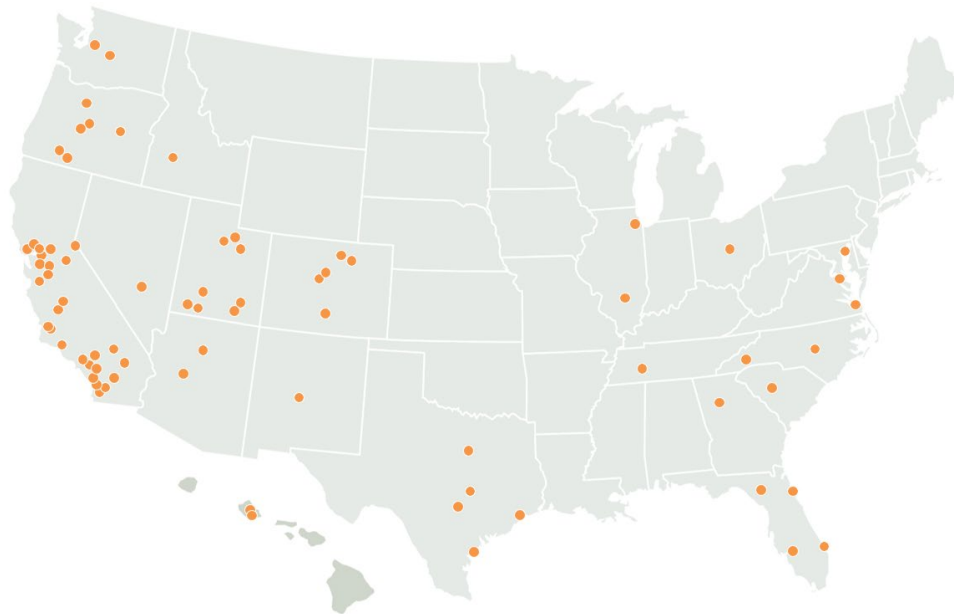
Figure J-1. DSS Model Main Page

and lifetime are compiled for each fixture. Additionally, state, and national plumbing codes and appliance standards are modeled by customer category. These fixtures and plumbing codes can be added to, edited, or deleted by the user. This process yields two demand forecasts, one with plumbing codes and one without plumbing codes.

Active Conservation Measure Analysis Using Benefit-Cost Analysis: The DSS Model evaluates active conservation measures using benefit-cost analysis with the present value of the cost of water saved (\$/Million Gallons or \$/Acre-Feet). Benefits are based on savings in water and wastewater facility operations and maintenance (O&M) and any deferred capital expenditures. The figures on the previous page illustrate the processes for forecasting conservation water savings, including the impacts of fixture replacement due to existing plumbing codes and standards.

Model Use and Validation: The DSS Model has been used and updated for the past 8 years by SCV Water and overtime used for 20 years for practical applications of conservation planning in over 300 service areas representing 60 million people, including extensive efforts nationally and internationally in Australia, New Zealand, and Canada.

Figure J-2. DSS Model Analysis Locations in the U.S.



The California Water Efficiency Partnership, or CalWEP (formerly the CUWCC), has peer reviewed and endorsed the model since 2006. It is offered to all CalWEP members for use to estimate water demand, plumbing code, and conservation program savings.

The DSS Model can use one of the following: 1) a statistical approach to forecast demands (e.g., an econometric model); 2) a forecasted increase in population and employment; 3) predicted future demands; or 4) a demand projection entered into the model from an outside source.