



City of Santa Cruz

2015 Urban Water Management Plan





City of Santa Cruz Water Department

2015 Urban Water Management Plan

Santa Cruz City Council

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Chapter 1

INTRODUCTION AND OVERVIEW

1.1 Urban Water Management Planning Act

This report has been prepared by the City of Santa Cruz Water Department in response to the Urban Water Management Planning Act. The Act, which became part of the California Water Code with the passage of Assembly Bill 797 in 1983, requires that every urban water supplier providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually prepare and adopt an Urban Water Management Plan, and to update it every five years.

The Act requires water agencies to evaluate and describe their water resource supplies and projected needs over a twenty-year planning horizon and to address a number of related subjects including water conservation, water service reliability, water recycling, opportunities for water transfers, and contingency plans for drought events.

The Act recognizes that water is a limited and renewable resource subject to ever-increasing demands and that conservation and efficient use of urban water supplies is a statewide concern. The Act also states that a long-term reliable supply of water is essential to protect the productivity of California's businesses and economic climate and, as part of its long-range planning activities, every urban water supplier should make every effort to ensure the appropriate level of reliability in its water service sufficient to meet the needs of its various categories of customers during normal, dry, and multiple dry years.

The purpose, required contents, and process for preparing and adopting Urban Water Management Plans are specified in Water Code sections 10608 and 10610 – 10656 (Appendix A). The overall goal is to provide water suppliers throughout the state a framework for carrying out their long-term planning responsibilities and for reporting their strategies to meet future water challenges to both state government and the communities they serve.

1.2 Recent Changes to the Water Code

The Act has been amended numerous times by the Legislature over the years in response to the State's water shortages, droughts, and other factors. A significant

amendment was made in 2009, after the drought of 2007-2009 and as a result of the governor's call for a statewide 20 percent reduction in per capita water use by the year 2020. The Water Conservation Act of 2009, also known as SB X7-7, required urban water suppliers to establish water use targets for 2015 and 2020 that would result in statewide savings of 20 percent by 2020 (Appendix B). Under the law, each urban water supplier is required to determine its baseline daily per capita water use and to calculate future water use targets in accordance with [technical methodologies](#) developed by the California Department of Water Resources, and to include this information beginning in its 2010 Urban Water Management Plan. Progress towards decreasing daily per capita water use and achieving future water use targets is then to be documented in subsequent plans starting with this 2015 update.

Recent legislative amendments to the Water Code since 2010 include the following:

- Water suppliers are required to provide a narrative description of their water demand management measures over the past 5 years, as well as the measures a supplier plans to implement to achieve its water use targets.
- Water suppliers are required to submit their 2015 plan electronically to the Department of Water Resources by July 1, 2016,
- Water suppliers are required to use standardized forms, tables, or displays specified by the Department of Water Resources, to facilitate statewide planning.
- Plans must quantify and report on distribution system water losses for the most recent 12-month period using a standardized water balance methodology developed by the American Water Works Association.
- Agencies are authorized, but not required, to include certain energy-related information for collection, treatment, and distribution of water supplies, as well as the water savings estimated to result from adopted codes, standards, or ordinances.

A summary of the changes to the Water Code since 2010 is included in Appendix C.

1.3 Urban Water Management Plans in Relation to Other Planning Efforts

Urban Water Management Plans serve a variety of purposes and are intended to be consistent with and support other local, regional, and statewide plans and processes.

Information about water use and supplies reported by water agencies is collected and used by the state in updating the California Water Plan every five years. They provide a common basis for cooperative water resource management through preparation of Integrated Regional Water Management Programs, such as one now being implemented in Santa Cruz County, of which the City of Santa Cruz is an active project participant. Land use agencies rely on a water agency's Urban Water Management Plan as a long-range planning document to aid in updating city and county General Plans and for the preparation of environmental documents under the California Environmental Quality Act (CEQA). They also serve as a detailed source of information to coordinate local water supply availability and certain land use decisions made by cities and counties under Senate Bills 610 and 221 of 2001.

1.4 City of Santa Cruz' 2015 Urban Water Management Plan

This document constitutes the sixth update of the City's Urban Water Management Plan. The first version was adopted by City Council in 1986. The plan was most recently updated in 2010/11 and adopted in late 2011. Since then, circumstances and events have evolved in a way that was difficult to foresee only a few short years ago. Some of the interrelated factors that have changed in the last five years include the following:

- **New Vision for the City's Water Supply.** The City of Santa Cruz has long faced challenges with the reliability of its water supply and had been actively pursuing ocean desalination as a supplemental water source for more than a decade. In spring 2014, the Santa Cruz City Council changed course and appointed a committee of 14 residents representing diverse viewpoints to take an exhaustive look at the City's water issues and ways to address them. The Water Supply Advisory Committee (WSAC) worked for 18 months in an open, public, and transparent process to develop recommendations to ensure a more stable and reliable water supply. In addition to more conservation, the WSAC recommended the City embark on a program to enhance regional groundwater storage using in-lieu water exchanges and/or aquifer storage and recovery with neighboring water districts. Advanced treated recycled water or desalination were recommended as backup plans.
- **Historic Drought Conditions.** The City of Santa Cruz, along with the rest of the State of California, has recently faced one of the most severe droughts in its history. At the local level, the Santa Cruz City Council declared a water shortage in each of the last four years and instituted mandatory water rationing in both 2014 and 2015. At the state level, Governor Brown in January 2014 proclaimed a State of

Emergency to exist throughout California due to the ongoing drought, leading to emergency conservation regulations being imposed on all urban water suppliers to achieve a statewide 25 percent reduction in urban water use in 2015. While water conditions improved in 2016 for parts of California, including Santa Cruz, all urban water suppliers remain subject to updated emergency water restrictions through at least January 2017, as well as other statewide orders aimed at permanently using water more wisely, eliminating water waste, and strengthening drought resilience.

- **Endangered Species Act Issues and Ecosystem Restoration.** The City has not yet finalized a flow agreement with state and federal fishery agencies but has been voluntarily releasing higher flows at various points of diversion to protect endangered Coho salmon and threatened steelhead trout. Improving habitat conditions to restore declining fish populations, while consistent with community values, will further limit the availability of water for municipal purposes in the future. The ultimate resolution of fish flow requirements for the City's sources of supply will be a result of forthcoming negotiations with state and federal fishery agencies.
- **Sustainable Groundwater Management.** In 2014, California enacted landmark legislation to bring the state's groundwater basins into a more sustainable regime of pumping and recharge. Facing declining groundwater supplies, the City recently joined together with two overlying water districts and the County of Santa Cruz to form a Joint Powers Agreement for the creation of a local Groundwater Sustainability Agency (GSA) required by the act. The GSA will oversee the preparation of a cooperative groundwater management plan for the Santa Cruz Mid-County Groundwater Basin, the status of which was recently designated by the State to be in a condition of critical overdraft.
- **Aging Infrastructure.** Key components of the City water system, including the North Coast System, the Newell Creek Dam Inlet/Outlet pipe, and water treatment facilities have reached the end of their useful life and are overdue for renewal and replacement. The Water Department's long-range Capital Improvement Program envisions a total of almost \$120 million in needed infrastructure reinvestment projects over the next 10 years, adding pressure on limited financial resources.

As with elsewhere in California, the challenges for managing water supply and demand in the central coast region are dynamic. This plan acknowledges that the future is both variable and uncertain and that change will continue to occur.

1.5 Report Format

For this 2015 submittal cycle, the City has elected to modify the basic structure and organization used in previous plans to better align the document and accompanying tables with the organization recommended in DWR's Guidebook for Urban Water Suppliers (CA DWR, 2016). Required content is grouped by topic as follows:

Chapter 1 – Introduction and Overview: This section covers the background, purpose, and scope of an Urban Water Management Plan.

Chapter 2 – Plan Preparation: This section covers the process used to develop the 2015 plan, including efforts in coordination and outreach.

Chapter 3 – System Description: This section describes the City's water service area including population, climate, and other factors affecting the City's water management planning, including governance and the Water Department's organizational structure.

Chapter 4 – System Water Use: This section covers the past, current, and projected water uses within the City's water service area. It also provides information on distribution system water losses.

Chapter 5 – Baselines and Targets: This section provides information about the City's baseline per capita water use and urban water use targets, describes the methods for calculating baseline and target consumption, and success in achieving its 2015 target.

Chapter 6 – System Supplies: This section describes and quantifies the current and projected sources of water available to the City, including surface water, groundwater, and potential new sources, transfers, or exchanges of water.

Chapter 7 – Water Supply Reliability: This section characterizes the reliability of the City water supply system, provides an updated assessment of the system reliability under differing hydrologic conditions and describes the overall strategy and work plan the City is pursuing to improve its water supply reliability.

Chapter 8 – Water Shortage Contingency Planning: This section summarizes the City's 5-stage plan for addressing water shortages and describes actions that would be undertaken in response to a catastrophic interruption of water supplies, including a regional power outage, earthquake, or other emergency situation.

Chapter 9 – Demand Management Measures: This section describes the measures currently being implemented by the City to promote conservation and discusses the planning process underway to guide water conservation activities in future years.

Chapter 10 – Plan Adoption, Submittal, and Implementation: This section describes the steps taken to adopt and submit the Urban Water Management Plan update, and to make the plan available for public use and reference.

1.6 UWMPs and Funding Eligibility

In order for an urban water supplier to be eligible for any state water grants or loans administered by DWR, the agency must have a current Urban Water Management Plan on file that has been determined by DWR to address the requirements of the Water Code.

Beginning in 2016, urban water suppliers must also comply with the requirements of the Water Conservation Act of 2009 in order to be eligible for state water grants and loans, meaning an agency must both meet its interim water use target and report compliance in its 2015 UWMP.

Chapter 2

PLAN PREPARATION

2.1 Basis for Preparing a Plan

In accordance with the California Water Code, every urban water supplier with 3,000 or more service connections or supplying more than 3,000 acre-feet of water per year are required to prepare an Urban Water Management Plan every five years. With 24,534 active service connections, the City of Santa Cruz clearly meets the definition of “Urban Water Supplier” and therefore must prepare a plan.

The Santa Cruz water system also qualifies under the California Health and Safety Code, Section 116275, as a “Public Water System” that provides drinking water for human consumption and is regulated by the State Water Resources Control Board, Division of Drinking Water. The City operates a single, retail drinking water system. It receives no water from any wholesale supplier nor does it supply either raw or treated water to another agency at the present time.

Table 2-1. Public Water Systems			
Public Water System Number	Public Water System Name	Number of Municipal Connections 2015	Volume of Water Supplied 2015
CA4410010	Santa Cruz Water Department	24,534	2,452
TOTAL		24,534	2,452
NOTES: Volume of water supplied in million gallons			

2.2 Regional Planning and Compliance

CWC 10620

(d)(1) An urban water supplier may satisfy the requirements of this part by participation in area wide, regional, watershed, or basin wide urban water management planning where those plans will reduce preparation costs and contribute to the achievement of conservation and efficient water use.

The City of Santa Cruz actively participates in several regional, interagency, groundwater and watershed basin management efforts. As indicated in Table 2-2, however, the City is choosing to prepare an individual Urban Water Management Plan.

Table 2-2. Plan Identification (Select One)	
☒	Individual UWMP
☐	Regional UWMP (RUWMP)
	Select One:
	☐ RUWMP includes a Regional Alliance
	☐ RUWMP does not include a Regional Alliance
NOTES:	

CWC 10608.20

(a)(1) ...Urban retail water suppliers may elect to determine and report progress toward achieving these targets on an individual or regional basis as provided in subdivision (a) of Section 10608.28...

Similarly, for the purpose of determining, reporting, and assessing compliance with its urban water use baselines and targets described in Chapter 5, the City of Santa Cruz is choosing to report as an individual supplier.

2.3 Reporting Year and Units of Measure

All information in this plan, except where otherwise noted, is reported on a calendar year basis, and volumes are expressed in units of million gallons.

Table 2-3: Agency Identification	
Type of Agency (select one or both)	
☐	Agency is a wholesaler
☒	Agency is a retailer
Fiscal or Calendar Year (select one)	
☒	UWMP Tables Are in Calendar Years
☐	UWMP Tables Are in Fiscal Years
Units of Measure Used in UWMP (select from Drop down)	
Unit	MG
NOTES:	

2.4 Coordination and Outreach

The process of developing the City's 2015 Urban Water Management Plan really began with the Water Supply Advisory Committee process starting in 2014. This intensive process included an enormous amount of data collection, analysis, modeling, and evaluation of myriad topics and issues associated with water supply planning over an 18-month period. The Committee itself consisted of 14 individuals appointed by the City Council representing diverse viewpoints and interests; including residents, business organizations, environmental organizations, Water Commission members, and an outside City water customer representative. The process was supported by a facilitation team, a technical team, an independent review panel, and by Water Department staff.

All Committee meetings were open to the public with numerous opportunities for public input. The Committee had its own [website](#) to share materials, agendas, and to communicate with the public. The committee hosted several public workshops, enrichment sessions, a strategies and ideas convention, open houses, and other outreach activities. Many of the work products developed for the Committee, including a new econometric water demand model, were intended to also serve in updating the City's Urban Water Management Plan.

In late 2015, City staff participated in a webinar and attended a workshop sponsored by DWR to become familiar with changes to the law, the 2015 guidebook, new UWMP tables and tools, and changes in the reporting of wastewater and recycled water.

Written notice regarding the plan review and update was sent to both the City of Capitola and the County of Santa Cruz in December 2015, more than 60 days prior to the public hearing, as required by Section 10621(b) of the Act (Appendix D). Notices were provided both to the City Manager/County Administrative Officer and the Director of Planning/Community Development of these two jurisdictions.

In February 2016, the City hosted and led a meeting to coordinate preparation among all major public water agencies, wastewater utilities, and land use agencies in Santa Cruz County. This meeting was also attended by representatives of the following organizations:

- California Department of Water Resources
- Association of Monterey Bay Area Governments
- Santa Cruz County Local Agency Formation Commission.
- Regional Water Management Foundation (local IRWM entity)

- Resource Conservation District of Santa Cruz County
- Santa Cruz County Environmental Health

Water Department staff prepared the draft urban water management plan in winter and spring of 2016 with the help of the state's *Guidebook for Urban Water Suppliers* (DWR, 2016). Throughout development of this plan, City staff was communicating and coordinating with neighboring water agencies, city and county land use agencies within the service area, as well as the staff from the City's wastewater treatment facilities, City of Scotts Valley, and the Santa Cruz County Sanitation District in accordance with section 10620(d)(2) of the Act.

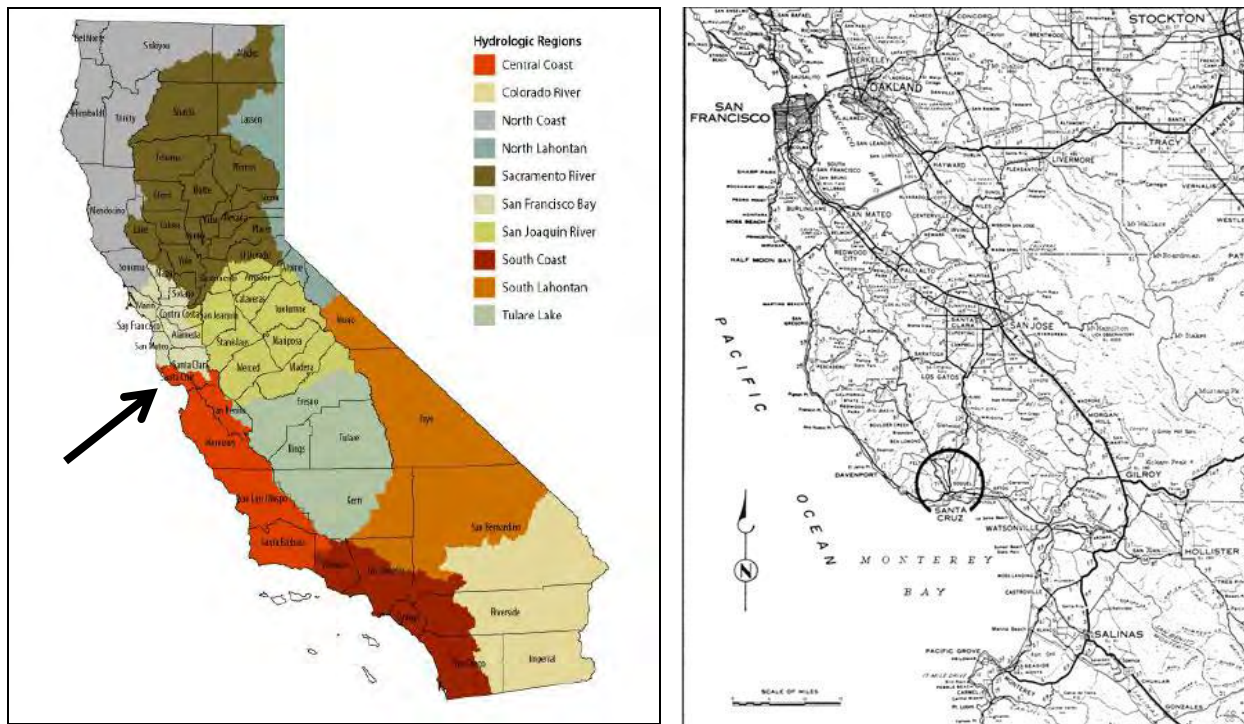
Chapter 3

SYSTEM DESCRIPTION

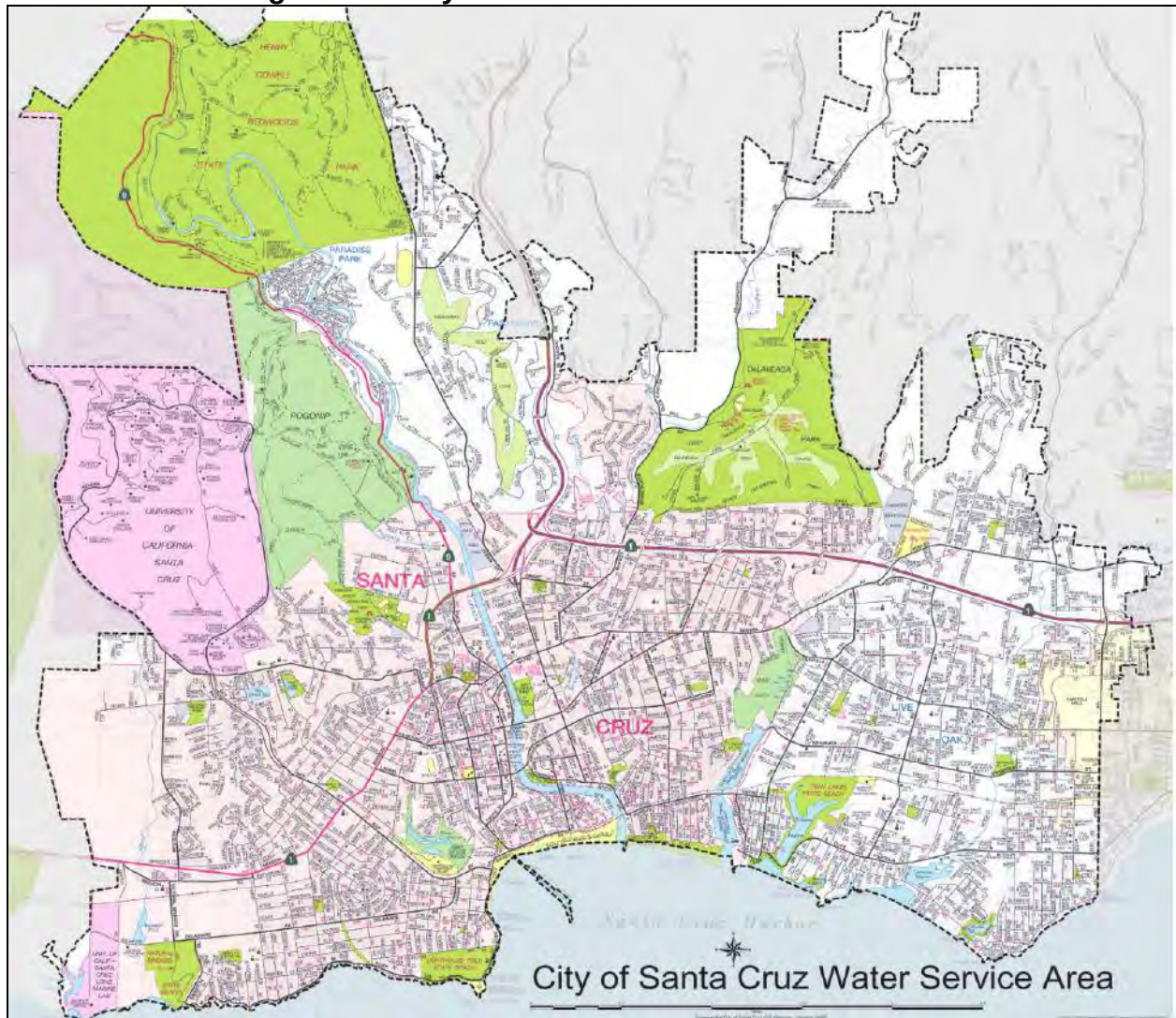
3.1 General Description of Service Area

The City of Santa Cruz is located on the central coast of California along the northern shore of Monterey Bay. The City's position on the northern end of the state's Central Coast Hydrologic Region (Region 3) and vicinity relative to the San Francisco Bay Area are shown below in Figure 3-1.

Figure 3-1. California Hydrologic Region and Vicinity Maps



Water service is provided to an area approximately 20 square miles in size, including the entire City of Santa Cruz, adjoining unincorporated areas of Santa Cruz County, a small part of the City of Capitola, and coastal agricultural lands north of the city. A generalized map of the water service area, excluding the north coast, is provided in Figure 3-2. No significant changes to the City's service area boundary have occurred in many years.

Figure 3-2. City of Santa Cruz Water Service Area

People are drawn to the Santa Cruz area for its recreational attractions, its small town ambiance and sense of community, its pleasant weather, its natural beauty and scenic coastline, and its higher education facilities. The sandy beaches and nearby mountains attract millions of visitors to the region every year. The City is bounded by several state parks and open-space lands that provide facilities for bicycling, hiking and other outdoor activities. The seashore and ocean waters of the Monterey Bay National Marine Sanctuary serve as a prime destination in the summer months for sunbathers, surfers, and tourists. Other visitor attractions include the Santa Cruz Beach Boardwalk, Municipal Pier, and Pacific Avenue Mall.

The [University of California, Santa Cruz](#) is situated atop the upper west side of the City overlooking the downtown area and Monterey Bay. The campus is nationally recognized

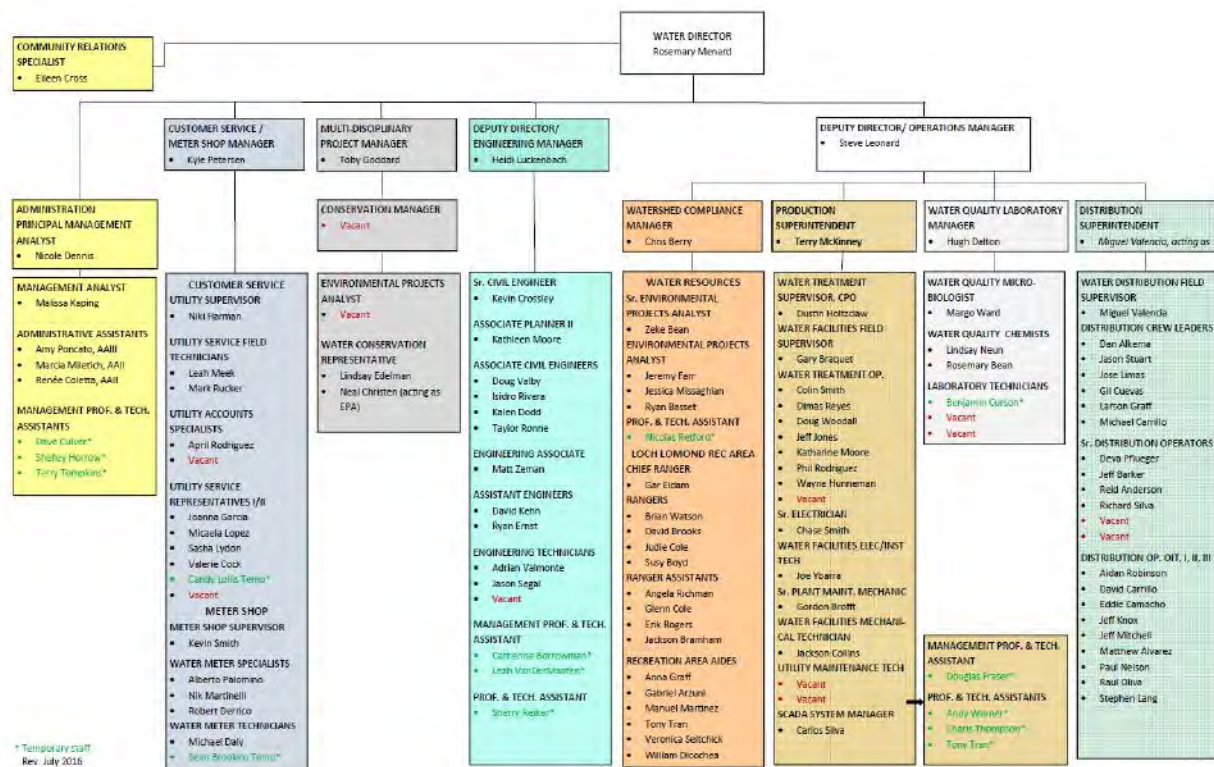
for its quality of instruction, its academic stature, and its research impact. It currently accommodates an enrollment of slightly more than 17,000 students during the academic year.

3.2 Water Department

The Santa Cruz Water Department is a municipal utility that is owned and operated by the City of Santa Cruz. It is led by a Director who is appointed by the City Manager. The governing body for the Water Department is the City Council. A seven-member Water Commission advises Council on policy matters involving the operations and management of the water system. The Commission is composed of six members who reside within the City limits and one member who resides in the unincorporated portion of the water service area.

The Department is organized into eight sections. These include Administration, Customer Service, Water Conservation, Engineering, Water Resources/Recreation, Water Production, Water Quality, and Water Distribution. There is currently the equivalent of 102 full-time staff positions in the Water Department. An organization chart of the Water Department is shown in Figure 3-3.

Figure 3-3. Water Department Organization



The Water Department's adopted mission statement is as follows:

"To provide a safe, clean, and continuous supply of water for municipal and fire protection purposes that meets or exceeds local, State, and Federal standards for public health and environmental quality, and to provide courteous, responsive, and efficient service in the most cost-effective manner to our customers".

The Department operates financially as an enterprise in which all the costs of running the system are paid by water rates, service charges, and related revenues. The Water Fund receives no tax or general fund revenues. In addition to providing water service, the Department has responsibility for billing and customer service functions related to sewer, refuse, and recycling services inside the City limits.

Long-range goals and policies for guiding growth and development in the City, including civic and community facilities like the water system, are contained in the City's [2030 General Plan](#). The General Plan includes a series of policy statements regarding water service that support and promote the General Plan's overarching goal of achieving a safe, reliable, and adequate water supply. (Appendix E). Some of these policies will need updating with the change in direction for the City's future water supply resulting from the recent WSAC process.

3.3 Service Area Climate

Santa Cruz enjoys a pleasant Mediterranean climate that is characterized by warm, mostly dry summers and mild, wet winters. Due to its proximity to Monterey Bay, fog and low overcast are common during the night and morning hours, especially in the summer. Monthly and annual climate data for Santa Cruz are shown in Table 3-1 below.

Mean monthly temperatures range between 51 to 65 degrees, with the warmest weather usually occurring during August and September. Extreme temperatures are rare and short-lived, with weather conditions being moderated by the oceanic influence and presence of summer fog.

Rainfall in Santa Cruz averages 31.35 inches annually, but varies considerably from year to year. The bulk of seasonal rainfall occurs between November and March. In the

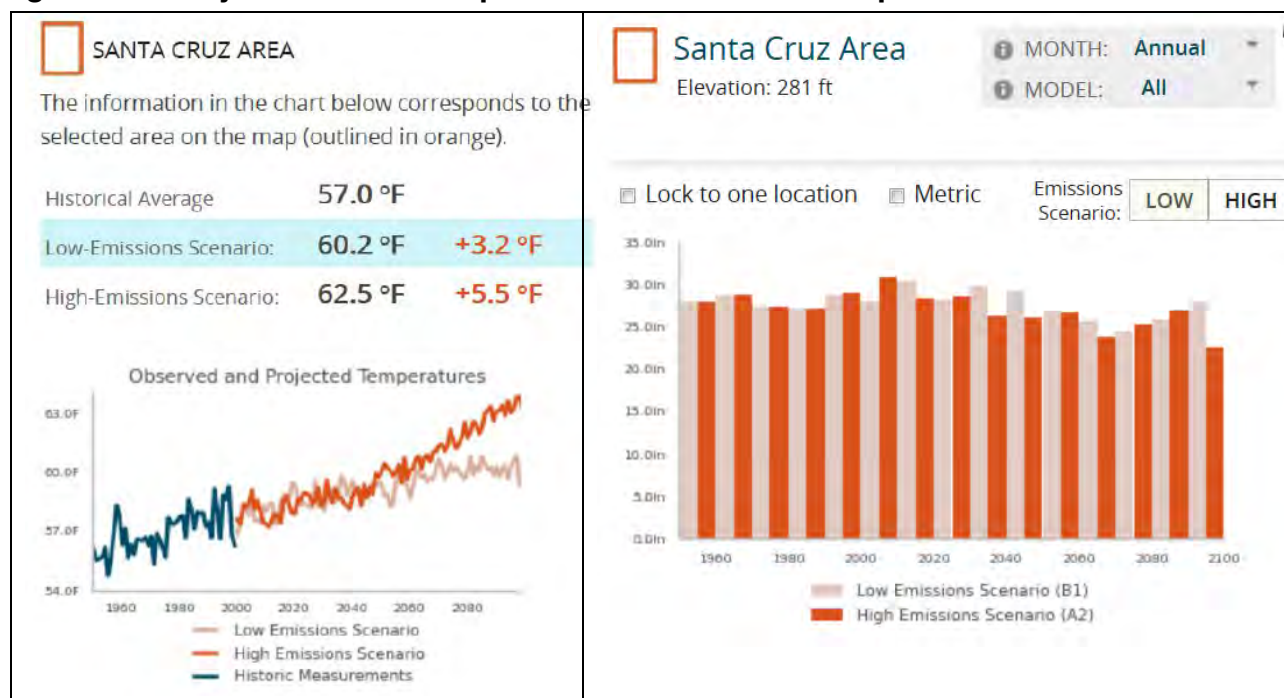
watershed above the City's reservoir in the Santa Cruz Mountains, rainfall averages nearly 50 inches per year.

Table 3-1. Climate Data for Santa Cruz													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean High Temp (F)	62.2	64.4	66.4	69.5	71.9	74.7	75.3	76.2	76.4	73.2	66.8	61.9	69.9
Mean Low Temp (F)	41.3	43.3	44.4	46.0	48.9	51.8	54.0	54.3	53.0	49.5	44.9	41.2	47.7
Mean Temp (F)	51.9	53.8	55.4	57.8	60.4	63.2	64.7	65.2	64.7	61.4	55.8	51.5	58.8
Precipitation (in)	6.28	6.24	4.63	1.97	0.84	0.19	0.01	0.04	0.27	1.45	3.75	5.68	31.35
Evapotranspiration (in)	1.5	1.8	2.6	3.5	4.3	4.4	4.8	4.4	3.8	2.8	1.7	1.2	36.6
NOTES: National Climate Data Center 1981-2010 Monthly Normals ; CA Department of Water Resources													

Reference evapotranspiration - a standard measurement of environmental parameters used for determining irrigation needs - averages 36.6 inches per year in Santa Cruz. Average monthly evapotranspiration varies seasonally from a low of 1.2 inches in December to a high of 4.8 inches in July.

Like other coastal communities, the marine influence on local air temperature, humidity, and cloud cover helps keep demand for water relatively low in the City's service area. The presence of summer fog moderates outdoor water use during peak summer season compared to inland locations within Santa Cruz County and elsewhere in California.

Future average temperatures in Santa Cruz are expected to increase. Figure 3-4 below shows two projections of mean temperature to 2100 under different climate change scenarios ([Cal-Adapt.org](#), 2016). A temperature increase of between 3.2 and 5.5 degrees F compared to the historic average is predicted by the end of the century. Conversely, models of future mean annual precipitation show a slight decline over time. The City's [Climate Adaptation Study](#) indicates changing temperatures and precipitation will impact ecosystems, fire risk, water quality and quantity, human and environmental health (City of Santa Cruz, 2009). As a coastal community, the City of Santa Cruz recognizes the significance of climate change to the City's economic well-being, public health, and environment, and has begun taking steps as a local agency to respond. Impacts of ongoing climate change on water demand, water supply, and water system reliability are discussed further in Chapters 4, 6, and 7.

Figure 3-4. Projected Mean Temperature and Annual Precipitation for Santa Cruz Area

3.4 Service Area Population and Demographics

The current population residing in the Santa Cruz water service area is estimated to be 95,251 people. Approximately two thirds of the total population, almost 64,000, lives inside the City limits. Within the City, about 9,100 people including students, faculty, staff, and their families reside on the UC Santa Cruz campus. It is estimated that another 31,462 people, or 34 percent of the service area population, live outside the City limits. Since the 2010 US Census, the water service area population has grown by approximately 4,000 persons, mostly inside the City limits.

Table 3-2 shows the current and projected population for the water service area out to 2035, in five year increments.

These figures are derived from a [regional growth forecast](#) prepared by the Association of Monterey Bay Area Governments (AMBAG, 2014). According to the forecast, the total number of people receiving water service is expected to grow by about 17,000 people and reach more than 112,000 in 2035. This equates to a population growth rate of less than one percent per year.

Table 3-2. Population - Current and Projected

Population Served	2015	2020	2025	2030	2035	2040(opt)
City of Santa Cruz	63,789	66,860	70,058	73,375	76,692	n/a
County of Santa Cruz, City of Capitola	31,462	32,543	33,562	34,614	35,698	n/a
Total	95,251	99,403	103,620	107,989	112,390	n/a
NOTES: AMBAG 2014 Regional Growth Forecast (adopted June 11, 2014), and City of Santa Cruz GIS section.						

Population is a key factor in determining water use. However, reductions in per capita water use over the last decade have more than offset gradual population increases; that is, even though the service area population has been slowly but steadily rising, total water use has declined. More information on per capita water use is covered in Chapter 5 of this report.

3.5 Housing

According to utility billing records, there are some 37,003 housing units within the City's water service area. The number of housing units, broken down by account type and jurisdiction is shown in Table 3-3 below. Approximately 19,029, or a little over half of all households in the service area are classified as single family accounts¹. The other 17,974 homes are multiple family dwelling units consisting of various housing types including duplexes, condominium and townhouse complexes, apartments, mobile homes and alternative housing types such as live/work units, mixed use development, single room occupancy, and accessory dwelling units. The figures below do not include dormitory rooms, apartments, and other housing units located on the UC Santa Cruz main campus, nor does it include residential units associated with mixed use/commercial accounts. A large proportion of the local housing stock (over 50 percent) is rented.

Each of the three jurisdictions served by the City has a recently adopted Housing Element that addresses its required regional fair share of the statewide housing needs established by AMBAG. These documents set forth goals and objectives for housing construction, rehabilitation, and conservation for the period 2015-2023.

¹ Water account categories are not the same as housing type. A single family account has one dwelling unit per meter, but may be any type of residence. A multifamily account has two or more dwelling units per meter.

Table 3-3. Housing Units, by Account Type and Jurisdiction			
Jurisdiction	Single Family	Multi-family	Total
City of Santa Cruz	12,273	10,034	22,307
County of Santa Cruz	6,622	7,821	14,443
City of Capitola	134	119	253
Service Area Total	19,029	17,974	37,003
NOTES: 2015 Annual Sales Report, EDEN Multi-residential units counts report Feb 3, 2016			

The regional housing goals for the three jurisdictions served by the City are shown below in Table 3-4. For this housing element cycle, the City is planning for an additional 747 units. The County is planning for a total of 1,837 units to be built Countywide through 2023, of which perhaps 372 units would be located within the City water service area. Capitola has a goal to construct 143 units by 2023 in its housing element, but only a small number of these are expected to fall into the City's water service area. Together, these housing plans represent a total residential development potential in the near term of about 1149 new homes within the City's water service area, of which an estimated 414, about one-third, are planned for lower income categories.

Table 3-4. Regional Housing Goals				
Period: 2015-2023	Total Housing Units		Units in Lower Income Categories	
	Entire Jurisdiction	City Water Service Area	Entire Jurisdiction	City Water Service Area
City of Santa Cruz	747	747	298	298
County of Santa Cruz	1,837	372	636	110
City of Capitola	143	30	57	6
Service Area Total	--	1,149	--	414
NOTES: County housing estimates within City water service area based on personal communication with Sarah Neuse, Santa Cruz County Planning Department. Capitola housing estimates within the City water service area based on personal communication with Richard Grunow, Community Development Director.				

It is important to note that while each jurisdiction must demonstrate it has land zoned that can accommodate its fair share of the regional housing needs, it does not necessarily mean such housing actually will be constructed. Some of the units listed above are already permitted and under construction. The City is planning to incentivize smaller, more vertical, mixed-use or multifamily-type housing units along its major transportation corridors. What type of housing is ultimately built, though, will depend largely on market forces. And despite the collective vision for increased housing in the community, actual progress remains slow. In the last five years, only 204 new single family units, and 6 multifamily projects have been built.

3.6 Community Growth and Development

All three jurisdictions served by the Santa Cruz water system have general plans, local coastal programs, zoning regulations, and development standards that determine the location, type, and density of growth allowed in the region. The General Plan serves as the principal policy and planning document guiding long-range land use and conservation decisions in cities and counties.

The cities of Santa Cruz and Capitola have both completed comprehensive updates to their General Plans in the last few years. The Santa Cruz City General Plan timeline extends to 2030, and Capitola's has a 20 to 30 year planning horizon. The County's current General Plan was adopted in 1994. It has recently prepared and adopted a [Sustainable Santa Cruz County](#) plan addressing sustainable land use, housing, economic development, and transportation objectives in the urban area of the County, part of which is served by the City's water system (Santa Cruz County, 2015). The time horizon of that plan is through 2035.

In addition to city and county General Plans, the University of California has Long Range Development Plans (LRDPs) for both its [main campus](#) (UCSC, 2005) and its [marine science campus](#) (UCSC, 2008, revised 2013) located on the western edge of the City. These plans provide a comprehensive framework to guide physical development, land use, and resource protection to meet the University's academic and institutional objectives through the year 2020.

The size of the City water service area has remained relatively fixed over time due to a long-standing prohibition against new water connections along the north coast, the acquisition of open space lands which created a greenbelt around the City, and the County's urban services boundary, all of which have served to inhibit urban sprawl. Accordingly, most growth and redevelopment that does happen going forward is

expected to be concentrated within the confines of the existing service area boundary. Any proposed changes to the City's service area boundary that do come forward are subject to approval by both City Council and the Santa Cruz Local Agency Formation Commission (LAFCO).

Within the City of Santa Cruz, only a small amount of land remains undeveloped. The same is true in the parts of the County and City of Capitola served by the City. Because of the relative scarcity of raw land, the majority of future growth in the area is likely to be achieved through redevelopment, remodeling, increased density on underutilized land, and infill development in the urban core and along major transportation corridors, along with new construction on the little amount of vacant land remaining

Many of the major decisions made by local governing bodies about public improvements and private development are also subject to the review and oversight of, or may be appealed to, the California Coastal Commission. Accordingly, change in the City water service area tends to occur slowly, if at all, and only after exhaustive public process.

3.7 Employment and the Economy

The State Employment Development Department estimates employment within the City's water service area in 2014 (the most recent year for which complete data exists) to average about 42,800, which represents roughly 50 percent of all non-farm jobs in Santa Cruz County (CA EDD, 2016). The three largest employment sectors are health care and social assistance, retail trade, and educational services (Table 3-5).

The University is a key component of the region's economic fabric in terms of employment, spending, research, and business creation. It is the area's largest single employer. Other top employers include the County of Santa Cruz, City of Santa Cruz, Plantronics, and the Santa Cruz Beach Boardwalk. Tourism and lodging are additional major economic drivers in the community. Commercial development is centered in downtown Santa Cruz including River Street, around 41st Avenue in Capitola, and along the major transportation corridors including Mission, Ocean, and Water Streets and Soquel Avenue. The Harvey West area and west side of Santa Cruz support a diverse mix of light industry, retail, high tech, research, and consumer goods and service enterprises. Regional hospitals, medical, and health care facilities and services are concentrated along Soquel Drive in unincorporated Santa Cruz County.

The local economy has rebounded from the great recession, continuing on trend to pace behind the San Jose market by about six months as reflected by reduced unemployment, an improved housing market, increased development activity, a vibrant tourism base, and sustainable increases in sales and hotel revenues. Like other coastal communities, the housing supply is very tight and housing affordability has become a major political, economic, and social issue for families, residents, and employers alike.

Table 3-5. Employment in Santa Cruz Water Service Area, 2014		
Major Industry NAICS Sector	NAICS Classification	Employment
Agriculture, Forestry, Fishing & Hunting	11	144
Utilities	22	*****
Construction	23	1,157
Manufacturing	31-33	2,015
Wholesale Trade	42	1,021
Retail Trade	44-45	6,160
Transportation & Warehousing	48-49	431
Information	51	408
Finance & Insurance	52	680
Real Estate & Rental & Leasing	53	568
Professional, Scientific, & Technical Skills	54	1,986
Management Of Companies And Enterprises	55	177
Admin & Support & Waste Mgmt & Remediation	56	1,714
Educational Services	61	5,282
Health Care & Social Assistance	62	7,722
Arts, Entertainment, & Recreation	71	1,460
Accommodation & Food Services	72	5,622
Other Services	81	1,737
Non-Classified	99	*****
Government	92	599
Sub-Total		38,989
Multiple Sites (Government Only)		3,829
Federal		210
Local		3,620
Service Area Total		42,818
NOTES: Source: Andy Wong, CA Employment Development Department, Labor Market Information Division, 2016		

Chapter 4

SYSTEM WATER USE

This chapter describes the City's customer classification system, summarizes trends in water consumption, and presents projections of water use out to the year 2035. It also covers information on distribution system losses, water for low income housing units, and future water savings expected water savings from plumbing codes and standards.

4.1 Customer Classification System

The City divides its water customers into eight major classes and one miscellaneous category, as follows:

Single Family Residential: Individually metered residential units (regardless of housing type).

Multiple Family Residential: Any residential account with more than one dwelling unit served by one water meter.

Business: Commercial establishments including restaurants, hotel/motel, retail, medical, schools, offices, churches and mixed-use buildings. This category also includes county and state government accounts.

Industry/UCSC: This category is comprised of one primary customer - the University of California, Santa Cruz - and a small number of manufacturing businesses.

Municipal: These are City-owned and operated facilities such as city offices, parks, police and fire stations, a wastewater treatment plant, street medians, and parking lots.

Irrigation: Dedicated water services for landscape irrigation associated with large multiple residential complexes and homeowners associations, or with commercial, industrial, and institutional sites, including schools, churches, parks, etc.

Golf Irrigation: Accounts serving the two golf courses in the service area.

Coast Irrigation: Agricultural accounts receiving untreated or "raw" water on the north coast.

Other: Miscellaneous uses such as temporary construction accounts, hydrant meters, and bulk water sales.

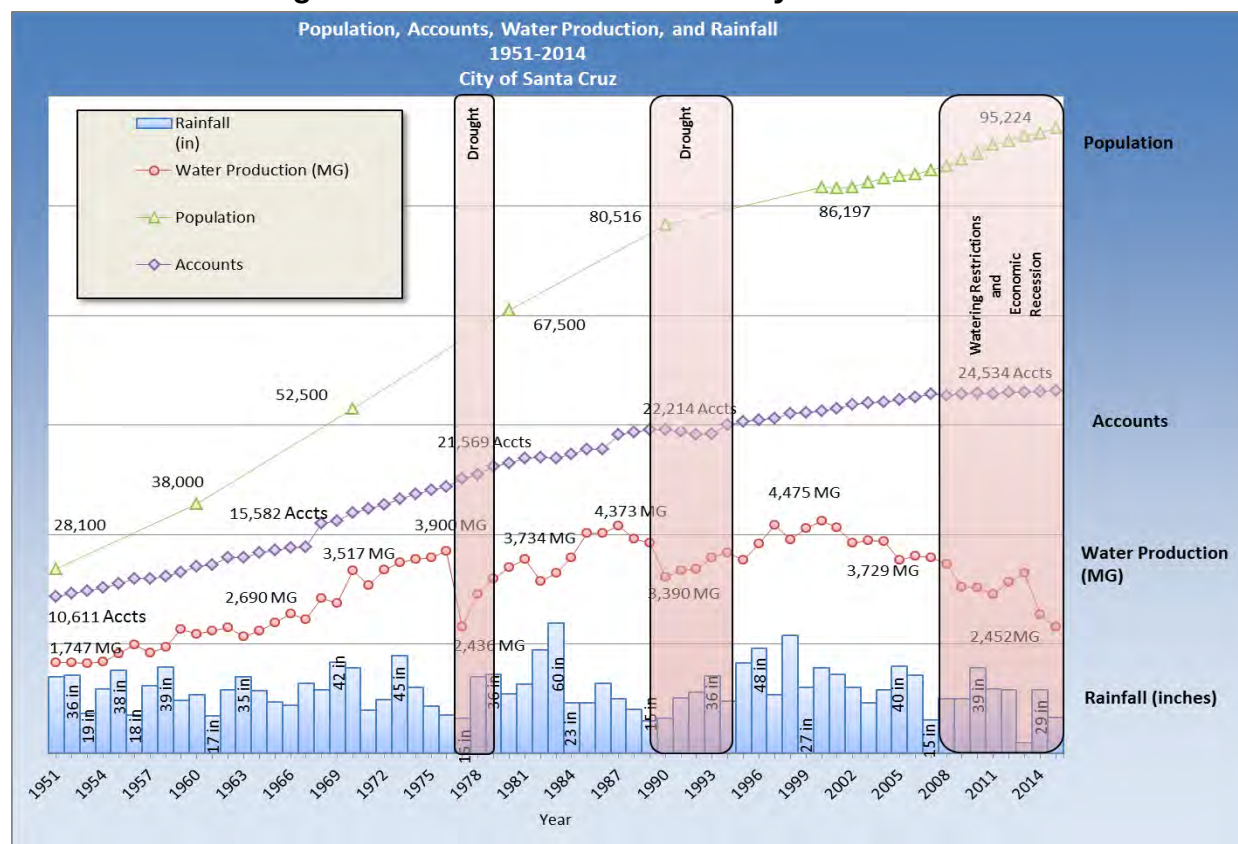
In addition to designating accounts into various customer classes, the City also groups its customers into either “inside-City” or “outside-City” categories for billing purposes.

Except for coast irrigation which receives raw water, all water supplied is potable water. The City does not currently provide recycled water within its service territory. Moreover, no water is presently sold to other agencies, or used for groundwater recharge, saline water intrusion barriers, conjunctive use, or any combination thereof. The potential future use of treated water for transfer, exchange, or groundwater recharge is discussed in Chapter 7.

4.2 Historical Water Use

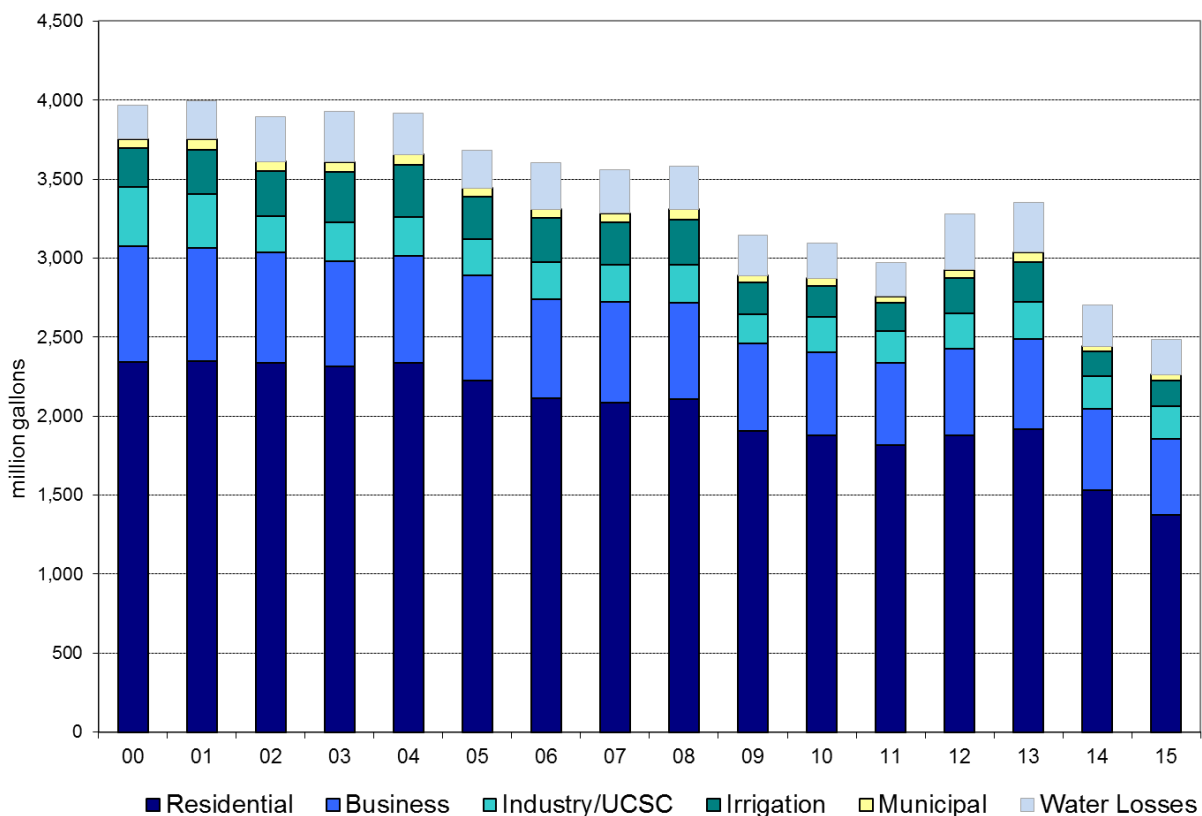
The overall trend in population, number of accounts and total annual water use going back to the 1950s is presented below in Figure 4-1.

Figure 4-1. Historic Trends for City of Santa Cruz



Until recently, the general trend in system demand was one in which water use rose roughly in parallel with account and population growth over time, except during two major drought periods in the late 1970s and the early 1990s. Around 2000, this pattern changed and system demand began a long period of decline, accelerated by pricing changes, drought, economic downturn, and other factors. In 2015, after 2 years of water rationing, annual water use fell to a level of about 2.45 billion gallons, similar to the level experienced during the 1970s drought. A breakdown of annual water consumption by City's major customer classes since 2000, along with system water losses, is illustrated in Figure 4-2.

Figure 4-2. Annual Water Consumption by Customer Category (million gallons)



4.3 Water Use by Sector

Actual demands for potable water in calendar year 2015 are reported by customer class in Table 4.1 below. As illustrated above, both the level and the composition of demand have been strongly affected by the recent drought. Compared to two years before, total system water demand was down nearly 900 million gallons or 27 percent due to local drought response and implementation of water rationing during 2015. In addition to the potable water demand listed below, the City also supplied 34 million gallons of raw water to coast irrigation accounts in 2015.

Table 4-1. Demands for Potable Water – Actual			
Use Type	2015 Actual		
	Additional Description (as needed)	Level of Treatment When Delivered	Volume (mg)
Single Family	Individually meter dwellings	Drinking Water	835
Multi-Family	2 or more dwelling units	Drinking Water	538
Commercial		Drinking Water	485
Industrial		Drinking Water	43
Industrial	UC Santa Cruz	Drinking Water	160
Institutional/Governmental	Municipal (city) accounts	Drinking Water	35
Landscape	Dedicated Irrigation Accounts	Drinking Water	46
Landscape	Golf Irrigation	Drinking Water	87
Losses		Drinking Water	223
TOTAL			2,452
NOTES: System water losses are considered provisional until 2015 annual water audit is completed. Figures above do not include raw water sales of 34 mg in 2015 for coast irrigation, or 2 mg received from Soquel Creek Water District during a major valve replacement project. No drinking water was otherwise used for groundwater recharge, saline water intrusion barrier, wetlands or wildlife habitat, or for sales, transfers, or exchanges to other agencies.			

4.4 Distribution System Water Losses

Total system water demand includes not only metered water sales but also authorized, unmetered uses from fire hydrants such as main flushing, fire fighting, street sweeping, and sewer flushing, as well as losses due to underground leaks. The difference between the amount of water produced at the City's water treatment plants entering the distribution system and the amount of water consumed, including both metered and unmetered uses, is referred to as system water losses. System losses have two components: physical losses from leaking service lines and water mains, and apparent losses in which actual consumption is underreported due to sales meter inaccuracies and other factors.

The City has conducted audits of the distribution system annually since the late 1990's to account for unmetered water uses and to track how much water is lost to leakage over time. The City uses AWWA water balance software to help quantify and track water losses associated with the water distribution system and identify areas for improved efficiency and cost recovery. Total water losses vary from year to year, averaging 265 million gallons per year or about 7.5 percent of treated water production.

The volume of water loss for calendar year 2014, which is the most recent 12-month period available, is presented in Table 4-2. The City is currently conducting a Water Loss Control project to examine the City’s water system and operations practices to better validate where losses are occurring, evaluate options, and set forth a formal strategy to improve water accountability and reduce lost water. More information on distribution system water losses is covered in Chapter 9.

Table 4-2. 12 Month Water Loss Audit Reporting	
Reporting Period Start Date (mm/yyyy)	Volume of Water Loss (million gallons)
01/2014	261
NOTES: AWWA Water Audit Software, V5.0 for Calendar Year 2014	

4.5 Water Demand Projections

One of the first requests made by the WSAC was for the Water Department to update the demand forecast to reflect current information on water usage and to account for effects of conservation, water rates, and other factors expected to impact the future demand for water. Accordingly, the Water Department contracted with M.Cubed to develop two products: 1) an interim forecast to assist the WSAC process, and 2) a separate econometric demand forecast for the service area extending to year 2035.

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

Econometric demand forecasting develops statistically-based models of average water use per service by customer class. A demand forecast was developed based on these models covering the period 2020-2035 and incorporating empirical relationships between water use and key explanatory variables, including season, weather, water rates, household income, employment, conservation, and drought restrictions. The approach builds on similar models of water demand developed for the California Urban Water Conservation Council (Western Policy Research, 2011), Bay Area Water Supply and Conservation Agency (Western Policy Research, 2014), California Water Service

Company (A&N Technical Services, 2014, M.Cubed 2015), and Contra Costa Water District (M.Cubed 2014).

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

A description of the model and forecasts of average demand by customer class are detailed in Appendix F. The forecasts include adjustments for future effects of water rates, plumbing codes and the City's baseline conservation program and are predicated on average weather and normal (predicted) income and growth.

Additional modeling was conducted to factor in updated information on passive and active conservation savings through the 2035 planning period (Maddaus Water Management, 2016). The resulting water demand projection, by customer class, is presented in Table 4-3. As summarized below, system water demands are expected to decline and then stabilize at a level of about 3.2 billion gallons per year.

Table 4-3. Demands for Potable Water - Projected						
Use Type	Additional Description	Projected Water Use (mgd)				
		2020	2025	2030	2035	2040-opt
Single Family	Individually metered dwellings	1,277	1,223	1,191	1,170	n/a
Multi-Family	2 or more dwelling units	772	714	690	678	n/a
Commercial		574	541	525	519	n/a
Industrial		56	59	60	61	n/a
Institutional/ Governmental	Municipal (city) accounts	46	42	40	40	n/a
Landscape	Dedicated Irrigation	112	119	134	144	n/a
Landscape	Golf Irrigation	58	52	47	47	n/a
Other	UC Santa Cruz	196	234	271	308	n/a
Water Losses		236	241	247	253	n/a
TOTAL		3,327	3,225	3,205	3,220	n/a
NOTES: David Mitchell, M Cubed, October 2015, and by Maddaus Water Management, February 2016						

Total water demands are presented in Table 4-4.

Table 4-4. Total Water Demands (mgd)						
	2015	2020	2025	2030	2035	2040 (opt)
Potable and Raw Water	2,452	3,327	3,225	3,205	3,220	n/a
Recycled Water Demand	0	0	0	0	0	0
TOTAL WATER DEMAND	2,452	3,327	3,225	3,205	3,220	n/a
NOTES: Excludes 34 mg of raw water for coast ag in 2015, projection of coast ag use not available; See Chapter 6 for information on recycled water as a potential source of supply.						

4.6 Estimating Future Water Savings

CWC 10631

(e)(4)(A) If available and applicable to an urban water supplier, water use projections may display and account for the water savings estimated to result from adopted codes, standards, ordinances, or transportation and land use plans identified by the urban water supplier, as applicable to the service area.

(B) To the extent that an urban water supplier reports the information described in subparagraph (A), an urban water supplier shall do both of the following: (i) Provide citations of the various codes, standards, ordinances, or transportation and land use plans utilized in making the projections.(ii) Indicate the extent that the water use projections consider savings from codes, standards, ordinances, or transportation and land use plans. Water use projections that do not account for these water savings shall be noted of that fact.

The City is in the final stages of completing a Water Conservation Master Plan, described later in Chapter 9. A major part of this planning effort was to model the impact of natural replacement of existing fixtures and appliances on future water use inside homes and businesses, as well as the impact of fixture codes on water use in new development. The model takes into account the existing proportion and characteristics of fixtures from a recent [Baseline Water Use Survey](#), estimated annual replacement rate, fixture life, and assumed market share at various points in the planning horizon (Envirosmart Solutions Group, 2013).

Different federal and state laws regulate the sale or manufacturing of various water using fixtures and appliances. The following laws and regulations were taken into account to estimate the decrease in water use expected to occur over the next 20 years:

- California Energy Commission Appliance Efficiency Regulations, Sept 2015 (toilets, urinals, faucets, and showerheads)
- U.S. Department of Energy standards (residential clothes washers, dishwashers)
- Federal Energy Policy Act of 1992 (toilets, urinals, showerheads, faucets, pre-rinse spray valves)
- 2013 California Green Building Code (new development)
- AB 715 (toilets, urinals)

The estimated cumulative impact of plumbing codes on water use over the next 20 years is a reduction of some 329 million gallons or 8.6 percent of baseline water demand (Table 4-5).

Table 4-5. Future Cumulative Water Savings From Plumbing and Appliance Codes					
	2020	2025	2030	2035	2040 (<i>opt</i>)
Water Savings (mgd)	94	179	269	329	n/a
NOTES: Maddaus Water Management, Inc., 2016					

4.7 Water Use for Lower Income Households

In its demand forecast, the City expects nearly 1,000 new housing units to be built in its service area by 2025. Table 3-4 on page 3-8 (Chapter 3) provides details about these housing units, including the 414 units that are planned for lower income categories. The water demand for these low income units, while not separately calculated, is well within the range of housing units factored into the City's demand forecast.

4.8 Climate Change

Information in Section 3.3 on the service area climate suggests a gradually hotter and somewhat drier climate can be expected to occur in Santa Cruz in future years. Indeed, in 2014 and 2015, at the height of the current drought, the mean annual temperature was between 2 and 3 degrees higher than the historic, long-term average temperature. It is not unreasonable, given normal seasonality of water use, to expect that a warmer and drier future could result in an overall increase in water demand.

Using parameters from the econometric demand models, weather effects on City water demand were investigated using historical data on sales and weather and expressed as the expected change in demand per a 1(one) degree F increase in average maximum daily air temperature over the entire year (M.Cubed, 2016). The analysis shows, based on current water use patterns, demand would increase from between 0.19 to 1.38

percent for one degree increase in average daily high temperature for every customer group except industrial. Results are summarized in Table 4-6. Golf consumption shows the largest increase in demand due to change in maximum daily temperature and multifamily consumption is the least responsive. Total system demand would be expected to increase by about 0.45 percent per one degree F increase in average daily high temperature (Appendix G). Therefore, in the higher scenario for projected temperature in year 2100 shown in Figure 3-4, if average temperature in Santa Cruz were to rise by 5.5 degrees, water demand could be expected according to this analysis to increase by 2.5 percent.

Table 4-6. Expected % Change in Demand per 1 Degree F Change in Monthly Average Maximum Daily Air Temperature

SFR	0.62
MFR	0.19
BUS	0.29
MUN	1.09
IRR	0.80
GOLF	1.38
IND	0.00
Weighted Average	0.45

NOTES: M.Cubed, 2016. UCSC not listed since it was not modeled in econometric demand forecast.

Chapter 5

SB X7-7 BASELINES AND TARGETS

This chapter provides a description and calculations for the City's baseline daily per capita water use and future water use targets, in accordance with technical methods developed by the California Department of Water Resources, as required by Water Code section 10608.

CWC 10608.20

(e) An urban retail water supplier shall include in its urban water management plan . . . the baseline daily per capita water use, urban water use target, interim water use target, along with the bases for determining those estimates, including references to supporting data.

5.1 Background Information

In February 2008, the Governor introduced a seven-part comprehensive plan for improving the Sacramento-San Joaquin Delta. As part of this effort, the Governor directed state agencies to develop a plan to reduce statewide per capita water use by 20 percent by the year 2020.

The 20x2020 Water Conservation Plan was designed to address several key questions, including the following:

- What is per capita use?
- How does it vary across the state?
- What is the conservation potential from current measures and new actions?
- Is it feasible to expect a 20 percent reduction in per capita water use?

The final [20x2020 Water Conservation Plan](#) was issued February 2010 (DWR, 2010). It reported urban water use currently varies between **152 gpcd** in the Central Coast region (Region 3) to **346 gpcd** in the Colorado River region (Region 10) and averages **192 gpcd** statewide. The report concluded that California could achieve a 20 percent reduction in urban per capita water use to an average of **154 gpcd** using current and new conservation actions. It also established for water resources planning purposes baseline values and future water use targets for each of the state's ten hydrologic regions, summarized in Figure 5-1.

Figure 5-1. Regional Urban Water Use Targets

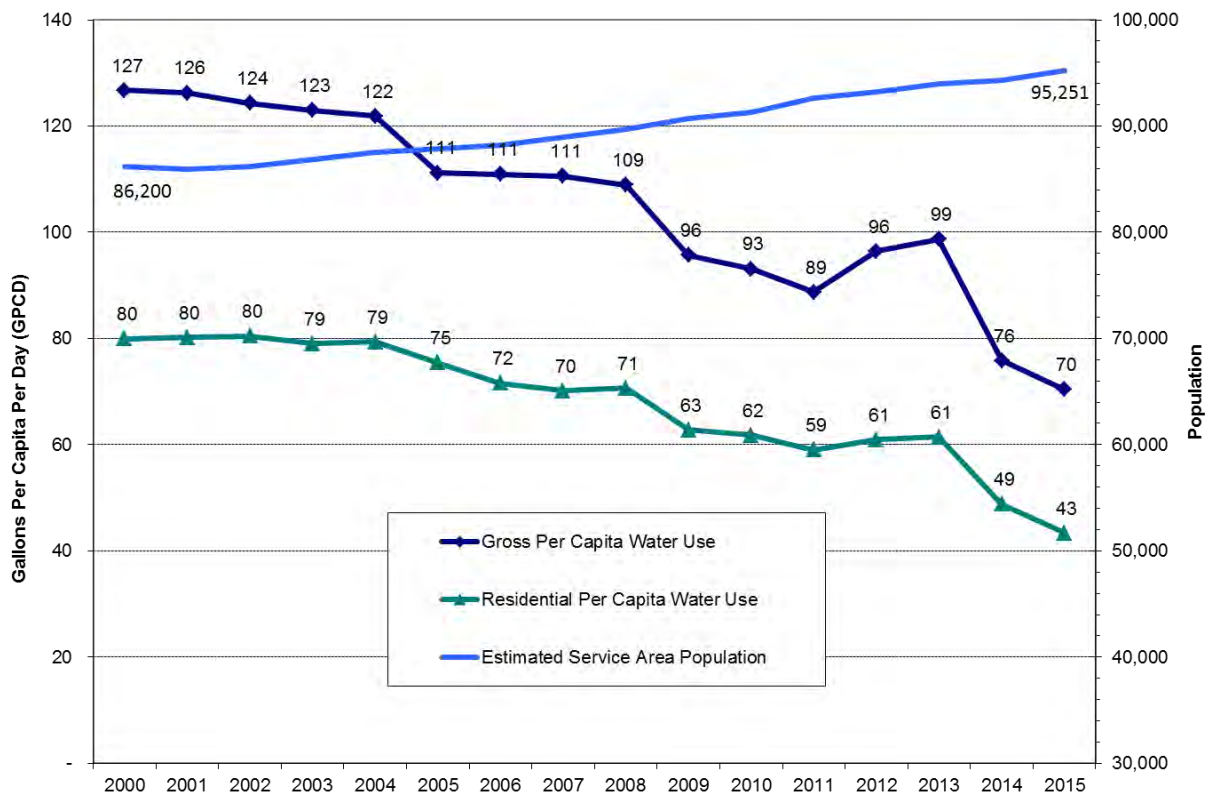
With the enactment of the Water Conservation Act of 2009, also known as SB X7-7, the state is required to set a goal to reduce urban per capita water use by 20 percent by the year 2020. Each retail urban water supplier must determine its baseline water use during their baseline period and also target water use for the years 2015 and 2020 in order to help the State achieve the 20 percent reduction. A copy of the law is included as Appendix B.

To provide for consistent implementation of the law, suppliers are required to conform to [Technical Methodologies](#) prepared by the CA Department of Water Resources, which details the process that urban water suppliers are to follow and the options available for complying with the legislation (DWR, February 2016). Water suppliers have some flexibility in setting and revising water use targets. For instance, a water supplier may set its water use target and comply individually, or as part of a regional alliance. The City of Santa Cruz is electing to report as an individual retail supplier.

In this 2015 Plan, water agencies must demonstrate compliance with their established water use target for the year 2015. This will also demonstrate whether or not the agency is currently on track to achieve its 2020 target. Retail water agencies are also required to separately complete and submit the standard tables in the SB X7-7 verification form.

Figure 5-2 below shows the City's per capita water use and estimated population since 2000. The top line labeled **Gross Per Capita Water Use** is the metric that water agencies are required to calculate and to reduce under SB X7-7. It represents all the treated water entering the distribution system over one year's time, divided by the total population, and expressed in gallons per person per day. As explained further below, gross per capita water use includes residential and nonresidential uses of water in the community, as well as unmetered uses such as firefighting and losses that occur due to leakage on the distribution system.

Figure 5-2. Per Capita Water Use and Service Area Population



The bottom line labeled Residential Per Capita Water Use is included for reference only. It represents the total annual metered water consumption at single and multiple

residential accounts, divided by the residential population¹. It is intended to show the estimated average amount of water used by a person both indoors and outdoors at their home on a daily basis. This metric better approximates how most people relate to their own personal water use at their property. It is also the same metric used by the State Water Board to set urban water reduction targets in 2014 and 2015, explained in Section 5.9 below.

Over the last 15 years, the City's gross per capita water use has declined from about **127 gpcd** in 2000 to **70 gpcd** in 2015. Similar to the pattern in total water use discussed in Chapter 4, the trend in per capita water has been mostly declining over this period, for various reasons. These include the cumulative effects of more conservation, higher water rates, economic downturn, drought, and industrial closures. The steep drop in 2014 and 2015 reflects the effect of water rationing that was instituted both years as a result of a declared emergency water shortage.

As is described below, the City's gross per capita water use is presently far below both its **2015 interim target of 111 gpcd** and its **2020 target of 110 gpcd**, as determined in accordance with DWR's technical methodologies. Accordingly, the City is presently in compliance with all requirements of SB X7-7.

The remainder of this Chapter strictly follows the DWR Guidebook for demonstrating and documenting compliance with the City's water use target for the year 2015.

5.2 Updating Calculations from 2010 Urban Water Management Plan

In accordance with Water Code section 10608.20, an urban retail water supplier may update its 2020 urban water use target in its 2015 Urban Water Management Plan. In the 2010 plan, the City elected to use **Target Method 3** (for an explanation of the four target methods, see section 5.7). No change to the target method is being made in this 2015 plan.

The 2010 plan also used both 2000 and 2010 U.S. Census data at the block level in its baseline population calculations. As a result, no recalculation of the baseline population calculations is needed for this 2015 plan. It should be noted, however, that the annual population estimates from the CA Department of Finance (CA DOF) for the Santa Cruz City in non-census years were slightly revised since the 2010 plan, and those revisions

¹ Residential population differs from total population. There are several thousand students, families, and staff living on the University main campus, which is classified as an industrial account. Only the people living in residences off-campus are counted for the purpose of calculating R-GPCD.

have been incorporated in this update. The change in population inside the City estimated by CA DOF ranged from a decline of 0.1 percent in 2001 to an increase of 0.6 percent in 2009 (-62 to +341 persons). These small revisions made no difference in the City's base daily per capita water use.

The baseline and targets water use development process consists of four basic steps, which are summarized below and detailed in a flow chart in Appendix H.

Step 1: Determine Baseline Daily Per Capita Water Use

Step 2: Determine Urban Water Use Target

Step 3: Confirm Urban Water Use Target

Step 4: Determine Interim Urban Water Use Target

Step 1 - determining baseline daily per capita water use – involves several steps on its own, as listed below:

- 1A. Establishing the baseline period,
- 1B. Estimating the service area population for each year in the baseline period,
- 1C. Measuring gross water use, typically expressed in million gallons per year, and
- 1D. Determining the daily per capita water use in each of the baseline years.

The calculations for Step 1, A-D are detailed further below in Sections 5.3 through 5.6. Steps 2 through 4 are then described in Section 5.7.

5.3 Baseline Period (Step 1A)

Under SB X7-7, water suppliers must define two baseline periods. The first is a continuous 10-year baseline period (or 15-year period if more than 10 percent of system water demand is met through recycled water) ending no earlier than December 2004 and no later than December 2010. The City does not provide recycled water service so the 15-year baseline period does not apply. The 10-year baseline period selected by the City of Santa Cruz is **2001-2010**.

The second is a continuous five-year baseline period ending no earlier than December 2007 and no later than December 2010. This second baseline period is used to confirm that the selected target meets the minimum water use reduction requirement (see section 5.7 on target confirmation). The 5-baseline period selected by the City of Santa Cruz is **2003-2007**. Both the 10-year and the 5-year baseline periods presented in this plan are the same as were reported in the 2010 plan.

5.4 Service Area Population (Step 1B)

Estimates of the City's water service area population are based on the sum of separate population estimates for inside and outside the Santa Cruz city limits.

Inside the City limits, population data is readily available on an annual and decennial basis for the City as a whole. The City uses data published by both the U.S. Census Bureau for census years and the California Department of Finance in non-census years.

Outside the City limits, however, including parts of unincorporated Santa Cruz County and the City of Capitola that are served by the City water system, population data are available only every ten years through the census. Moreover, because the City's service area boundary in those jurisdictions does not coincide neatly with census tract or block boundaries, estimates must be derived using a Geographic Information System at the census block level. In split census blocks, population is apportioned based the percentage of each individual block that is located within the water service area.

For non-census years, it is standard practice among water utilities to estimate population growth by using a people-per-residential connection method. Between 2000 and 2010, approximately 425 residential accounts were added to the system outside the City limits. But because census data indicated that the overall population outside the City actually declined during this period, this approach was not considered to be applicable or appropriate for that time period. Therefore, annual estimates of the outside city population were derived simply by interpolating between the 2000 and 2010 census years. Between 2010 and 2015, the outside City population was determined using a people-per-connection method.

5.5 Gross Water Use (Step 1C)

Gross water use² is a measure of water that enters the distribution system of a supplier over a specified period of time. Gross water use includes not just residential consumption but all the other uses of water in a community, including schools, parks, and commercial buildings such as restaurants, hotels, and office buildings. It also captures water used for public purposes, such as firefighting and water main flushing, and losses that arise from leaks on the water system.

² The terms "gross water use" as used in this chapter and "net water production" used in Chapter 3 mean effectively the same thing; i.e., they both refer to treated water production volumes supplied to the distribution system.

Gross water use was determined in a manner that is consistent with the definition in Water Code section 10608.12(g) and the method outlined in the AWWA Manual M36 as part of the City’s annual distribution system water audit process (AWWA, 2016). These annual water use figures represent the total amount of treated water entering the distribution system from the City’s Graham Hill and Live Oak water treatment plants, after corrections have been applied to adjust for both production meter accuracy and net change in distribution system storage at the beginning and end of the year.

Gross water use does not include raw water sales to coast agriculture, since it is fed to these customers before it reaches the water treatment plant.

5.6 Baseline Daily Per Capita Water Use (Step 1D)

The calculation of baseline daily per capita water use combines information described above and is provided in Tables 5-1 below. The City’s baseline daily per capita use is **113 gpcd**.

Table 5-1: Gallons Per Capita Per Day (GPCD)				
Baseline Year		Service Area Population	Gross Water Use (million gallons)	Daily Per Capita Water Use (GPCD)
10 Year Baseline GPCD				
Year 1	2001	85,972	3,962	126
Year 2	2002	86,158	3,909	124
Year 3	2003	86,865	3,898	123
Year 4	2004	87,556	3,895	122
Year 5	2005	87,864	3,567	111
Year 6	2006	88,170	3,570	111
Year 7	2007	88,929	3,590	111
Year 8	2008	89,666	3,565	109
Year 9	2009	90,728	3,169	96
Year 10	2010	91,291	3,103	93
10 Year Average Baseline GPCD				113

5 Year Baseline GPCD				
Baseline Year		Service Area Population	Gross Water Use	Daily Per Capita Water Use
Year 1	2003	86,865	3,898	123
Year 2	2004	87,556	3,895	122
Year 3	2005	87,864	3,567	111
Year 4	2006	88,170	3,570	111
Year 5	2007	88,929	3,590	111
5 Year Average Baseline GPCD				116
NOTES:				

5.7 2015 and 2020 Targets

CWC 10608.20

(e) An urban retail water supplier shall include in its urban water management plan due in 2010. . . urban water use target, interim urban water use target,...along with the bases for determining those estimates, including references to supporting data (10608.20(e)).

CWC 10608.20

(g) An urban retail water supplier may update its 2020 urban water use target in its 2015 urban water management plan...

5.7.1 Select and Apply a Target Method (Step 2)

Under SB X7-7, urban water suppliers must next set a 2020 water use target using one of the following four methods:

Method 1: Eighty percent of the water supplier's baseline per capita water use.

Method 2: Per capita daily water use estimated using the sum of performance standards applied to indoor residential use; landscaped area water use; and commercial, industrial and institutional water uses.

Method 3: Ninety-five percent of the applicable state hydrologic region target as stated in the State's April 30, 2009, draft 20x2020 Water Conservation Plan.

Method 4: A method developed by CA DWR that identifies water savings obtained through identified practices and subtracts them from the agency's baseline GPCD.

As mentioned above, the City of Santa Cruz elected in 2010 to use **Method 3**. For the Central Coast Region, 95 percent of the region's 2020 target is **117 gpcd** ($0.95 \times 123 \text{ gpcd} = 117 \text{ gpcd}$). 100 percent of the City's water service area is located within the Central Coast region.

5.7.2 5-Year Baseline – 2020 Target Confirmation (Step 3)

CWC 10608.22

Notwithstanding the method adopted by an urban retail water supplier pursuant to Section 10608.20, an urban retail water supplier's per capita daily water use reduction shall be no less than 5 percent of base daily per capita water use as defined in paragraph (3) of subdivision (b) of Section 10608.12. This section does not apply to an urban retail water supplier with a base daily per capita water use at or below 100 gallons per capita per day.

Water Code section 10608.22 requires water suppliers to achieve at least a 5 percent minimum reduction in per capita water use, as compared to a different, 5-year baseline period, as mentioned earlier in section 5.3. The 5-year baseline period may end no earlier than December 2007 and no later than December 2010. The 5-year baseline period selected by the City of Santa Cruz is **2003-2007**.

As indicated in Table 5-1 above, the City's 5-year baseline water use calculates out to be **116 gpcd**. Accordingly, the City's maximum allowable gpcd target in 2020 (per section 10608.22) is **110 gpcd** ($0.95 \times 116 \text{ gpcd} = 110 \text{ gpcd}$).

5.7.3 Calculate the 2015 Interim Urban Water Use Target (Step 4)

The last step in complying with SB X7-7 requires calculating an interim urban water use target, meaning the midpoint between the base daily per capita water use and the 2020 target water use for measuring progress in the year 2015. The City's interim urban water use target is:

$$\text{Interim Urban Water Use Target} = (113 \text{ gpcd} + 110 \text{ gpcd})/2 = \mathbf{111.5 \text{ gpcd}}$$

5.7.4 Baselines and Targets Summary

All the discussion above regarding baseline periods, baseline GPCD, 2015 interim target and 2020 target is summarized in Table 5-2 below:

Table 5-2. Baselines and Targets Summary					
Baseline Period	Start Year	End Year	Average Baseline GPCD*	2015 Interim Target *	Confirmed 2020 Target*
10-15 year	2001	2010	113	111	110
5 Year	2003	2007	116		
*All values are in Gallons per Capita per Day (GPCD)					
NOTES:					

5.8 2015 Compliance Daily per Capita Water Use

All water suppliers are required to calculate their actual 2015 water use to determine whether or not they have met their per capita 2015 target and to assess their progress toward meeting their 2020 target. Beginning in 2016, eligibility for state grants and loans is conditioned on an agency meeting its 2015 target.

Table 5-2 below documents the City of Santa Cruz has not only met but far surpassed its 2015 target and is therefore in compliance with the requirements in SB X7-7.

Table 5-2. 2015 Compliance								
Actual 2015 GPCD	2015 Interim Target GPCD	Optional Adjustments to 2015 GPCD Enter "0" for adjustments not used <i>From Methodology 8</i>					2015 GPCD (Adjusted if applicable)	Did Supplier Achieve Targeted Reduction for 2015? Y/N
		Extraordinary Events	Economic Adjustment	Weather Normalization	TOTAL Adjustments	Adjusted 2015 GPCD		
70	111	0	0	0	0	70	70	Yes
*All values are in Gallons per Capita per Day (GPCD)								
NOTES:								

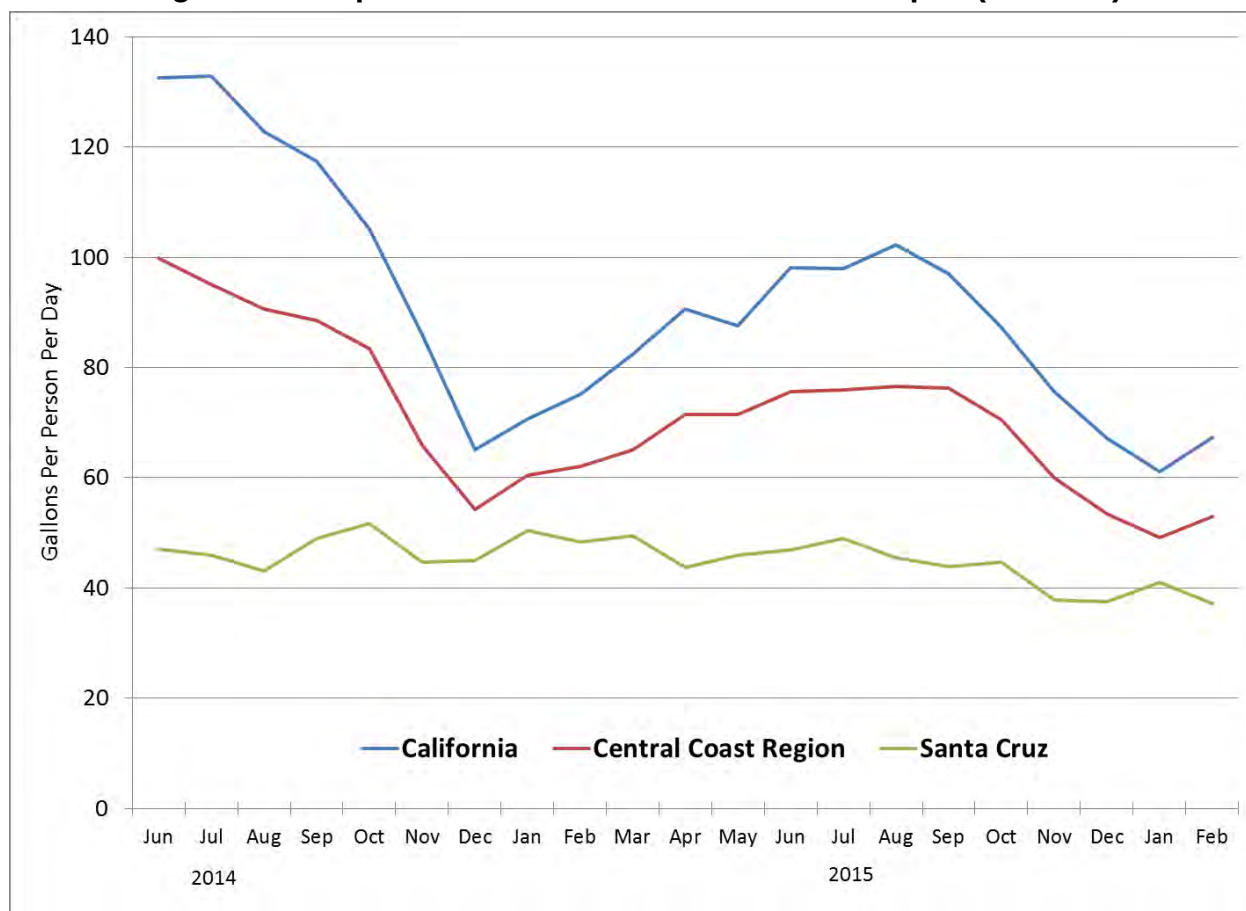
5.9 Drought Emergency Water Conservation and R-GPCD

Beginning June 2014, urban water suppliers were required under separate drought emergency regulations to submit monthly reports to the State Water Resources Control Board on their urban water conservation efforts. These reports initially focused on the total monthly water production compared to the amount produced in the same month during 2013.

Shortly thereafter, beginning October 15, 2014, urban water suppliers were required to report R-GPCD (residential per capita water use) on a monthly basis to the State Water Board as an informational metric. An agency's monthly R-GPCD differs from the annual GPCD calculation discussed above. It takes into account the percentage of total monthly potable water production being used for residential purposes and the residential population served. Unlike gross daily per capita water use, R-GPCD does not include commercial, industrial or institutional water or non-revenue water (water losses).

On April 1 2015, the Governor issued an [Executive Order](#) that directed the State Board to impose restrictions on water suppliers to achieve a 25 percent reduction in potable urban usage. The regulations that were adopted shortly thereafter gave agency-specific reduction targets based on their R-GPCD. Agencies with a higher R-GPCD were required to cutback more than agencies with a lower R-GPCD. Targets ranged from 8 percent for agencies, including the City of Santa Cruz, whose average R-GPCD was less than 65 gallons per person per day, up to 36 percent for agencies whose R-GPCD was 215 gallons per person per day, or more.

Figure 5-3 below shows the R-GPCD for the City of Santa Cruz compared to the statewide and the Central Coast Hydrologic Region averages for the period June 2014 through February 2016, as reported by the State Water Resources Control Board on its [Conservation Reporting website](#) in April 2016. Over this period, as a result of strict water rationing in effect through October 2015, the City consistently had one of the lowest levels for R-GPCD in all of California. The City will continue to report and track R-GPCD through at least January 2017, as required under statewide emergency water conservation regulations.

Figure 5-3. Reported Residential Water Use Per Capita (R-GPCD)

5.10 New Water Use Targets

On May 9, 2016, the Governor issued [Executive Order B-37-16](#). One of the provisions in this order was that the CA Department of Water Resources work with the State Water Resources Control Board to develop new targets as part of a permanent framework for urban water agencies. These new targets would build upon the state law requirements that the state achieve a 20 percent reduction in urban per capita water use by 2020. The targets would be customized to the unique conditions of each water agency, would generate more statewide conservation than existing requirements, and would be based on strengthened standards for:

- Indoor residential per capita water use;
- Outdoor irrigation, in a manner that incorporates landscape area, local climate, and new satellite imagery data;
- Commercial, industrial, and institutional water use; and
- Water lost through leaks

A draft framework for these new water use targets is planned for early 2017. It is unknown how this new target will change the current 2020 requirement for the City.

Chapter 6

SYSTEM SUPPLIES

This chapter describes the City's water supply system, presents supply source production volumes, and discusses possible future sources and opportunities to enhance the City's existing supply portfolio, including potential transfers, exchanges, and recycled water. Potential new sources are discussed further, in terms of planning for supply reliability, in Chapter 7.

The Santa Cruz water system relies predominantly on local surface water supplies, which include the North Coast sources, the San Lorenzo River, and Loch Lomond Reservoir. Together, these surface water sources represent approximately 95 percent of the City's total annual water production. The balance of the City's supply comes from groundwater, all of which is extracted from wells in the Purisima Formation in the mid-County area. These main production elements of the City's water supply system are illustrated below in Figure 6-1.

6.1 Purchased or Imported Water

The City of Santa Cruz does not now, nor does it plan to, import water, either from outside the Central Coast Hydrologic Region, or outside the Santa Cruz County boundaries. All of its water resources are obtained from local sources. The system relies entirely on rainfall, surface runoff, and groundwater infiltration occurring within watersheds located in Santa Cruz County. No water is purchased from state or federal sources or imported to the region from outside the Santa Cruz area.

6.2 Groundwater

Even though groundwater constitutes only up to about 5 percent of the entire City water supply on an annual basis, it has been a crucial component of the water system for meeting peak season demands, maintaining pressure in the eastern portion of the distribution system, and for weathering periods of drought since the facilities were acquired from the Beltz Water Company in 1964.

Figure 6-1. City of Santa Cruz Water Supply System

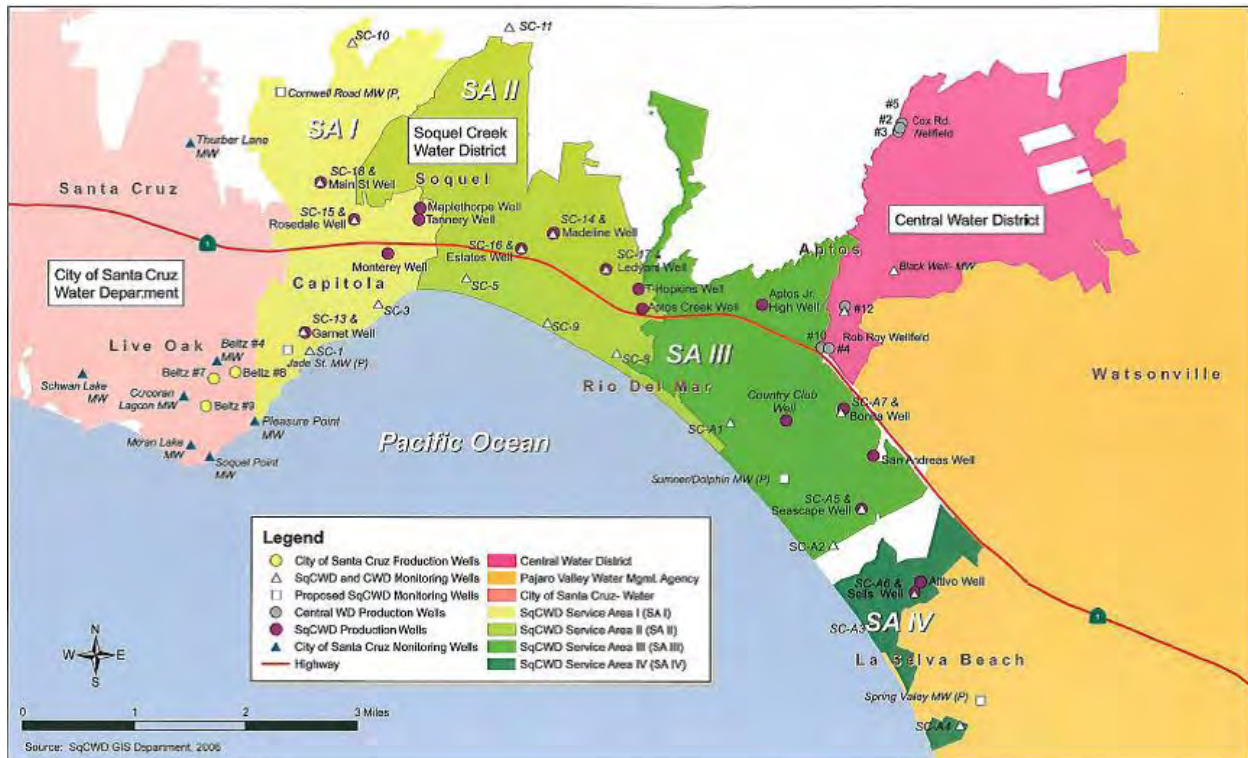
The Live Oak Well system consists of four production wells and two water treatment plants located in the eastern portion of the City water service area. The facilities were originally acquired by the City from the Beltz Water Company in 1964, and are still referred to as the “Beltz” wells. Wells 8 and 9 were installed in 1998 as replacement wells for Wells 1 and 2, which were damaged in the 1989 Loma Prieta earthquake. Well 7, which began operating in 1974, has been replaced by Well 10. The newest well, Beltz 12 and associated water treatment facilities, were completed in 2015.

The geographical area from which the City pumps groundwater is identified as the *West Santa Cruz Terrace Groundwater Basin* ([Basin Number 3-26](#)), whose western and eastern boundaries coincide roughly with the City’s water service area (CA DWR, Bulletin 118). The entire production of the City’s Live Oak well field is derived from the Purisima Formation, which is the primary groundwater aquifer underlying the entire

Mid-county region and makes up most of what is commonly referred to elsewhere as the “Soquel-Aptos” basin. As will be discussed in Section 6.2.2, a request to redefine the basin includes the reassignment of the eastern portion of the West Santa Cruz Terrace Groundwater Basin into the new Santa Cruz Mid-County Groundwater Basin.

Groundwater from the Purisima Formation is used by the City, the Soquel Creek and Central Water Districts, several small water systems, and numerous private rural water wells. A map of the public water supplier’s monitoring and production well networks within the region is shown in Figure 6-2. The City’s groundwater production and monitoring wells are concentrated on the western side, shown in the light pink area.

Figure 6-2. Public Water System Production and Monitoring Wells



6.2.1 Basin Description

The Purisima Formation is a collection of distinct geologic units composed of sandstone interbedded with layers of siltstone and claystone. These units, designated as AA through FF, vary in thickness and hydrogeological characteristics, with AA being the deepest and oldest unit. The formation is relatively shallow under the City’s water service area, but dips southeast, becoming deeper and thicker towards Capitola and Aptos and outcrops at the cliffs along the Monterey Bay shoreline. The A zone is the

primary supply for both the City's Live Oak (Beltz) wells and the Soquel Creek Water District's Service Area 1 wells and is continuous and connected between these areas of groundwater extraction (Hopkins Groundwater Consultants, 2009). Recharge is thought to occur from deep percolation of rainfall in the upper watersheds and along streambeds of Branciforte Creek, Arana Gulch, Rodeo Creek and Soquel Creek.

To better understand how the Purisima Formation responds to pumping stresses and to detect seawater intrusion, the City has installed and maintains a network of 34 monitoring wells at 14 sites. Groundwater levels and water quality, including chlorides, pH, total dissolved solids, general minerals, and other constituents are measured at regular intervals. Several new inland monitoring wells were added in 2012 and 2013. Data collected from these monitoring wells are shared with adjoining public water agencies interested in management and planning of groundwater supply.

6.2.2 Groundwater Management

The City of Santa Cruz Water Department has not itself prepared a groundwater management plan; however, a groundwater management plan has been prepared by the Soquel Creek and Central Water Districts for the Soquel-Aptos Area consistent with Assembly Bill 3030. This plan was originally prepared in 1996 then updated in 2007 and currently serves as a living document with the most recent update having occurred in 2013.

A new framework for sustainable management of groundwater supplies was provided in 2014 when Governor Brown signed the landmark [Sustainable Groundwater Management Act](#) or SGMA. Key milestones of SGMA are shown in the sidebar to the right.

In July 2015, the Soquel-Valley Groundwater Basin ([Basin Number 3-01](#)) was identified by the Department of Water Resources as one of 21 groundwater basins to be reclassified as **critically overdrafted**. This was done on the basis of seawater intrusion detected at the coastline, and the local declaration of a Groundwater Emergency by Soquel Creek Water District in 2014.

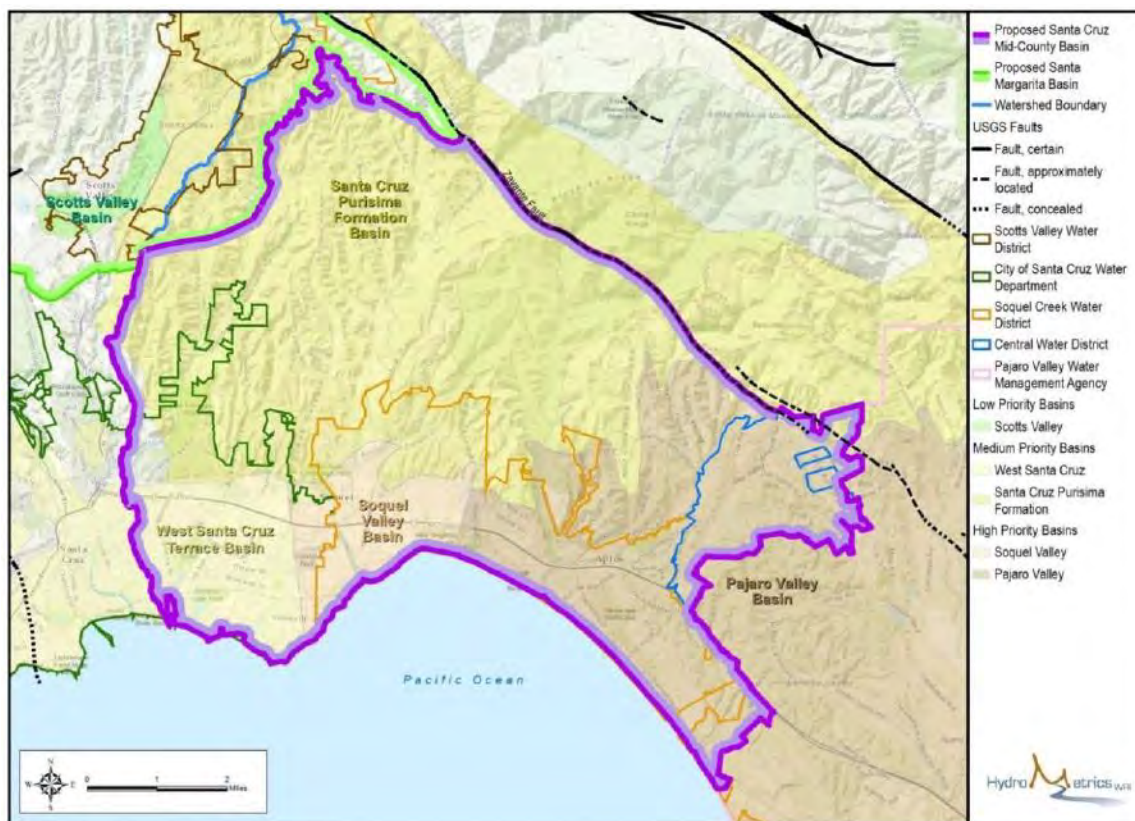
In September 2015, the [Soquel-Aptos Groundwater Management Committee](#) (SAGMC) was formed which



includes representatives from the County of Santa Cruz, Central Water District, Soquel Creek Water District, the City of Santa Cruz, and private well owners. This group is a joint exercise of powers entity with interest in management of the Soquel-Aptos groundwater basin. Its efforts include collecting, maintaining and sharing data; undertaking cooperative research and resource management initiatives; jointly pursuing groundwater management grants and studies; and facilitating requirements of the Sustainable Groundwater Management Act. The SAGMC also provides public outreach and education on groundwater topics and issues.

The SAGMC established a Groundwater Sustainability Agency Formation Subcommittee and appointed six members. Following the framework provided by the state, the subcommittee was charged with creating an approved Groundwater Sustainability Agency prior to the June 2017 deadline. Additional activities recently initiated by the SAGMC include requesting a basin boundary revision, developing quarterly monitoring reports, conducting an evaluation of shallow wells, and making progress on a comprehensive groundwater model by integrating information available for the entire management area.

Figure 6-3. Proposed Santa Cruz Mid-County Basin Boundary Area



Part of the recently completed work to redefine the boundary includes changing the name from Soquel-Aptos to Santa Cruz Mid-County Groundwater Basin, as illustrated in Figure 6-3. In early 2016 the SAGMC drafted a joint powers agreement (JPA) to create a fully empowered and independent Santa Cruz Mid-County Groundwater Agency (MGA) as authorized by the Sustainable Groundwater Sustainability Act (Appendix I). With the establishment of the Agency, the focus will shift from agency creation to the development of the Groundwater Sustainability Plan (GSP) that is required to be completed and submitted to the state in 2020. The City is a partner agency in the JPA and will have an allocated share of the total annual budget for the MGA that is consistent with the contributions provided under the previous planning and management efforts for the Soquel-Aptos Basin.

6.2.3 Overdraft Conditions

At this time, no court or board has adjudicated the right to pump groundwater from the Purisima aquifer, nor has the California Department of Water Resources identified the West Santa Cruz Terrace basin as critically overdrafted. Even so, the aquifer from which the City pumps long has been recognized locally as being threatened by the problem of over-pumping, as evidenced by a decline in static water levels and a broad, persistent trough consistently below sea level surrounding the Soquel Creek Water District's production wells, signaling that cumulative groundwater production exceeds the long-term sustainable yield of the aquifer.

Moreover, there is an ongoing risk of seawater intrusion into productive units of the Purisima Formation that could jeopardize the future production of groundwater by the City. This condition is due to coastal groundwater levels being below protective elevations. Although all units of the Purisima Formation extend offshore, the westernmost area of the A unit outcrops in the vicinity of Pleasure Point in close proximity to the Live Oak (Beltz) well field. This outcrop provides a pathway for seawater to enter the Unit A aquifer. Even though pumping by the City constitutes a small portion of the total extraction from the Purisima Formation, because the City's wells are located closest to the shoreline, they would be among the first impacted by seawater intrusion. This potential for seawater intrusion could reduce the City's dry year supply and exacerbate supply shortfalls during extended dry periods.

6.2.4 Groundwater Pumping

In 2010, the City was advised by its hydrogeologist that the yield of the Live Oak (Beltz) well field was substantially less than half the 420 mgd annual production that the City had long assumed for water supply planning purposes, and that the dry season

pumping rate that can be sustained without causing seawater intrusion in average years was closer to 170 mgy (Hopkins Groundwater Consultants, 2010). As a direct result of these findings, the City relocated pumping further inland to a new well site, shown as “Beltz 12” on the Figure 6-4 aerial image. This unexpected loss of drought year groundwater yield is emblematic of the continuing change and uncertainty facing the City in its effort to provide a safe, reliable, and adequate municipal water supply.

Figure 6-4. Location of Beltz Well Sites

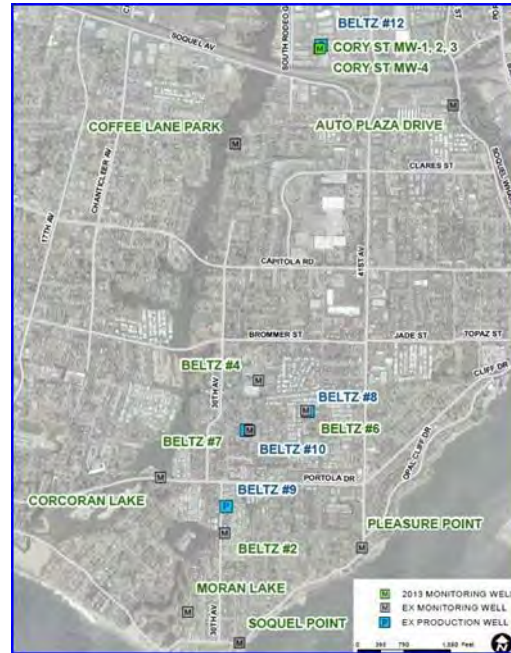


Table 6-1 below shows the actual volume pumped from the City’s well fields during the peak season over the last five years. Average volume over this time is 164 mgy. As a result of the hydrogeology work, the City has limited groundwater pumping to a volume far below 420 mgy level. The current agreed upon sustainable yield volume is 170 mgy and has been utilized by the City when planning for the operation of the well fields. Due to the severe drought conditions in 2014, the City did rely on groundwater for a somewhat higher volume in order to meet peak demand in the dry summer months.

Table 6-1. Groundwater Volume Pumped (mgy)						
Groundwater Type	Location or Basin Name	2011	2012	2013	2014	2015
Alluvial Basin	West Santa Cruz Terrace Groundwater Basin (3-26)	163	163	160	188	145
TOTAL		163	163	160	188	145

6.3 Surface Water

As presented in Chapter 3, the surface water system supplies are located both within and outside of the City of Santa Cruz with a mix of flowing sources and a storage reservoir. The map provided as Figure 6-1 in the introductory section illustrates the various surface water sources and the conveyance systems that comprise the supply facilities of the City. Each of the surface water sources are briefly described in the following sections.

6.3.1 North Coast Creeks and Springs

The North Coast sources consist of surface diversions from three coastal streams and a natural spring located approximately six to eight miles northwest of downtown Santa Cruz. These sources are: Liddell Spring, Laguna Creek, Reggiardo Creek, and Majors Creek. The use of these sources by the City dates back as far as 1890.

Figure 6-5. Laguna Creek Diversion Dam



6.3.2 San Lorenzo River

The San Lorenzo River is the City's largest source of water supply. The main surface water diversion is located at Tait Street near the City limits just north of Highway 1. Use of this source dates back to the 1870s and was consolidated under public ownership in

1917. The Tait Street Diversion is supplemented by shallow, auxiliary wells located directly across the river. These wells are potentially hydraulically connected to the river and tied to the City's appropriative rights for surface diversion. The drainage area above the Tait Street Diversion is 115 square miles.

Figure 6-6. San Lorenzo River Diversions at Tait Street and at Felton



The other diversion on the San Lorenzo River is Felton Diversion, which is an inflatable dam and intake structure built in 1974, located about six miles upstream from the Tait Street Diversion. Water is pumped from this diversion through the Felton Booster Station to Loch Lomond Reservoir. The facility is used to augment storage in the reservoir during dry years when natural inflow from Newell Creek is low.

While the City is the largest user of water from the San Lorenzo River basin, two other water districts, several private water companies and numerous individual property owners share the San Lorenzo River watershed as their primary source for drinking water supply (Figure 6-7).

6.3.3 Newell Creek and Loch Lomond Reservoir

Loch Lomond Reservoir is located near the town of Ben Lomond in the Santa Cruz Mountains. The reservoir was constructed in 1960 and has a maximum capacity of 2,810 million gallons (mg). In addition to providing surface water storage, the reservoir and surrounding watershed are used for public recreation purposes, including fishing, boating, hiking, and picnicking (swimming and wading are prohibited). The Newell Creek watershed above the reservoir is about nine square miles. In addition to the City, the San Lorenzo Valley Water District is entitled by contract to receive a portion of the water stored in Loch Lomond.

Water System Operations

The Water Department follows a variety of policies, procedures, and legal restrictions in operating the water supply system. In general, the system is managed to use available flowing sources to meet daily demands as much as possible. Groundwater and stored water from Loch Lomond are used mainly in the summer and fall months when flows in the coast and river sources decline and additional supply is needed to meet higher daily water demands. On a typical summer day, the North coast sources yield 1-2 mgd, the San Lorenzo River produces 7.5 mgd, groundwater makes up 0.8 mgd, and the reservoir contributes an average of 1-2 mgd.

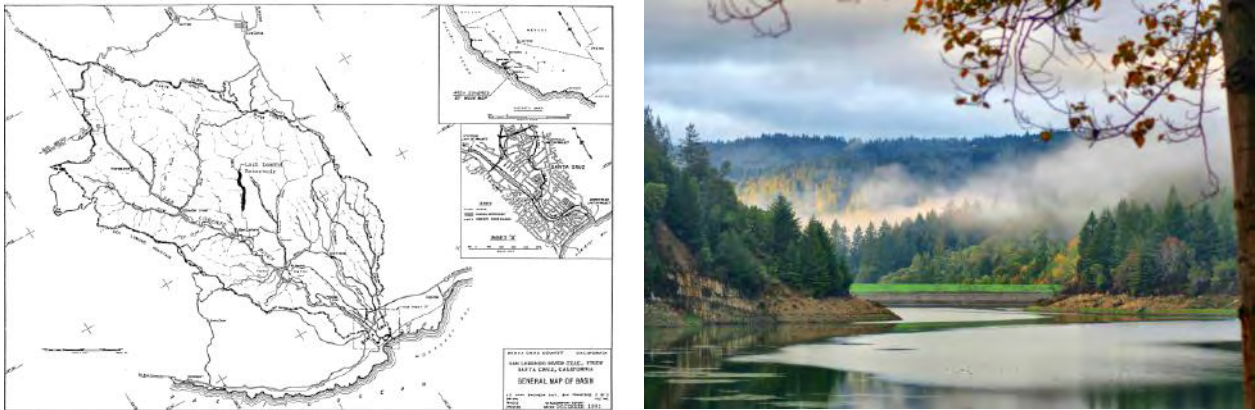
The amount of water produced from each of the City surface water sources is controlled by different water rights. A summary of these water rights is presented below.

Summary of Water Rights Held by the City of Santa Cruz

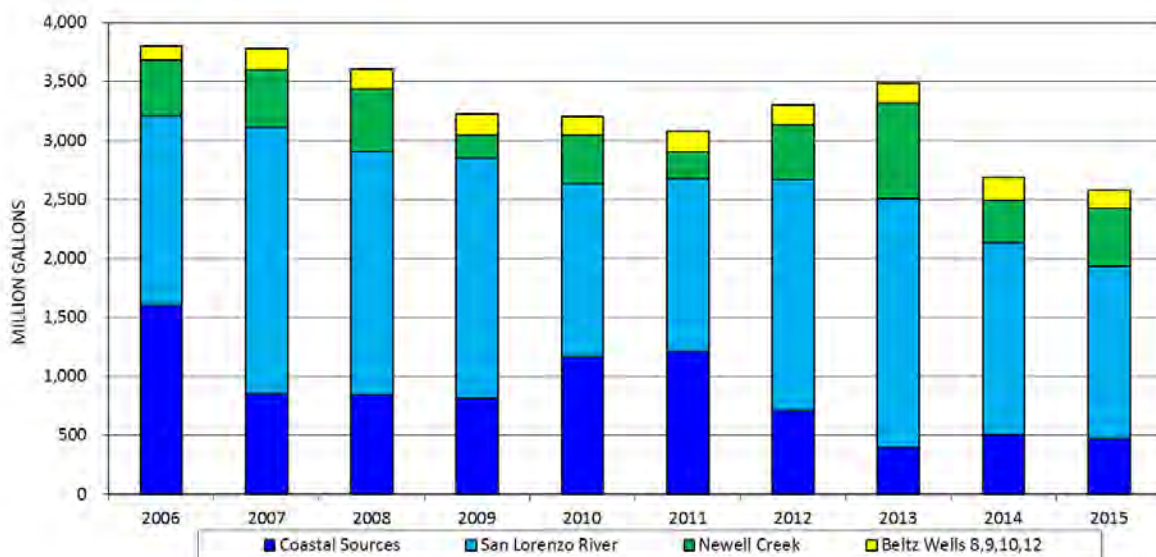
Source	License/ Permit Number	Period	Maximum Diversion Rate (cfs)	Fish Flow Requirement (cfs)	Annual Diversion Limit (mg)
North Coast	Pre-1914	Year round	No limit	None	None
San Lorenzo River: Tait Street Diversion and Wells Felton Diversion to Loch Lomond Reservoir	1553, 7200 16601, 16123	Year-round Sept Oct Nov-May Jun-Aug	12.2 7.8 20 20 0	None 10 25 20 --	None 977
Newell Creek: Collection to storage (max amount/year) Withdrawal	9847	Sept-Jun --	No limit --	-- 1	1,825 1,042

In accordance with the requirements of its water rights, the City releases a minimum flow of 1.0 cfs (equal to 0.65 mgd or approximately 20 million gallons per month) from storage in Loch Lomond Reservoir, to support fishery resources beneath the dam.

The City in 2007 voluntarily began releasing in-stream flows from the North Coast system on an interim basis in connection with an ongoing pursuit of an Incidental Take Permit under the Federal Endangered Species Act. Over the last 3 years, the City has dramatically reduced its diversion of water from Laguna Creek and increased instream flow releases on the San Lorenzo River to benefit fisheries habitat. Water system operations are likely to continue shifting toward using less flowing water and more water from reservoir storage to meet demand in the future (See Chapter 7).

Figure 6-7. San Lorenzo River Watershed and Loch Lomond Reservoir

Gross annual production volumes from the City's surface and groundwater sources over the past 10 years are shown in Figure 6-8, broken down by source of supply. During the past decade, the North Coast sources represented 26 percent of the total water supply, the San Lorenzo River represented 55 percent, Newell Creek (Loch Lomond Reservoir) represented 14 percent, and Live Oak (Beltz) wells contributed the remaining 5 percent.

Figure 6-8. Annual Production Volumes by Source of Supply (million gallons)

6.4 Storm Water

At this time, local urban storm runoff is not used by the City to meet its urban water demands. The City is regulated, however, by the California Regional Water Quality Control Board and has responsibility to reduce the amount of pollutants discharged in urban runoff, and to improve and protect water quality. The City is currently covered

under the State's General Permit for Storm Water Discharges from Small Municipal Storm Sewer Systems (MS4s). The General Permit requires the City to develop and implement a comprehensive Storm Water Management Program (SWMP). A complete description of this program is provided in the [Storm Water Annual Report](#).

The City of Santa Cruz, through its Public Works Department, maintains seven miles of underground storm water pipelines, eight miles of surface storm ditches, one pump station, approximately 1,500 catch basins, and 125 outfalls. The City also maintains the U.S. Army Corps of Engineers flood control channel and levee system on the San Lorenzo River, which is approximately three miles long with five pump stations. The City's operations and maintenance program for the flood control facilities on the San Lorenzo River includes removal of sand and silt from the channels of the river and Branciforte Creek; maintenance of pumps, gates and levees; and removal of weeds and growth in drainage ditches and catch basins. As a best management practice the City has routine street sweeping and regularly cleans the storm drain pipeline system, among other activities.

Storm water system management maintenance in the unincorporated area and Capitola is provided by the Santa Cruz County Flood Control and Water Conservation District, Zone 5, operated through the County Public Works Department. The County Board of Supervisors serves as the Board of Directors for the District. Facilities include underground storm drain systems and above ground ditches and watercourses.

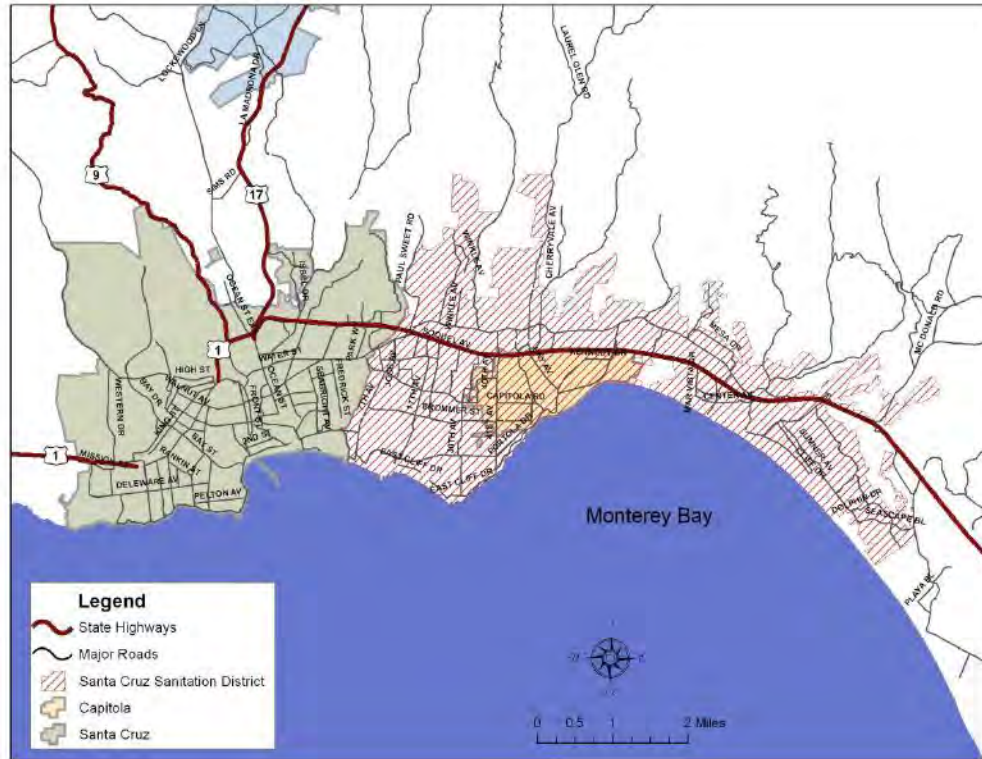
6.5 Wastewater and Recycled Water

The City of Santa Cruz owns and operates a city-wide wastewater collection and regional wastewater treatment and disposal facility providing service to a total urban population of approximately 130,000 people in an area extending from Santa Cruz out to the communities of Seaside and Aptos in unincorporated Santa Cruz County (Figure 6-9).

The City's Wastewater Treatment Facility (WWTF) is not currently permitted for and does not now produce recycled water for offsite reuse. Treated wastewater is reused internally within the wastewater plant to meet its major process water needs, including chemical mixing, contact and non-contact cooling water, equipment washing, heating, and cleaning. The 1998 upgrade of the plant to provide reuse water for on-site activities reduced potable water demand at the WWTF by about 90 percent. It now operates using only 3 to 4 million gallons per year for sanitary, irrigation, and other miscellaneous onsite uses. The only use of recycled water outside the WWTF has been that used by

the City's Public Works crews in trucks for flushing the sanitary sewer system as a way to conserve potable water during the recent drought.

Figure 6-9. Geographic Area Served by Santa Cruz Wastewater Facility



Over the years, the City has commissioned several engineering studies regarding the potential uses of recycled water for agricultural irrigation, landscape irrigation, groundwater recharge, direct potable reuse, and use of recycled water from neighboring water districts. These studies include the following:

- Alternative Water Supply Study (Carollo Engineers, 2000)
- Evaluation of Regional Water Supply Alternatives (Carollo Engineers, 2002)
- Integrated Water Plan Environmental Impact Report (City of Santa Cruz, 2005)
- Opportunities and Limitations for Recycled Water Use (Kennedy/Jenks, 2010)
- Current and Potential Future Opportunities for Indirect and Direct Potable Reuse of Recycled Water Use (Kennedy/Jenks, 2010)

The City of Santa Cruz is once again actively investigating the feasibility of recycled water through a regional Recycled Water Facilities Planning Study, funded in part by a grant from the State Water Board Division of Financial Assistance, Water Recycling

Funding Program. In addition, the City has been working to establish a small recycled water facility and is coordinating with the Pasatiempo Golf Club on a project to use treated wastewater from the Scotts Valley wastewater plant instead of potable water supplied by the City for the majority of its irrigation needs. A groundbreaking ceremony for the golf club's recycled water project was recently held. These two projects are described further in Section 6.5.4 in the discussion on beneficial uses of recycled water within the service area.

6.5.1 Recycled Water Coordination

As presented in Section 2.4, preparation of this 2015 UWMP was coordinated with all local water, wastewater, groundwater, and planning agencies throughout the water service area and Santa Cruz County. For this recycled water section, in particular, coordination involved working with the following entities:

- Santa Cruz Public Works Department (regional WWTF operator)
- Santa Cruz County Sanitation District (local wastewater collection agency)
- City of Scotts Valley Public Works (local WWTF operator)
- Scotts Valley Water District
- Soquel Creek Water District
- Pasatiempo Golf Course

6.5.2 Wastewater Collection, Treatment, and Disposal

6.5.2.1 Wastewater Collection

Municipal wastewater generated within the City limits is delivered to the treatment plant through a collection system consisting of 160 miles of gravity mains, 3.5 miles of force main, and 21 pumping stations. The City's collection system, treatment plant and ocean disposal system are managed and operated by the City's Public Works Department.

The Santa Cruz County Sanitation District, a special district operated through the Santa Cruz County Public Works Department, collects wastewater from the Live Oak, Capitola, Soquel, Aptos, and Seacliff areas through a system consisting of 188 miles of gravity main, 14 miles of force main, and 35 pump stations. It transports wastewater from a central pumping facility in Live Oak to the Santa Cruz WWTF for treatment and disposal. This wastewater is generated from outside the service area of the City of Santa Cruz and is treated within the service area. Table 6-2 summarizes wastewater collected from these two agencies in 2015.

Table 6-2. Wastewater Collected Within Service Area in 2015						
Wastewater Collection			Recipient of Collected Wastewater			
Name of Wastewater Collection Agency	Wastewater Volume Metered or Estimated?	Volume of Wastewater Collected in 2015 (mgd)	Name of Wastewater Treatment Agency Receiving Collected Wastewater	Treatment Plant Name	Is WWTP Located Within UWMP Area?	Is WWTP Operation Contracted to a Third Party?
City of Santa Cruz	Metered	1,480	City of Santa Cruz	Wastewater Treatment Facility	Yes	No
Santa Cruz County Sanitation District	Metered	1,149	City of Santa Cruz	Wastewater Treatment Facility	Yes	No
Total Wastewater Collected from Service Area in 2015:		2,629				

With the exception of some outlying areas and individual parcels that have onsite wastewater systems, the vast majority of the estimated 95,251 persons residing in the City of Santa Cruz water service area are served by these two wastewater collection systems. A third-party organization is not operating a facility under contract in the Santa Cruz service area.

In addition to the City and County Sanitation District, two small County Service Areas serving the communities of Rollingwoods and Woods Cove are connected to the City's wastewater system. Dry weather flows from Neary Lagoon are also diverted through the WWTF to help protect water quality at local beaches for public health and recreation.

6.5.2.2 Wastewater Treatment

The City's treatment plant was modernized in the late 1990's from the advanced primary level to provide full secondary treatment in order to meet State and Federal waste discharge requirements (Figure 6-10).

The treatment process consists of screening, grit removal, primary sedimentation, biological treatment (trickling filters), secondary clarification, and disinfection (UV).

Bio-solids removed from the wastewater stream are treated by gravity thickening, anaerobic digestion, and dewatering by centrifuges.

Figure 6-10. City of Santa Cruz Wastewater Treatment Facility



The City's WWTF is designed to treat an average dry weather flow of 17 million gallons per day (mgd) and can accommodate peak wet weather flows of up to 81 mgd. Typical dry weather flows in past years have ranged between 9-10 mgd. Due to strict conservation measures in recent years, the amount of wastewater generated in the City and the Sanitation District's service areas has dropped substantially, averaging 6.5 mgd during the dry season and totaling 2,629 million gallons in 2015.

In 2013 the WWTF was awarded Plant of the Year by the California Water Environment Association (for facilities in the range of 5-20 million gallons per day). The award is based on the review of infrastructure, management practices and compliance records.

6.5.2.3 Wastewater Disposal

Wastewater effluent from the WWTF is disinfected with UV prior to being discharged to the Pacific Ocean through a deep water outfall extending 12,250 feet on the ocean bottom and terminating one mile offshore at a depth of approximately 110 feet below sea level. A 2,100 foot diffuser at the end of the pipe provides a minimum initial dilution of 139 parts seawater to one part wastewater.

The City's wastewater facility is regulated under a waste discharge permit issued by the California Regional Water Quality Control Board, Central Coast Region (Order No. R3 - 2010 - 0043). Monterey Bay and surrounding ocean waters was designated in 1992 as a National Marine Sanctuary and is widely recognized for its unique and diverse biological characteristics and physical features. To protect receiving water quality and sanctuary resources, the wastewater influent and effluent characteristics are carefully monitored for compliance with state water quality requirements. The City also performs receiving water monitoring and participates in a regional monitoring program with other dischargers in the Monterey Bay area, known as [Central Coast Long-Term Environmental Assessment Network](#) (CCLEAN).

The City of Scotts Valley treats its wastewater separately and transmits secondary treated effluent to Santa Cruz for combined disposal through the City's ocean outfall. Since 2002, the City of Scotts Valley, in conjunction with Scotts Valley Water District, has operated a 1.0 mgd tertiary treatment plant and delivered recycled water within its service area mainly for landscape irrigation purposes.

Table 6-3 below provides the total amount of wastewater treated and disposed by the City's wastewater treatment facility in 2015.

Table 6-3: Wastewater Treatment and Discharge Within Service Area in 2015								
☐ No wastewater is treated or disposed of within the UWMP service area. The supplier will not complete the table below.								
Wastewater Treatment Plant Name	Discharge Location Name or Identifier	Discharge Location Description	Wastewater Discharge ID Number (optional)	Method of Disposal	Does This Plant Treat Wastewater Generated Outside the Service Area?	Treatment Level	2015 volumes (mg)	
							Wastewater Treated	Discharged Treated Wastewater
Wastewater Treatment Facility	Monterey Bay/Pacific Ocean Bay Outfall	Deep water outfall	3-440102001	Ocean outfall	Yes	Secondary, Undisinfected	2,629	2,629
Total							2,629	2,629
NOTES: Treatment and discharge volumes are presented as equal to satisfy the objective of this table. The recycled water that is reused within the Facility is not considered eligible for designation as recycled water under current Title 22 requirements. Figures presented do not include Scotts Valley waste discharge volumes.								

6.5.3 Recycled Water System

As mentioned above, the City does not operate a recycled water system in its service area at this time. The only use of recycled water outside the WWTF has been that used

by the City's Public Works crews in trucks for flushing the sanitary sewer system as a way to conserve potable water during the recent drought.

6.5.4 Recycled Water Beneficial Uses

6.5.4.1 Current and Planned Uses of Recycled Water

Title 22 [California Code of Regulations, Division 4, Chapter 3, Sections 60301-60355](#) is the regulation overseeing the reuse or recycling of municipal wastewater to protect public health. Level of treatment and bacteriological water quality standards define what uses are legally allowed. The quality of wastewater produced at the City's treatment plant currently would be best classified under the Title 22 criteria as "Secondary, Undisinfected", even though the wastewater plant provides ultraviolet disinfection, and the City consistently meets its receiving water limitations contained in its NPDES permit for bacteriological objectives. The City's treated wastewater is therefore potentially suitable for only very limited agricultural applications and for flushing sanitary sewers according to the standards in Title 22.

The present level of wastewater treatment is not sufficient for the water to be used for unrestricted use on playgrounds, parks, schoolyards, construction, cooling and other non-contact industrial processes, or general landscape irrigation. Additional treatment above that currently provided would be needed to meet the state public health and safety requirements. In addition to the treatment upgrades, a separate distribution system, including pumps, storage facilities, and piping would be required to convey non-potable recycled water to potential customers.

As mentioned earlier, the City is undertaking a regional Recycled Water Facilities Planning Study (RWFPS) under a contract with Kennedy/Jenks Consultants. The goals of the RWFPS are:

- to assess beneficial reuse of wastewater from a resource recovery perspective
- to evaluate local and regional recycled water projects
- to identify near-term, mid-term and long-term projects
- to meet the schedule for the WSAC Implementation Plan, and
- to initiate a strategy for continued outreach related to recycled water.

Table 6-4 below lists the number and type of recycled water projects that are being considered in the planning study. This planning study is scheduled to be completed in 2017. The scope of work for this project is included as Appendix J.

Table 6-4. List of Potential Recycled Water Projects Under Investigation				
Project No:	Recycled Water Use	Source Water	Treatment	Project Area(s)
1a	Industrial Use/ Landscape Irrigation	Santa Cruz WWTF	Tertiary	City, District and County
1b		Local Raw Wastewater	MBR Tertiary	UC Santa Cruz
2a	Irrigation	Santa Cruz WWTF	Tertiary	North Coast Agricultural Irrigation
2b		Santa Cruz WWTF -or- SVWD WWTP	Secondary or Tertiary	Pasatiempo + Other Landscape
2c		Santa Cruz WWTF	Tertiary	Landscape
3	Seawater Barrier	Santa Cruz WWTF	Advanced Treatment	Lower Groundwater Basins
4a	Groundwater Replenishment	Santa Cruz WWTF	Advanced Treatment	Upper/Lower Purisma Formation and Soquel Valley Groundwater Basin
4b		Local Raw Wastewater	MBR + Advanced Treatment	
4c		Santa Cruz WWTF -and- Scotts Valley WWTP	Advanced Treatment	Santa Margarita GW Basin
5	Reservoir Augmentation	Santa Cruz WWTF	Advanced Treatment	Loch Lomond Reservoir
6	Streamflow Augmentation	Santa Cruz WWTF	Tertiary or Advanced Treatment	San Lorenzo River
7	Direct Potable Reuse	Santa Cruz WWTF	Advanced Treatment	City, District and County

In the meantime, the City is actively pursuing two recycled water projects: 1) a bulk recycled water fill station and pilot City park irrigation project adjacent to the WWTF, and 2) supporting delivery of recycled water from Scotts Valley to the Pasatiempo golf course.

The City Department of Public Works is planning to expand the internal reuse water system at the WWTF to produce Title 22 tertiary treated water and to build a small distribution system for offsite use. The maximum amount of recycled water production from this system would be about 0.25 mgd; about half of which would be used within the plant and the other half potentially available for offsite demand. Current bulk water use in the service area is approximately 4 mgy, which could be reduced partially or wholly

by switching to recycled water. In addition, there is the potential demand at La Barranca Park of about 1 mgd for landscape irrigation.

The Pasatiempo Golf Course is also in the process of finalizing arrangements to receive secondary effluent from the City of Santa Cruz. The Scotts Valley Water District has been working on an agreement with the management of the Pasatiempo Golf Club and the City of Santa Cruz to allow the golf course to have a right to receive up to 170,000 gallons per day (up to 35 MGD – equivalent of 206 days per year) of secondary treated water from the City of Santa Cruz. The Golf Club would then treat the water to meet the standard in Title 22 for unrestricted access golf courses. The City of Santa Cruz would continue to supply a portion of the water demand as needed for potable water uses and supplemental water for recycled water irrigation.

The current and projected uses of recycled water for these near-term projects within the City's service area are presented in Table 6-5 below.

Table 6-5. Current and Projected Recycled Water Direct Beneficial Uses Within Service Area (mgd)									
☐	Recycled water is not used and is not planned for use within the service area of the supplier. The supplier will not complete the table below.								
Name of Agency Producing (Treating) the Recycled Water:				City of Santa Cruz/SVWD/SqCWD					
Name of Agency Operating the Recycled Water Distribution System:				City of Santa Cruz/City of Santa Cruz/SVWD/SqCWD					
Beneficial Use Type	General Description of 2015 Uses	Level of Treatment	2015	2020	2025	2030	2035	2040 (opt)	
Agricultural irrigation									
Landscape irrigation (excludes golf courses)	N/A	Tertiary	N/A	up to 1	up to 2	up to 3	up to 4		
Golf course irrigation	N/A	Tertiary	N/A	35 (est)	35 (est)	35 (est)	35 (est)		
Wildlife Habitat Enhancement/Wetland									
Commercial, Industrial	N/A	Tertiary	N/A	up to 4	up to 4	up to 4	up to 4		
Groundwater recharge (IPR)				TBD	TBD	TBD	TBD		
Reservoir Augmentation				TBD	TBD	TBD	TBD		
Direct potable reuse				TBD	TBD	TBD	TBD		
Other	Type of Use								
Total:			0	0	0	0	0	0	0
IPR - Indirect Potable Reuse									
NOTES: Due to the preliminary nature of the proposed recycled water projects, please refer to the narrative for details as these numbers represent potential volumes for planning purposes and are not known quantities suitable for operational purposes. Agencies involved include the City of Santa Cruz, City of Santa Cruz, Scotts Valley Water District (SVWD), and Soquel Creek Water District (SqCWD). For golf course irrigation, the source of water is the City of Santa Cruz wastewater plant treated to secondary level and then treated to a tertiary level at the golf course.									

6.5.4.2 Planned Versus Actual Use of Recycled Water

Recycled water, as defined by the California Department of Water Resources, was not used by the City in 2010 nor projected for use in 2015.

Table 6-6. 2010 UWMP Recycled Water Use Projection Compared to 2015 Actual

☒	Recycled water was not used in 2010 nor projected for use in 2015. The supplier will not complete the table below.

6.5.5 Description of Actions to Encourage and Optimize Future Recycled Water Use

Currently the City does not produce recycled water for use outside its wastewater treatment plant, therefore actions to encourage the use, including financial incentives, and development of a plan to optimize the use of recycled water in the City's service area do not apply at this time. The steps and actions to encourage and optimize recycled water will be defined in the future if and when recycling is selected and pursued to diversify the City's water supply portfolio.

Currently, the City is pursuing groundwater storage strategies including projects for in-lieu/passive recharge, and aquifer storage and recovery/active recharge (ASR). In the event these strategies prove insufficient to meet the accepted goals of cost-effectiveness, timeliness, or yield, either advanced treated recycled water or desalinated water would be developed as a supplemental replacement supply. These strategies and the underlying assumptions and goals are discussed further in Chapter 7.

To prevent significant delay in developing an effective supply of reliable water, recycled water is being considered simultaneously with groundwater storage feasibility (in-lieu and ASR). After the initial five-year study phase, strategy options will be selected for buildout beginning in year 2020 to augment the existing supply by 2025.

Table 6-7. Methods to Expand Future Recycled Water Use

☐	Supplier does not plan to expand recycled water use in the future. Supplier will not complete the table below but will provide narrative explanation.		
	Provide page location of narrative in UWMP		
Name of Action	Description	Planned Implementation Year	Expected Increase in Recycled Water Use
Recycled Water Facilities Planning Study	Contract with Kennedy/Jenks to research potential uses of recycled water	TBD	TBD
Total			TBD

6.6 Desalinated Water Opportunities

For a decade or more, the City had been pursuing a 2.5 mgd desalination facility as a regional project with Soquel Creek Water District to diversify both agencies' water

supply portfolio. It remains a possible project for the City. In the recently completed Final Report on Agreements and Recommendations (Appendix K), the Water Supply Advisory Committee presented a supply strategy that includes desalinated water, but only as a last resort, and after exhausting several other preferred options (City of Santa Cruz, 2015). Soquel Creek Water District is continuing to consider desalinated water through a Memorandum of Interest with a different regional “Deepwater Desal” project proposed at Moss Landing Harbor.

6.7 Exchanges or Transfers

Following years of discussion and coordination on groundwater management, the City and Soquel Creek Water District recently signed a “Cooperative Water Transfer Pilot Project for Groundwater Recharge and Water Resource Management” agreement to transfer a small amount of water to Soquel Creek Water District in the winter months when surface water from the North Coast is available (Appendix Y). This transfer would allow the District to assess the effects of reduced pumping of the basin. The agreement is a first step in the implementation of the Water Supply Augmentation Strategy and serves to further study and determine the potential benefits of local exchanges and transfers as a groundwater management tool and supply reliability strategy.

6.8 Future Water Projects

The Final Report on Agreements and Recommendations presented by the Water Supply Advisory Committee includes an implementation strategy and work plan for determining which project to pursue. At this time it is unknown which project(s) will be carried out over the 20-year planning horizon of this Urban Water Management Plan. The Final Report, summarized in Chapter 7, provides the framework for the decision-making for initiating future water projects and describes the need either for substantial additional storage or some other strategy to increase supply reliability. Therefore the City is unable to complete Table 6-8 as some or all of the future water supply projects or programs are not compatible with the table and are described in a narrative format within the Plan.

Table 6-8. Expected Future Water Supply Projects or Programs	
☒	Some or all of the supplier's future water supply projects or programs are not compatible with this table and are described in a narrative format.
6-21 & 7-12 to 7-21	Provide page location of narrative in the UWMP

6.9 Summary of Existing and Planned Sources of Water

6.9.1 Existing Sources of Water

The City's existing sources and actual production volumes for 2015 are presented in Table 6-9. The figures represent production volumes experienced under severe drought conditions and with emergency water shortage regulations and restrictions in effect locally between the months of May and October.

Table 6-9. Water Supplies — Actual				
Water Supply	Additional Detail on Water Supply	2015		
		Actual Volume	Water Quality	Total Right or Safe Yield (optional)
Surface water	North Coast	382	Raw Water	
Surface water	San Lorenzo River	1,458	Raw Water	
Surface water	Loch Lomond	495	Raw Water	
Groundwater	Live Oak Wells	145	Raw Water	
Total		2,480		0
NOTES: Net production figures in million gallons				

6.9.2 Planned Sources of Water

Table 6-10 provides an estimate of the volume of water, by source, that is reasonably available from 2020 to 2035. These volumes are based on deliveries for average years, projected water demands, and available surface water flows consistent with ecosystem protection goals, according to the City's water supply operations model, Confluence.

The City is currently developing a supply augmentation plan that will include increased production between 2020 and 2035. However these volumes and the prospective sources are not fully understood at this time. A shift in the balance of the supply sources may occur as a component of the supply augmentation strategies shown as potential planned water sources. For instance, the City expects to produce less water from the North Coast sources in the future compared to historic production levels. In total, the expectation is that existing and planned sources of water available to the City over the next twenty years, on average, are estimated to meet the predicted total annual water demand of about 3.2 to 3.3 billion gallons annually.

As part of the augmentation strategy the City recognizes the importance of additional supply storage as a safeguard against future water shortages. Chapter 7 discusses the

challenges to the City's supply system and provides additional narrative that proves useful in understanding the information presented in Table 6-10 below.

Table 6-10. Water Supplies — Projected						
Water Supply	Additional Detail on Water Supply	Projected Water Supply (mgd) <i>Report To the Extent Practicable</i>				
		2020	2025	2030	2035	2040 (opt)
		Reasonably Available Volume	Reasonably Available Volume	Reasonably Available Volume	Reasonably Available Volume	Reasonably Available Volume
Surface water	North Coast Sources	637	642	671	671	n/a
Surface water	San Lorenzo River	1,882	1,842	1,829	1,834	n/a
Surface water	Loch Lomond Reservoir	595	551	540	547	n/a
Groundwater	Live Oak/Beltz Wells	138	129	127	128	n/a
Transfers	Near term transfer to SqCWD of up to 100 mgd to assess the effect of reduced pumping on the groundwater basin and explore the opportunity of developing a longer-term agreement for aquifer storage and recovery					
Exchanges						
Recycled Water	Recycled water feasibility study investigating options including regional partnership opportunities for a recycled water project to provide drought resistant supply and options for groundwater management strategies due to overdraft conditions of local basins					
Desalinated Water				Potential project to expand recycled water supply or investigate desalination		
Other						
Total		3,252	3,164	3,167	3,180	0
NOTES: Projected supply volumes shown represent the output values from the City's Confluence (water supply) model. These projections consider the operations of the City's current supply system in response to a projected demand.						

6.10 Climate Change Impacts to Supply

As the City of Santa Cruz water supply consists of only local sources maintained and recharged by natural processes, the potential weather conditions related to climate change could greatly impact the sources of supply. A widely accepted profile is that climate change may make the future hydrology drier than the historical record maintained in the region (1937 to today). General forecasts describe deviation in the seasonal patterns of rainfall with longer and more severe droughts. Additionally, the annual average temperature in the region may increase leading to variability in the rate of evaporative processes that can greatly impact local sources and watersheds (Stratus Consulting, 2015).

With these potential impacts to the available local supply in mind, the City is exploring projects that not only diversify supply options, but also enhance the reliability of the system. In Chapter 7, the long-term reliability of the system supplies is presented along with an analysis of known constraints on existing sources. Climate change impacts are likely to be a contributor to a less reliable supply and also a driver for strengthening demand management planning as discussed in Chapter 9.

Chapter 7

WATER SUPPLY RELIABILITY ASSESSMENT

This chapter of the plan describes the long-term reliability of the City's water supplies including assessment of supply relative to demand and the management strategies being implemented to create a more dependable supply. While this chapter is focused on assessment, Chapter 9 discusses the City's water conservation planning process and demand management measures currently being implemented. Short-term reliability planning that requires immediate action, such as drought or a catastrophic supply interruption, is addressed in Chapter 8, Water Shortage Contingency Planning.

7.1 Constraints on Water Sources

The City of Santa Cruz is facing several obstacles in meeting its present and future water supply needs. While each complication presents a unique set of water management challenges, the common theme is the limitation in where, when, and how much water is available to meet the area's water service needs, particularly during years when rainfall is below average. The following sections outline the known constraints on supply and include the management strategies implemented for each.

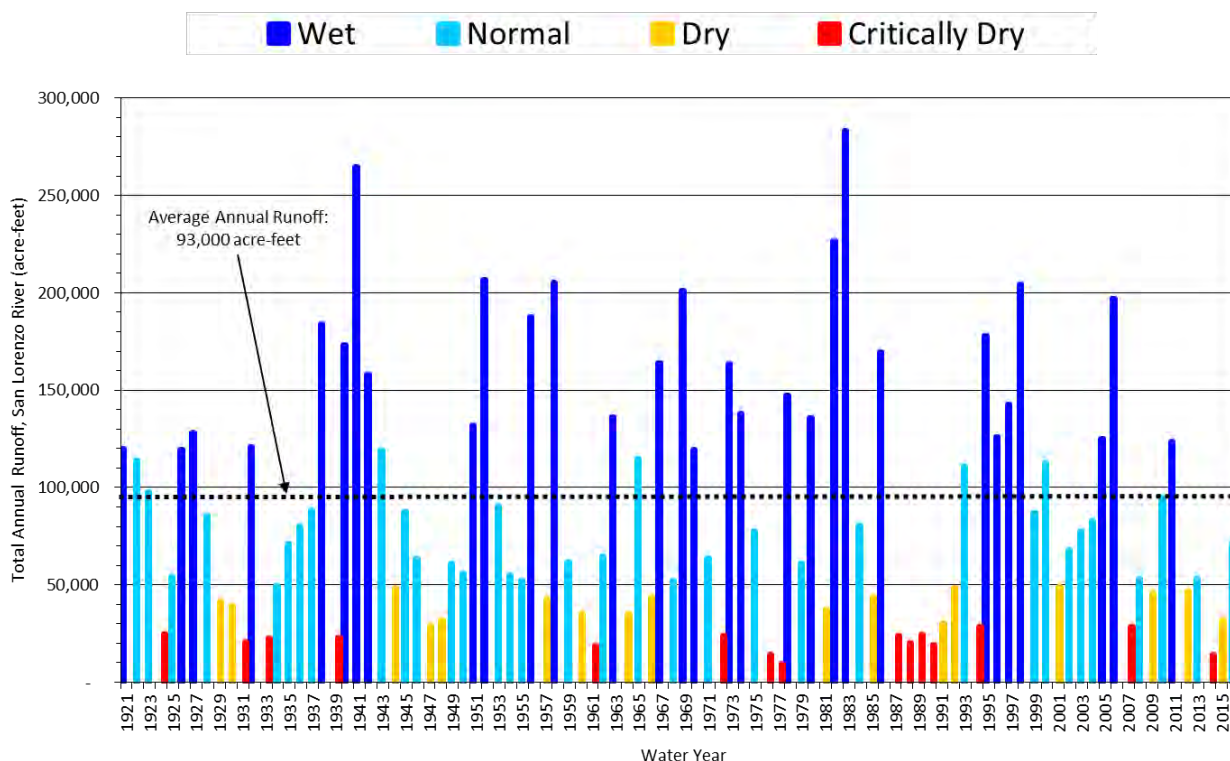
7.1.1 Local Supply Variability

As explained in Chapter 3, the City water system draws almost exclusively on local surface water sources, whose yield varies from year to year depending on the amount of rainfall received during the winter season and generated runoff that provides beneficial inflows. This local variation has been a significant constraint in recent years as the Central Coast, and the State of California more generally, were held in the grip of a multi-year drought. Declaration of a local water shortage emergency for the past two years underscores the effect of the drought on the City of Santa Cruz system.

Figure 7-1 below shows the total annual runoff for the San Lorenzo River over the 95-year period from 1921 to 2016 and the classification for each water year. The graph illustrates the dramatic variation in discharge from year to year. This natural variation in the level of runoff available in local streams and rivers, from which the City draws the majority of its supply, is the major factor that results in an inconsistent level of water supply from year to year. Ultimately, the only water available to the City is that which originates from rain that falls on the ocean side of the Santa Cruz Mountains. In normal

and wet years, when rainfall and runoff are abundant, the water system is capable of meeting the community's current total and anticipated annual water requirements.

Figure 7-1. Total Annual Stream Discharge from the San Lorenzo River (Acre feet)



The system is highly vulnerable to shortage, however, in extended dry periods or critically dry years, when the flow in local streams and river sources runs low. Moreover, like other communities on California's central coast, the Santa Cruz water system is physically and geographically isolated. Limited emergency interconnection capability may be possible due to existing interties with a neighboring water district. The primary function of the interties is to allow for the movement of water to the Soquel Creek Water District that currently relies solely on groundwater from a critically over drafted basin.

Water is currently stored in Loch Lomond Reservoir (impounded by the Newell Creek Dam) to serve peak season demands and is an integral part of the supply system. Some amount of storage is used each year, mainly in the summer and fall months when the flows in the coast and river sources decline and additional supply is needed to meet higher daily water demands than during winter and spring.

During dry years, the system relies more heavily on water stored in Loch Lomond to satisfy demand, which draws down the reservoir level lower than usual and depletes

available storage. In multi-year or critical drought conditions, the combination of very low surface flows in the coast and river sources and depleted storage in Loch Lomond reservoir reduces available supply to a level which cannot support average dry season demands. Compounding the situation is the need to retain a certain amount of water in the reservoir if drought conditions continue into the following year. The existing system is not able to provide a reliable supply during multi-year droughts or prolonged periods of drier than normal hydrologic conditions within the source watersheds.

7.1.2 Ecosystem Restoration and Protected Species

Since 2002, the City of Santa Cruz has been working toward the development of a Habitat Conservation Plan (HCP) that covers operation and maintenance activities at the North Coast streams and San Lorenzo River diversions as well as other activities which may result in “take” of threatened and/or endangered species. An HCP is an operational avoidance and minimization and mitigation plan prepared under Section 10 of the Federal Endangered Species Act (FESA) and Section 2081 of the California Endangered Species Act (CESA) by nonfederal parties seeking to obtain a permit for incidental take of federally or state-listed threatened and endangered species.

The City initiated the HCP process because the streams from which the City diverts water currently support steelhead trout and the San Lorenzo River and Laguna Creek support coho salmon. Within the Central California Coast Region, steelhead (*Oncorhynchus mykiss*) is currently listed as “threatened” and Coho salmon (*Oncorhynchus kisutch*) is listed as “endangered” on the ESA federal list and Coho salmon are also listed as “threatened” under CESA.

Numerous studies undertaken in support of the HCP have evaluated what limiting factors may be affecting fish in these streams. Among other things, this includes evaluation of instream flow needs during all freshwater life phases (migration, spawning, incubation and rearing) over a range of hydrologic year types. Because these studies indicated that habitat conditions in these streams could be improved with increased instream flows, the City began voluntarily diverting less flow in 2007 on an interim basis in connection with the pursuit of the HCP.

Although the HCP negotiations are ongoing, the City is forecasting that ultimate compliance with the state and federal Endangered Species Acts will result in less water being available from the City’s flowing sources for supply in future years compared to the past. This, in turn, will place greater reliance on water stored in Loch Lomond Reservoir to meet the community’s annual water needs and exacerbate the aforementioned vulnerability to shortage.

7.1.3 Source Water Quality and Treatment Capacity

The City's Graham Hill Water Treatment Plant (GHWTP) currently complies with all drinking water standards set by the US Environmental Protection Agency (EPA) and the State Water Resources Control Board Division of Drinking Water (DDW). These regulations require monitoring of water sources, watershed protection, treatment techniques, and extensive monitoring of treated water quality throughout the distribution system.



The primary issues with respect to water quality are the treatment challenges posed by future changes in our source water mix driven in part by ecosystem protection requirements. The GHWTP is a conventional surface water treatment plant that was commissioned in 1960 as a 12 mgd plant and has undergone an expansion and a number of improvements over the last 50 years. Except for groundwater from the Live Oak wells, all water delivered through the City system is treated at this plant. In other words, it must operate properly 100 percent of the time to maintain water service throughout the entire system.

Following the last major expansion the plant can process up to 16 mgd and year-round average production is 10 mgd. The City has been evaluating improvements to accommodate a variety of changing conditions such as potential higher daily plant output in the winter, evolving water quality regulations, and future changes in the source water mix. As information has become available from the various studies such as the Initial Distribution System Evaluation—conducted as part of preparing to comply with the State 2 Disinfectant and Disinfection Byproducts Rule, and work toward the HCP, the focus has narrowed to strategies to reduce the formation of disinfection byproducts and the treatment of more turbid source water with greater natural organic matter.

The City plans to continue investment in the plant by taking on projects that upgrade the existing facility to enhance water quality and respond to detection of contaminants of emerging concern (CECs) including pharmaceuticals and personal care products (PPCPs). As water quality and treatment regulations change these investments are

designed to prevent noncompliance with drinking water standards and/or mission-critical values of supplying adequate, safe, and reliable water for the City's customers.

7.1.4 The Water Rights Conformance Project for Water Rights and Entitlements

In 2008, the City developed and submitted filings to the SWRCB to address a historical oversight in the language of the City's water rights documents for Newell Creek and the San Lorenzo River at Felton (Felton Diversion) and to request a time extension for the full development of the 3,000 ac-ft permit to divert water from the San Lorenzo River at Felton.

The Newell Creek and San Lorenzo River permits to divert at Felton were originally granted as "diversion to storage," rather than as "direct diversion" rights. A diversion to storage is used when the water diverted is put into storage and is retained in storage for some time prior to being used. Current State Water Resources Control Board practice, however, requires rights of "direct diversion" as well as diversion to storage for the same operations as the City originally proposed and has historically undertaken.

The City's interest in initiating the Water Rights Conformance Project is to eliminate technical constraints for the operations of its water supply resources. While the water rights granted pursuant to the original filings were thought to be adequate at the time, it is now necessary to add the right of direct diversion to the rights to divert to storage. If this is not rectified, the Newell Creek inflow could be considered unavailable as a source for City use during times when, for example, the reservoir is receiving more inflow from Newell Creek than is being released downstream (Gary Fiske & Associates, 2003).

The City's permits to divert water at Felton for storage in Loch Lomond Reservoir (as amended by earlier requests for time extensions in the mid-1980s and again in the mid-1990s) required the City to put all of its approximately 980 mgd entitlement to full beneficial use by December 2006. While the City has been diligently using water from the Felton Diversion for beneficial use over the years, to date the City has used just over half the permitted amount on an annual basis. In the future, the City expects to need the full 980 mgd and, therefore, filed timely petitions (in 2008) with the SWRCB to extend the time allowed for putting the full 980 mgd to beneficial use. The need for such time extensions is typical for municipal water rights, the use of which increases over time.

Recently completed water supply planning work done by the Water Supply Advisory Committee identified water from the Felton Permits as being critical to meeting the City's projected future demand. In particular, the winter water harvest strategy is highly likely to result in greater use of water from Felton during the coming decade. In addition, water from the Felton diversion is an important asset during operational outages, changes in

operations in response to environmental concerns, and as a significant component of the City's response to dry year conditions. The City mid-1990s extension required reaching an agreement with California Department of Fish and Wildlife (DFW) and execution of a Memorandum of Agreement that modified the manner in which the City operated the Felton Diversion facility to enhance fish passage.

Like the petitions to add direct diversion to the Newell Creek and Felton Diversion permits, the time extension petition are currently pending while the City works with the DFW and the National Marine Fisheries Service to complete a Habitat Conservation Plan and a federal Endangered Species Act Section 10 permit and a 2081 state permit that will address the impacts of the water system on threatened steelhead trout and endangered Coho salmon.

The Water Supply Advisory Committee's priority water supply augmentation strategy recommended developing and implementing conjunctive use of surface and groundwater resources in mid and northern Santa Cruz County. A significant barrier to proceeding to implement more conjunctive use of the City's San Lorenzo sources of supply is constraints on the Place of Use language included in the water rights documents for these sources. In particular, the Soquel Creek and Central Water Districts are not included in the Place of Use for any of the San Lorenzo water rights, which include rights related to Newell Creek, Felton Diversion and Tait Street Diversion. In addition, while Scotts Valley and the San Lorenzo Valley Water Districts are covered in the Place of Use descriptions for the Newell Creek and Felton Diversion water rights, they are not included in the Place of Use language of the Tait Street water right.

To address these Place of Use issues the City will be folding into the Water Rights Conformance Project a request to modify the Place of Use for the City's San Lorenzo River water rights and permits.

7.2 Reliability by Type of Year

For the purposes of assessing reliability, DWR uses the following definitions for determining year type:

Average/Normal Year: a year, or averaged range of years, that most closely represents the average water supply available to the agency.

Single-dry Year: a year that represents the lowest water supply available to the agency.

Multiple-dry Year: a period that represents the lowest average water supply available to the agency for a consecutive multiple year period of three years or more.

Table 7-1. Basis of Water Year Data			
Year Type	Base Year	Available Supplies if Year Type Repeats (mgy)	
		Agency may provide volume only, percent only, or both	
		Volume Available	% of Average Supply
Average Year		3,251	100%
Single-Dry Year	2014	2,692	83%
Multiple-Dry Years 1st Year	1976	2,430	75%
Multiple-Dry Years 2nd Year	1977	1,969	61%
Multiple-Dry Years 3rd Year	1977	1,597	49%
NOTES: Quantity volume of available water represents the maximum over time by year type. Projected volumes of available water produced by the Confluence model take into account demand assumptions.			

For this assessment the normal or average water supply available to the City was developed using the long-term average over the 78-year period of record (1936-2014). This record does include all water year types from critically dry to extremely wet and therefore represents a historical hydrologic average base year type.

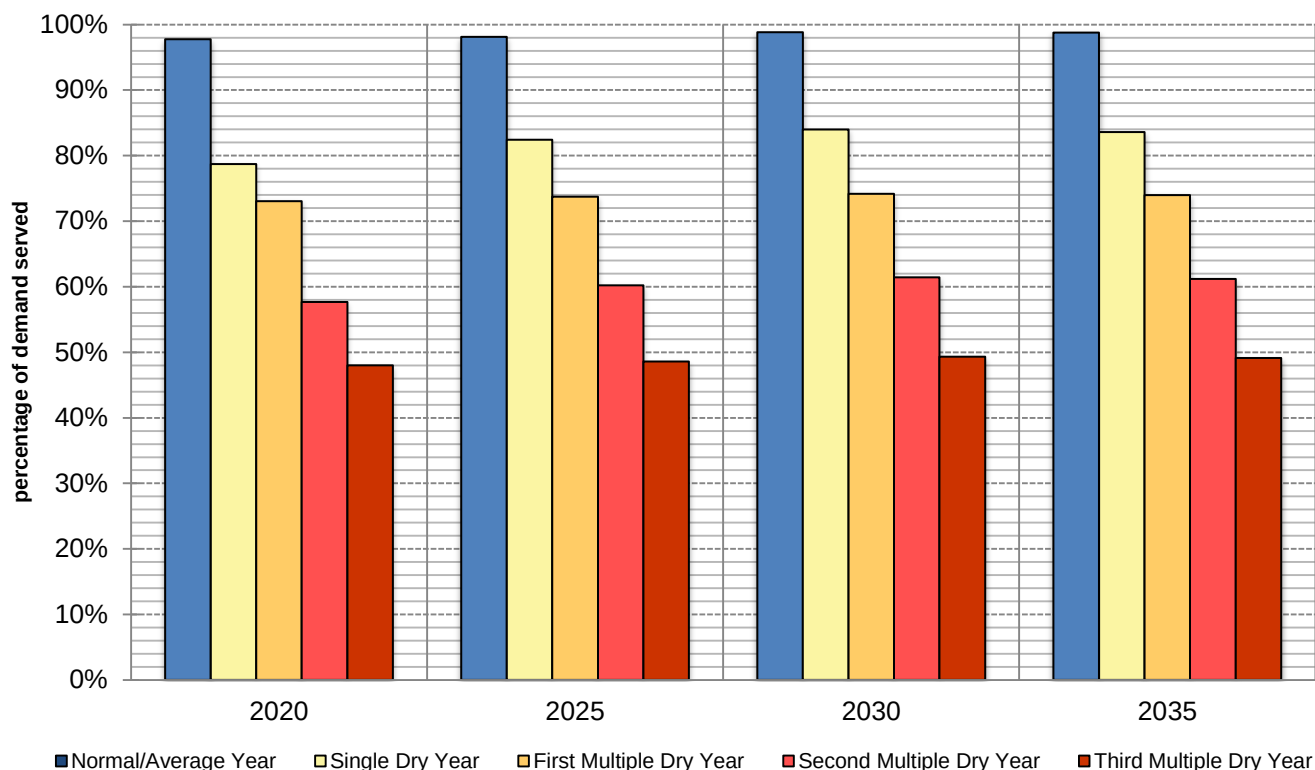
The City chose water year 2014 to represent the lowest water supply available to the agency for a single-dry year. Although 2014 was part of a larger drought sequence, the City was able to isolate the conditions for that single year. In terms of local source assessment, water year 2014 was representative of critically dry conditions for the City.

Consistent with previous plans and assessments, the City chose water years 1976-1977 as representing the most critical drought on record for a consecutive multiple-year period. A second 1977 year type was appended to the sequence to create the required third year for the assessment exercise. This sequence was used in the recent supply planning work completed in 2015 (see Section 7.4) and is consistent with the stated goal to create a reasonable worst-case scenario in a multi-year drought.

Each of the volumes included in the chart are the maximum available volumes by base year type as projected at the five-year intervals from 2020 to 2035. As such the percentage of average supply shown is the highest relative to average supply for all the base year types modelled.

To demonstrate the slight variability over time for each base year type modelled, Figure 7-2 shows the projected supply available relative to demand. Although the City chose the maximum value for comparison in Table 7-1, use of an average supply volume or a minimum supply volume would not substantially alter the presentation of the projections.

Figure 7-2. Projected Supply Availability as Demand Served



As will be expanded on in the following section, operationally the City has sufficient water supply available in normal years to meet demand even though a slight deficit seems to exist in the modelled projections. In single dry years, supplies are slightly inadequate to meet expected demands by 2020 and beyond. In multiple dry years, available supplies fall substantially short of system demands. The one variable that represents the biggest unknown at this time is the amount of water that will be required for ecosystem protection purposes. Should the City agree to release more water than is assumed in the operations model utilized for this analysis, these conclusions could change and shortages could be even greater than the estimated available supply presented.

7.3 Supply and Demand Assessment

The City of Santa Cruz utilizes the Confluence model to analyze the variability of water supplies to determine potential water supply shortages. The City has been utilizing the

Confluence model to support water supply planning activities since 2003 and this model was used to generate the results for the 2010 UWMP (City of Santa Cruz, 2011). The model takes into account the variation in demand both within and between years, the availability of water from various sources, and the capacity of infrastructure to pump and treat the water. The results presented in this section provide perspective on the City's water supply reliability based on accepted assumptions and projected conditions in the water system.

Water suppliers are required to characterize water supply reliability in a manner prescribed by law. In the analysis that follows, estimates of supply are given by both individual source and for the total available supply. The analysis assumes that future diversions, beginning sometime within the next five years will be limited due to the constraints of the specific factors described above. Although the constraints may ultimately be modified, the City is presenting the proposed forecasts as a composite of what total supply is likely to be, based on what is known at this time.

7.3.1 Normal/Average Water Year

After developing the normal year from the 78-year period of record, average conditions were projected for the future 5-year intervals. The summary results of this assessment are presented in Table 7-2 below. Notice the maximum availability of water for this base year type occurs in 2020; however reliability improves over time due to projected demand reduction in the future (M.Cubed, 2015).

Table 7-2. Normal Year Supply and Demand Comparison (mg)				
	2020	2025	2030	2035
North Coast Sources	637	642	671	671
San Lorenzo River	1882	1842	1829	1834
Loch Lomond Reservoir	595	551	540	547
Groundwater	138	129	127	128
Supply totals	3,252	3,164	3,167	3,180
Demand totals	3,327	3,225	3,205	3,220
Difference (mg)	(75)	(61)	(38)	(40)
Demand served %	97%	97%	98%	98%

In order to understand the source balance behind the numbers in Table 7-2, the City chose to provide the projected supply volumes by source to illustrate how the system provides water during these years. Of note, production from the North Coast sources is shown at a much lower diversion rate (637-671) than was projected in the 2010 UWMP (860 mgd). However, the modeling to support these new projections includes approval of an HCP with significant bypass flow requirements prior to the first five-year forecast year. This reduction is partly compensated for in normal water years by increased diversion from the San Lorenzo River and greater withdrawals from Loch Lomond Reservoir. Additionally, the expected future demand has reduced considerably since the 2010 Plan due to significant conservation and water efficiency programs.

Although the City has not previously seen shortages in normal water years, by adding the ecosystem protection conditions (HCP) likely to begin prior to 2020 a small shortage (1-3%) can be reasonably expected. Historically in normal water years, the City experienced a slight surplus of supply and this trend can be expected to continue until the HCP agreement is approved and higher instream flows are maintained. As the City chose to create a representative average year by using the historic record, the inclusion of the dry years and critically dry years within the average may explain the predicted small deficit. It is important to note that the City predicts the supply and demand volumes to be in balance for 90% of all normal water years for 2020-2035.

7.3.2 Single Dry Water Year

This assessment presents water supply available to the City as reflecting conditions comparable to water year 2014, which was a recent critically dry year. As shown in Table 7-3, water supply during a single dry year is not sufficient to meet the demand in the near term although the shortage experienced is projected to decrease over time. During a single dry year annual shortages of 16-21% are projected given the modelled supply and demand figures developed for planning and reliability purposes.

Due to the local conditions of the water supply sources and the tourist economy of the City, water shortages are typically concentrated into a “peak season” with much greater gaps between demand and supply of available water. The greatest demand for water occurs in the summer months when less water is available from surface water sources. Therefore the model predicts greater dependence on groundwater supply in dry years by increasing the volume by 25-35% more than during normal years. Evidence of this shift is shown in the groundwater supply volumes for Table 7-2 and 7-3.

Table 7-3 Retail: Single Dry Year Supply and Demand Comparison (mg)				
	2020	2025	2030	2035
North Coast	429	432	452	452
San Lorenzo River	1300	1275	1268	1271
Newell Creek	716	780	802	798
Groundwater	174	171	170	171
Supply totals	2619	2658	2692	2692
Demand totals	3,327	3,225	3,205	3,220
Difference (mg)	(708)	(567)	(513)	(528)
Demand served %	79%	82%	84%	84%
NOTES:				

Of interest when discussing a single dry year, the model makes assumptions about management of the reserve supply to be maintained in storage at Loch Lomond. The City may choose to draw more water from storage to meet customer demand in a dry year during the peak season than the model predicts (shown in Table 7-3) as operations are not always consistent with modeling assumptions. This decision is commonly applied when the storage level of the reservoir is reasonably expected to return to capacity during the following winter.

7.3.3 Multiple Dry Water Year Period

The City chose to present the estimated water supply available during the multiple dry water year period of a three-year drought sequence using hydrology from 1976, 1977, and a second 1977 year. The results of the multiple dry year supply and demand comparison are provided as totals and overall differences in Table 7-4. A breakdown of supply by source is not provided for this sequence in an effort to simplify the table for easy navigation and comparison between years and over time.

In an extreme multi-year drought similar to the 1976-77 event, the estimated water supply available to the City in the first year of that event, according to model, ranges between 2,430 and 2,377 or an average of 25% less water on an annual basis than is available in a normal water year. During the second year the average shortage over time increases to 39% and in the third year modeled, the average reduction compared

to a normal year is over 50%. Fortunately, growth in water demand is not anticipated to be a contributing factor to shortage as the City is projecting a small decrease in overall demand between 2020 and 2035.

Table 7-4. Multiple Dry Years Supply and Demand Comparison (mgd)					
		2020	2025	2030	2035
First year	Supply totals	2,430	2,377	2,377	2,381
	Demand totals	3,327	3,225	3,205	3,220
	Difference	(897)	(848)	(828)	(839)
Second year	Supply totals	1,918	1,942	1,968	1,969
	Demand totals	3,327	3,225	3,205	3,220
	Difference	(1,409)	(1,283)	(1,237)	(1,251)
Third year	Supply totals	1,597	1,567	1,580	1,581
	Demand totals	3,327	3,225	3,205	3,220
	Difference	(1,730)	(1,658)	(1,625)	(1,639)

The deficit calculated for Table 7-4 is expressed as annual average deficits. However, as discussed in the single dry year analysis, supplies available to meet demand are reduced mainly during the peak season period between April and October, the actual shortage is likely to be experienced at a much greater percentage over a reduced number of months.

The annual shortages associated with the multiple dry year sequence range from 25%-52% and the peak season could experience a shortage greater than 60% at least once during a multiple year drought. The magnitude of a shortage volume of 60% is roughly equivalent to the total water usage for all residential customers in the service area during the year of 2014. As the likelihood of a recurring multiple dry year sequence is strong, the City is seeking a solution to this dilemma through an increase in storage of 3.0 billion gallons and/or a project to increase the reliability of peak season supply.

7.4 Water Supply Reliability Management Strategies

The City follows a variety of policies, procedures, and legal restrictions in operating the water supply system. As indicated in the foregoing sections, there are many complex

challenges and uncertainties that the City faces in its effort to maintain a safe, adequate, and reliable water supply. These include hydrologic, environmental, water quality, and legal factors. The City is pursuing a balanced approach to meet these challenges that includes both demand reduction and a phased, flexible augmentation strategy to diversify the City's and the region's existing water supply sources.

Over the past several decades the City has been studying ways to improve the reliability of its water supply; the problem has been defined in a variety of reports, plans, and projects that speak to the relative importance of the issues faced at the time.

Participation by the community has been a significant element in the planning process for previous Integrated Water, Water Shortage Contingency, and Water Conservation Master Plans in addition to the review process for potential supply projects.

The most recent shift toward a new water supply vision occurred in late 2013 following expressed interest from the community to enhance public engagement on the subject of water supply planning. In response to this interest, the City developed a framework for moving forward in order to:

- greatly expand opportunities for community engagement;
- improve our water conservation efforts; and,
- help set a course for the future approach to improving the reliability of the City's water supply.

In early 2014, City Council appointed members to the Water Supply Advisory Committee (WSAC). The aim of the WSAC process was to 1) explore the City's water profile, including supply, demand and future risks; 2) analyze potential solutions to deliver a safe, adequate, reliable, affordable and environmentally sustainable water supply; and 3) develop recommendations for City Council consideration.

The backbone of the WSAC work is the problem statement developed for use by the City when addressing the assessment of supply reliability.

Committee Agreement on Problem Statement

On September 11, 2015, the Committee Agreed to the following problem statement:

Santa Cruz's water supply reliability issue is the result of having only a marginally adequate amount of storage to serve demand during dry and critically dry years when the system's reservoir doesn't fill completely. Both expected requirements for fish flow releases and anticipated impacts of climate change will turn a marginally adequate situation into a seriously inadequate one in the coming years.

Santa Cruz's lack of storage makes it particularly vulnerable to multi-year droughts. The key management strategy currently available for dealing with this vulnerability is to very conservatively manage available storage. This strategy typically results in regular calls for annual curtailments of demand that may lead to modest, significant, or even critical requirements for reduction. In addition,

the Santa Cruz supply lacks diversity, thereby further increasing the system's vulnerability to drought conditions and other risks.

The projected worst-year gap between peak-season available supply and demand during an extended drought is about 1.2 billion gallons. While aggressive implementation of conservation programs will help reduce this gap, conservation alone cannot close this gap. The Committee's goal is to establish a reasonable level of reliability for Santa Cruz water customers by substantially decreasing this worst-year gap while also reducing the frequency of shortages in less extreme years.

City of Santa Cruz, 2015

One of the primary objectives in creating the WSAC was to allow for broad representation of community interests by bringing together individuals with a diverse set of perspectives and viewpoints. The WSAC began and concluded the process with fourteen appointed members:

Water Supply Advisory Committee Members

David Green Baskin, Santa Cruz Water Commission

Sarah Mansergh, Surfrider Foundation

Peter Beckman, Think Local First

Mark Mesiti-Miller, Santa Cruz Chamber of Commerce

Doug Engfer, City Resident

Greg Pepping, Coastal Watershed Council

Suzanne Holt, Outside-City Water Customer

Mike Rotkin, Sustainable Water Coalition

Dana Jacobson, City Resident

Sid Slatter, Santa Cruz County Business Council

Charlie Keutmann, City Resident

Erica Stanojevic, Sierra Club

Rick Longinotti, Santa Cruz Desalination Alternatives

David Stearns, Santa Cruz Water Commission

The overarching goal of the WSAC process that concluded in October 2015 was “to provide significant improvement to the sufficiency and reliability of the Santa Cruz water supply by 2025.” While this planning horizon is a decade shorter than the required UWMP 20-year outlook, it presents a strategy that can be built upon based on the analysis and progress during the first 10-12 years. The WSAC process recognized that “like all long range planning, water supply planning must deal with the realities of an uncertain future” and further that a final strategy requires the ability “to respond to the new information that will emerge and the potential changes in our understanding of circumstances that will occur over time.” (City of Santa Cruz, 2015)

7.4.1 Water Supply Advisory Committee Final Report

In late 2015, consensus was achieved among WSAC members for how best to address an agreed-upon worst year gap of 1.2 billion gallons between water supply and water demand during times of extended drought.

A report was created to conclude the WSAC process and was presented to City Council, as a Final Report on Agreements and Recommendations in November 2015. The Final Report was accepted by the City Council and staff was directed to integrate the water supply portfolio strategy (including the entirety of the agreements and recommendations) into the Urban Water Management Plan update to be submitted to DWR in 2016. The guiding recommendations are provided below and further reference material for the underlying agreement details can be found in the full report provided as Appendix K (City of Santa Cruz, 2015).

Article IV. Recommendations

Section 4.01 The Water Supply Augmentation Plan

The Committee has worked on developing a Plan that would eliminate future water shortages by 2025, give or take two years, while allowing for robust stream flows to support and enhance fish habitat.

*The agreed-upon **Water Supply Augmentation Plan** (Plan) includes:*

- 1. A **specific goal for Yield**, as well as the assumptions underlying this goal;*
- 2. A **Timeframe** for improving the reliability of the Santa Cruz Water Supply;*
- 3. The **Water Supply Augmentation Plan Elements**;*
- 4. An **Adaptive Pathway** to provide a structure within which work on the Elements can be pursued and evaluated; and*
- 5. A **Change Management Strategy** to guide adjustments and adaptations within the Plan, as described below.*

Section 4.02 Yield Goal

The Committee recommends the City implement additional demand management and supply augmentation programs and projects and address key infrastructure and operating constraints to reliably make available an additional 1.2 bgy during modeled worst-year conditions.

Section 4.03 Timeframe for Improvement

The Committee recommends that the City adopt a goal of completing the improvements to Santa Cruz's water supply necessary to meet the specified yield goal by the end of 2025;

Section 4.04 Water Supply Augmentation Plan Portfolio Elements

The Water Supply Advisory Committee recommends that the City Council adopt a portfolio of measures for improving the reliability of the water supply. The recommended package includes the following Elements:

- **Element 0:** Additional water conservation with a goal of achieving an additional 200 to 250 million gallons of demand reduction by 2035 by expanding water conservation programs;
- **Element 1:** Passive recharge of regional aquifers by working to develop agreements for delivering surface water as an in lieu supply to the Soquel Creek Water District and/or the Scotts Valley Water Districts so they can rest their wells, help the aquifers recover, and effectively store water for use by Santa Cruz Water Department in drought years;
- **Element 2:** Active recharge of regional aquifers by using existing infrastructure (wells, pipelines, and treatment capacity) and potential new infrastructure (wells, pipelines and treatment capacity) in the regionally shared Purisima aquifer in the Soquel-Aptos basin and/or in the Santa Margarita/Lompico/Butano aquifers in the Scotts Valley area to store water that can be available for use by Santa Cruz in drought years;
- **Element 3:** A potable water supply using advanced treated recycled water as its source, as a supplemental or replacement supply in the event the groundwater storage strategies described above prove insufficient to meet the Plan's goals of cost effectiveness, timeliness or yield. In the event advanced treated recycled water does not meet the needs, desalination would then become Element 3.

Section 4.05 WSAC Value Statement on Implementing Plan Elements

The recommended Water Supply Augmentation Plan reflects the Committee's preference for pursuing a groundwater storage and retrieval strategy provided the yield goal can be achieved in a cost-effective and timely manner. Before making a choice to move away from groundwater storage, the Committee recommends that the City diligently pursue all reasonable measures to make the groundwater strategies work.

Recognizing the cost differential between some of the strategies the Committee considered in developing its recommendations, the WSAC agreed to express its preference for the Strategy One, groundwater storage and retrieval, over Strategy Two, and has agreed that as long as the annualized cost per million

gallons of average year yield (ACAYY) for implementing Strategy One is not more than 130% of the ACAYY for Strategy Two, while still meeting other metrics, Strategy One should be pursued.

Section 4.06 Adaptive Pathway Implementation Strategy

The Committee recommends that the Council adopt a staggered Adaptive Pathway to guide implementation of the Plan and that decision-making at the various decision-nodes identified in this Adaptive Pathway be guided by the provisions of the Change Management Strategy.

Section 4.07 Change Management Strategy

The Committee recommends that the Council adopt the Change Management Strategy described in Section 3.24 (City of Santa Cruz, 2015).

Section 4.08 Additional Recommendations Related to Infrastructure and Operating Constraints

(a) Infrastructure Constraints

The Committee also supports the Water Department’s plans to address certain key infrastructure constraints that are keeping the City from fully utilizing available water, especially during the high flow season. These include, but are not limited to:

- Rehabilitation of the pipeline between the Felton Diversion and Loch Lomond that would allow the City to increase diversions to Loch Lomond during the high flow season;*
- Evaluation of additional pumping capacity at Felton to push more water to Loch Lomond through the replacement pipeline; and*
- If proven cost-effective, and needed for the implementation of Strategy One, complete improvements that will allow the Department to treat water with turbidities that are higher than can be effectively treated by the current Graham Hill Water Treatment Plant facilities and processes. The specific method for how to address the water treatment constraint should include evaluating a range of potential options, including, but not limited to Ranney Collectors or satellite treatment plants, and choosing the most cost-effective approach.*

(b) Operating Constraints

Another focus of the Committee’s review relates to some system operational constraints. Operating constraints typically include both daily parameters for drawing water from the City’s sources and operating constraint parameters that are used in modeling system performance.

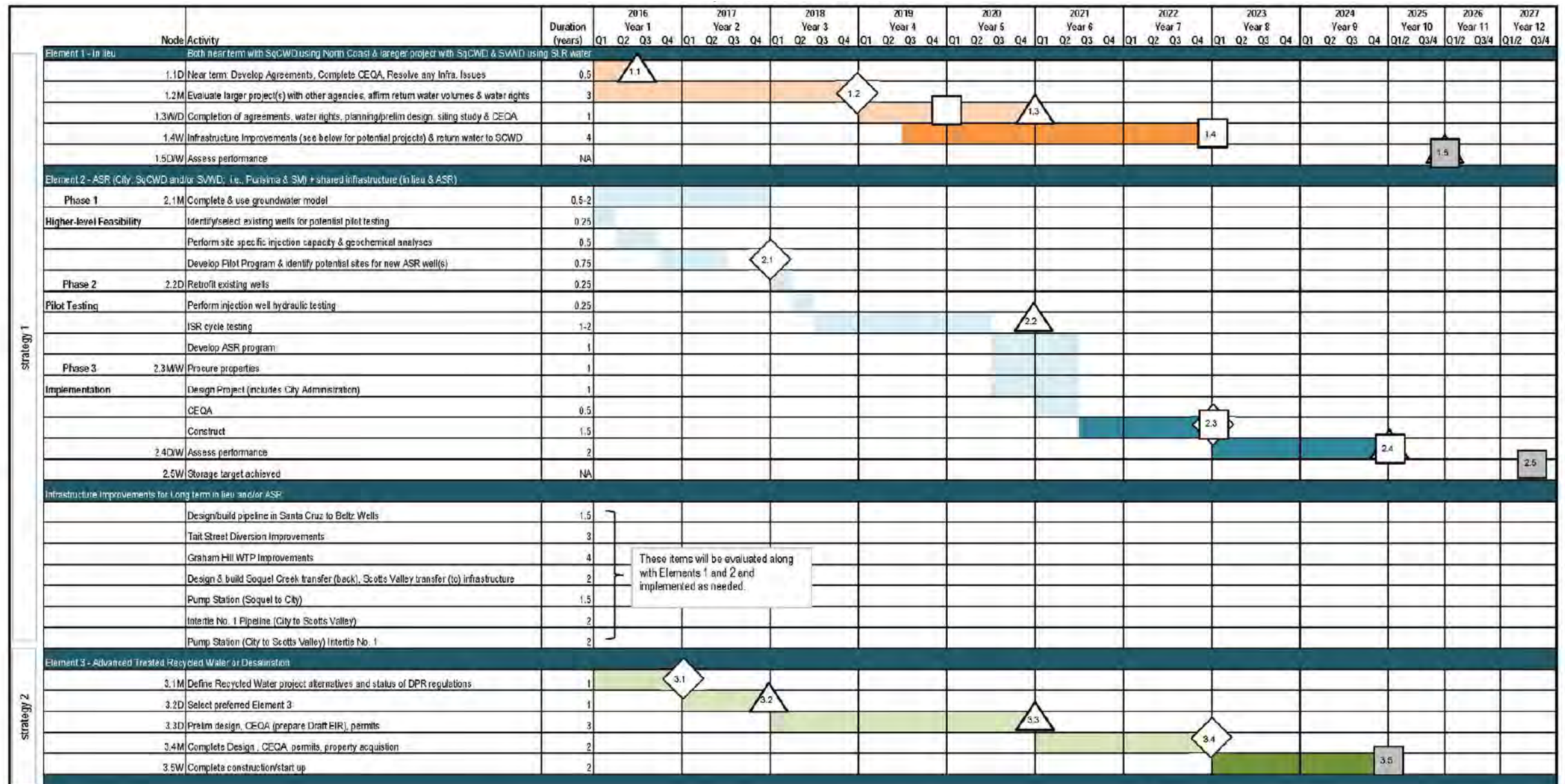
The Committee recommends that the Water Department identify and regularly evaluate operating constraints to determine whether those constraints continue to be justified as necessary to protect the system and finished water quality and to support efficient and cost-effective operations. Early focus should be given to issues related to Loch Lomond year-end carry over storage requirements, particularly if/when in lieu and/or ASR have provided a sufficient drought supply, and to the “first flush” constraint impacting the City’s ability to pump water from Felton to Loch Lomond under critically dry year conditions.

Section 4.09 Implementation Plan and Timeline

As part of the process for developing the WSAC Agreement, City Staff and the technical team developed a Gantt chart shown in Figure 12. This Gantt chart, together with the Decision Node Table (Table 16) and the Staggered Adaptive Pathways Map (Figure 11) comprise the Implementation Plan and Timeline.

On the following page, Figure 7-3 is a reproduction of the Gantt chart originally included as Figure 12 in the Final Report and referenced in Article IV. Recommendations provided above. This Strategy Implementation Plan and Timeline was developed by City Staff and the technical team as a tool to move the City into the work plan phase.

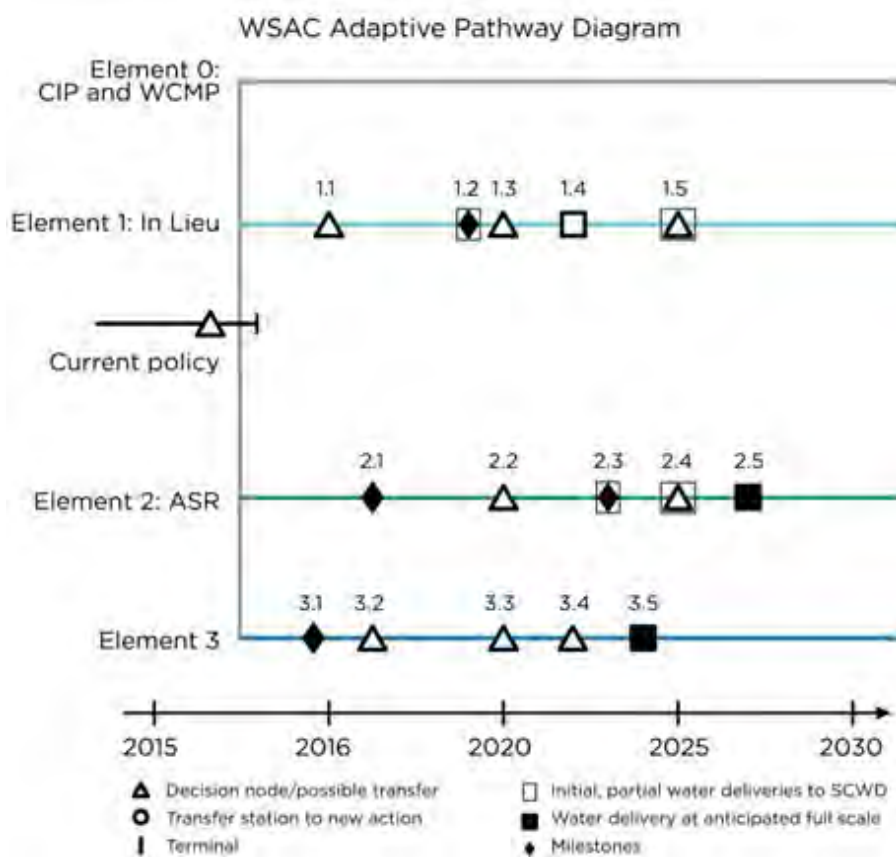
Figure 7-3. Water Supply Strategy Implementation Plan and Timeline, Water Supply Advisory Committee. Final Report, 2015



Upon acceptance of the Report by City Council, development began on the supply augmentation strategy work plan that further defines the components of the implementation plan and timeline included in the WSAC Final Report. The initial phase of the strategy involves enhancement of the existing conservation programs as well as significant exploration of feasibility and potential alternatives for future supply projects focused on solving the 1.2 billion gallon supply gap.

As shown in Figure 7-4 below and discussed as the “Staggered Adaptive Pathway” in the recommendations, the City will use the WSAC change management strategy to determine when and why adjustment of the progressing elements will occur. This movement will occur between the component elements of Strategies 1 and 2 while the tasks within the Capital Improvement Plan (CIP) and the Water Conservation Master Plan (WCMP) shown as Element 0 will continue along a consistent trajectory.

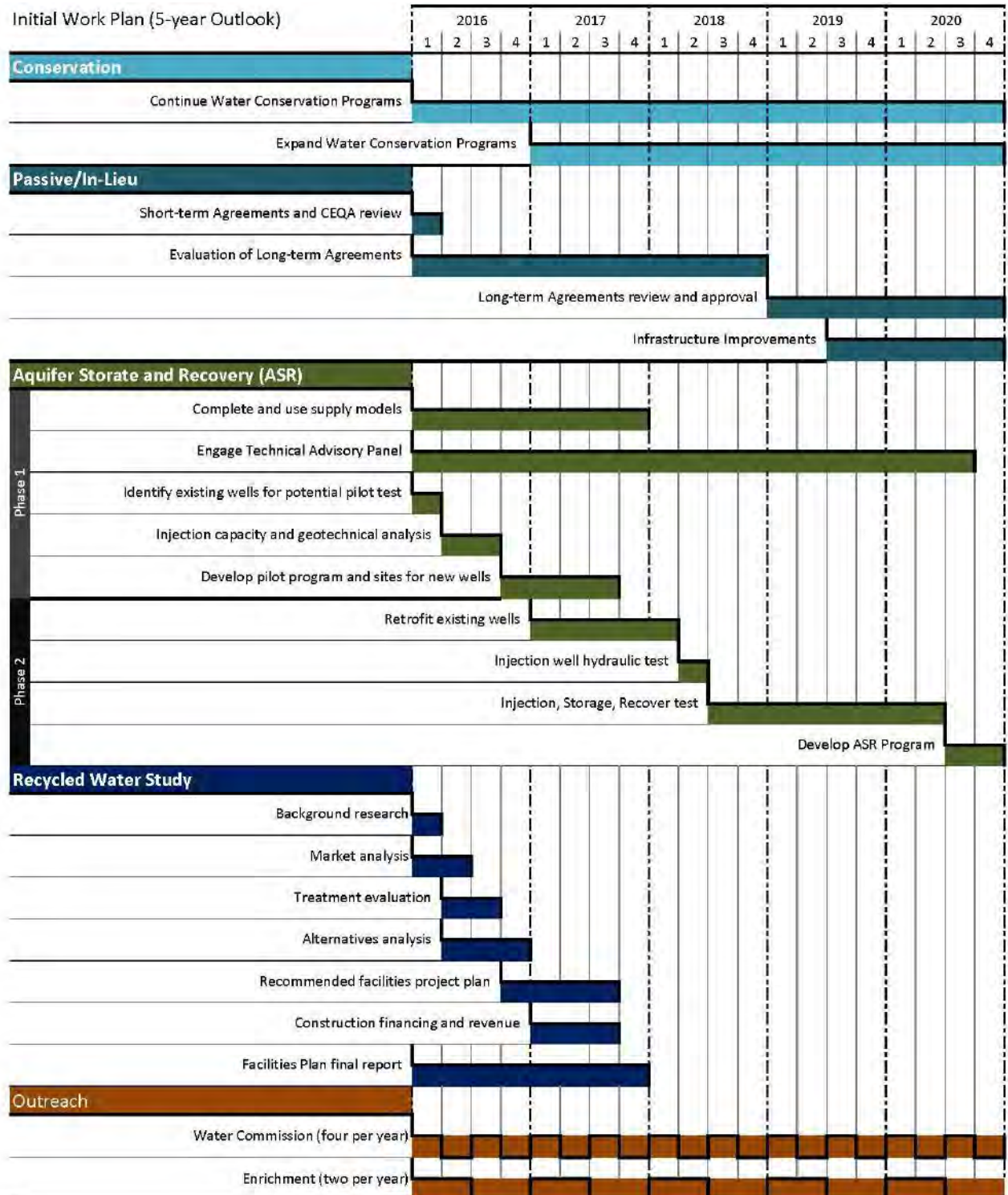
Figure 7-4. Change Management Strategy



The final components of the supply augmentation portfolio are not yet fully defined and will not be known prior to the adoption of this Plan. Therefore, the City provided projections on the long-term reliability of demand relative to supply based solely on the

information available at this time. Development of the work plan to support the progress of the Elements began in Spring 2016 with a snapshot of the current associated tasks and timelines provided in Figure 7-5 below.

Figure 7-5. Water Supply Augmentation Strategy, Implementation Timeline



The City intends to implement the recommendations developed through the WSAC process as accepted by City Council in the Final Report. Adopting this update to the UWMP signifies adoption of the recommendations as the City's water supply strategy and the new course to overcome known supply reliability constraints and challenges.

7.5 Regional Supply Reliability

CWC 10620

(f) An urban water supplier shall describe in the plan water management tools and options used by that entity that will maximize resources and minimize the need to import water from other regions.

The City of Santa Cruz continues to focus supply planning and reliability efforts on programs and projects that emphasize the maximization of available resources. To date, the City has avoided supply planning that included importing water from outside the Central Coast hydrologic region by concentrating on options within Santa Cruz County.

Currently, all of the City's water resources are obtained from local sources. In order to build drought supply reliability, the City continually works to develop partnerships within the region that promote responsible and sustainable water resource management. A known constraint on the regional supply are the over drafted, threatened, and recovering aquifers. The City's future supply vision includes projects serving to benefit regional aquifer recovery and increased reliability of groundwater sources. Recognizing the path toward regional reliability requires a comprehensive framework that supports dependability of all recognized supplies within the region, the types of tools being proposed and evaluated at present seek to benefit multiple stakeholders.

At this point in time, the City is participating in two recognized regional teams formed to increase coordination of activities among resource agencies. The first is the [Santa Cruz Integrated Regional Water Management](#) Group (IRWM) made up of nine local agencies. Several of the City's augmentation plan elements may benefit from the ability to work collaboratively with the partners and stakeholders that include government and non-government resource management agencies. Additionally, the City is one of four members of the [Mid-County Groundwater Agency](#) (MGA). As discussed in Chapter 6, the MGA was only formally established in May 2016 and the City has participated in several partnership groups with the mission to promote responsible management of the Soquel-Aptos Basin over the past several decades. Coordination and collaboration is expected to increase even further within Santa Cruz County in the coming decades with the potential for similar programs throughout the Central Coast Region.

Chapter 8

WATER SHORTAGE CONTINGENCY PLANNING

This chapter presents information about how the City of Santa Cruz manages the water system during a water shortage emergency that arises as a result of drought. It also describes actions that would be undertaken in response to a catastrophic interruption of water supplies, including a regional power outage, earthquake, or other emergency situation.

8.1 Background

In 2009, the City of Santa Cruz completed a comprehensive update of its [Water Shortage Contingency Plan](#). This project was an outgrowth of a previous Urban Water Management Plan, which recognized the many changes in regional conditions and local water supply planning that had taken place over the previous decade and identified a need to better prepare for the possibility of future water shortages in advance of the next major drought. Since then, the City has had to declare a water shortage in five of the past seven years, including a Stage 3 Water Shortage Emergency in both 2014 and 2015.

The City's Water Shortage Contingency Plan describes the conditions which constitute a water shortage and provides guidelines, actions, and procedures for managing water supply and demands during a declared water shortage. The primary focus of the plan is on measures that reduce customer demand for water, but it also covers actions that can be implemented to stretch or increase the water supply.

The overarching goals of this plan are as follows:

1. to conserve the water supply of the City for the greatest public benefit,
2. to mitigate the effects of a water supply shortage on public health and safety, economic activity, and customer lifestyle, and
3. to budget water use so that a reliable and sustainable minimum supply will be available for the most essential purposes for the entire duration of the water shortage.

Development of the City's Water Shortage Contingency Plan was a collaborative effort among the City Water Department staff, the City's Water Commission, City Council, and the public over a three year period beginning in 2006. Research involved reviewing state regulations and legal requirements ([Water Code section 350](#) et seq.) and the water shortage plans of 21 other urban water utilities from throughout California, and from selected cities in the western United States and across the country. The Water Commission provided its input and recommendations throughout the process.

The plan is based on lessons learned here and from other water agencies during past droughts. Nevertheless, it is important to note that every drought will evolve differently and that it is not practical to develop a set of hard and fast rules that apply to all situations. The plan should be thought of as a general framework that will need to be adjusted and refined based on actual conditions.

Early in the planning process, staff and the Water Commission developed a set of principles to guide the water shortage planning process. These principles are as follows:

- **Shared contribution.** All customers will be asked to save their share in order to meet necessary reduction goals during water shortages.
- **Reduce non-essential uses first.** The plan concentrates on the elimination of non-essential water uses and on outdoor reductions, and gives the highest priority to essential health and safety uses.
- **Preserve jobs and protect the local economy.** The plan minimizes actions that would have substantial impact on the community's economy and provides large users the flexibility to determine their own reduction strategies within a water budget.
- **Existing conservation measures recognized.** Customers that have already implemented water conservation measures are acknowledged to have less potential for reduction and should not be penalized for conserving.
- **Communication at every stage.** A public information campaign at every level of shortage is essential for customer preparation and will encourage confidence in the City's ability to respond to water shortages.
- **Public participation.** Public participation in the development and implementation of the plan will help to ensure fairness, encourage cooperation, and facilitate implementation and with demand reduction measures in times of shortage.

The final [Water Shortage Contingency Plan](#) was adopted by resolution of the City Council of the City of Santa Cruz in March 2009 as an amendment to the City's Urban Water Management Plan (Appendix L) and is adopted herein by reference. Subsequently, the City Council adopted an ordinance implementing the water shortage regulations and restrictions contained in the plan ([Santa Cruz Municipal Code Chapter 16.01](#), Appendix M). The water shortage regulations and restrictions were updated in early 2015 to integrate some changes recognized as being needed during implementation of rationing in 2014.

Portions of the City's Water Shortage Contingency Plan have since been published and highlighted by the American Water Works Association in its new Manual of Water Supply Practices, [M60: Drought Preparedness and Response](#) as an example of a model staged demand reduction program (AWWA, 2011).

8.2 Stages of Action

The updated Water Shortage Contingency Plan uses a staged approach that classifies a shortage event into one of five levels spanning a range from less than 5 percent up to 50 percent (Table 8-1).

Table 8-1. Stages of Water Shortage Contingency Plan		
Stage	Percent Supply Reduction ¹ <i>Numerical value as a percent</i>	Water Supply Condition
1	0-5%	Water Shortage Alert
2	5-15%	Water Shortage Warning
3	15-25%	Water Shortage Emergency
4	25-35%	Severe Water Shortage Emergency
5	35-50%	Critical Water Shortage Emergency
¹ One stage in the Water Shortage Contingency Plan must address a water shortage of 50%.		
NOTES:		

The overall concept is that water shortages of different magnitudes require different measures to overcome the deficiency. Because there is so little the City can do in the short run to increase the supply of water, the focus of this plan is primarily on measures that reduce demand. Each stage includes a set of demand reduction measures that

become progressively more stringent as the shortage condition escalates. When a demand reduction is necessary, typically one of these five stages would be put into effect by a resolution of the Santa Cruz City Council at the recommendation of the Water Director in the spring and remain in force for the entire dry season.

8.2.1 Assessing Water Supply and Demand

There is no one single criterion, trigger, or definition that is used to determine if a water shortage exists. The determination of a shortfall involves consideration of multiple indicators of water supply, as well as expected system demand.

Rainfall, runoff, reservoir storage, and water year classification are the key hydrologic indicators used by the City to evaluate water conditions. The plan describes these factors affecting the City's water supply and discusses the forecasting process and management considerations used in dry years to determine whether a water shortage is expected for the year ahead and how much water use must be cut back system-wide in response. In recent years, the City has also considered statewide drought intensity, long-range weather predictions, and local instream flow requirements in its analysis.

In Santa Cruz, a water shortage occurs when the combination of low surface flows in the coast and river sources and depleted surface water storage in Loch Lomond Reservoir reduces the available supply to a level that cannot support existing demand.

After an unusually dry winter or period of consecutive dry years, when a lack of supply appears possible, the Water Department undertakes an analysis to determine whether water supplies will be deficient relative to estimated water needs for the coming dry season. This analysis involves first comparing projected water supply and demand on a monthly basis, assuming no restriction on water use, to forecast the end of season water level and storage volume in Loch Lomond Reservoir. The Department then evaluates whether the amount of carryover storage in Loch Lomond at the end of the year will be sufficient to meet essential health and safety needs in case the dry weather pattern continues into the following year. If this analysis shows that Loch Lomond Reservoir would be depleted to a dangerously low level, then a decision is made regarding how much reservoir water is available to use in the current year and how much should be banked as a safeguard against the possibility of another dry year. The amount of cutback in demand needed to reduce the rate of reservoir depletion and end the year at a safer level of storage is then determined. If necessary, cutbacks would go into effect in late April/early May and span the entire dry season, typically through late

October. A hypothetical situation is provided in the full plan to illustrate this decision-making process.

The degree of shortage is normally defined as the supply deficiency in relation to normal water use over a given period of time, and expressed as a percentage. For example, a 25 percent shortage means the City has one-quarter less water supply available than what is normally used during the seven-month long dry season.

8.2.2 Timeline for Declaring Water Shortage

The timeline showing when the City evaluates water supply conditions and, if necessary, declares a water shortage is presented in Table 8-2 below.

Table 8-2. Calendar for Declaring Water Shortage	
Target Date	Action
Months of Oct -Dec	Monitor rainfall, reservoir level, and runoff amounts
Late January	Prepare written status report on water supply conditions
Early February	Present initial estimate of water supply availability for year ahead
Early March	Present revised estimate of water supply availability for year ahead
Mid-March	SCWD announces existence of water shortage (if applicable)
Mid to late March	SCWD determines monthly water production budget and need for voluntary or mandatory response.
Early April	Present shortage response recommendation to Water Commission; notice of public hearing published
Mid-April	City Council formally declares a water shortage, adopts emergency ordinance
May	Water shortage regulations become effective
NOTES:	

8.2.3 Process for Declaring Water Shortage

Once the water shortage condition has been defined (as soon as reasonably certain), recommendations regarding water shortage rules and regulations consistent with this contingency plan are discussed with the City Water Commission. Monthly Water Commission meetings serve as a public forum for discussing water conditions and for hearing issues associated with implementation of the water shortage ordinance throughout the entire duration of the water shortage event.

Following consideration by the Water Commission, a declaration of water shortage is made by a resolution of the City Council. The legal requirements for such action are covered in Section 350 et seq. of the California Water Code. The code requires the following process be followed:

- That City Council hold a public hearing on the matter;
- That the public hearing be properly noticed (minimum of publishing once in newspaper at least seven days prior to the date of the hearing);
- Upon determining and declaring the existence of a water shortage, City Council may then adopt regulations and restrictions governing the use and delivery of water.

In accordance with Municipal Code section 16.04.480, rules adopted by the City Council establishing water use regulations become effective immediately after their publication in a newspaper of general circulation published in the City of Santa Cruz.

8.3 Demand Reduction Strategy

The City's strategy for dealing with water shortages of all levels involves the following four interrelated components:

1. An allocation system to establish reduction goals for different customer groups
2. Demand reduction measures
3. Publicity and communications
4. Operating actions

These four components are summarized below.

8.3.1 Allocation System

A fundamental issue any water supplier faces in managing a water shortage involves the allocation of water and how to distribute the available supply among customer categories when supplies fall short. In the process of updating this plan, various options and alternatives were reviewed and a priority-based allocation system was selected. This allocation system produces specific demand reduction goals for each major customer category at various levels of shortfall based on the unique usage characteristics of each customer category.

Customer reduction goals for all but the first stage were developed by evaluating the composition of demand for each major group and dividing it into three usage priorities. These priorities are, from highest to lowest, 1) health/safety, i.e., all domestic and sanitary uses, 2) business and industrial uses and, 3) irrigation and other outdoor uses. Normal demands were then scaled back in accordance with the schedule presented in Table 8-3.

Table 8-3. Reduction in Water Delivery by Usage Priority (percent of normal deliveries)				
Stage	Magnitude of Water Shortage:	Health/Safety	Business	Irrigation
2	15%	95	95	64
3	25%	95	90	34
4	35%	90	85	12
5	50%	75	67	0

In essence, this allocation system strives to balance available supplies in times of drought as much as possible through cutbacks in outdoor water use. At each level of shortfall, public health and sanitation usage is afforded the highest priority by cutting back on interior usage the least. The importance of water in protecting the City's employment base is also acknowledged through disproportionate, modest cutbacks to the commercial sector as compared to the overall system shortfall. Irrigation and other outdoor uses are cut back the most. The larger the water shortage, the greater the cutbacks, but this same order of priorities is maintained throughout the range of potential shortages.

The heavy reliance on outdoor use reductions makes sense, both from a water system perspective because it reduces peak demands, which is important to preserving storage in Loch Lomond Reservoir, and from a public health and welfare perspective, because irrigation and other outdoor uses are the most discretionary of all uses when drinking water is in short supply. It also makes sense from an operational perspective because outdoor water use cutback can be achieved relatively quickly. From a legal perspective, this allocation system is consistent with the priorities and requirements of Water Code section 354. The resulting water supply allocation and customer reduction goals are presented in Table 8-4.

Because both total and categorical water demand has undergone a significant decline in the intervening time since this allocation was initially developed in 2009, it is recommended that this schedule and the monthly rationing allotments be revised once demand stabilizes again following the 2014-2015 implementation of residential/irrigation water rationing.

Table 8-4. Water Supply Allocation and Customer Reduction Goals

Normal Peak Season Demand = 2,473 mil gal	No Deficiency		Stage 2 15% Deficiency		Stage 3 25% Deficiency		Stage 4 35% Deficiency		Stage 5 50% Deficiency	
	Delivery		Delivery		Delivery		Delivery		Delivery	
Customer Category:	%	Volume (mil gal)	%	Volume (mil gal)	%	Volume (mil gal)	%	Volume (mil gal)	%	Volume (mil gal)
Single Family Residential	100	1,031	84%	864	73%	753	62%	639	48%	495
Multiple Residential	100	524	87%	454	78%	411	69%	361	55%	287
Business	100	438	95%	416	92%	402	87%	381	70%	307
UC Santa Cruz	100	132	85%	113	76%	100	66%	87	52%	68
Other Industrial	100	23	95%	22	90%	21	85%	20	67%	15
Municipal	100	48	76%	36	57%	27	41%	20	28%	14
Irrigation	100	110	64%	70	34%	37	12%	13	0%	0
Golf Course Irrigation	100	106	73%	78	51%	54	34%	36	20%	21
Coast Agriculture	100	59	95%	56	90%	53	85%	50	67%	40
Other	100	2	95%	2	90%	2	50%	1	50%	1
Total	100	2,473	85%	2,111	75%	1,861	65%	1,607	50%	1,247
Demand Reduction %, Million gallons	0	0	15%	-362	25%	-612	35%	-866	50%	-1,226

8.3.2 Demand Reduction Measures

The City's Water Shortage Contingency Plan uses a combination of voluntary and mandatory demand reduction measures, which vary depending on level of cutback. As mentioned earlier, the regulations against water waste are in effect in Santa Cruz on a permanent basis. Once a water shortage is declared, however, enforcement of this ordinance is increased and enhanced by the use of fines.

The primary demand reduction measures used in **Stage 1** are to restrict all landscape irrigation to certain hours of the day and to prohibit certain uses defined as non-essential.

The main approach to reducing water use in **Stage 2** involves expanding mandatory water restrictions and limiting landscape irrigation to specified days, times, and durations. Large landscape users are required to adhere to water budgets.

A **Stage 3** water shortage constitutes an emergency situation. The three primary measures to meet this emergency reduction goal are 1) residential water rationing, 2) mandatory water shortage signage in all commercial buildings, and 3) reduced water budgets for large landscapes. Single family residential customers are rationed using a hybrid approach that provides a base allocation for a family of four and an additional amount per person for larger households. Multi-family residential accounts are rationed based on the number of dwelling units at an account.

A **Stage 4** water shortage requires expanding water rationing to cover all water customers, including business, and reducing residential allocations. At this severe level of shortage, only minimal water is available for outdoor purposes.

Stage 5 represents an extraordinary crisis threatening health, safety, and security of the community. It would involve reduced rationing levels for all customers and a ban on outdoor uses to cut back normal water use by half.

A summary of the demand reduction methods and mandatory prohibitions against specific water use practices is provided in Table 8-5.

8.3.3 Publicity and Communications

Effective communication is essential to the success of any water shortage contingency plan in achieving the desired water use reductions. All customers need to be adequately

informed about water supply conditions, understand the need to conserve, and know what actions they are being requested or required to take to mitigate the shortage. The full Water Shortage Contingency Plan articulates the City's communications strategy, identifies the main customers and groups that need to be kept updated, advised, and informed, and outlines various communication and public outreach measures to employ in a water shortage. The plan also provides prepared public statements for each of the 5 stages that are intended to help communications stay on message and set the tone for subsequent communications through the duration of the incident.

8.3.4 Operating Actions

The City's Water Shortage Contingency Plan outlines the added responsibilities and internal actions taken Water Department when a water shortage arises. Many represent increased costs to the Department for additional personnel, services, and supplies. An important initial step is to designate a working group consisting of the Water Director and senior staff to lead and manage the Department's internal and external water shortage response. The Water Department then must mobilize the necessary personnel, resources, and equipment to undertake the various activities that are critical to implementing an effective response. These initial actions may include, among other things:

- Establishing water production budgets
- Coordinating with other city departments and affected public agencies
- Establishing a public communications program to publicize use restrictions and to engage and involve the community and key water-using sectors in curtailing their demand
- Ensuring adequate staff and training to effectively respond to customer inquiries and enforce water shortage regulations
- Adapting utility billing format and database capabilities
- Expanding water conservation assistance, outreach, and education
- Instituting a system for processing exception requests and appeals
- Addressing policy issues and updating status with decision makers
- Implementing monitoring mechanisms to track actual usage and measure performance

A summary of these key operating and communications actions is provided in Table 8-5.

Table 8-5. Summary of Demand Reduction Actions and Measures

Water Shortage Condition	Key Water Department Communication and Operating Actions	Customer Demand Reduction Measures
Stage 1: Water Shortage Alert (0-5%)	• Initiate public information and advertising campaign • Publicize suggestions and requirements to reduce water use • Adopt water shortage ordinance prohibiting nonessential uses • Step up enforcement of water waste • Coordinate conservation actions with other City Departments, green industry	• Voluntary water conservation requested of all customers • Adhere to water waste ordinance • Landscape irrigation restricted to early morning and evening • Non-essential water uses banned • Shutoff nozzles on all hoses used for any purpose • Encourage conversion to drip, low volume irrigation
Stage 2: Water Shortage Warning (5-15%)	• Intensify public information campaign • Send direct notices to all customers • Establish conservation hotline • Conduct workshops on large landscape requirements • Optimize existing water sources; intensify system leak detection and repair; suspend flushing • Increase water waste patrol • Convene and staff appeals board	• Continue all Stage 1 measures • Landscape irrigation restricted to designated watering days and times • Require large landscapes to adhere to water budgets • Prohibit exterior washing of structures • Require large users to audit premises and repair leaks • Encourage regular household meter reading and leak detection
Stage 3: Emergency Water Shortage (15-25%)	• Expand, intensify public information campaign • Provide regular media briefings; publish weekly consumption reports • Modify utility billing system and bill format to accommodate residential rationing, add penalty rates • Convert outside-City customers to monthly billing • Hire additional temporary staff in customer service, conservation, and water distribution • Give advance notice of possible moratorium on new connections if shortage continues	• Institute water rationing for residential customers • Reduce water budgets for large landscapes • Require all commercial customers to prominently display "save water" signage and develop conservation plans • Maintain restrictions on exterior washing • Continue to promote regular household meter reading and leak detection
Stage 4: Severe Water Shortage Emergency (25-35%)	• Contract with advertising agency to carry out major publicity campaign • Continue to provide regular media briefings • Open centralized drought information center • Promote gray water use to save landscaping • Scale up appeals staff and frequency of hearings • Expand water waste enforcement to 24/7 • Develop strategy to mitigate revenue losses and plan for continuing/escalating shortage	• Reduce residential water allocations • Institute water rationing for commercial customers • Minimal water budgets for large landscape customers • Prohibit turf irrigation, installation in new development • Prohibition on on-site vehicle washing • Rescind hydrant and bulk water permits
Stage 5: Critical Water Shortage Emergency (35-50%)	• Continue all previous actions • Implement crisis communications plan and campaign • Activate emergency notification lists • Coordinate with CA Department of Public Health regarding water quality, public health issues and with law enforcement and other emergency response agencies to address enforcement challenges • Continue water waste enforcement 24/7	• Further reduce residential water allocations • Reduce commercial water allocations • Prohibit outdoor irrigation • No water for recreational purposes, close pools • Continue all measures initiated in prior stages as appropriate

8.4 Prohibitions on End Uses

As identified above, the City's water shortage regulations and restrictions include a variety of temporary prohibitions on various end uses of water, which vary according to the stage of shortage. These prohibitions fall into four main categories:

- Landscape irrigation
- Washing of outdoor surfaces, structures, and vehicles
- Commercial end uses
- Swimming pools, spas and water features

These restriction and prohibitions are summarized in Table 8-6 below:

Table 8-6. Restrictions and Prohibitions on End Uses (continues on next page)			
Stage	Restrictions and Prohibitions on End Uses	Additional Explanation or Reference	Penalty, Charge, or Other Enforcement?
1-3	Landscape - Limit landscape irrigation to specific times		Yes
1-3	Landscape - Restrict or prohibit runoff from landscape irrigation		Yes
2,3	Landscape - Limit landscape irrigation to specific days	1-2 days per week	Yes
2-4	Landscape - Other landscape restriction or prohibition	Limit on duration of watering with automatic irrigation systems	Yes
4	Landscape - Prohibit certain types of landscape irrigation		Yes
5	Landscape - Prohibit all landscape irrigation		Yes
3	Landscape - Other landscape restriction or prohibition	within 48 hours of measureable rainfall	
2-4	Landscape - Other landscape restriction or prohibition	Require large landscapes to adhere to water budgets	Yes
4,5	Landscape - Other landscape restriction or prohibition	Prohibit installation in new development	Yes
1-5	CII - Lodging establishment must offer opt out of linen service		Yes
1-5	CII - Restaurants may only serve water upon request		Yes

Stage	Restrictions and Prohibitions on End Uses	Additional Explanation or Reference	Penalty, Charge, or Other Enforcement?
2-5	CII - Other CII restriction or prohibition	Mandatory water conservation plans for large businesses	
3-5	CII - Other CII restriction or prohibition	Business water conservation plans required	Yes
3-5	CII - Other CII restriction or prohibition	Mandatory water waste signage for all business establishments	Yes
1-2	Other water feature or swimming pool restriction	Prohibit initial filling or draining and refilling of residential swimming pools	Yes
2-5	Water Features - Restrict water use for decorative water features, such as fountains		Yes
3	Other water feature or swimming pool restriction	Prohibit initial filling or draining and refilling of all swimming pools	Yes
4-5	Other water feature or swimming pool restriction	Prohibit filling or topping off swimming pools and outdoor spas	Yes
1-5	Other - Customers must repair leaks, breaks, and malfunctions in a timely manner		Yes
1-5	Other - Require automatic shut of hoses		Yes
4-5	Other - Prohibit use of potable water for construction and dust control		Yes
4,5	Other	Prohibit vehicle washing, except at commercial car washes that use recycled water	Yes

8.5 Penalties, Charges, Other Enforcement of Prohibitions

The City's water shortage regulations and restrictions ordinance contains provisions for enforcing water use rules and regulations, and processes for issuing exceptions and hearing appeals. Administrative enforcement methods include the following:

Administrative Penalties These penalties are for failure to comply with water waste prohibitions and mandatory water use restrictions and are applied to the customer's

next utility bill. The object of imposing increasingly significant penalties is to assure compliance by creating a meaningful disincentive to commit future code violations. When a violation occurs, the Water Department first provides a written notice and gives the customer an opportunity to correct the situation. Additional violations are penalized as follows:

2nd Violation \$100

3rd Violation \$250

4th Violation \$500

Large users (defined as using over a million gallons per year) are penalized at triple the amounts listed above.

Excessive Water Use Penalties These penalties are assessed when a customer uses more water in a given billing cycle than their rationing allocation provides. Excessive use penalties are in addition to ordinary water consumption charges, as follows:

1% to 10% over customer rationing allotment: \$25.00/CCF

More than 10% over customer rationing allotment: \$50.00/CCF

In addition to any administrative penalties and excess water use penalties, a flow restrictor and/or discontinuation of service may be ordered for willful violations of the City's water shortage regulations and restrictions ordinance.

The ordinance contains an exception process and that allows the Water Department, upon making specified findings, to provide for special or exceptional circumstances that otherwise would create undue hardship for an individual customer or class of customers. It also allows any water service customer who considers an enforcement action to have been erroneously undertaken to appeal their case before an independent hearing officer. The hearing officer considers the evidence presented by the customer and by the City and decides whether to uphold the enforcement action or to provide relief.

In 2014 and 2015, the City created and administered a "Water School" to provide one-time relief from excessive use penalties in exchange for customers attending a 2-hour evening class about the drought and ways to save water. More than 1,200 penalties totaling over \$800,000 were waived through Water School during this time.

8.6 Consumption Reduction Methods

Refer to Section 8.3.2 and Table 8.5 above for a discussion and summary of the primary consumption reduction methods used by the City at various stages of water shortage. The City also implements measures listed in Table 8-7 below:

Table 8-7. Stages of Water Shortage Contingency Plan - Consumption Reduction Methods		
Stage	Consumption Reduction Methods by Water Supplier	Additional Explanation or Reference (optional)
1-5	Expand Public Information Campaign	
3	Increase Frequency of Meter Reading	The City permanently changed to monthly meter reading in 2014 to facilitate water rationing
1-5	Provide Rebates on Plumbing Fixtures and Devices	Increased marketing of ongoing programs
1-5	Provide Rebates for Landscape Irrigation Efficiency	Increased marketing of ongoing programs
1-5	Provide Rebates for Turf Replacement	Increased marketing of ongoing programs
1-5	Decrease Line Flushing	
1-5	Increase Water Waste Patrols	
5-Mar	Implement or Modify Drought Rate Structure or Surcharge	
NOTES:		

8.7 Determining Water Shortage Reductions

Under normal water supply conditions, water production and gross consumption are recorded daily and monthly by treatment plant operators and reported to the Production Superintendent. Metered water consumption is reported on a monthly basis through automated sales reports generated by the utility billing system.

During a water shortage, a monthly production forecast and budget are developed for each source of supply. Actual production and the lake level are closely monitored on a daily and weekly basis to verify that the budgeted goals are being met. Consumption by large users is monitored and reported on a frequent basis. In severe stages of a water shortage, production and consumption data would be evaluated daily and the status reported to the Water Director's office. If the trend in consumption is such that the rate of drawdown at Loch Lomond is greater than anticipated, the City Manager and Council

are notified so that corrective action (such as increased publicity and enforcement or consideration of declaring the next higher stage) can be taken.

Beginning in August 2014, the Water Department began reporting its monthly water production on a statewide database used to keep track of urban water use in response to emergency water conservation regulations. These reports include the amount of potable water produced in the preceding month, an estimate of the gallons of water used per person per day by its residential customers, and various enforcement statistics. This reporting is expected to become a permanent requirement in 2016.

The University of California, the City's largest customer, closely tracks its consumption on campus and meets regularly with the City to ensure it is meeting its reduction target.

Figures 8-1 and 8-2 below show two examples of charts used by the Water Department to track production and water savings goals in the 2014 and 2015 drought and to publicize the community's success in meeting water reduction goals.

Figure 8-1. 2015 Water Production Goals (mgd)

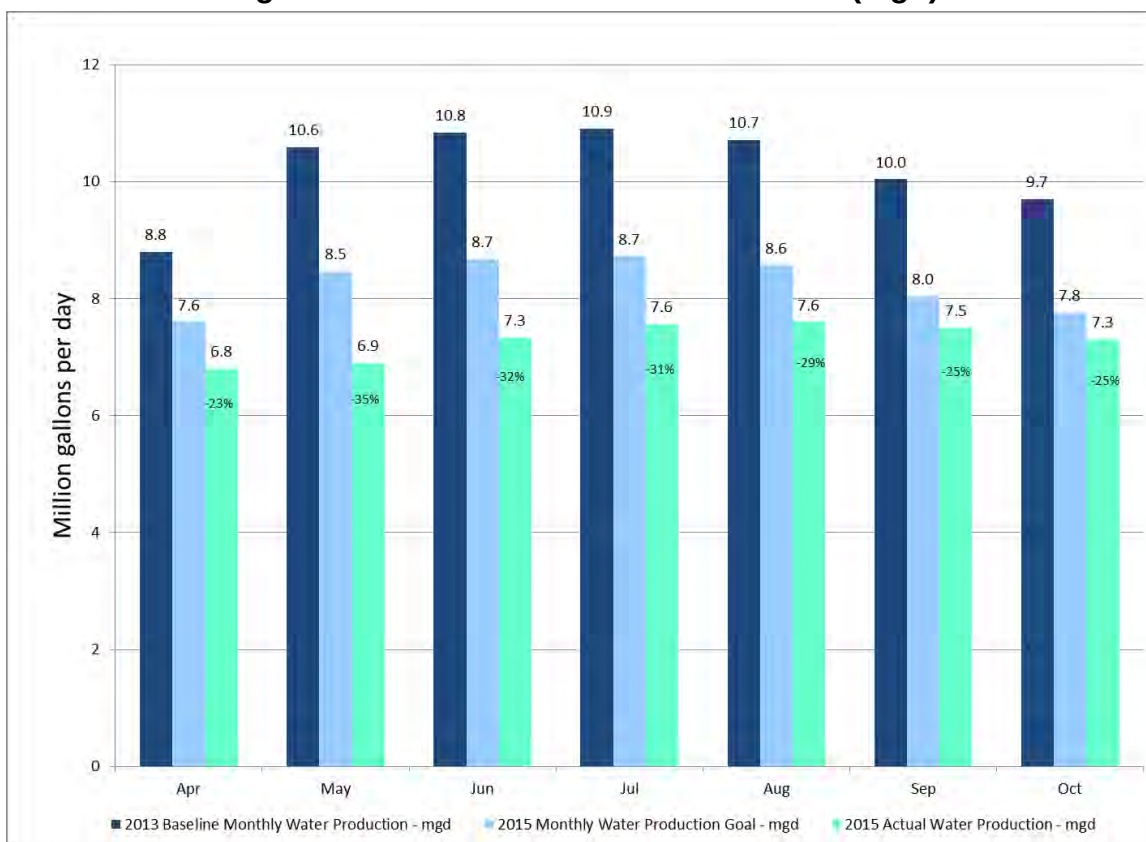
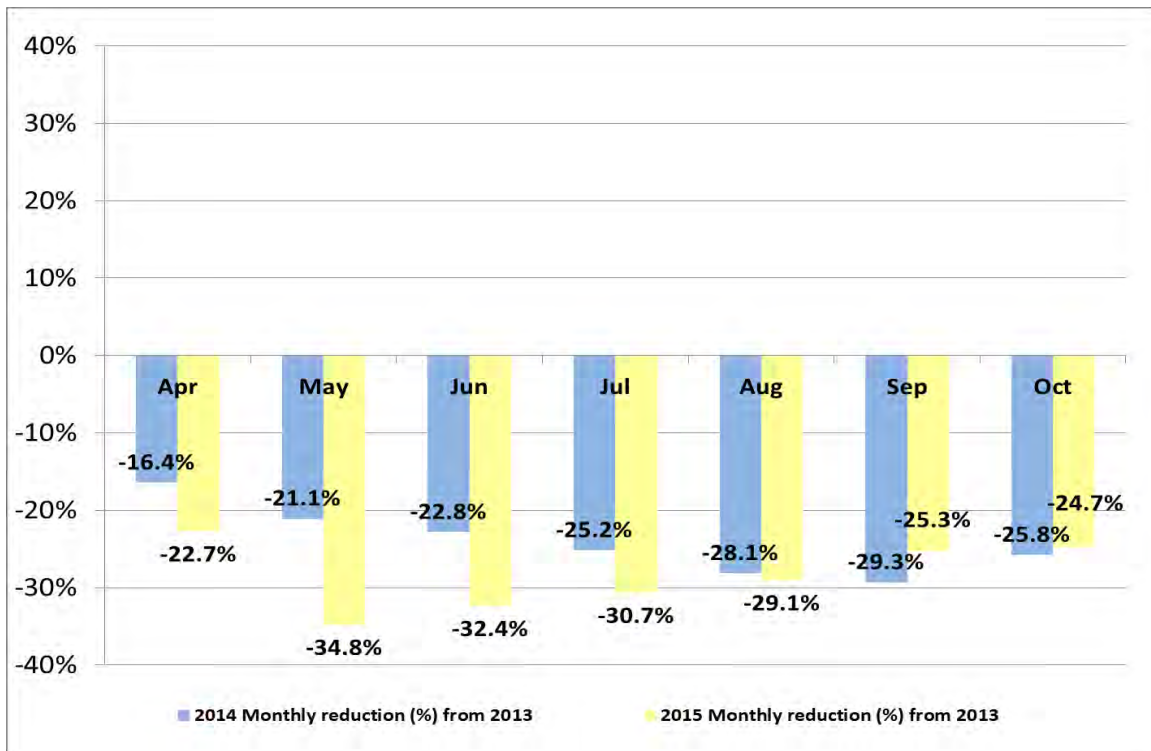


Figure 2. Monthly Water Savings Compared to 2013 (%)

8.8 Revenue and Expenditure Impacts

One of the negative consequences of using demand reduction to deal with water shortages is the corresponding reduction in revenue that occurs to the City's Water Fund as a result of reduced water sales. The full plan provides an analysis of the magnitude of revenue losses that the Water Fund might experience for each of the five stages, based on annual revenues at the time of just over \$22 million.

The analysis assumes the "ready-to-serve" or fixed monthly service charge that is based on meter size would remain unaffected while the volumetric portion of the Department's revenue derived from water sales would vary by customer class in accordance with the allocation presented in Table 8-4 over the seven month period in which water shortage regulations are likely to be in effect.

The analysis shows revenue losses ranging from just under \$0.6 million in a 5 percent water shortage situation to almost \$5.8 million in a critical 50 percent water shortage. These estimates of losses were considered ballpark figures only and probably underestimate the problem. Actual revenue losses would be different for the following reasons:

- The spreadsheet did not model the effect of tiered pricing in the single family residential category, which would exacerbate revenue losses from this group;
- It is unlikely that system water use would immediately recover to normal levels in the months following a period of curtailment as modeled, thereby further depressing income;
- The table above does not include added operating costs of staff, equipment, and materials related to the water shortage response.

On the other hand, the time of year in which regulations would take effect is spread over two fiscal years, so the full effect of revenue losses of a single year drought would not impact the Department's annual budget to such a large degree. In addition, there would be relatively minor cost savings associated with reduced power and chemical usage at the Graham Hill water treatment plant, ranging from <\$0.1 million in Stage 1 to about \$0.4 million in Stage 5. Finally, some of the revenue loss would be offset by penalty and/or excess use fees. On the expenditure side, the major expense of implementing the water shortage plan identified was for added personnel costs for temporary field and office positions, which were estimated to range from approximately \$100,000 in Stage 1 to \$600,000 in Stage 5, and power cost for pumping water from Felton to Loch Lomond.

The Water Department's total annual revenue has increased somewhat since the Water Shortage Contingency Plan was prepared in 2009, but the actual revenue impact of the recent drought was fairly close to the \$2.9 million projected annual loss estimated for Stage 3.

To address this problem, the City in 2014 instituted a new Drought Cost Recovery Fee, which is a surcharge that is automatically triggered by City Council action declaring a water shortage and continues through the end of the fiscal year following the shortage (Appendix N). The fee is a fixed monthly amount that varies by meter size and stage of shortage. It is designed to mitigate the risk of revenue shortfalls associated with usage curtailment events. The maximum targeted cost recovery amount ranges from \$1.0 million in Stage 1 to \$7.5 million in Stage 5. Table 9-4 below shows the Drought Cost Recovery fees in effect in 2015 and 2016.

Table 8-8. Drought Cost Recovery Fee Rate (2015)	
Meter Size	Inside & Outside City (monthly)
5/8 & 3/4"	\$7.37
1"	\$18.43
1.5"	\$36.85
2"	\$58.96
3"	\$110.55
4"	\$184.25
6"	\$368.50
8"	\$847.55
10"	\$1,046.54

8.9 Resolution or Ordinance

The City's water shortage regulations and restrictions were adopted as an ordinance and codified as [Santa Cruz Municipal Code Chapter 16.01](#) (Appendix M). The water shortage regulations and restrictions were last updated in early 2015.

8.10 Plan Evaluation

In 2009, after a year's experience implementing a Stage 2 Water Shortage Warning, Water Department staff prepared a report to document the response and compile records for future reference. This report, entitled: [The 2009 Water Shortage: An Evaluation of Water Management Strategies, Actions, and Results](#) evaluates which aspects of the plan succeeded and which didn't, and why, and makes recommendations and refinements to the plan for the next time a water shortage occurs. Much progress was made with putting enforcement systems, procedures, and tools in place that were not in place prior to 2009 and will help in future events. Even so, there were numerous lessons learned from this experience and several areas where improvements could be made to better manage water shortages in the future.

It is recommended that the Water Department conduct a similar review and prepare an "After Action" report based on the lessons learned during the recent 2014/15 Stage 3 Water Shortage Emergency.

8.11 Catastrophic Supply Interruption

CWC 10632

(a)(3) Actions to be undertaken by the urban water supplier to prepare for, and implement during, a catastrophic interruption of water supplies including, but not limited to, a regional power outage, an earthquake, or other disaster.

The City plans for and responds to emergency incidents, including floods, earthquakes, fires, and hazardous materials incidents in accordance with the Santa Cruz County Operational Area Memorandum of Understanding (MOU). The MOU ratifies local government agreements to follow the Standardized Emergency Management System or SEMS, as mandated under California law. The City maintains an Emergency Management Plan, which defines and describes the emergency management organization and guides the response of appropriate personnel to a major emergency. The City Manager, functioning as the City's Director of Emergency Services, would coordinate the emergency response to maintain water delivery and/or restore service as necessary. The Emergency Management Plan also addresses the integration and coordination with other government agencies and levels when required.

The Water Department maintains a mutual assistance agreement with other water agencies through the Water/Wastewater Agency Response Network (WARN) to share equipment, personnel, and supplies in times of an emergency. The City is within the California Office of Emergency Services Coastal Region II, which includes the counties in the San Francisco Bay region and northern California coast.

The Water Department has its own **General Emergency Plan and Emergency Response Plan for Terrorist Activity and Natural Disasters** in accordance with state and federal laws. This document sets forth the primary objectives of the Department in an emergency as follows:

- Maintain water service for domestic and firefighting purposes,
- Protect the water supply from possible contamination,
- Control the loss of water, and
- Keep the public informed

The plan outlines the roles and responsibilities of key Departmental personnel during an emergency at both the City Emergency Operations Center and Water Department

Operations Center. It also describes general actions to be taken to 1) assess situation status and extent of damage to the water system, 2) prevent contamination and loss of water, and 3) restore water service in response to the following types of emergencies:

- Earthquake
- Tsunami
- Flood
- Fire
- Suspected Contamination of Water Supply
- Civil Disorder
- Power Outage
- Treatment Plant Failure
- Damage to Distribution Storage Reservoirs or Booster Pumping Station
- Telecommunications Failure

The plan contains an emergency water rationing plan intended to preserve treated water supplies in the event a catastrophe results in impairment of the water system. The emergency rationing plan has two stages, which are defined as follows:

Serious shortage: This condition exists when the system is unable to meet normal demand, but can supply enough water for basic public health and safety needs. In this situation, not taking swift action to ration water could jeopardize available water in storage, or could leave the City vulnerable in the event of further outages.

Critical shortage: This condition exists when production facilities are rendered incapable of meeting 50% or less of normal daily production levels and the current rate of consumption poses an immediate threat of draining Bay Street reservoir or other storage tank.

The restrictions that would be instituted in a serious or critical shortage are summarized in Table 8-9.

The City has four portable auxiliary generators to run booster pumps in case of an extended power outage. In addition, the treatment plant and major pump stations have stationary diesel-powered electrical generators as a stand-by source of power in case of a local or regional power outage.

Table 8-9. Emergency Water Rationing Plan	
Serious Shortage	
<i>Prohibited Uses:</i>	<i>Permitted Uses:</i>
1. Watering lawns, gardens or landscaping 2. Washing cars, boats, building exteriors 3. Washing sidewalks, driveways, or any exterior surfaces 4. No outdoor use for any reason 5. Car washes closed 6. Watering plants at nurseries, garden centers 7. Filling of swimming pools, hot tubs, decorative pools, or fountains (must be turned off) 8. Public showers closed	1. Normal domestic uses: drinking, cooking (paper plates and plastic utensils requested) 2. Toilet flushing, only when necessary 3. Limit showers to three minutes 4. Bathing only if absolutely necessary (no more than half full) 5. Minimize clothes and dish washing
Critical Shortage	
<i>Prohibited Uses:</i>	<i>Permitted Uses:</i>
1. Outdoor water use for any reason (garden, landscape, car washing, cleaning, maintenance) 2. Clothes washing and commercial laundering, except for health reasons 3. Janitorial cleaning 4. Businesses and institutions that use water in their operations may be forced to close or restrict operations: - Restaurants, bars, and coffee shops - Laundromats - Public and Private Schools - Manufacturing - Gyms and health spas - Beauty salons and barber shops 5. No water for construction 6. No water for crop irrigation	1. Water limited to health and safety only: drinking and cooking (paper plates and plastic utensils required) 2. Toilet flushing for solid waste only 3. Shower/bathing should be limited to every other day 4. Use water only when absolutely necessary

A separate Emergency Response and Public Notification Plan was developed in 2007 in anticipation of the deconstruction of Bay Street Reservoir. As part of this plan, communication and standard public notification procedures were put in place in the event a water emergency arose. This plan included developing the capability to trigger an automated call-out notification system (Reverse 911) to rapidly disseminate a generalized water emergency warning throughout the Santa Cruz water service area.

Finally, the Water Department has separate earthquake response procedures that outline responsibilities for inspection and reporting the status of critical structures, including Newell Creek Dam and other major water production facilities following an earthquake.

8.12 Minimum Supply Next Three Years

CWC 10632

(a)(2) *An estimate of the minimum water supply available during each of the next three water years based on the driest three-year historic sequence for the agency's water supply.*

For this exercise, it is assumed that the next three water years spans the period 2016-2018. For water year 2016, more than half the year has already passed and conditions are fairly well known. The reservoir is currently at full capacity and the water year is classified as Normal. Accordingly, no water shortage is expected for the remainder of the 2016. It is assumed that the supply available under this circumstance is the same as in an Average year as listed in Table 7-1. But because system water demand continues to be low, the total annual supply available, 3.2 billion gallons, likely overstates actual production the City expects to see through the remainder of 2016.

For 2017 and 2018, water conditions are assumed to be as dry as they were in 1976 and 1977, corresponding with the first two years of the 3-year, multiple dry year sequence listed in Table 7-1. The supply available for those two years is substantially lower, and would likely require significant cutbacks to balance supply and demand, especially in 2018. For 2017, a production level of 2.4 billion gallons is close to what the City actually experienced in 2015 with a declared Stage 3 Water Shortage Emergency in place. For 2018, an annual production level of 1.9 billion gallons would represent a critical water shortage emergency and require a tough decision about whether to tap the 1.0 billion gallon reserve in Loch Lomond Reservoir to meet essential public health needs.

Table 8-10. Minimum Supply Next Three Years (mg)

	2016	2017	2018
Available Water Supply	3,252	2,430	1,969
NOTES: Reference Table 7-1.			

Chapter 9

DEMAND MANAGEMENT MEASURES

The City of Santa Cruz has long recognized the importance of conserving water as a responsible demand management strategy to help protect the area's natural resources, to stretch existing water supplies, to help downsize and/or delay the need for costly additional water supply, treatment, and distribution upgrades, and to fulfill the City's overall goal of ensuring a safe, reliable, and adequate water supply. This section describes the water demand management measures (DMMs) currently being implemented by the City and discusses the City's water conservation planning process that will guide water conservation activities over the next decade and beyond.

In June 2001, the City of Santa Cruz became a signatory to the [MOU Regarding Urban Water Conservation in California](#) and joined the [California Urban Water Conservation Council](#) (CUWCC) in promoting water conservation locally and statewide. By becoming a signatory, the City committed to implementing all 14 urban water conservation Best Management Practices (BMPs) contained in the MOU deemed to be locally cost-effective and to periodically report progress made to the CUWCC.

9.1 Demand Management Measures for Wholesale Agencies

The City of Santa Cruz currently is not a wholesale water supplier nor does it receive water from a wholesale agency. This requirement does not apply to the City.

9.2 Demand Management Measures for Retail Agencies

9.2.1 Water Waste Prevention Ordinances

The definition of water waste prevention under the MOU consists of enacting, enforcing, or supporting legislation, regulations, ordinances, or terms of service that prohibit water waste in new development and by existing users, or that facilitate implementation of water shortage response measures.

The City's water conservation ordinance ([Santa Cruz Municipal Code 16.02](#)) has been in operation since 1981 and was updated last in 2003 (Appendix O). Under the ordinance it is unlawful for any person to use water for any of the following:

- unauthorized use of water from a fire hydrant,
- watering of landscaping in a manner or to an extent that allows excess water running off the property,
- allowing plumbing leaks to go unrepaired,
- outdoor washing of structures, vehicles, or surfaces without the use of an automatic shut-off nozzle, and
- operation of a fountain unless water is recycled

Provisions of the ordinance regulating new development include prohibitions on:

- The use of water in new ice-making machines and any other new mechanical equipment that utilizes a single pass cooling system to remove and discharge heat to the sanitary sewer,
- washing of vehicles at a commercial car wash unless the facility utilizes water recycling equipment
- the use of water for new non-recirculating industrial clothes wash systems, and
- the use of potable water for dust control or soil compaction purposes in construction activities where there is a reasonably available source of reclaimed water appropriate for such use

The ordinance is in effect at all times and is upheld mainly through communication with the responsible customer. However, during mandatory water restrictions, violations of the water waste ordinance are enforced first by a warning and then by progressive series of fines ranging from \$100 up to \$500 and levied on the utility bill. Under a declared water shortage, field staff actively patrols the water service area to enforce restrictions, including water waste violations, seven days per week.

The public is also encouraged to report water waste, either by calling the Water Conservation Office's designated "leak line" (831 420-LEAK) or reporting water waste through the City website. When water waste is observed, site visits, in-person customer contact, phone, and/or mail correspondence is used to resolve the issue. Field staff will increase drive-by checks of sites receiving water waste complaints to help ensure the issue was resolved. New software was acquired in 2009 to help document, track and manage water waste complaints, including the photo evidence of water waste incidents. Since then, the City documented and addressed over 6,000 cases with this software.

Water waste prevention is also implemented through the City's Landscape Water Conservation Ordinance ([Santa Cruz Municipal Code Chapter 16.16](#)) to ensure

landscapes and irrigation systems in new and renovated development are designed to avoid runoff, overspray, low-head drainage and other similar conditions where water flows off site onto adjacent property.

9.2.2 Metering

All of the City's 24,534 water connections are fully metered with most using Automated Meter Reading (AMR) technology. Approximately 15 percent of all City water meters are now connected with Advanced Metering Infrastructure (AMI) technology, allowing access to hourly meter reads. Water meters are required for all new service connections. In addition, a separate, dedicated irrigation meter is required for all new and renovated multi-family and commercial landscape projects with over 5,000 square feet of landscaped area.

All meters are read and billed monthly according to the volume of water consumed. Monthly billing was first instituted inside the City in 2005 mainly to facilitate rising rates for all City utilities, but it also served in aiding in leak detection and allowing for more accurate monitoring of individual account usage and categorical water consumption. Outside City customers were later transitioned to monthly billing in April 2014 to facilitate water rationing.

As a member of the CUWCC, the City undertook two actions required under BMP 1.3 regarding metering. First, the Water Department in 2010 adopted a new Meter Testing, Repair, and Replacement Policy that accelerated large meter replacement and should help improve overall meter accuracy. In 2013, the Water Conservation Office completed a feasibility study to assess the merits of a program to switch mixed-use commercial accounts that have substantial irrigation demands by installing a dedicated landscape meter. Of the almost 1,900 commercial properties analyzed, only nine sites, mostly schools, were identified as potential commercial candidates meriting retrofitting or future sub-metering.

9.2.3 Conservation Pricing

The Customer Service section, also referred to as "Santa Cruz Municipal Utilities," provides customer service and handles utility billing for water, sewer, refuse, and recycling services to the residents and businesses of the City of Santa Cruz, and services for water only to the unincorporated surrounding areas and part of the City of Capitola.

The water portion of the City's utility bill consists of three components: 1) a fixed, monthly "Readiness-to-serve" charge, 2) a volumetric charge, and 3) for customers residing in elevated pressure zones, an elevation charge applies.

The current Readiness-to-serve charge varies by meter size and location (Table 9-1).

Table 9-1. Readiness to Serve Charges (2015)		
Meter Size	Inside City (monthly)	Outside City (monthly)
5/8 and 3/4"	\$21.08	\$26.87
1"	\$52.67	\$67.16
1.5"	\$105.34	\$134.29
2"	\$168.52	\$214.86
3"	\$315.99	\$402.88
4"	\$526.65	\$671.47
6"	\$1,053.27	\$1,342.91
8"	\$2,422.49	\$3,089.55
10"	\$2,991.23	\$3,813.84

For the volumetric charges, the City has had a multi-block, inclining rate structure in place for single family residential customers since 1995. In 2004, following a comprehensive water rate study, a five-tier rate structure was adopted that applies to residential accounts with either one or two dwelling units. The current rates are listed in Table 9-2. For all other customers, including multi-family (3 or more dwelling units), business, industrial, municipal, and irrigation customers, water is billed at a uniform rate corresponding with Block 2.

Table 9-2. Single Family and Two-Unit Residential Water Rate Structure (2015)					
Block	Category	Inside City (monthly)		Outside City (monthly)	
		Units	Rate	Units	Rate
1	Essential needs	1-4 ccf	\$1.91	1-4 ccf	\$2.42
2	Average indoor needs	5-9 ccf	\$4.84	5-9 ccf	\$6.18
3	Average outdoor needs	10-14 ccf	\$6.23	10-14 ccf	\$7.94
4	High use	15-18 ccf	\$8.54.	15-18 ccf	\$10.87
5	Inefficient or excessive use	>18 ccf	\$10.64	>18 ccf	\$13.58

Customers in elevated pressure zones also pay an elevation surcharge of \$0.20/CCF for the cost of being served by an elevated storage reservoir.

In August 2014, the Santa Cruz City Council adopted an annual 10 percent water rate increase over the next five years to complete several critical infrastructure projects. These projects included: Phase 3 of the North Coast System pipeline (\$10 mil), rehabilitating and replacing six filter basins at the Graham Hill Treatment Plant (\$6 mil), converting the Bay Street Reservoir to two modern, 6-million gallon tanks (\$25 mil), annually replacing 2-4 miles of aging main, and rehabilitated storage tanks, pumps, and completing the Beltz 12 well project. All utility rates and rate change proposals are established by resolution of the City Council. See Appendix P for the 2014 Notice of Proposed Rate Changes.

The City of Santa Cruz is currently in the process of developing a long-range, 10-year financial plan and undertaking a new, 5-year rate study to support the Department's ongoing operations and planned capital improvement programs (Appendix Q). Capital projects during the first five years will be focused on system rehabilitation and replacement projects. Major investments to implement the Water Supply Augmentation Strategy are anticipated to occur in the second five years of the financial planning horizon. The new rate study is expected to be completed in fall 2016. Table 9-3 shows the recommended rate design proposed to meet both conservation pricing and other pricing objectives.

Table 9-3. Recommended Basic Rate Structures for Customer Classes	
Customer Category	Basic Rate Structure
Single Family Residential	Keep inclining rates but reduce both tier width and number of tiers
Multi-Family Residential	Change from uniform to tiered rates based on number of dwelling units
Commercial/Municipal/UCSC	Maintain uniform rate structure
Landscape Irrigation	Transition all irrigation accounts to a simple water budget-based rate
North Coast Agriculture	Maintain uniform rate structure

The rate structure being recommended will move from one that collects about 65 percent of revenue in volume charges (based on the amount of water used) to one that collects about 90 percent of revenues from volume charges. Other planned changes include:

- Establishing an Infrastructure Reinvestment Fee that will collect the funding needed to support pay-as-you-go capital and debt service costs. The fee would be collected as a separate charge based on water use.
- Establishing a \$1.00/CCF surcharge on water use beginning in July 2017 to increase the Department's Rate Stabilization Fund. This fund would be used to mitigate the potential revenue instability associated with the recommended rate structure, and augment revenues in normal years should consumption fall below a level of 2.5 billion gallons per year.
- Retaining the existing Drought Cost Recovery Fees that are triggered by a City Council declared water shortage and would be collected as a fixed charge for the full fiscal year.

The financial plan and recommended rates are needed to ensure the long-term financial health of the utility, and enable the Water Department to support ongoing operations and maintenance of the water system and make the capital investments required to comply with regulations, rehabilitate and replace aging infrastructure. The notice of proposed new rates that would go into effect starting in October 2016 is included as Appendix R.

9.2.4 Public Education and Outreach

The City of Santa Cruz Water Department actively values and promotes public awareness and education about the City's water resources and the importance of water conservation. The City of Santa Cruz disseminates information to the general public in different forms including: 1) media, 2) workshops and community events, 3) billing and customer service, and 4) school education programs.

The City uses media coverage in order to broadly share information and updates on events, programs, and news to the public in the following ways:

- "SCMU Review", utility newsletter which includes news and information on water conservation topics;
- [City of Santa Cruz Water Conservation website](#);
- [Water Supply Advisory Committee website](#);
- Formal water supply outlook published three times a year sharing the water conditions/ supply availability;
- Weekly water conditions webpage;

- Paid advertising in local newspapers;
- Opinion page coverage;
- Marketing and advertising of EPA's "Fix a Leak Week"; and
- Television and radio news interviews and community television programs.

In addition, the City uses workshops and community events to engage and interact with the public by the following:

- Public meetings and speaking events to community organizations, industry and homeowners associations, and service groups;
- Tabling at local fairs, farmers markets, and events;
- Participation in regional water forums;
- Participation with other local water agencies in local events and sponsorships of water conservation-related activities;
- Free workshops on irrigation efficiency, new irrigation technologies, and water conservation strategies for the landscape; and
- Financial support to the Green Gardener Program, California Water Awareness Campaign, Water-Smart Gardening Faire, Green Business Program, and the Water Education Foundation.

The City of Santa Cruz also uses a personable approach to public education and outreach through billing and customer service, which includes the following:

- Marketing and distribution of free water conservation devices and literature;
- Marketing of rebates and distribution of rebate applications;
- Bill inserts;
- Field representatives showing customers how to read their meter and check for leaks at their properties;
- Partnership with the Monterey Bay Area Green Business Program;
- Messages and information on customer's bills showing daily consumption and a graph charting monthly consumption for the entire year; and
- Water supply tours.

The City offers school education activities for students ranging from upper elementary age children up to the University level. The program gives students an opportunity to learn about the City's water supply system and water conservation. School educational activities include:

- Field trips and ranger presentations at Loch Lomond Reservoir and San Lorenzo River;
- Loch Lomond Trout in the Classroom fish release field trip;
- Distribution of age and grade level appropriate curriculum and educational materials, including a water education booklet specially developed for Santa Cruz County students;
- Classroom presentations; and
- High School Watershed Academy program.

9.2.4.1 Water School

In summer 2014, the City of Santa Cruz Water Department started hosting Water School as a result of rationing and curtailment during a declared water shortage. Residential customers were required to stay within their assigned allotment or pay an excessive use penalty for each additional unit of water used over their allotment. Water School served as a one-time opportunity for customers who exceeded their monthly allotment to dismiss their penalty by attending a two-hour class session held at the local community center. The session was followed by a short quiz and a survey for feedback and additional questions. The class curriculum consisted of an overview of the City water system, statewide and local drought conditions, Santa Cruz Municipal Utility (SCMU) services, water use regulations and restrictions, and water conservation strategies to practice at home and outside. The purpose of water school was to educate customers about the water shortage and local impacts, show customers support, empower customers to conserve and think critically about their own usage, and prevent customers from exceeding their allotment in the future. The City's Water School curriculum was used as a model in the [CUWCC's Water Shortage Toolkit](#) for other water agencies starting their own water schools. In 2014, the city held 27 classes for 702 customers, which collectively waived \$462,050 in penalties. In 2015, there were 14 classes for 461 customers, which dismissed \$266,760.

The City of Santa Cruz also offered a separate Water School for large landscape account that exceeded their water budget created from landscape water budget software, Waterfluence. The landscape water school shared some elements with the residential water school curriculum and included tips on how to use Waterfluence effectively and communicate with different staff or stakeholders. In 2014, 28 irrigation customers attended and dismissed \$40,375. In 2015, a pre-rationing water efficient workshop was offered to prepare irrigation accounts for rationing where 19 customers attended. The 2015 landscape water school consisted of 20 customers and dismissed \$34,850 in excessive use penalties.

9.2.4.2 Water Supply Advisory Committee

In 2015, City Council created the Water Supply Advisory Committee to engage the community in an examination of water supply issues. The Committee consisted of 14 members of the community who represented various interests including the environment, business, education, and the Water Commission. The Water Supply Advisory Committee offered meetings, forums, and other opportunities for the public to learn, engage, and share their opinions about the future of Santa Cruz's water supply. In addition, the City invited the public to attend a series of Enrichment Session installments with different topics including climate change, groundwater, water reuse and more. The goal for these forums and workshops was to bring transparency and collaboration to the community regarding decision-making of water supply alternatives for the City of Santa Cruz.

9.2.5 Programs to Assess and Manage Distribution System Losses

As mentioned in section 4.4, the Water Conservation Office has conducted an annual water audit of the City's water distribution system since 1997 using the approach described in the AWWA M36 "Manual of Water Supply Practices". The purpose of the audit is to quantify how much water and revenue is lost through physical leaks and apparent losses and to identify steps to minimize system losses and improve the operational efficiency of the water system. Beginning in 2006, the City also began to use the water balance approach developed through the International Water Association (IWA), now advocated by AWWA, to better characterize water losses in the distribution system.

Water audit results indicate average system water loss from 1997 to 2014 is approximately 7.5 percent of total treated water production or 266 mgy. Of this amount, it is estimated that 5 to 6 percent (198 mgy) is lost due to physical leakage in the distribution system, also referred to as "real" losses, including leaking service lines, valves, fittings, and water mains. It is estimated that another 1 to 2 percent (68 mgy) is not physically lost but goes unreported on the billing system primarily due to sales meter inaccuracies, billing and accounting errors, and other factors. This second category of losses, labeled "apparent" losses, has a negative impact on both utility revenue and on consumption data accuracy.

In 2015, the City contracted with Water Systems Optimization, Inc. (WSO) to examine the City's water system and operations practices, validate where losses are occurring, evaluate options, and set forth a formal strategy to improve water accountability and reduce lost water. WSO's proposed scope of work is organized into three tasks, involving the following elements:

1. Water audit validation, to assess the accuracy of the system input meters and data transfer systems, and to perform a business process review of meter testing, reading, and billing activities;
2. Component analysis of real losses, to quantify the volume of different types of leaks and determine the economic level of leakage – the balance between the value of the water that is lost through leakage and the cost of finding and fixing leakage or reducing leakage through pressure management; and
3. Water loss control program design, to outline the most cost-effective strategies for reducing both real and apparent losses over time.

Results of the 2014 water audit that was validated as part of the project are summarized in Figure 9-1.

Figure 9-1. 2014 Water Balance

Water from Treatment Plant 2,416 MG	Water Supplied 2,603 MG	Authorized Consumption 2,355 MG	Billed Authorized Consumption 2,344 MG	Billed Metered Consumption 2,343 MG	Revenue Water 2,344 MG
				Billed Unmetered Consumption 1 MG	
		Water Losses 248 MG	Unbilled Authorized Consumption 11 MG	Unbilled Metered Consumption 7 MG	Nonrevenue Water 259 MG
				Unbilled Unmetered Consumption 4 MG	
		Apparent Losses 47 MG	Real Losses 201 MG	Unauthorized Consumption 6 MG	
				Customer Metering Inaccuracies 41 MG	
				Systematic Data Handling Errors 0 MG	
				Leakage on Mains	
				Leakage on Service Connections	
				Leakage on Appurtenances	
Water from Wells 187 MG				Leakage and Overflow at Storage Tanks	

The recommendations produced from this year-long study will be used to guide development of a robust water loss control strategy and will serve as a foundation for completing and reporting future annual water audits to the state beginning in 2017 under the requirements of [SB 555](#) of 2015.

Currently, the Water Department addresses physical leakage by expediting leak repairs on service connections and mains, and by performing service line and water main replacements on an ongoing basis. The Water Department budgets a total of about \$1.25 million annually in its capital improvement program for water main replacement projects. Although a formal leak detection program is currently not in place, the Water Department uses sonic leak detection equipment to locate and repair leaks in the water system. In addition, the Department monitors for leaks on the customer's side of the meter by reviewing exception reports for high meter readings. Customers are notified so they can take appropriate action to repair leaks, even before they receive their water bills.

9.2.6 Water Conservation Program Coordination and Staffing Support

The Water Conservation section is responsible for promoting efficient water use and implementing management practices that reduce customer demand for water. This section consists of the Water Conservation Manager, one Water Conservation Analyst, and two Water Conservation Representatives. The Water Conservation Manager is responsible for planning, organizing, and directing the operations of the Water Conservation section and for reporting on BMP implementation. The Water Conservation Manager meets regularly with the Water Director and senior managers to coordinate conservation activities with the administration, engineering, production, distribution, and customer service sections. The Water Conservation Analyst and Water Conservation Representatives are responsible for operating existing programs and assisting with new program development.

9.2.6.1 Water Conservation Program Responsibilities and Activities

The responsibilities and major activities fall into the following four general categories:

Public Awareness and Education: to promote public awareness and education about the City's water resources and the importance of water conservation; and to provide timely and accurate information to utility customers and the general public about conservation practices and technologies, as well as the City's conservation programs and policies.

Water Demand Monitoring: to monitor water production, consumption and system water losses; to track weather and population data; to evaluate trends in per capita water use; to track demand associated with new service connections; to compare actual water demand with projected use by customer category; and to develop and support water demand forecasts for the water service area for use in supply planning.

Long-Term Water Conservation Programs: to develop and implement various conservation projects and programs that result in a sustained reduction in customer water demand; to track water savings from ongoing conservation programs; and to evaluate the need for program modifications to improve efficiency, customer service, and water savings in keeping with conservation goals.

Planning and Emergency Management: to periodically update and implement the City's Water Shortage Contingency Plan and the Urban Water Management Plan, and to assist in Departmental and City-wide emergency planning and management activities.

Between 2012 and 2015, drought management became the section's primary function, which dramatically accelerated public education and outreach activities as well as public interest and participation in long-term conservation programs.

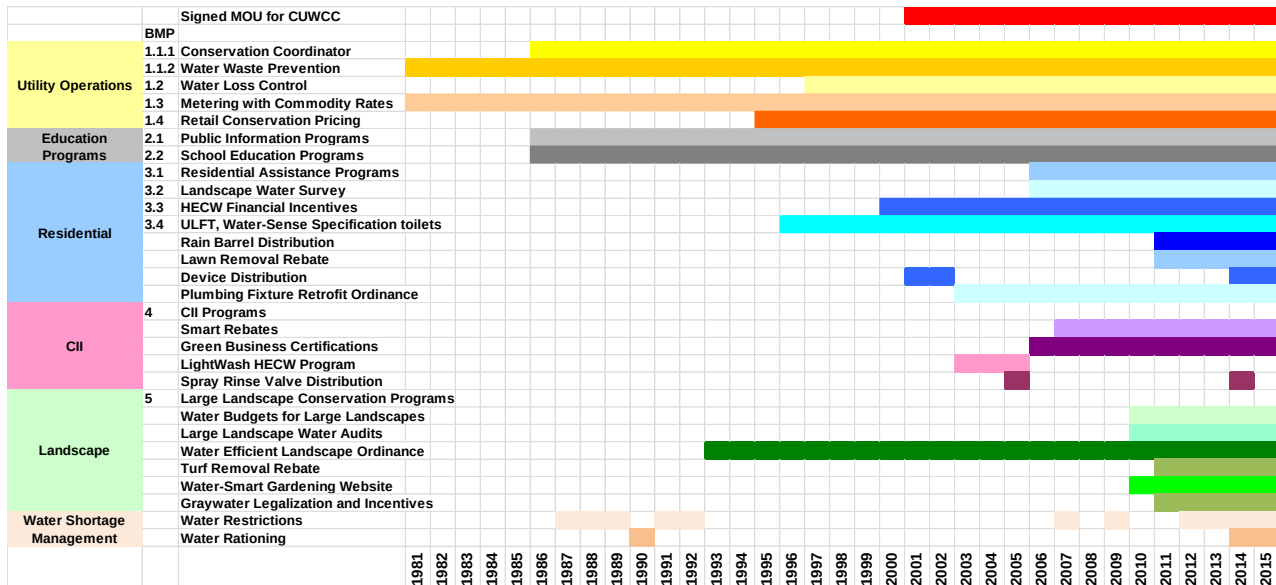
9.2.6.2 Program Funding

The City's water conservation program is funded by a combination of water rates, system development charges, and miscellaneous service fees. With regard to water conservation, revenues from system development charges are used primarily for various rebate programs, including residential and commercial toilets, urinals, clothes washers, Smart Rebates, and more recently, lawn removal rebates, which account for the majority of long-term water savings generated each year. The total amount resources budgeted for the Water Conservation Section in FY 2017 is \$1.1 million.

9.2.7 Other Demand Management Practices

As a member of the California Urban Water Conservation Council, the City of Santa Cruz is implementing all the CUWCC's Best Management Practices. These demand management measures apply to all customer types including residential, business, and landscape accounts. Figure 9-2 below provides a summary and timeline of past and current water conservation activities, organized in accordance with the MOU.

The nature and extent of these measures are described below.

Figure 9-2. Timeline of Past and Current Water Conservation Activities

9.2.7.1 Demand Management Measures for Residential Customers

Residential water use constitutes almost two thirds of system consumption and therefore is a main focal point of the City's water conservation efforts. The residential water conservation programs consist of the following: 1) Home Water Survey Program, 2) High Efficiency Clothes Washer Rebate Program, 3) Toilet Rebate Program, 4) Laundry to Landscape Rebate Programs, 5) Rain Barrel Program and 6) Plumbing Fixture Retrofit Ordinance.

The Home Water Survey program is a free service offered to single and multi- family residences and consists of reviewing billing and consumption information, showing how to read a meter and detect leaks, inspecting home plumbing fixtures and offering free showerheads, faucet aerators, and rebate forms. The survey also assesses outdoor water use and needs by checking the irrigation system and timer, and evaluating the landscape area, design, and plants. Although home water surveys are not in high demand – only 124 were performed in the last five years - they play an important role in providing education and customer service.

The High Efficiency Clothes Washer Rebate program offers \$100 for the purchase and installation of an Energy Star clothes washer to single and multi-family (non-communal laundry) residences. The City will soon be modifying the rebate program to offer an additional \$100 for Energy Star Most Efficient models. The Energy Star Most Efficient

models have the lowest water factor and energy factor of all clothes washers. In addition, only these models qualify for a rebate through PG&E. By increasing the rebate amount for these specific models, the City is hoping to encourage customers to use clothes washers that have the lowest water factors. Between 2011 and 2015, the City approved rebates for about 3,000 water efficient clothes washers saving an estimated 25 million gallons per year.

The City has operated a rebate program to promote the installation of ultra-low-flush or high efficiency toilets in residential accounts since 1995. The program originally featured a \$75 rebate as a financial incentive for customers to remove their higher-volume toilets and replace them with 1.6 gallon ultra-low-flush toilets. This \$75 rebate was discontinued in 2010. The City's current toilet rebate program offers \$150 rebate for toilets meeting Water Sense criteria of 1.28 gallon per flush maximum. Eligibility requirements depend on the flush volume of the toilet that customer is replacing. Older, higher usage toilets of 3.5+ gallons per flush are eligible with the replacement of a high efficiency toilet of 1.28 gpf or lower. Customers who have toilets less than 3.5 gallons per flush must install ultra-high efficiency toilets of 1.0 gallons per flush or less to be eligible. In the last five years, 2,257 water efficient toilets were installed under the program saving approximately 14.7 million gallons of water annually.

The City also offers a Laundry to Landscape rebate of \$150 to customers who install a laundry to landscape greywater system and attend a workshop offered by Central Coast Grey Water Alliance. The requirement to attend a workshop is intended to ensure systems are installed in accordance with guidelines listed in the CA plumbing code. The program has attracted only very sporadic participation though.

The Rain Barrel Program currently offers a 50-gallon rain barrel catchment system at a subsidized rate of \$50 per barrel. Customers are able to order online during the rainy season from [Rainwater Solutions](#) to reserve rain barrels for the upcoming distribution event. Several distribution events are held during the rain barrel sale for customers to pick up their orders at the City's corporation yard. At the beginning of the program in 2010, rain barrels were delivered to customers' homes, but this has since changed due to increased customer interest. A total of more than 4,000 rain barrels have been sold since then saving about 0.8 mgy.

In 2003, the City adopted a plumbing fixture retrofit ordinance, codified as [Santa Cruz Municipal Code Chapter 16.03](#). This regulation requires that all residential, commercial, and industrial properties be retrofitted with low consumption showerheads, toilets, and urinals when real estate is sold. As part of the initial program implementation, the City worked closely with the County of Santa Cruz and the City of Capitola to have similar

ordinances passed in these other jurisdictions. Under the law, the seller of the property is responsible for retrofitting any older toilets, urinals, and showerheads on the property with low consumption fixtures, and for obtaining a water conservation certificate from the Water Department. There is an option in the ordinance that allows the responsibility for retrofitting to be transferred from the seller to the buyer, if both parties agree. In either case, the City tracks real estate sales and requires every property to be inspected to verify that the plumbing fixtures on the property being sold meet the low consumption standards, with the exception of already existing 1.6 gallon per flush toilets. A custom database program was developed by a consultant to manage property sales data on local properties and retrofitting records, as well as follow-up enforcement of the ordinance. In the last five years, 2,359 properties have been certified under the program, saving about 12.5 million gallons per year.

9.2.7.2 Demand Management Measures for Commercial Customers

The City provides water to about 1,900 commercial and industrial accounts within the service area, which together represents about 26 percent of total system water use. The City offers several programs to encourage commercial customers to become more water efficient by using water-saving technology. These include: 1) Smart Business Rebate Program and 2) The Monterey Bay Green Business Program.

The Smart Business Rebate Program was offered as a result of the conclusion of the statewide Smart Rebate program in 2013. The City's Smart Business Rebate Program mirrors the old statewide program by offering businesses rebates for installing water efficient fixtures including:

- High Efficiency (1.28 gpf) or Ultra High Efficiency (1.0 gpf) toilets- \$200
- High Efficiency Urinals (0.125 gpf)- \$300
- High Efficiency Clothes Washer- \$400

The eligibility requirements for these rebates are the same for the other programs. Clothes washers must be Energy Star certified and inspected if five or more are installed. Toilet rebate eligibility depends on what is currently being replaced, like the residential program. In the last five years, 46 businesses have taken advantage of the program, saving an estimated 10.2 million gallons per year.

The Monterey Bay Area Green Business program is a partnership of environmental agencies, utilities, and nonprofit organizations that assist, recognize and promote businesses that volunteer to operate sustainably. To be certified "green," participants

must be in compliance with all regulations and program standards for conserving water and energy, preventing pollution, and minimizing waste. The City became a participant in the program in 2006, which is coordinated through the Public Works Department.

Businesses must meet a set of indoor and outdoor water conservation standards as part of achieving their Green Business Certification. All businesses are required to meet basic, mandatory measures and a minimum number of elective requirements from several categories. Customers are also required to meet additional measures specific to their type of business (e.g. low flow spray rinse valves for restaurants). In order to certify a business, a water conservation representative meets with the applicants and inspects the site, checks for leaks and interviews the applicants.

The City has also distributed water conservation materials to all local hotels, and drinking water upon request table tents to all local restaurants, and continues to make them available upon request.

9.2.7.3 Demand Management Measures for Landscapes

The City of Santa Cruz also offers rebates and programs for outdoor water use and landscapes which include: 1) Lawn Removal Rebate Program, 2) Large Landscape Water Budgets, and 3) Water Efficient Landscape Ordinance.

The Lawn Removal Rebate Program currently offers \$.50 per square foot of lawn removed for single family, multi-family, and commercial customers. Single family residences are eligible to receive up to \$500 (1,000 square feet) and multi-family or commercial are eligible for up to \$2,500 (5,000 square feet). The general requirements are the following:

- Lawn that is maintained or previously maintained prior to drought,
- Lawn must be watered by an in-ground irrigation system,
- Removal or capping of the overhead spray system in the area to be converted,
- Replacement of lawn with very low or low water use plants and mulch (with or without low volume drip irrigation) or install no water use permeable hardscape options,
- Agreement to pre- and post- inspections to take measurements and ensure eligibility requirements have been met,
- Completion of landscape conversion within a year, and
- One rebate per customer per year.

The City plans on increasing the rebate to \$1.00 per square foot removed with the same limitations of rebating up to 1,000 square feet for single family residences and 5,000 square feet for multi-family and commercial. The City hopes to encourage more lawn conversions by offering a higher rebate. Over the last five years, this program has resulted in a total of over 395,000 square feet (9.0 acres) of turf to be removed, saving an estimated 7.5 million gallons of water per year.

In July, 2010, the City launched a new program for customers with large landscapes and dedicated irrigation accounts. After converting all dedicated irrigation accounts to monthly meter reading, the City contracted with a consultant, Waterfluence LLC, to map landscape areas using aerial imagery, to develop irrigation budgets for the City's 110 largest irrigation customers, and to distribute the information through monthly Landscape Water Use Reports. Since then the program has expanded its participation to 230 sites representing 426 acres or 18.5 million square feet of irrigated area and over 250 million gallons per year of water. For each site, Waterfluence provides a site-specific irrigation budget based on landscape size and plantings, type of irrigation, and real-time local weather conditions that is obtained from the CIMIS station located at the DeLaveaga golf course. Customers receive monthly reports via mail or email comparing their actual consumption to the irrigation budget over a 1-3 year long period. A 2013 program assessment showed annual savings equal to about 15 million gallons per year. With these accounts being rationed the last two years, however, water use at large landscape sites was temporarily reduced by more than 130 million gallons in 2015. Further evaluation is needed in the future to better quantify long-term program impact.

In addition to receiving monthly reports, participants in the program are also eligible for a professional irrigation audit performed by Waterfluence. The audits include an assessment of irrigation efficiency, notation of irrigation issues (scheduling, tilted nozzles, leaks, breaks, pressure, overspray etc.), and a confirmation of the landscape area measurements. Customers receive a detailed report with site photos noting irrigation problems, a sprinkler condition analysis, cost-effective recommendations, scheduling suggestions, and a list of water management essentials.

The City is currently enrolling more participants into the program in order to continue adding customers that have recent history of high usage or water waste of over 100 CCF per year. Large landscape and irrigation account customers that used between 10-100 CCF per year are being mapped for potential enrollment in the future. Irrigation customers that used under 10 CCF were simply noted. The City is measuring all landscape irrigation accounts using over 10 CCF in anticipation of changing over to a simple water budget-based rate structure.

The City's Water Efficient Landscape Ordinance was first adopted to establish landscape water conservation regulations for major development projects situated in the City's service area in 1993 ([Santa Cruz Municipal Code Chapter 16.16](#)). Since then it has been rewritten and revised in 2001 and 2010. It is in the process of being updated again in response to 2015 emergency conservation regulations. The overall purpose of the ordinance is to ensure that the City's limited water supply is used efficiently and effectively in new landscapes within the City's water service area and to avoid certain landscape and irrigation design aspects that have the potential to result in water waste.

The City's ordinance applies throughout the entire water service area as a condition of receiving water service. It covers all new and renovated, commercial, industrial, and public projects, new single-family and multifamily development projects resulting in three or more dwelling units where: 1) the landscape is installed by the developer, and 2) the total landscape area of the project is 500 square feet or more, and new single family and two-unit residential development projects on properties equal to or larger than 10,000 square feet. Certain provisions also apply to pre-existing landscapes over one acre in size. The ordinance contains provisions for:

- Dedicated irrigation meters for new landscapes or expansion of existing landscapes over 5,000 square feet in area;
- Landscape water budget based on 55 % (residential) and 45% (non-residential) of reference evapotranspiration;
- Turf is limited to 25% on residential projects (turf not permitted for non-residential);
- Requiring very low to moderate water using plant materials, grouping plants with similar water needs;
- Irrigation design to avoid conditions that lead to runoff and overspray;
- Appropriate irrigation equipment, including requiring weather-based irrigation controllers and flow sensors to maximize water efficiency and detect leaks;
- Soil preparation and mulching;
- Storm water management; and
- Alternative water sources.

A complete landscape plan must be submitted and found to satisfy the standards before a building permit can be issued. Water Conservation staff reviews the landscape plans for compliance with the ordinance, coordinates plan review with Water Engineering and other City Departments and jurisdictions, and once installed, performs final inspections of the completed landscape.

9.3 Implementation over the Past Five Years

All of the water conservation programs described above in Section 9. 2 and illustrated in Figure 9-1 have been actively implemented over the past 5 years. Since 2011, however, most activity has been devoted to addressing four consecutive years of water shortage. In particular, emergency water shortages in both 2014 and 2015 saw a dramatic increase in the level of public information and outreach, water waste enforcement, conservation program and staffing support, short-term changes in pricing, and huge increases in participation in the City's turf removal, rain barrel, and conservation device distribution programs, as well as a repurposing of the landscape water budget program from an informational aid to a water rationing tool. A second round of a pre-rinse spray nozzle replacement program was completed in 2014, and the new water loss control study was begun. On top of all that, the City continued working on its long-term Water Conservation Master Plan, which is described further below.

9.4 Planned Implementation to Achieve Water Use Targets

In 2013, the City contracted with Maddaus Water Management, Inc. (MWM) to develop an updated Water Conservation Master Plan. The goal of the updated plan is to define the next generation of water conservation activities and serve as a roadmap to help the community achieve maximum, practical water use efficiency. Strengthening water conservation efforts has been identified as a top priority by the City Council, the City's Water Commission, and more recently by the City's Water Supply Advisory Committee in its effort aimed at delivering a safe, adequate, affordable, and environmentally sustainable water supply.

The process used to develop the plan included analyzing conservation measures and programs using the consultant's Least Cost Planning Water Demand Management Decision Support System Model (DSS Model). Work was divided into two phases separated by a year of in-depth review of the work by the City's Water Supply Advisory Committee. The Recommended Plan, which covers the same 2035 planning horizon as this Urban Water Management Plan, matches the recommended measures list published in the Final Report on Agreements and Recommendations (Appendix K). The WSAC's involvement helped shape the plan in two important ways: 1) it shifted conservation program emphasis to the peak season period (April – October) to better address the City's supply-demand gap, and 2) it produced recommendations leading to several additional conservation measures.

The plan includes a total of 35 measures for implementation between now and 2021 (Figure 9-3). Many are already underway. The City Council accepted the plan in concept as a Technical Memorandum in April 2016 (Appendix S), and the final report is almost complete. The goal is to include and adopt the Water Conservation Master Plan in its entirety as an element of this 2015 Urban Water Management Plan.

Figure 9-3. Recommended Program Implementation Schedule

No.	Measure	Time Period	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
1	System Water Loss Reduction	2015 - 2035																					
2	Advanced Metering Infrastructure	2021 - 2035																					
3	Large Landscape Budget-Based Water Rates	2018 - 2020																					
4	General Public Information	2015 - 2035																					
5	Public Information (Home Water Use Report)	2018 - 2035																					
6	Residential Leak Assistance	2018 - 2035																					
7	Single Family Residential Surveys	2015 - 2035																					
8	Plumbing Fixture Giveaway/Opt	2015 - 2017																					
9	Residential Ultra High Efficiency Toilet Rebates	2015 - 2020																					
10	High Efficiency Clothes Washer Rebates	2015 - 2026																					
11	High Efficiency Clothes Washer - New Development	2021 - 2035																					
12	Hot Water On Demand - New Development	2021 - 2035																					
13	Toilet Retrofit at Time of Sale	2015 - 2019																					
14	CII MF Common Laundry Room High Efficiency Clothes Washer	2015 - 2024																					
15	CII Incentives	2021 - 2026																					
16	Pre-Rinse Spray Nozzle Installation	2015 - 2016																					
17	CII Surveys	2021 - 2026																					
18	High Efficiency Urinal Program	2015 - 2018																					
19	Public Restroom Faucet Retrofit - MUN	2021 - 2023																					
20	Public Restroom Faucet Retrofit - COM	2021 - 2030																					
21	School Retrofit	2021 - 2030																					
22	Water Efficient Landscape Ordinance	2015 - 2035																					
23	Single Family Residential Turf Removal	2015 - 2035																					
24	Multifamily Residential/CII Turf Removal	2015 - 2035																					
25	Expand Large Landscape Survey/Water Budgets	2018 - 2035																					
26	Sprinkler Nozzle Rebates	2018 - 2035																					
27	Gray Water Retrofit	2015 - 2035																					
28	Residential Rain Barrels	2015 - 2035																					
29	Climate Appropriate Landscaping and Rainwater Infiltration	2015 - 2035																					
30SF	SF Conservation Pricing - Water and Sewer	2018 - 2035																					
30MF	MF Conservation Pricing - Water and Sewer	2018 - 2035																					
30COM	COM Conservation Pricing - Water and Sewer	2018 - 2035																					
31	Single Family Multifamily Dishwasher Rebates	2018 - 2022																					
32	Hot Water Recirculation Systems	2018 - 2022																					
33	Rewarding Businesses For Adopting Best Practices	2020 - 2035																					
34	Additional Building Code Requirements for New Development	2018 - 2035																					
35	Innovation Incubator Program	2021 - 2035																					

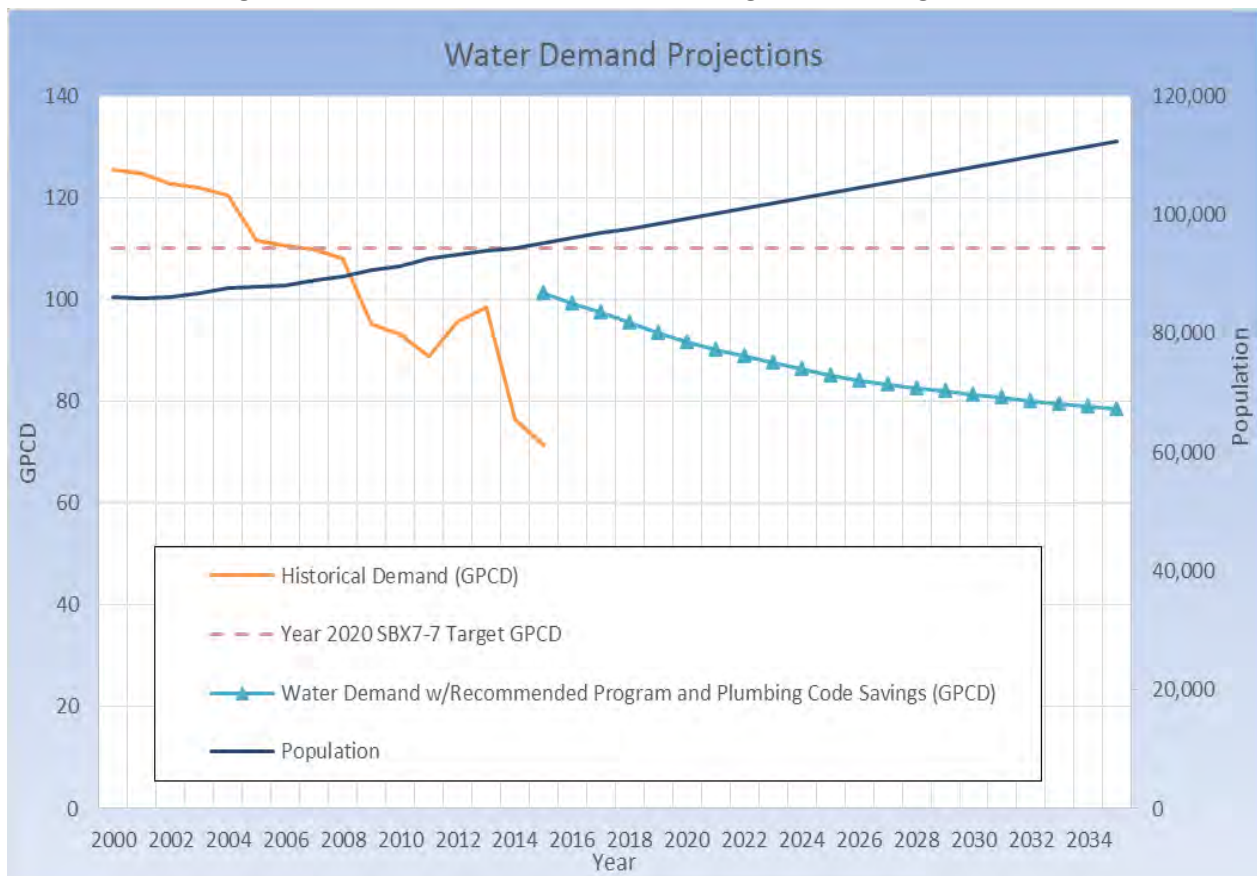
Table 9-5 presents the projected water savings in 5-year increments, broken down into two components: the passive plumbing codes savings referenced in Chapter 4, and active water savings associated with the Recommended Program, expressed in millions of gallons per year.

Table 9-5. Long-Term Conservation Program Savings (mgd)

Conservation Program	2020	2025	2030	2035
Plumbing Code	96	179	269	329
Recommended Program	137	232	269	291
Recommended Program with Plumbing Code Savings	233	411	538	620

NOTES: Maddaus Water Management, Inc., 2016

Figure 9-4 shows the projected per capita water use in gallons per person per day (GPCD) in 5-year increments for the projected demand with the recommended program implementation and plumbing code savings. The model indicates that the City's GPCD in 2020 will decline to about 92 gallons per person per day, far below the City's 2020 target of 110 GPCD under SB X7-7, and continuing to decline to a level of about 78 GPCD by 2035.

Figure 9-4. Water Conservation Program Savings, GPCD

9.5 Members of the California Urban Water Conservation Council

CUWCC members have the option of submitting their 2013–2014 Best Management Practice (BMP) annual reports in lieu of, or in addition to, describing the DMMs in their UWMP. The City is including its 2013 and 2014 BMP reports for additional informational purposes in Appendix T. In 2013 and 2014, the City was considered to be “On Track” by the California Urban Water Conservation Council in all areas with the following exceptions:

BMP 1.2 Water Loss Control:

- Completed training in component analysis process? No (Since completed in 2016)
- Component Analysis? No (Since completed in 2016)

BMP 1.4 Retail Conservation Pricing:

- Conservation pricing for sewer service: For water agencies that provide retail sewer service, rates that charge customers a fixed amount per billing cycle for sewer service regardless of the units of service consumed do not satisfy the CUWCC’s definition of conservation pricing of sewer service. This applies to City’s single family and multifamily sewer charges, which are charged a flat monthly rate for sewer service¹.

The Water Department has raised this matter previously and will continue to discuss sewer rates and conservation pricing as a matter of policy within the City organization.

¹Low water users who meet an average winter use criteria of 2.25 CCF/month or less qualify for a reduced sewer rate.

Chapter 10

PLAN ADOPTION, SUBMITTAL, AND IMPLEMENTATION

The City of Santa Cruz began the process of developing the 2015 Urban Water Management Plan after participating in a webinar and workshop sponsored by DWR in late 2015. While Chapter 2 describes the process of preparing the plan, this chapter summarizes the process of plan adoption, submittal, and implementation including the steps for amendment if it becomes necessary.

10.1 Inclusion of all 2015 Data

As mentioned in Section 2.3, the City is reporting on a calendar year basis. The plan was prepared in 2016 and accordingly includes water use and planning data for the entire calendar year of 2015, except where noted.

10.2 Notice of Public Hearing

Water suppliers must hold a public hearing before adopting an Urban Water Management Plan. The public hearing provides an opportunity for the public to provide input before it is adopted by City Council.

Prior to the public hearing, the draft plan was made available for public inspection, review, and comment on the City's web site, at the Water Department office, and at the City's Central Library beginning in late July 2016.

In addition, the City Water Commission reviewed the draft plan and provided comments at its August 1, 2016 meeting. Water Commission meetings serve to encourage active involvement and participation of diverse groups and individuals, in accordance with section 10642 of the Act. In the process of reviewing the plan, the Water Commission recommended several changes and additions for the final plan, including the following:

- Updating Table 6-10 regarding volume of water transferred to Soquel Creek, and include recent interagency agreement,
- Updating language about water rights (flexibility, place of use) needed to support regional solutions,
- Correcting statement of storage amount needed to overcome supply/demand gap,
- Better characterizing the distinctions between inside and outside customers, and
- Miscellaneous editorial clarifications and corrections

The Water Commission's full written comments, and all other written comments received from the public are included as Appendix W.

The draft plan was also circulated in July 2016, along with notice of the time and place of the public hearing, to the County of Santa Cruz and the City of Capitola as required by law. Notification letters included the location where the 2015 UWMP could be viewed, the hearing schedule, and contact information of the preparer for the City. Copies of these letters are provided in Appendix U.

Table 10-1 below lists all the cities and counties that receive water service from the City of Santa Cruz and that were sent a notice of the public hearing. As mentioned in Section 2.4, these jurisdictions were previously sent written notice regarding the plan review and update process well in advance of 60 days before the public hearing (Appendix D), in accordance with the Section 10621(b) of the Act.

Table 10-1 Retail: Notification to Cities and Counties		
City Name	60 Day Notice	Notice of Public Hearing
City of Capitola	☒	☒
City of Santa Cruz	☒	☒
County Name	60 Day Notice	Notice of Public Hearing
Santa Cruz County	☒	☒

In addition to these jurisdictions, the City provided the notice of the public hearing to the Association of Monterey Bay Area Governments, local elected officials, the Santa Cruz Local Agency Formation Commission, and to all major public water utilities in Santa Cruz County, including the following:

- Soquel Creek Water District
- San Lorenzo Valley Water District
- Scotts Valley Water District
- Central Valley Water District
- City of Watsonville

The public hearing was noticed to the public in the local newspaper as prescribed in Government Code 6066. The notice included the time and place of the hearing, as well as the various locations where the plan was made available for public review. A copy of the notice of the public hearing published in the newspaper is provided as Appendix V.

10.3 Public Hearing and Adoption

The City Council held the public hearing on the plan in accordance with CWC section 10642 on August 9, 2016. At the public hearing, City Council directed that the final plan be brought back for adoption at its August 23, 2016 meeting. Copies of all written comments received during the public review process and at the public hearing are included in Appendix W. The official minutes of the public hearing are included with the Notice of Public Hearing in Appendix V.

City Council adopted the plan, as modified by input from the Water Commission, on August 23 2016. The official resolution adopting the plan is provided as Appendix X.

In accordance with the City Council resolution adopting the plan, the Water Supply Advisory Committee's Final Report on Agreements and Recommendations, the Water Shortage Contingency Plan, and the City's final Water Conservation Master Plan are adopted by reference in their entirety as elements of the City's 2015 Urban Water Management Plan.

10.4 Plan Submittal

The final plan was then submitted electronically to DWR and the California State Library within 30 days of its adoption, and transmitted to all jurisdictions receiving water service from the City of Santa Cruz within 60 days of its submission to DWR, in accordance with CWC sections 10644(a) and 10635(b). Additionally, the final data tables were submitted using the WUE data tool available online through the DWR Urban Water Management webpage.

10.5 Public Availability

The final, adopted plan was also made available to the public in accordance with section 10645 of the Act by posting it on the City's web site.

10.6 Amending an Adopted UWMP

If the City of Santa Cruz chooses or needs to amend the adopted 2015 plan, proper notification including copies of the amendments will be provided in accordance with sections 10644(a) and 10621 in a manner set forth for the notification, public hearing, adoption and submittal.

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- 28 American Water Works Association (AWWA), 2011. M60: Drought Preparedness and Response, First Edition.

List of Appendices

- A Urban Water Management Planning Act (Water Code 10610-10656)
- B Water Conservation Act of 2009 (SBx 7-7, Water Code 10608)
- C Changes to the Water Code Since 2010
- D Notice to City of Capitola, County of Santa Cruz
- E City General Plan 2030 Policies Regarding Water Service
- F City of Santa Cruz Water Demand Forecast
- G Effect of Temperature on City of Santa Cruz Water Demands
- H Water Conservation Baseline and Targets Development Process
- I Joint Powers Agreement – Mid-County Groundwater Agency
- J Recycled Water Facilities Planning Study - Scope of Work
- K Water Supply Advisory Committee – Final Report on Agreements and Recommendations
- L City of Santa Cruz Water Shortage Contingency Plan
- M Santa Cruz Municipal Code Chapter 16.01 – Water Shortage regulations and Restrictions
- N City Council Resolution – Drought Cost Recovery Fee
- O Santa Cruz Municipal Code Chapter 16.02 – Water Conservation
- P 2014 Notice of Proposed Water Rate Changes
- Q City of Santa Cruz Water Department – Long Range Financial Plan
- R 2016 Notice of Proposed Water Rate Changes
- S Water Conservation Master Plan Final Technical Memorandum
- T Santa Cruz BMP Coverage Report, 2013 and 2014
- U Notice of Public Hearing to County of Santa Cruz and City of Capitola
- V Notice of Public Hearing and Meeting Minutes
- W Written Comments Received From Public
- X City Council Resolution Adopting 2015 Urban Water Management Plan
- Y Cooperative Water Transfer Pilot Project for Groundwater Recharge and Water Resource Management

Appendix A

California Water Code

Urban Water Management Planning

California Water Code Division 6, Part 2.6.

Chapter 1. General Declaration and Policy §10610-10610.4

Chapter 2. Definitions §10611-10617

Chapter 3. Urban Water Management Plans

Article 1. General Provisions §10620-10621

Article 2. Contents of Plans §10630-10634

Article 2.5. Water Service Reliability §10635

Article 3. Adoption And Implementation of Plans §10640-10645

Chapter 4. Miscellaneous Provisions §10650-10656

Chapter 1. General Declaration and Policy

SECTION 10610-10610.4

10610. This part shall be known and may be cited as the "Urban Water Management Planning Act."

10610.2. (a) The Legislature finds and declares all of the following:

- (1) The waters of the state are a limited and renewable resource subject to ever-increasing demands.
- (2) The conservation and efficient use of urban water supplies are of statewide concern; however, the planning for that use and the implementation of those plans can best be accomplished at the local level.
- (3) A long-term, reliable supply of water is essential to protect the productivity of California's businesses and economic climate.
- (4) As part of its long-range planning activities, every urban water supplier should make every effort to ensure the appropriate level of reliability in its water service sufficient to meet the needs of its various categories of customers during normal, dry, and multiple dry water years.
- (5) Public health issues have been raised over a number of contaminants that have been identified in certain local and imported water supplies.
- (6) Implementing effective water management strategies, including groundwater storage projects and recycled water projects, may require specific water

quality and salinity targets for meeting groundwater basins water quality objectives and promoting beneficial use of recycled water.

(7) Water quality regulations are becoming an increasingly important factor in water agencies' selection of raw water sources, treatment alternatives, and modifications to existing treatment facilities.

(8) Changes in drinking water quality standards may also impact the usefulness of water supplies and may ultimately impact supply reliability.

(9) The quality of source supplies can have a significant impact on water management strategies and supply reliability.

(b) This part is intended to provide assistance to water agencies in carrying out their long-term resource planning responsibilities to ensure adequate water supplies to meet existing and future demands for water.

10610.4. The Legislature finds and declares that it is the policy of the state as follows:

(a) The management of urban water demands and efficient use of water shall be actively pursued to protect both the people of the state and their water resources.

(b) The management of urban water demands and efficient use of urban water supplies shall be a guiding criterion in public decisions.

(c) Urban water suppliers shall be required to develop water management plans to actively pursue the efficient use of available supplies.

Chapter 2. Definitions

SECTION 10611-10617

10611. Unless the context otherwise requires, the definitions of this chapter govern the construction of this part.

10611.5. "Demand management" means those water conservation measures, programs, and incentives that prevent the waste of water and promote the reasonable and efficient use and reuse of available supplies.

10612. "Customer" means a purchaser of water from a water supplier who uses the water for municipal purposes, including residential, commercial, governmental, and industrial uses.

10613. "Efficient use" means those management measures that result in the most effective use of water so as to prevent its waste or unreasonable use or unreasonable method of use.

10614. "Person" means any individual, firm, association, organization, partnership, business, trust, corporation, company, public agency, or any agency of such an entity.
10615. "Plan" means an urban water management plan prepared pursuant to this part. A plan shall describe and evaluate sources of supply, reasonable and practical efficient uses, reclamation and demand management activities. The components of the plan may vary according to an individual community or area's characteristics and its capabilities to efficiently use and conserve water. The plan shall address measures for residential, commercial, governmental, and industrial water demand management as set forth in Article 2 (commencing with Section 10630) of Chapter 3. In addition, a strategy and time schedule for implementation shall be included in the plan.
10616. "Public agency" means any board, commission, county, city and county, city, regional agency, district, or other public entity.
- 10616.5. "Recycled water" means the reclamation and reuse of wastewater for beneficial use.
10617. "Urban water supplier" means a supplier, either publicly or privately owned, providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually. An urban water supplier includes a supplier or contractor for water, regardless of the basis of right, which distributes or sells for ultimate resale to customers. This part applies only to water supplied from public water systems subject to Chapter 4 (commencing with Section 116275) of Part 12 of Division 104 of the Health and Safety Code.

Chapter 3. Urban Water Management Plans

Article 1. General Provisions

SECTION 10620-10621

10620. (a) Every urban water supplier shall prepare and adopt an urban water management plan in the manner set forth in Article 3 (commencing with Section 10640).
- (b) Every person that becomes an urban water supplier shall adopt an urban water management plan within one year after it has become an urban water supplier.
- (c) An urban water supplier indirectly providing water shall not include planning elements in its water management plan as provided in Article 2 (commencing with Section 10630) that would be applicable to urban water suppliers or public agencies directly providing water, or to their customers, without the consent of those suppliers or public agencies.
- (d) (1) An urban water supplier may satisfy the requirements of this part by participation in areawide, regional, watershed, or basinwide urban water management

planning where those plans will reduce preparation costs and contribute to the achievement of conservation and efficient water use.

- (2) Each urban water supplier shall coordinate the preparation of its plan with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies, and relevant public agencies, to the extent practicable.
 - (e) The urban water supplier may prepare the plan with its own staff, by contract, or in cooperation with other governmental agencies.
 - (f) An urban water supplier shall describe in the plan water management tools and options used by that entity that will maximize resources and minimize the need to import water from other regions.
10621. (a) Each urban water supplier shall update its plan at least once every five years on or before December 31, in years ending in five and zero, except as provided in subdivision (d).
- (b) Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days before the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan. The urban water supplier may consult with, and obtain comments from, any city or county that receives notice pursuant to this subdivision.
 - (c) The amendments to, or changes in, the plan shall be adopted and filed in the manner set forth in Article 3 (commencing with Section 10640).
 - (d) Each urban water supplier shall update and submit its 2015 plan to the department by July 1, 2016.

Article 2. Contents of Plan

SECTION 10630-10634

10630. It is the intention of the Legislature, in enacting this part, to permit levels of water management planning commensurate with the numbers of customers served and the volume of water supplied.
10631. A plan shall be adopted in accordance with this chapter that shall do all of the following:
- (a) Describe the service area of the supplier, including current and projected population, climate, and other demographic factors affecting the supplier's water management planning. The projected population estimates shall be based upon data from the state, regional, or local service agency population projections within the service area of the urban water supplier and shall be in five-year increments to 20 years or as far as data is available.

(b) Identify and quantify, to the extent practicable, the existing and planned sources of water available to the supplier over the same five-year increments described in subdivision (a). If groundwater is identified as an existing or planned source of water available to the supplier, all of the following information shall be included in the plan:

- (1) A copy of any groundwater management plan adopted by the urban water supplier, including plans adopted pursuant to Part 2.75 (commencing with Section 10750), or any other specific authorization for groundwater management.
 - (2) A description of any groundwater basin or basins from which the urban water supplier pumps groundwater. For basins that a court or the board has adjudicated the rights to pump groundwater, a copy of the order or decree adopted by the court or the board and a description of the amount of groundwater the urban water supplier has the legal right to pump under the order or decree. For basins that have not been adjudicated, information as to whether the department has identified the basin or basins as overdrafted or has projected that the basin will become overdrafted if present management conditions continue, in the most current official departmental bulletin that characterizes the condition of the groundwater basin, and a detailed description of the efforts being undertaken by the urban water supplier to eliminate the long-term overdraft condition.
 - (3) A detailed description and analysis of the location, amount, and sufficiency of groundwater pumped by the urban water supplier for the past five years. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.
 - (4) A detailed description and analysis of the amount and location of groundwater that is projected to be pumped by the urban water supplier. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.
- (c) (1) Describe the reliability of the water supply and vulnerability to seasonal or climatic shortage, to the extent practicable, and provide data for each of the following:
- (A) An average water year.
 - (B) A single-dry water year.
 - (C) Multiple-dry water years.
- (2) For any water source that may not be available at a consistent level of use, given specific legal, environmental, water quality, or climatic factors, describe

plans to supplement or replace that source with alternative sources or water demand management measures, to the extent practicable.

- (d) Describe the opportunities for exchanges or transfers of water on a short-term or long-term basis.
- (e) (1) Quantify, to the extent records are available, past and current water use, over the same five-year increments described in subdivision (a), and projected water use, identifying the uses among water use sectors, including, but not necessarily limited to, all of the following uses:
 - (A) Single-family residential.
 - (B) Multifamily.
 - (C) Commercial.
 - (D) Industrial.
 - (E) Institutional and governmental.
 - (F) Landscape.
 - (G) Sales to other agencies.
 - (H) Saline water intrusion barriers, groundwater recharge, or conjunctive use, or any combination thereof.

Article 2.5. Water Service Reliability

SECTION 10635

10635. (a) Every urban water supplier shall include, as part of its urban water management plan, an assessment of the reliability of its water service to its customers during normal, dry, and multiple dry water years. This water supply and demand assessment shall compare the total water supply sources available to the water supplier with the total projected water use over the next 20 years, in five-year increments, for a normal water year, a single dry water year, and multiple dry water years. The water service reliability assessment shall be based upon the information compiled pursuant to Section 10631, including available data from state, regional, or local agency population projections within the service area of the urban water supplier.
- (b) The urban water supplier shall provide that portion of its urban water management plan prepared pursuant to this article to any city or county within which it provides water supplies no later than 60 days after the submission of its urban water management plan.

(c) Nothing in this article is intended to create a right or entitlement to water service or any specific level of water service.

(d) Nothing in this article is intended to change existing law concerning an urban water supplier's obligation to provide water service to its existing customers or to any potential future customers.

Article 3. Adoption and Implementation of Plans

SECTION 10640-10645

10640. Every urban water supplier required to prepare a plan pursuant to this part shall prepare its plan pursuant to Article 2 (commencing with Section 10630). The supplier shall likewise periodically review the plan as required by Section 10621, and any amendments or changes required as a result of that review shall be adopted pursuant to this article.

10641. An urban water supplier required to prepare a plan may consult with, and obtain comments from, any public agency or state agency or any person who has special expertise with respect to water demand management methods and techniques.

10642. Each urban water supplier shall encourage the active involvement of diverse social, cultural, and economic elements of the population within the service area prior to and during the preparation of the plan. Prior to adopting a plan, the urban water supplier shall make the plan available for public inspection and shall hold a public hearing thereon. Prior to the hearing, notice of the time and place of hearing shall be published within the jurisdiction of the publicly owned water supplier pursuant to Section 6066 of the Government Code. The urban water supplier shall provide notice of the time and place of hearing to any city or county within which the supplier provides water supplies. A privately owned water supplier shall provide an equivalent notice within its service area.

After the hearing, the plan shall be adopted as prepared or as modified after the hearing.

10643. An urban water supplier shall implement its plan adopted pursuant to this chapter in accordance with the schedule set forth in its plan.

10644. (a) (1) An urban water supplier shall submit to the department, the California State Library, and any city or county within which the supplier provides water supplies a copy of its plan no later than 30 days after adoption. Copies of amendments or changes to the plans shall be submitted to the department, the California State Library, and any city or county within which the supplier provides water supplies within 30 days after adoption.

- (2) The plan, or amendments to the plan, submitted to the department pursuant to paragraph (1) shall be submitted electronically and shall include any standardized forms, tables, or displays specified by the department.
- (b) (1) Notwithstanding Section 10231.5 of the Government Code, the department shall prepare and submit to the Legislature, on or before December 31, in the years ending in six and one, a report summarizing the status of the plans adopted pursuant to this part.

The report prepared by the department shall identify the exemplary elements of the individual plans. The department shall provide a copy of the report to each urban water supplier that has submitted its plan to the department. The department shall also prepare reports and provide data for any legislative hearings designed to consider the effectiveness of plans submitted pursuant to this part.
- (2) A report to be submitted pursuant to paragraph (1) shall be submitted in compliance with Section 9795 of the Government Code.
- (c) (1) For the purpose of identifying the exemplary elements of the individual plans, the department shall identify in the report water demand management measures adopted and implemented by specific urban water suppliers, and identified pursuant to Section 10631, that achieve water savings significantly above the levels established by the department to meet the requirements of Section 10631.5.
- (2) The department shall distribute to the panel convened pursuant to Section 10631.7 the results achieved by the implementation of those water demand management measures described in paragraph (1).
- (3) The department shall make available to the public the standard the department will use to identify exemplary water demand management measures.

Chapter 4. Miscellaneous Provisions

SECTION 10650-10656

10650. Any actions or proceedings to attack, review, set aside, void, or annul the acts or decisions of an urban water supplier on the grounds of noncompliance with this part shall be commenced as follows:

- (a) An action or proceeding alleging failure to adopt a plan shall be commenced within 18 months after that adoption is required by this part.

- (b) Any action or proceeding alleging that a plan, or action taken pursuant to the plan, does not comply with this part shall be commenced within 90 days after filing of the plan or amendment thereto pursuant to Section 10644 or the taking of that action.
10651. In any action or proceeding to attack, review, set aside, void, or annul a plan, or an action taken pursuant to the plan by an urban water supplier on the grounds of noncompliance with this part, the inquiry shall extend only to whether there was a prejudicial abuse of discretion. Abuse of discretion is established if the supplier has not proceeded in a manner required by law or if the action by the water supplier is not supported by substantial evidence.
10652. The California Environmental Quality Act (Division 13 (commencing with Section 21000) of the Public Resources Code) does not apply to the preparation and adoption of plans pursuant to this part or to the implementation of actions taken pursuant to Section 10632. Nothing in this part shall be interpreted as exempting from the California Environmental Quality Act any project that would significantly affect water supplies for fish and wildlife, or any project for implementation of the plan, other than projects implementing Section 10632, or any project for expanded or additional water supplies.
10653. The adoption of a plan shall satisfy any requirements of state law, regulation, or order, including those of the State Water Resources Control Board and the Public Utilities Commission, for the preparation of water management plans or conservation plans; provided, that if the State Water Resources Control Board or the Public Utilities Commission requires additional information concerning water conservation to implement its existing authority, nothing in this part shall be deemed to limit the board or the commission in obtaining that information. The requirements of this part shall be satisfied by any urban water demand management plan prepared to meet federal laws or regulations after the effective date of this part, and which substantially meets the requirements of this part, or by any existing urban water management plan which includes the contents of a plan required under this part.
10654. An urban water supplier may recover in its rates the costs incurred in preparing its plan and implementing the reasonable water conservation measures included in the plan. Any best water management practice that is included in the plan that is identified in the "Memorandum of Understanding Regarding Urban Water Conservation in California" is deemed to be reasonable for the purposes of this section.
10655. If any provision of this part or the application thereof to any person or circumstances is held invalid, that invalidity shall not affect other provisions or applications of this part which can be given effect without the invalid provision or application thereof, and to this end the provisions of this part are severable.
10656. An urban water supplier that does not prepare, adopt, and submit its urban water management plan to the department in accordance with this part, is ineligible to receive funding pursuant to Division 24 (commencing with Section 78500) or Division 26

(commencing with Section 79000), or receive drought assistance from the state until the urban water management plan is submitted pursuant to this article.

Appendix B

California Water Code

Sustainable Water Use and Demand Reduction

California Water Code Division 6, Part 2.55.

Chapter 1. General Declarations and Policy §10608-10608.8

Chapter 2. Definitions §10608.12

Chapter 3. Urban Retail Water Suppliers §10608.16-10608.44

Chapter 4. Agricultural Water Suppliers §10608.48

Chapter 5. Sustainable Water Management §10608.50

Chapter 6 Standardized Data Collection §10608.52

Chapter 7 Funding Provisions §10608.56-10608.60

Chapter 8 Quantifying Agricultural Water Use Efficiency §10608.64

Chapter 1. General Declarations and Policy

SECTION 10608-10608.8

10608. The Legislature finds and declares all of the following:

- (a) Water is a public resource that the California Constitution protects against waste and unreasonable use.
- (b) Growing population, climate change, and the need to protect and grow California's economy while protecting and restoring our fish and wildlife habitats make it essential that the state manage its water resources as efficiently as possible.
- (c) Diverse regional water supply portfolios will increase water supply reliability and reduce dependence on the Delta.
- (d) Reduced water use through conservation provides significant energy and environmental benefits, and can help protect water quality, improve streamflows, and reduce greenhouse gas emissions.
- (e) The success of state and local water conservation programs to increase efficiency of water use is best determined on the basis of measurable outcomes related to water use or efficiency.
- (f) Improvements in technology and management practices offer the potential for increasing water efficiency in California over time, providing an essential water management tool to meet the need for water for urban, agricultural, and environmental uses.
- (g) The Governor has called for a 20 percent per capita reduction in urban water use statewide by 2020.

- (h) The factors used to formulate water use efficiency targets can vary significantly from location to location based on factors including weather, patterns of urban and suburban development, and past efforts to enhance water use efficiency.
- (i) Per capita water use is a valid measure of a water provider's efforts to reduce urban water use within its service area. However, per capita water use is less useful for measuring relative water use efficiency between different water providers. Differences in weather, historical patterns of urban and suburban development, and density of housing in a particular location need to be considered when assessing per capita water use as a measure of efficiency.

10608.4. It is the intent of the Legislature, by the enactment of this part, to do all of the following:

- (a) Require all water suppliers to increase the efficiency of use of this essential resource.
- (b) Establish a framework to meet the state targets for urban water conservation identified in this part and called for by the Governor.
- (c) Measure increased efficiency of urban water use on a per capita basis.
- (d) Establish a method or methods for urban retail water suppliers to determine targets for achieving increased water use efficiency by the year 2020, in accordance with the Governor's goal of a 20-percent reduction.
- (e) Establish consistent water use efficiency planning and implementation standards for urban water suppliers and agricultural water suppliers.
- (f) Promote urban water conservation standards that are consistent with the California Urban Water Conservation Council's adopted best management practices and the requirements for demand management in Section 10631.
- (g) Establish standards that recognize and provide credit to water suppliers that made substantial capital investments in urban water conservation since the drought of the early 1990s.
- (h) Recognize and account for the investment of urban retail water suppliers in providing recycled water for beneficial uses.
- (i) Require implementation of specified efficient water management practices for agricultural water suppliers.
- (j) Support the economic productivity of California's agricultural, commercial, and industrial sectors.
- (k) Advance regional water resources management.

10608.8. (a) (1) Water use efficiency measures adopted and implemented pursuant to this part or Part 2.8 (commencing with Section 10800) are water conservation measures subject to the protections provided under Section 1011.

- (2) Because an urban agency is not required to meet its urban water use target until 2020 pursuant to subdivision (b) of Section 10608.24, an urban retail water supplier's failure to meet those targets shall not establish a violation of law for purposes of any state administrative or judicial proceeding prior to January 1, 2021. Nothing in this paragraph limits the use of data reported to the department or the board in litigation or an administrative proceeding. This paragraph shall become inoperative on January 1, 2021.
- (3) To the extent feasible, the department and the board shall provide for the use of water conservation reports required under this part to meet the requirements of Section 1011 for water conservation reporting.
- (b) This part does not limit or otherwise affect the application of Chapter 3.5 (commencing with Section 11340), Chapter 4 (commencing with Section 11370), Chapter 4.5 (commencing with Section 11400), and Chapter 5 (commencing with Section 11500) of Part 1 of Division 3 of Title 2 of the Government Code.
- (c) This part does not require a reduction in the total water used in the agricultural or urban sectors, because other factors, including, but not limited to, changes in agricultural economics or population growth may have greater effects on water use. This part does not limit the economic productivity of California's agricultural, commercial, or industrial sectors.
- (d) The requirements of this part do not apply to an agricultural water supplier that is a party to the Quantification Settlement Agreement, as defined in subdivision (a) of Section 1 of Chapter 617 of the Statutes of 2002, during the period within which the Quantification Settlement Agreement remains in effect. After the expiration of the Quantification Settlement Agreement, to the extent conservation water projects implemented as part of the Quantification Settlement Agreement remain in effect, the conserved water created as part of those projects shall be credited against the obligations of the agricultural water supplier pursuant to this part.

Chapter 2 Definitions

SECTION 10608.12

10608.12. Unless the context otherwise requires, the following definitions govern the construction of this part:

- (a) "Agricultural water supplier" means a water supplier, either publicly or privately owned, providing water to 10,000 or more irrigated acres, excluding recycled water. "Agricultural water supplier" includes a supplier or contractor for water, regardless of the basis of right, that distributes or sells water for ultimate resale to customers. "Agricultural water supplier" does not include the department.
- (b) "Base daily per capita water use" means any of the following:

- (1) The urban retail water supplier's estimate of its average gross water use, reported in gallons per capita per day and calculated over a continuous 10-year period ending no earlier than December 31, 2004, and no later than December 31, 2010.
 - (2) For an urban retail water supplier that meets at least 10 percent of its 2008 measured retail water demand through recycled water that is delivered within the service area of an urban retailwater supplier or its urban wholesale water supplier, the urban retail water supplier may extend the calculation described in paragraph (1) up to an additional five years to a maximum of a continuous 15-year period ending no earlier than December 31, 2004, and no later than December 31, 2010.
 - (3) For the purposes of Section 10608.22, the urban retail water supplier's estimate of its average gross water use, reported in gallons per capita per day and calculated over a continuous five-year period ending no earlier than December 31, 2007, and no later than December 31, 2010.
- (c) "Baseline commercial, industrial, and institutional water use" means an urban retail water supplier's base daily per capita water use for commercial, industrial, and institutional users.
- (d) "Commercial water user" means a water user that provides or distributes a product or service.
- (e) "Compliance daily per capita water use" means the gross water use during the final year of the reporting period, reported in gallons per capita per day.
- (f) "Disadvantaged community" means a community with an annual median household income that is less than 80 percent of the statewide annual median household income.
- (g) "Gross water use" means the total volume of water, whether treated or untreated, entering the distribution system of an urban retail water supplier, excluding all of the following:
- (1) Recycled water that is delivered within the service area of an urban retail water supplier or its urban wholesale water supplier.
 - (2) The net volume of water that the urban retail water supplier places into long-term storage.
 - (3) The volume of water the urban retail water supplier conveys for use by another urban water supplier.
 - (4) The volume of water delivered for agricultural use, except as otherwise provided in subdivision (f) of Section 10608.24.
- (h) "Industrial water user" means a water user that is primarily a manufacturer or processor of materials as defined by the North American Industry Classification

System code sectors 31 to 33, inclusive, or an entity that is a water user primarily engaged in research and development.

- (i) "Institutional water user" means a water user dedicated to public service. This type of user includes, among other users, higher education institutions, schools, courts, churches, hospitals, government facilities, and nonprofit research institutions.
- (j) "Interim urban water use target" means the midpoint between the urban retail water supplier's base daily per capita water use and the urban retail water supplier's urban water use target for 2020.
- (k) "Locally cost effective" means that the present value of the local benefits of implementing an agricultural efficiency water management practice is greater than or equal to the present value of the local cost of implementing that measure.
- (l) "Process water" means water used for producing a product or product content or water used for research and development, including, but not limited to, continuous manufacturing processes, water used for testing and maintaining equipment used in producing a product or product content, and water used in combined heat and power facilities used in producing a product or product content. Process water does not mean incidental water uses not related to the production of a product or product content, including, but not limited to, water used for restrooms, landscaping, air conditioning, heating, kitchens, and laundry.
- (m) "Recycled water" means recycled water, as defined in subdivision (n) of Section 13050, that is used to offset potable demand, including recycled water supplied for direct use and indirect potable reuse, that meets the following requirements, where applicable:
 - (1) For groundwater recharge, including recharge through spreading basins, water supplies that are all of the following:
 - (A) Metered.
 - (B) Developed through planned investment by the urban water supplier or a wastewater treatment agency.
 - (C) Treated to a minimum tertiary level.
 - (D) Delivered within the service area of an urban retail water supplier or its urban wholesale water supplier that helps an urban retail water supplier meet its urban water use target.
 - (2) For reservoir augmentation, water supplies that meet the criteria of paragraph (1) and are conveyed through a distribution system constructed specifically for recycled water.

- (n) "Regional water resources management" means sources of supply resulting from watershed-based planning for sustainable local water reliability or any of the following alternative sources of water:
 - (1) The capture and reuse of stormwater or rainwater.
 - (2) The use of recycled water.
 - (3) The desalination of brackish groundwater.
 - (4) The conjunctive use of surface water and groundwater in a manner that is consistent with the safe yield of the groundwater basin.
- (o) "Reporting period" means the years for which an urban retail water supplier reports compliance with the urban water use targets.
- (p) "Urban retail water supplier" means a water supplier, either publicly or privately owned, that directly provides potable municipal water to more than 3,000 end users or that supplies more than 3,000 acre-feet of potable water annually at retail for municipal purposes.
- (q) "Urban water use target" means the urban retail water supplier's targeted future daily per capita water use.
- (r) "Urban wholesale water supplier," means a water supplier, either publicly or privately owned, that provides more than 3,000 acre-feet of water annually at wholesale for potable municipal purposes.

Chapter 3 Urban Retail Water Suppliers

SECTION 10608.16-10608.44

- 10608.16. (a) The state shall achieve a 20-percent reduction in urban per capita water use in California on or before December 31, 2020.
 - (b) The state shall make incremental progress towards the state target specified in subdivision (a) by reducing urban per capita water use by at least 10 percent on or before December 31, 2015.
- 10608.20. (a) (1) Each urban retail water supplier shall develop urban water use targets and an interim urban water use target by July 1, 2011. Urban retail water suppliers may elect to determine and report progress toward achieving these targets on an individual or regional basis, as provided in subdivision (a) of Section 10608.28, and may determine the targets on a fiscal year or calendar year basis.
 - (2) It is the intent of the Legislature that the urban water use targets described in paragraph (1) cumulatively result in a 20-percent reduction from the baseline daily per capita water use by December 31, 2020.

- (b) An urban retail water supplier shall adopt one of the following methods for determining its urban water use target pursuant to subdivision (a):
- (1) Eighty percent of the urban retail water supplier's baseline per capita daily water use.
 - (2) The per capita daily water use that is estimated using the sum of the following performance standards:
 - (A) For indoor residential water use, 55 gallons per capita daily water use as a provisional standard. Upon completion of the department's 2016 report to the Legislature pursuant to Section 10608.42, this standard may be adjusted by the Legislature by statute.
 - (B) For landscape irrigated through dedicated or residential meters or connections, water efficiency equivalent to the standards of the Model Water Efficient Landscape Ordinance set forth in Chapter 2.7 (commencing with Section 490) of Division 2 of Title 23 of the California Code of Regulations, as in effect the later of the year of the landscape's installation or 1992. An urban retail water supplier using the approach specified in this subparagraph shall use satellite imagery, site visits, or other best available technology to develop an accurate estimate of landscaped areas.
 - (C) For commercial, industrial, and institutional uses, a 10-percent reduction in water use from the baseline commercial, industrial, and institutional water use by 2020.
 - (3) Ninety-five percent of the applicable state hydrologic region target, as set forth in the state's draft 20x2020 Water Conservation Plan (dated April 30, 2009). If the service area of an urban water supplier includes more than one hydrologic region, the supplier shall apportion its service area to each region based on population or area.
 - (4) A method that shall be identified and developed by the department, through a public process, and reported to the Legislature no later than December 31, 2010. The method developed by the department shall identify per capita targets that cumulatively result in a statewide 20-percent reduction in urban daily per capita water use by December 31, 2020. In developing urban daily per capita water use targets, the department shall do all of the following:
 - (A) Consider climatic differences within the state.
 - (B) Consider population density differences within the state.
 - (C) Provide flexibility to communities and regions in meeting the targets.
 - (D) Consider different levels of per capita water use according to plant water needs in different regions.

- (E) Consider different levels of commercial, industrial, and institutional water use in different regions of the state.
 - (F) Avoid placing an undue hardship on communities that have implemented conservation measures or taken actions to keep per capita water use low.
- (c) If the department adopts a regulation pursuant to paragraph (4) of subdivision (b) that results in a requirement that an urban retail water supplier achieve a reduction in daily per capita water use that is greater than 20 percent by December 31, 2020, an urban retail water supplier that adopted the method described in paragraph (4) of subdivision (b) may limit its urban water use target to a reduction of not more than 20 percent by December 31, 2020, by adopting the method described in paragraph (1) of subdivision (b).
 - (d) The department shall update the method described in paragraph (4) of subdivision (b) and report to the Legislature by December 31, 2014. An urban retail water supplier that adopted the method described in paragraph (4) of subdivision (b) may adopt a new urban daily per capita water use target pursuant to this updated method.
 - (e) An urban retail water supplier shall include in its urban water management plan due in 2010 pursuant to Part 2.6 (commencing with Section 10610) the baseline daily per capita water use, urban water use target, interim urban water use target, and compliance daily per capita water use, along with the bases for determining those estimates, including references to supporting data.
 - (f) When calculating per capita values for the purposes of this chapter, an urban retail water supplier shall determine population using federal, state, and local population reports and projections.
 - (g) An urban retail water supplier may update its 2020 urban water use target in its 2015 urban water management plan required pursuant to Part 2.6 (commencing with Section 10610).
 - (h) (1) The department, through a public process and in consultation with the California Urban Water Conservation Council, shall develop technical methodologies and criteria for the consistent implementation of this part, including, but not limited to, both of the following:
 - (A) Methodologies for calculating base daily per capita water use, baseline commercial, industrial, and institutional water use, compliance daily per capita water use, gross water use, service area population, indoor residential water use, and landscaped area water use.
 - (B) Criteria for adjustments pursuant to subdivisions (d) and (e) of Section 10608.24.
 - (2) The department shall post the methodologies and criteria developed pursuant to this subdivision on its Internet Web site, and make written copies available, by October 1, 2010. An urban retail water supplier shall use the methods developed by the department in compliance with this part.

(i) (1) The department shall adopt regulations for implementation of the provisions relating to process water in accordance with subdivision (l) of Section 10608.12, subdivision (e) of Section 10608.24, and subdivision (d) of Section 10608.26.

(2) The initial adoption of a regulation authorized by this subdivision is deemed to address an emergency, for purposes of Sections 11346.1 and 11349.6 of the Government Code, and the department is hereby exempted for that purpose from the requirements of subdivision (b) of Section 11346.1 of the Government Code. After the initial adoption of an emergency regulation pursuant to this subdivision, the department shall not request approval from the Office of Administrative Law to readopt the regulation as an emergency regulation pursuant to Section 11346.1 of the Government Code.

(j) (1) An urban retail water supplier is granted an extension to July 1, 2011, for adoption of an urban water management plan pursuant to Part 2.6 (commencing with Section 10610) due in 2010 to allow the use of technical methodologies developed by the department pursuant to paragraph (4) of subdivision (b) and subdivision (h). An urban retail water supplier that adopts an urban water management plan due in 2010 that does not use the methodologies developed by the department pursuant to subdivision (h) shall amend the plan by July 1, 2011, to comply with this part.

(2) An urban wholesale water supplier whose urban water management plan prepared pursuant to Part 2.6 (commencing with Section 10610) was due and not submitted in 2010 is granted an extension to July 1, 2011, to permit coordination between an urban wholesale water supplier and urban retail water suppliers.

10608.22. Notwithstanding the method adopted by an urban retail water supplier pursuant to Section 10608.20, an urban retail water supplier's per capita daily water use reduction shall be no less than 5 percent of base daily per capita water use as defined in paragraph(3) of subdivision (b) of Section 10608.12. This section does not apply to an urban retail water supplier with a base daily per capita water use at or below 100 gallons per capita per day.

10608.24. (a) Each urban retail water supplier shall meet its interim urban water use target by December 31, 2015.

(b) Each urban retail water supplier shall meet its urban water use target by December 31, 2020.

(c) An urban retail water supplier's compliance daily per capita water use shall be the measure of progress toward achievement of its urban water use target.

(d) (1) When determining compliance daily per capita water use, an urban retail water supplier may consider the following factors:

(A) Differences in evapotranspiration and rainfall in the baseline period compared to the compliance reporting period.

(B) Substantial changes to commercial or industrial water use resulting from increased business output and economic development that have occurred during the reporting period.

(C) Substantial changes to institutional water use resulting from fire suppression services or other extraordinary events, or from new or expanded operations, that have occurred during the reporting period.

(2) If the urban retail water supplier elects to adjust its estimate of compliance daily per capita water use due to one or more of the factors described in paragraph (1), it shall provide the basis for, and data supporting, the adjustment in the report required by Section 10608.40.

(e) When developing the urban water use target pursuant to Section 10608.20, an urban retail water supplier that has a substantial percentage of industrial water use in its service area may exclude process water from the calculation of gross water use to avoid a disproportionate burden on another customer sector.

(f) (1) An urban retail water supplier that includes agricultural water use in an urban water management plan pursuant to Part 2.6 (commencing with Section 10610) may include the agricultural water use in determining gross water use. An urban retail water supplier that includes agricultural water use in determining gross water use and develops its urban water use target pursuant to paragraph (2) of subdivision (b) of Section 10608.20 shall use a water efficient standard for agricultural irrigation of 100 percent of reference evapotranspiration multiplied by the crop coefficient for irrigated acres.

(2) An urban retail water supplier, that is also an agricultural water supplier, is not subject to the requirements of Chapter 4 (commencing with Section 10608.48), if the agricultural water use is incorporated into its urban water use target pursuant to paragraph (1).

10608.26. (a) In complying with this part, an urban retail water supplier shall conduct at least one public hearing to accomplish all of the following:

(1) Allow community input regarding the urban retail water supplier's implementation plan for complying with this part.

(2) Consider the economic impacts of the urban retail water supplier's implementation plan for complying with this part.

(3) Adopt a method, pursuant to subdivision (b) of Section 10608.20, for determining its urban water use target.

(b) In complying with this part, an urban retail water supplier may meet its urban water use target through efficiency improvements in any combination among its customer sectors. An urban retail water supplier shall avoid placing a disproportionate burden on any customer sector.

(c) For an urban retail water supplier that supplies water to a United States Department of Defense military installation, the urban retail water supplier's

implementation plan for complying with this part shall consider the conservation of that military installation under federal Executive Order 13514.

- (d) (1) Any ordinance or resolution adopted by an urban retail water supplier after the effective date of this section shall not require existing customers as of the effective date of this section, to undertake changes in product formulation, operations, or equipment that would reduce process water use, but may provide technical assistance and financial incentives to those customers to implement efficiency measures for process water. This section shall not limit an ordinance or resolution adopted pursuant to a declaration of drought emergency by an urban retail water supplier.
- (2) This part shall not be construed or enforced so as to interfere with the requirements of Chapter 4 (commencing with Section 113980) to Chapter 13 (commencing with Section 114380), inclusive, of Part 7 of Division 104 of the Health and Safety Code, or any requirement or standard for the protection of public health, public safety, or worker safety established by federal, state, or local government or recommended by recognized standard setting organizations or trade associations.

10608.28. (a) An urban retail water supplier may meet its urban water use target within its retail service area, or through mutual agreement, by any of the following:

- (1) Through an urban wholesale water supplier.
 - (2) Through a regional agency authorized to plan and implement water conservation, including, but not limited to, an agency established under the Bay Area Water Supply and Conservation Agency Act (Division 31 (commencing with Section 81300)).
 - (3) Through a regional water management group as defined in Section 10537.
 - (4) By an integrated regional water management funding area.
 - (5) By hydrologic region.
 - (6) Through other appropriate geographic scales for which computation methods have been developed by the department.
- (b) A regional water management group, with the written consent of its member agencies, may undertake any or all planning, reporting, and implementation functions under this chapter for the member agencies that consent to those activities. Any data or reports shall provide information both for the regional water management group and separately for each consenting urban retail water supplier and urban wholesale water supplier.

10608.32. All costs incurred pursuant to this part by a water utility regulated by the Public Utilities Commission may be recoverable in rates subject to review and approval by the Public Utilities Commission, and may be recorded in a memorandum account and reviewed for reasonableness by the Public Utilities Commission.

- 10608.36. Urban wholesale water suppliers shall include in the urban water management plans required pursuant to Part 2.6 (commencing with Section 10610) an assessment of their present and proposed future measures, programs, and policies to help achieve the water use reductions required by this part.
- 10608.40. Urban water retail suppliers shall report to the department on their progress in meeting their urban water use targets as part of their urban water management plans submitted pursuant to Section 10631. The data shall be reported using a standardized form developed pursuant to Section 10608.52.
- 10608.42. (a) The department shall review the 2015 urban water management plans and report to the Legislature by July 1, 2017, on progress towards achieving a 20-percent reduction in urban water use by December 31, 2020. The report shall include recommendations on changes to water efficiency standards or urban water use targets to achieve the 20-percent reduction and to reflect updated efficiency information and technology changes.
- (b) A report to be submitted pursuant to subdivision (a) shall be submitted in compliance with Section 9795 of the Government Code.
- 10608.43. The department, in conjunction with the California Urban Water Conservation Council, by April 1, 2010, shall convene a representative task force consisting of academic experts, urban retail water suppliers, environmental organizations, commercial water users, industrial water users, and institutional water users to develop alternative best management practices for commercial, industrial, and institutional users and an assessment of the potential statewide water use efficiency improvement in the commercial, industrial, and institutional sectors that would result from implementation of these best management practices. The taskforce, in conjunction with the department, shall submit a report to the Legislature by April 1, 2012, that shall include a review of multiple sectors within commercial, industrial, and institutional users and that shall recommend water use efficiency standards for commercial, industrial, and institutional users among various sectors of water use. The report shall include, but not be limited to, the following:
- (a) Appropriate metrics for evaluating commercial, industrial, and institutional water use.
 - (b) Evaluation of water demands for manufacturing processes, goods, and cooling.
 - (c) Evaluation of public infrastructure necessary for delivery of recycled water to the commercial, industrial, and institutional sectors.
 - (d) Evaluation of institutional and economic barriers to increased recycled water use within the commercial, industrial, and institutional sectors.
 - (e) Identification of technical feasibility and cost of the best management practices to achieve more efficient water use statewide in the commercial, industrial, and institutional sectors that is consistent with the public interest and reflects past investments in water use efficiency.
- 10608.44. Each state agency shall reduce water use at facilities it operates to support urban retail water suppliers in meeting the target identified in Section 10608.16.

Chapter 4 Agricultural Water Suppliers

SECTION 10608.48

10608.48. (a) On or before July 31, 2012, an agricultural water supplier shall implement efficient water management practices pursuant to subdivisions (b) and (c).

(b) Agricultural water suppliers shall implement all of the following critical efficient management practices:

(1) Measure the volume of water delivered to customers with sufficient accuracy to comply with subdivision (a) of Section 531.10 and to implement paragraph (2).

(2) Adopt a pricing structure for water customers based at least in part on quantity delivered.

(c) Agricultural water suppliers shall implement additional efficient management practices, including, but not limited to, practices to accomplish all of the following, if the measures are locally cost effective and technically feasible:

(1) Facilitate alternative land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including drainage.

(2) Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not harm crops or soils.

(3) Facilitate the financing of capital improvements for on-farm irrigation systems.

(4) Implement an incentive pricing structure that promotes one or more of the following goals:

(A) More efficient water use at the farm level.

(B) Conjunctive use of groundwater.

(C) Appropriate increase of groundwater recharge.

(D) Reduction in problem drainage.

(E) Improved management of environmental resources.

(F) Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions.

- (5) Expand line or pipe distribution systems, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance, and reduce seepage.
- (6) Increase flexibility in water ordering by, and delivery to, water customers within operational limits.
- (7) Construct and operate supplier spill and tailwater recovery systems.
- (8) Increase planned conjunctive use of surface water and groundwater within the supplier service area.
- (9) Automate canal control structures.
- (10) Facilitate or promote customer pump testing and evaluation.
- (11) Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress reports.
- (12) Provide for the availability of water management services to water users. These services may include, but are not limited to, all of the following:
 - (A) On-farm irrigation and drainage system evaluations.
 - (B) Normal year and real-time irrigation scheduling and crop evapotranspiration information.
 - (C) Surface water, groundwater, and drainage water quantity and quality data.
 - (D) Agricultural water management educational programs and materials for farmers, staff, and the public.
- (13) Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage.
- (14) Evaluate and improve the efficiencies of the supplier's pumps.
- (d) Agricultural water suppliers shall include in the agricultural water management plans required pursuant to Part 2.8 (commencing with Section 10800) a report on which efficient water management practices have been implemented and are planned to be implemented, an estimate of the water use efficiency improvements that have occurred since the last report, and an estimate of the water use efficiency improvements estimated to occur five and 10 years in the future. If an agricultural water supplier determines that an efficient water management practice is not locally cost effective or technically feasible, the supplier shall submit information documenting that determination.
- (e) The data shall be reported using a standardized form developed pursuant to Section 10608.52.

- (f) An agricultural water supplier may meet the requirements of subdivisions (d) and (e) by submitting to the department a water conservation plan submitted to the United States Bureau of Reclamation that meets the requirements described in Section 10828.
- (g) On or before December 31, 2013, December 31, 2016, and December 31, 2021, the department, in consultation with the board, shall submit to the Legislature a report on the agricultural efficient water management practices that have been implemented and are planned to be implemented and an assessment of the manner in which the implementation of those efficient water management practices has affected and will affect agricultural operations, including estimated water use efficiency improvements, if any.
- (h) The department may update the efficient water management practices required pursuant to subdivision (c), in consultation with the Agricultural Water Management Council, the United States Bureau of Reclamation, and the board. All efficient water management practices for agricultural water use pursuant to this chapter shall be adopted or revised by the department only after the department conducts public hearings to allow participation of the diverse geographical areas and interests of the state.
- (i) (1) The department shall adopt regulations that provide for a range of options that agricultural water suppliers may use or implement to comply with the measurement requirement in paragraph (1) of subdivision (b).
- (2) The initial adoption of a regulation authorized by this subdivision is deemed to address an emergency, for purposes of Sections 11346.1 and 11349.6 of the Government Code, and the department is hereby exempted for that purpose from the requirements of subdivision (b) of Section 11346.1 of the Government Code. After the initial adoption of an emergency regulation pursuant to this subdivision, the department shall not request approval from the Office of Administrative Law to readopt the regulation as an emergency regulation pursuant to Section 11346.1 of the Government Code.

Chapter 5 Sustainable Water Management

Section 10608.50

- 10608.50. (a) The department, in consultation with the board, shall promote implementation of regional water resources management practices through increased incentives and removal of barriers consistent with state and federal law. Potential changes may include, but are not limited to, all of the following:
- (1) Revisions to the requirements for urban and agricultural water management plans.
 - (2) Revisions to the requirements for integrated regional water management plans.

- (3) Revisions to the eligibility for state water management grants and loans.
 - (4) Revisions to state or local permitting requirements that increase water supply opportunities, but do not weaken water quality protection under state and federal law.
 - (5) Increased funding for research, feasibility studies, and project construction.
 - (6) Expanding technical and educational support for local land use and water management agencies.
- (b) No later than January 1, 2011, and updated as part of the California Water Plan, the department, in consultation with the board, and with public input, shall propose new statewide targets, or review and update existing statewide targets, for regional water resources management practices, including, but not limited to, recycled water, brackish groundwater desalination, and infiltration and direct use of urban stormwater runoff.

Chapter 6 Standardized Data Collection

SECTION 10608.52

- 10608.52. (a) The department, in consultation with the board, the California Bay-Delta Authority or its successor agency, the State Department of Public Health, and the Public Utilities Commission, shall develop a single standardized water use reporting form to meet the water use information needs of each agency, including the needs of urban water suppliers that elect to determine and report progress toward achieving targets on a regional basis as provided in subdivision (a) of Section 10608.28.
- (b) At a minimum, the form shall be developed to accommodate information sufficient to assess an urban water supplier's compliance with conservation targets pursuant to Section 10608.24 and an agricultural water supplier's compliance with implementation of efficient water management practices pursuant to subdivision (a) of Section 10608.48. The form shall accommodate reporting by urban water suppliers on an individual or regional basis as provided in subdivision (a) of Section 10608.28.

Chapter 7 Funding Provisions

Section 10608.56-10608.60

- 10608.56. (a) On and after July 1, 2016, an urban retail water supplier is not eligible for a water grant or loan awarded or administered by the state unless the supplier complies with this part.

- (b) On and after July 1, 2013, an agricultural water supplier is not eligible for a water grant or loan awarded or administered by the state unless the supplier complies with this part.
- (c) Notwithstanding subdivision (a), the department shall determine that an urban retail water supplier is eligible for a water grant or loan even though the supplier has not met the per capita reductions required pursuant to Section 10608.24, if the urban retail water supplier has submitted to the department for approval a schedule, financing plan, and budget, to be included in the grant or loan agreement, for achieving the per capita reductions. The supplier may request grant or loan funds to achieve the per capita reductions to the extent the request is consistent with the eligibility requirements applicable to the water funds.
- (d) Notwithstanding subdivision (b), the department shall determine that an agricultural water supplier is eligible for a water grant or loan even though the supplier is not implementing all of the efficient water management practices described in Section 10608.48, if the agricultural water supplier has submitted to the department for approval a schedule, financing plan, and budget, to be included in the grant or loan agreement, for implementation of the efficient water management practices. The supplier may request grant or loan funds to implement the efficient water management practices to the extent the request is consistent with the eligibility requirements applicable to the water funds.
- (e) Notwithstanding subdivision (a), the department shall determine that an urban retail water supplier is eligible for a water grant or loan even though the supplier has not met the per capita reductions required pursuant to Section 10608.24, if the urban retail water supplier has submitted to the department for approval documentation demonstrating that its entire service area qualifies as a disadvantaged community.
- (f) The department shall not deny eligibility to an urban retail water supplier or agricultural water supplier in compliance with the requirements of this part and Part 2.8 (commencing with Section 10800), that is participating in a multiagency water project, or an integrated regional water management plan, developed pursuant to Section 75026 of the Public Resources Code, solely on the basis that one or more of the agencies participating in the project or plan is not implementing all of the requirements of this part or Part 2.8 (commencing with Section 10800).

10608.60. (a) It is the intent of the Legislature that funds made available by Section 75026 of the Public Resources Code should be expended, consistent with Division 43 (commencing with Section 75001) of the Public Resources Code and upon appropriation by the Legislature, for grants to implement this part. In the allocation of funding, it is the intent of the Legislature that the department give consideration to disadvantaged communities to assist in implementing the requirements of this part.

- (b) It is the intent of the Legislature that funds made available by Section 75041 of the Public Resources Code, should be expended, consistent with Division 43 (commencing with Section 75001) of the Public Resources Code and upon appropriation by the Legislature, for direct expenditures to implement this part.

Chapter 8 Quantifying Agricultural Water Use Efficiency

SECTION 10608.64

10608.64. The department, in consultation with the Agricultural Water Management Council, academic experts, and other stakeholders, shall develop a methodology for quantifying the efficiency of agricultural water use. Alternatives to be assessed shall include, but not be limited to, determination of efficiency levels based on crop type or irrigation system distribution uniformity. On or before December 31, 2011, the department shall report to the Legislature on a proposed methodology and a plan for implementation. The plan shall include the estimated implementation costs and the types of data needed to support the methodology. Nothing in this section authorizes the department to implement a methodology established pursuant to this section.

Appendix C

Changes to the Water Code since 2010 UWMPs

Topic	CWC Section	Legislative Bill	Summary	Guidebook Section
Demand Management Measures	10631 (f)(1) and (2)	AB 2067 Weber 2014	Requires water suppliers to provide narratives describing their water demand management measures, as provided. Requires retail water suppliers to address the nature and extent of each water demand management measure implemented over the past 5 years and describe the water demand management measures that the supplier plans to implement to achieve its water use targets.	Chapter 9
Submittal Date	10621 (d)	AB 2067 Weber 2014	Requires each urban water supplier to submit its 2015 plan to the Department of Water Resources by July 1, 2016.	Chapter 10
Submittal Format	10644 (a) (2)	SB 1420 Wolk 2014	Requires the plan, or amendments to the plan, to be submitted electronically to the department.	Chapter 10
Standardized Forms	10644 (a) (2)	SB 1420 Wolk 2014	Requires the plan, or amendments to the plan, to include any standardized forms, tables, or displays specified by the department.	CH 1, Section 1.4
Water Loss	10631 (e) (1) (J) and (e) (3) (A) and (B)	SB 1420 Wolk 2014	Requires a plan to quantify and report on distribution system water loss.	Appendix L

Voluntary Reporting of Passive Savings	10631 (e) (4)	SB 1420 Wolk 2014	Provides for water use projections to display and account for the water savings estimated to result from adopted codes, standards, ordinances, or transportation and land use plans, when that information is available and applicable to an urban water supplier.	Appendix K
Voluntary Reporting of Energy Intensity	10631.2 (a) and (b)	SB 1036	Provides for an urban water supplier to include certain energy-related information, including, but not limited to, an estimate of the amount of energy used to extract or divert water supplies.	Appendix O
Defining Water Features	10632		Requires urban water suppliers to analyze and define water features that are artificially supplied with water, including ponds, lakes, waterfalls, and fountains, separately from swimming pools and spas.	CH 8, Section 8.2.4



W A T E R D E P A R T M E N T

212 Locust Street, Santa Cruz, CA 95060 • (831) 420-5200 • Fax (831) 420-5201 • www.cityofsantacruz.com

December 15, 2015

Susan Mauriello, County Administrative Officer
County of Santa Cruz
701 Ocean Street, Room 520
Santa Cruz, CA 95060

SUBJECT: Urban Water Management Plan Update

Dear Ms. Mauriello,

The City of Santa Cruz is preparing an update to its Urban Water Management Plan, as required by state law. This letter is to notify the County of Santa Cruz that the Santa Cruz Water Department will be reviewing the plan and considering changes and amendments over the next few months and welcomes your input and comments during the update process. The updated plan is scheduled to be presented to the Santa Cruz City Council at a public hearing in June 2016 to meet the state's submittal deadline of July 1, 2016. We will send you notice of the time and place of the public hearing, along with information on where the 2015 UWMP can be viewed, in advance of that meeting.

Please contact Toby Goddard, Administrative Services Manager, at 420-5232, if you have any questions or wish to discuss the information covered in the plan.

Sincerely,

Rosemary Menard
Water Director

cc: Kathy Previsich, Planning Director



W A T E R D E P A R T M E N T

212 Locust Street, Santa Cruz, CA 95060 • (831) 420-5200 • Fax (831) 420-5201 • www.cityofsantacruz.com

December 15, 2015

Jamie Goldstein, City Manager
City of Capitola
420 Capitola Ave.
Capitola, CA 95010

SUBJECT: Urban Water Management Plan Update

Dear Mr. Goldstein,

The City of Santa Cruz is preparing an update to its Urban Water Management Plan, as required by state law. This letter is to notify the City of Capitola that the Santa Cruz Water Department will be reviewing the plan and considering changes and amendments over the next few months and welcomes your input and comments during the update process. The updated plan is scheduled to be presented to the Santa Cruz City Council at a public hearing in June 2016 to meet the state's submittal deadline of July 1, 2016. We will send you notice of the time and place of the public hearing, along with information on where the 2015 UWMP can be viewed, in advance of that meeting.

Please contact Toby Goddard, Administrative Services Manager, at 420-5232, if you have any questions or wish to discuss the information covered in the plan.

Sincerely,

Rosemary Menard
Water Director

cc: Richard Grunow, Community Development Director

Appendix E:

City of Santa Cruz General Plan 2030 Policies Regarding Water Service

Goal CC 3 A safe, reliable, and adequate water supply

CC3.1 *Implement the City's Integrated Water Plan.*

- CC3.1.1 Implement the City's Long-Term Water Conservation Plan to reduce average daily water demand and maximize the use of existing water resources.
- CC3.1.2 Periodically update the City's Water Shortage Contingency Plan to prepare for responding to future water shortages.
- CC3.1.3 Develop a desalination plant of 2.5 mgd for drought protection, with the potential for incremental expansion to 4.5 mgd, if it is environmentally acceptable and financially feasible.

CC3.2 *Meet or exceed all regulatory drinking water standards.*

- CC3.2.1 Regularly and comprehensively evaluate the water system relative to federal and State water quality regulations and standards, and develop recommendations and an action plan to address findings.
- CC3.2.2 Develop, maintain, and update sampling and analysis programs, and laboratory procedures for the treated water distribution system and storage facilities.
- CC3.2.3 Maintain required federal and State laboratory certification.
- CC3.2.4 Prepare and submit compliance reports to all regulatory agencies.
- CC3.2.5 Regularly sample and analyze finished water in accordance with approved methods and parameters identified by the State, U.S. Environmental Protection Agency, and the City.
- CC3.2.6 Monitor the quality of water from all sources.
- CC3.2.7 Provide annual drinking water quality reports to all consumers of city water.

CC3.3 Safeguard existing surface and groundwater sources.

- CC3.3.1 Manage City watershed lands relative to protecting the sources of drinking water.
- CC3.3.2 Maintain compliance with all applicable drinking water source protection-related regulations.
- CC3.3.3 Secure and maintain all City water rights to existing and future water supplies to provide certainty and operational flexibility for the water system.
- CC3.3.4 Review and comment on new State Water Resources Control Board water rights applications and timber harvest plans on City drinking water source watersheds.
- CC3.3.5 Pursue appropriate regulatory enforcement of environmental violations committed by other watershed stakeholders.
- CC3.3.6 Conduct hydrologic and biotic monitoring throughout drinking water source watersheds to protect water supplies and habitat. Cf. CD4.3.3 and NRC2.1, 2.2, 2.4, and 6.3.
- CC3.3.7 Ensure that fisheries conservation strategies address and protect water storage, drinking water source quality, and water system flexibility, as well as protect the environmental resource.
- CC3.3.8 Provide adequate pumping, treatment, and distribution facilities for peak season production of groundwater of 170 mgd in normal years and 215 mgd during droughts.
- CC3.3.9 Monitor groundwater levels and quality.
- CC3.3.10 Participate with the Soquel-Aptos Groundwater Management Alliance in cooperative efforts to assure the quality and production of groundwater resources.

CC3.4 Maintain and improve the integrity of the water system.

- CC3.4.1 Maintain and improve water facilities to meet pressure and fire flow requirements and ensure customer delivery. Cf. HZ1.4.3.
- CC3.4.2 Modernize City water treatment plants.

CC3.4.3 Optimize storage, transmission, and distribution capacities and efficiencies.

CC3.4.4 Evaluate and improve the water system so as to minimize water outages due to emergencies and disasters.

CC3.5 *Promote maximum water use efficiency.*

CC3.5.1 Implement 14 urban water conservation “best management practices” and meet reporting requirements in the Memorandum of Understanding Regarding Urban Water Conservation in California.

CC3.5.2 Promote public education and awareness about the City’s water resources and the importance of water conservation.

CC3.5.3 Offer water audit programs and technical assistance for homes, businesses, and large landscapes to help customers reduce their average daily water use and control their utility bills.

CC3.5.4 Provide financial incentives to City water customers for installing high efficiency plumbing fixtures, appliances, and equipment.

CC3.5.5 Provide public information regarding onsite water catchment systems.

CC3.5.6 Administer and enforce water waste regulations, plumbing fixture retrofit requirements, and water efficient landscape standards for new development.

CC3.5.7 Explore and consider promoting or requiring new opportunities and technologies for more efficient use of water and energy.

CC3.5.8 Evaluate water use by residential, commercial, industrial and other customer categories and trends per capita.

CC3.5.9 Regularly audit the water distribution system and implement programs to minimize system losses and underground leaks.

CC3.5.10 Participate in regional water conservation partnerships, events, and opportunities.

- CC3.5.11 Play a leadership role in supporting research, policy development, standards, and legislation aimed at furthering water use efficiency across the state.
- CC3.5.12 Implement additional water conservation programs that provide a reliable gain in supply and can be justified in terms of their cost.

CC3.6 Coordinate major land use planning decisions in all three jurisdictions served by the City water system based on water supply availability.

- CC3.6.1 Implement the City's Urban Water Management Plan and update it periodically as required by State law.
- CC3.6.2 Provide annual updates to the city council on the status of remaining water supply.
- CC3.6.3 Confirm or adjust the estimate of remaining supply to avoid oversubscribing the water system.
- CC3.6.4 Consider developing criteria for determining significance of environmental impacts of development projects on the City water system to streamline the environmental review process.

CC3.7 Allow extension of the Water Service Area only if an application is approved by city council and/or LAFCO

CC3.8 Prohibit additional connections to the North Coast water system, in accordance with City Council Resolutions NS-17372 and NS-21056.

CC3.9 Sustain long-term fiscal stability.

- CC3.9.1 Maintain a rate schedule based on cost of service and designed to provide an economic incentive for conservation.
- CC3.9.2 Collect sufficient revenues to assure adequate maintenance of the water system infrastructure.
- CC3.9.3 Maintain a Water Rate Stabilization Fund to protect against unanticipated emergencies, and Operating Reserves as needed for cash flow.
- CC3.9.4 Confine long-term borrowing to major capital improvements.

CC3.9.5 Develop and implement a long-term Capital Improvements Plan for prioritizing and financing major projects.

CC3.10 Investigate new supply options to meet planned growth.

CC3.10.1 Explore opportunities to use recycled water for future water supply.

CC3.11 Conserve water resources. Cf. NRC1.3.1 and 3.1.

CC3.11.1 Promote water conservation.

CC3.11.2 Regularly update guidelines and standards for new landscaping that emphasizes xeriscaping, climate-appropriate landscape design, and other water-conserving practices.

CC3.11.3 Conduct a landscape irrigation audit program and target large water consumers to reduce consumption. Examples of large consumers are large turf customers, large commercial and industrial customers, and property management firms.



CITY OF SANTA CRUZ WATER DEMAND FORECAST

Abstract

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

Prepared by
David Mitchell
M.Cubed

October 2015

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EXECUTIVE SUMMARY

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

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

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

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

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

Statistical Models of Average Demand

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

The statistical models of demand were estimated using historical data on class water use, weather, water price, household income, conservation, and other economic variables driving water demand. The

monthly models of average water demand are combined with service and housing growth forecasts to predict future water demands. The average demand models explain 90 to 99% of the observed variation in historical average use over the 14 year estimation period.

The forecasts of average demand by customer class are summarized in Table ES-1. The forecasts include adjustments for future effects of plumbing codes and the City's baseline conservation program¹ and are predicated on average weather and normal economic conditions.

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

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

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

CI = 95% confidence interval.

Industrial and UCSC Demand Forecast

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

Table ES - 2. Industrial Demand Forecast (MGY)

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

Notes

1/ Actual per Water Department billing records.

2/ Caltrans Economic Forecast for Santa Cruz County.

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

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

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

Table ES - 3. UCSC Water Demand Forecast (MGY)

	2013 ^{1/}	2020	2025	2030	2035
Low	182	186	213	240	268
Primary	182	196	234	271	308
High	182	207	254	302	349
Notes					
1/ Actual per Water Department billing records.					

Population, Housing, and Non-Residential Connection Forecasts

Forecasts of population, housing units, and non-residential connections are anchored to AMBAG's 2014 Regional Growth Forecast (AMBAG 2014). Projected growth in single- and multi-family housing units are shown in Table ES-4 and projected growth in non-residential services (excluding industrial and UCSC) are summarized in Table ES-5.³

Table ES - 4. Forecast of Occupied Housing Units

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

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

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

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

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

Notes

1/ Actual per Water Department billing records.

2/ Based on ratio of business to residential demand.

3/ No expected growth in number of municipal services.

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

Demand Forecasts

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

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

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

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

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

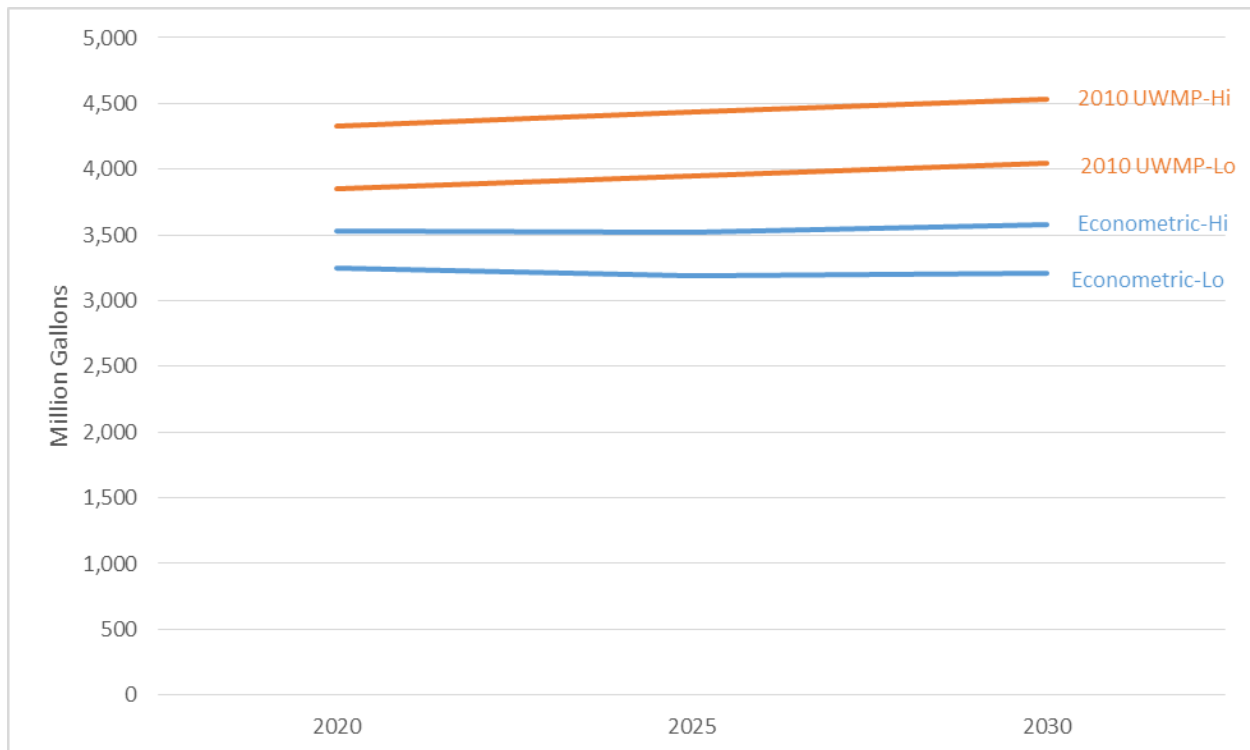


Figure ES - 2. Comparison of Demand Forecast with Interim WSAC Demand Forecast

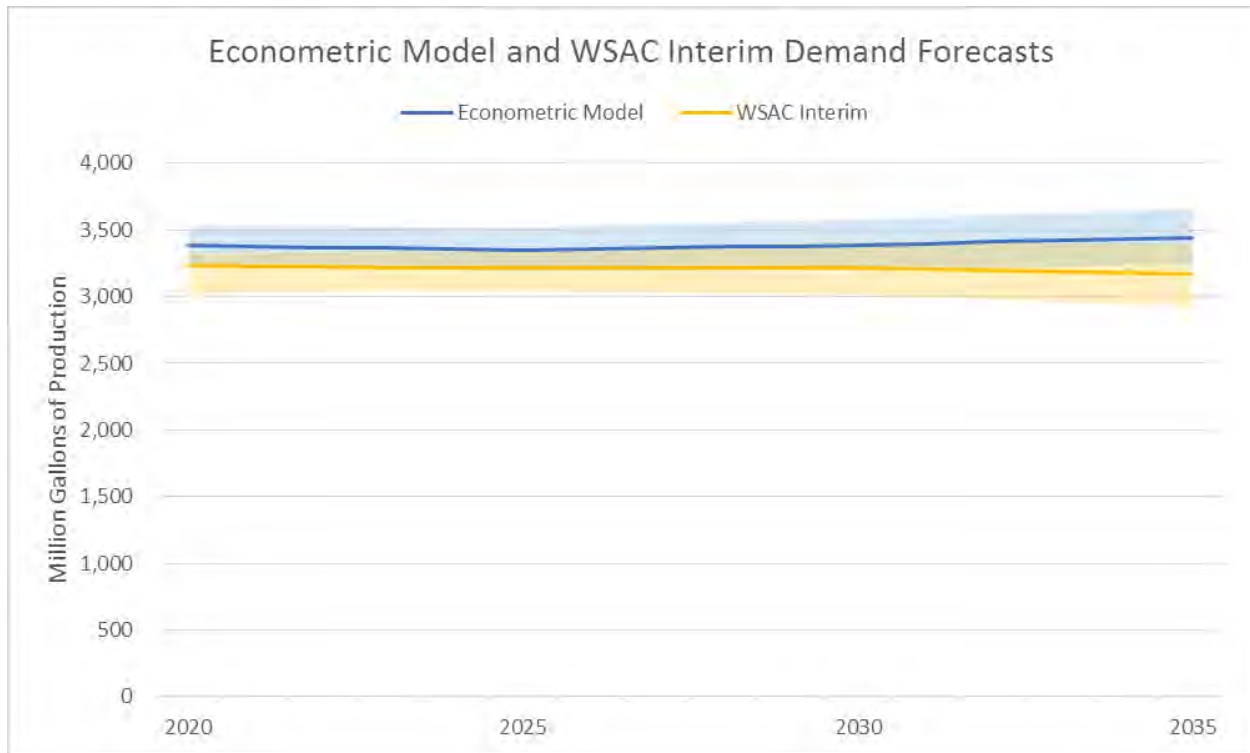


Figure ES - 3. Historical and Forecast Production in Millions of Gallons

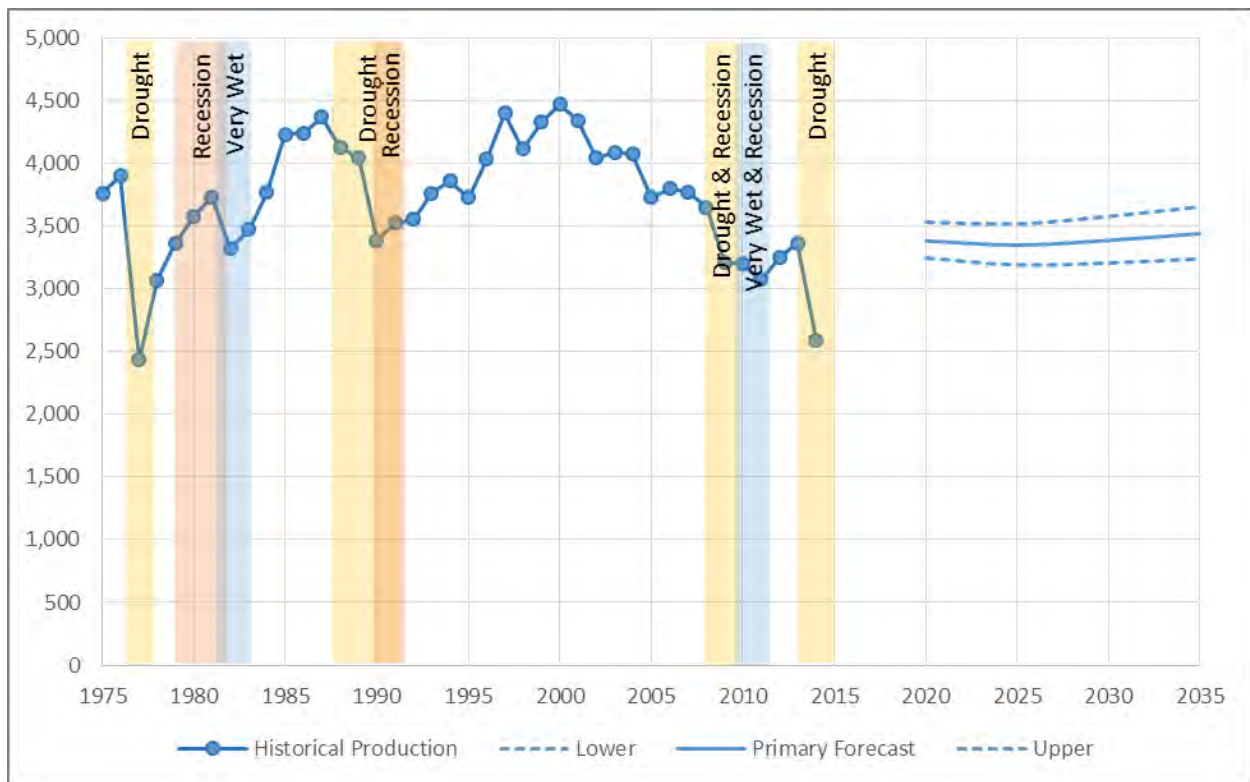


Table ES - 6. Primary Forecast of Class Demands and System Production

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

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

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

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

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

1 INTRODUCTION

1.1 NEED FOR UPDATED DEMAND FORECAST

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

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

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

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

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

1.2 PROJECT OBJECTIVE

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

1.3 REPORT ORGANIZATION

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

2 STATISTICAL MODELS OF AVERAGE DEMAND

2.1 APPROACH

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

2.2 MODEL DEFINITION

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

The model of expected demand has several useful features. First, climate and weather effects on demand are decomposed into two distinct components. The climate component measures the seasonal

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

The model of expected demand is stated as:

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

Where:

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

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

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

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

Table 1. Seasonal Index of Monthly Average Demand

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

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

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

Where⁴

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

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

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

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

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

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

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

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

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

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

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

$$\text{Weather Normalized } \tilde{y}_{it} = \exp(\mu_i + \beta_S \text{Season}_t + \beta_E \text{Economic}_{it}) \quad (9)$$

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

$$\text{WeatherEffect}_t = \exp(\beta_{w1} dLR_t + \beta_{w2} dLR_{t-1} + \beta_{w3} dLR_{t-2} + \beta_{w4} dLT_t \text{ (or } dLET_t)) \quad (10)$$

Weather normalized observed demand is then given by

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

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

$$\beta_E \text{Economic}_{it} = \beta_{E1} lPrice_{it} + \beta_{E2} lInc_{it} + \beta_{E3} dLVac_t + \beta_{E4} dlUnempl_t \quad (12)$$

Where

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

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

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

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

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

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

Table 2. Economic Variable Restrictions in Customer Class Models

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

2.3 DATA DEVELOPMENT

2.3.1 Water Consumption

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

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

Once aggregate monthly consumption was estimated, it was divided by the annual number of housing units (for single and multi-family classes), services (for business, municipal, and irrigation classes), or acres (for golf courses) to get average monthly consumption. Figure 1 illustrates the transformation of the raw aggregated meter read data into its corresponding estimated monthly aggregate and average consumption for the Inside City Single Family customer class. The erratic pattern in the raw meter read

data prior to 2005 is primarily due to variability in the number of meters being read in a month and thus total consumption recorded in the aggregate data.⁶

2.3.2 Weather

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

2.3.3 Economic Variables

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

2.3.4 Conservation Adjustment

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

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

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

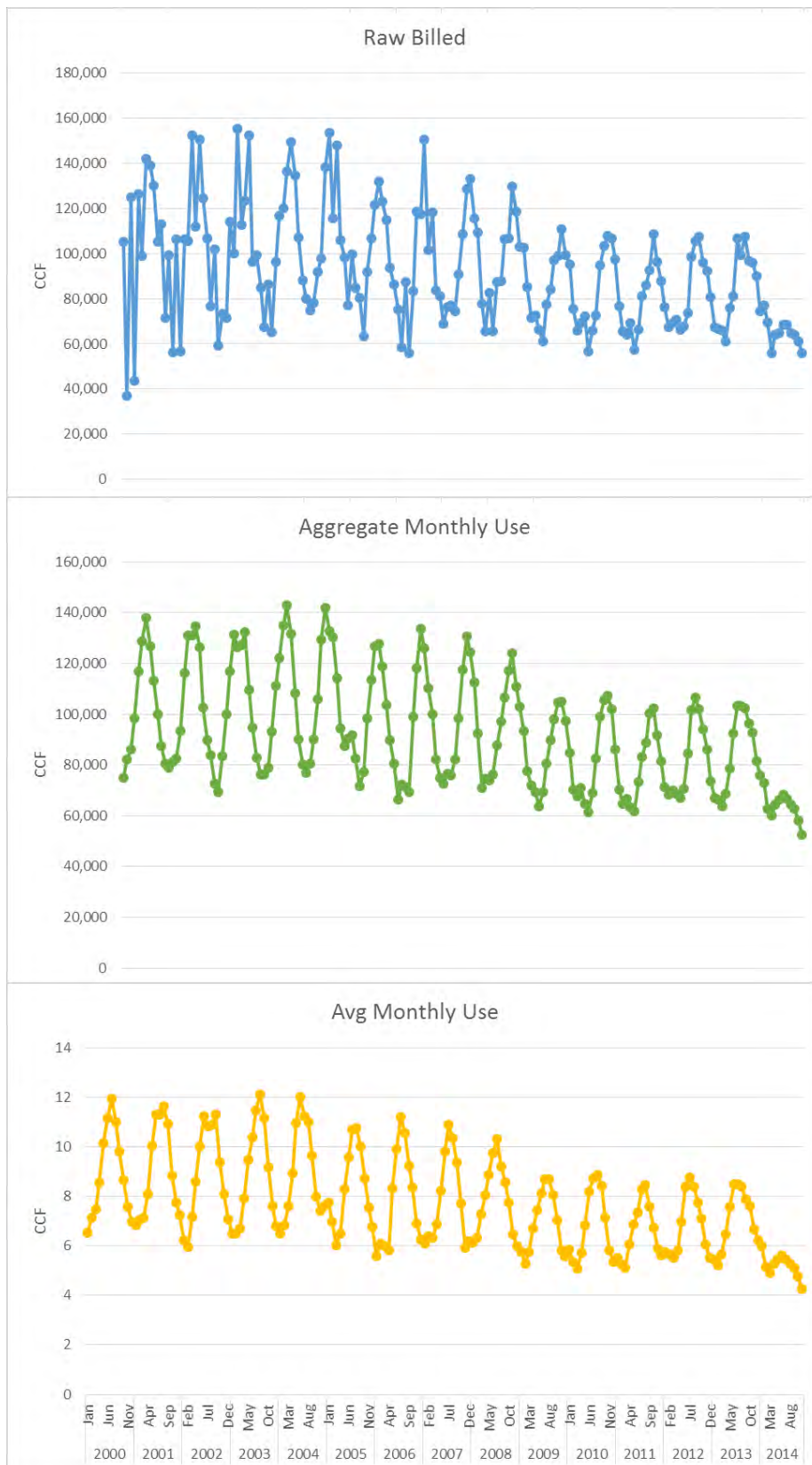
$$\hat{y}_{it} = \widehat{\tilde{y}}_{it} - c_{it} \quad (18)$$

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

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

City of Santa Cruz Water Demand Forecast

Figure 1. Inside City Single Family Consumption Data



2.4 MODEL ESTIMATION RESULTS

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

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

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

2.4.1 Seasonal Load Shape

The seasonal load shape describes how monthly average demand changes over the year due to seasonal effects. Average demand is lower in the winter months and peaks in the summer months. However, the degree of difference between these periods varies by customer class depending on the extent of irrigation uses. Table 1 shows how the seasonal parameter estimates can be used to estimate a seasonal index for each customer class. The estimated seasonal indices are given in Table 4.⁷ The indices express average monthly demand as a percentage of total annual demand. For example, from Table 4 it is seen that single family average demand in May is about 1.6 times greater than average demand in January. More generally, single family average demand in the summer months is a bit less than double winter average demand. Summer peaking for multi-family is much less pronounced, with summer average demand only about 20% greater than winter average demand. Business average demand mostly falls between single- and multi-family average demands. The municipal and irrigation classes show greater peaking than the residential or business categories, with summer average demand five to eight times greater than winter average demand.⁸ Average demands by the two golf courses served by the City are almost entirely in the summer. There is very little golf course demand in the winter months.

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

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

Table 4. Seasonal Indices of Average Demand

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

2.4.2 Weather Effects

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

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

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

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

Table 5. Statistically Significant Weather Parameters in Average Demand Models

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

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

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

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

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

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

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

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

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

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

2.4.3 Economic Effects

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

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

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

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

Table 8. Economic Parameter Estimates

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

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

2.4.4 Drought Effects

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

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

Table 9. Estimated Drought Stage Parameters

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

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

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

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

2.5 FORECASTS OF AVERAGE DEMAND BY CUSTOMER CLASS

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

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

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

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

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

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

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

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

CI = 95% confidence interval.

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

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

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

3 FORECASTS OF POPULATION, HOUSING, AND SERVICES

3.1 APPROACH

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

3.2 FORECAST DEVELOPMENT

3.2.1 Population

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

Table 12. Service Area Population Forecast

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

Notes:

1/ Actual per 2010 Census

2/ AMBAG 2014 Regional Growth Forecast (adopted June 11, 2014). Includes UCSC population.

3/ Developed by Water Department Staff from 2014 Regional Growth Forecast data.

3.2.2 Housing Units

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

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

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

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

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

Table 13. Inside-City Household Population Forecast

	2010 ^{1/}	2020	2025	2030	2035
Total Population	59,946	66,860	70,058	73,375	76,692
Adjustments					
Campus population ^{2/}	7,331	8,845	9,602	10,359	11,116
Group quarters ^{3/}	1,904	2,099	2,188	2,280	2,373
Non-household population	9,235	10,944	11,790	12,639	13,489
Population In households ^{4/}	50,711	55,916	58,268	60,736	63,203
Notes					
1/ Actual per 2010 Census.					
2/ See Attachment 9 for calculation.					
3/ Ratio of group quarters population to total (non-campus) population from 2010 Census multiplied by total (non-campus) population.					

Table 14. Outside-City Household Population Forecast

	2010 ^{1/}	2020	2025	2030	2035
Total Population	31,342	32,543	33,562	34,614	35,698
Group quarters adjustment ^{2/}	665	690	712	734	757
Population In households	30,677	31,853	32,850	33,880	34,941
Notes					
1/ Actual per 2010 Census					
2/ Ratio of group quarters population to total population from 2010 Census multiplied by total population.					

Total occupied housing units are then estimated by dividing household population by average household size. Average household size starts with the 2010 Census estimate, which is then scaled to increase at the same rate as average household size in the AMBAG 2014 Regional Growth Forecast. The forecast of

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

total occupied housing units for the inside- and outside-city portions of the service are shown in Table 15.¹⁹

Table 15. Forecast of Occupied Housing Units

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

Notes

1/ Actual per 2010 Census

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

The last step in the forecast of service area housing units is to allocate total housing units between single-family and multi-family units. This is shown in Table 16. It starts with the Water Department's 2014 estimates of housing units calculated from its billing data. Single-family housing units are then increased at their historical growth rate. In the case of inside-city single-family housing, growth is capped at 1,000 units based on the General Plan's estimate of potential for new single family housing.²⁰ No cap is applied to the outside-city forecast. Multi-family units are then the difference between the forecast of total units and single-family units. For the inside-city portion of the service area, three-fourths of the gain in housing units is in the multi-family category. For the outside-city portion of the service area, a little less than half of the gain is in the multi-family category. For the whole service area, more than two-thirds of the gain in housing units is in the multi-family category.

Total housing units shown for the inside-city portion of the service area in Table 16 calibrates exactly to the total shown in Table 15. This is not the case for the outside-city total in Table 16. There is a discrepancy between Water Department data on total outside-city housing units in 2014 and the forecast of occupied housing units in Table 15. The Water Department's estimate is higher by several hundred housing units. The water demand forecast uses the housing unit forecasts shown in Table 16.²¹

¹⁹ Occupied housing units rather than total housing units are used to forecast water demand because it is assumed that water use in vacant units is negligible.

²⁰ The General Plan, which extends to 2030, identified a potential for 840 new single family units. This was increased to 1000 units since this forecast runs to 2035.

²¹ The outside-city housing unit forecast in Table 16 assumes the same rate of growth in the housing stock as the forecast in Table 15, but starts with the Water Department's higher estimate of housing units in 2014.

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

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

3.2.3 Non Residential Services and City-Irrigated Golf Acreage

The forecast of business services is based on the ratio of business to residential water use. Historically this ratio has averaged about 0.295 with very little variation (see Figure 2). The number of new business services is forecast such that the ratio of business to residential water use is maintained at 0.295 over the forecast period. This results in a gain of 166 new business services between 2013 and 2035.²²

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

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

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

water by 2020 and not more than 20 acres by 2030. It currently irrigates about 67.5 acres with City water.

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

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

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

Notes

1/ Actual per Water Department billing records.

2/ Based on ratio of business to residential demand.

3/ No expected growth in number of municipal services.

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

City of Santa Cruz Water Demand Forecast

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

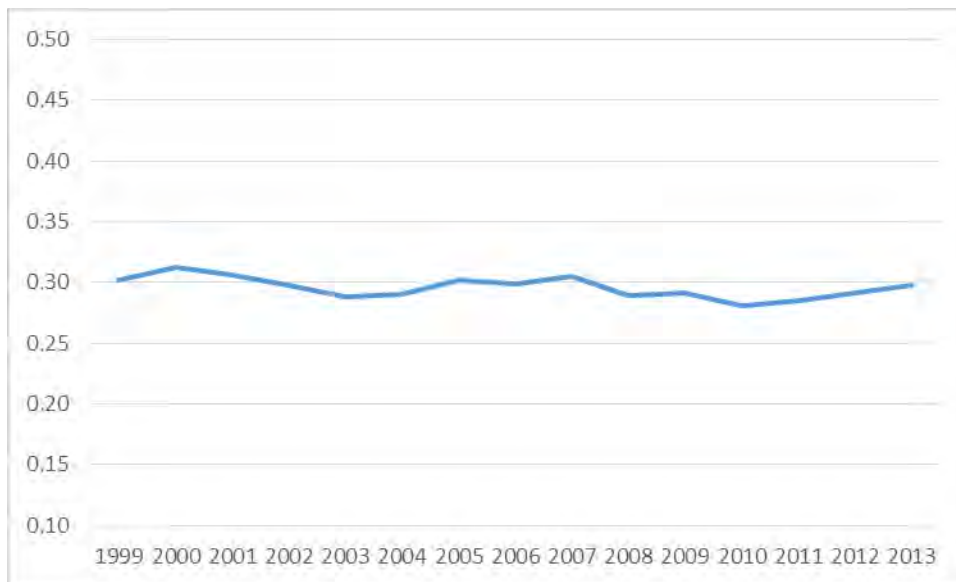
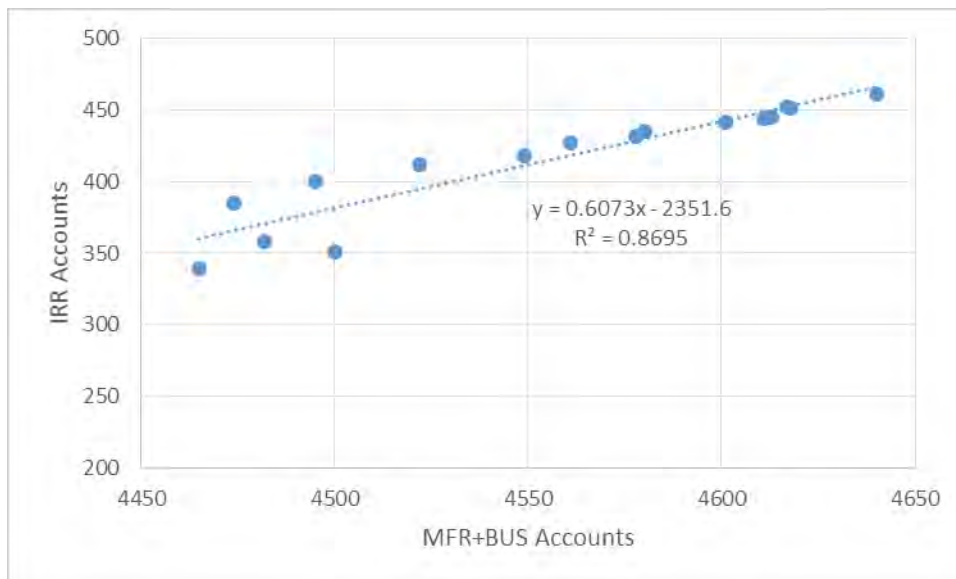


Figure 3. Irrigation vs Multi-Family + Business Accounts: 1999-2013



4 FORECASTS OF WATER DEMAND

4.1 APPROACH

4.1.1 Class Demands other than Industrial and UCSC

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

4.1.2 Industrial and UCSC Demands

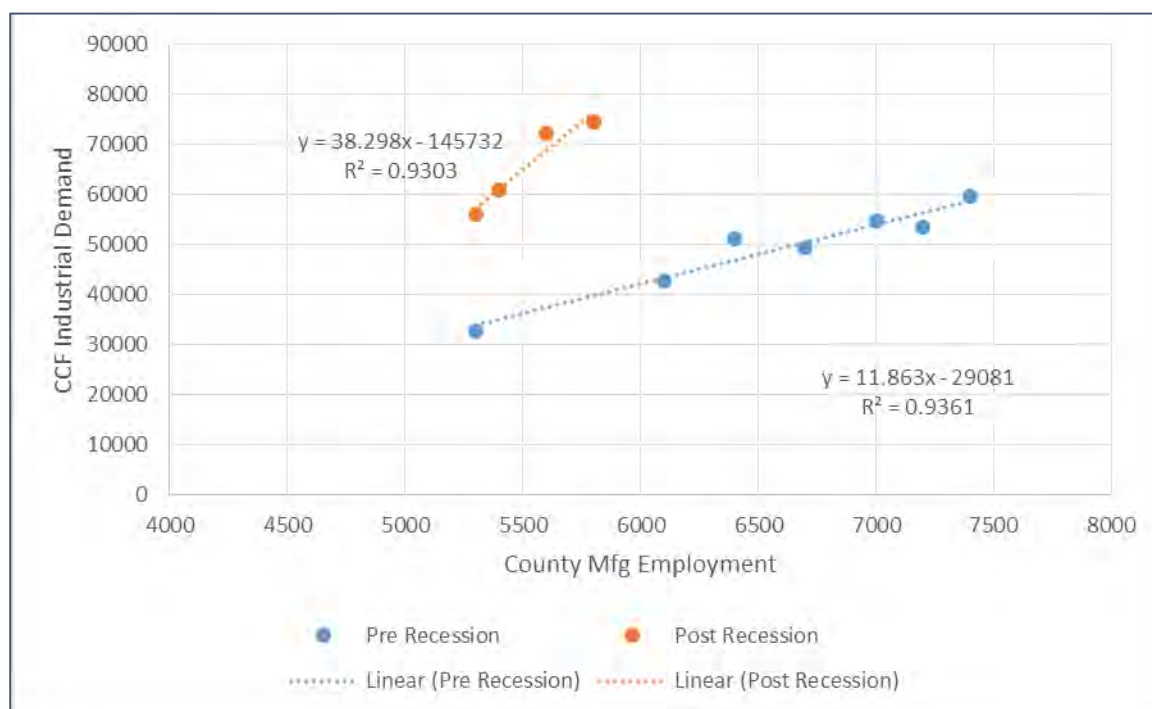
There is a strong relationship between Santa Cruz County manufacturing employment and industrial water demand. This relationship is illustrated in Figure 4. Prior to the recession, annual industrial demand increased by 11.9 CCF per manufacturing job, on average. Immediately after the recession this increased to about 38.3 CCF per job. We use the pre-recession rate with a forecast of manufacturing employment in Santa Cruz County to project future industrial water demand. The pre-recession rate of water use per job is used because it does not include the transitory effects of the economic recovery. The 95% confidence interval for the water use per job parameter is used to produce the lower and upper bound forecasts.²³ The Caltrans forecast of manufacturing employment for Santa Cruz County is used to forecast industrial water use. The California Employment Development Department also has a forecast of manufacturing employment, but this forecast extends only to 2022. However, the two forecasts are consistent. The forecast of industrial demand is given in Table 18.

Table 18. Industrial Demand Forecast

	2013 ^{1/}	2020	2025	2030	2035
Mfg Employment Forecast					
Cal Trans		5,900	6,200	6,400	6,500
Industrial Water Demand (MG)					
Low	56	56	58	59	60
Primary	56	57	59	61	62
High	56	57	60	63	64
Notes					
1/ Actual per Water Department billing records.					

²³ The 95% confidence interval is [8.4, 15.3]. The data and model output are provided in Attachment 10.

Figure 4. Industrial Demand vs County Manufacturing Employment



The forecast of UCSC demand is the same as in the interim WSAC demand forecast. The interim forecast was based on a linear projection of the UCSC demand requirement under its LRDP, assuming two alternative buildout dates. In both cases, buildout demand is 349 MGY. In the lower bound forecast, buildout occurs in 2050. In the upper bound forecast it occurs in 2035. The primary forecast is the midpoint between the lower and upper bound forecasts. The forecast of UCSC demand is given in Table 19. The primary forecast almost exactly replicates a forecast based on projected enrollment and average rates of water use per student.²⁴

Table 19. UCSC Water Demand Forecast

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

Notes

1/ Actual per Water Department billing records.

²⁴ The enrollment-based approach yields a 2035 demand of 304 MG, which differs from the primary forecast by less than 2%.

4.1.3 System Production

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

4.2 CLASS DEMANDS AND SYSTEM PRODUCTION FORECASTS

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

Table 20. Primary Forecast of Class Demands and System Production

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

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

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

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

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

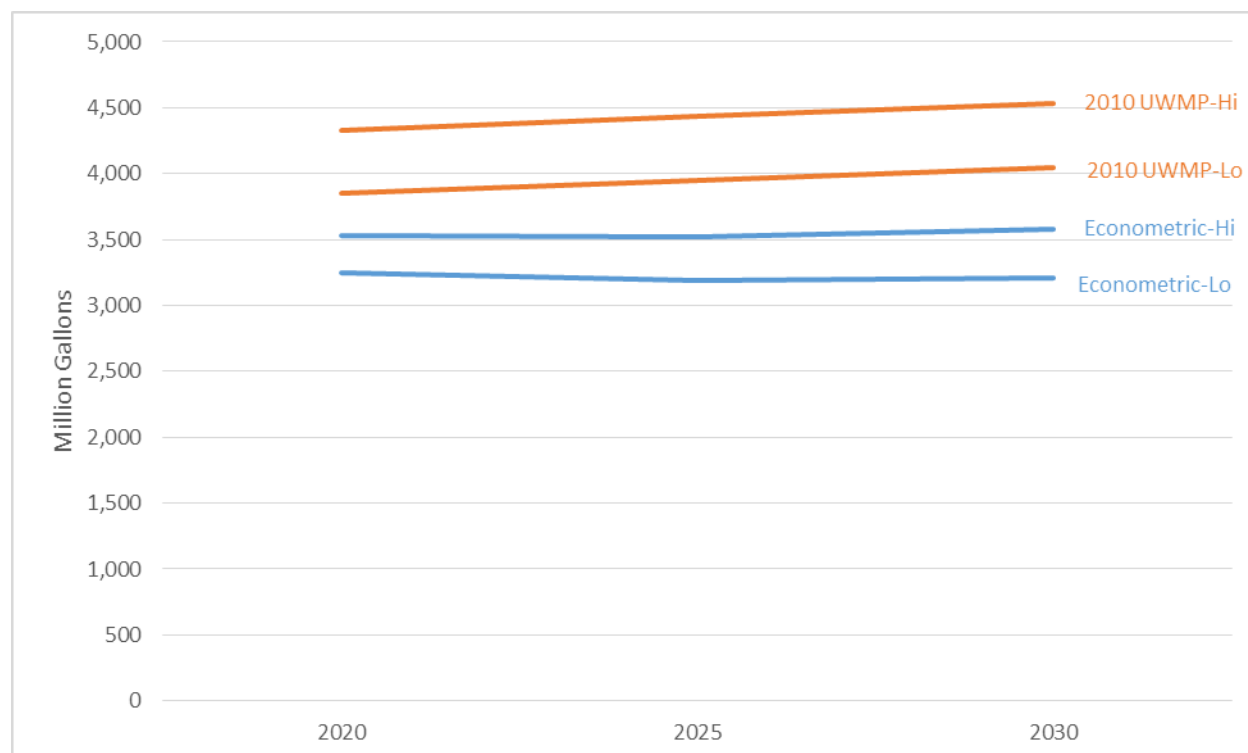
5 COMPARISON WITH PREVIOUS FORECASTS AND HISTORICAL PRODUCTION

5.1 2010 UWMP FORECAST

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

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

Figure 5. Comparison of Demand Forecast with 2010 UWMP Forecast

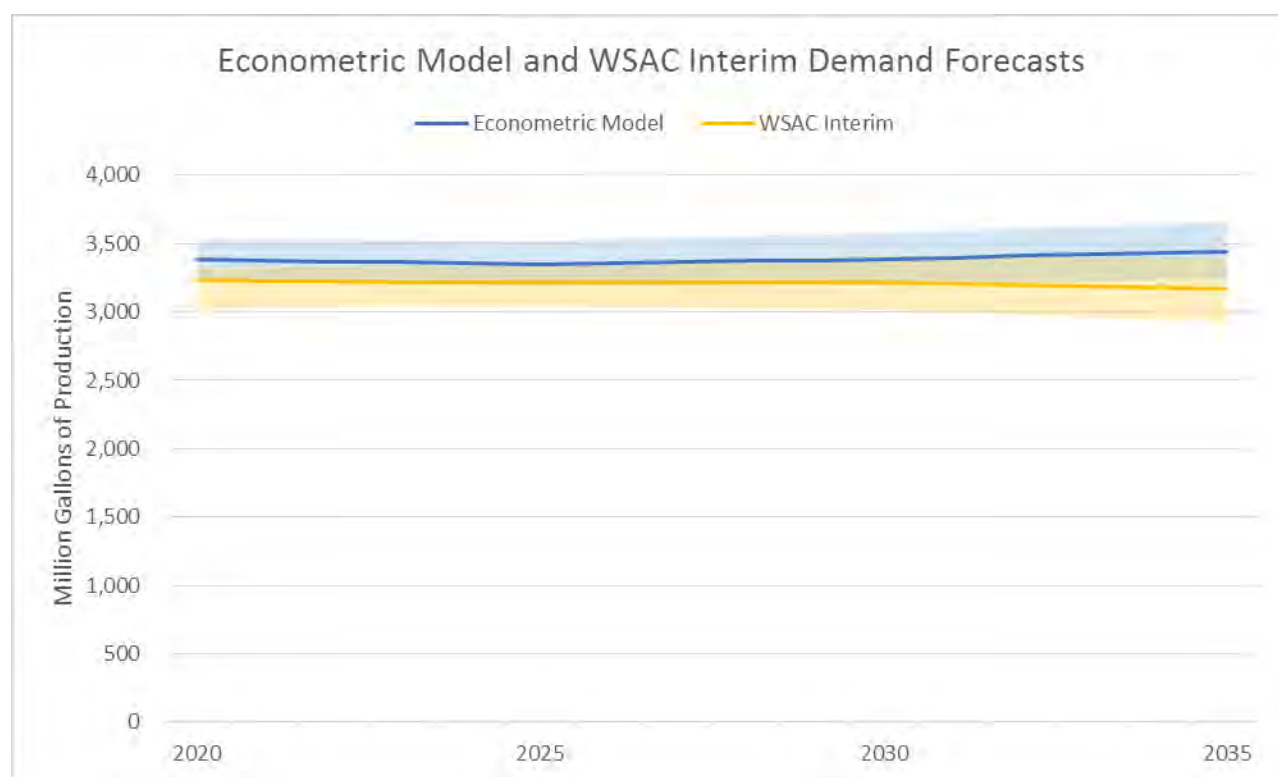


5.2 INTERIM WSAC DEMAND FORECAST

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

The WSAC Interim and econometric demand forecasts are compared in Figure 6. On average, the econometric demand forecast is approximately five and a half percent greater than the WSAC interim forecast. Figure 6 also shows the uncertainty band around each forecast – light blue for the econometric model forecast and light yellow for the WSAC interim forecast. The uncertainty band on the econometric forecast is based on the 95% confidence intervals for the class-level average use per service forecasts developed with the econometric models. The uncertainty band on the WSAC interim forecast is the range between the low and high interim forecasts. From Figure 6 it is seen that the econometric forecast represented by the dark blue line essentially tracks the upper-bound of the WSAC interim forecast while the WSAC interim forecast represented by the dark yellow line essentially tracks the lower-bound of the corrected econometric forecast. Between these two lines, the forecasts overlap. Future production in the range of 3,200 to 3,400 MGY is consistent with both forecasts.²⁵

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

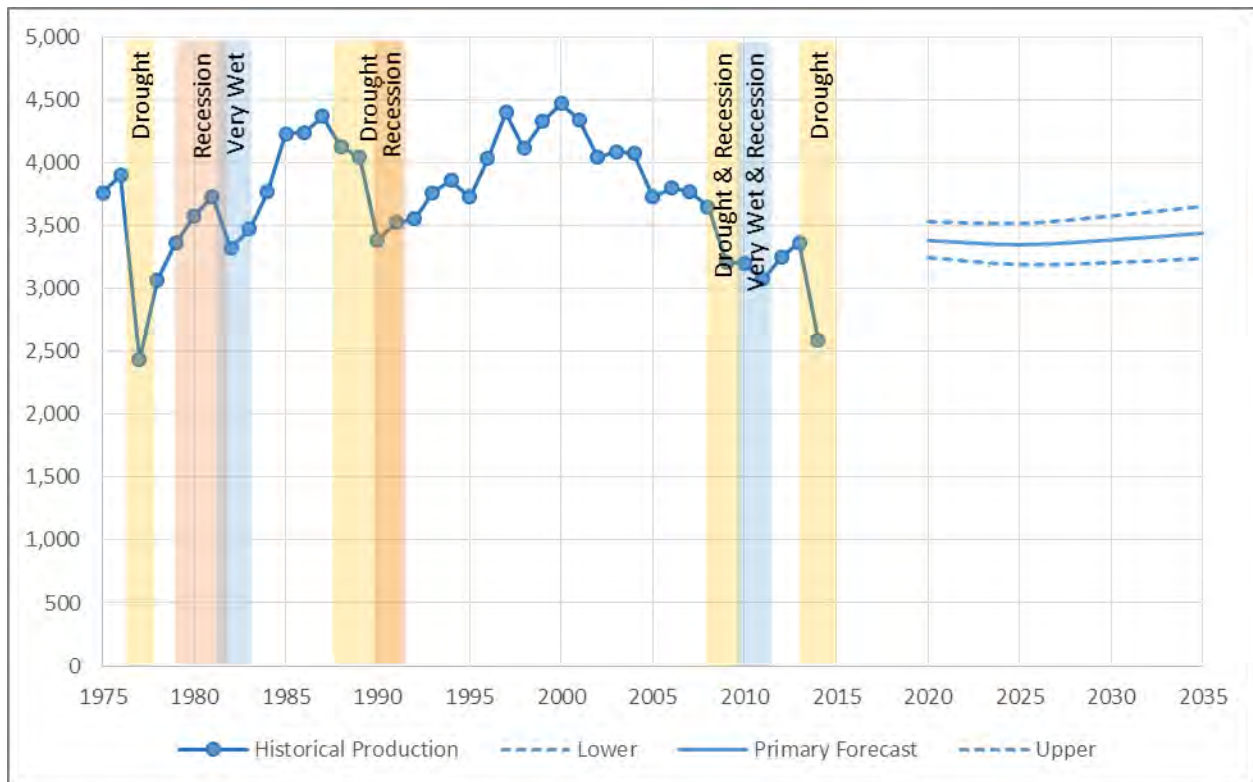


²⁵ A more conservative uncertainty band obtained by taking the union of the two forecasts suggests future production in the range of 3,000 to 3,500 MGY over most of the forecast period, with a slightly wider band in the last five years of the forecast.

5.3 HISTORICAL PRODUCTION

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

Figure 7. Historical and Forecast Production in Millions of Gallons



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ATTACHMENT 1 MONTHLY ALLOCATION PERCENTAGES FOR AGGREGATED METER READ DATA

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

Seasonal Use Indices

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

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

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

City of Santa Cruz Water Demand Forecast

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

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

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

City of Santa Cruz Water Demand Forecast

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

ATTACHMENT 2 WEATHER DATA

The weather data are from CIMIS Station 104 (DeLaveaga)

Average maximum daily air temperature (F)

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

City of Santa Cruz Water Demand Forecast

Monthly total precipitation (in)

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

City of Santa Cruz Water Demand Forecast

Monthly total ETo (in)

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

ATTACHMENT 3 ECONOMIC DATA

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

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

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

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

Per capita and median household income (2013 dollars)

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

California Department of Finance Report E-8

Housing Vacancy Rates

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

**California Employment Development Department
Unemployment Rates**

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

ATTACHMENT 4 CONSERVATION ADJUSTMENT DATA

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

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

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

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

City of Santa Cruz Water Demand Forecast

SFR Inside City Housing Units

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

SFR Outside City Housing Units

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

City of Santa Cruz Water Demand Forecast

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

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

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

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

City of Santa Cruz Water Demand Forecast

SFR Inside City Avg Use (CCF/Housing Unit)

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

SFR Outside City Avg Use (CCF/Housing Unit)

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

City of Santa Cruz Water Demand Forecast

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

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

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

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

City of Santa Cruz Water Demand Forecast

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

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

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

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

City of Santa Cruz Water Demand Forecast

MFR Inside City Housing Units

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

MFR Outside City Housing Units

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

City of Santa Cruz Water Demand Forecast

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

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

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

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

City of Santa Cruz Water Demand Forecast

MFR Inside City Avg Use (CCF/Housing Unit)

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

MFR Outside City Avg Use (CCF/Housing Unit)

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

City of Santa Cruz Water Demand Forecast

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

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

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

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

City of Santa Cruz Water Demand Forecast

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

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

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

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

City of Santa Cruz Water Demand Forecast

BUS Inside City Services

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

BUS Outside City Services

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

City of Santa Cruz Water Demand Forecast

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

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

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

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

City of Santa Cruz Water Demand Forecast

BUS Inside City Avg Use (CCF/Service)

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

BUS Outside City Avg Use (CCF/Service)

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

City of Santa Cruz Water Demand Forecast

BUS Inside City Adjusted Avg Use (CCF/Service)

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

BUS Outside City Adjusted Avg Use (CCF/Service)

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

ATTACHMENT 5 MODEL ESTIMATION RESULTS

Single Family Customer Class Model

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

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

Multi Family Customer Class Model

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

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

Business Customer Class Model

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

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

Municipal Customer Class Model

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

=====	
Dependent variable:	

	ln.use

fmonthFeb	-0.025 (0.040)
fmonthMar	0.101 (0.057)*
fmonthApr	0.767 (0.052)***
fmonthMay	1.214 (0.049)***
fmonthJun	1.424 (0.046)***
fmonthJul	1.553 (0.040)***
fmonthAug	1.579 (0.041)***
fmonthSep	1.360 (0.045)***
fmonthOct	1.061 (0.042)***
fmonthNov	0.521 (0.039)***
fmonthDec	0.087 (0.034)**
eto.nov.mar	0.516 (0.138)***
eto.apr.jun	0.804 (0.242)***
eto.jul.oct	0.357 (0.107)***
rain.nov.mar	0.037 (0.036)
rain.apr.jun	-0.147 (0.050)***
rain.jul.oct	0.006 (0.038)
ln.rain.dev.lag1	-0.097 (0.019)***
ln.rain.dev.lag2	-0.063 (0.019)***
ln.price	-0.237 (0.063)***
ln.unemp.rate.dev.city	-0.142 (0.046)***
drght.stage2	-0.108 (0.034)***
drght.stage3	-0.621 (0.035)***
Constant	2.645 (0.076)***

Observations	177
R2	0.957
Adjusted R2	0.951
Residual Std. Error	0.137 (df = 153)
F Statistic	149.772*** (df = 23; 153)
=====	
Note:	*p<0.1; **p<0.05; ***p<0.01

Irrigation Customer Class Model

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

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

Golf Customer Class Model

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

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

ATTACHMENT 6 MONTHS DROUGHT STAGES IN EFFECT

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

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

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

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

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

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

ATTACHMENT 7 WATER RATE AND INCOME FORECASTS

Forecasted Increase in Water Rates

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

The forecasted nominal annual percentage change in water rate for 2014-2019 is from the Water Department. The forecasted nominal annual percentage change in water rate from 2020-2035 is set to the long-term annual rate of increase in the BLS Consumer Price Index for Water, Sewer, and Solid Waste Services (<http://data.bls.gov/timeseries/CUSR0000SEHG>). The source of the Caltrans inflation rate forecast for Santa Cruz County is:

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

Forecasted Increase in Income

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

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

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

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

Santa Cruz County, CA

Median Household Income

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

City of Santa Cruz Water Demand Forecast

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

Source: US Census and ACS

ATTACHMENT 8 PLUMBING CODE AND PROGRAM A SAVINGS FORECASTS

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

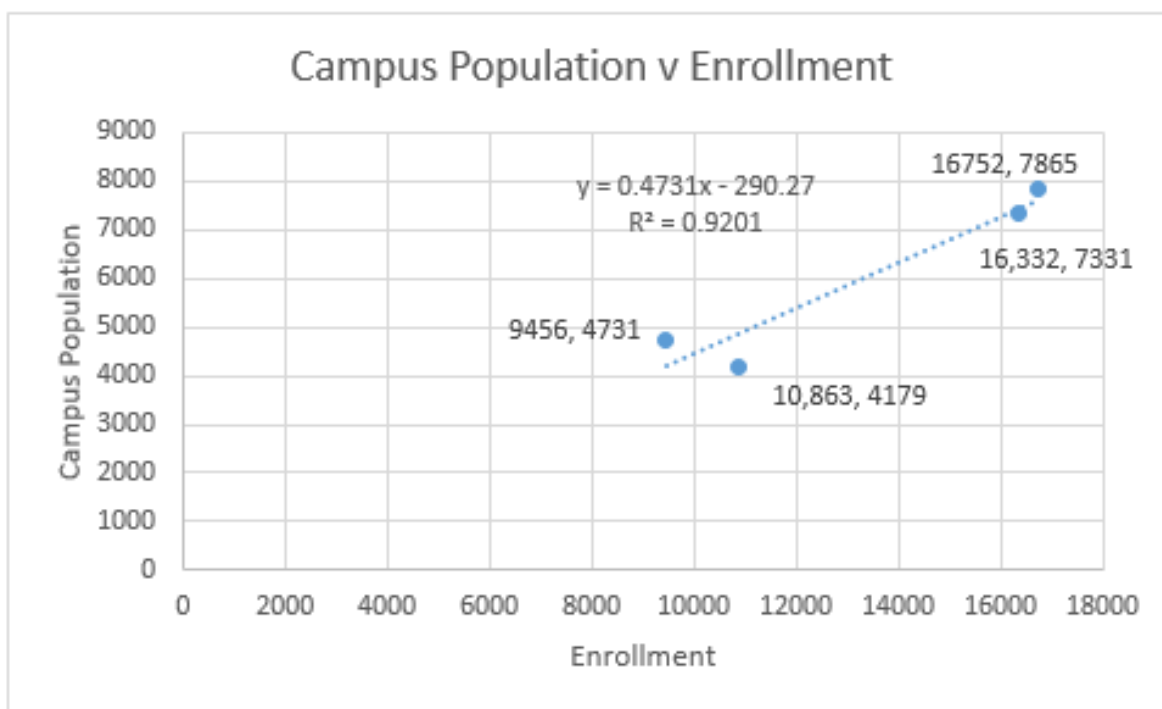
	SFR Code Savings, 2013 Base Year			
Year	MG/Yr	CCF/Yr	Services	CCF/Service
2020	32.7	43,717	19559	2.2
2025	68.0	90,909	19907	4.6
2030	103.3	138,102	20256	6.8
2035	124.7	166,711	20256	8.2
	SFR Prog A Savings, 2013 Base Year			
Year	MG/Yr	CCF/Yr	Services	CCF/Service
2020	55.8	74,663	19559	3.8
2025	61.6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

Program A Savings Allocation to Customer Classes

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

ATTACHMENT 9 UCSC CAMPUS POPULATION FORECAST

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



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

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

ATTACHMENT 10 INDUSTRIAL DEMAND FORECAST MODEL

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

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

```

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

```

DATE: March 30, 2016
TO: Toby Goddard, City of Santa Cruz
FR: David Mitchell
RE: Effect of Temperature on City of Santa Cruz Water Demands

Summary

This memorandum presents estimates of the expected percentage change in demand per a 1 degree F change in monthly average maximum daily air temperature. These estimates are shown in Table 1. Per the table, a 1 degree F increase in monthly average maximum daily air temperature would be expected to increase SFR demand by 0.62 percent, but golf course demand by 1.38 percent. Total system demand would be expected to increase by 0.45 percent.

The estimates in Table 1 assume a 1 degree F increase from the long-term average in monthly average maximum daily air temperature across all twelve months. Thus it is the average change across the entire year given a uniform increase in temperature. The expected change in demand for specific months would differ from the estimates in Table 1, being generally higher in the spring and fall and lower in the winter.

Table 1. Expected % Change in Demand per 1 Degree F Change in Monthly Average Maximum Daily Air Temperature

Customer Category	% change in demand per 1 degree F
SFR	0.62
MFR	0.19
BUS	0.29
MUN	1.09
IRR	0.80
GOLF	1.38
IND	0.00
Weighted Average	0.45

Estimation

The following analytical steps were taken to develop the estimates in Table 1.

Step 1: Estimate relationship between temperature, rainfall, and ETo

Weather effects for City of Santa Cruz water demand were estimated econometrically. For the residential and business customer categories, the weather effects were measured based on deviations in rainfall and temperature from their 25-year normal. However, for the municipal, irrigation, and golf course customer categories, ETo was used instead of temperature. It therefore is necessary to translate

a 1 degree F change in temperature to the corresponding change in ETo. This was done by regressing rainfall and temperature against ETo for each month to get the average change in monthly ETo per 1 degree change in temperature. The results are shown in Table 2.

Table 2. Change in ETo per 1 Degree F Change in Temperature

Month	Mean Monthly Value		Change in ETo per Degree Change in Temp
	Max Daily Temp F	ETo Inches	
Jan	60.6	1.63	0.0478
Feb	61.2	2.03	0.0000
Mar	63.9	3.56	0.0485
Apr	66.4	4.42	0.0760
May	69.7	5.18	0.1064
Jun	72.4	5.48	0.1233
Jul	72.8	5.16	0.0648
Aug	74.7	4.85	0.0623
Sep	74.4	3.93	0.1322
Oct	71.7	2.98	0.0828
Nov	65.0	1.80	0.0491
Dec	59.4	1.35	0.0560

Step 2: Estimate % Change in Demand per 1 Degree F Change in Temp by Month and Customer Category

The next step was to use the results of the econometric demand models to estimate the percentage change in demand given a 1 degree F change in monthly average maximum daily air temperature by month and by customer category.

If all variables in the econometric demand models other than temperature or ETo are assumed constant, a customer category's expected monthly demand can be represented as:

$$y = kx^{\beta}$$

where y is expected monthly demand, x is temperature or ETo, k is a constant, and β is the econometrically estimated parameter for temperature or ETo.

Let $\bar{x}$ be the 25-year normal for monthly average maximum daily air temperature or ETo. Then for the residential and business demand categories, the expected percentage change in monthly demand given a 1 degree F increase in the 25-year normal temperature is given by

$$\frac{y_1 - y_0}{y_0} = \frac{k(\bar{x} + 1)^{\beta} - k\bar{x}^{\beta}}{k\bar{x}^{\beta}} = \left(\frac{\bar{x} + 1}{\bar{x}}\right)^{\beta} - 1$$

For the customer categories that utilize ETo the 1 degree F increase in temperature must be translated into the corresponding expected change in ETo using the results in Table 2. Denoting the change in ETo by ϵ , the expected percentage change in monthly demand for these customer categories is given by

$$\frac{y_1 - y_0}{y_0} = \frac{k(\bar{x} + \varepsilon)^\beta - k\bar{x}^\beta}{k\bar{x}^\beta} = \left(\frac{\bar{x} + \varepsilon}{\bar{x}}\right)^\beta - 1$$

The 25-year normals for temperature and ETo used to implement these equations are given in Table 2. The β parameters from the econometric demand models are given in Table 3.

Table 3. β Parameters for Temperature and ETo from Econometric Demand Models

	Temperature			ETo		
Month	SFR	MFR	BUS	MUN	IRR	GOLF
Jan	0.203	0.100	0.243	0.516	0.509	1.135
Feb	0.203	0.100	0.243	0.516	0.509	1.135
Mar	0.203	0.100	0.243	0.516	0.509	1.135
Apr	0.422	0.338	0.400	0.804	0.660	0.173
May	0.422	0.338	0.400	0.804	0.660	0.173
Jun	0.422	0.338	0.400	0.804	0.660	0.173
Jul	0.636	0.000	0.000	0.357	0.163	0.792
Aug	0.636	0.000	0.000	0.357	0.163	0.792
Sep	0.636	0.000	0.000	0.357	0.163	0.792
Oct	0.636	0.000	0.000	0.357	0.163	0.792
Nov	0.203	0.100	0.243	0.516	0.509	1.135
Dec	0.203	0.100	0.243	0.516	0.509	1.135

The resulting estimates of the percentage change in demand given a 1 degree F increase in temperature by month and customer category are shown in Table 4.

Table 4. Expected % Change in Demand per 1 Degree F Change in Temperature

Month	SFR	MFR	BUS	MUN	IRR	GOLF
Jan	0.333	0.164	0.399	1.504	1.483	3.338
Feb	0.330	0.162	0.395	0.000	0.000	0.000
Mar	0.316	0.155	0.378	0.700	0.691	1.546
Apr	0.632	0.506	0.599	1.381	1.132	0.295
May	0.603	0.482	0.571	1.647	1.350	0.352
Jun	0.581	0.465	0.550	1.804	1.479	0.385
Jul	0.872	0.000	0.000	0.447	0.204	0.993
Aug	0.850	0.000	0.000	0.457	0.208	1.017
Sep	0.853	0.000	0.000	1.188	0.541	2.655
Oct	0.885	0.000	0.000	0.985	0.448	2.197
Nov	0.310	0.153	0.372	1.400	1.381	3.105
Dec	0.340	0.167	0.407	2.115	2.086	4.710

Step 3: Estimate Annual % Change in Demand per 1 Degree F Change in Temperature for Each Customer Category

The next step is to use each customer categories seasonal demand index to estimate the percentage change in annual demand per 1 degree F change in temperature. The seasonal demand indices for the customer categories were estimated using the econometric demand models and are shown in Table 5.

Table 5. Seasonal Demand Indices

Month	SFR	MFR	BUS	MUN	IRR	GOLF
Jan	6.02	7.62	6.96	3.14	1.97	0.18
Feb	5.94	7.69	7.19	3.06	2.09	0.29
Mar	6.11	7.57	7.30	3.47	2.88	0.43
Apr	7.06	7.86	7.81	6.75	6.92	3.89
May	9.45	8.77	8.94	10.55	10.75	9.54
Jun	10.58	9.17	9.68	13.03	13.69	15.32
Jul	11.33	9.25	10.34	14.81	14.97	17.92
Aug	11.14	9.21	10.18	15.22	14.44	19.26
Sep	10.44	8.85	9.14	12.21	13.44	15.59
Oct	8.63	8.51	8.26	9.06	9.90	11.35
Nov	6.95	7.88	7.27	5.28	5.76	5.02
Dec	6.35	7.61	6.92	3.42	3.18	1.21
Total	100.00	100.00	100.00	100.00	100.00	100.00

Denoting the monthly change in demand from Table 4 for customer category j as d_{ij} and the monthly seasonal index value from Table 5 as s_{ij} , then the percentage change in annual demand for customer category j, D_j , per 1 degree F change in temperature is given by

$$D_j = \frac{1}{100} \sum_{i=1}^{12} d_{ij} \times s_{ij}$$

The results of this calculate for each customer category is given in Table 6.

Table 6. Expected % Change in Demand per 1 Degree F Change in Monthly Average Maximum Daily Air Temperature

Customer Category	% change in demand per 1 degree F
SFR	0.62
MFR	0.19
BUS	0.29
MUN	1.09
IRR	0.80
GOLF	1.38

Step 4: Estimate Annual % Change in Demand per 1 Degree F Change in Temperature for Total Demand

The final step is to construct the consumption-weighted average change in annual demand across all customer categories. This was done using the customer category demand shares given in Table 7.

Table 7. Customer Category Demand Shares

Year	SFR	MFR	BUS	MUN	IRR	GOLF	IND
2001	1486	859	717	63	130	110	342
2002	1503	836	696	60	129	114	233
2003	1502	812	666	64	132	108	247
2004	1521	798	671	55	124	80	229
2005	1424	798	671	55	124	80	229
2006	1359	752	630	53	118	83	236
2007	1357	728	636	59	131	111	238
2008	1374	735	610	66	137	120	240
2009	1217	687	554	46	91	91	185
2010	1185	691	527	49	96	78	227
Total	13928	7696	6378	570	1212	975	2406
% Total	42%	23%	19%	2%	4%	3%	7%

Denoting the annual change in demand from Table 6 for customer category j as D_j and the customer category j 's share of demand from Table 7 as δ_j , then the weighted average percentage change in annual demand, D , per 1 degree F change in temperature is given by

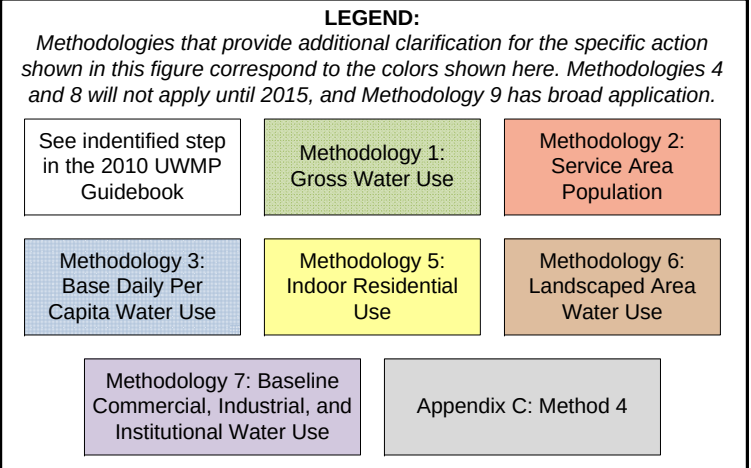
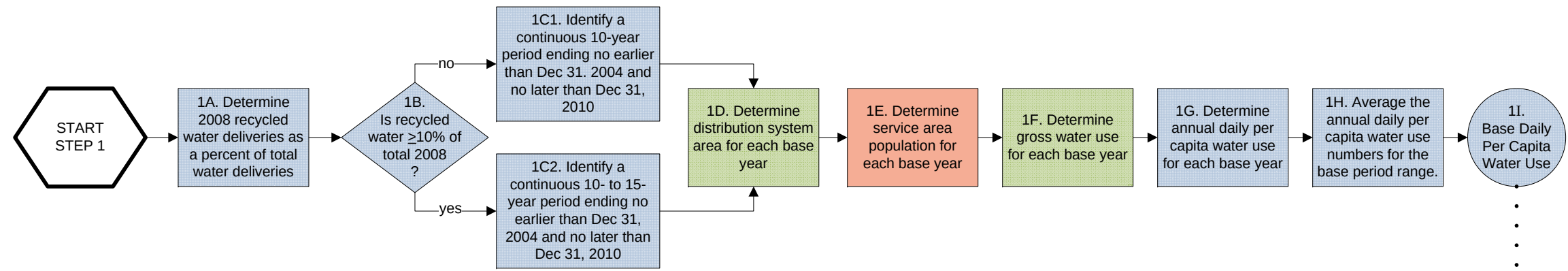
$$D = \frac{1}{100} \sum_{j=1}^7 D_j \times \delta_j$$

In this calculation, it is assumed the temperature effect for the industrial customer category is zero. The resulting value for the percentage change in total demand per 1 degree F increase in temperature is 0.45, as shown in the last row of Table 1.

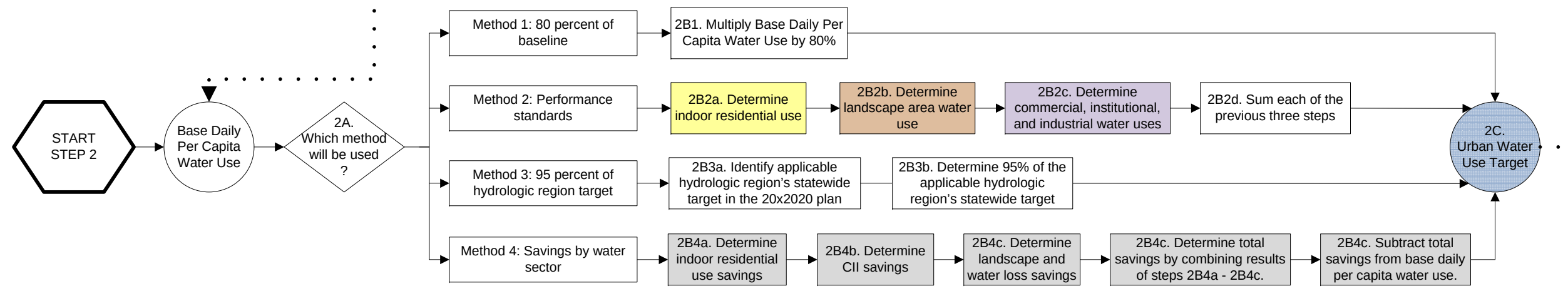
Calculation Workbook

The calculations described above are provided in the workbook "uwmp_climate_effects_workbook.xlsx."

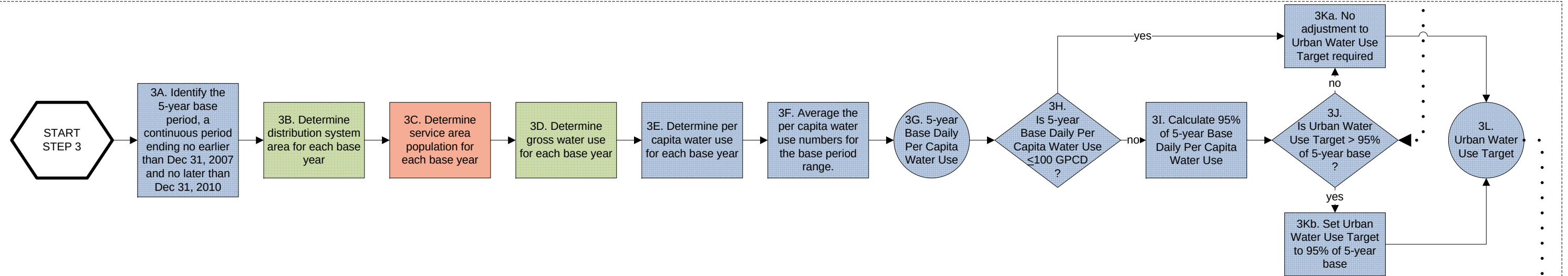
STEP 1: DETERMINE BASE DAILY PER CAPITA WATER USE



STEP 2: DETERMINE URBAN WATER USE TARGET



STEP 3: CONFIRM URBAN WATER USE TARGET



STEP 4: DETERMINE INTERIM URBAN WATER USE TARGET

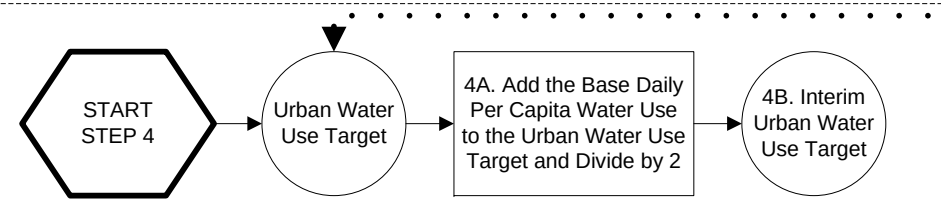


Figure D-2
Water conservation baseline and targets development process

JOINT EXERCISE OF POWERS AGREEMENT

by and among

CENTRAL WATER DISTRICT

CITY OF SANTA CRUZ

COUNTY OF SANTA CRUZ

and

SOQUEL CREEK WATER DISTRICT

creating the

SANTA CRUZ MID-COUNTY GROUNDWATER AGENCY

March 17, 2016

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**JOINT EXERCISE OF POWERS AGREEMENT
OF THE SANTA CRUZ MID-COUNTY GROUNDWATER AGENCY**

This **Joint Exercise of Powers Agreement** ("Agreement") is made and entered into as of March 17, 2016 ("Effective Date"), by and among the Central Water District, the City of Santa Cruz, the County of Santa Cruz, and the Soquel Creek Water District, sometimes referred to herein individually as a "**Member**" and collectively as the "**Members**" for purposes of forming the Santa Cruz Mid-County Groundwater Agency ("**Agency**") and setting forth the terms pursuant to which the Agency shall operate. Capitalized defined terms used herein shall have the meanings given to them in Article 1 of this Agreement.

RECITALS

- A. Each of the Members is a local agency, as defined by the Sustainable Groundwater Management Act of 2014 ("**SGMA**"), duly organized and existing under and by virtue of the laws of the State of California, and each Member can exercise powers related to groundwater management.
- B. SGMA requires designation of a groundwater sustainability agency ("**GSA**") by June 30, 2017, for groundwater basins designated by the California Department of Water Resources ("**DWR**") as medium- and high-priority basins.
- C. SGMA requires adoption of a groundwater sustainability plan ("**GSP**") by January 31, 2020, for all medium- and high-priority basins identified as being subject to critical conditions of overdraft.
- D. Each of the Members either extracts groundwater from or regulates land use activities overlying a common groundwater basin located within the mid-county coastal region of the County of Santa Cruz. This Basin includes all or part of four basins identified in DWR's Bulletin Number 118, including the following basins (designated by the name of the basin and number assigned to it in DWR-Bulletin No. 118): Soquel Valley (3-1), West Santa Cruz Terrace (3-26), Santa Cruz Purisima Formation (3-21), and Pajaro Valley Basin (3-2). All or some of these basins have been designated as medium or high priority basins. Through the Agency, the Members provided modifications to the Bulletin-118 boundaries as allowed by Title 23 of the California Code of Regulations to create a new consolidated basin called the "Santa Cruz Mid-County Groundwater Basin" with 3-1 as the number for the consolidated basin under DWR Bulletin No. 118 (hereafter "**Basin**").
- E. The Members intend for the Agency to develop a GSP and manage the Basin pursuant to SGMA.
- F. Under SGMA, a combination of local agencies may form a GSA through a joint powers agreement.
- G. The Members have determined that the sustainable management of the Basin pursuant to SGMA may best be achieved through the cooperation of the Members operating through a joint powers agency.
- H. The Joint Exercise of Powers Act of 2000 ("**Act**") authorizes the Members to create a joint powers authority, to jointly exercise any power common to the Members, and to exercise additional powers granted under the Act.
- I. The Act, including the Marks-Roos Local Bond Pooling Act of 1985 (Government Code sections 6584, *et seq.*), authorizes an entity created pursuant to the Act to issue bonds, and under certain circumstances, to purchase bonds issued by, or to make loans to, the Members for financing public capital

improvements, working capital, liability and other insurance needs or projects whenever doing so results in significant public benefits, as determined by the Members. The Act further authorizes and empowers a joint powers authority to sell bonds so issued or purchased to public or private purchasers at public or negotiated sales.

J. The Members have a history of collaborating on groundwater management issues in the Santa Cruz Mid-County Groundwater Basin, originally with a joint powers agreement formed in 1995 by the Soquel Creek Water District and the Central Water District, which was subsequently amended in August of 2015 to include the City of Santa Cruz and the County of Santa Cruz, to form the Soquel-Aptos Groundwater Management Committee.

K. The Members agree that by approving the creation of the Santa Cruz Mid-County Groundwater Agency they are withdrawing from and disbanding the joint powers agency formed as a result of earlier joint powers agreements originally creating the Basin Implementation Group as subsequently amended to create the Soquel-Aptos Groundwater Management Committee.

L. Based on the foregoing legal authority, the Members desire to create a joint powers authority for the purpose of taking all actions deemed necessary by the joint powers authority to ensure sustainable management of the Basin as required by SGMA.

M. The governing board of each Member has determined it to be in the Member's best interest and in the public interest that this Agreement be executed.

TERMS OF AGREEMENT

In consideration of the mutual promises and covenants herein contained, the Members agree as follows:

ARTICLE 1 DEFINITIONS

The following terms have the following meanings for purposes of this Agreement:

1.1 "Act" means the Joint Exercise of Powers Act, set forth in Chapter 5 of Division 7 of Title 1 of the Government Code, sections 6500, *et seq.*, including all laws supplemental thereto.

1.2 "Agreement" has the meaning assigned thereto in the Preamble.

1.3 "Auditor" means the auditor of the financial affairs of the Agency appointed by the Board of Directors pursuant to Section 14.3 of this Agreement.

1.4 "Agency" has the meaning assigned thereto in the Preamble.

1.5 "Basin" has the meaning assigned thereto in Recital D.

1.6 "Board of Directors" or "Board" means the governing body of the Agency as established by Article 6 of this Agreement.

1.7 "Bylaws" means the bylaws, if any, adopted by the Board of Directors pursuant to Article 11 of this Agreement to govern the day-to-day operations of the Agency.

1.8 "Director" and "Alternate Director" mean a director or alternate director appointed pursuant to Sections 6.3 and 6.4 of this Agreement. "Member Director" is a Director or Alternate Director appointed by and representing a Member agency pursuant to Section 6.1.1 of this agreement.

1.9 "DWR" has the meaning assigned thereto in Recital B.

1.10 "GSA" has the meaning assigned thereto in Recital B.

1.11 "GSP" has the meaning assigned thereto in Recital C.

1.12 "Member" means each party to this Agreement that satisfies the requirements of Section 5.1 of this Agreement, including any new members as may be authorized by the Board, pursuant to Section 5.2 of this Agreement.

1.13 "Officer(s)" means the Chair, Vice Chair, Secretary, or Treasurer of the Agency to be appointed by the Board of Directors pursuant to Section 7.1 of this Agreement.

1.14 "SGMA" has the meaning assigned thereto in Recital A.

1.15 "State" means the State of California.

ARTICLE 2 CREATION OF THE AGENCY

2.1 Creation of a Joint Powers Authority. There is hereby created pursuant to the Act a joint powers authority, which will be a public entity separate from the Members to this Agreement, and shall be known as the Santa Cruz Mid-County Joint Powers Agency ("Agency"). Within 30 days after the Effective Date of this Agreement and after any amendment, the Agency shall cause a notice of this Agreement or amendment to be prepared and filed with the office of the California Secretary of State containing the information required by Government Code section 6503.5. Within 10 days after the Effective Date of this Agreement, the Agency shall cause a statement of the information concerning the Agency, required by Government Code section 53051, to be filed with the office of the California Secretary of State and with the County Clerk for the County of Santa Cruz, setting forth the facts required to be stated pursuant to Government Code section 53051(a).

2.2 Purpose of the Agency. Each Member to this Agreement has in common the power to study, plan, develop, finance, acquire, construct, maintain, repair, manage, operate, control, and govern the water supply and water management within the Basin, either alone or in cooperation with other public or private non-member entities, and each is a local agency eligible to serve as a GSA within the Basin, either alone or jointly through a joint powers agreement as provided for by SGMA. The purpose of this Agency is to serve as the GSA for the Basin and to develop, adopt, and implement the GSP for the Basin pursuant to SGMA and other applicable provisions of law.

ARTICLE 3 TERM

This Agreement shall become effective upon execution by each of the Members and shall remain in effect until terminated pursuant to the provisions of Article 17 (Withdrawal of Members) of this Agreement.

ARTICLE 4 POWERS

The Agency shall possess the power in its own name to exercise any and all common powers of its Members reasonably related to the purposes of the Agency, including but not limited to the following powers, together with such other powers as are expressly set forth in the Act and in SGMA. For purposes of Government Code section 6509, the powers of the Agency shall be exercised subject to the restrictions upon the manner of exercising such powers as are imposed on the County of Santa Cruz, and in the event of the withdrawal of the County of Santa Cruz as a Member under this Agreement, then the manner of exercising the Agency's powers shall be those restrictions imposed on the City of Santa Cruz.

- 4.1 To exercise all powers afforded to a GSA pursuant to and as permitted by SGMA.
- 4.2 To develop, adopt and implement the GSP pursuant to SGMA.
- 4.3 To adopt rules, regulations, policies, bylaws and procedures governing the operation of the Agency and adoption and implementation of the GSP.
- 4.4 To obtain rights, permits and other authorizations for or pertaining to implementation of the GSP.
- 4.5 To perform other ancillary tasks relating to the operation of the Agency pursuant to SGMA, including without limitation, environmental review, engineering, and design.
- 4.6 To make and enter into all contracts necessary to the full exercise of the Agency's power.
- 4.7 To employ, designate or otherwise contract for the services of agents, officers, employees, attorneys, engineers, planners, financial consultants, technical specialists, advisors, and independent contractors.
- 4.8 To exercise jointly the common powers of the Members, as directed by the Board, in developing and implementing a GSP for the Basin.
- 4.9 To investigate legislation and proposed legislation affecting the Basin and to make appearances regarding such matters.
- 4.10 To cooperate and to act in conjunction and contract with the United States, the State of California or any agency thereof, counties, municipalities, public and private corporations of any kind (including without limitation, investor-owned utilities), and individuals, or any of them, for any and all purposes necessary or convenient for the full exercise of the powers of the Agency.
- 4.11 To incur debts, liabilities or obligations, to issue bonds, notes, certificates of participation, guarantees, equipment leases, reimbursement obligations and other indebtedness, and, to the extent provided for in a duly adopted Agency to impose assessments, groundwater extraction fees or other charges, and other means of financing the Agency as provided in Chapter 8 of SGMA commencing at Section 10730 of the Water Code.
- 4.12 To collect and monitor data on the extraction of groundwater from, and the quality of groundwater in, the Basin.

4.13 To establish and administer a conjunctive use program for the purposes of maintaining sustainable yields in the Basin consistent with the requirements of SGMA.

4.14 To exchange and distribute water.

4.15 To regulate groundwater extractions as permitted by SGMA.

4.16 To impose groundwater extraction fees as permitted by SGMA.

4.17 To spread, sink and inject water into the Basin.

4.18 To store, transport, recapture, recycle, purify, treat or otherwise manage and control water for beneficial use.

4.19 To apply for, accept and receive licenses, permits, water rights, approvals, agreements, grants, loans, contributions, donations or other aid from any agency of the United States, the State of California, or other public agencies or private persons or entities necessary for the Agency's purposes.

4.20 To develop and facilitate market-based solutions for the use and management of water rights.

4.21 To acquire property and other assets by grant, lease, purchase, bequest, devise, gift or eminent domain, and to hold, enjoy, lease or sell, or otherwise dispose of, property, including real property, water rights, and personal property, necessary for the full exercise of the Agency's powers.

4.22 To sue and be sued in its own name.

4.23 To provide for the prosecution of, defense of, or other participation in actions or proceedings at law or in public hearings in which the Members, pursuant to this Agreement, may have an interest and may employ counsel and other expert assistance for these purposes.

4.24 To exercise the common powers of its Members to develop, collect, provide, and disseminate information that furthers the purposes of the Agency, including but not limited to the operation of the Agency and adoption and implementation of the GSP to the Members, legislative, administrative, and judicial bodies, as well the public generally.

4.25 To accumulate operating and reserve funds for the purposes herein stated.

4.26 To invest money that is not required for the immediate necessities of the Agency, as the Agency determines is advisable, in the same manner and upon the same conditions as Members, pursuant to Government Code section 53601, as it now exists or may hereafter be amended.

4.27 To undertake any investigations, studies, and matters of general administration.

4.28 To perform all other acts necessary or proper to carry out fully the purposes of this Agreement.

ARTICLE 5 MEMBERSHIP

5.1 Members. The Members of the Agency shall be the Central Water District, the City of Santa Cruz, the County of Santa Cruz, and the Soquel Creek Water District, as long as they have not, pursuant to the provisions hereof, withdrawn from this Agreement.

5.2 New Members. Any public agency (as defined by the Act) that is not a Member on the Effective Date of this Agreement may become a Member upon: (a) the approval of the Board of Directors by a supermajority of at least seventy-five (75%) of the votes held among all Directors as specified in Article 9 (Member Voting); (b) payment of a pro rata share of all previously incurred costs that the Board of Directors determines have resulted in benefit to the public agency, and are appropriate for assessment on the public agency; and (c) execution of a written agreement subjecting the public agency to the terms and conditions of this Agreement.

ARTICLE 6 BOARD OF DIRECTORS AND OFFICERS

6.1 Formation of the Board of Directors. The Agency shall be governed by a Board of Directors ("Board"). The Board shall consist of eleven (11) Directors consisting of the following representatives who shall be appointed in the manner set forth in Section 6.3:

6.1.1 Two representatives appointed by the governing board of each of the following public agency Members: the Central Water District, the City of Santa Cruz, the County of Santa Cruz, and the Soquel Creek Water District.

6.1.2 Three representatives of private well owners within the boundaries of the Agency.

6.2 Duties of the Board of Directors. The business and affairs of the Agency, and all of its powers, including without limitation all powers set forth in Article 4 (Powers), are reserved to and shall be exercised by and through the Board of Directors, except as may be expressly delegated to the staff or others pursuant to this Agreement, Bylaws, or by specific action of the Board of Directors.

6.3 Appointment of Directors. The Directors shall be appointed as follows:

6.3.1 The two representatives from the Central Water District shall be appointed by resolution of the Central Water District Board of Directors.

6.3.2 The two representatives from the City of Santa Cruz shall be appointed by resolution of the City of Santa Cruz City Council.

6.3.3 The two representatives from the County of Santa Cruz shall be appointed by resolution of the County of Santa Cruz Board of Supervisors.

6.3.4 The two representatives from the Soquel Creek Water District shall be appointed by resolution of the Soquel Creek Water District Board of Directors.

6.3.5 The three representatives of private well owners shall be appointed by majority vote of the eight public agency Member Directors. The procedures for nominating the private well owners shall be set forth in the Bylaws.

6.4 Alternate Directors. Each Member may have one Alternate to act as a substitute Director for either of the Member's Directors. One Alternate shall also be appointed to act as a substitute Director for any of the three Directors representing private well owners. All Alternates shall be appointed in the same manner as set forth in Section 6.3. Alternate Directors shall have no vote, and shall not participate in any discussions or deliberations of the Board unless appearing as a substitute for a Director due to absence or conflict of interest. If the Director is not present, or if the Director has a conflict of interest which precludes participation by the Director in any decision-making process of the Board, the Alternate Director appointed to act in his/her place shall assume all rights of the Director, and shall have the authority to act in his/her absence, including casting votes on matters before the Board. Each Alternate Director shall be appointed prior to the third meeting of the Board. Alternates are strongly encouraged to attend all Board meetings and stay informed on current issues before the Board.

6.5 Requirements. Each Member's Directors and Alternate Director shall be appointed by resolution of that Member's governing body to serve for a term of four years except, for the purpose of establishing staggered terms, one of the initially-appointed Directors of each Member shall, as designated by the Member, serve an initial term of two years. A Member's Director or Alternate Director may be removed during his or her term or reappointed for multiple terms at the pleasure of the Member that appointed him or her. A Director representing private well owners may be removed or reappointed in the same manner as he or she was appointed as set forth in Section 6.3. No individual Director may be removed in any other manner, including by the affirmative vote of the other Directors.

6.6 Vacancies. A vacancy on the Board of Directors shall occur when a Director resigns or at the end of the Director's term as set forth in Section 6.5. For Member Directors, a vacancy shall also occur when he or she is removed by his or her appointing Member. For Directors representing private well owners, a vacancy shall also occur when the Director is removed as set forth in Section 6.5. Upon the vacancy of a Director, the Alternate Director shall serve as Director until a new Director is appointed as set forth in Section 6.3 unless the Alternate is already serving as a substitute Director in the event of a prior vacancy, in which case, the seat shall remain vacant until a replacement Director is appointed as set forth in Section 6.3. Members shall provide notice of any changes in Director or Alternate Director positions to the Board of Directors or its designee in writing and signed by an authorized representative of the Member.

ARTICLE 7 OFFICERS

7.1 Officers. Officers of the Agency shall be a Chair, Vice Chair, Secretary, and Treasurer. The Treasurer shall be appointed consistent with the provisions of Section 14.3. The Vice Chair, or in the Vice Chair's absence, the Secretary, shall exercise all powers of the Chair in the Chair's absence or inability to act.

7.2 Appointment of Officers. Officers shall be elected annually by, and serve at the pleasure of, the Board of Directors. Officers shall be elected at the first Board meeting, and thereafter at the first Board meeting following January 1st of each year, or as duly continued by the Board. An Officer may serve for multiple consecutive terms, with no term limit. Any Officer may resign at any time upon written notice to the Board, and may be removed and replaced by a simple majority vote of the Board.

7.3 Principal Office. The principal office of the Agency shall be established by the Board of Directors, and may thereafter be changed by a simple majority vote of the Board.

ARTICLE 8 DIRECTOR MEETINGS

8.1 Initial Meeting. The initial meeting of the Board of Directors shall be held in the County of Santa Cruz, California, within thirty (30) days of the Effective Date of this Agreement.

8.2 Time and Place. The Board of Directors shall meet at least quarterly, at a date, time and place set by the Board within the jurisdictional boundaries of one or more of the Members, and at such other times as may be determined by the Board.

8.3 Special Meetings. Special meetings of the Board of Directors may be called by the Chair or by a simple majority of Directors, in accordance with the provisions of Government Code section 54956.

8.4 Conduct. All meetings of the Board of Directors, including special meetings, shall be noticed, held, and conducted in accordance with the Ralph M. Brown Act (Government Code sections 54950, *et seq.*). The Board may use teleconferencing in connection with any meeting in conformance with and to the extent authorized by applicable law.

8.5 Local Conflict of Interest Code. The Board of Directors shall adopt a local conflict of interest code pursuant to the provisions of the Political Reform Act of 1974 (Government Code sections 81000, *et seq.*)

ARTICLE 9 MEMBER VOTING

9.1 Quorum. A quorum of any meeting of the Board of Directors shall consist of an absolute majority of Directors plus one Director. In the absence of a quorum, any meeting of the Directors may be adjourned by a vote of the simple majority of Directors present, but no other business may be transacted. For purposes of this Article, a Director shall be deemed present if the Director appears at the meeting in person or participates telephonically, provided that the telephone appearance is consistent with the requirements of the Ralph M. Brown Act.

9.2 Director Votes. Voting by the Board of Directors shall be made on the basis of one vote for each Director. A Director, or an Alternate Director when acting in the absence of his or her Director, may vote on all matters of Agency business unless disqualified because of a conflict of interest pursuant to California law or the local conflict of interest code adopted by the Board of Directors.

9.3 Affirmative Decisions of the Board of Directors. Except as otherwise specified in this Agreement, all affirmative decisions of the Board of Directors shall require the affirmative vote of a simple majority of all appointed Directors participating in voting on a matter of Agency business, provided that if a Director is disqualified from voting on a matter before the Board because of a conflict of interest, that Director shall be excluded from the calculation of the total number of Directors that constitute a majority. Notwithstanding the foregoing, a unanimous vote of all Member Directors participating in voting shall be required to approve any of the following: (i) any capital expenditure that is estimated to cost \$100,000 or more; (ii) the annual budget; (iii) the GSP for the Basin or any amendment thereto; (iv) the levying of assessments or fees; (v) issuance of indebtedness; or (vi) any stipulation to resolve litigation concerning groundwater rights within or groundwater management for the Basin.

ARTICLE 10

AGENCY ADMINISTRATION, MANAGEMENT AND OPERATION

The Board of Directors may select and implement an approach to Agency administration and management that is appropriate to the circumstances and adapted to the GSA's needs as they may evolve over time. Details of the Board's decision on Agency administration, management and operation shall be incorporated into the GSA's bylaws and reviewed and revised as needed using the established process for revising the GSA's bylaws.

ARTICLE 11

BYLAWS

The Board of Directors shall cause to be drafted, approve, and amend Bylaws of the Agency to govern the day-to-day operations of the Agency. The Bylaws shall be adopted at or before the first anniversary of the Board's first meeting.

ARTICLE 12

ADVISORY COMMITTEES

The Board of Directors may from time to time appoint one or more advisory committees or establish standing or ad hoc committees to assist in carrying out the purposes and objectives of the Agency. The Board shall determine the purpose and need for such committees and the necessary qualifications for individuals appointed to them.

ARTICLE 13

OPERATION OF COMMITTEES

Each committee shall include a Director as the chair thereof. Other members of each committee may be constituted by such individuals approved by the Board of Directors for participation on the committee. However, no committee or participant on such committee shall have any authority to act on behalf of the Agency except as duly authorized by the Board.

ARTICLE 14

ACCOUNTING PRACTICES

14.1 General. The Board of Directors shall establish and maintain such funds and accounts as may be required by generally accepted public agency accounting practices. The Agency shall maintain strict accountability of all funds and a report of all receipts and disbursements of the Agency.

14.2 Fiscal Year. Unless the Board of Directors decides otherwise, the fiscal year for the Agency shall run concurrent with the calendar year.

14.3 Appointment of Treasurer and Auditor; Duties. The Treasurer and Auditor shall be appointed in the manner, and shall perform such duties and responsibilities, specified in Sections 6505.5 and 6505.6 of the Act.

ARTICLE 15

BUDGET AND EXPENSES

15.1 Budget. Within 120 after the first meeting of the Board of Directors, and thereafter prior to the commencement of each fiscal year, the Board shall adopt a budget for the Agency for the ensuing fiscal

year no later than June 30th. In the event that a budget is not so approved, the prior year's budget shall be deemed approved for the ensuing fiscal year, and any groundwater extraction fee or assessment(s) of contributions of Members, or both, approved by the Board during the prior fiscal year shall again be assessed in the same amount and terms for the ensuing fiscal year.

15.2 Agency Funding and Contributions. For the purpose of funding the expenses and ongoing operations of the Agency, the Board of Directors shall maintain a funding account in connection with the annual budget process. The Board of Directors may fund the Agency and the GSP as provided in Chapter 8 of SGMA, commencing with Section 10730 of the Water Code, and may also issue assessments for contributions by the Members in the amount and frequency determined necessary by the Board. Such Member contributions shall be paid by each Member to the Agency within 30 days of assessment by the Board.

15.3 Return of Contributions. In accordance with Government Code section 6512.1, repayment or return to the Members of all or any part of any contributions made by Members and any revenues by the Agency may be directed by the Board of Directors at such time and upon such terms as the Board of Directors may decide; provided that (1) any distributions shall be made in proportion to the contributions paid by each Member to the Agency, and (2) any capital contribution paid by a Member voluntarily, and without obligation to make such capital contribution pursuant to Section 15.2, shall be returned to the contributing Member, together with accrued interests at the annual rate published as the yield of the Local Agency Investment Fund administered by the California State Treasurer, before any other return of contributions to the Members is made. The Agency shall hold title to all funds and property acquired by the Agency during the term of this Agreement.

15.4 Issuance of Indebtedness. The Agency may issue bonds, notes or other forms of indebtedness, as permitted under Section 4.11, provided such issuance be approved at a meeting of the Board of Directors by unanimous vote of the Member Directors as specified in Article 9 (Member Voting).

ARTICLE 16 LIABILITIES

16.1 Liability. In accordance with Government Code section 6507, the debt, liabilities and obligations of the Agency shall be the debts, liabilities and obligations of the Agency alone, and not the Members.

16.2 Indemnity. Funds of the Agency may be used to defend, indemnify, and hold harmless the Agency, each Member, each Director, and any officers, agents and employees of the Agency for their actions taken within the course and scope of their duties while acting on behalf of the Agency. Other than for gross negligence or intentional acts, to the fullest extent permitted by law, the Agency agrees to save, indemnify, defend and hold harmless each Member from any liability, claims, suits, actions, arbitration proceedings, administrative proceedings, regulatory proceedings, losses, expenses or costs of any kind, whether actual, alleged or threatened, including attorney's fees and costs, court costs, interest, defense costs, and expert witness fees, where the same arise out of, or are in any way attributable, in whole or in part, to negligent acts or omissions of the Agency or its employees, officers or agents or the employees, officers or agents of any Member, while acting within the course and scope of a Member relationship with the Agency.

ARTICLE 17 WITHDRAWAL OF MEMBERS

17.1 Unilateral Withdrawal. Subject to the Dispute Resolution provisions set forth in Section 18.9, a Member may unilaterally withdraw from this Agreement without causing or requiring termination of this Agreement, effective upon 30 days written notice to the Board of Directors or its designee.

17.2 Rescission or Termination of Agency. This Agreement may be rescinded and the Agency terminated by unanimous written consent of all Members, except during the outstanding term of any Agency indebtedness.

17.3 Effect of Withdrawal or Termination. Upon termination of this Agreement or unilateral withdrawal, a Member shall remain obligated to pay its share of all debts, liabilities and obligations of the Agency required of the Member pursuant to terms of this Agreement, and that were incurred or accrued prior to the effective date of such termination or withdrawal, including without limitation those debts, liabilities and obligations pursuant to Sections 4.11 and 15.4. Any Member who withdraws from the Agency shall have no right to participate in the business and affairs of the Agency or to exercise any rights of a Member under this Agreement or the Act, but shall continue to share in distributions from the Agency on the same basis as if such Member had not withdrawn, provided that a Member that has withdrawn from the Agency shall not receive distributions in excess of the contributions made to the Agency while a Member. The right to share in distributions granted under this Section 17.3 shall be in lieu of any right the withdrawn Member may have to receive a distribution or payment of the fair value of the Member's interest in the Agency.

17.4 Return of Contribution. Upon termination of this Agreement, any surplus money on-hand shall be returned to the Members in proportion to their contributions made. The Board of Directors shall first offer any property, works, rights and interests of the Agency for sale to the Members on terms and conditions determined by the Board of Directors. If no such sale to Members is consummated, the Board of Directors shall offer the property, works, rights, and interest of the Agency for sale to any non-member for good and adequate consideration. The net proceeds from any sale shall be distributed among the Members in proportion to their contributions made.

ARTICLE 18 MISCELLANEOUS PROVISIONS

18.1 No Predetermination or Irretrievable Commitment of Resources. Nothing herein shall constitute a determination by the Agency or any of its Members that any action shall be undertaken, or that any unconditional or irretrievable commitment of resources shall be made, until such time as the required compliance with all local, state, or federal laws, including without limitation the California Environmental Quality Act, National Environmental Policy Act, or permit requirements, as applicable, has been completed.

18.2 Notices. Notices to a Director or Member hereunder shall be sufficient if delivered to the respective Director or clerk of the Member agency and addressed to the Director or clerk of the Member agency. Delivery may be accomplished by U.S. Postal Service, private mail service or electronic mail.

18.3 Amendments to Agreement. This Agreement may be amended or modified at any time only by subsequent written agreement approved and executed by all of the Members.

18.4 Agreement Complete. The foregoing constitutes the full and complete Agreement of the Members. This Agreement supersedes all prior agreements and understandings, whether in writing or oral, related to the subject matter of this Agreement that are not set forth in writing herein.

18.5 Severability. Should any part, term or provision of this Agreement be decided by a court of competent jurisdiction to be illegal or in conflict with any applicable federal law or any law of the State of California, or otherwise be rendered unenforceable or ineffectual, the validity of the remaining parts, terms, or provisions hereof shall not be affected thereby, provided however, that if the remaining parts, terms, or provisions do not comply with the Act, this Agreement shall terminate.

18.6 Withdrawal by Operation of Law. Should the participation of any Member to this Agreement be decided by the courts to be illegal or in excess of that Member's authority or in conflict with any law, the validity of the Agreement as to the remaining Members shall not be affected thereby.

18.7 Assignment. The rights and duties of the Members may not be assigned or delegated without the written consent of all other Members. Any attempt to assign or delegate such rights or duties in contravention of this Agreement shall be null and void.

18.8 Binding on Successors. This Agreement shall inure to the benefit of, and be binding upon, the successors and assigns of the Members.

18.9 Dispute Resolution. In the event that any dispute arises among the Members relating to (i) this Agreement, (ii) the rights and obligations arising from this Agreement, or (iii) or a Member proposing to withdraw from membership in the Agency, the aggrieved Member or Member proposing to withdraw from membership shall provide written notice to the other Members of the controversy or proposal to withdraw from membership. Within thirty (30) days thereafter, the Members shall attempt in good faith to resolve the controversy through informal means. If the Members cannot agree upon a resolution of the controversy within thirty (30) days from the providing of written notice specified above, the dispute shall be submitted to mediation prior to commencement of any legal action or prior to withdraw of a Member proposing to withdraw from membership. The mediation shall be no less than a full day (unless agreed otherwise among the Members) and the cost of mediation shall be paid in equal proportion among the Members. The mediator shall be either voluntarily agreed to or appointed by the Superior Court upon a suit and motion for appointment of a neutral mediator. Upon completion of mediation, if the controversy has not been resolved, any Member may exercise all rights to bring a legal action relating to the controversy or (except where such controversy relates to withdrawal of a Member's obligations upon withdrawal) withdraw from membership as otherwise authorized pursuant to this Agreement.

18.10 Counterparts. This Agreement may be executed in counterparts, each of which shall be deemed an original.

18.11 Singular Includes Plural. Whenever used in this Agreement, the singular form of any term includes the plural form and the plural form includes the singular form.

18.12 Member Authorization. The legislative bodies of the Members have each authorized execution of this Agreement, as evidenced by their respective signatures below.

IN WITNESS WHEREOF, the Members hereto have executed this Agreement by authorized officials thereof.

CENTRAL WATER DISTRICT

APPROVED AS TO FORM:

By: 

Title: Board President - CWD

By: 

Title: District Counsel

CITY OF SANTA CRUZ

APPROVED AS TO FORM:

By: 

Title: City Manager
2-23-16

By: 

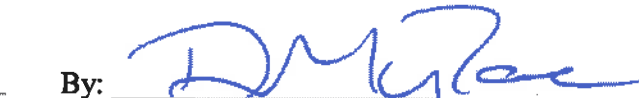
Title: Anthony P. Gandotti
City Attorney

COUNTY OF SANTA CRUZ

APPROVED AS TO FORM:

By:

Title: County Administrative
Officer

By: 

Title: County Counsel

SOQUEL CREEK WATER DISTRICT

APPROVED AS TO FORM:

By:

Title: President, Board

By: 

Title: District Counsel

Appendix A

Scope of Work for the City of Santa Cruz

Regional Recycled Water Facilities Planning Study

Detailed Scope of Work for City of Santa Cruz-Kennedy/Jenks Consultants Agreement

The following Tasks summarize the proposed scope of work to develop a Santa Cruz Regional Recycled Water Facilities Planning Study (RWFPS), which is prepared to meet the goals posed by the City of Santa Cruz (City) and satisfies the project report requirements under the State Water Resource Control Board (SWRCB) Water Recycling Funding Program Guidelines. The primary purpose of the RWFPS for the Water Department is to meet the timeline outlined in the WSAC Agreements and Recommendations Report with the development of information on recycled water alternatives by December 2016, and to develop information about the recommended recycled water alternative early in 2017 for inclusion in a separate evaluation of In Lieu/ASR, recycled water, and seawater desalination, which will be completed by the end of 2017. The primary purpose of the RWFPS for the Department of Public Works is to develop a plan to reduce wastewater discharge into the Monterey Bay by determining the footprint and cost effectiveness of its treatment, distribution, and sale to potential new customers of the regional wastewater resource managed by the City of Santa Cruz and the County of Santa Cruz Sanitation District. The Santa Cruz Regional RWFPS will also meet the requirements of the SWRCB planning grant, which will position the City to apply for future grants and financial incentives available for recycled water projects, should a recommended recycled water project rise to the top in the analysis of the three water supply options noted above. The purpose for public outreach in the Santa Cruz Regional RWFPS is to share information with the public about the topics in the RWFPS as directed by the Santa Cruz City Council, to involve stakeholders in the progress of the study, and to satisfy the requirements of the SWRCB recycled water planning grant with regard to public outreach.

Additionally, the Santa Cruz Regional RWFPS will bring together information from former and newer studies of recycled water regarding opportunities in the region, incorporating the feasibility studies that are nearing completion. Seasonal demands also require thought to make full use of the recycled water resource, which is climate independent. For example, the City may elect to implement direct potable reuse, groundwater replenishment, irrigation water of North Coast agriculture and golf courses, and/or surface water augmentation with recycled water in dry years from the Spring to the Fall. However, there could be some evaluation of utilizing more surface water from Loch Lomond reservoir during the winter season to meet regional potable water demands and rest groundwater pumping to make room for purified recycled water when dilution water is available, and bank the groundwater for use in the dry season. Kennedy/Jenks will evaluate the efficiency of using recycled water year-round for multiple end-uses, taking into consideration the combination of several end uses for tertiary and purified recycled water in the region. This work will efficiently build on previous planning and design documents by the City and other Regional entities, including the Soquel Creek Water District (District), County of Santa Cruz (County), Scotts Valley Water District (SVWD) and other

local agencies, as appropriate. This work will also build on the technical work described in the Water Supply Advisory Committee Agreements and Recommendations Final Report (City of SC, October 2015).

Summary of Work

The scope of work for the Regional RWFPS is organized to follow the State Water Resource Control Board's (SWRCB) Water Recycling Program Funding - Recommended Planning Outline for Water Recycling Projects (Appendix B). The scope is organized into ten tasks, as shown in Table 1, which align with chapters recommended in the SWRCB outline. A more detailed discussion of each task is provided in the Scope of Work section. Table 2 provides additional detail about each task, including subtasks, key deliverables, the associated format for each deliverable, the Regional RWFPS Chapter the work will feed into, the City's role, key Subconsultant roles and dependencies.

Table 1: Task Structure

Task	Regional RWFPS Chapter
Task 1 - Project Management & QA/QC	
Task 2 - Background Information	Chapter 1 – Study Area Characteristics Chapter 2 – Water Supply Characteristics and Facilities
Task 3 - RW Market Analysis	Chapter 3 – Wastewater Characteristics and Facilities Chapter 5 – Recycled Water Market
Task 4 - Treatment Evaluation / Reg Requirements	Chapter 4 – Treatment Requirements for Discharge and Reuse
Task 5 - Alternatives Analysis	Chapter 6 – Project Alternative Analysis
Task 6 – Stakeholder Involvement	Chapter 5 – Recycled Water Market
Task 7 - Recommended Project	Chapter 7 – Recommended Facilities Project Plan
Task 8 – Financial Analysis	Chapter 8 – Construction Financing Plan and Revenue Program
Task 9 – Regional RWFPS Report	
Task 10 - Meetings and Workshops	

Table 2: Sub-Task Structure, Deliverables, Roles and Dependencies

Task	Key Deliverable	Presentation Format	RWFPS Chapter(s)	Lead	City Role	Dependent on
Task 1 – PM & QA/QC						
1.1 Monthly Status Reports and Invoices	18 invoices	Email to City	n/a	K/J - Dawn	Approve Invoices	Effort to date
1.2 Status Calls/Web Meetings	36 - 1 hr calls	Conf Call/Web	n/a	K/J - Dawn	Participation	Include participants involved in current task as-needed
1.3 Subcontracting Agreements	n/a	n/a	n/a	K/J - Dawn	n/a	Scope of Work
1.4 Schedule	Monthly schedule update	digital	n/a	K/J - Dawn	Review / Comment, Schedule mtgs with Regional Stakeholders and TWG	TWG milestones and Stakeholder Mtgs
1.5 Project Setup and Establish QA/QC Program	Project Work Plan	Update as-needed	n/a	K/J - Dawn	Review / Comment	n/a
Task 2 – Background Info						
2.1 Data Collection and Review	Data Request	Tracking Table	n/a	Team	Respond/Fulfill	Availability and speed of acquisition
2.2 Study Area Characteristics	Summary Table/Figure	Draft	Chapter 1	K/J	Review and provide updated information	Data Collection and Review
2.3 Water Supply and Facilities	Summary Table/Figure	Draft	Chapter 2	K/J	Review and provide updated information	
Task 3 – Recycled Water Market Analysis						
3.1 WWTF Facility and Supply Analysis	Summary Table/Figure	Draft	Chapter 3	Trussell - K/J	Coordination with WWTF and Santa Cruz County Sanitation District (SCCSD)	SqCWD Groundwater Replenishment Recycled Water Feasibility Study
3.2 NPR Demand Analysis	Summary Tables/ Chapter Text	Draft	Chapter 5	K/J	Coordination with City Staff who will identify and communicate with customers	Available meter data from City, input from customers, input from CA State Parks and farmers regarding recycled water use on the North Coast
3.3 Recycled Water Market Survey Map	Market Survey Map	Draft	Chapter 5	K/J	Provide GIS files	RW IPR maps would include SVWD and SqCWD; Loch Lomond; RW NPR maps would include North Coast Ag, and irrigation/industrial
3.4 IPR Potential - GW Replenishment	Tech Memo #1	Draft	Chapter 5	K/J	Coordination with Groundwater Stakeholders (SVWD, SqCWD, and the Soquel-Aptos Groundwater Management Committee)	Available hydrogeologic assessments, In-Lieu ASR Feasibility Study Consultant Input from SqCWD on Mid-County GWR Project and from SVWD on RW Hansen Quarry project
3.5 IPR Potential - Reservoir Augmentation	Tech Memo #2	Draft	Chapter 5	Welch - K/J	Coordination with Stakeholders	
3.6 Streamflow Augmentation	Tech Memo #3	Draft	Chapter 5	K/J - Smith	Coordination with Stakeholders / Regulators	Input from Regulators
3.7 DPR Potential	Tech Memo #4	Draft	Chapter 5	K/J	Coordination with Stakeholders	Input from Brown and Caldwell on DPR Project
Task 4 – Treatment Eval/Reg Requirements						
4.1 Define Water Quality Objectives for Uses	Summary Tables	Draft	Chapter 4	K/J	Coordination with customers	Input from potential users
4.2 Summarize Regulatory Requirements	Summary Tables	Draft	Chapter 4	K/J		
4.3 Treatment Evaluation	Tech Memo #5	Draft	Chapter 4	Trussell - K/J	Coordination with WWTF	Input from WWTF
Task 5 – Alternatives Analysis						
5.1 Refine Long-List of Alternatives	Summary Table/Figure	Draft	Chapter 6	K/J	Coordination with Regional Stakeholders	Input from City & Regional Partners and TWG
5.2 Preliminary Screening	Summary Table	Draft	Chapter 6	K/J - GHD	Coordination with Regional Stakeholders/ Regulators	
5.3 Evaluate Short List of Alternatives	Screening Tables	Draft	Chapter 6	K/J	Coordination with Regional Stakeholders	
5.4 Alternative Capital, O&M and Life Cycle Costs	Cost Tables	Draft	Chapter 6	K/J		
Task 6 – Stakeholder Involvement						
6.1 Outreach Strategy and Advice	Materials as requested	Draft	Chapter 5	DI - K/J	Development of strategy for maintaining stakeholder communication	May include input from stakeholders and potential users
6.2 Outreach Materials and Support	Materials as requested	Draft	Chapter 5	DI - K/J	Coordination/Logistics/Materials for meetings	Questions/Requests received, collection of data for report regarding customer commitments
Task 7 – Recommended Project						
7.1 Preliminary Facilities Design Criteria	Summary Table/Figure	Draft	Chapter 7	K/J	Facilities Input	Outcome of Task 5 and City Preferences
7.2 Implementation Plan	Summary Table/Figure	Draft	Chapter 7	K/J	Operational Input	
Task 8 – Financial Analysis						
8.1 Anticipated Financing Plan	Tech Memo #6	Draft	Chapter 8	RFC	City Staff or Contract with Raftelis Financial Consultants, Inc	Cost Tables from Task 5
8.2 Revenue Projection Program	Tech Memo #6	Draft	Chapter 8	RFC	City Staff or Contract with Raftelis Financial Consultants, Inc	Cost Tables from Task 5
Task 9 – Regional RWFPS Report						
9.1 Admin Draft for City	Admin Draft	digital	n/a	K/J	Distrbute, coordinate and compile comments from City, Regional Partners and Stakeholders	
9.2 SWRCB Draft	Draft	digital/hard copy	n/a	K/J		
9.3 Final Report	Final	digital/hard copy	n/a	K/J		Distribute final document
Task 10 - Meetings and Workshops						
10.1 Kick-off Meeting (1)	Meeting Materials	digital/hard copy	n/a	K/J	Meeting Minutes	
10.2 F2F Meeting (w/ City PW and Water, TWG & Regional Partners) (2)	Meeting Materials / ppt	Draft/Final	Chapter 4/5	K/J	Create/manage TWG, logistics for workshops (coordinate, distribute materials, meeting minutes), facilitate workshop, team meeting before and after workshop	Task 3 & 4
10.3 Workshops - Alternatives Analysis/Recommended Project (2)	Meeting Materials / ppt	Draft/Final	Chapter 6	K/J		Task 5
10.4 Present Final RWFPS (1)	Meeting Materials / ppt	Draft/Final	Chapter 6	K/J		Task 5
10.5 SWRCB Mid-Course Mtg - Draft Report (1)	Meeting Materials / ppt	Draft/Final	Chapter 7	K/J		Task 7

General Assumptions

The general assumptions used to prepare this Scope of Work are summarized as follows.

- Regional Partners for this study include the Soquel Creek Water District, Scotts Valley Water District and the County of Santa Cruz Sanitation District.
- Project geographic area includes the City of Santa Cruz service area and portions of each Regional Partners service area and/or jurisdiction.
- This work will build on the technical team work described in the WSAC Agreement and Recommendations Final Report, other City and SqCWD consultants, and prior and ongoing planning work.
- Draft technical memoranda (TM), summary tables and figures produced under each task will be presented during meetings/workshops and are intended to be incorporated in the Regional RWFPS as-appropriate. Comments received will be integrated into a revised version to be incorporated into the Admin Draft Regional RWFPS for further review by the City and Regional Partners.
- Each subtask deliverable will include a draft presented during a conference call or meeting, and a final incorporating any comments. Summary tables, figures and associated text will be integrated into the Regional RWFPS as appropriate.
- The Regional RWFPS Report will include (1) administrative initial draft for review by the City and Regional Partners, (2) second draft for review by the City, Regional Partners and the SWRCB and (3) final Report for publication.
- For each deliverable, the City will provide a set of combined written comments from City and/or Regional Partners. The project schedule has been developed assuming all review comments will be received within two weeks of the draft documents' date. Comments will be discussed as required and incorporated into the final document as appropriate.
- The Kennedy/Jenks team will provide verbal progress updates to City staff during scheduled conference calls and a monthly status report will accompany each invoice for work.
- The work under this task order is assumed to be performed over an 18-month period starting upon receipt of the Notice to Proceed (NTP). If the work extends beyond this time period due to delays caused by others, the project management budget shall be increased as-required based on discussions with the City. This budget will be used to cover additional effort associated with additional meetings, invoices and coordination, etc resulting from the schedule extension.
- The Scope of Work shall be managed to be within the overall budget established for the project. Some tasks and subtasks may require more or less effort to complete, based on conditions that may be unforeseen at the time of scoping. Kennedy/Jenks reserves the right to move budget between tasks/subtasks for the base scope.
- Sampling and other field work is not included in this scope of work.
- Design or implementation of a pilot study is not included in this scope of work. Treatment technologies and facilities sizing will be evaluated using existing effluent water quality data from the Santa Cruz Wastewater Treatment Facility (WWTF), and other information provided by the City. Recommendations for bench-scale and/or pilot-scale treatment technology studies may be provided depending on the recommended project.

Public Outreach Assumptions

- Outreach activities will be coordinated with existing City Communications staff, who will provide services as described in the scope of work.
- The Kennedy/Jenks Team will prepare and present outreach materials within the scope described herein.

- As needed graphic support (layout, text & design) for collateral outreach materials and public meeting support materials such as posters, PowerPoint presentations and handouts is included up to the budgets established herein.

Services Provided by the City

The scope of work, schedule and budget assumes that the following services will be provided by City:

- The City will designate one or more individuals (as-needed) to:
 - o Serve as a point of contact to assist the Kennedy/Jenks Team in obtaining needed data and scheduling meetings, workshops, site visits as defined in the scope of work.
 - o Coordinate with other City Departments, other City consultants, potential customers, groundwater (GW) stakeholder groups, regulators and other stakeholders as-requested to support the scope of work.
 - o Coordinate, schedule and provide logistics for meetings with potential users, workshops and meetings with Regional Partners.
 - o Create and manage the Technical Working Group (TWG) and provide coordination and logistics for TWG workshops.
 - o Distribute materials, take meeting minutes and provide support as-needed during meetings/workshops.
 - o Distribute deliverables and coordinate the review process with the Regional Partners and other reviewers, and to provide consolidated comments and information to the Kennedy/Jenks team within the durations shown on the project schedule.
- The City will provide prior reports, technical memoranda, presentations and other information from prior planning efforts upon request, and in digital format if available.
- Aerial photos, GIS shapefiles, AutoCAD files and other facility information from previous planning and design efforts, or other City sources will be made available at no additional cost to the Kennedy/Jenks Team.
- The City Water Engineering and Public Works Staff will provide draft report text/tables/figures from previous planning efforts and will provide data to assist K/J GIS staff with the production of graphics for workshops as-requested.
- The City will provide relevant customer water use data including all meter data and previous demand estimates, at the start of the project to facilitate confirmation of the market assessment demands. These data will be provided in a digital format. If data input for hard copy information is required, additional scope and budget will be required.

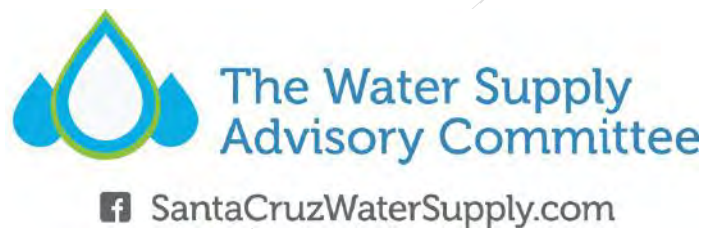
Work by Subconsultants

- Merritt Smith Consulting– Regulatory Strategy Support
- Data Instincts – Stakeholder Outreach
- Trussell Technologies – WWTF Facility/Supply Analysis, Treatment Technologies and QA/QC Support
- Stratus Consulting/Abt Associates – Triple Bottom Line Analysis
- GHD Inc. – CEQA/Environmental Compliance Support
- Michael Welch, PhD. – Reservoir Augmentation

City of Santa Cruz Water Supply Advisory Committee

Final Report on Agreements and Recommendations

October, 2015



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GLOSSARY

Active recharge: Regarding aquifer storage, active recharge implies artificially moving water from the surface into ground water systems.

Adaptation framework: General approach to enable the City and Water Department to adjust plans (i.e., to adapt) in the face of key future uncertainties, by taking account of future information as it becomes available.

Adaptive flexibility: The ability of a plan to adjust to changing circumstances and emerging information over time.

Adaptive pathway: The path forward through time, representing where and why plans may need adjustment (adaptation) as new information becomes available.

Adjustment framework: Similar to the adaptation framework, but pertaining to modest-sized adjustments to a path rather than a possible movement from one future path to another.

AFY, acre feet per year: A unit of measurement that demonstrates both water supply and demand on a municipal-wide scale. One acre foot is the volume of one acre of surface area to a depth of one foot. One acre foot is 43,560 cubic feet or 325,851 gallons.

Alternatives: Proposed solutions or alleviations to the system's supply shortfall that intend to use new or underutilized sources of water, expanding storage, and/or creating or adapting production methods.

CII: Commercial, institutional and industrial entities; non-residential customers of the Water Department.

CII MF: CII (see above) and multi-family residential customers.

Confluence®: An analytical water resources planning tool that simulates current and future water supply and demand scenarios, evaluates the results, and presents them in an understandable fashion. (Confluence was developed by Gary Fiske and Associates.)

Confluence model: The presentation of the Confluence results which provides a vast array of information in a flexible manner.

Conjunctive use: Using groundwater and surface waters together to improve water availability and reliability.

Decision nodes: Points along an adaptive pathway at which information is anticipated that may support a decision to either proceed as initially planned, or adjust the plan (e.g., switch to a different pathway forward).

Decision space: The factors, information, and time in which a decision is to be made.

Demand management: The guidance of reduced water consumption through conservation and other curtailment methods (e.g., departmental rebate for low-flow toilet installation).

Direct potable reuse: An approach to recycled water where advanced purified wastewater is introduced directly into a potable water supply distribution system.

Drought-resistant: Alternative water supply that is not highly dependent on rainfall for its source.

Econometric: A form of statistical analysis applied in the social sciences (e.g., to explain or forecast water demand).

Fish flows: Designation of specific stream flows at a particular location for a defined time, and typically follows seasonal variations with the intent of protecting and preserving resources for the surrounding environment and fish. [Ref. http://www.dfg.ca.gov/water/instream_flow.html]

Flow regime: The amount of water that is (or is required to be) found instream, across seasons and hydrologic years.

Forward osmosis (FO): Forward osmosis (FO) is an osmotic process that uses a semi-permeable membrane to effect separation of water from dissolved solutes. The driving force for this separation is an osmotic pressure gradient between a solution of high concentration, often referred to as a “draw” and a solution of lower concentration, referred to as the “feed”.

Gantt chart: A bar chart that demonstrates components of a project’s schedule.

GPCD: Gallons per capita per day, or the average daily water usage per person.

HCP: A Habitat Conservation Plan (HCP) is a required part of an application for permits to continue to take water from the San Lorenzo River and North Coast Streams. The HCP evaluates the impacts the City’s water withdrawals have on endangered fish and spells out how they will be avoided or minimized. The HCP establishes an agreed upon amount of water that is needed for fish protection, and therefore how much remains for City consumption.

Indirect potable reuse: An approach to recycled water where advanced purified water is combined with water from a natural water source (often in an aquifer or reservoir) where it can later receive more treatment before being introduced to a potable water supply distribution system.

Interest-based bargaining: A method intended to increase the effectiveness of negotiations to develop consensus. The goal is for every member of the negotiation to win something, and to do so by addressing all interests, maintain a cooperative approach, and focus on the importance of relationships among members. There is usually more than one satisfactory solution in Interest-based bargaining.

Intertie: A connecting pipeline between water systems that allows the transfer of potable water.

Karst: A terrain with distinctive landforms and hydrology created from the dissolution of soluble rocks, principally limestone and dolomite. Karst terrain is characterized by springs, caves, sinkholes, and a unique hydrogeology that results in aquifers that are highly productive but extremely vulnerable to contamination. In the United States, about 40% of the groundwater used for drinking comes from karst aquifers. [Ref. <http://water.usgs.gov/ogw/karst/pages/whatiskarst>]

MGY, Million gallons per year: A unit of measurement that demonstrates both water supply and demand on a municipal-wide scale.

Modeling and forecasting: Water supply planning and analytical tools used in designing the water system and estimating its performance and demands under various future scenarios.

Multi criteria decision system (MCDS): A framework for organizing, analyzing, and communicating considerations of proposed approaches to water supply and demand. MCDS produces a model that contains criterion and alternatives. Each criterion and alternative has a description, ratings scales, and weights.

NTUs (Nephelometric Turbidity Units): A measure of the level of turbidity, or suspended particles, in a liquid. Drinking water standards require turbidity to be in the range of ~ 0-1NTU.

Passive recharge: Regarding aquifer storage, passive recharge implies moving water naturally from the surface into ground water systems (such as by substituting surface water to supply water users, and thereby resting extraction wells).

Peak season: The months between May and October where demand for water is higher than the remaining months due to dry weather conditions and a significant increase in tourist activity.

Portfolio: Collections of potential solutions and alleviations to the system’s supply and demand shortfall distributed to the Committee to review, consider, and assess.

Production: The volume of potable water generated in a specific time period, which may vary during different times of the year and different hydrologic conditions. The difference between production

and yield is production measures each supply source, while yield measures the water supply system as a whole.

Price elasticity: Regarding demand, price elasticity is an economic term that represents the responsiveness of demand when the price of goods and/or services are subjected to changes.

Ranney collectors: A patented type of radial collector well used to extract water from a direct connection to a surface water source (e.g., a river) by extending radially under the surface floor (e.g., river bed). These radial or horizontal wells flow to a conventional well before being pumped to the surface.

Reverse osmosis: A system of filtering dissolved solids from water by driving the water through a semi-permeable membrane. Compared to forward osmosis, reverse osmosis is a high pressure driven system.

Rule curve: As applied to dam operations, for example, indicating the guidelines for how releases from the dam are managed (i.e., when to use the water, and when to store it).

Runoff: The flow of surface water from excess rain or other sources. This occurs when the source of water is distributed faster than the surface is able to absorb it, resulting in the flow of water.

Scalability: The capability to alter a project's plans to meet differing demand scenarios (ex.: adapting the plans regarding the size of a recycled water plant to produce less water for a smaller customer base than what was originally imagined).

Scenario planning: Exercises intended to demonstrate potential future water supply and demand situations (ex.: long periods of drought, lowered demand due to conservation, etc.).

Supply augmentation: Adding to the water supply.

Supply-demand gap: The difference between a water system's ability to sustainably store and provide water to its customers and the demand on the system. The amount by which demand may exceed supply, such as in the peak demand season.

Turbidity: The cloudiness or haziness of a fluid caused by the presence of particulates in the water.

UHET: Ultra high efficiency toilet.

Urban Water Management Plan: A report that fulfills the requirements described in the Urban Water Management Planning Act. The report describes the utility's water resource supplies and projects needs over a twenty-year planning horizon with relation to conservation, water service reliability, water recycling, opportunities for water transfers, and contingency plans for drought events. The latest report was published in 2010.

Yield: The resulting reduction in system-wide water shortages during the peak season when a new source is added to the system. Two measures of yield are typically shown: (1) under the worst hydrologic conditions; and (2) as an average across all hydrologic conditions. The difference between production and yield is production measures each supply source, while yield measures the water supply system as a whole.

Water year: Each water year begins October 1 and extends through September 30.

Water-neutral: As applied to development paths (i.e., levels of population or economic growth), signifying an approach that does not change overall demand for water.

Article I. Executive Summary

Appointed by City Council in 2014, the Water Supply Advisory Committee's (WSAC) charge was to *explore, through an iterative, fact-based process, the City's water profile, including supply, demand and future risks; analyze potential solutions to deliver a safe, adequate, reliable, affordable and environmentally sustainable water supply; and, to develop recommendations for City Council consideration.* This document lays out the WSAC Process, Information Developed and Considered, Analysis, Agreements and Recommendations.

The WSAC brought together a diverse set of perspectives and viewpoints from a broad sector of the community. The Committee placed a high value on transparency, trust and consensus. With that in mind, developing the "how" – the Agreements – was as critical as the "what" – the Recommendations.

The Agreements lay out strategies for how the recommendations will be implemented, with particular emphasis on how to approach managing change. The Committee agreed to a *Staggered Implementation Approach*, allowing work to begin on full scale implementation of the Strategy One elements, with clearly defined decision points, thresholds and metrics; and to begin preliminary work on Strategy Two elements. The implementation protocol is discussed in Section 3.22 of this document.

In addressing the issues of trust and transparency, the Agreements provide an in-depth *Change Management Strategy*. This strategy underscores the guidelines and principles that reflect the Committee's values and priorities, and establishes mechanisms for dealing with changes that will occur over time. The Change Management Strategy includes procedures for planning, doing, checking and acting; an Adaptive Pathway framework for implementing the three main supply recommendations; defined roles and responsibilities for Water Department staff and the Water Commission; and clear guidance for decision making. The Change Management Strategy is discussed in Section 3.24.

The overarching goal of the Committee's Plan is to provide significant improvement to the sufficiency and reliability of the Santa Cruz water supply by 2025. The recommendations made in this report reflect consensus among WSAC members for how best to address an agreed-upon worst year gap of 1.2 billion gallons between water supply and water demand during times of extended drought. The strategies recommended include: strengthened water conservation programs; storage of available San Lorenzo River flows during the rainy season in regional aquifers, through processes known as "In Lieu" water transfers, for passive recharge, and Aquifer Storage and Recovery (ASR) for active recharge; and a supply augmentation plan to use advanced-treated recycled water,¹ with desalination as a back-up, should the use of advanced-treated recycled water not be feasible. This report provides detailed information on each of the recommended strategies. Importantly, the Committee's Plan accomplishes the City's water supply goal while providing robust stream flows to support and enhance fish habitat restoration and protection.

In brief:

Strategy 0 – Conservation – In addition to the existing conservation programs such as home and business evaluations, water saving rebates, water budgets for large landscapes and free water-saving

¹ See Framework for Direct Potable Reuse: Water Reuse Foundation, American Water Works Association, Water Environment Foundation, National Water Research Institute, September 2015.

devices, the WSAC recommends looking at new programs, such as increased rebates and better management of peak season demand. The goal of these additional programs would be to further reduce demand by 200 to 250 million gallons per year (mgy) by 2035, with a particular focus on producing savings during the peak season.

Strategy One – Groundwater Storage: In Lieu Water Exchanges – In normal years, the Santa Cruz Water Department (SCWD) receives more rainfall than is needed to meet customer demand and can be stored in Loch Lomond Reservoir. Using In Lieu Water Exchanges, available winter flows would be delivered to Soquel Creek Water District (SqCWD) and/or Scotts Valley Water District (SVWD) customers, thus allowing reduced pumping from these regional aquifers and enabling the aquifer to passively rest and recharge. Using **Aquifer Storage and Recover (ASR)**, available winter flows would be injected into aquifers through new and existing wells owned by the SCWD, SVWD and/or SqCWD, thereby actively recharging aquifers. A portion of the water delivered using In Lieu or ASR would be effectively banked in the aquifers to be extracted and returned to SCWD when needed in future dry years.

Strategy Two – Advanced Treated Recycled Water or Desalinated Water would be developed as a supplemental or replacement supply in the event the groundwater storage strategies described above prove insufficient to meet the plan's goals of cost-effectiveness, timeliness or yield. If it is determined that recycled water cannot meet our needs, then desalinated seawater would be used.

With these recommendations, the Water Supply Advisory Committee has met its charge to reach consensus on how best to deliver a safe, adequate, reliable, affordable and environmentally sustainable water supply to our community by 2025. The body of this report provides the detailed information that which supports the findings reported in this Executive Summary.

Article II. Preamble

Section 2.01 Committee Charge

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

Section 2.02 Committee Membership

The following individuals were appointed to the Water Supply Advisory Committee to represent the interests listed:

Community Interest	Representative
Business Organization (Think Local First)	Peter Beckmann
City Resident	Doug Engfer
Santa Cruz Water Commission	David Green Baskin
Non-City Resident (Outside-City Water Customer)	Sue Holt
City Resident	Dana Jacobson
City Resident	Charlie Keutmann
Santa Cruz Desalination Alternatives	Rick Longinotti
Environmental Organization (Surfrider Foundation)	Sarah Mansergh
Business Organization (Santa Cruz Chamber of Commerce)	Mark Mesiti-Miller
Environmental Organization (Coastal Watershed Council)	Greg Pepping
Santa Cruz Sustainable Water Coalition	Mike Rotkin
Business Organization (Santa Cruz County Business Council)	Sid Slatter
Environmental Organization (Sierra Club)	Erica Stanojevic
Santa Cruz Water Commission	David Stearns
Santa Cruz Water Department (ex officio/non-voting member)	Rosemary Menard

Section 2.03 Committee Agreement about Decision-Making

The Committee’s decision-making processes will differ from the Council or City Commissions in that it is intended to reach consensus through a collaborative process. Therefore, the Committee will use this hierarchy of decision tools:

- i. The preferred decision tool is for the Committee to arrive at a “sense of the meeting.”

- ii. Consensus is highly desirable.
- iii. Informal voting may only be used to explore the decision space.
- iv. Formal voting may be used as a fallback when consensus fails as long as there is consensus that a vote should take place. The voting shall be by a supermajority of 10.

Section 2.04 General Context and Framing Issues

The most important element of a problem solving process is defining the problem. Yet one of the characteristics of long range planning for complex systems is that even the problem itself is difficult to define. This is true of Santa Cruz's water planning.

Like all long range planning, water supply planning must deal with the realities of an uncertain future. In a historical context, water supply planning uncertainties have included the normal sources of variability:

- Weather and its impacts on supply;
- Demand increases in the future due to growth and development;
- Demand decreases resulting from changing plumbing codes, technologies, demographics, or consumer behaviors (conservation); and
- Potential supply decreases due to regulatory requirements to release water to support threatened or endangered fish species.

Today, uncertainties related to impacts of climate change must be added to this list.

During the first phase of the WSAC's work, the Committee was presented information about a variety of decision tools that the technical and facilitation teams believed could be useful in the Committee's work. The Committee considered and applied a variety of tools:

1. Scenario planning, including portfolio development,
2. Risk analysis and risk management, and
3. Criteria based evaluation of alternatives and portfolios using a Multi-Criteria Decision Support tool (MCDS).

The Committee explored or applied all of these tools as it did its work. The Adaptation Strategy described in more detail in Section 3.24 later in this document exists largely as a result of the Committee's efforts to create a plan that would be able to respond to the new information that will emerge and the potential changes in our understanding of circumstances that will occur over time.

Section 2.05 Overview of Committee Process

The Committee's process was divided into three phases:

- A Reconnaissance Phase where the Committee learned about the water system and its issues and identified a broad range of alternatives approaches for addressing the system reliability issues;

- An Analysis Phase where more detailed information about supply, demand, the supply shortfall, and the alternative approaches to solving the problem were explored in some detail; and
- An Agreements Phase where the Committee developed the agreements and recommendations that they conveyed to the City Council. The process has been iterative without stark boundaries between the phases but with a steadily increasing level of understanding of the issues, drivers, opportunities and constraints that the Committee was dealing with.

The Committee's process has been supported by a technical team that brought a diverse range of skills, experience and expertise to the tasks the Committee defined. The Committee also selected a group of four water professionals to serve as an Independent Review Panel and provide perspective about technical issues that the Committee dealt with. Finally, the Committee was professionally facilitated by a team of individuals experienced in collaborative problem solving and multi-party negotiations.

All Committee meetings were open to the public and opportunities for public comment and input were regularly provided including, specifically, in advance of the Committee's taking action on any important decisions. The Committee had its own website and received and responded to all website communications received from the public. All public communications received via the website were shared with all Committee members, and with City staff and the technical team.

Section 2.06 WSAC Process and Support Team

In addition to their monthly meetings, a number of other opportunities were made available to inform the WSAC on the myriad topics and issues associated with water supply planning. Six "Modeling and Forecasting" workshops were offered to WSAC members and the community on the various tools used by the Water Department related to water supply planning. These workshops covered topics on surface and groundwater supplies, forecasting water demand, demand management, and water shortage contingency planning. There were also a series of "Enrichment" meetings which included discussions on building code impacts on water demand, fishery agency perspective on protecting and enhancing fish habitat, climate change, water transfers/exchanges as a water supply augmentation, conservation, and recycled water.

The WSAC was supported by a Facilitation Team, Independent Review Panel, and Technical Support Team as described below.

Facilitation Team: The facilitation team was hired to guide the WSAC through its process including assessing community concerns; designing the WSAC process; reviewing committee composition; assisting with establishing committee meeting agendas, format and structure, legal and ethical guidelines and other process considerations; proposing work plans, objectives and deliverables; interfacing with City staff, consultants and community members; and maintaining strong lines of communications and relationships between the City, Committee and the greater community toward the end of timely delivering a set of water supply recommendations for City Council consideration. The prime consultant was Nicholas Dewar (Public Policy Collaboration) with subconsultants Carie Fox (Fox Mediation) and Philip Murphy (InfoHarvest).

Independent Review Panel: The WSAC hired four individuals to assist them to effectively interact with the technical consulting support team by providing critical review of products created by the technical

team and offering advice or suggestions to the WSAC regarding lines of inquiry or technical questions that should be evaluated by the technical team.

- Michael A. Cloud, Registered Geologist, County of Santa Cruz (retired)
- Patrick T. Ferraro, Water Resource management, Executive Director The Silicon Valley Pollution Prevention Center (1995 – 2004); Director on the Board of the Santa Clara Valley Water District (1973 – 1995)
- Brian L. Ramaley, P.E., Drinking water supply, treatment, distribution; Director City of Newport News Department of Public Works (1989 – 2013) (retired)
- Roy L. Wolfe, PH.D., Environmental science, water resources, utility management, water research, Metropolitan Water District of Southern California (retired).

Technical Team: A number of consultants were available to develop and provide information on the various topics considered by the WSAC. Stratus Consulting functioned as a general contractor and, together with Water Department staff, orchestrated the work of a number of subject matter experts. Stratus Consulting and the other consultants listed below were approved by the WSAC at their May, June, August and September 2014 meetings.

- Stratus Consulting Inc. acted as general contractor to the WSAC. Stratus provided environmental research, analytics and consulting services and responded to technical and analytical issues.
- Brown and Caldwell provided engineering support services, developing conceptual level designs and cost estimates on a myriad of options.
- Balance Hydrologics provided information related to stream flows and impacts to those flows resulting from climate change and potential release requirements for fish and other habitat.
- Gary Fiske and Associates developed the Confluence model to assist utilities manage water supply resources. Gary has consulted to the City for many years and assisted the WSAC evaluate various water supply alternatives.
- Hagar Environmental Science provided information to the WSAC on fisheries and aquatic issues as they relate to water resource management and aquatic species conservation.
- Lennihan Law provided information related to water rights.
- Maddaus Water Management Inc. has several decades of experience with water resource planning, water demand management and conservation. Maddaus has worked with the Water Department on several water conservation master planning efforts and worked with the WSAC on several occasions to discuss conservation practices and approaches to lower Santa Cruz demands.
- M. Cubed developed an econometric demand model during the WSAC to more comprehensively evaluate the water demands of the city and its influencing factors.

Article III. Agreements

Section 3.01 Introduction

This Article summarizes the work the Committee members did in several major topic areas that were key to developing their understanding of the issues and their recommendations to the Council. Each of the following sections describes a topic, summarizes the Committee's work on that topic, presents any agreement that the Committee reached about that topic, and articulates the key assumptions.

The analysis, assumptions and agreements presented in this section create the foundation for the Committee's recommendations to the City Council presented in Article IV.

Section 3.03 begins with a brief statement about the nature of Santa Cruz's water supply problem that was based on conventional wisdom and past studies and analysis. The analysis described in Section 3.04 through Section 3.07 deconstructs and then reconstructs that conventional wisdom to quantify the supply-demand gap and to include the potential impacts of fish flow releases and climate change on the size and characteristics of Santa Cruz's water supply reliability issues.

Section 3.02 Background

The Water Supply Advisory Committee's Analysis Phase work program was designed around the use of scenario planning to explore and evaluate a range of alternatives. This section summarizes the basic work to date and provides an overview of the products developed to support the Committee's work. Several additional documents are attached to this document as appendices; they provide more detailed information where such information was thought to be relevant and potentially of interest.

The key ingredients of the Committee's scenario planning include:

- Problem definition
 1. Forecasts of current and future water demand;
 2. Analyses of supply available to meet current and future water demand; and
 3. Identification of probable and plausible challenges that will need to be addressed in the future; in this case these include a probable requirement for releasing water for fish flows and plausible impacts of climate change.
- Solution development
 - o A range of demand management (water conservation) and supply augmentation alternatives that can be combined in various portfolios to meet the supply demand gap; and
 - o Evaluation criteria to use in considering the portfolios created.

The following sections provide a high level summary of the Committee's progress in their work related to scenario planning and, where relevant, links are provided to more detailed information, typically found in materials developed for committee meetings. In addition, comprehensive information about the Committee's work is available through its website: www.santacruzwatersupply.com.

Section 3.03 Preliminary Problem Definition

Over the many years that Santa Cruz has been studying ways to improve the reliability of its water supply, the problem has been defined in a variety of ways that were relevant at the time. Today, it is fair to say that the fundamental cause of the Santa Cruz water system's reliability problem is the inability to store sufficient volumes of available winter flows for use in the driest years and/or the lack of a supply that does not depend on those flows. At least one of these is needed to ensure an adequate and dependable supply during water years classified as critically dry and, to some degree, dry.

Section 3.04 Historical Context – The Challenge of Variability

The City uses a water year classification system as an index of water supply conditions for operations, to forecast river flows, and to communicate its water supply status to the public. The system is based on total annual runoff in the San Lorenzo River, the City's most important source, measured at the Big Trees gage in Henry Cowell Redwoods State Park.

Annual discharge of the San Lorenzo River was selected as the best individual benchmark of the City's water supply condition for two reasons. First, the river is the city's single largest source of drinking water, providing about half the normal annual supply. Second, about three quarters of all the water used by city water customers is obtained from a flowing source of supply. In general, the higher the volume discharged from the San Lorenzo River means that:

- the local watersheds in the Santa Cruz mountains are more saturated;
- the stream sources will flow at higher levels later into the dry season; and
- there is more water available from all surface water sources, including the reservoir, to meet system demands over the course of the year.

The converse is also generally true: the lower the volume discharged by the San Lorenzo River means less water is available from all surface water sources to meet system demands.

Under this classification system, the water year (October 1- September 30) is designated as one of four types: wet, normal, dry, or critically dry, depending on the total annual river discharge, as follows:

Table 1 – Water Year Classification System

Classification	Runoff (ac-ft)
Wet	> 119,000
Normal	49,000 - 119,000
Dry	29,000 – 49,000
Critically Dry	<29,000

Figure 1 and Figure 2 show two versions of local, historical information for water years (October 1 to September 30) classified into water-year types. These are familiar figures to many, but the purpose of including them up front is to emphasize two issues:

- Figure 1 shows the data sorted chronologically over the period from 1921 - 2015². This view underlines the significant variability of the data emphasizing the fact that the City has no certainty about what the following year will bring, nor any certainty about how long any pattern may last. Average runoff during this period is about 93,000 acre-feet or 30 billion gallons³. The least amount of runoff, 9,500 ac-ft, occurred in the drought of 1977. The maximum recorded discharge was over 280,000 ac-ft in 1983, one of the wettest years on record in California. This natural variation in the level of runoff available in local streams and rivers, from which the City draws the majority of its supply, is the major factor that results in an inconsistent level of water supply from year to year.
- Figure 2 sorts the data into year types, showing the number of years that have historically fallen into each year type. As will be discussed later in this section, a plausible impact of climate change on Santa Cruz's water supply would be an increase, perhaps even a significant increase, in the fraction of dry and critically dry years that Santa Cruz will experience, thereby exacerbating the reliability issues the system currently faces.

² The actual period of record for the gage on the San Lorenzo River began in 1936, but synthesized flow records generated for earlier modeling studies were used to extend the period of record back to 1921.

³ One ac-ft equals 325,851 gallons; 3.07 ac-ft equals one million gallons.

Figure 1 – Water Year Classification System Based on San Lorenzo River Runoff (by year)

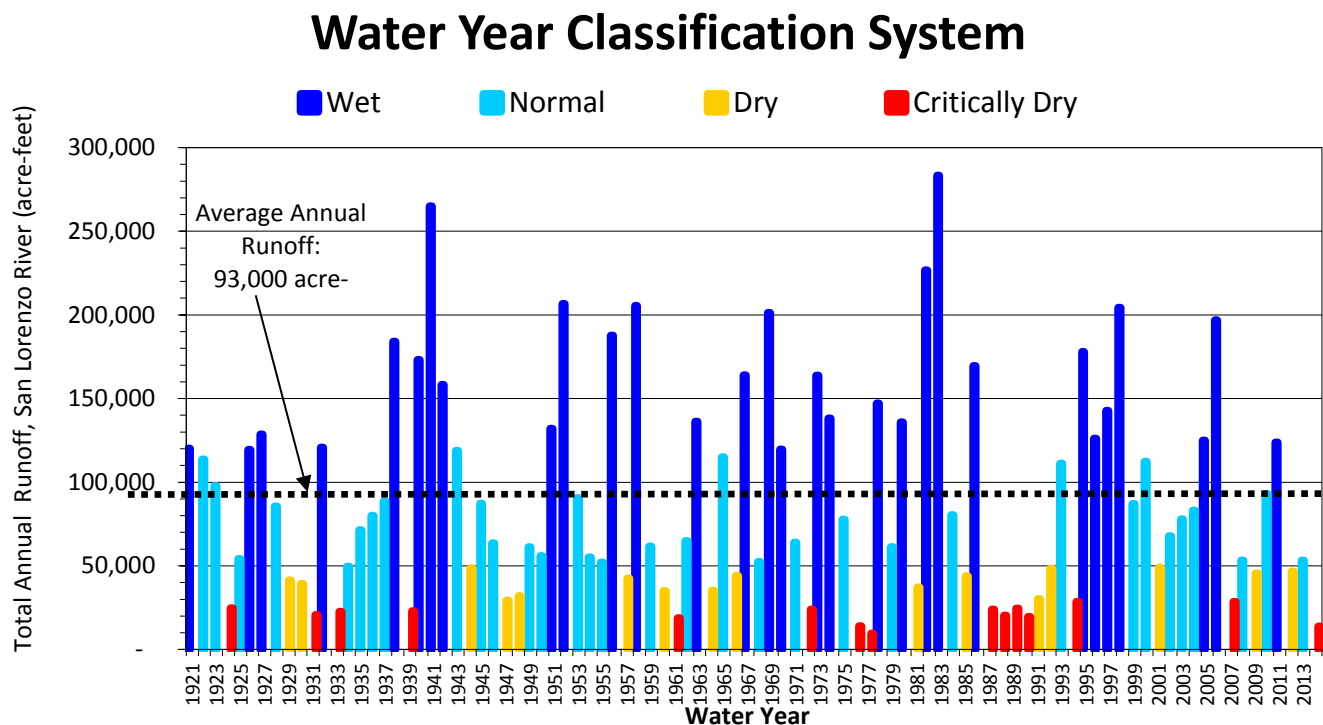
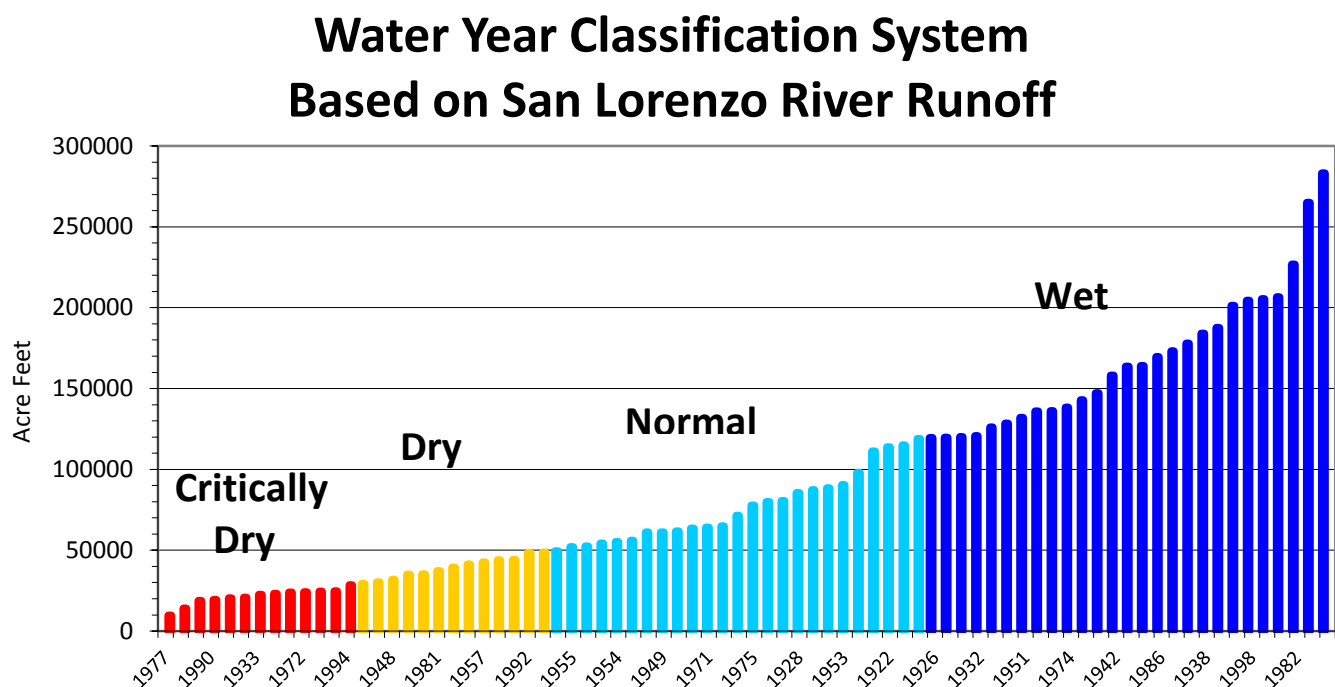


Figure 2 – Water Year Classification System Based on San Lorenzo River Runoff (by water year type)



Section 3.05 Forecast of Current and Future Water Demand

(a) Water Demand and Growth – the City General Plan

At its August 1, 2014 meeting, the Water Supply Advisory Committee agreed that using water scarcity to change the assumptions about the City’s future growth and development, as laid out in the 2010 Council adopted General Plan, was not part of the Committee’s charge from the Council. In making this agreement, the Committee recognized that there are several growth issues that are within the Committee’s purview including, for example, the potential impacts of growth on water demand for the period after that covered by the General Plan.

The Committee also acknowledged the requirements in the California Urban Water Management Planning Act (Water Code Section 10631) requiring that “... The projected population estimates shall be based upon data from the state, regional, or local service agency population projections within the service area of the urban water supplier and shall be in five-year increments to 20 years or as far as data is available.”

(b) Water Demand and Growth – UCSC Future Demands

Significant work has been done to update the water demand forecast used in the 2010 Urban Water Management Plan. This demand forecast incorporates the changes in population and development that were part of the City’s General Plan update as well as whatever up to date information was available at the time for the Water Department’s outside-city service area.

The University’s estimated build-out demand is 349 mgd. The WSAC did not generate an independent estimate of UCSC demand. The 349 mgd figure for the University’s build-out demand is based in part on its 2005 - 2020 Long Range Development Plan with added demand for the University’s Marine Science and Delaware Street facilities. The only change made by City staff to the University water demand was to extend the previous forecast of 349 mgd in 2030 further out into the future to reflect a lower, more realistic, rate of growth, with two potential endpoints: 2035 and 2050. In the lower bound forecast, build-out occurs in 2050. In the upper bound forecast it occurs in 2035. The primary forecast is the midpoint between the lower and upper bound forecasts. The forecast of UCSC demand is given in Table 2. The primary forecast almost exactly replicates a forecast based on projected enrollment and average rates of water use per student.⁴

Table 2 – Primary, High and Low Projections for University Growth

	2013*	2020	2025	2030	2035
Low	182	186	213	240	268
Primary	182	196	234	271	308
High	182	207	254	302	349
Notes					
*Actual per Water Department billing records.					

⁴ The enrollment-based approach yields a 2035 demand of 304 MG, which differs from the primary forecast by less than 2%.

(c) Interim Demand Forecast – February to April 2015

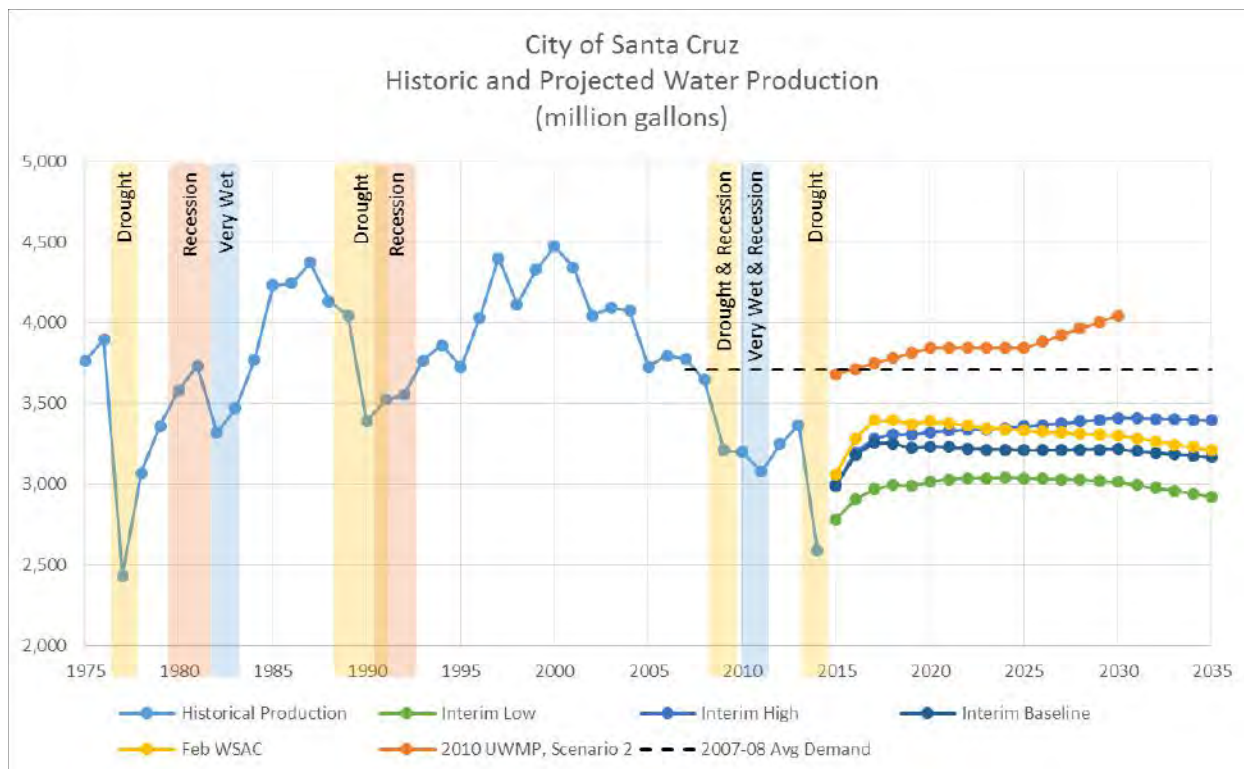
An interim demand forecast was developed by working from the demand forecast used in the 2010 Urban Water Management Plan. The 2010 Urban Water Management Plan demand forecast incorporates the changes in population and development that were part of the City's General Plan update as well as whatever up-to-date information was available at the time for the Water Department's outside-city service area at the time. Working from the 2010 forecast, the interim forecast incorporated a number of key changes including:

- Incorporating effects of existing, ongoing water conservation programs,
- Integrating the expected impacts of changes in the state's building and plumbing codes that will affect future water use in both existing and new construction,
- Adding into the forecast the effects of income changes and price increases on water use,
- Revising the projected growth of commercial services, and
- Using the university's projection of its ultimate build-out demand but extending its time for completion as described above.

The result was a forecast for current and future demand that looks substantially different from the 2010 Urban Water Management Plan forecast. Most notably, the revised forecast no longer shows an increase in water demand during the coming 20 years.

Figure 3 below portrays the interim demand forecast and incorporates the changes described above as well as the revisions to the University's growth projections described above.

Figure 3 – April 2015 Interim Demand Forecast with High and Low Forecasts



An explanation of how the high and low demand forecasts were developed can be found in the April 17, 2015 Technical Memo included in Appendix 1.⁵

At the April 30 – May 1, 2015 meeting the Committee agreed that this interim forecast would be used as the basis for the Committee’s work until the results of the econometric forecast became available.

(d) Econometric Demand Forecast – July to September 2015

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

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

i) Statistical Models of Average Demand

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

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

The forecasts of average demand by customer class are summarized in Table 3. The forecasts include adjustments for future effects of water rates, plumbing codes and the City’s baseline conservation program⁶ and are predicated on average weather and normal (predicted) income and growth.

⁵ Appendix 1 includes Technical Memos on Demand Forecasts authored by M.Cubed (D. Mitchell) and City Staff.

⁶ The baseline conservation program level is Program A in the City’s forthcoming water conservation master plan.

Table 3 – Forecasted Average Demand by Customer Class (CCF/Year)⁷

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

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

CI = 95% confidence interval.

ii) Industrial Demand

Because of its unique characteristics, industrial demand was forecasted separately from the other customer categories. In the case of industrial demand, there is a strong relationship between Santa Cruz County manufacturing employment and aggregate industrial water use. This relationship is used to generate the industrial demand forecast shown in Table 4 below.

Table 4 – Industrial Demand Forecast

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

Notes

1/ Actual per Water Department billing records.

2/ Caltrans Economic Forecast for Santa Cruz County.

iii) Population, Housing, and Non-Residential Connection Forecasts

Forecasts of population, housing units, and non-residential connections are anchored to AMBAG's 2014 Regional Growth Forecast (AMBAG 2014). Projected growth in single- and multi-family housing units are shown in Table 5 and projected growth in non-residential services (excluding industrial and UCSC) are summarized in Table 6.⁸

⁷ Table 2 through Table 7 are from M.Cubed's August 2015 Draft Final Report on its work developing the econometric demand model, which can be found in Appendix 1.

⁸ The decrease in forecasted golf acreage is due to the intention of Pasatiempo golf course to shift to non-City sources of irrigation water.

Table 5 – Forecast of Occupied Housing Units

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

Table 6 – Forecast of Non-Residential Services and City-Irrigated Golf Acreage

	2013 ^{1/}	2020	2025	2030	2035
Business ^{2/}	1,889	1,948	1,971	2,008	2,055
Municipal ^{3/}	218	218	218	218	218
Irrigation ^{4/}	452	651	723	845	951
Golf					
DeLaveaga	79	79	79	79	79
Pasatiempo	68	40	30	20	20
Total Golf	146	119	109	99	99
Notes					
1/ Actual per Water Department billing records.					
2/ Based on ratio of business to residential demand.					
3/ No expected growth in number of municipal services.					
4/ Based on historical rate of gain in irrigation services per gain in multi-family and business services.					

iv) Demand Forecasts

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

Table 7 -- Primary Forecast of Class Demands and System Production

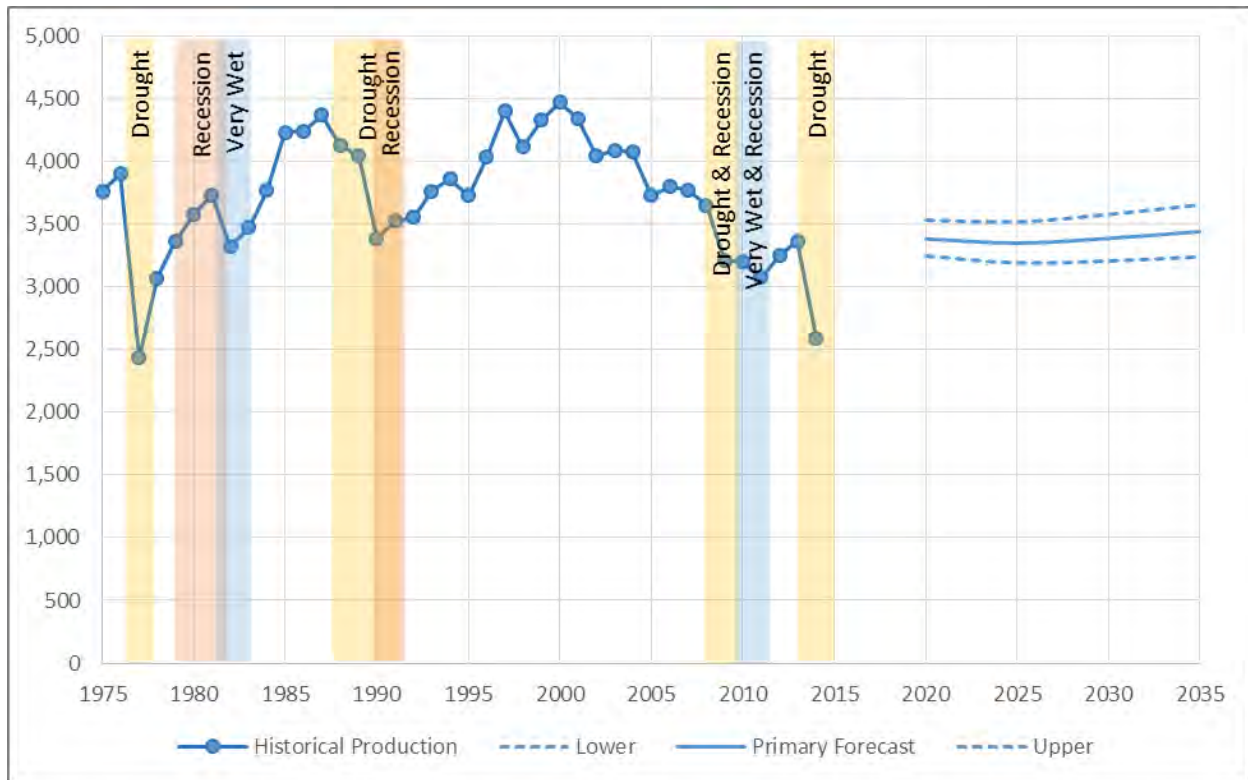
YEAR		2020	2025	2030	2035
		Forecast	Forecast	Forecast	Forecast
Service Units	Units				
SFR	Housing Units	19,456	19,854	20,260	20,636
MFR	Housing Units	18,867	19,430	20,416	21,174
BUS	Services	1,948	1,971	2,008	2,055
IND	NA	NA	NA	NA	NA
MUN	Services	218	218	218	218
IRR	Services	651	723	845	951
GOLF	Acres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

Forecasted demands are significantly lower than the 2010 UWMP forecast. The primary reasons for this are that the 2010 UWMP forecast

1. did not include adjustments for the future effects of passive and active conservation and higher water rates on future water use, and
2. assumed higher UCSC demand.

Figure 4 shows a comparison of historical production and the primary, lower, and upper bound forecasts from the econometric models. It is interesting to see how historical production has been influenced by weather and economic events. The forecast does not exhibit a similar degree of variability because it is based on average weather and normal economic conditions. In other words, it is a forecast of *expected future demand*. Realized future demand will certainly not be smooth like the forecast. It will vary about the expected value depending on year-to-year variation in future weather and economic conditions. The forecast, however, provides the baseline around which this variability is likely to occur.

Figure 4 – Historical and Forecast Production in Millions of Gallons⁹



⁹ An explanation of how the high and low demand forecasts from the economic demand model were developed can be found in the August 2015 City of Santa Cruz Water Demand Forecast report included in Appendix 1.

(e) Committee Agreement(s)

At the Committee's April 30 – May 1, 2015 meeting they agreed that the interim forecast would be used as the basis for the Committee's work until the results of the econometric forecast became available.

At its July 23, 2015 meeting, the Water Supply Advisory Committee agreed to use the econometric demand forecast as presented by David Mitchell of M Cubed Consulting at this meeting.

On September 10, 2015, the Committee accepted a revised forecast that corrected an error in the way that future plumbing and building code changes were incorporated into the forecast. Figure 4 above, reflects the revised, corrected forecast.

(f) List of Key Assumptions for Econometric Demand Forecast

- Future growth rates for service area population, housing units, and service connections are based on AMBAG's 2014 Regional Growth Projections and the City's General Plan.
- UC demand at build-out is assumed to be 349 MGY. Upper- and lower-bound demand forecasts assume UC build-out occurs in 2035 and 2050, respectively. The primary forecast uses the midpoint of the upper- and lower-bound forecasts.
- Future demand is progressively adjusted for expected water savings from national appliance standards (clothes and dish washers), California plumbing codes (showerheads, faucets, toilets, and urinals), and continuation of the City's basic conservation programs. These adjustments total approximately 370 MGY by 2035.
- The Pasatiempo Golf Course is assumed to shift off of City water so that by 2030 no more than 20 acres of the course (29%) are irrigated with City water.
- Water rates are assumed to increase by an average of 10% per year for the next five years and by an average of 4.4% per year thereafter.
- Median household income is assumed to grow at its long-term historical rate of growth (based on 30 years of census data).
- Regional unemployment and housing vacancy rates are assumed to equal their long-term average rates.
- Monthly rainfall and average maximum daily air temperature are assumed to equal their 30-year normal values.
- No restrictions on water use due to drought or other reason are assumed to be in place. The forecast assumes unrestricted customer water demands.

Section 3.06 Analysis of Supply Available to Meet Current and Projected Future Water Demand¹⁰

The projected change in demand has had an immediate and important impact on the analysis of the adequacy of current supply to meet demand. Essentially the projected stabilization and longer term reduction in demand would allow the water system to fully meet customer demand, under natural

¹⁰ Appendix 2 includes Technical Memos used in the analyses described in Sections 3.06 and 3.07.

(unconstrained) flow conditions, even in historically worst case conditions such as the 1976-1977 drought.

City staff and members of the technical team discussed this result and recognized that modeled results based on historic hydrological information underestimate the real-world likelihood of curtailments being implemented. This is because water managers making decisions in the late winter and spring of one water year may act more conservatively than the model to conserve storage in light of the uncertainty the coming months and the next water year will bring. In fact, this reality was behind City staff's recommendation for implementing Stage 3 water restrictions in the spring of 2015.

The key assumption of using natural (unconstrained) flow conditions is also an important one. Natural flows mean no externally driven constraints on the City's ability to withdraw water from its existing sources, except for those associated with the City's water rights. The likelihood of this condition being the case in the future is low. The more likely case is that the City's ability to withdraw water from its supply sources will be affected by both the need to release water for fish flows (to meet the federal and state requirements for the protection of threatened and endangered coho salmon and steelhead trout) and the impact climate change will have on available resources resulting in changed hydrology and increased likelihood of extended droughts. The implications of both of these factors on the City's future supply are discussed in more detail in the next sections.

(a) Future Challenges – Fish Flow Releases

The City has not yet finalized a flow agreement with state and federal fishery agencies. Two flow regimes have been identified and were used by the WSAC to assess water supply reliability. The lower bound flow regime is called "City Proposal" and the upper bound flow regime is called "DFG-5." Both result in less water available for diversion than the natural flows discussed above and both have different impacts on the long-term availability of water to meet City needs.

- i) Potential implications of Fish Flow Releases on the Frequency and Severity of Water Shortages

Table 8 and Table 9 respectively show the forecasted peak-season shortage profiles in 2020 and 2035.

Table 8 – 2020 Shortage Profiles

2020 Shortage Profiles						Worst-Year Peak-Season Shortage
FLOWS	Likelihood of Peak-Season Shortages					
	0%	<15%	15%-25%	25%-50%	>50%	
	0	<300 mg	300-500 mg	500-1000 mg	>1000 mg	
Natural	100%	0%	0%	0%	0%	0%
City Prop	86%	12%	0%	1%	0%	34%
DFG-5	81%	10%	7%	1%	1%	68%

Table 9 – 2035 Shortage Profiles

2035 Shortage Profiles						Worst-Year Peak-Season Shortage
FLOWS	Likelihood of Peak-Season Shortages					
	0%	<15%	15%-25%	25%-50%	>50%	
	0	<305 mg	305-515 mg	515-1025 mg	>1025 mg	
Natural	100%	0%	0%	0%	0%	0%
City Prop	86%	12%	0%	1%	0%	34%
DFG-5	81%	10%	4%	4%	1%	69%

ii) Committee Conclusions on Fish Flow Releases

The Committee discussed this information and agreed that the following conclusions can be drawn from these profiles:

- With unconstrained natural flows, there are no shortages of any magnitude under any hydrologic condition. Since we saw above that there are no expected shortages under worst-year conditions, this is not surprising.
- As expected, the DFG-5 profile is worse (i.e., results in a higher likelihood of larger shortages) than the profile for City Proposed flows. For example, in both forecast years, there is about a 10% likelihood (7 out of 73 years) of a peak-season shortage larger than 15% under DFG-5. This compares to around 1% (1 out of 73 years) under the City Proposal.
- Even under the most stringent flow regime (DFG-5), there are no expected shortages in 80% of historic hydrologic conditions. Without taking into account the possible impacts of climate change, the City's supply reliability challenges have been and will continue to be in the driest years.
- The 2020 and 2035 profiles are similar since the forecast demands for those two years are similar.
- The key conclusion is that under baseline conditions, and assuming that future hydrology looks like the historic record, the City would have sufficient supply to serve its demands in the absence of any HCP flow restrictions. Under either of the habitat conservation plan flow proposals, the City faces peak-season shortages in the driest hydrologic conditions. In those driest years, those shortages can be significant, around 700 million gallons under City-Proposed flows and 1.2 billion gallons under DFG-5 flows.

iii) Key Assumptions about Fish Flow Releases

Fish flow assumptions used in the WSAC process are based on two key data sets:

- The City's July 2012 flow proposal to state and federal agencies for flow releases for the San Lorenzo River and Laguna and Majors creeks and Liddell Springs (City Proposal); and
- The September 2012 response received from the (then) California Department of Fish and Game suggesting modifications to the City Proposal (DFG-5).

Both fish flow regimes are designed to address flow requirements needed to maintain habitat for endangered coho salmon and threatened steelhead trout during their various fresh water life-stages. Both flow regimes are indexed to the amount of water available using a modified version of the year class types shown in Figure 1 and Figure 2, which divide years into five rather than four categories and specifically link flow releases for a coming month to the year class type for the amount of water in the system in the previous month.

The ultimate resolution of fish flow requirements for the City's sources of supply will be the result of the City's negotiations with state and federal fishery agencies. Negotiated flows will be the foundation of a habitat conservation plan for the City's water system. At the completion of the environmental review of the habitat conservation plan, the City will receive a long term permit, called an Incidental Take Permit (and a state version), that will give the City an ability to plan for and operate its water system with long term certainty.

iv) Committee Agreements on Fish Flow Releases

On April 30, 2015, the WSAC agreed that, for planning purposes, using the DFG-5 flows as an upper bound or the potential impacts of fish flow releases on Santa Cruz's water system made the most sense. If the ultimate negotiated flow releases are lower, then the supply demand gap will be smaller and those results can be incorporated into future planning for supply augmentation.

(b) Potential Impacts of Climate Change

The second potentially significant factor to impact the City's current water system is climate change. With California in the throes of a deep multi-year drought, the City's water system may already be experiencing the impacts of climate change. For example, with the exception of the summer of 2011, the City has imposed some form of water restrictions on its customers every year since 2009. And this year's second consecutive year of rationing is unprecedented.

The Water Supply Advisory Committee explored the impacts on future water supply reliability of two potential manifestations of climate change:

- Longer and more severe extended droughts; and
- Changes in ongoing hydrologic patterns.

i) Extended Droughts

As the Committee began to delve into the issue of climate change, the Technical Team conducted a brief literature search to frame the discussion. A summary of information related to drought is provided here.

Recent evaluations of paleoclimate records and future climate model projections indicate that longer droughts have occurred in the past and are likely to occur again within the next century. In this section we review paleoclimate and climate change projection studies relevant to drought planning in California and the Santa Cruz region. Several publications, including some very recent ones, compare modern climate observations to historical records and to future climate projections.

Fritts (1991) shows that droughts in the Santa Cruz region were frequently much longer than three to eight years. Paleoclimate reconstruction for the California valleys show that precipitation from the 17th century until the 20th century was consistently below average 20th-century values, with long periods of relative drought and short periods of high rainfall. These data show that cycles of below-average precipitation have commonly lasted from 30 to 75 years (Fritts, 1991)¹¹.

Other paleoclimate analyses, summarized in Fritts (1991), have concluded:

- “The variability of precipitation was reconstructed to have been higher in the past three centuries than in the present” (p. 7).
- “Lower variability occurred in twentieth-century precipitation. Reconstructions of this kind should be used to extend the baseline information on past climatic variations so that projections for the future include a more realistic estimate of natural climatic variability than is available from the short instrumental record” (p. 8).

A recent publication by Cook et al. (2015)¹² compares paleoclimate drought records with future predicted conditions based on climate change models. Using tree ring data and current climate models, the authors found that drought conditions in the coming century are likely to be as bad as or worse than the most severe historical droughts in the region, with severe dry periods lasting several decades (20–30 years). In some cases, winter precipitation may increase, but gains in water during that period will most likely be lost due to hotter, drier summers and greater evaporation.

Other recent studies linking climate change, precipitation changes, and drought conditions have found that warming temperatures greatly increase drought risks in California (Diffenbaugh et al., 2015)¹³.

The historic hydrologic record on which all of the prior analyses of Santa Cruz water supplies are based only goes back to 1937. This record therefore cannot adequately capture the kind of historic variability found in these paleoclimate studies and by extension the conditions the City might face under future conditions of climate change. The WSAC technical team created an extended-drought planning scenario that represents a discrete plausible future event that can help guide water resource planning in Santa Cruz. Building on examples from utilities around the state, the Santa Cruz extended drought planning sequence combines and places back to back the City’s two worst drought sequences: 1976-77 and 1987-92. This eight-year drought sequence is worse than anything in the historic hydrologic record, but is intended to represent what might be experienced under climate change. It was combined with each of the fish flow proposals discussed above and evaluated for the frequency and severity of the shortages that would be produced. Table 10 summarizes these results.

¹¹ Fritts, H.C. 1991. *Reconstructing Large-Scale Climatic Patterns from Tree-Ring Data: A Diagnostic Analysis*. University of Arizona Press, Tucson, AZ.

¹² Cook, B.I., T.R. Ault, and J.E. Smerdon. 2015. Unprecedented 21st century drought risk in the American southwest and central plains. *Science Advances* 1(1):e1400082. doi: 10.1126/sciadv.1400082

¹³ Diffenbaugh, N.S., D.L. Swain, and D. Touma. 2015. Anthropogenic warming has increased drought risk in California. *PNAS*. doi: 10.1073/pnas.1422385112.

Table 10 – Extended drought peak-season shortage statistics (mg)

	City Proposal	DFG-5
Total 8-year (mg)	875	5,300
Average	5%	33%
Maximum	34%	69%
Minimum	0%	0%
Years > 20%	1	7

The key take-away message from Table 10 is that combining a multi-year drought with a significant commitment to fish flow releases would result in serious water shortages for Santa Cruz’s water service customers. In the eight years modeled, customers would face curtailments of greater than 20% in seven out of the eight peak seasons. On average the shortage would be 33% and in the worst year the shortage would be nearly 70%.

To put these data in perspective, prior to the droughts occurring in water years 2014 and 2015 (October 1, 2013 through September 30, 2015) Santa Cruz’s residential customers used on average about 60 gallons of water per person per day (gpcd). On average, during the extended drought modeled in this analysis, residential use would have to be reduced to 40 gpcd, and in the worst year, residential use would need to be reduced to 18 gpcd.

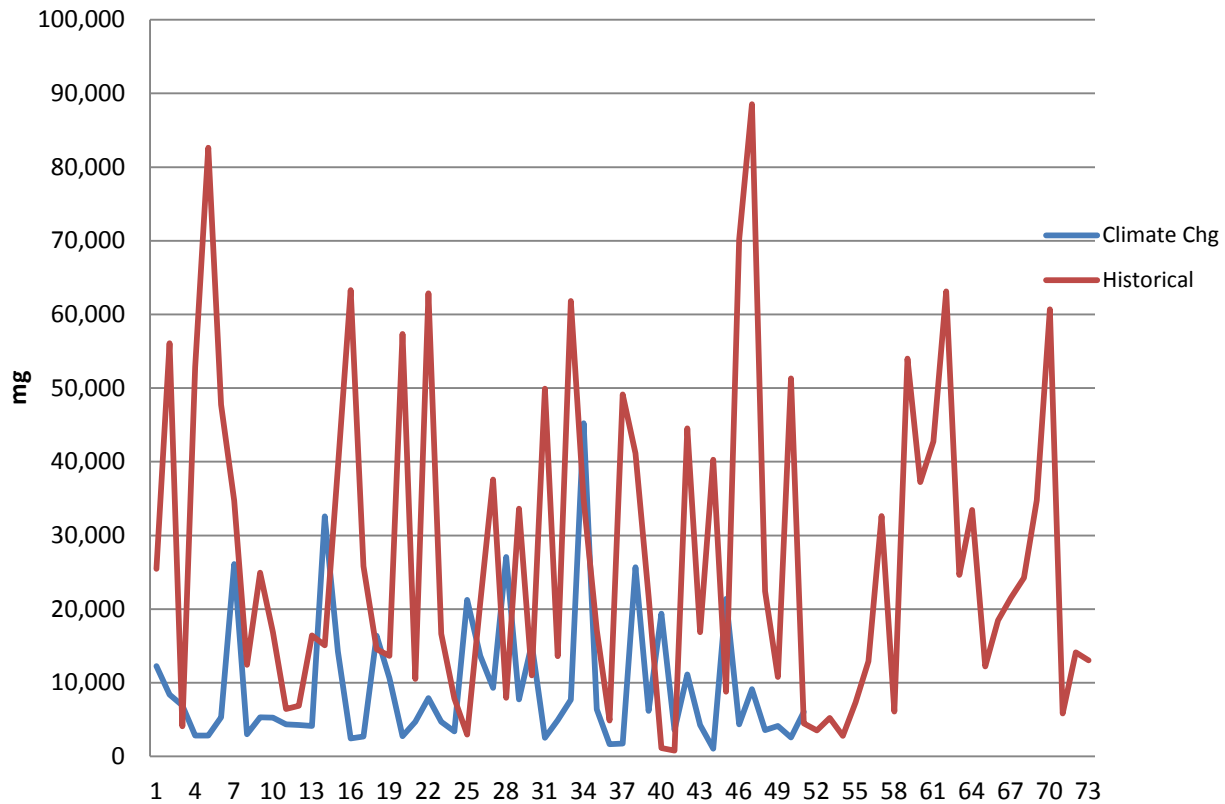
ii) Changes in Ongoing Hydrology

Across hundreds of modeling runs evaluating Santa Cruz water supplies, beginning with the 2003 Integrated Water Plan, the essential characteristics of the historic hydrologic flow record have remained constant. The worst drought event was 1976–1977. The 1987–1992 period represented another major drought. It was clear which years in the record were very wet and which were exceptionally dry.

This historical foundation on which to plan and operate water systems no longer applies when analyzing how the system will respond to potential changed hydrology driven by climate change. The essence of analyzing this type of climate change is the assumption that future weather and stream flows will not be the same as the past.

To analyze the plausible impact of climate change, a new 51 year flow record has been produced by working with hydrologic conditions that would occur in a selected global climate model and downscaling those conditions to Santa Cruz’s sources and local conditions. In the resulting flow projection, there is no longer a 1976–1977 worst-case drought benchmark or a 1987–1992 sequence. As is illustrated in Figure 5 for City proposed HCP flows at Big Trees, a standard and long-term flow gauging station on the San Lorenzo River, the distribution of flows is completely different from that of the historic record.

Figure 5 – Comparison of annual flows at Big Trees: City proposal



While the worst years in the climate change scenario are no worse than the driest historic years, the overall pattern is a considerably drier one, which might be expected to result in a higher fraction of years in which there is insufficient water to meet the needs of both Santa Cruz water customers and fisheries.

iii) Committee Agreements on Climate Change

On April 30, 2015, the WSAC agreed that the Climate (hydrologic) Change and Extended Drought scenarios provide plausible parameters to use in its water system planning and that this analysis provides a useful point of depart for its scenario planning work. For planning purposes, the Committee agreed that the eight year drought sequence was useful as a design drought, and recognized that this drought sequence would be reviewed and revised as new information became available.

iv) Key Assumptions about Climate Change

Use of climate change projections to assess potential impacts to water supply carries the following major assumptions.

1. The utilized climate projections provide plausible climate trajectories, not predictions, for the future time period simulated.
2. The utilized climate projections provide reasonably bounded potential impacts/trends to water supply for the future time period simulated.

3. The physical character and nature of the watersheds utilized by the City for water supply will not change appreciably for the future time period simulated, specifically including:
 - a. The physical characteristics which lead to development of surface runoff including types, spatial patterns and intensities of land use, and landscape scale vegetative communities and
 - b. The physical expression of instream habitat conditions based on channel morphology types, occurrences, etc.
4. Historical hydrologic characteristics of supply source watersheds are a reasonable basis to simulate general hydrologic conditions under future climate trajectories, specifically including:
 - a. The distribution of average daily flows for any month of the year over the historical period will not change appreciably during the future time period simulated and
 - b. The relative timing and magnitude of average daily flows between supply source watersheds will not change appreciably during the future time period simulated.
5. Historical utilization or exercising of water rights within the supply source watersheds will not change appreciably during the future time period simulated, and includes water rights held by the City, other water purveyors, and others.
6. Summertime and late fall stream flows will be the primary limiting condition for water supply and instream habitat, as it has been during the historical time period, for the future time period simulated.

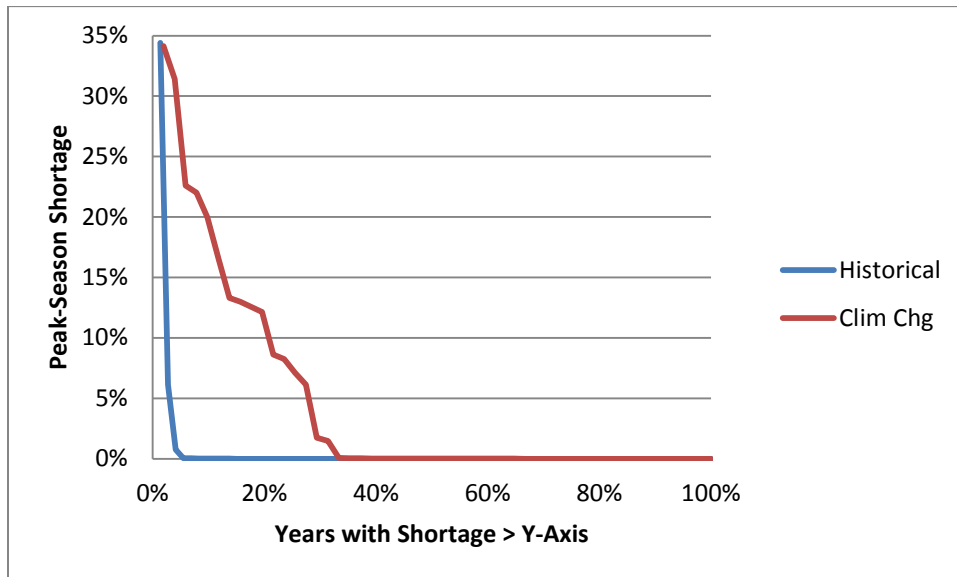
Section 3.07 How Climate Change Affects the System Modeling Results:

Combining potential fish flow releases and climate change impacts shows that climate change results in increasing both the frequency and the size of shortages. The discussion below summarizes and explores these results.

(a) City Proposed Flows

Figure 6 compares the peak-season shortage duration curves for City Proposed flows with and without climate change.

**Figure 6 – Peak season shortage duration curves with and without climate change:
City Proposed Flows**

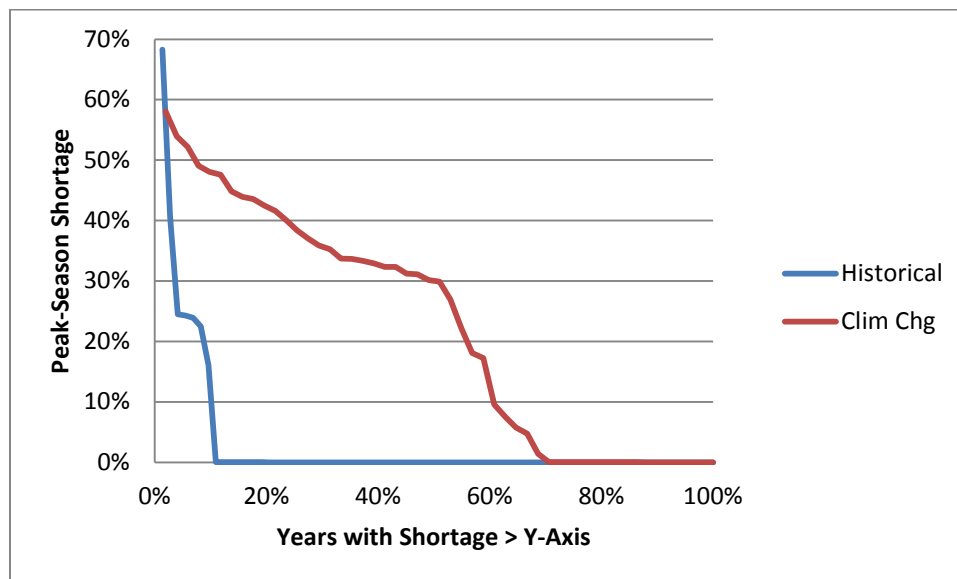


The differences between the two curves are immediately noticeable: Climate change shifts the curve upward and to the right, meaning there is an increased likelihood of larger shortages. Whereas with historic flows, there is a small chance (< 10%) of any shortage at all, this rises to more than 20% with climate change. The probability of a shortage greater than 20% increases from about 1% with historic flows to about 8% with climate change.

(b) DFG-5 Flows

Figure 7 shows the same system reliability comparisons for DFG-5 flows.

Figure 7 – Peak season shortage duration curves with and without climate change: DFG – 5 flows



While the types of impacts are similar, their magnitudes with DFG-5 are increased. For example, with DFG-5 flows and climate change there will be a peak-season shortage under nearly 70% of hydrologic conditions. In fact, a shortage exceeding 25% can be expected in just over half the years.

The foregoing results are consistent with the flow patterns of Figure 5, and highlight the importance of considering climate change as Santa Cruz plans for its water supply future. Even under the City's proposed HCP flows, which represent the potential lowest impact to Santa Cruz's water supply, water customers would have to contend with frequent shortages under this climate change scenario. If the outcome of the HCP negotiations are closer to the California Department of Fish and Wildlife's (CDFW's) DFG-5 proposal, the frequency and magnitude of shortages becomes much more onerous.

Thus with climate change, the City's water future will look qualitatively different. With historical flows, while there is a real possibility of large peak-season shortages, these are generally confined to the driest years with the large majority of conditions having no shortages. Clearly, that will not be the case with the impact of climate change. Instead, significant shortages can be expected in many years. With DFG-5 flows, large shortages can be expected in the majority of years. The pattern of water availability to customers will be markedly altered and water rationing will be both more frequent and more severe.

Section 3.08 Problem Statement

Based on the preceding analysis, the WSAC recommendations are designed to address the following revised problem statement:

Santa Cruz's water supply reliability issue is the result of having only a marginally adequate amount of storage to serve demand during dry and critically dry years when the system's reservoir doesn't fill completely. Both expected requirements for fish flow releases and anticipated impacts of climate change will turn a marginally adequate situation into a seriously inadequate one in the coming years.

Santa Cruz's lack of storage makes it particularly vulnerable to multi-year droughts. The key management strategy currently available for dealing with this vulnerability is to very conservatively manage available storage. This strategy typically results in regular calls for annual curtailments of demand that may lead to modest, significant, or even critical requirements for reduction. In addition, the Santa Cruz supply lacks diversity, thereby further increasing the system's vulnerability to drought conditions and other risks.

The projected worst-year gap between peak-season available supply and demand during an extended drought is about 1.2 billion gallons. While aggressive implementation of conservation programs will help reduce this gap, conservation alone cannot close this gap. The Committee's goal is to establish a reasonable level of reliability for Santa Cruz water customers by substantially decreasing this worst-year gap while also reducing the frequency of shortages in less extreme years.

On September 11, 2015 meeting, the Committee adopted this formal problem statement. The basic understandings reflected in this problem statement underpin all the work the Committee did during

the Analysis Phase of its process to identify, evaluate and select strategies for improving the reliability of Santa Cruz's water supply.

The Committee also noted that the Water Department is already taking steps to address the supply-demand gap, including incorporating into its Capital Improvement Plan funding for replacement of the pipeline between Felton and Loch Lomond.

Section 3.09 Data Driven Decision Making

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

After defining the problem, the Committee worked hard to use a fact-based process in its work. Section 3.10 summarizes the work the Committee did to:

- Identify and evaluate alternatives, to
- Identify and apply committee's evaluation criteria, and
- Use scenario planning and portfolio building to explore risks and uncertainties.

Section 3.10 Evaluation Criteria

Criteria that enable one to distinguish among potential solutions are essential for effective problem solving. Understanding how various alternatives or portfolios of alternatives rate against those criteria is at the heart of the Committee's problem solving process. The development of the multi-criteria decision support (MCDS) model provided a focal point for the definition of criteria, subcriteria, and rating scales. Committee members also individually prioritized the criteria by applying weights to them. A key purpose of using this approach is to support data-driven decision-making.

The Council's charge to the Committee emphasizes the importance of data-driven decision making. The goal of developing and using a MCDS tool is not to produce an outcome by "pouring in the ingredients, turning the crank and having the answer come out."

No analytical tool can (or should) completely replace the judgment and careful weighing and balancing of values, uncertainties, and risks in this kind of decision-making. Rather the goal of using such a tool is to help develop information in a form that decision-makers can effectively and efficiently use as they make their decisions.

An additional benefit is that the careful thought that goes in to the creation of the MCDS tool creates many opportunities to talk about values and interests that are important to address as the collaborative problem solving process proceeds. Creating the MCDS model required the WSAC to identify important criteria and subcriteria, define what is meant by those criteria, establish individual weights for the criteria, and create rating scales for each criterion. When the model was applied to the alternatives or portfolios the Committee developed, it allowed Committee members to see how their evaluations of the options were similar and different, and how their values were reflected in the way they prioritized the criteria.

Table 11 lists the evaluation criteria used by the Committee in the MCDS evaluation it conducted in the spring of 2015. The questions articulated in the table reflect what was relevant at the time the Committee used these criteria in their work.

In addition to using these criteria in that formal evaluation, these criteria were used more informally through much of the Committee's work during the Spring and Summer of 2015 as they worked together to identify and evaluate portfolios of measures to improve the reliability of Santa Cruz's water supply.

Table 11– WSAC Evaluation Criteria

Criterion	Questions
Technical Feasibility	How likely is each Plan to be technically successful? For Plan B, consider the technical feasibility at the time the plan would actually start
Time Required to Demonstrate Technical Feasibility	How much time is required to demonstrate whether a Plan is technically feasible? When rating Plan B, start from the time Plan B actually begins.
Time Required to Full Scale Production	What is the time required to full scale production? For all Plans, start the clock when the Plan is permitted, has all needed rights and property ownership issues resolved and is ready to proceed.
Adaptive Flexibility (includes Scalability)	What benefits in terms of adaptive flexibility is each Plan likely to contribute in the face of external conditions such as climate change, demand levels or streamflow requirements?
Supply Reliability	How likely would each Plan be to improve the reliability of the Santa Cruz water system in the face of different operating conditions such as turbidity, low flows, etc.?
Supply Diversity (Portfolio Level Only)	How does the Portfolio affect the diversity of Santa Cruz water supply portfolio?
Energy Profile	How much energy does each Plan require? Units are megawatts of energy per million gallons produced, mw/mg expressed as weighted average by Plan.
Environmental Profile	What is the environmental profile of each Plan? Note: this criterion covers a range of issues and a diversity of Plans. This is a great place to provide details about your rating using the comment button.
Regulatory Feasibility	How easy or difficult would the regulatory approval process be for these Plans?
Legal Feasibility	How easily and within what time period are these Plans likely to obtain the necessary rights in the form needed? When considering a Plan B that would start after a trigger, start the clock at the point at which the trigger actually occurs.
Administrative Feasibility	To what degree do each of the Plans require cooperation, collaboration, financial participation, and/or intergovernmental agreements to succeed? How likely is it that these can be obtained?
Potential for Grants or Special Low Interest Loans for Engineering and/or Construction	What is the potential for these Plans to qualify for grants and/or special low interest loans?
Political Feasibility	What level of political support is each Plan approach likely to have? When rating Plan B, take into account the impacts of additional time and the (hypothetical) failure of Plan A would have on Santa Cruz's political landscape.
Cost Metrics	How much do each of these Plans cost? Metric is annualized unit cost in dollars per million gallons, \$/mg.

Appendix 3 provides the detailed criteria the Committee used in its MCDS modeling and portfolio-building exercises conducted in the spring and summer of 2015.

(a) Identifying and Evaluating Solutions¹⁴

The WSAC used an iterative process to identify and evaluate alternative approaches to improving the reliability of the Santa Cruz water supply. Their efforts began with their work in the summer and fall of 2014 to identify a full range of demand management and water supply options for consideration. Since then, the WSAC, City staff and the technical team supporting the WSAC have invested considerable resources in developing and fleshing out demand management and supplemental water supply and infrastructure addition and operating change options to develop more specific planning level information for use in evaluating alternatives.

This section, describes the Committee’s iterative process for identifying and evaluating alternatives to improve the reliability of the Santa Cruz water supply.

i) Alternatives Identification: Our Water, Our Future – The Santa Cruz Water Supply Convention

During the community discussions of the desalination Draft Environmental Impact Report (DEIR), a common criticism was that the City hadn’t adequately evaluated other alternatives during the decades of water supply planning that preceded the selection of desalination in the Integrated Water Planning process in early 2000s. A key element of the Council’s decision to convene the WSAC was to have a community based process to consider alternatives to solve the water supply problem. The goal was to look in more detail at alternatives to desalination while not excluding desalination from further consideration.

As the Committee got underway in the spring of 2014, it was clear that a handful of very engaged citizens had ideas they wanted to share with the Committee regarding how to improve the reliability of the Santa Cruz water system. The challenge was to make sure that all those who might have ideas to share would have the opportunity to do so.

In June, the WSAC decided to include in its Reconnaissance phase an event that would engage the broader public by inviting those with strategies, alternatives, or ideas for improving water supply reliability to submit their proposals. The goal was to ensure that citizen and community-based ideas, as well as those provided by the technical team and other outside experts, were considered as possible strategies to improve water supply reliability in the Santa Cruz water system.

By late July, the Committee was starting to receive submissions covering a wide range of topics including but not limited to:

- Enhancing conservation efforts
- Climate appropriate landscaping improvements
- Expanding rainwater catchments and grey water systems
- Incentivizing conservation through pricing structures

¹⁴ See Appendix 4 – Identifying and Evaluating Alternatives for Committee work products and related Technical Memos.

- Revisiting old strategies such as exchanging highly treated wastewater for irrigation water used for north coast agriculture
- Developing recycled water facilities and systems
- More groundwater development
- Aquifer storage and recovery
- On-stream and off-stream storage projects
- Desalination using a variety of existing and new approaches and technologies for both the desalination process and the energy issues related to desalination.

In August those submitting ideas in the first round were invited to further develop their proposals for submission to the WSAC and for public review at an event called “*Our Water, Our Future – the Santa Cruz Water Supply Convention.*”

The *Convention* was held from 11:00 a.m. to 9:00 p.m. on Thursday, October 16, 2014 at the Civic Auditorium. More than 40 ideas were presented in poster session presentations set up around the hall. Brief oral presentations by the submitters were provided at noon and at 6:00 p.m. and attendees were invited and encouraged to visit the poster presentations of strategies, ideas, and alternatives and to interact with the submitters.

Approximately 350 people attended the convention. Attendees included most of the members of the WSAC, members of the City Council, and many staff members of the Water Department. WSAC members practiced rating and ranking the proposals using four criteria: effectiveness, environmental impact, community impact, and practicability.

Following the conclusion of the *Convention*, the WSAC continued to accept ideas and alternatives for addressing the issues that have been identified. The most recent proposal, a project for storing water in Hanson Quarry, was received in early January 2015. The Committee’s purpose in keeping the door open for submission of new proposals was to ensure that the arbitrary exercise of a deadline did not keep a great idea from being considered.

ii) Selected Alternatives

Between the Committee’s October and November meetings, WSAC members provided their technical consultant, Stratus Consulting, with their input on the alternatives identified in the *Convention* that they were most interested in considering further. Stratus’ job was to select a dozen or so alternatives that were representative of a broad range of approaches that the Committee would use in testing the decision model. Alternatives not selected as part of this effort were not eliminated from further consideration, just not selected for further evaluation in the Reconnaissance phase of the Committee’s work.

Twelve alternatives were selected by Stratus and approved by the Committee at their November meeting. The alternatives selected were:

- WaterSmart Software Implementation
- Landscaping Revisions, Rainwater Capture and Grey Water Reuse
- Water Neutral Development

- North Coast Off Stream Storage
- The Lochquifer Alternative
- Expanded Treatment Capacity on San Lorenzo River
- Ranney Collectors on San Lorenzo River
- Reuse for Agriculture
- Aquifer Restoration
- Potable Water Reuse
- Reverse Osmosis Desalination
- Forward Osmosis Desalination

The varied and often incomplete nature of the information provided by those proposing many of the alternatives submitted in the Water Supply Convention proved to be a challenge for the Committee, City staff, and the technical team. Almost immediately following the November Committee meeting, information and assumptions about the selected alternatives were needed to support the Committee's use of the Reconnaissance MCDS model. To facilitate this timing, City staff made a variety of assumptions to fill in data gaps and used this information to provide default ratings for the alternatives and scenarios in the MCDS model. Still there is was a critical need to develop reasonably accurate technical details to support further analysis.

iii) Consolidated Alternatives

From the more than 80 initial suggestions and the more than 40 proposals presented by community interests, project proponents, and City staff during and after the October 16, 2014 Water Supply Convention, the technical team created 20 Consolidated Alternatives.

"Consolidated Alternatives" were created from groups of Water Convention Alternatives with similar concepts and attributes. Consolidated Alternatives were created for a range of options and approaches such as additional demand management activities, approaches to improving storage for available system flows in the winter, to developing supply augmentation sources such as using advanced treated recycled water.

Table 12 is a list of Consolidated Alternatives and the Water Convention Alternatives they were inspired by.

Table 12 – Consolidated Alternatives

#	Name/ Water Source	Description	#	Author and comments
CA-01	Peak Season Reduction/ Conservation (mandated)	Develop programs to decrease peak season demands through peak reduction or peak-demand shifting	WCA-69	SCWD: Peak season reductions – 10%, 25% and 50%
CA-02	Water-Neutral Development/ Conservation (mandated)	Implement a demand offset program required for new development to offset new demands	WCA-03	SCDA: Water-Neutral Development
CA-03	Water conservation measures/ Conservation (voluntary)	Implement Program C Recommended (Crec) -- Maddaus Water Management, September 30, 2014, Table 4)	WCA-20	McGilvray (9): Implement Conservation
			WCA-22	SCDA: Conservation Education
			WCA-65	zNano: Conservation rebate program
			WCA-68	SCWD: Program C from Long-Term Water Conservation Master Plan
CA-04	WaterSmart Home Water Reports/ Conservation (voluntary)	Use this software to promote conservation and efficient water use	WCA-04	WaterSmart: Home Water Reports
			WCA-16	Gratz: Maximize Conservation Behavior
CA-05	Home Water Recycling/ Decentralized (graywater)	Package automatic treatment system suitable for single family home or condo or multi-family development; recycles gray water for toilet flushing and landscape irrigation; requires dual plumbing.	WCA-39	Garges: Residential Gray-Water
			WCA-66	zNano: Onsite Water re-use
			WCA-70	Home Water Recycling
CA-06	Landscaping, Capture, Reuse/ Decentralized (rainwater, graywater)	Use gray water for irrigation; minimize irrigation for lawns; capture and use rainwater for domestic, non-potable	WCA-01	Markowitz: Landscaping, Capture, Re-use
			WCA-21	SCDA: Climate Appropriate Landscape

#	Name/ Water Source	Description	#	Author and comments
CA-07	Deepwater Desalination/ Seawater	In cooperation with Soquel Creek Water District, sign up for water delivered from the Deepwater Desalination Project at Moss Landing. Work with SqCWD to create the transfer facilities for potable water conveyance. Upgrade SCWD distribution system to accept water transferred through SqCWD.	WCA-19	McGilvray: (11) Seawater Desal
			WCA-36	Aqueous: Desalination (non-membrane)
			WCA-37	Brown: Zero-emission Wave energy
			WCA-67	Tanaka: Energy Efficient Desal
			WCA-72	Seawater desalination-- Deepwater Desalination
CA-08	Water from Atmosphere/ Moist air	Extract water from the air to offset other demands	WCA-38	DewPoint : Atmospheric Water Generation
			WCA-77	SKYH2O
CA-09	Winter flows capture/ Winter flows	Capture winter flows for treatment and storage or infiltration	WCA-29	Malone: Stormwater capture
			WCA-60	SCDA: Watershed Restoration
			WCA-63	Smallman: Water Skate Parks
			WCA-71	SVWD: Quarry storage/GW recharge at Hanson Quarry
			WCA-74	McGilvray: Additional Pipeline-- Felton Diversion to Loch Lomond
			WCA-76	Bixler: Olympia Quarry
CA-10	Water Reuse for aquifer recharge/ Reclaimed water	Produce CAT water at City WWTP and pump to SVWD for aquifer recharge (IPR-- Indirect Potable Reuse).	WCA-31	McGilvray: (3) Water Capture and Transfers
			WCA-44	McGilvray: (8) Tertiary Treatment, Re-use
			WCA-62	Smallman: (17) Recycled Water
			WCA-64	Weisz: Water Recycling

#	Name/ Water Source	Description	#	Author and comments
CA-11	Water reuse for direct potable/ Reclaimed water	Produce CAT water at City WWTP and pump to GHWTP for treatment and distribution system addition, a Direct Potable Reuse (DPR) alternative.	WCA-11	SCWD: Water Reuse
			WCA-46	McKinney: Water Reuse
			WCA-64	Weisz: Water Recycling
CA-12	Water Reuse for indirect potable/ Reclaimed water	Produce CAT water at City WWTP and pump to Loch Lomond.	WCA-44	McGilvray: (8) Tertiary Treatment, Re-use
			WCA-52	Paul: (17) Detention Tub String
			WCA-62	Smallman: Recycled Water
			WCA-64	Weisz: Water Recycling
CA-13	Water Reuse for non-potable/ Reclaimed water or groundwater	The City would pump the Title 22 unrestricted effluent north through a new pipeline aligned along the railroad right of way, with turnouts to irrigate up to about 1,300 acres on private land and leased land. The City would use wells on ag land to produce water for treatment at GHWTP.	WCA-09	Ripley: Reuse for Agriculture
			WCA-40	Gratz: Recycled Water for Irrigation
			WCA-41	McGilvray: (1) Recycled Water for Irrigation
			WCA-45	McKinney: Additional Wells and WTPs
			WCA-43	McGilvray: (6,7) Pipelines Along RR Line
			WCA-64	Weisz: Water recycling
CA-14	Desal using Forward Osmosis/ Reclaimed water or seawater	Use seawater desalting through a Trevi forward osmosis (FO) system. This alternative's other components would match those for seawater desalting. The alternative has several outstanding issues, e.g., Trevi technology and other FO technologies are still in their infancy and being tested at a pilot scale. As described, Trevi would require a lower grade heat source for separately drawing the solution from the potable water but the alternative description did not designate a source for lower grade heat.	WCA-13	Trevi: Forward Osmosis Desalination (separate FAQs and technical memorandum summarize FO in its various incarnations and its implementation status around the world)

#	Name/ Water Source	Description	#	Author and comments
CA-15	Desalination using Reverse Osmosis/ Seawater	This alternative for initial comparison would use seawater desalting through a new reverse osmosis desalination facility to produce about 2.5 mgd for addition to the City potable water supply. This alternative's components and development would match those for the previously proposed scwd2 desalination facility. The City would own and operate the facility and would use the water produced year round. Excess water would allow the City either to idle the Live Oak wells for conjunctive-use aquifer recovery or to undertake Live Oak well operation in an ASR mode to restore the aquifer more rapidly. In wet years, the City could sell excess desalted to SqCWD and/or SVWD.	WCA-12	Sustainable Water Coalition:
			WCA-19	Desalination
			WCA-36	McGilvray: (11) Seawater Desal
			WCA-37	Aqueous: Desalination (non-membrane)
			WCA-67	Brown: Zero-emission Wave energy Tanaka: Energy Efficient Desal
CA-16	Aquifer restoration and storage/ Winter flows	The City would sell treated water to SqCWD during normal and wet years. SqCWD would use the transferred water for either groundwater recharge or demand reduction and conjunctive use. SqCWD would sell pumped groundwater water to City during droughts. The City also should have improved production from its Live Oak wells.	WCA-08	Paul: (13) The Lochquifer
			WCA-28	Alternatives
			WCA-49	Malone: Regional Water Exchanges (also possibly addressed through CA-11)
			WCA-59	Paul: (14) Upgrade Water Intertie
			WCA-10	SCDA: Enhance Existing Infrastructure SCDA: Regional Aquifer Restoration
CA-17	Expand Treatment Capacity/ Winter Flows	Add a new 14-mgd water treatment plant (WTP) (pretreatment for turbidity control and membrane filtration) near the Tait Street Diversion to produce treated water that would be piped directly into the distribution system. It would increase capacity to divert to Loch Lomond and produce additional water for aquifer recharge.	WCA-06	McKinney: Expanded Treatment Capacity
			WCA-27	Malone: Enhanced Storage and Recharge

#	Name/ Water Source	Description	#	Author and comments
CA-18	Off-stream water storage/ Winter Flows	Convert Liddell Quarry into 650 MG reservoir, filled with water from City North Coast diversions; use stored water to offset water demand during drought	WCA-05	Bevirt: North Coast Quarries (modified to include diversion of water from City existing sources)
			WCA-26	Fieberling: expand storage (addresses off stream storage)
			WCA-30	McGilvray (2): Quarries for Water Storage
			WCA-32	SCWD: Zayante Dam and Reservoir
			WCA-33	Smallman: Reservoirs
			WCA-34	Smallman: Storm Aquarries
CA-19	Ranney Collectors/ Winter flows	Use Ranney collectors with a 12.9-mgd capacity (maximum capacity allowed under the current City of Santa Cruz [City] diversion permit), installed near the City's Felton diversion to draw water allocated under the City's existing water rights. Water drawn through the collectors would have greatly reduced turbidity and allow continuous refilling of Loch Lomond while also operating the GHWTP. It would produce additional water for aquifer recharge.	WCA-07	McKinney: Ranney Collectors on SLR (requires a storage component to be a viable alternative)
			WCA-42	McGilvray: (4,5) Upgrade Water Treatment
			WCA-48	Paul: (12) Diversion Alternatives
			WCA-49	Paul: (14) Upgrade Water Intertie
			WCA-57	Paul: (23) Loch-Down Alternatives
CA-20	Interagency Cooperation - County Water Authority/ Institutional and Administrative	Establish Santa Cruz County Water Authority to manage water resources development and use for public agencies and private diverters and groundwater users	WCA-14	Gratz: Regional Water Authority
			WCA-15	Smallman: Regional Water Authority
			WCA-18	McGilvray: (10) Regional Collaboration

(b) Analytical Work on Alternatives

During the spring and early summer of 2015, the technical team developed and shared information with the Committee about each of the Consolidated Alternatives. The Committee worked with this material, which included information about capital, operating, and energy costs, yield, as well as

planning level information for each CA for each evaluation criteria. Based on questions raised and comments received from both Committee members and the public, the WSAC directed the technical team to do additional vetting of the CAs to understand the potential benefits and contributions to the water supply issues facing the City of Santa Cruz.

Committee members also developed and used the multi-criteria decision support (MCDS) model to individually rate CAs as well as portfolios of measures, including expressing their values by weighting the criteria. At their December 2014 and July 2015 meeting, the Committee discussed the results of their evaluations and used this information to both better understand their various interests and points of view as well as to focus the alternatives for further explanation.

Appendix 4 to this document includes some of the key technical memos and Committee reports that provide examples of the Committee's analysis of alternatives. In addition, an archive of all of the Committee's meeting materials is available on DVD and at www.santacruzwatersupply.com

(c) Alternatives Considered but Not Pursued at this Time

As the Committee explored the diverse range of CAs in some detail, some CAs emerged as being more feasible and better fitted to the WSAC's vision of how to approach improving water system reliability than others. As the technical team's research and analysis work continued, information became available about some of the alternatives that raised questions about their feasibility. For others, issues of potential scale or suitability created issues that took them out of the running. As the Committee moved into their portfolio building efforts during the summer of 2015, they directed staff and the technical team to put together a list of all the CAs and the status, including those that were no longer being considered. For each CA, information was provided about its current status, and the WCAs covered by that CA. Appendix 5 includes information about the CAs, WCA's and other submittals not selected for further consideration at this time. At its September 10, 2015 meeting the WSAC, the Committee approved the information in Appendix 5 as its conclusions about the alternatives it evaluated and its reasons for not further pursuing these alternatives at this time.

Section 3.11 Scenario Planning

Scenario planning is a tool often used to facilitate planning in the face of uncertainty. A goal of scenario planning is to explore a range of futures that are different from what would occur if current trends continue, but not so unlikely as to be a waste of time. One way to maximize the benefits of scenario planning is to create scenarios based on what are called "deep drivers of change." For Santa Cruz, the obvious deep drivers of change are climate change and fish flows.

Scenario planning isn't intended to result in the selection of a preferred scenario to pursue but to explore and get a better understanding of the degree to which key uncertainties such as climate change could affect the problem we need to solve or the outcomes we might be able to achieve. The "best" solutions are those that address conditions in multiple scenarios.

Throughout the Reconnaissance Phase of its work, the Committee used simple scenario planning to explore a range of potential water futures. For example, different scenarios were created to explore how the community's water supply needs would be affected by the need to release water for fish, the

implications of climate change, and potential changes to the local economy that would make Santa Cruz a place where people could both live and work.

During the first half of 2015, the technical team worked to develop consistent information about Consolidated Alternatives so that the Committee could use them as building blocks in the two rounds of scenario planning. Among the most important information emerging from this technical analysis was the result of system simulation modeling using the Confluence model.¹⁵ These simulations concluded that two broad approaches have the potential to completely address the City's water supply challenges:

1. Harvesting and storing winter flows. This approach can work, even with current water rights, DFG-5 instream flows, and climate change. The analysis considered how the Santa Cruz water system would benefit if there were additional storage in the form of a "virtual reservoir." To achieve this benefit, the "virtual reservoir" used in the Confluence analysis would have to become real, i.e. suitable infrastructure improvements and institutional arrangements would have to be made to have a place to reliably store sufficient water and to be able to recover and use a sufficient portion of that water. The analysis indicated that the estimated quantity, about three billion gallons, would need to be banked and be recoverable at required daily volumes. This would require increasing the capacities of various current infrastructure components.
2. Developing a more drought-resistant supply (i.e. one that is insulated from year-to-year variability in weather and streamflow). Examples of such a supply include desalination and use of advanced treated recycled water. These alternatives would also require development and improvement of infrastructure.

The first round of scenario planning occurred during the March 2015 meeting. In this effort, Committee members broke into small groups, with each group working on one of three scenarios:

- Changed hydrology that results from City proposed flows;
- Changed hydrology that results from DFG-5 flows; and
- DFG-5 flows and a potential extended drought that is a plausible event under future climate change conditions.

Following several hours of work in their small groups, Committee members presented the demand management and water supply improvement measures they had created to address the conditions described in their scenario. These groups of measures were called portfolios.

Two key themes emerged from this work:

1. Committee members created water supply portfolios which included additional investments in demand management; and
2. Each of the groups gravitated to some form of winter flow capture and storage as a key strategy for meeting future water supply needs for Santa Cruz. One group acknowledged the potential need for a supplemental supply to help get the aquifer storage program going before it could

¹⁵ See Appendix 2 for a description of the Confluence model and its use in the WSAC process.

be completely filled by available winter flows, and chose to fill that potential gap with recycled water.

Round two of scenario planning occurred at the Committee's April/May 2015 meeting and included two scenarios:

- DFG-5 flows with extended drought and
- DFG-5 flows with climate change.

Two working groups of Committee members were assigned to each scenario. Again, winter flow harvest was the centerpiece of each group's solution to the scenario they were given, and again, advanced treated recycled water played a role if and as needed as a back-up resource.

Section 3.12 Portfolio Development and Evaluation¹⁶

Starting in May 2015, the Committee began exploring and building portfolios of measures to close the supply-demand gap. Portfolios were typically made up of combinations of demand management and supply augmentation strategies that often included projects or approaches for improving the performance of the existing water system, particularly as it relates to its ability to capture and store winter flows.

One goal of portfolio building was to provide opportunities for Committee members to explore the risks and uncertainties associated with various combinations of measures. Another was for Committee members to work with each other to create portfolios that met their common interests using interest based bargaining techniques. And a third was to give Committee members a hands-on way to engage with the information about the technical aspects of various approaches.

Especially with respect to the last goal, Committee members have received, processed, and asked for clarification of and additional information about just about every aspect of water system operation, technical and financial assumptions, and have built a substantial base of knowledge upon which to create their recommendations. The diversity of Committee member backgrounds and interests has been a significant asset to the group as it has done this important work and they have learned from each other as well as from the Technical Team and City staff participating in their work. In addition, this hands-on approach has created an unparalleled opportunity for Committee members to learn about, and learn to respect their individual perspectives and interests, which is an invaluable asset to any collaborative problem solving process.

Section 3.13 Issues of Risks and Uncertainties

At the Committee's June 2015 meeting, Committee members worked with a set of four different staff-created water supply portfolios that have at their center some form of winter water harvest. In addition to a winter water harvest approach provided as a "Plan A," each portfolio contained a proposed "Plan B" and a "trigger" that would define the conditions for moving from Plan A to Plan B. The task was to consider the risks and uncertainties related to the various approaches, and the

¹⁶ See Appendix 6 Portfolio Development and Evaluation for Committee materials related to work summarized in Sections 3.12 through 3.14

addition of a Plan B and a trigger was designed to get the Committee members thinking about and working with ideas related to “what ifs.”

The four portfolios developed were:

1. **Plan A:** In lieu recharge of regional aquifers by providing system flows during the rainy season to Soquel Creek Water District and Scotts Valley Water District to meet their customer demand, thereby allowing them to rest their wells. Infrastructure or operating rule changes were added to extend the season during which in lieu recharge could be provided, thereby increasing the rate of recharge. The goal would be for groundwater to come back to Santa Cruz Water Department customers from water stored in regional aquifers when Santa Cruz needs it during drought years or other unusual events. **Plan B:** Advanced treated recycled water piped back to and mixed with Loch Lomond supplies (a technique called indirect potable reuse or IPR).
2. **Plan A:** Active recharge of regional aquifers using injection wells (a technique called Aquifer Storage and Recovery, or ASR) by providing excess flows to SVWD or SqCWD for injection into the aquifers to accelerate the rate of groundwater recharge. The goal would be for groundwater to come back to SCWD from regional aquifers when needed. **Plan B:** Advanced treated recycled water piped to and mixed with North Coast and San Lorenzo River supplies, retreated at Graham Hill Water Treatment Plant and delivered to customers (a technique called direct potable reuse, or DPR).
3. **Plan A:** ASR along with using advanced treated recycled water to create a seawater barrier along the coast to manage and impede salt water intrusion. The ultimate goal would be for groundwater to come back to Santa Cruz from regional aquifers when Santa Cruz needs it. Creating a salt water intrusion barrier would accelerate the timeline when this source would fully meet Santa Cruz’s needs. Should the ASR program ultimately completely solve Santa Cruz’s problem, the stranded assets in this plan would be an advanced water treatment plant for producing advanced treated recycled water and related infrastructure. **Plan B:** Converting the advanced treated recycled water plant producing water for the salt water intrusion barrier to a source of water for DPR use.
4. **Plan A:** ASR coupled with desalinated water from the proposed DeepWater Desalination plant at Moss Landing. The ultimate goal would be for groundwater to come back to Santa Cruz from regional aquifers when Santa Cruz needs it. Creating a supplemental source of potable water could result in a combined ASR and in lieu recharge strategy that would accelerate the restoration of regional aquifers, making the timeline when this source would fully meet Santa Cruz’s needs shorter. Should the ASR program ultimately completely solve Santa Cruz’s problem, the stranded assets in this plan would be a share of a regional desalination facility that might be sold to another party and a pipeline that might be repurposed for a different use. **Plan B:** DeepWater Desalination.

None of these portfolios was designed to be the best one. Rather, they were designed to be purposefully different from each other so that the Committee could explore the risks and uncertainties associated with different approaches. It was not part of the goal of the Committee’s June meeting to select one of the portfolios as the preferred approach.

The focus on risks and uncertainties associated with the performance of these portfolios is an important one. At the level of analysis and information currently available, it is inevitable that there will be questions about actual performance of various approaches.

Section 3.14 Committee Member Portfolio Building

Between the July and August meetings (2015) Committee members worked independently or in teams to prepare portfolios that addressed the supply demand gap.

One portfolio was created by David Baskin, Peter Beckmann, Sue Holt, Charlie Keutmann and David Stearns. This proposal includes In Lieu and ASR along with direct potable reuse (a more drought resistant element to be implemented concurrently). This portfolio was designed to effectively cover the “gap” and, in the long term, would go further by providing the capacity to supply water even if events occurred such as a wildfire around Loch Lomond.

A second portfolio was created by Greg Pepping, Rick Longinotti, Mark Mesiti-Miller and Sid Slatter. This portfolio proposed a combination of In Lieu and aquifer storage and recovery (ASR) with direct potable reuse. This group reached consensus on the component parts and found that they disagreed as to whether, to ensure success, it would be necessary to implement the parts of the proposal sequentially or concurrently. This proposal provides for concurrent implementation, and Rick Longinotti developed a separate portfolio (described below) that proposed a sequential implementation.

A third portfolio was developed by Rick Longinotti in consultation with Erica Stanojevic and members of Santa Cruz Desalination Alternatives. As noted above, this proposal scales down the in lieu to operate initially within the capacity of the existing system, thus avoiding significant upgrade costs for modifications to the Graham Hill Water Treatment Plant. Ongoing monitoring of the response of the aquifer would provide the information needed to determine whether to maintain the level of effort or scale up as necessary.

A fourth portfolio was developed by Sarah Mansergh. This proposal shows an approach that portrays a lower level of urgency for moving forward than some of the other portfolios. The portfolio is also designed to seek and achieve multiple benefits through regional partnerships focused on restoring regional aquifers.

The fifth portfolio was developed by Erica Stanojevic. This proposal combines the storage capacity of Loch Lomond with the aquifer. By starting the project immediately and sorting out our water rights, security will be increased and we could achieve 3BG in storage by 2020.

All of these portfolios incorporated demand management.

In the discussion that followed the following agreements were articulated:

- The Committee developed consensus that the environmental benefits of fish habitat restoration is an important value and that the supply-demand gap should reflect a commitment to releasing flows to support restoration of threatened and endangered fish species. (The specifics of the DFG-5 flow proposal are not agreed to, as the Committee wants the City to work with the agencies to define the final flow proposal.)

- The Committee has developed consensus that there are substantial benefits from pursuing regional solutions for Santa Cruz’s water supply issues and that reasonable regional solutions should be pursued if possible.
- The Committee developed consensus that energy requirements for any new water supply augmentation project should be met with power from renewable sources.
- The Committee reached agreement that groundwater storage strategies implemented by in lieu (passive recharge) and ASR (active recharge) are preferred.
- The Committee has developed consensus that their direction be focused on policy versus prescriptive level detail.
- The Committee has developed consensus that the plan they develop and recommend to the City Council will include an adaptation or Change Management Strategy.

Section 3.15 Alternatives that Emerged as Key Strategies to Consider

As the Committee worked through its first several meetings of the Analysis Phase, information developed by the WSAC Technical Team identified challenges with some of the alternatives. For example, it would be impractical to build surface water storage reservoirs in old quarries underlain by Karst formation geology. Other alternatives emerged as being more feasible and began to appear consistently as measures included in scenario planning results. By late spring 2015 the Committee had defined a set of alternatives and approaches that became their focus. Each area is described briefly below in Section 3.16 through Section 3.20.

Section 3.16 Demand Management

During much of the Committee’s work a program known as “C recommended” (Crec) was a focus of the conversation around what additional demand management activities the City should pursue. Crec is a combination of water conservation measures identified during the development of the City’s updated Water Conservation Master Plan in a process that began in 2013 but was still underway in the spring and summer of 2014.

As the Committee gained a better understanding of the nature of the reliability problem Santa Cruz faces, it began to look at whether and how well the measures combined into Program Crec focused on peak season demand. In the spring of 2015, the Committee formed a Peak Season Demand Management Working Group to look at strategies for improving the focus of the future Demand Management program on peak season reductions.

The Working Group developed and presented some strategies focusing on peak season demand management. When its results were received, the Working Group had proposed that the City set a goal of reducing peak season demand by an additional 150 mgd using a variety of strategies. This proposal raised a concern about the potential for double counting demand management savings due to the significant impact of price elasticity in reducing future demand. Double counting of demand reductions is a concern because of the possibility that an unknown number of customers will respond to higher rates by switching to water-conserving landscapes, for example, and will also participate in a water Department rebate program while doing so. If this occurs, their water savings would be counted

twice – once as a program participant and again as a response to higher rates. Double counting could lead to overestimating the potential for demand reductions from programmatic conservation.

Table 13 below, lays out the impact of price response on future water demand.

Table 13 – Peak Season Savings Due to Price Response¹⁷

Peak (May-Oct) Demand Without Price Response, MG

	SFR	MFR	BUS	MUN	IRR	GOLF	TOTAL
2020	750	386	372	39	123	58	1,728
2025	763	375	373	39	138	52	1,739
2030	778	383	381	39	162	46	1,790
2035	798	393	393	39	184	46	1,854

Peak (May-Oct) Demand With Price Response, MG

	SFR	MFR	BUS	MUN	IRR	GOLF	TOTAL
2020	705	364	348	35	93	52	1,598
2025	703	347	342	35	104	45	1,575
2030	702	347	341	34	111	37	1,572
2035	703	347	342	33	119	35	1,580

Peak (May-Oct) Savings from Price Response, MG

	SFR	MFR	BUS	MUN	IRR	GOLF	TOTAL	% Savings
2020	46	22	23	4	30	5	131	8%
2025	60	28	31	5	34	7	164	9%
2030	76	36	40	6	51	9	218	12%
2035	95	46	51	7	65	11	274	15%

The price elasticity used to produce these numbers was based on the measured impact of price on the demand of various customer groups in Santa Cruz between 2000 and 2013. These elasticities were integrated into the econometric demand forecast presented to the Committee in July of 2015.

During the development of the econometric forecast, considerable effort was expended to ensure water conservation savings were not counted twice. The forecast includes an estimated 274 mgy of peak season demand reduction due to price, an estimated 170 mgy due to continuing existing programs and 248 mgy in demand reductions due to the impacts of building and plumbing codes. An additional 170 mgy in demand reduction from Program Crec was included as a supply alternative in all the Confluence modeling analyses, including those analyses used to establish the 1.4 billion gallon worst year shortage.

As the Conservation Master Plan is finalized, the new conservation measures proposed by the Working Group will be more fully analyzed and the Committee agreed that until that analysis is completed, it

¹⁷ From Presentation by David Mitchell (M. Cubed) to the Water Supply Advisory Committee, July 23, 2015.

was best to be cautious about including the full additional 150 mgd of demand reduction in the projections.

(a) Development of Recommendations on Demand Management¹⁸

At its July 24, 2015 meeting, the Committee members decided they wanted their recommendations on Demand Management to combine providing the Council with their recommendations on a package of demand management programs as well as with a results-oriented, policy level direction, including guidance about key criteria.

City staff worked with two members of the Demand Management Working Group to develop recommendations reflecting both the Committee's strong interest in pursuing conservation with the uncertainties regarding costs and water savings associated with the package of measures outlined by the working group. The recommendations developed included:

1. **Expressly acknowledge the conservation savings that have been embedded into the new econometric demand forecast.** The econometric forecast carefully factored in different estimates of conservation savings that together amount to over 700 million gallons of water per year saved by 2035. These include the savings representing the passive effects of plumbing codes (278 mgd), active water savings associated with measures currently being implemented, (also referred to "Program A", 170 mgd), and the peak season savings that is related to economic effects over the 20-year planning horizon (274 mgd). These three elements play a large role in keeping water demand relatively constant over the next 20 years, and represent a combined 17 percent savings that should be communicated and highlighted as a key part of the overall solution to balancing the City's future water supply and demand.
2. **Set a goal, expressed as a range, between 200 and 250 million gallons per year of additional water savings by 2035, with emphasis on implementing measures that focus on peak season demand reduction.** Although the exact number is yet to be finalized and needs to be revisited, modeling performed by Maddaus indicates another 168 mgd of water savings is potentially attainable by 2035 through new or expanded conservation measures (referred to as "Program C"). More savings may be possible by incorporating the working group's recommendations into the City's Water Conservation Master Plan. Various estimates have been put forward about the savings of its recommendations, ranging from 81 to 183 mgd. The proposed goal recognizes and agrees with the Working Group that more water savings is possible, especially in the peak season, but expresses it as a range to reflect the uncertainty involved at this time.
3. **Complete additional analysis** to finalize the package of programs to be implemented and to more specifically establish the savings goal. Earlier modeling performed by Maddaus Water Management indicates another 168 mgd of water savings is potentially attainable by 2035 through new or expanded conservation measures from Program Crec. Additional programmatic savings will be identified both due to changing the \$2500 per million gallon threshold used in the Maddaus Water Management modeling work conducted in 2013 to a \$10,000 per million gallon average program cost recommended by the WSAC and by identifying, developing and implementing more programs focused on peak season savings.

¹⁸ See Appendix 7 for materials related to Demand Management Recommendations.

4. **Identify the water conservation measures listed in Program C and in the working group's report as the demand management package the Committee recommends.** Providing a list such as the one presented in Table 14 below would fulfill the Committee's desire to articulate a recommended suite of demand management measures.

Table 14 – Recommended Water Conservation Measures

No.	Water Conservation	Included in Working Groups	Comments
1	System Water Loss Reduction		Project Initiated July 2015
2	Advanced Metering Infrastructure		
3	Large Landscape Budget-Based Water Rates	Yes	Identified in Peak Season Report as "Shifting Landscape Budgets Toward Climate Appropriate Irrigation Levels"; lower water budgets over time
4	General Public Information		
5	Public Information (Home Water Use Report)	Yes	Assume 3-5% savings
6	Residential Leak Assistance		
7	Single Family Residential Surveys	Yes	Identified in Peak Season Report as "Personalized Outreach to Highest Users and Generic Landscape Budgets"; combine with water budgets
8	Plumbing Fixture Giveaway/Opt		
9	Residential UHET Rebates		
10	High Efficiency Clothes Washer Rebates B	Yes	Alternative delivery/financing mechanisms
11	High Efficiency Clothes Washer - New Development		
12	Hot Water On Demand - New Development		
13	Toilet Retrofit at Time of Sale		
14	CII MF Common Laundry Room High Efficiency Clothes Washer		
15	CII Incentives	Partially	
16	Pre-Rinse Spray Nozzle Installation		Project Completed 2014
17	CII Surveys		
18	HEU Program		
19	Public Restroom Faucet Retrofit - MUN		
20	Public Restroom Faucet Retrofit - COM		

No.	Water Conservation	Included in Working Groups	Comments
21	School Retrofit		
22	Water Efficient Landscape Ordinance		State mandated update due by end of 2015
23	Single Family Residential Turf Removal A	Yes, as part of "Climate Appropriate Landscaping and Rainwater infiltration"	Recommend B (increased rebate amount)
24	Multifamily Residential/CII Turf Removal A		Recommend B (increased rebate amount)
25	Expand Large Landscape Survey/Water Budgets	Yes	
26	Sprinkler Nozzle Rebates		
27	Gray Water Retrofit		
28	Residential Rain Barrels		
29	Climate Appropriate Landscaping and Rainwater Infiltration		Includes requirement to convert spray to drip for shrub irrigation, prohibit spray irrigation in narrow areas. Rainwater infiltration component to be led by other City Department or agency
30	Conservation Pricing - Water and Sewer		Water rate project underway through separate contract with Raftelis Financial Consultants; conservation pricing for sewer service
31	Dishwashers		Not recommended by staff
32	Hot Water Recirculation Systems		Not included in Program C but worth reconsideration
33	Rewarding Businesses For Adopting Best Practices		Hotel laundry recycling one example; reduced curtailment level as reward
34	Additional Building Code Requirements for New Development		Some requirements already in place; urinals, dishwashers, graywater, pre-rinse spray nozzles
35	Innovation Incubator Program		Capitalize on local programs to support research and continue role as conservation innovators

5. **Acknowledge that a final estimate of conservation savings is subject to change pending completion of the Master Plan.** A contract amendment for a second phase of work on this project was approved by the City Council at its September 8, 2015 meeting. Work is scheduled to resume this fall and will include coordinating the consultant's DSS model with the latest demand forecast, adjusting model parameters based on input received from Committee members and the Water Commission, incorporating new measures with greater emphasis on peak season savings

forwarded by the working group, and rerunning modeling scenarios. This will ensure consistency in how water savings and costs are estimated and help avoid speculation and/or double counting. In addition, staff has identified the need to revisit the sequencing and scheduling of measures listed in the latest version of Program C, and this will affect estimated savings. The final plan will, of course, be subject to public review and stakeholder input prior to its final adoption by City Council.

(b) Committee Agreement about Demand Management

At the Committee's meeting of September 10, 2015, the Committee agreed to the recommendations described in Section 3.16(a) above.

(c) Key Assumptions about Demand Management

The following are key assumptions about the Demand Management Program being recommended by the WSAC:

- The Econometric Demand Forecast includes significant demand reductions associated with the implementation of existing plumbing and building codes, the continuation of existing demand management programs (as a baseline) and as a function of the effect on demand of expected increases in water rates.
- A focus of new demand management programs will be on peak season demand reduction, which is also a significant focus of the expected demand reduction associated with anticipated price increases.
- New and enhanced demand management programs will be developed to build on the Water Department's current program that has contributed to reducing per capita demand in Santa Cruz to one of the lowest levels in the state.
- The programs to be implemented in the coming decade are a mix of lower cost and some higher cost measures. Those higher cost measures are meant as small-scale experiments that may be broadened if they prove popular and their costs decline over time. Together these measures incur an average total program cost of no more than \$10,000 per million gallons of water saved. This figure is lower than the expected cost of supply augmentation projects recommended to be pursued as a result of WSAC's work.

Section 3.17 Supply Development

As described earlier, the Committee considered a wide range of supply augmentation alternatives during its deliberations. Committee members focused on options that are local including demand management, capturing and storing surface water flows during the rainy season, or developing some form of either recycled water or desalinated water to augment existing supplies.

As the Committee worked through the process of defining the problem and evaluating potential solutions during the winter and spring of 2015, they consistently identified winter water capture and storage through passive and active recharge as an opportunity that made sense to pursue.

As previously described, the Committee's scenario planning and portfolio building efforts focused on selecting supply alternatives and then exploring the risks and uncertainties associated with the

portfolios they selected. During the Committee’s work, the supply augmentation strategies that emerged included:

- Passive recharge of regional aquifers (in lieu);
- Active recharge of regional aquifers (aquifer storage and recovery – ASR);
- Some form of advanced treated recycled water (indirect potable reuse or direct potable reuse); and
- Some form of desalinated water (local desalination or a regional project called DeepWater Desalination).

To help the Committee consider the effectiveness of the supply augmentation options they were most interested in pursuing, all of the options were evaluated using the Confluence model. The estimated Confluence model yields are shown in Table 15. The yields indicated are defined as the reduction in peak-season shortages that are realized when each element is fully operational, i.e., when all technical and institutional (legal, regulatory, public acceptance) uncertainties have been successfully resolved.

Table 15 – Estimated Peak-Season Yields and Remaining Shortage

Element	Worst Year			Average		
	Peak-Season Yield	Remaining Peak-Season Shortage		Peak-Season Yield	Remaining Peak-Season Shortage	
	mg	mg	%	mg	mg	%
Base Case	--	1230	63%	--	470	24%
In Lieu	750	480	25%	350	120	6%
ASR	760	470	24%	380	90	5%
Combined In Lieu, ASR	760	470	24%	380	90	5%
Advanced treated RW/Desalination *	810	420	22%	440	30	2%
All Elements Combined	1230	0	0%	470	0	0%

* Either DPR, Deepwater Desalination, or Local Desalination.

The yield¹⁹ estimates are necessarily based on a variety of infrastructure and operational assumptions, including but not limited to:

- For both in lieu storage and ASR, it is assumed that the maximum daily capacity to pump water from the aquifer and convey it to Santa Cruz is 4 million gallons per day (mgd). For ASR, it is assumed that the maximum ability to inject water is 5 mgd.
- For ASR, it is assumed that 80% of the injected water is recoverable. This is a function of assumed physical characteristics of the aquifers. For in lieu, it is assumed that 60% of the water conveyed to neighboring water districts is available to Santa Cruz, a function of both assumed aquifer characteristics and the outcome of discussions with the city's negotiating partners.
- For advanced treated recycled water/desalination, it is assumed that the maximum available supply on any day is 3 mgd, which is based on the estimated availability of local wastewater (i.e., excluding Soquel Creek wastewater).
- In all cases, the modeling of these supply elements makes particular assumptions about how they will be operated in conjunction with current supplies.

Given these assumptions, none of the elements on its own completely eliminates all projected water shortages though each substantially improves water supply reliability. However, since it is likely that some or all of these and other assumptions will change as better information is generated regarding physical, operational, and institutional parameters, these yields will also undoubtedly change.

During the Committee's scenario planning work, the idea of packaging various demand management and supply augmentation measures into a portfolio or integrated strategy emerged as an effective way to deal with the various uncertainties that are inevitably present in any long range planning work.

Ultimately the Committee selected two basic strategies to pursue, in addition to demand management (Element 0):

1. **Strategy One:** Development of groundwater storage using a combination of both passive and active recharge approaches and available surface water flows during the rainy season; and
2. **Strategy Two:** Development of advanced treated recycled water or desalinated water if and as needed to address any remaining supply-demand gap.

Strategy One includes the following Elements:

- **Element 1** – in lieu, passive recharge of the groundwater aquifers with either or both the Scotts Valley Water District and the Soquel Creek Water District; and

¹⁹ "Yield is used to characterize the capacity of a water resource to serve as a long-term water supply. It is a fundamental water-supply planning concept, and an understanding of its attributes is critical for those who participate in water-supply issues. In the context of surface-water resources, yield is often synonymous with safe yield or firm yield. Safe yield or firm yield in the context of water reservoirs is defined as the maximum quantity of water which can be guaranteed during a critical dry period (Linsley and Franzini, 1979). The simplicity of this definition, however, belies two "complicating" factors. First, yield changes as watershed conditions, such as land use and ground-water-surface-water interactions, evolve. Second, yield is uncertain because of our inability to know the severity and duration of future drought periods."

From: <http://www.kgs.ku.edu/Publications/Bulletins/239/Leib/>

See also, page 3 of <https://www.owasa.org/Data/Sites/1/media/whatwedo/appendix%20iii-a.pdf>

Additional definitions of production and yield are provided in the Glossary and Appendix 8.

- **Element 2** – aquifer storage and recovery, active recharge of the groundwater aquifers, with or without regional partners in regional aquifers.

Strategy Two includes the following Elements:

- **Element 3** – advanced treated recycled water to be used in either an indirect potable reuse or a direct potable reuse application, as the initial focus of Strategy Two approaches. In the event advanced treated recycled water is eliminated from consideration, desalination would then become Element 3.

As the WSAC discussed the potential development of the potential for advanced treated recycled water to be developed if Element 3 were to be needed, it received numerous comments from members of the public who expressed the critical importance of ensuring that all supply options be safe to human health. Specifically, comments received included cautions related to recycled water, a desire for the SCWD to carefully analyze the latest research on potential human health risks from contaminants of emerging concern and the synergistic or compounding effects of mixtures of multiple constituents that may occur in advanced treated recycled water, a recommendation that the SCWD use the precautionary principle when evaluating advanced treated recycled water options, and also that the City learn from other communities using similar supplies.

Section 3.18 Rationale for the Committee's Preference for the Groundwater Storage and Retrieval Strategy

Throughout the Committee's work in the spring and summer of 2015, it consistently demonstrated a preference for developing available winter flows as a supplemental supply. As the list below shows, the Committee's reasons for this preference were numerous and diverse.

1. More fully utilizes winter water flows in the San Lorenzo River.
2. Can contribute water to storage in many years. Even in dry years winter water may be available to store in local aquifers.
3. May start returning water before the entire groundwater system is built out.
4. May help reduce the threat of seawater intrusion.
5. Groundwater strategies are regional solutions. Regional solutions may help the regional economy, and thus the local economy.
6. Even without agreements to return water to SCWD in the future, in lieu recharge strategies can start immediately with existing infrastructure (an agreement is already in place for winter 2015), and can grow over time.
7. Because each ASR injection well acts as an independent storage and recovery site, together the individual wells create a flexible, resilient and scalable system, not just for the groundwater strategy but for Santa Cruz's overall water supply portfolio.
8. Water stored underground is much less affected by evaporation.
9. As aquifers are restored, base flows from groundwater to local creeks and streams may be improved and may offset some fish flow requirements.

10. May eliminate future water use curtailments during extended droughts.
11. It is believed to be politically feasible.

Section 3.19 Infrastructure Constraints

As is the case with all water systems, the City of Santa Cruz water system's operation is limited by a number of infrastructure constraints. Chief among these is the inability of the Graham Hill Water Treatment Plant to efficiently treat waters with turbidities over about 15 Nephelometric turbidity units²⁰ (NTU). Additional infrastructure constraints involve the limited hydraulic capacity and pressure constraints of the existing pipeline between the Felton Booster Station and Loch Lomond Reservoir. Once the pipeline between Felton and Loch Lomond is replaced, the capacity of the existing Felton pumps could potentially be increased.

In the recently completed Conjunctive Use and Water Transfer Phase II study report,²¹ the Graham Hill Water Treatment Plant turbidity constraint was identified as a potentially significant barrier to the idea of capturing and using winter flows for passive and active recharge of regional groundwater basins. That report laid out a phased implementation of in lieu (passive) recharge that would not require addressing the treatment plant constraints right away. The report also described various infrastructure improvements to both Graham Hill Water Treatment Plant and the Tait Street Diversion that could be required as winter water deliveries to Soquel Creek and Scotts Valley are increased.

During the Committee's scenario planning process, the technical team modified the Confluence model's operating parameters in order to assess how the water system would perform without infrastructure constraints. The Committee, City staff and the technical team gave the issue of infrastructure constraints considerable attention, and a range of possible approaches to addressing these problems was discussed.

In the "State of the Water System Report" provided to the Committee at its April/May 2015 meeting, City staff provided a high level overview of the deferred maintenance and major rehabilitation and replacement issues the system has and laid out a conceptual framework for a 15 year Capital Improvement Program (CIP) to tackle these issues. The CIP includes projects to address certain infrastructure constraints, such as the need for a replacement pipeline from Felton to Loch Lomond, but not others, like upgrades to the Graham Hill Water Treatment plant to allow it to treat higher turbidity water. The rationale for including the pipeline is that it is needed to improve system operation whether or not a winter harvest option is pursued. The need for other infrastructure improvements to address the higher turbidities of winter water, whether through the implementation of the treatment plant upgrades identified in the Conjunctive Use and Water Transfer report, or possibly the installation of Ranney collectors or other approaches, is dependent upon selection of a water supply augmentation strategy. Including such improvements in a long term CIP prior to the Committee having completed its work would not be appropriate.

²⁰ Nephelometric turbidity units (NTU) is a measure of water clarity that is used in drinking water treatment and safe drinking water regulations.

²¹ Final Report, Conjunctive Use and Water Transfers – Phase II, May 2015

http://scceh.com/Portals/6/Env_Health/water_resources/Task%206%20Report%20051215%20clean.pdf

While current infrastructure does allow some initial regional cooperation efforts to get underway relatively soon, to fully utilize available winter water for in lieu and/or ASR will require substantial additional infrastructure. The minimum additional infrastructure requirements include creating an intertie with Scotts Valley, expansion of transmission capacity to Soquel Creek, and creating the infrastructure necessary to transfer water stored in aquifers back to Santa Cruz when needed during drought years.

Section 3.20 Operational Constraints

The Santa Cruz water system uses a variety of operating rules and practices to guide its daily operation. A utility's operating rules provide straightforward and reasonable parameters for both operating the system and for modeling system performance.

Most of the City's operating rules and practices have developed over time and are based on experience operating the system. A major influence underlying the operating rules is that avoiding problems is more effective than dealing with their consequences after the fact. Some of the key operating constraints have been incorporated into the Confluence Model to help insure that system modeling results reasonably represent reality.

The WSAC examined operating rules and constraints that limit the water system's ability to provide water. During the dry season, the key constraint is the existing operating rule curve for Loch Lomond drawdown. During the rainy season, the key constraints were related to taking first flush water and dealing with turbidity levels over 15 NTU, whether for treatment at the Graham Hill Water Treatment Plant or to send to Loch Lomond to store in years when winter precipitation is not expected to fill the reservoir.

The technical team explored modifying the operating parameters using the Confluence model to simulate different operating rules. A number of recommendations for change and further evaluation were developed. Of those, two particular operating constraints stand out: the rule curve used to operate Loch Lomond, and the first flush constraint for sending water from Felton to Loch Lomond.

The existing Loch Lomond rule curve is designed to keep about a billion gallons of water in the reservoir as drought supply for a potential third year of drought conditions. When modeling the system, the Confluence Model currently runs the system to ensure that on October 31st of the second year of a drought, the reservoir still has one billion gallons remaining in storage. This constraint could potentially be relaxed in the event the City develops additional storage. The first flush constraint is designed to allow a sufficient quantity of water to bypass the City's Felton Diversion on the San Lorenzo River to avoid introducing large quantities of nutrients and pathogens into Loch Lomond. In critically dry years the quantity of water needed to meet the first flush criterion, 48 hours at 100 cubic feet per second or greater, may never be achieved. If this criterion can be relaxed without threatening Loch Lomond's water quality or ecosystem health, the additional water diverted to Loch Lomond during dry years could have significant benefits in reducing the size of worst year shortages.

Bearing in mind the complexity of Loch Lomond's ecosystem and the need to avoid creating a problem that would likely be time-consuming and expensive to solve, the potential supply-enhancing benefits of changing any of these constraints make it worthwhile to seriously explore this matter over the coming

years. If it is feasible to modify this operating constraint, the fix may entail operational changes, infrastructure modifications, or both.

Section 3.21 Agreement on Elements of the Water Supply Augmentation Plan

As WSAC proceeded, it focused on both what the Plan should include and how it should be implemented. As had been the case during the Committee's scenario planning and portfolio building work during the spring and summer of 2015, the Committee found it relatively easy to coalesce around groundwater storage strategies, but more challenging to build agreement around whether or how it might make sense to include additional supply augmentation measures.

Beginning with the Committee's July 2015 meeting, the WSAC began developing an adaptive management plan that would be used to guide the implementation of the Plan. Through the August and early September 2015 meetings, the Committee continued to solidify its agreement about the elements of the Plan, while recognizing that final agreement would be based on both what the Plan Elements were as well as how the Plan would be implemented. At its September 11, 2015, the Committee agreed to the following Plan Elements, contingent on the Committee also reaching agreement on the implementation plan and adaptive management strategy.

Element 0: Demand Management, with a goal to generate an additional 200 to 250 million gallons of demand reduction by 2035 from expanded water conservation;

Element 1: In Lieu start quickly as a small program relying on existing infrastructure to provide potable water to the SqCWD. The program is intended to grow over time, if/as additional infrastructure is developed, additional agreements are reached with SqCWD and SVWD, and any needed changes to water rights are granted by the State of California. Details of sharing capital and operating costs would and how much water returns to Santa Cruz and when it would be available would be addressed in these agreements.

Element 2: Aquifer Storage and Recovery (ASR), involves development of a program to inject treated water from available winter flows into regional aquifers and recover a large portion of the stored water as a supplemental supply for Santa Cruz. This program would proceed through evaluation and piloting steps as detailed in technical reports (e.g., the May 2015 Pueblo Water Resources report) and, if successful, can be implemented on a scale sufficient to meet the yield goals of this Plan.

Element 3: Advanced Treated Recycled Water, is intended to supplement or replace Elements 1 and 2 to the extent they do not generate sufficient yield to fill the supply/demand gap in a cost-effective and timely manner, as stipulated in the Plan. In the event advanced treated recycled water is eliminated from consideration, desalination would then become Element 3.

In addition to developing Elements 0, 1, 2 and 3 above, the Committee suggests that the City should continuously review and take steps to address infrastructure and operating constraints that are keeping the existing system from performing as well as it could, within reason. Some specific suggestions are included in the recommendation section of this report.

Section 3.22 Implementation Strategy Options

Following the August 2015 Committee meeting, staff and the technical team worked to lay out a phased implementation plan for Strategies One and Two. The purpose of this task was to provide Committee members with a way to visualize how a staggered plan might actually be implemented, and to support a more thorough discussion of implementation strategy options.

As they mixed and matched supply augmentation strategies, the Committee also considered how measures in the portfolio would be implemented. The technical team provided the Committee with a useful model for thinking about both potential implementation options and adaptive management drawn from work done in the Netherlands (see <https://www.deltares.nl/en/adaptive-pathways/>).

As part of developing both the Committee's implementation and adaptive management strategies, the WSAC evaluated several implementation approaches, including sequential, staggered and parallel. Each approach is briefly described below.

- A sequential implementation plan would involve working on Strategy One approaches until they either succeeded or failed. Only if these approaches fail to meet the yield target would Priority Two approaches be pursued.
- A staggered implementation plan involves advancing work on Strategy One approaches to demonstrate their effectiveness, while simultaneously doing some work on Strategy Two approaches with a goal of shortening the time required to produce water from a Strategy Two approach should Strategy One approaches not prove successful.
- A parallel approach would involve moving forward on both Strategy One and Strategy Two strategies with a goal of pursuing both types of projects and significantly enhancing the City water system's reliability and robustness.

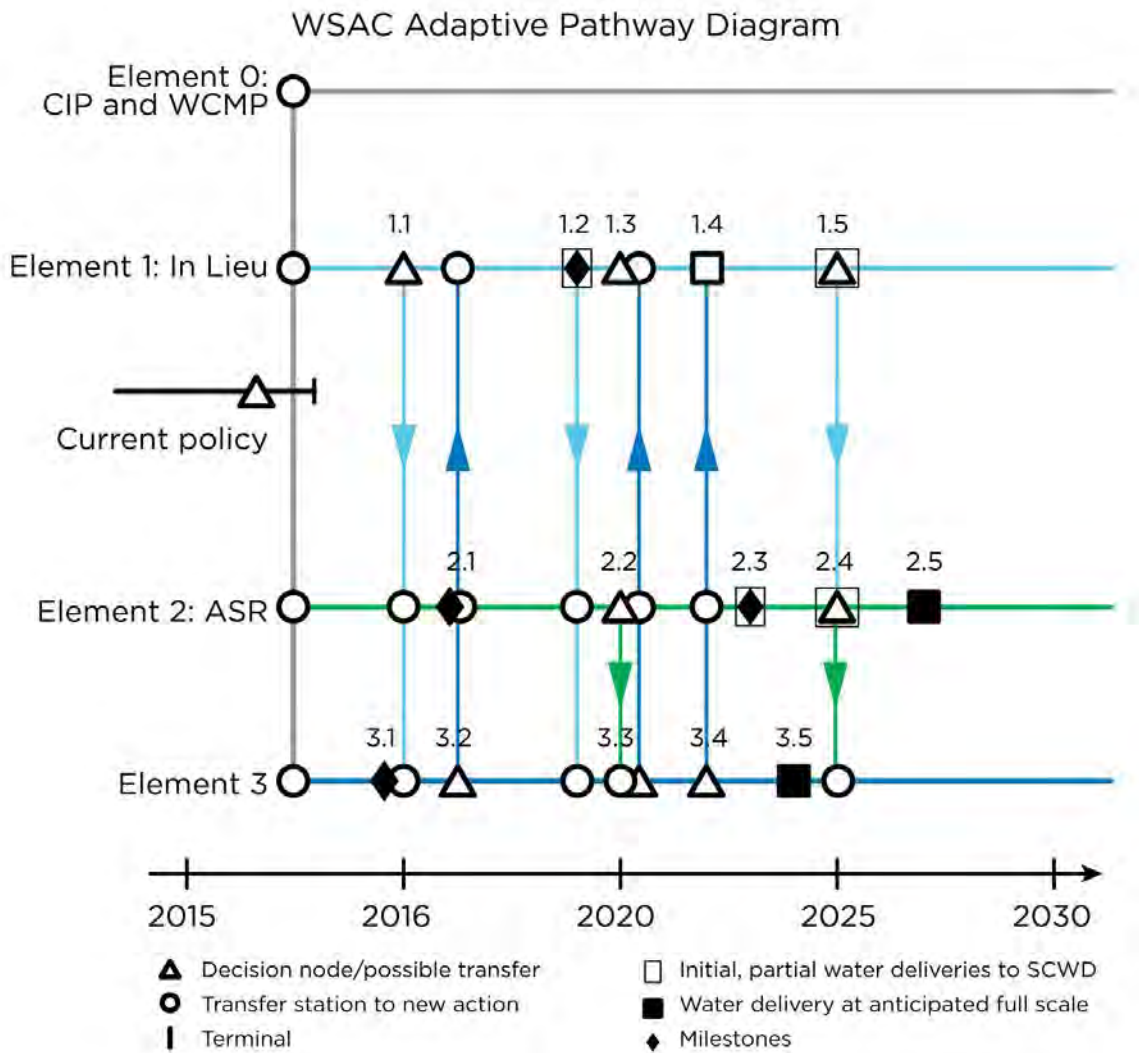
The idea behind an adaptive pathway is that you work down a path through the phases of a project or program and when you reach a decision node, you have an opportunity to decide whether to continue or change to a different approach. There are two types of decision nodes used in the adaptive pathways:

1. Open circles represent start points and possible change direction points and
2. Open triangles represent project transition points between one phase of work and the next.

Opportunities for initiating work or reviewing progress and making changes, either in the form of adjustments or as a result of assessments occur at these decision nodes. As an additional feature, the Committee decided to develop thresholds that would act as triggers for considering either adjustments or assessments. The Change Management Strategy, including further information on adjustments, assessments, and thresholds, is presented in more detail in Section 3.24.

Figure 8 shows the adaptive pathway chosen for implementation.

Figure 8 –Adaptive Pathway Map for Implementing the Water Supply Augmentation Plan



Section 3.23 Developing a Change Management Strategy

At the same time as the Committee members were developing the implementation strategy, they were also thinking about how to deal with decision-making and dealing with the new and changing information that will develop as the plan or project is implemented.

(a) Exploring Example Change Management Approaches

The Committee had explored several types of strategies used by others in setting up a policy and/or procedural framework to guide implementation of various kinds of plans over time. Included in this review were several specific examples of different approaches to developing policy or implementation frameworks. The most relevant examples are:

- Borrego Water Coalition Recommendations on the Groundwater Sustainability Plan being developed by the Borrego Water District.
 - o Example of: Policy recommendations with phased in reduction in water production to improve groundwater sustainability and specific incremental performance targets <http://www.borregospringschamber.com/bwc/documents/2014/BWC%20Policy%20Recs%20FINAL%2011-06-14.pdf>
- Clackamas River Hydro Relicensing Settlement Agreement/Agreement in Principle – Fish Passage Provisions with performance based phased-in of fish passage measures:
 - o Example of: Performance Benchmarks used in determining additional actions, in this case, additional measures to improve/enhance the success of fish passage at a hydroelectric dam facility.

For details of the A, B, C and D measures called for as part of the performance based implementation of fish passage improvements, see Clackamas Agreement in Principle (AIP) document, Section II – Downstream Fish Passage Measures. This section begins on page 3 and goes to page 11 of the Agreement in Principle Fish Passage and Protection Plan that is embedded in the larger document. Using the pdf document page counter, typically found in the upper left hand area of the screen, this section starts on page 39 and goes to page 47.

Additional Information: General information about Portland General Electric’s Fish Protection Programs: https://www.portlandgeneral.com/community_environment/initiatives/protecting_fish/clackamas_river/default.aspx
- Owens Lake Dust Control – Section 5 – Framework for Resource Protection Protocols (RPP) including criteria, monitoring, indicators, triggers, and actions, significant impact thresholds, and mitigation measures.
 - o Example of: Outcome oriented performance criteria; performance measurement; tiered (incremental) action oriented steps to take if performance metrics are not being met; and significant impact thresholds with required mitigation.

<https://owenslakebed.pubspsvr.com/masterproject/Master%20Project%20Document%20Library/Advisory%20Committee/April%202015/Owens%20Lake%20MP%20Advisory%20Committee%20Recommendations%20to%20LADWP.pdf> (Section 5 starts on page 28 of the pdf that opens at this link.)

Two common themes of these examples are the idea that implementing plans is an inherently adaptive process and that, within reason, it is feasible to lay out an approach to making future decisions that maintains the integrity of the agreements on which the plans were based.

By the early summer of 2015, the WSAC understood that the planning level information available was only going to be adequate to allow them to make contingent recommendations. The City would need to be able to adjust or adapt them during implementation. The Committee acknowledged that questions would arise about how to proceed when new information became available and concluded that developing a Change Management Strategy, and especially guidelines and principles that reflected

their values and priorities, was as important as agreeing upon the portfolio of measures to recommend to the Santa Cruz City Council.

Section 3.24 WSAC's Change Management Strategy

A major goal of the WSAC's Change Management Strategy is to establish clearly defined mechanisms for dealing with changes that will need to be made to the Plan over time. The success of whatever is done to implement the proposed recommendations is dependent upon a high degree of both transparency and accountability. The Change Management Strategy the WSAC has developed is specifically designed to facilitate that success.

(a) The Plan-Do-Check-Act Cycle²²

The basic premise of the WSAC's Change Management Strategy is that developing and implementing any Plan, and the projects within a plan, is a cyclic activity of continuous improvement that involves planning, doing, checking and acting (PDCA). Figure 9 shows this cycle and describes each part.

Figure 9 – Plan, Do, Check, Act Cycle

Plan–Do–Check–Act Procedure



1. Plan. Recognize an opportunity and plan a change.
2. Do. Test the change. Carry out a small-scale study.
3. Check. Review the test, analyze the results and identify what you've learned.
4. Act. Take action based on what you learned in the study step: If the change did not work, go through the cycle again with a different plan. If you were successful, incorporate what you learned from the test into wider changes. Use what you learned to plan new improvements, beginning the cycle again.

This cycle is designed to incorporate new information and well adapted to the circumstances involved in implementing the Water Supply Augmentation Plan (Plan).

The elements of the WSAC's Change Management Strategy include the following:

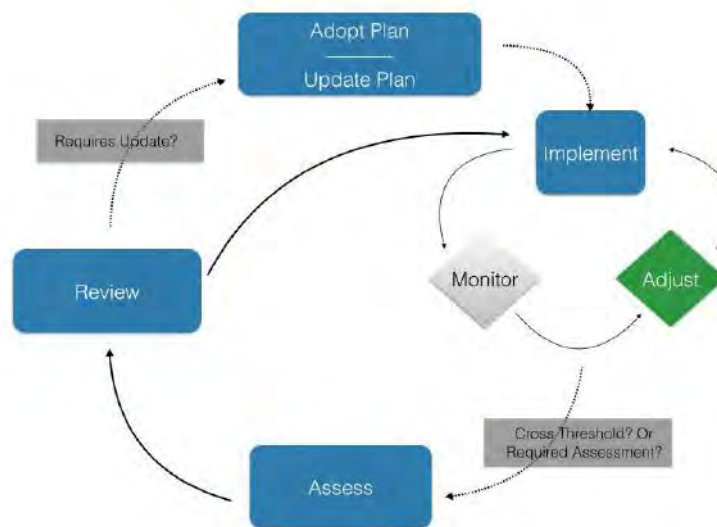
1. A Plan-Do-Check-Act model specifically adapted to the work being planned;
2. An Adaptive Pathway framework for implementing the three main supply augmentation elements;
3. Guiding Principles reflecting the WSAC's values and priorities;

²² From: <http://asq.org/learn-about-quality/project-planning-tools/overview/pdca-cycle.html>

4. Procedures for implementing the strategy, including roles and responsibilities for Water Department staff and the Water Commission as they work with the Council on the issues and initiatives covered by the plan; and
5. Guidance for Decision-Making.

Figure 10 shows the Change Management Process WSAC developed:

Figure 10 – WSAC Change Management Process



This framework actually incorporates a smaller PDCA cycle within the larger PDCA cycle. The larger PDCA framework functions in concert with the adaptive pathways and mostly relates to adaptive decisions that would need to be made to switch from one path to another. The smaller PDCA cycle is shown on the upper right of the figure above as the “Implement, Monitor, Adjust” cycle and would be used to make needed adjustments while implementing the various Plan Elements that are part of the Plan. For example, as in lieu and ASR are being developed, their progress in meeting their project goals would be monitored. An adjustment would be needed if, for example, eight wells were needed to produce the desired yield instead of the six originally estimated. The sections below present the parameters and mechanisms the WSAC developed to guide the implementation of the Water Supply Augmentation Plan.

(b) Definitions and Context

The WSAC’s Change Management Strategy was built around several specific definitions and application of concepts. This section provides the definitions and context used in the Change Management Strategy and the circumstances under which the various adaptation approaches would be used.

1. An **Adjustment** is a change in implementation that helps the Plan stay on track. In a continuous feedback loop, the Water Department will make adjustments to help achieve (or exceed) performance targets for the various Plan Elements.

2. An **Adaptation** is a shift from an Element or a set of Elements to another Element or set of Elements within the Plan's Adaptive Pathway. An adaptation may be recommended when certain thresholds are reached.
3. **Guiding Principles** are qualitative policy and value-based provisions that are taken into account in decision-making along with quantitative information that will be available.
4. A **Threshold** is the set of information that leads to an Assessment of the Plan and possible adaptation. The Committee identified thresholds for the key issues that need to be considered during decision-making about a possible Adaptation. The goal was to avoid trying to address each possible eventuality, and to focus on overall program goals rather than implementation specifics. Once a threshold issue has prompted an assessment, other considerations captured in the Guiding Principles, such as regional collaborations or the collateral benefits of an approach, may be taken into consideration. The thresholds are:
 - Cost
 - Yield
 - Timeliness
5. **Performance Metrics** are developed and used to assess how well individual Elements are tracking against their performance targets. As work on implementing the Plan Elements goes forward, tracking performance will generate information that will be used in several ways:
 - a. Deliver greater understanding about the system from management activities, technical work, pilot testing and modeling results and other work.
 - b. Ongoing cycles of monitoring and adjusting may help the Department keep the Elements moving forward to achieve their goals and determine when and how Adjustments might affect overall goals or when Adaptation may be appropriate.

The Committee had a chance to learn about the potential Performance Metrics that would be used in assessing Element 2, ASR, through all of its developmental phases. Further work will be needed to develop Performance Metrics for other Plan Elements.
6. **Catastrophic Events** (or other exogenous events), such as earthquakes or wildfire could disrupt the plan. Catastrophic Events are low probability/high consequence events.

(c) Guiding Principles

The Committee recommends that the following Guiding Principles be taken into account in all applications of the Change Management Strategy:

- **Public Health** – public health protection is every water utility's most fundamental duty. The SCWD, as an organization, and as individual employees, work every day to produce and deliver an adequate and high quality supply of water that complies with numerous public health-based regulatory standards and is used for human consumption, sanitation, for other domestic and commercial use and for fire protection.

WSAC recommends that, prior to reaching a decision on a potential preferred supply augmentation project; the City will consult with experts (recommended by the Water Department and approved by City Council) in public health, endocrinology and water chemistry

to evaluate and report on local water quality data and the public health implications of the preferred choice. This consultation would take place with ample opportunity for public review and input.

- **Public Acceptance** –The Committee was aware that the most important reason for convening the WSAC was to address the public’s concerns about the proposed desalination plant. The Committee notes public acceptance issues were raised during the WSAC process about costs, including overall costs and costs to rate-payers, energy consumption, schedule for implementation and public health concerns.

The WSAC has, throughout its process, created and applied criteria reflecting the community’s values. Along with the yield, costs, timeliness and technical feasibility of various supply augmentation alternatives (including conservation), the Committee also considered energy use, and environmental impacts of the alternatives. Accordingly, these considerations and criteria should be taken into account in any future decision-making.

- **Regional Collaboration** – Where consistent with the goal of achieving a sufficient water supply, the City should promote regional collaboration to improve water supplies, reversing or slowing seawater intrusion, and support habitat restoration.
- **Plan Goal** – The Committee agrees that, to improve the sufficiency and reliability of Santa Cruz’s supply using groundwater storage, an additional 2.4 billion gallons of water needs to be accessible from regional aquifers in a timely manner which will require storage of a larger volume. This additional storage, along with other key infrastructure modifications outlined in the Plan, would provide water needed to meet a worst year peak season shortage of 1.2 billion gallons under forecasted climate change and DFG5 flows.
- **Incremental Implementation** – An important premise of the Water Supply Augmentation Plan is incremental implementation. The Committee worked to develop a phased approach to develop the additional water supply needed and to integrate this approach into the Adaptive Pathway and Change Management Strategy. A significant benefit of this approach is that it will help the City avoid investing resources before they are needed and justified based on performance and other metrics.

(d) Change Management Strategy

As the Water Department implements this Plan, the Committee recommends that staff apply the following Committee agreements in making adjustments and recommending adaptations:

For Adjustments:

1. Diligently implement the groundwater storage strategy: when implementing Plan Elements related to groundwater storage, the City will take all reasonable and necessary steps to explore and demonstrate the technical feasibility of these approaches.
2. In addition, the City will adopt and implement communication practices that support the goals of transparency and accountability about Adjustments or Adaptations.

For Adaptations:

1. Prefer groundwater storage strategies: before making a choice to move away from groundwater storage, diligently pursue all reasonable measures to make the groundwater strategies work.
2. Should the choice need to be made between options available within Element 3, the Committee's preference is for advanced treated recycled water, rather than desalination, which is estimated to cost more and use more energy than advanced treated recycled water. The Committee viewed recycled water as more sustainable than desalinating seawater and therefore more aligned with the community's values. However, if the City determines that recycled water cannot provide sufficient yield then desalination should be pursued.
3. System robustness, resilience, redundancy, and adaptive flexibility are important values.

Thresholds are an important element of the overall Change Management Strategy. The Committee developed its agreements based on assumptions and information available to it at the time it did its work and recognized that new information would be developed as the Plan is implemented.

Establishing thresholds (which could, themselves, be updated as new information is developed and analyzed) gave the Committee a way to provide parameters within which to continue developing an Element as well as clear sign posts for when the Plan or an Element might be failing to perform as anticipated. Exceeding a threshold value would not necessarily result in stopping work on an Element, but would trigger an Assessment. There are three key types of thresholds:

1. Cost
2. Yield
3. Timeliness

For several of these thresholds there is no fixed number or value. This is because for items such as cost and timeliness, the threshold value is necessarily relative to the other options available at the time the threshold is reached. The achievable schedule for implementing the Elements will become clearer as additional work is done. At a decision node, the most up-to-date information should be considered.

The Committee understood that new information would be developed as the Plan was implemented and therefore what was important was to set the threshold metric rather than the threshold value. And, in addition, the Committee understood that numbers produced by planning level analyses cannot be considered exact and thus applying an acceptable range around a threshold metric would be an appropriate way to express the Committee's values and provide flexibility in implementing the Plan.

While thresholds may operate as independent triggers for an assessment, once an assessment is undertaken it would look at each Plan Element's status as it relates to each of the thresholds as well as to the Guiding Principles. Taking this more comprehensive approach to the Assessment is intended to avoid unintended consequences that could result from applying a more narrow focus.

(i) Cost Metric

Cost-effectiveness is an important consideration in making pathway changes. Any decision on cost-effectiveness will require comparing the costs of available alternatives at the time a decision is made.

After considering the range of possible cost metrics to evaluate cost-effectiveness, the Committee recommends the threshold Cost Metric be the Annualized Cost per million gallons of Average Year Yield (ACAYY). This is the cost identified in Line k of the Project Elements Summary Table included in Appendix 8, Cost Data and Cost Analysis, which table is incorporated by reference.

This metric adds the amortized annual cost of capital investments and the annual operating and maintenance cost and divides it by the estimated project average year yield.

Amortized annual cost is preferred because it takes into account the amortized capital investment as well as operation and maintenance costs. *Average year yield* is preferred because *yield* focuses on benefits to the overall system and *the average year yield* allows comparison among options. While other costs may be considered in future decision-making, this Cost Metric was favored because it focuses on the cost of the yield produced in an average year.

(ii) Committee Preference Statement Related to Cost

Recognizing the cost differential between some of the strategies the Committee considered in developing its recommendations, the WSAC agreed to express its preference for Strategy One over Strategy Two, and has agreed that as long as the ACAYY for implementing Strategy One is not more than 130% of the ACAYY for Strategy Two, Strategy One should be pursued provided Strategy One meets other threshold metrics.

(iii) Yield Metric

The Yield Metric is the most straight-forward, the most quantifiable, and the least flexible of the thresholds. As described earlier in this document, the supply-demand gap has been established at 1.2 billion gallons per year (bg/y) for the worst year, based on Confluence modeling of the frequency and severity of shortages. The analysis takes into account DFG-5 fish flows and a plausible estimate of climate change impacts.

Updating the supply-demand gap requires both new demand forecasts and the kinds of analyses described earlier in Section 3.05 and Section 3.06. This analysis will be refreshed every five years as part of the Urban Water Management Plan update.

(iv) Timeliness Metric

For the Timeliness Metric, the Committee has agreed that a 10-year window is a reasonable target for achieving water supply sufficiency, defined as having a fully functional water system able to meet the supply-demand gap forecasted during extended droughts. Assessments, Reviews and Update to Plan

1. Procedural Steps

- a. An **Assessment** is performed by the Water Department and includes updated information and a recommendation about whether a change to the Plan is needed.

- b. The Water Department submits a report to the Water Commission for its **Review, including development of recommendations to the Council**. Following Water Commission action, the recommendation is forwarded to the Council for its consideration.
- c. If the Council so chooses, the Plan will be **updated**.

2. Information Sharing

- a. The Water Department will report to the Water Commission and the City Council
 - i. At all decision nodes identified in the Plan;
 - ii. Informally, as part of the Water Director's Oral Report at each Water Commission meeting, providing specific information about work in progress, successes and failures, and challenges and opportunities;
 - iii. Quarterly in the spring, summer and fall, as an agenda item with accompanying staff report on the Water Commission agenda for discussion, public comment, and action as needed; and
 - iv. Formally and annually to the Water Commission and the City Council in the winter of each year during the budget cycle, including Plan performance and significant adjustments
- b. As part of the Water Commission's and City Council's review of an updated Urban Water Management Plan, including
 - i. Performance
 - ii. Significant adjustments
 - iii. Updated Plan Goals and Assumptions (including demand, climate change, systems improvements etc.)
- 3. If the Water Department recommends an adaptation, such a report must contain a synthesis of each Strategy and/or Element's actual performance or most current projected performance against the most current Thresholds and an evaluation of whether the performance of individual Elements warrants making a change to the Plan as a whole, or to one or more Elements within the Plan.

(e) Staggered Adaptive Pathway and Decision Nodes

At its September 10, 2015 meeting, the Committee agreed to use a staggered implementation approach. Figure 11 shows the agreed-upon adaptive pathway map, and Table 16 lists the numbered decision nodes and provides descriptions about the expected information, decision, or result anticipated at that node.

Figure 11 – Agreed-Upon Adaptive Pathway Map

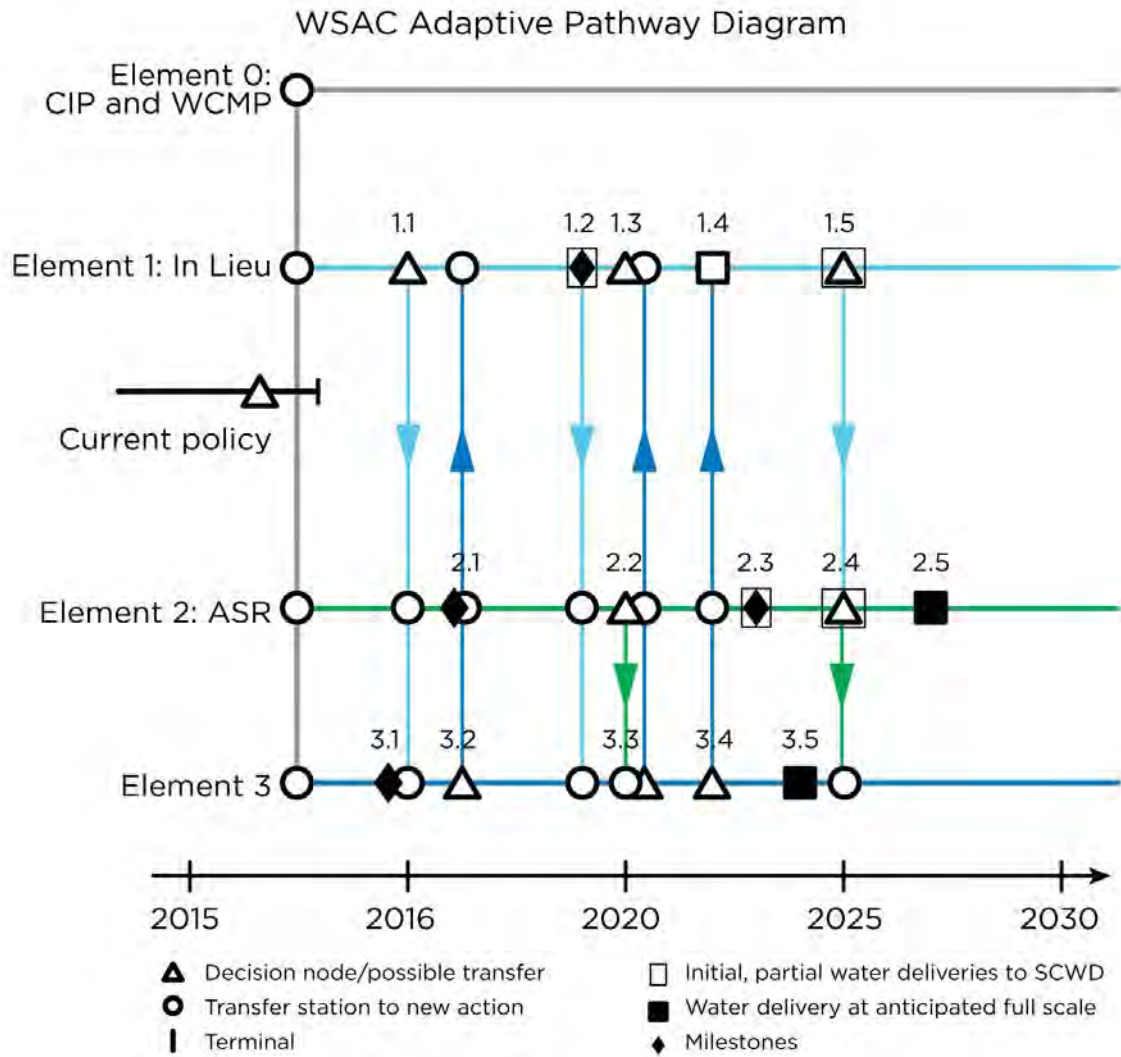


Table 16 – Table of Decision Nodes and Related Milestones

NODE	ABBREVIATED DESCRIPTION	ENDING YEAR
In Lieu (Element 1)		
1.1D 	Near Term: Initiation of near term water transfer/sale to SqCWD using North Coast water; agreements in place, and CEQA completed.	c. 2016
1.2M 	Larger Project: Understanding the feasibility of a potentially larger water transfer/exchange project with SqCWD and/or SVWD using North Coast and San Lorenzo River waters. Includes quantifying return water (using groundwater models) from SqCWD and/or SVWD to Santa Cruz as well as understanding of water rights and inter-agency collaboration.	c. 2018
1.3W/D  	Larger Project: Completion of agreements specifying terms of transfers to/from SqCWD and/or SVWD, water right modifications, planning/prelim design; complete assessments of cost, yield and schedule; and define CEQA. Decision point for proceeding on final design of associated infrastructure improvements.	c. 2019 c. 2020
1.4W 	Larger Project: Potential for return of water from SqCWD, and/or SVWD, to SCWD with the construction of infrastructure/treatment improvements.	c. 2022
1.5D/W  	Assess in lieu performance: amount to SqCWD, SVWD, and SCWD; reduced groundwater pumping, groundwater elevations, etc.	c. 2025
Aquifer Storage and Recovery, ASR (Element 2) Includes evaluation of Purisima and Santa Margarita		
2.1M 	High level feasibility work: use of groundwater model; completion of site specific injection capacity and geochemical analyses; development of pilot program.	c. 2017
2.2D 	Completion of all administrative items to conduct pilot testing (e.g., CEQA/permits/agreements and well modifications), completion of pilot testing, and assessment of probable ASR system performance, cost and schedule to complete build out of ASR system.	c. 2020
2.3M/W  	Develop/construct ASR wells, ready to operate.	c. 2022
2.4D/W  	Assess ASR performance against projections and ability to meet project goals.	c. 2024
2.5W 	Aquifer storage target attained (ability to sustain return flows to SCWD at desired levels).	c. 2027
Advanced Treated Recycled Water or Desalination (Element 3)		
3.1M 	Identify recycled water alternatives; increase understanding of recycled water (regulatory framework, feasibility, funding opportunities, public outreach and education)	c. 2016

3.2D 	Complete high level feasibility studies, as-needed demonstration testing, and conceptual level designs of alternatives; define CEQA processes; and continue public outreach and education. Select preferred Element 3.	c. 2017
3.3D 	Preliminary design, CEQA (including preparation of draft EIR), and apply for approvals and permits (except building permit).	c. 2020
3.4M 	Complete property acquisition, final design, complete CEQA and all permits.	c. 2022
3.5W 	Construction completed: plant start-up, water production begins	c. 2024

Abbreviations

ASR = Aquifer Storage and Recovery

CEQA = California Environmental Quality Act

DDW = Division of Drinking Water

DPR = Direct Potable Reuse

GHWTP = Graham Hill Water Treatment Plant

IPR = Indirect Potable Reuse

SCWD = Santa Cruz Water Department

SqCWD = Soquel Creek Water District

SVWD = Scotts Valley Water District

Notes

- This table is intended as a companion piece to the implementation Gantt chart and subway map. Gantt chart contains additional activity detail(s) for each node.
- Node types
 - D = decision node (triangle on subway chart)
 - M = milestone (diamond on the subway chart), furthering the understanding of feasibility.
 - W = water production potentially available (squares on the subway chart; open square indicates some water; solid square represents full goal being met).
- Node types have been assigned based on a set of assumptions as to how the implementation will proceed. However, if a threshold is being tripped, the node becomes a decision node regardless of its current designation.
- Ending Year refers to when all work associated with reaching node and/or achieving goal(s) will be accomplished. Dates shown are approximate based on current information and project understanding. Dates may adjust depending on: volumes of water available due to winter precipitation levels (which may limit amount of in lieu and ASR); ability to establish agreements, permits, etc.; and ability to implement workload.

As noted in earlier discussions, thresholds represent “special decision nodes” that can be reached by any Element, at any time.

(f) Guidance for Decision-Making at Decision Nodes

This section provides guidance for decision-making.

When a decision node on the adaptive pathway map is reached, or when the Plan or any Element appears it will fail to meet any threshold value at any time, the Committee’s Change Management Strategy recommends a “pause and assess” step. At this juncture, there are three basic kinds of decisions:

1. A decision to stay on the same path;
2. A decision to add another path or paths; or
3. A decision to switch to a different path or paths.

A decision to stay on the same path may include consideration of a range of actions. A decision to continue to the next phase in the Plan's development could involve, for example:

- Moving from preliminary engineering to design, or
- Expanding an element by deciding to make additional infrastructure investments, or
- Deciding not to put additional money into an element or approach that is struggling but to maintain the production already developed.

In general the possible decisions associated with the staying on the same pathway include:

- Start planning and/or pilot testing,
- Start preliminary engineering and/or regulatory and permitting processes,
- Start final design,
- Start construction,
- Build out or scale up,
- Stop further investment,
- Operate and maintain, and
- Stop pursuing altogether.

A decision to switch to a different path or paths may result from concluding that a particular task cannot be accomplished, for example not reaching agreement with other regional water providers for in lieu recharge, or from a failure to meet any threshold.

Recommended factors to be taken into account in decision-making about Plan implementation include the Guiding Principles as well as how well Plan Elements are performing relative to their Performance Metrics or Thresholds.

(i) Examples of Decision Guidance

This section provides several specific examples of decision guidance or special considerations for adjustments, adaptation or decision-making at specific decision nodes. Refer to Table 16 for details about decision nodes.

- **Element 1, Decision Node 1.3**

- Build Out Element 1 – If agreements with one or more regional partners are reached, water rights issues have been resolved, assumptions about the availability of river flows are confirmed, and groundwater modeling indicates sufficient water will be returned to Santa Cruz in a cost-effective and timely manner, then proceed to build out water transfers up to the original design limits of Element 1, adding additional infrastructure as needed to optimize project effectiveness.

- Stop Element 1 – If no agencies choose to participate with the City in pursuing in lieu recharge, including return of sufficient stored water in a cost-effective and timely manner, the City will evaluate whether Element 1 should be pursued further or abandoned.
- **Element 2, Decision Node 2.2**
 - Build Out Element 2 – Use results of pilot testing and estimates of cost-effectiveness and schedule for final system build-out to decide whether to continue implementing ASR up to the original design limits of Element 2.
 - Stop Element 2 – Consider stopping Element 2 if the solution is not working within acceptable performance parameters, for example, something systemic to the aquifer appears to make too many test sites unsuccessful in effecting aquifer recharge, or costs greatly exceed budget, or the schedule for final build-out exceeds the target completion date, and other Elements can meet or exceed their performance parameters, such that the Plan can meet its goals without Element 2.
- **Element 3, Decision Node 3.2** – Select preferred approach for Element 3 (e.g., DPR, IPR, desalination), initiate high level feasibility studies, as needed demonstration testing, and conceptual designs, define CEQA process; continue public outreach and education, and select preferred alternative.
 - Start Preliminary Design Engineering and Regulatory Process for selected Element 3 – (start work outlined in 3.3). Initiate preliminary design, prepare a draft EIR, and continue public discussions about the selected Element 3. This effort involves activity up to, but not including, site acquisition, final design and EIR (Draft EIR only at this stage). A key goal of the work would be to have Element 3 ready to go into the final design stage at node 2.2.
 - Stopping Element 3 -- Decide to stop or pause Element 3 if other Elements can meet or exceed their performance parameters, such that the Plan can meet its goals without Element 3.

As each decision is made, thresholds, performance metrics developed for each Strategy and/or Element, including budget, schedule, and yield, objective results-oriented measures, would be reviewed and changes made either within the **Adjustment** framework by the Water Department, or within the **Adaptation** framework in collaboration with the Water Commission and under the direction of the City Council. In both cases, communication about progress, issues, and actions would be open, frequent and data-based.

Section 3.25 Article III Summary – listing of all Committee Agreements

As indicated in Section 2.02, the Committee chose to use a consensus based decision-making process during its work. All Agreements presented in this section and elsewhere in this document were reached using this consensus process.

(a) Committee Agreements on Demand Forecasts

At the Committee's April 30 – May 1, 2015 meeting they agreed that the interim forecast would be used as the basis for the Committee's work until the results of the econometric forecast became available.

At its July 23, 2015 meeting, the Water Supply Advisory Committee agreed to use the econometric demand forecast as presented by David Mitchell of M Cubed Consulting at this meeting.

On September 10, 2015, the Committee accepted a revised forecast that corrected an error in the way that future plumbing and building code changes were incorporated into the forecast. Figure 4 above, reflects the revised, corrected forecast.

(b) Committee Agreement on Fish Flow Releases

On April 30, 2015, the WSAC agreed that, for planning purposes, using the DFG-5 flows as an upper bound or the potential impacts of fish flow releases on Santa Cruz's water system made the most sense. If the ultimate negotiated flow releases are lower, then the supply demand gap will be smaller and those results can be incorporated into future planning for supply augmentation.

(c) Committee Agreement on Climate Change

On April 30, 2015, the WSAC agreed that the Climate (hydrologic) Change and Extended Drought scenarios provide plausible parameters to use in its water system planning and that this analysis provides a useful point of depart for its scenario planning work. For planning purposes, the Committee agreed that the eight-year drought sequence was useful as a design drought, and recognized that this drought sequence would be reviewed and revised as new information became available.

(d) Committee Agreement on Problem Statement

On September 11, 2015, the Committee Agreed to the following formal problem statement:

Santa Cruz's water supply reliability issue is the result of having only a marginally adequate amount of storage to serve demand during dry and critically dry years when the system's reservoir doesn't fill completely. Both expected requirements for fish flow releases and anticipated impacts of climate change will turn a marginally adequate situation into a seriously inadequate one in the coming years.

Santa Cruz's lack of storage makes it particularly vulnerable to multi-year droughts. The key management strategy currently available for dealing with this vulnerability is to very conservatively manage available storage. This strategy typically results in regular calls for annual curtailments of demand that may lead to modest, significant, or even critical requirements for reduction. In addition, the Santa Cruz supply lacks diversity, thereby further increasing the system's vulnerability to drought conditions and other risks.

The projected worst-year gap between peak-season available supply and demand during an extended drought is about 1.2 billion gallons. While aggressive implementation of conservation programs will help reduce this gap, conservation alone cannot close this gap. The Committee's goal is to establish a reasonable level of reliability for Santa Cruz water customers by substantially decreasing this worst-year gap while also reducing the frequency of shortages in less extreme years.

(e) Committee Agreement on the List of Alternatives Considered but Not Being Pursued at this Time

At its September 10, 2015 meeting the WSAC, the Committee approved the information in Appendix 5 as its conclusions about the alternatives it evaluated and its reasons for not further pursuing these alternatives at this time.

(f) Committee Agreement about Demand Management (Conservation)

At the Committee's meeting of September 10, 2015, the Committee agreed to the recommendations related to demand management described in Section 3.16(a) of this report.

(g) Committee Agreement on Supply Augmentation Strategies

At its September 10-11, 2015 meeting, the Committee agreed to the following Supply Augmentation Strategies:

1. **Strategy One:** Development of groundwater storage using a combination of both passive and active recharge approaches and available surface water flows during the rainy season; and
2. **Strategy Two:** Development of advanced treated recycled water or desalinated water if and as needed to address any remaining supply-demand gap.

(h) Committee Agreement on Elements of the Water Supply Augmentation Plan

At its September 10-11, 2015 meeting, the Committee agreed to the following Elements of the Water Supply Augmentation Plan:

Element 0: Demand Management, with a goal to generate an additional 200 to 250 million gallons of demand reduction by 2035 from expanded water conservation;

Element 1: In Lieu, start quickly as a small program relying on existing infrastructure to provide potable water to the SqCWD. The program is intended to grow over time, if/as additional infrastructure is developed, additional agreements are reached with SqCWD and SVWD, and any needed changes to water rights are granted by the State of California. Details of sharing capital and operating costs would and how much water returns to Santa Cruz and when it would be available would be addressed in these agreements.

Element 2: Aquifer Storage and Recovery (ASR), involves development of a program to inject treated water from available winter flows into regional aquifers and recover a large portion of the stored water as a supplemental supply for Santa Cruz. This program would proceed through evaluation and piloting steps as detailed in technical reports (e.g., the May 2015 Pueblo Water Resources report) and, if successful, can be implemented on a scale sufficient to meet the yield goals of this Plan.

Element 3: Advanced Treated Recycled Water, is intended to supplement or replace Elements 1 and 2 to the extent they do not generate sufficient yield to fill the supply/demand gap in a cost-effective and timely manner, as stipulated in the Plan. In the event advanced treated recycled water could not meet the needs, desalination would then become Element 3.

In addition to developing Elements 0, 1, 2 and 3 above, the Committee suggests that the City should continuously review and take steps to address infrastructure and operating constraints that are keeping the existing system from performing as well as it could, within reason. Some specific suggestions are included in the recommendation section of this report.

(i) Committee Agreement on a Staggered Implementation Adaptive Pathway

At its September 30, 2015 meeting, the Committee agreed that implementation of the Water Supply Augmentation Plan should use a staggered approach that would include active pursuit of Strategy One at the same time as initial project planning and development work is occurring on Strategy Two. This approach is designed to ensure that should Strategy Two be needed as a water supply, enough work would have been done so that it will be feasible to achieve the yield goal within the original 10 to 12 year timeframe.

(j) Committee Agreement on a Change Management Strategy

At its October 2, 2015 meeting, the Committee agreed to the Change Management Plan presented in Section 3.24.

(k) Committee Agreement on Conveyance of Recommendations to the Santa Cruz City Council.

At its October 2, 2015 meeting, the Committee agreed to convey the Recommendations in Article IV of this report to the Santa Cruz City Council.

(l) Committee Agreement on the WSAC Agreement

Eleven of the 14 WSAC members were present at the October 2, 2015 meeting. By consensus (including proxies for two of the absent members) the Committee unanimously affirmed and approved the Agreements and Recommendations described in this report. The Committee's consensus reflects the strong commitment of the parties to move forward with addressing and ultimately resolving the community's long-standing water supply issues.

Article IV. Recommendations

Section 4.01 The Water Supply Augmentation Plan

The Committee has worked on developing a Plan that would eliminate future water shortages by 2025, give or take two years, while allowing for robust stream flows to support and enhance fish habitat.

The agreed-upon **Water Supply Augmentation Plan** (Plan) includes:

1. A **specific goal for Yield**, as well as the assumptions underlying this goal;
2. A **Timeframe** for improving the reliability of the Santa Cruz Water Supply;
3. The **Water Supply Augmentation Plan Elements**;
4. An **Adaptive Pathway** to provide a structure within which work on the Elements can be pursued and evaluated; and
5. A **Change Management Strategy** to guide adjustments and adaptations within the Plan, as described below.

Section 4.02 Yield Goal

The Committee recommends the City implement additional demand management and supply augmentation programs and projects and address key infrastructure and operating constraints to reliably make available an additional 1.2 bgy during modeled worst-year conditions.

Section 4.03 Timeframe for Improvement

The Committee recommends that the City adopt a goal of completing the improvements to Santa Cruz's water supply necessary to meet the specified yield goal by the end of 2025;

Section 4.04 Water Supply Augmentation Plan Portfolio Elements

The Water Supply Advisory Committee recommends that the City Council adopt a portfolio of measures for improving the reliability of the water supply. The recommended package includes the following Elements:

- **Element 0:** Additional water conservation with a goal of achieving an additional 200 to 250 million gallons of demand reduction by 2035 by expanding water conservation programs;
- **Element 1:** Passive recharge of regional aquifers by working to develop agreements for delivering surface water as an in lieu supply to the Soquel Creek Water District and/or the Scotts Valley Water Districts so they can rest their wells, help the aquifers recover, and effectively store water for use by SCWD in drought years;
- **Element 2:** Active recharge of regional aquifers by using existing infrastructure (wells, pipelines, and treatment capacity) and potential new infrastructure (wells, pipelines and treatment capacity) in the regionally shared Purisima aquifer in the Soquel-Aptos basin and/or in the Santa Margarita/Lompico/Butano aquifers in the Scotts Valley area to store water that can be available for use by Santa Cruz in drought years;

- **Element 3:** A potable water supply using advanced treated recycled water as its source, as a supplemental or replacement supply in the event the groundwater storage strategies described above prove insufficient to meet the Plan’s goals of cost effectiveness, timeliness or yield. In the event advanced treated recycled water does not meet the needs, desalination would then become Element 3.

Section 4.05 WSAC Value Statement on Implementing Plan Elements

The recommended Water Supply Augmentation Plan reflects the Committee’s preference for pursuing a groundwater storage and retrieval strategy provided the yield goal can be achieved in a cost-effective and timely manner. Before making a choice to move away from groundwater storage, the Committee recommends that the City diligently pursue all reasonable measures to make the groundwater strategies work.

Recognizing the cost differential between some of the strategies the Committee considered in developing its recommendations, the WSAC agreed to express its preference for the Strategy One, groundwater storage and retrieval, over Strategy Two, and has agreed that as long as the ACAYY for implementing Strategy One is not more than 130% of the ACAYY for Strategy Two, while still meeting other metrics, Strategy One should be pursued.

Section 4.06 Adaptive Pathway Implementation Strategy

The Committee recommends that the Council adopt a staggered Adaptive Pathway to guide implementation of the Plan and that decision-making at the various decision-nodes identified in this Adaptive Pathway be guided by the provisions of the Change Management Strategy.

Section 4.07 Change Management Strategy

The Committee recommends that the Council adopt the Change Management Strategy described in Section 3.24.

Section 4.08 Additional Recommendations Related to Infrastructure and Operating Constraints

(a) Infrastructure Constraints

The Committee also supports the Water Department’s plans to address certain key infrastructure constraints that are keeping the City from fully utilizing available water, especially during the high flow season. These include, but are not limited to:

- Rehabilitation of the pipeline between the Felton Diversion and Loch Lomond that would allow the City to increase diversions to Loch Lomond during the high flow season;
- Evaluation of additional pumping capacity at Felton to push more water to Loch Lomond through the replacement pipeline; and
- If proven cost-effective, and needed for the implementation of Strategy One, complete improvements that will allow the Department to treat water with turbidities that are higher than can be effectively treated by the current Graham Hill Water Treatment Plant facilities and

processes. The specific method for how to address the water treatment constraint should include evaluating a range of potential options, including, but not limited to Ranney Collectors or satellite treatment plants, and choosing the most cost-effective approach.

(b) Operating Constraints

Another focus of the Committee’s review relates to some system operational constraints. Operating constraints typically include both daily parameters for drawing water from the City’s sources and operating constraint parameters that are used in modeling system performance.

The Committee recommends that the Water Department identify and regularly evaluate operating constraints to determine whether those constraints continue to be justified as necessary to protect the system and finished water quality and to support efficient and cost-effective operations. Early focus should be given to issues related to Loch Lomond year-end carry over storage requirements, particularly if/when in lieu and/or ASR have provided a sufficient drought supply, and to the “first flush” constraint impacting the City’s ability to pump water from Felton to Loch Lomond under critically dry year conditions.

Section 4.09 Implementation Plan and Timeline

As part of the process for developing the WSAC Agreement, City Staff and the technical team developed a Gantt chart shown in Figure 12. This Gantt chart, together with the Decision Node Table (Table 16) and the Staggered Adaptive Pathways Map (Figure 11) comprise the Implementation Plan and Timeline.

Figure 12 – Gantt Chart: Implementation Plan and Timeline

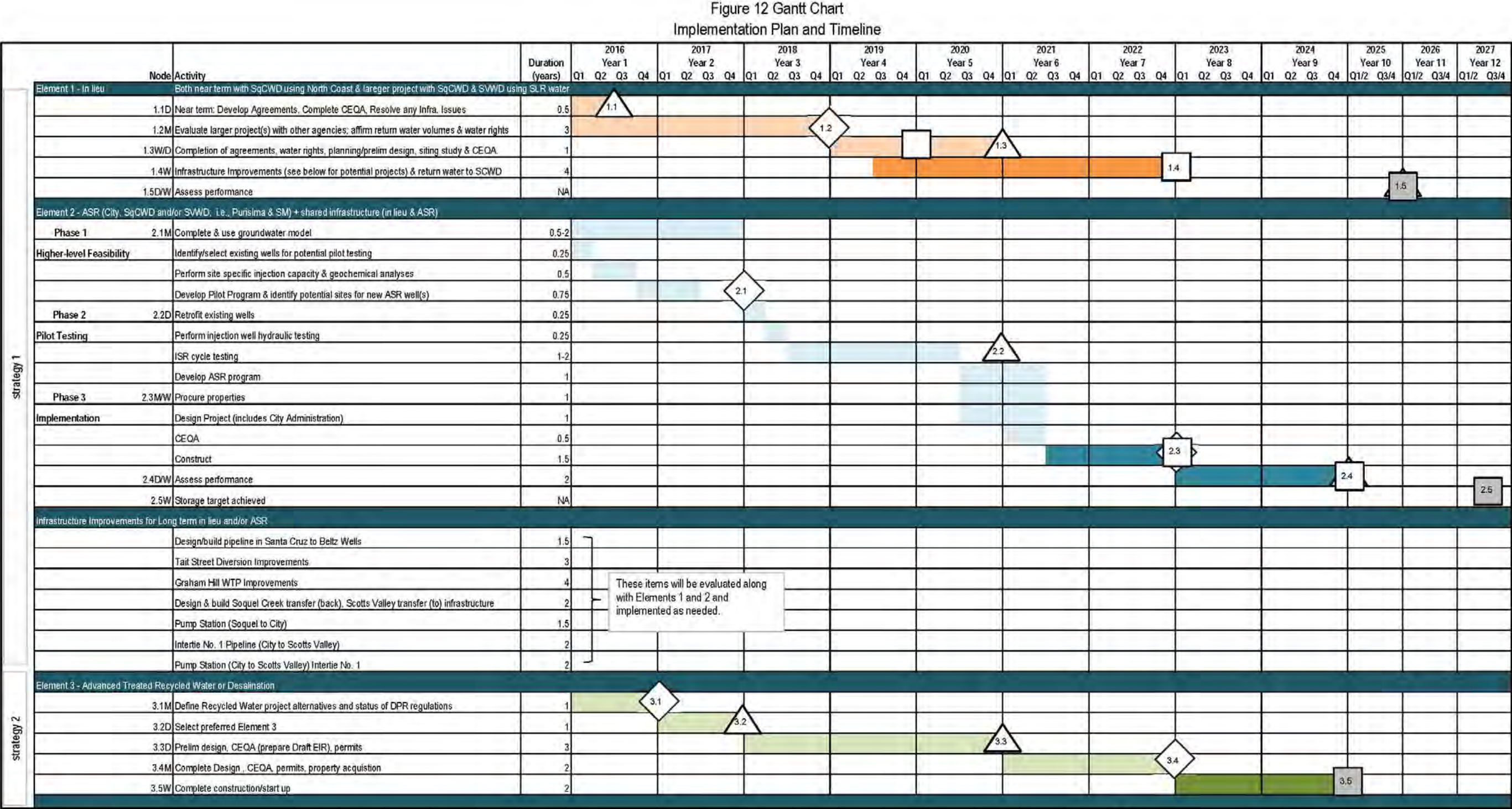


Table Notes & Select Assumptions
This table approximates activities, costs, durations and sequencing of each element, all of which are subject to change. Elements are shown to start in Q1 - 2016. This may or may not occur depending upon agreements, contracts, etc. Rehab/replacement of the Newell Creek Pipeline is part of the existing CIP and not shown here. Some infrastructure improvements may not be required if other pursuits are successful. E.g., evaluation of Ranney collectors may substitute GHWTP improvements. CEQA is used generically, implies compliance with California Environmental Quality Act. Pilot ASR work assumes major infrastructure not required. E.g., intertie to Scotts Valley or new well(s). Element 2 includes 8 wells for in lieu plus 8 additional wells for ASR.

Legend
ASR = Aquifer Storage and Recovery
CEQA = California Environmental Quality Act
DDW = Division of Drinking Water
DPR = Direct Potable Reuse
EIR = Environmental Impact Report
GHWTP = Graham Hill Water Treatment Plant
IPR = Indirect Potable Reuse
ISR = Injection, Storage, Recovery
SCWD = Santa Cruz Water Department
SqCWD = Soquel Creek Water District
SVWD = Scotts Valley Water District

Decision Node
 Milestone Node
 Some amount of water returned to SCWD
 Full required amount of water returned to SCWD

Appendix 8

Cost Data and Cost Analyses

Overview

This Appendix describes key activities undertaken by City staff and the project technical team to support the Water Supply Advisory Committee (WSAC or Committee) as it evaluated alternatives and later defined the recommended water resources plan and associated costs (capital, operations and maintenance [O&M], and present value).

Progression: Ideas to Building Block Development to a Robust Adaptive Program

Figure A8-1 presents an overall flow schematic for the progressive development that moved from public and staff ideas offered at the Strategies and Ideas Convention (October 2014), through consolidated alternatives (CAs) to building blocks (BBs), portfolios, and final elements and strategies.

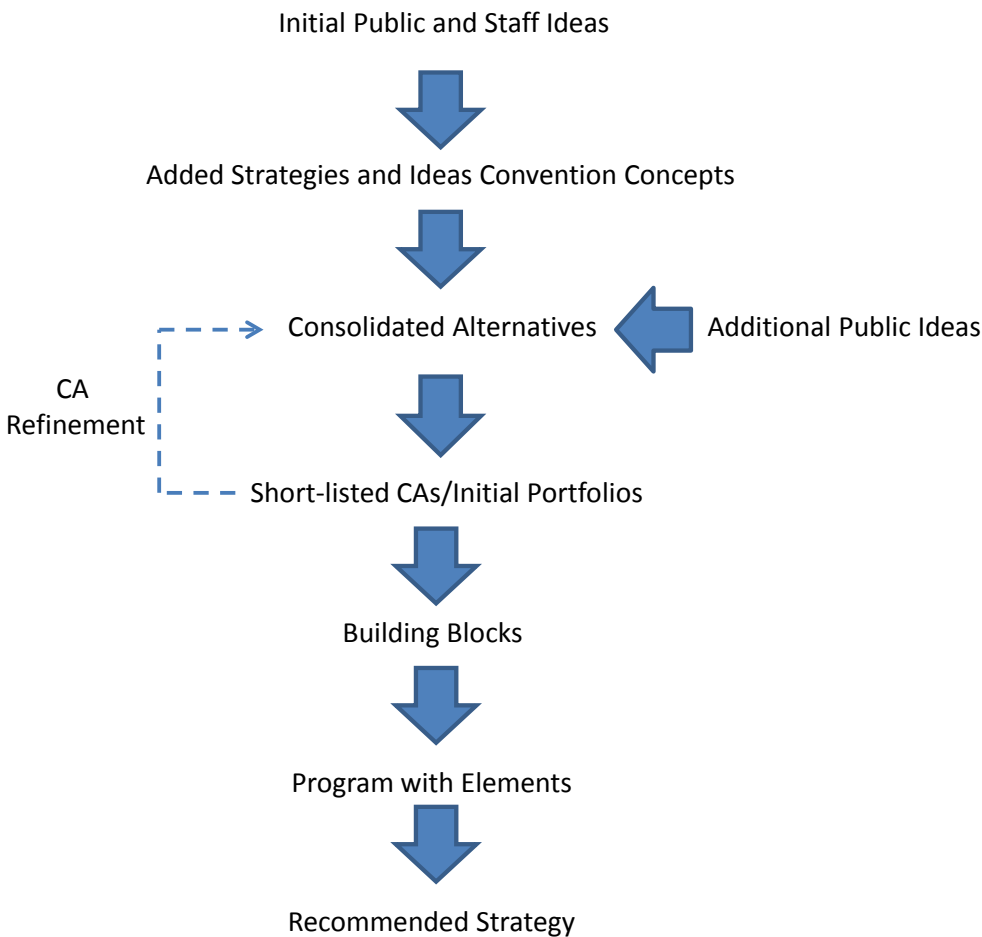


Figure A8-1 Overall flow schematic for the progressive development of the Proposed Water Supply Program

The April/May 2015 WSAC meeting marked the start of the modeling of the manner in which supply/ infrastructure alternatives address the reliability issues identified to that point. Analyses were performed on the following Consolidated Alternatives (CAs):

- Harvesting Winter Flows (CA-9, CA-16, CA-18)
- Ranney Collectors and Additional Storage (CA-19)
- North Coast Reclaimed Water Exchange (CA-13)
- Indirect Potable Reuse (CA-10)
- Additional Water Conservation (Program CRec) (CA-03)

By the June 2015 WSAC meeting, the Consolidated Alternatives considered above had evolved into several portfolios. All of the portfolios included the CRec conservation programs (CA-3). In addition, each portfolio included a Plan A and a Plan B. The initial supply/infrastructure additions represented by Plan A depended in whole or in part on storing excess winter flows in groundwater aquifers. The Plan B additions consisted of drought-proof supplies that did not vary with streamflow.

The portfolios were refined in several iterations, and the final set that was discussed at the June meeting was intended to enable the Committee to wrestle with different adaptive approaches to dealing with the uncertainties associated with all of the alternatives, particularly the abilities of the regional aquifers to store and allow recovery of significant volumes of water. Resolution of these uncertainties requires a robust program of groundwater modeling, analysis, and testing, and the portfolios recognized the significant risk of simply relying on the Plan A alternatives.

Based on WSAC discussions around these potential portfolios assembled from parts of the CAs, City staff and the Project Team developed BBs that WSAC combined into its preferred/recommended Elements. In this process, CAs were refined and consolidated into BB portfolios that could accomplish key water production, transfer and return goals. Elements from the BB portfolios were then extracted and further refined as separate potential projects. These elements were as follows:

1. In lieu recharge to Soquel Creek Water District (SqCWD) and Scotts Valley Water District (SVWD),
2. ASR as a supplement or in place of in lieu recharge to SqCWD and SVWD, and
3. Advanced Treated Recycled Water or Desalination.

The Elements form an adaptive program that the City, likely with cooperation with adjacent agencies, will implement and modify based on relative success of the Elements. Attachment 1 presents a summary of the recommended elements, including estimated capital costs, energy use, yield, etc., of the Elements in this Plan. Attachment 2 is a Gantt Chart timeline for

implementation. Attachment 3 is the companion piece describing the decision points and milestones. And Attachment 4 includes the three subway diagrams that can be used with the other attachments to understand in the implementation plan.

Key Physical Components

The City plans to use existing facilities wherever possible and build new facilities as needed to augment its existing supply. Key existing components include:

- The City's diversions (North Coast streams and San Lorenzo River via Tait Street and Felton),
- Beltz Wells,
- Loch Lomond Reservoir,
- Graham Hill Water Treatment Plant (GHWTP),
- Associated storage and conveyance infrastructure (raw water and treated water pipelines, pumping stations and distribution system reservoirs),
- The City's wastewater treatment plant (WWTP) and ocean effluent outfall.

Potential new facilities include:

- Upgrades to the GHWTP,
- Modifications to diversions (e.g., Ranney collectors and/or upgraded Felton and Tait Street facilities, and replacement of the pipeline from Felton Pump Station to the Newell Creek Dam/Loch Lomond),
- New wastewater effluent advanced purification facilities (likely at the WWTP),
- Replacement or addition of new infrastructure (both within the City and connecting to/within the Soquel Creek Water District and Scotts Valley Water District), and
- New wells within the City, Soquel Creek Water District (SqCWD), and/or Scotts Valley Water District (SVWD).

The diagrams in Figures A8-2, A8-3, and A8-4 show examples of how the pieces could fit together into functioning systems.

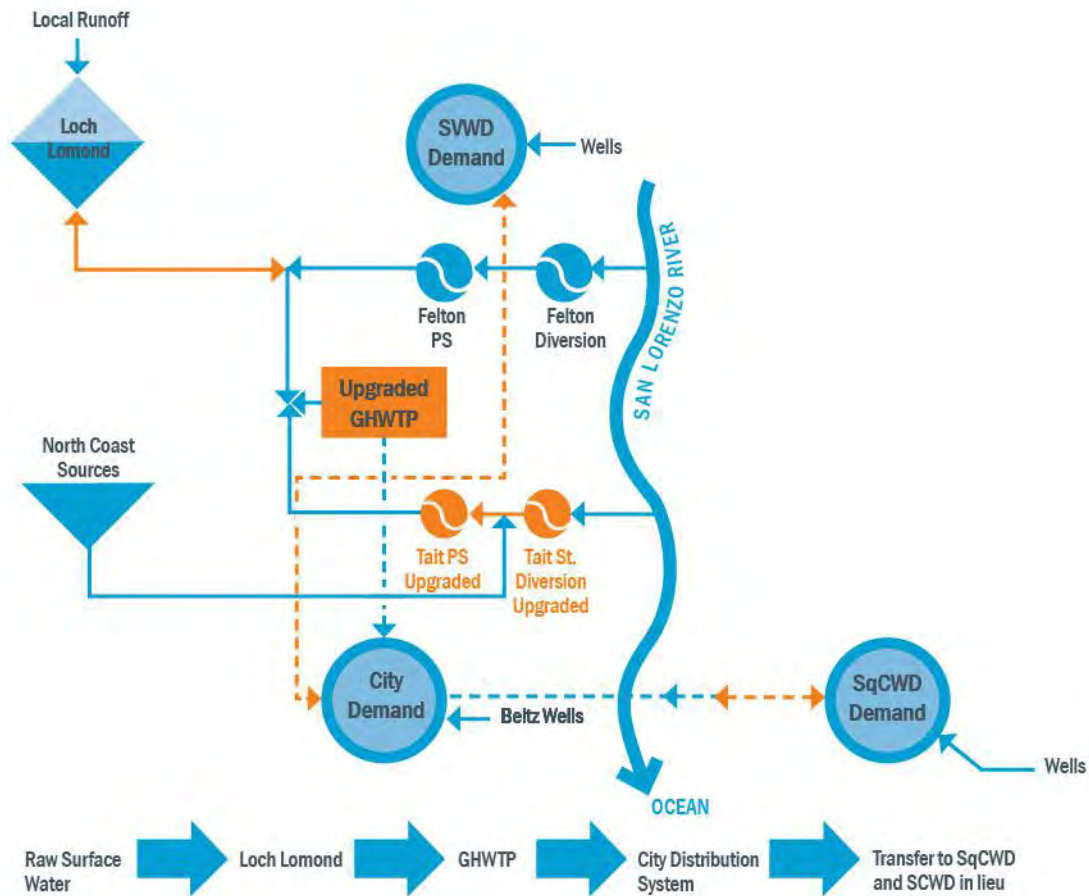


Figure A8-2. Illustration of the Conceptual Approach for Element 1, In lieu Recharge

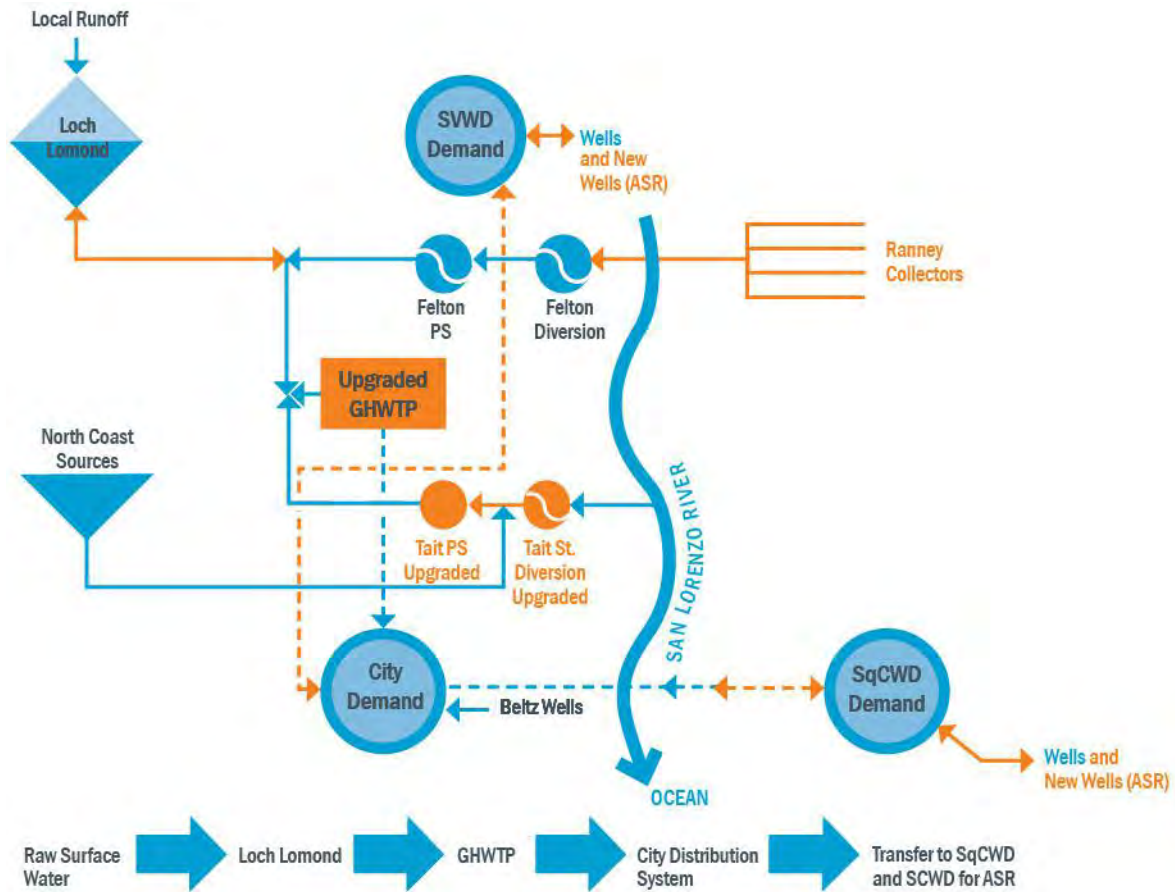


Figure A8-3. Illustration of the Conceptual Approach for Element 2, ASR.

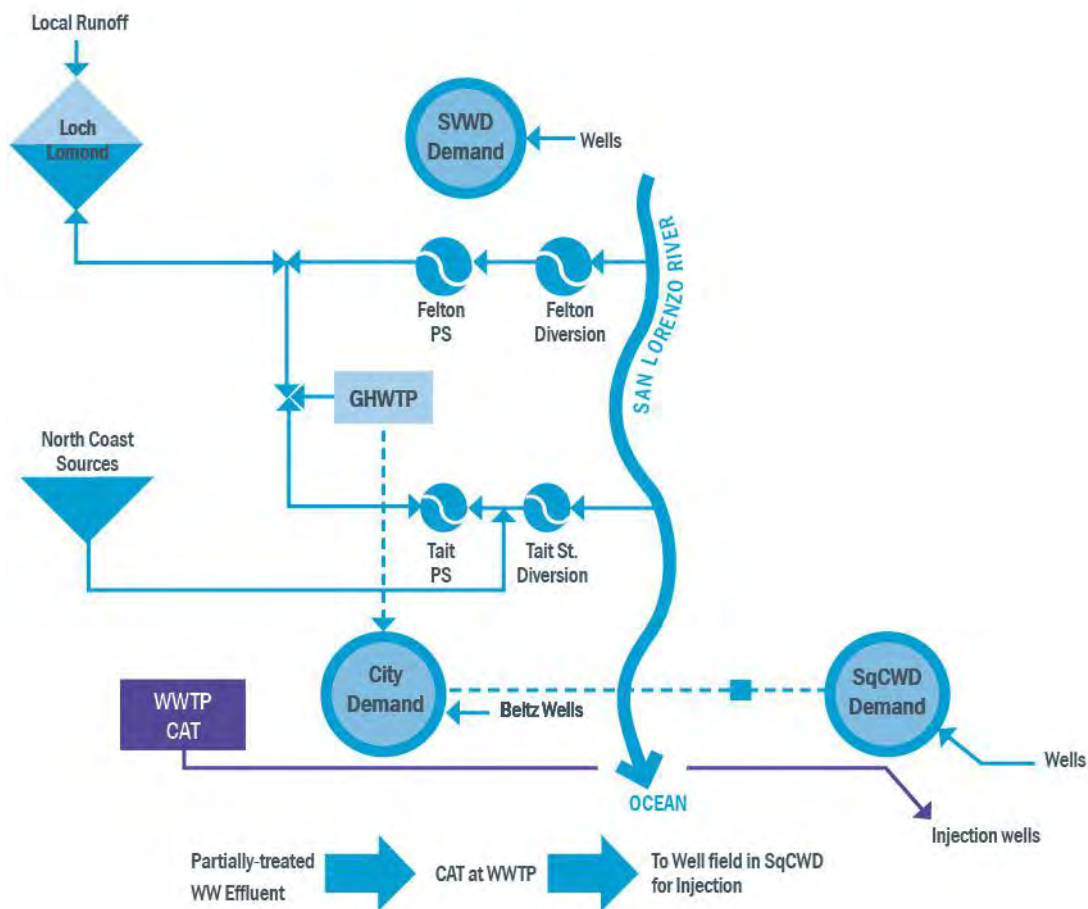


Figure A8-4. Illustration of the Conceptual Approach for Element 3a, Potable Reuse via Groundwater Recharge—i.e., Indirect Potable Reuse

Cost Estimating

The technical team developed costs (capital, operations and maintenance [O&M] and present value) at several stages of potential program component development. All costs, from the Portfolio stage through the original Building Block concepts (which were expanded on by committee members) to the final Recommended Project Elements were based on the conceptual-level construction and operating costs on project components like those shown in the schematics above. Information available in previous technical studies conducted by the City, Santa Cruz County, SVWD, and SqCWD and previous projects/studies by Brown and Caldwell (BC) were used to inform this work. For example, the 2015 Pueblo ASR report informed the development of the ASR well number and cost estimates; the new conveyance between Soquel Creek Water District and the City is based on the alignment for a potential intertie and pump station developed for the City by Kennedy Jenks; and the treatment train concept for this work was based on the most exhaustive complete advanced treatment (CAT) process being piloted in California as of Summer 2015: nitrification of the wastewater

effluent—ozone with biologically active carbon (O₃/BAC)—microfiltration (MF)—reverse osmosis (RO)—advanced oxidation ultraviolet light with peroxide (UV-AOP) conditioning of the product water, as illustrated in Figure A8-5. This process train is very robust since regulations for potable reuse via reservoir augmentation and direct reuse are still in flux and the City may wish to pursue one of these options. The more robust process train also responds to concerns expressed by citizens at WSAC meetings. The proposed train would ensure a greater removal of constituents such as emerging contaminants of concern (e.g., pharmaceuticals).

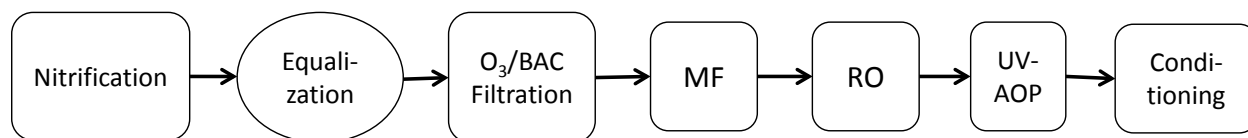


Figure A8-5. Illustration of the CAT Conceptual Approach for Element 3a, Potable Reuse

Table A8-1 below describes the final project elements. The cost estimates for Elements 1, 2 and 3 all contain a range of uncertainty. For example, while it is possible that the final cost for implementing Strategy 1 may be substantially less, it is also possible the costs may be more. Focusing only on Strategy 1, the factors that may lead to lower costs include the following:

1. It is beyond the scope of the WSAC to recommend the actual design of these Elements. For example, in lieu recharge (Element 1) might be implemented in many different ways, depending on the interests of neighboring districts, the constraints of water treatment, the constraints of existing distribution pipelines, etc. Similarly, direct injection (Element 2) may be conducted by the City alone, or in conjunction with neighboring districts, focused on one aquifer strata, or focused on several strata, etc. I.e., there are many unknowns that must be answered to define the final project.
2. The Project Elements Summary does not include the revenue from sale of water to neighboring districts, or other means of potential cost-sharing. It is premature to estimate that cost sharing contribution or possible revenues back to Santa Cruz.
3. The cost of upgrade of GHWTP, \$62 million, is the largest single line item on the Gantt Chart. The purpose of this expenditure is to allow treatment of more winter water from the San Lorenzo River for the purpose of maximizing Elements 1 and 2. To be able to produce and deliver more water in the winter, we may need to deal with water with turbidity levels that are beyond that which can be effectively treated by the GHWTP. Lower cost options for addressing this purpose may be available and include: a) using existing GHWTP treatment capacity, b) constructing a Ranney Collector to reduce turbidity, and/or c) installation of a small-scale satellite treatment plant. The information needed to assess the feasibility of these alternatives is currently

unavailable. A principal piece of needed data is an understanding of the current GHWTP's ability to treat water at the quality and quantity needed for Elements 1 and 2, followed by an understanding of the most cost-effective way of meeting treatment goals associated with these elements where the GHWTP might fall short.

4. The cost of upgrading the Tait St. Diversion, \$14 million, is included in the cost estimate and is a placeholder for achieving increased diversion capacity on the San Lorenzo River for the purposes of maximizing Elements 1 and 2. However, with the City adoption of the aquifer recharge strategy and the completion of a Habitat Conservation Plan, the expectation is that state and federal fisheries agencies will remove their long-standing protest of the City's water rights application to use Felton Diversion for direct pumping to Graham Hill Treatment Plant. State approval of this water rights revision may allow the City to use the Felton Diversion for additional winter water diversion, rather than expand the Tait St. Diversion.
5. Current calculations are based on a 30-year life-cycle and do not account for residual value in capital expenditures beyond 30 years. Longer-lived infrastructure, such as pipelines between Santa Cruz and neighboring districts, likely has value that is not included in the cost accounting.
6. Costs could be significantly greater in order to generate yield sufficient to meet the gap, e.g., final pipeline routes could be longer or geological conditions could require more injection wells.
7. Strategy 1 will be implemented in incremental fashion. Initial expenditures are intended to define the project(s) and its feasibility at meeting the Plan's goals in the most cost effective way possible. Subsequent expenditures would be made based on feasibility and cost effectiveness with little risk of creating stranded assets.

Table A8-1. Project Element Capital Cost Components and Assumptions

Element Number/Type	Capital Cost Components	Basis for Assumptions
1 – In lieu	<u>Existing Infrastructure Improvements</u> • Tait Street Diversion Improvements • Graham Hill WTP Improvements <u>Pumps and Pipelines</u> • 3,600 gpm Pump Station (City to Scotts Valley) at Intertie No. 1 • 16-inch Intertie 1 Pipeline (City to Scotts Valley), 3,600 linear feet (LF) • 3,600 gpm Pump Station (Soquel to City) at SqCWD Intertie • 16-inch Intertie Pipeline (City to Soquel Creek), 25,000 LF <u>Wells</u> • 4 350-gpm extraction wells in SVWD • 4 350-gpm extraction wells in SqCWD • Iron & manganese treatment, 8 wells • Land acquisition for wells, 4 sites in SqCWD and 4 sites in SVWD	• In lieu is based on winter demands for SqCWD and SVWD. • Water could be transferred to wells within the City, to SqCWD, and to SVWD. • Infrastructure is sized to accommodate 2.5-mgd (million gallons per day) peak flow between the City and SVWD and between the City and SqCWD. This sizing is to allow inclusion additional flows for ASR in the future. • The ultimate number and distribution of wells between agencies will be determined during project development. • The Tait Street and GHWTP improvements are based on current information that indicates that these facility upgrades are needed to treat a larger volume of higher turbidity water. This will be better defined moving forward. • It is assumed that the wells will all have a peak extraction flow rate of 350 gpm. • It is assumed that on-site iron and manganese treatment will be needed at each well. • Well footprints are estimated at 0.1 acre each. •
2 – ASR	<u>Pumps and Pipelines</u> • In-City pipeline to Beltz Wells, 4,000 LF <u>Wells</u> • 2 350-gpm Wells in SVWD)	• ASR is based on the assumption that there is adequate capacity in the basin to store and produce water as supplied from available winter flows. It is also assumed that early project activities will include field work to evaluate the validity of these initial assumptions (i.e., how well ASR is likely to work in terms of both storage capacity and future yield). • The project elements for the ASR program build on the project elements already developed in

	• 2 350-gpm Wells in SqCWD • 4 350-gpm Wells in Santa Cruz • Iron & manganese treatment, 4 wells • Land acquisition, 0.1 ac. each in SVWD and SqCWD	Element 1. • Water could be transferred to wells within the City, to SqCWD, and to SVWD. • Infrastructure is sized to accommodate 2.5-mgd peak flow between the City and SVWD and between the City and SqCWD. • The ultimate number and distribution of wells between agencies will be determined during project development. • It is assumed that the wells will all have a peak injection flow rate of 250 gpm and a peak extraction flow rate of 350 gpm. • It is assumed that on-site iron and manganese treatment will be needed at each well. • Well footprints are estimated at 0.1 acre each.
3 – Indirect potable reuse via groundwater recharge	CAT Process • Nitrification (3.9 mgd) • Ozone/BAC Filters (3.9 mgd) • Microfiltration (3.9 mgd) • Reverse Osmosis (3.5 mgd) • Advanced Oxidation (Peroxide + UV) (3.0 mgd) • Conditioning Facilities (3.0 mgd) • Effluent Diffuser Modification <u>Pumps and Pipelines</u> • 2,700 gpm Pumping System—WWTP to CAT • Pipeline Installation—WWTP to CAT, 200 LF • Equalization Basin, 0.5 million gallons • 2,100 gpm Pumping System—WWTP to Soquel Creek • 16-inch Pipeline to Wells, 20,100 LF • 16-inch Pipeline under San Lorenzo River, 350 LF • 16-inch Pipeline Under Woods Lagoon, 445 LF	• Potable reuse capacity is designed for 3-mgd product water 365 days a year based on treating only City of Santa Cruz flows. (I.e., conservatively assuming raw sewage and/or effluent from SqCWD and SVWD was unavailable.) • Infrastructure for potable reuse treatment is identical for all potable reuse alternatives. Treatment is on-site at the WWTP. Costs to treat blended water at GHWTP not included (~\$2.7M/yr for 3 mgd daily flow) • Groundwater recharge is assumed to occur near the coast.

	• 16-inch Pipeline Installation—transmission line to well 1, 2,640 LF • 14-inch Pipeline Installation—well 1 to well 2, 2,640 LF • 12-inch Pipeline Installation—well 2 to well 3 to well 4, 5,280 LF • 10-inch Pipeline Installation (WWTP to wells 5-6, 10"), 5,280 LF • 8-inch Pipeline Installation—well 6 to well 7, 2,640 LF • 6-inch Pipeline Installation—well 7 to well 8, 2,640 LF <u>Wells</u> • 8 350-gpm Injection Wells at SqCWD	
4 – City desalination	• City Desalination Plant Capital Cost (from earlier Santa Cruz work) • Effluent Outfall Modifications	• The City desalination option capacity is 3 mgd product water 365 days a year. • Cost includes property rights acquisition. • Water from the facility would be added in at Bay Street has been added (instead of into the distribution system at a lower point).

Capital Costs.

The capital cost estimates represent an order-of-magnitude (AACEI Class 5) approach. For an order of magnitude estimate the planners, hydrogeologists and engineers have defined major project components (see examples above), estimated approximate required capacities, established preliminary design criteria, and selected rough locations for facilities and routings for connection infrastructure such as pipelines. BC used capital cost information from other similar projects (for example, City of San Diego Pure Water and Orange County Sanitation District/Orange County Water District Groundwater Replenishment Supply—GWRS) and many Northern California pumping stations and pipelines from previous BC planning and design assignments. Pueblo Water Resources supplied information about well construction costs. In terms of costs, Class 5 planning-level estimates, which include a 50 percent contingency factor, are also accompanied by an accuracy range of -30% to +50%. For example, a project presented with a \$100M cost including contingency allowance (\$66.7 million plus \$33.3 million = \$100 million) likely would have a final cost between \$70 million and \$150 million. Table A8-2 and Figure A8-6 below summarize the AACE Estimate Classification System.

Table A8-2 AACE Estimate Classification System, adapted from AACE RP No. 18R-97, *Cost Estimate Classification System – As Applied in Engineering, Procurement and Construction for the Process Industries* (1998)

Estimate Class	Primary Characteristic	Secondary Characteristic			
	Level of Project Definition (% complete)	End Use	Methodology	Expected Accuracy Range (Typical variation in low and high ranges)	Preparation Effort (Typical degree of effort relative to least cost index of 1)
Class 5	0-2%	Concept Screening	Capacity factored, parametric models, judgement or analogy	L: -20% to -50% H: +30% to 100%	1
Class 4	1-15%	Study or Feasibility	Equipment factored or parametric models	L: -15% to -30% H: +20% to +50%	2 – 4
Class 3	10-40%	Budget Authorization or Control	Semi-detailed unit costs with assembly-level line items	L: -10% to -20% H: +10% to +30%	3 – 10
Class 2	30-70%	Control or Bid/Tender	Detailed unit cost with forced detailed take-off	L: -5% to – 15% H: +5% to 20%	4 – 20
Class 1	50-100%	Check Estimate or Bid/Tender	Detailed unit cost with detailed take-off	L: -3% to – 10% H: +3% to 15%	5 - 100

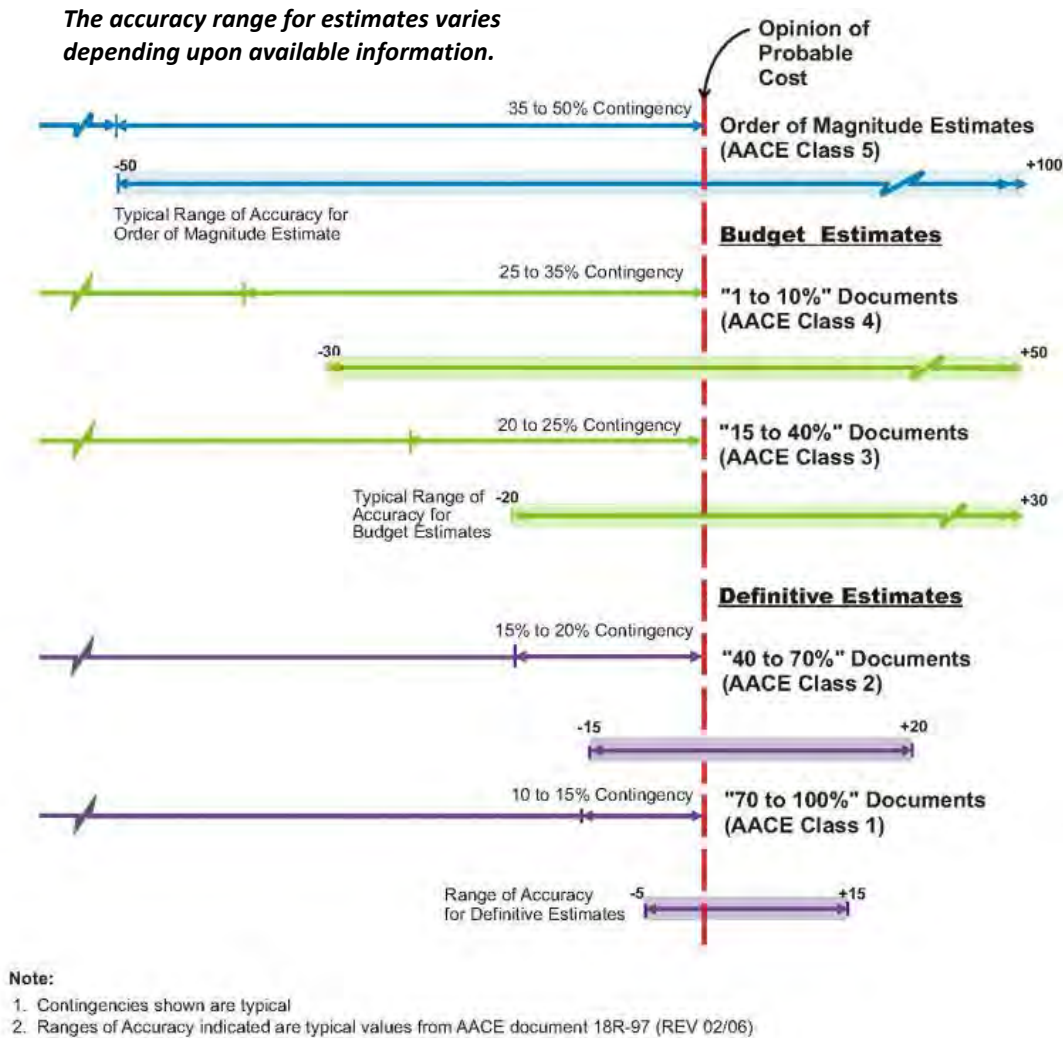


Figure A8-6 Opinions of Probable Cost Typical Contingencies and Ranges of Accuracy

The standard cost multipliers used on the construction subtotal (1.5X the base capital materials cost) in the capital estimates included:

- Engineering and Administration 20%
- Legal 5%
- Geotechnical Investigation 1%
- Permitting - CEQA/NEPA 5%

Project sizing, e.g., flow rate for a pumping station or pipeline, came from a combination of Confluence® model runs (for available raw water from the City's current sources) and assessment of available resources such as raw wastewater flows and estimated recovery of

recycled water after allowing for production losses. For this project, the reader should note that each estimated construction cost includes a contingency allowance for both “known unknowns” and “unknown unknowns.” Known unknowns include items such as site geotechnical conditions (at most sites no investigations have occurred yet but some sites such as the WWTP are built over originally swampy ground) and existing potential utility interferences. Unknown unknowns could be things such as endangered species habitat that requires rerouting/relocation of facilities or potential well site exploration that would show unsuitable underlying geology. The contingency allowance was set at 50 percent to reflect the very early conceptual level for the work.

Capital costs also recognize that the City will expend considerable funds in its planning, design, and facilities permitting.

O&M Costs

O&M costs include a wide variety of ongoing project costs. CAT-specific treatment O&M costs were based on South District WWTP (Miami-Dade Sanitation District Miami, FL) costs prepared by BC. Basic O&M cost elements included:

- Electricity to run equipment and to pump (based on elevation lift and frictional losses) at \$0.013/kW-hr,
- Infrastructure and mechanical spare parts, equipment repairs and replacement:
 - o Pumping Systems: Pump replacement every 15 years + pumping system replacement every 30 years.
 - o Pipelines: Annual O&M 1.5% of capital cost + 60-year replacement.
 - o Storage Tank: Annual O&M at 0.5% of capital cost + painting every 20 years + 60-year replacement.
 - o Treatment Processes Nitrification, Ozone/BAC, Conditioning Facilities – Annual O&M 1.5% of capital cost + 60-year replacement for full unit.
 - o Treatment Processes MF, RO, and UV-AOP: Microfiltration and RO based on expected average membrane life and company warranty, UV and Ballast based on average life and company warranty. This also includes 60-year replacement for full unit.
- Treatment chemicals (e.g., greensand and chlorine for the wellhead treatment systems, anti-scalant for the RO system, caustic for pH adjustment post-RO), and
- Cost of treating water through the GHWTP (if the City would choose direct potable reuse later in project implementation).

The O&M costs have similar uncertainty to capital costs.

Unit Costs

BC based unit costs on those prepared by BC for North City Water Reclamation Plant (NCWRP), Harbor Drive Advanced Water Purification Facility (HD AWPf), and North City Water Reclamation Plant, NCWRP Upgrades/Improvements. BC used the sizing criteria from San Diego's Pure Water program for unit processes with a general assumption that the City could modify the existing highly under-loaded SC TF/SC WWTP to achieve nitrification. BC knows the effluent flow rates available and general water quality. The cost curves and the six-tenth rule served as the basis for adjusting estimated capital costs for facility scale changes. For final analysis, a 3-mgd output facility was considered that would treat only City wastewater.

Why was “yield” selected as the basis of the cost comparison?

An important metric for evaluating different water supply (and conservation) enhancement options can be developed by examining the cost per some unit of water-related benefit provided. Two water-related benefit measures that might be applied in this context are:

1. **Yield** is defined within the WSAC context as the amount by which a water option, or a portfolio of options, decreases the gap between peak season demand and the supply of water available in that peak season. Yield is typically measured in terms of the estimated millions of gallons (mg) by which the gap is reduced over the peak season. Yield may also be portrayed in terms of the size of the remaining peak season gap in a given projected water year (measured in MG, and/or in terms of the percent of peak season demand remaining unmet). Yield estimates reflect how the water supply components operate together as part of the overall SCWD *system*, and yield estimates are generated through application of the *Confluence* model.
2. **Production** is the volume of water potentially generated when operating at full design capacity by a water supply option, and is typically described in terms of volume produced in a typical day (e.g., 3 mgd). Production also may be described as how much water would likely be produced over a year (e.g., a 3 mgd facility producing water at that rate for 365 days would produce almost 1,100 MG per year). Production can be a somewhat hypothetical measure of the actual amount of water generated, as many options do not operate at full scale every day of the year (e.g., they may be constrained by the amount of river flows, and/or limited by other components of the overall water system). Production estimates do not account for how components of the overall system interact, but they are useful for scaling the size of the necessary infrastructure and estimating annual operation and maintenance costs.

Either of these water measures can be applied in a “unit cost” metric – i.e., one can use a cost per yield metric and/or a cost per production metric or both.

Of these two possible metrics, the “cost per yield” version was selected by the WSAC as the most informative and relevant during the evaluation phase. This is because “yield” reflects the true value to the community of the water generated by an alternative—it reflects how much an option (or portfolio of options) helps address water shortages in the times of year when shortages otherwise would arise and result in curtailments being imposed on the Water Department’s customers.

In contrast, water “production” reflects how much water might theoretically be generated in total, but not necessarily how much water would be truly generated, nor how much of the water shortage problem it might help address.

- **How will “Annualized Cost per Average Year Yield” be used with other metrics in comparing projects?**

A metric selected by WSAC for evaluating options is the Annualized Cost per Average Year Yield (ACAYY). This metric applies the estimated total annualized cost of an option (the annualized capital expense, such as would be incurred through bond repayments, plus the annual operation and maintenance costs), divided by the estimated average year yield (AYY).

The total annualized costs portion of the metric provides a useful approximation of how much the community will pay each year for the alternative. The AYY portion of the metric reflects the estimated value realized by the community (in terms of yield—the amount by which water shortage problems are resolved) averaged across projected future water year outcomes. This metric thus provides an indication of costs borne relative to the benefit received by rate payers.

This metric will be used to help guide deliberations about how the preferred water plan elements may be adjusted over time, as more information becomes available through the initial stages of investigation and implementation. For example, if technical or institutional complications (or simplifications) arise that render the expected cost of a preferred alternative considerably higher (or lower) than initially estimated, and/or result in lower (or higher) anticipated water yields, then the expected ACAYY cost per yield metric for that element will increase (or decrease). If the increase (or decrease) in ACAYY is sufficiently large, then the unit cost information will be considered—along with other factors—with respect to whether there should be some change in the portfolio moving forward (e.g., to enlarge or reduce the scale of one element as compared to another).

It is important to note that there is not a hard cut-off value for ACAYY for when an alternative may be modified or dropped from further consideration. WSAC opted for a benchmark of a 130% difference in the ACAYY unit cost metric, for comparing one portfolio element against another, as a basis for whether or not an adaptive change in strategy should be *considered*.

However, WSAC also clearly indicated that an ACAYY beyond the 130% level should not necessarily result in a change in strategy. WSAC also noted that some options provide ancillary benefits that are not necessarily reflected in the ACAYY metric (e.g., aquifer restoration may enhance instream flows), and such additional benefits may justify a higher unit cost compared to the ACAYY of other options.

List of Attachments

Attachment 1 Project Element Summary

Attachment 2 Gantt Chart, Implementation Plan and Timeline

Attachment 3 Table of Decision Nodes and Related Milestones

Attachment 4 Subway Diagrams

Project Elements Summary

	Element	1	2	3a	3b	3c	3d
	Building Block Approach	In-Lieu	ASR and In-Lieu Combined*	DPR Small (3 mgd)	IPR-Loch (3 mgd)	IPR-GW (3 mgd)	Local Desal (3mgd)
a	Capital Cost (\$ M)	131	159	89	132	119	147
b	Annual O&M cost (\$ M/yr)	2.6	3.7	3.5	5.2	4.2	3.9
c	Total Annualized Cost (\$ M/yr)	11.6	14.6	9.6	14.3	12.4	14.0
d	Present Value Costs (\$M)	185	237	162	241	207	229
h	Worst Year Yield (MG)	750	760	810	660	740	810
i	Average Year Yield (MG)	350	380	440	430	380	440
j	Worst year yield unit cost (Total Ann Cost/Wst Yr Yield)	15,500	19,300	11,900	21,600	16,700	17,300
k	ACAYY** (Total Ann Cost/Ave Yr Yield)	33,200	38,500	21,900	33,200	32,600	31,800
l	Worst Year Peak Season Shortage (MG)	480	470	420	570	490	420
m	Worst Year Peak Season Shortage (%)	25%	24%	22%	29%	25%	22%
n	Average Year Peak Season Shortage (MG)	120	90	30	40	90	30
o	Average Year Peak Season Shortage (%)	6%	5%	2%	2%	5%	2%

* Both the costs and yields in this column reflect the combined costs of implementing both in-lieu and ASR.

**ACAYY = Annualized Cost per million gallons of Average Year Yield

NOTES:

- All estimates are preliminary, rounded, and subject to revision and refinement as more detailed analysis is developed.
- Total annualized costs based on amortizing capital outlays using a capital recovery factor of 0.0688 (reflecting a 30-year bond term at a 5.5% rate of interest to estimate the annual payment), and adding annual O&M costs.
- Present Value Costs calculated based on capital outlays occurring in first year, followed by 30 years of annual O&M expense, discounted to present worth using a 2.5% real discount rate. No inflation escalation included.
- ASR costs and yields reflect the *combined* cost and yields associated with adding ASR to the In-lieu program. Energy use for the combined ASR and In-Lieu elements reflect a volume-weighted average across the two elements.
- Potential for revenues from water sales, cost sharing, and grant funding are not reflected.
- All Element 3 options scaled at 3 mgd, reflecting potential reuse production based solely on City of Santa Cruz effluent flows.
- See additional notes on following page.

C = Averaged Costs (All BBs)			
	-30%	Mean	+30%
Worst Yr	11,935	17,050	22,165
Avg Yr	22,307	31,867	41,427
median		32,900	1.03
C' = Averaged Costs (Element 3 BBs)			
	-30%	Mean	+30%
Worst Yr	11,813	16,875	21,938
Avg Yr	20,912	29,875	38,837
median		32,200	1.08
C'' = Averaged Costs (Element 1 & 2 BBs)			
	-30%	Mean	+30%
Worst Yr	12,180	17,400	22,620
Avg Yr	25,095	35,850	46,605
median		35,850	1

ADDITIONAL NOTES

Elements 1&2: In lieu/ASR: Capital Costs

1. Infrastructure is sized to accommodate In-lieu plus ASR (to allow peak flow for recharge of 5 mgd -- 2.5 mgd out to Soquel Creek and 2.5 mgd to Scotts Valley).
2. All infrastructure costs needed for the in lieu program are included in the in lieu option. The ASR capital costs added to the in-lieu costs for the combined option include only additional elements that would be needed for doing recharge and recovery: pipeline to Beltz wells, upgrade of in lieu extraction wells to allow for injection, and additional wells and treatment of the extracted water.
3. In a departure from previous Building Blocks, in the ASR option, a pipeline to the Beltz Wells and 4 wells in Santa Cruz are included. This addition is to allow flexibility in where the water is moved.
4. The capital costs associated with in lieu and ASR include \$62M for upgrading the GHWTP and \$14M to upgrade the San Lorenzo River Tait Street Diversion. Feasibility studies will evaluate whether there are alternative(s) to these two large projects to meet the same goals at a lower cost. One alternative, as it relates to ASR & in lieu combined, may be installing Ranney Collectors at Felton Diversion. Together with a modified water right to allow for direct diversion from Felton Diversion to GHWTP. This change could lower the cost of this strategy by as much as ~\$60M. This would result in an Average year yield unit cost of \$27,700.

O&M Costs

1. Operations for recharge and for recovery are set at 180 days each for both in lieu and ASR. That means moving water out for 180 days and moving water back for 180 days. Real-world costs will vary over time.
2. Flow rates are similar to previous building block scenarios. Cost includes both sending water out to SqCWD and SVWD and later sending water back to SCWD.
3. Average flow rate for costing in lieu returns = 4 mgd, split evenly between Soquel Creek and Scotts Valley.
4. Average flow rate for costing ASR = 5 mgd out (same volume would be available for transfer whether it was in lieu or ASR, and this also maintains consistency), split evenly between SqCWD and SVWD. Flow back would be 80% of that volume, or 4 mgd split evenly between SqCWD and SVWD. Real-world recovery will vary from well-to-well.
5. Well extraction pumping in SVWD or SqCWD is **not** included - it is roughly balanced out by the energy savings of not running wells in SqCWD and in SVWD when in lieu water is being sent.
6. Cost and energy use estimates for combined In-lieu and ASR would be higher if less water were directed to in-lieu and instead directed to ASR (e.g., more water injected if more goes to ASR).

Element 3

General assumptions

1. Potable reuse capacity is designed for 3-mgd *product water 365 days a year* based on treating only City of Santa Cruz flows. (I.e., conservatively assuming effluent from SqCWD and SVWD are unavailable.)
2. Infrastructure for potable reuse treatment is identical for all potable reuse alternatives. Treatment is on-site at the WWTP. Costs to treat blended water at GHWTP not included (~\$2.7M/yr).

Element 3a: DPR

1. DPR water blends with raw water near Bay Street Reservoir. Energy calculation uses very conservative estimate that existing pressure pipe will not be changed. (A pipeline improvement would decrease energy needs.)
2. It is reasonable to assume that the City would investigate pipeline improvements and a lower-pressure operating scenario might be found. This change could significantly reduce the energy cost per MG.

Element 3b: IPR to Loch Lomond

1. A very significant portion of energy use is embedded in the pumping costs to move water ~800 vertical feet up to Loch Lomond.

Element 3c: IPR for Groundwater Recharge

1. Groundwater recharge is assumed to occur near the coast.
2. Eight wells included for 3 mgd capacity scenario used here.

Element 3d: Local Desal

1. The City desalination option capacity is 3 mgd product water 365 days a year.
2. Cost now includes property rights acquisition.
3. An O&M cost element for lifting the water to Bay Street has been added (instead of into the distribution system at a lower point).

Item		Units	Quantity	Cost, dollars	
				Cost per unit	Cost
Treatment Processes					
1	Nitrification (6.1 mgd)	LS	1	1,500,000	1,500,000
2	Ozone/BAC Filters (6.1 mgd)	LS	1	9,000,000	9,000,000
3	Microfiltration (6.1 mgd)	LS	1	14,000,000	14,000,000
4	Reverse Osmosis (5.5 mgd)	LS	1	20,000,000	20,000,000
5	Advanced Oxidation (Peroxide + UV) (4.7 mgd)	LS	1	3,250,000	3,250,000
6	Conditioning Facilities (4.7 mgd)	LS	1	1,432,500	1,432,500
7	Effluent Diffuser Modification	LS	1	1,000,000	1,000,000
	Site Work Subtotal				50,182,500
Pumps and Pipes					
8	Pumping System (WWTP to CAT)	GPM	4,300	400	1,720,000
9	Pipeline Installation (WWTP to CAT)	LF	200	600	120,000
10	Pumping System (CAT to Bay St. Reservoir)	GPM	3,200	400	1,280,000
11	Pipeline Installation (CAT to Bay St. Reservoir)	LF	6,000	440	2,640,000
12	Equalization Basin	LS	1		500,000
Pipeline, Pumps, Dam, Appurtenances Subtotal					6,260,000
	Construction Subtotal				56,442,500
	Contingency	percent	50	---	28,221,250
Subtotal					84,663,750
	Engineering and Administration	percent	20	---	16,932,750
	Legal	percent	5	---	4,233,188
	Geotechnical Investigation	percent	1	---	846,638
	Permitting - CEQA/NEPA	percent	5	---	4,233,188
	Other	percent	0	---	0
Subtotal					26,245,763
	Line Maintenance Facility Relocation				5,200,000
Total Project Cost					116,200,000

Operation and Maintenance Cost for Building Block 3	
Parameter	Value
Nitrification Tower Rework & Pipeline capital cost (\$)	\$2,947,500
Nitrification Tower electricity cost (\$/year)	\$28,470
Nitrification Tower O&M Cost	1.5%
Annual O&M cost (\$/year)	\$44,212.50
Nitrification Tower Replacement	60
Nitrification Tower Replacement Cost (\$/year)	\$49,125
Total Nitrification Tower electricity, O&M and replacement cost (\$/year)	\$121,808
Ozone/BAC Filters	
Ozone/BAC Filter capital cost (\$)	\$17,685,000
Ozone/BAC electricity cost (\$/year)	\$48,916
Ozone/BAC O&M Cost	1.5%
Ozone/BAC Filter annual cost (\$/year)	\$265,275
Ozone/BAC Filter replacement	60
Ozone/BAC Filter replacement cost (\$/year)	\$294,750
Total Ozone/BAC Filter O&M and replacement cost (\$/year)	\$608,941
Microfiltration	
Microfiltration system installation cost (\$)	\$27,510,000
Electricity consumption cost (\$/year)	\$250,536
Microfiltration maintenance cost (\$/year)	\$51,429
Chemical/Cleaning Cost	\$207,386
Microfiltration system replacement	60
Microfiltration system replacement cost (\$/year)	\$458,500
Total Microfiltration system O&M and replacement cost (\$/year)	\$967,851
Reverse Osmosis	
RO system installation cost (\$)	\$39,300,000
Electricity Consumption Cost (\$/year)	\$740,220
RO System maintenance cost (\$/year)	\$136,080
Chemical/cleaning cost	\$193,389
RO system replacement	60
RO system replacement cost (\$/year)	655,000
Total RO system O&M and replacement cost (\$/year)	\$1,724,689
Peroxide/UV Disinfection	
UV system installation cost (\$)	\$6,386,250
Electricity Consumption Cost (\$/year)	\$182,208
Maintenance/Replacement UV & Ballast cost (\$/year)	\$73,234
Hydrogen Peroxide	\$67,634
UV system replacement	30
UV system replacement cost (\$/year)	\$212,875
Total UV system replacement cost (\$/year)	\$535,951

Conditioning Facilities	
Conditioning facilities installation cost (\$)	\$2,814,863
Electricity Consumption Cost (\$/year)	\$28,470
Maintenance cost (\$/year)	1.5%
Maintenance cost (\$/year)	\$42,223
Conditioning facility replacement	30
Conditioning facility replacement cost (\$/year)	\$93,829
Total Conditioning facility O&M and replacement cost (\$/year)	\$164,522
Pumping System (WWTP to CAT)	
Pumping System	\$3,379,800
Electricity Consumption Cost (\$/year)	\$64,912
Pump replacement interval	15
Pump replacement cost (\$)	\$250,000
Pump replacement cost (\$/year)	\$16,667
Pumping System Replacement	30
Pumping System Replacement cost (\$/year)	\$112,660
Total Pump and Pumping System O&M and Replacement cost (\$/year)	\$194,238
Pipeline (WWTP to CAT)	
Pipeline capital cost (\$)	235,800
Pipeline O&M Cost	1.5%
Pipeline annual cost (\$/year)	\$3,537
Pipeline replacement	60
Pipeline replacement cost (\$/year)	\$3,930
Total Pipeline O&M and replacement cost (\$/year)	7,467
Pumping System (CAT to Bay St. Reservoir)	
Pumping System	\$2,515,200
Electricity Consumption Cost (\$/year)	\$580,788
Pump replacement interval	15
Pump replacement cost (\$)	\$250,000
Pump replacement cost (\$/year)	\$16,667
Pumping System Replacement	30
Pumping System Replacement cost (\$/year)	\$83,840
Total Pump and Pumping System O&M and Replacement cost (\$/year)	\$681,295
Pipeline (CAT to Bay St. Reservoir)	
Pipeline capital cost (\$)	5,187,600
Pipeline O&M Cost	1.5%
Pipeline annual cost (\$/year)	\$77,814
Pipeline replacement	60
Pipeline replacement cost (\$/year)	\$86,460
Total Pipeline O&M and replacement cost (\$/year)	164,274
Equalization Basin	
Steel Equalization Tank	\$982,500

Operation and Maintenance	\$4,913
Painting Cost (\$)	\$150,000
Painting interval	20
Painting Cost (\$/year)	\$7,500
Tank replacement	60
Tank replacement cost (\$/year)	\$16,375
Total tank painting, O&M, and replacement cost (\$/year)	\$28,788
Sampling/Water Quality Analysis	
Sampling/Water Quality Analysis	\$25,999.12
Total Annual O&M Cost	\$5,200,000

Figure 12 Gantt Chart
Implementation Plan and Timeline

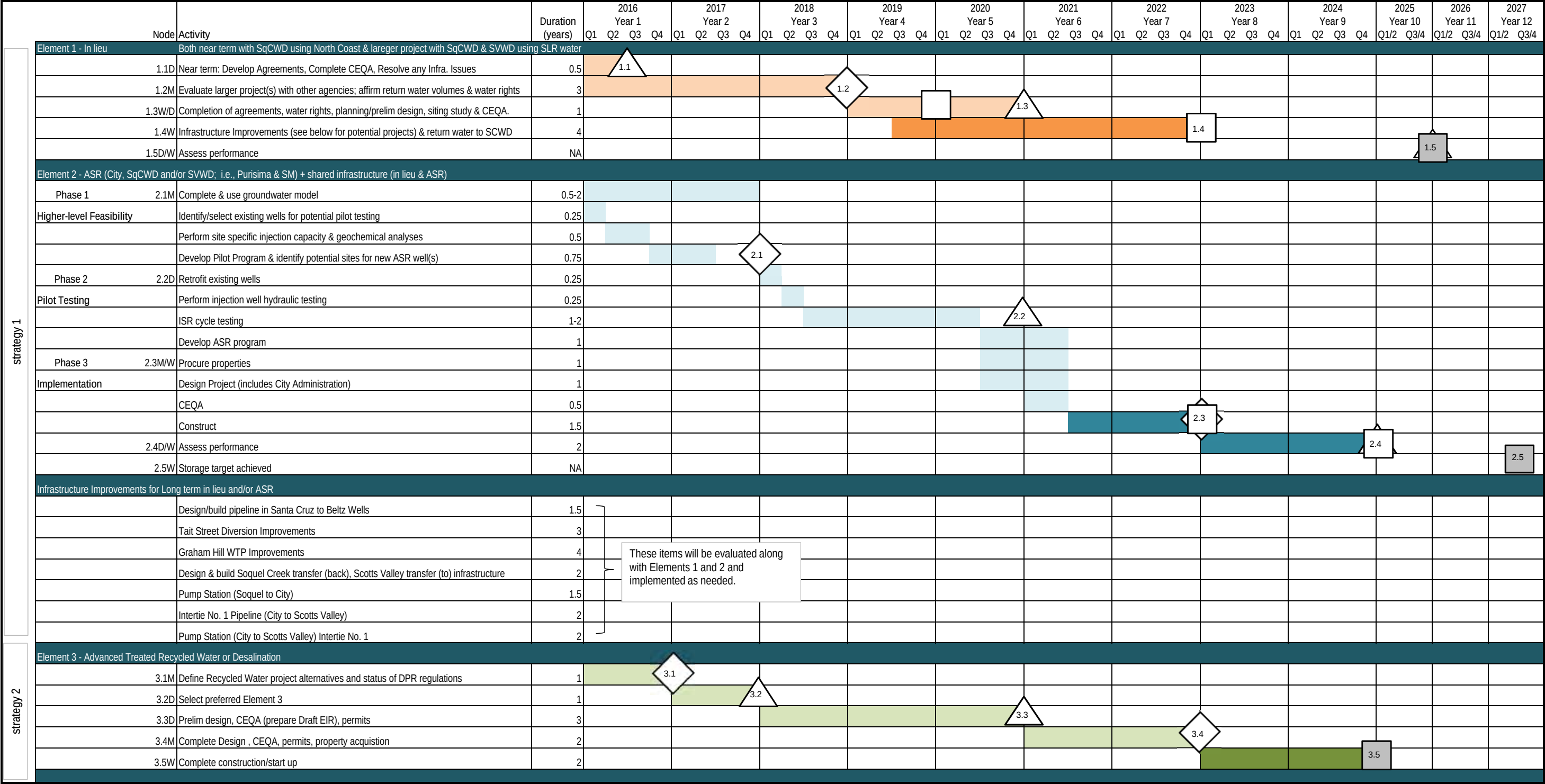


Table Notes & Select Assumptions
This table approximates activities, costs, durations and sequencing of each element, all of which are subject to change. Elements are shown to start in Q1 - 2016. This may or may not occur depending upon agreements, contracts, etc. Rehab/replacement of the Newell Creek Pipeline is part of the existing CIP and not shown here. Some infrastructure improvements may not be required if other pursuits are successful. E.g., evaluation of Ranney collectors may substitute GHWTP Improvements. CEQA is used generically; implies compliance with Califorina Environmental Quality Act. Pilot ASR work assumes major infrastructure not required. E.g., intertie to Scotts Valley or new well(s). Element 2 includes 8 wells for in lieu plus 8 additional wells for ASR.

Legend
ASR = Aquifer Storage and Recovery
CEQA = California Environmental Quality Act
DDW = Division of Drinking Water
DPR = Direct Potable Reuse
EIR = Environmental Impact Report
GHWTP = Graham Hill Water Treatment Plant
IPR = Indirect Potable Reuse
ISR = Injection, Storage, Recovery
SCWD = Santa Cruz Water Department
SqCWD = Soquel Creek Water District
SVWD = Scotts Valley Water District

△ Decision Node
◇ Milestone Node
□ Some amount of water returned to SCWD
■ Full required amount of water returned to SCWD

Overview of Decision Nodes and Related Milestones along Adaptive Pathway Diagram

NODE	ABBREVIATED DESCRIPTION	ENDING YEAR
In-Lieu (Element 1)		
1.1D 	Near Term: Initiation of near term water transfer/sale to SqCWD using North Coast water; agreements in place, and CEQA completed.	c. 2016
1.2M 	Larger Project: Understanding the feasibility of a potentially larger water transfer/exchange project with SqCWD and/or SVWD using North Coast and San Lorenzo River waters. Includes quantifying return water (using groundwater models) from SqCWD and/or SVWD to Santa Cruz as well as understanding of water rights and inter-agency collaboration.	c. 2018
1.3W/D  	Larger Project: Completion of agreements specifying terms of transfers to/from SqCWD and/or SVWD, water right modifications, planning/prelim design; complete assessments of cost, yield and schedule; and define CEQA. Decision point for proceeding on final design of associated infrastructure improvements.	c. 2019 c. 2020
1.4W 	Larger Project: Potential for return of water from SqCWD, and/or SVWD, to SCWD with the construction of infrastructure/treatment improvements.	c. 2022
1.5D/W  	Assess in-lieu performance: amount to SqCWD, SVWD, and SCWD; reduced groundwater pumping, groundwater elevations, etc.	c. 2025
Aquifer Storage and Recovery, ASR (Element 2) Includes evaluation of Purisima and Santa Margarita		
2.1M 	High level feasibility work: use of groundwater model; completion of site specific injection capacity and geochemical analyses; development of pilot program.	c. 2017
2.2D 	Completion of all administrative items to conduct pilot testing (e.g., CEQA/permits/agreements and well modifications), completion of pilot testing, and assessment of probable ASR system performance, cost and schedule to complete build out of ASR system.	c. 2020
2.3M/W  	Develop/construct ASR wells, ready to operate.	c. 2022
2.4D/W  	Assess ASR performance against projections and ability to meet project goals.	c. 2024
2.5W 	Aquifer storage target attained (ability to sustain return flows to SCWD at desired levels).	c. 2027
Advanced Treated Recycled Water or Desalination (Element 3)		
3.1M 	Identify recycled water alternatives; increase understanding of recycled water (regulatory framework, feasibility, funding opportunities, public outreach and education)	c. 2016
3.2D 	Complete high level feasibility studies, as-needed demonstration testing, and conceptual level designs of alternatives; define CEQA processes; and continue public outreach and education. Select preferred Element 3.	c. 2017
3.3D 	Preliminary design, CEQA (including preparation of draft EIR), and apply for approvals and permits (except building permit).	c. 2020
3.4M 	Complete property acquisition, final design, complete CEQA and all permits.	c. 2022

3.5W 	Construction completed: plant start-up, water production begins	c. 2024

Abbreviations

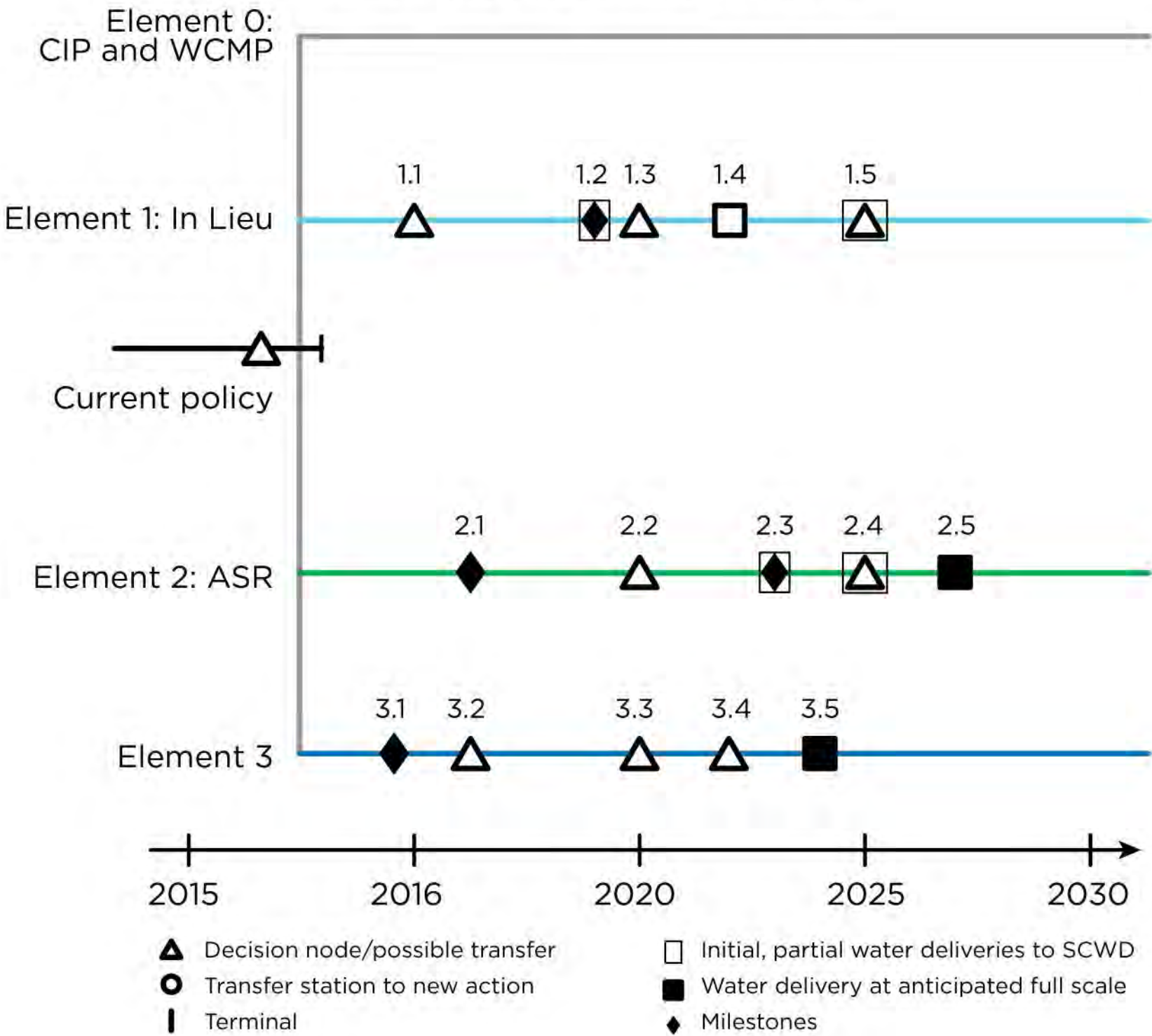
ASR = Aquifer Storage and Recovery
CEQA = California Environmental Quality Act
DDW = Division of Drinking Water
DPR = Direct Potable Reuse
GHWTP = Graham Hill Water Treatment Plant

IPR = Indirect Potable Reuse
SCWD = Santa Cruz Water Department
SqCWD = Soquel Creek Water District
SVWD = Scotts Valley Water District

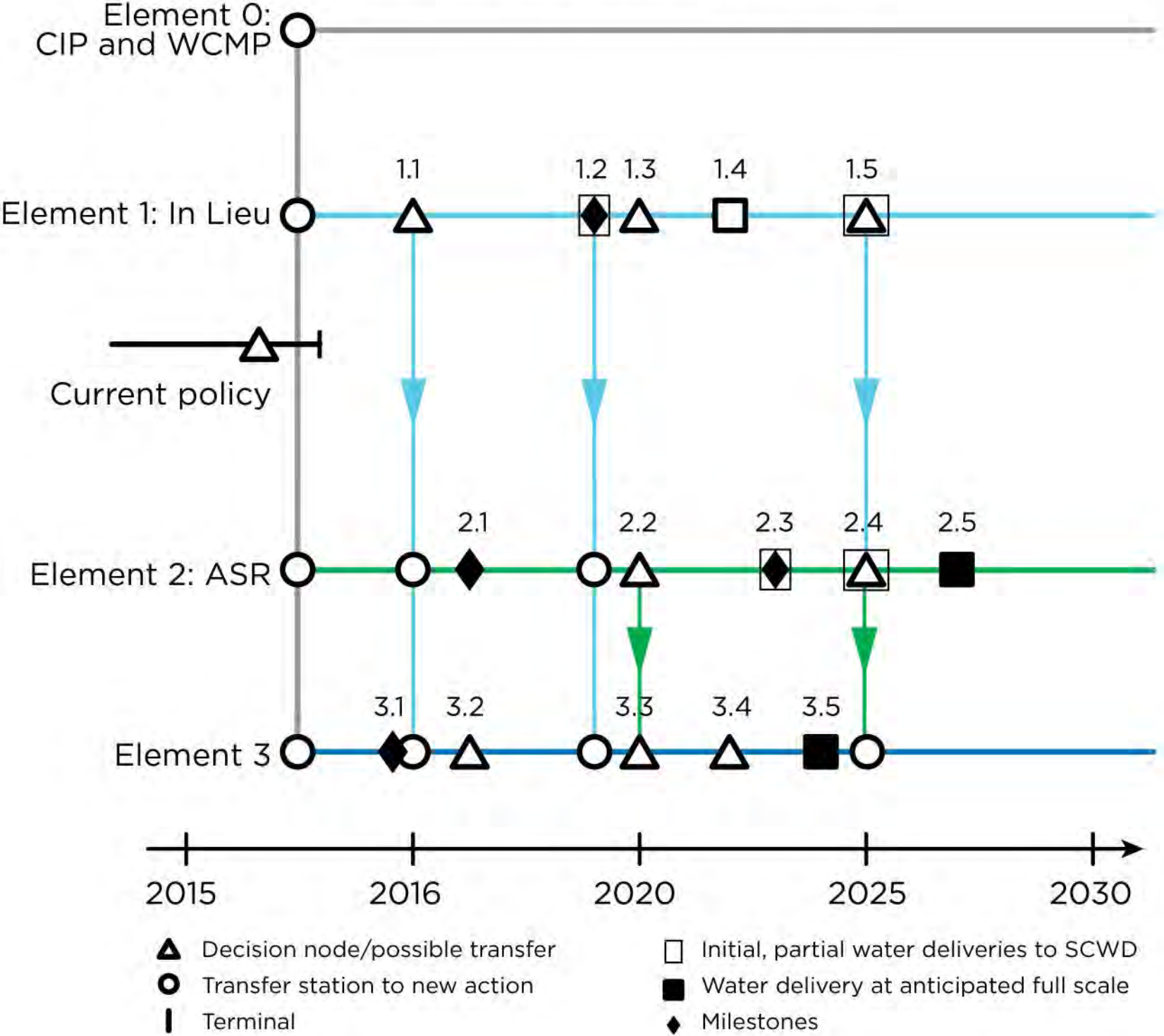
Notes

- This table is intended as a companion piece to the implementation Gantt chart and subway map. Gantt chart contains additional activity detail(s) for each node.
- Node types
 - D = decision node (triangle on subway chart)
 - M = milestone (diamond on the subway chart), furthering the understanding of feasibility.
 - W = water production potentially available (squares on the subway chart; open square indicates some water; solid square represents full goal being met).
- Node types have been assigned based on a set of assumptions as to how the implementation will proceed. However, if a threshold is being tripped, the node becomes a decision node regardless of its current designation.
- Ending Year refers to when all work associated with reaching node and/or achieving goal(s) will be accomplished. Dates shown are approximate based on current information and project understanding. Dates may adjust depending on: volumes of water available due to winter precipitation levels (which may limit amount of in-lieu and ASR); ability to establish agreements, permits, etc.; and ability to implement workload.

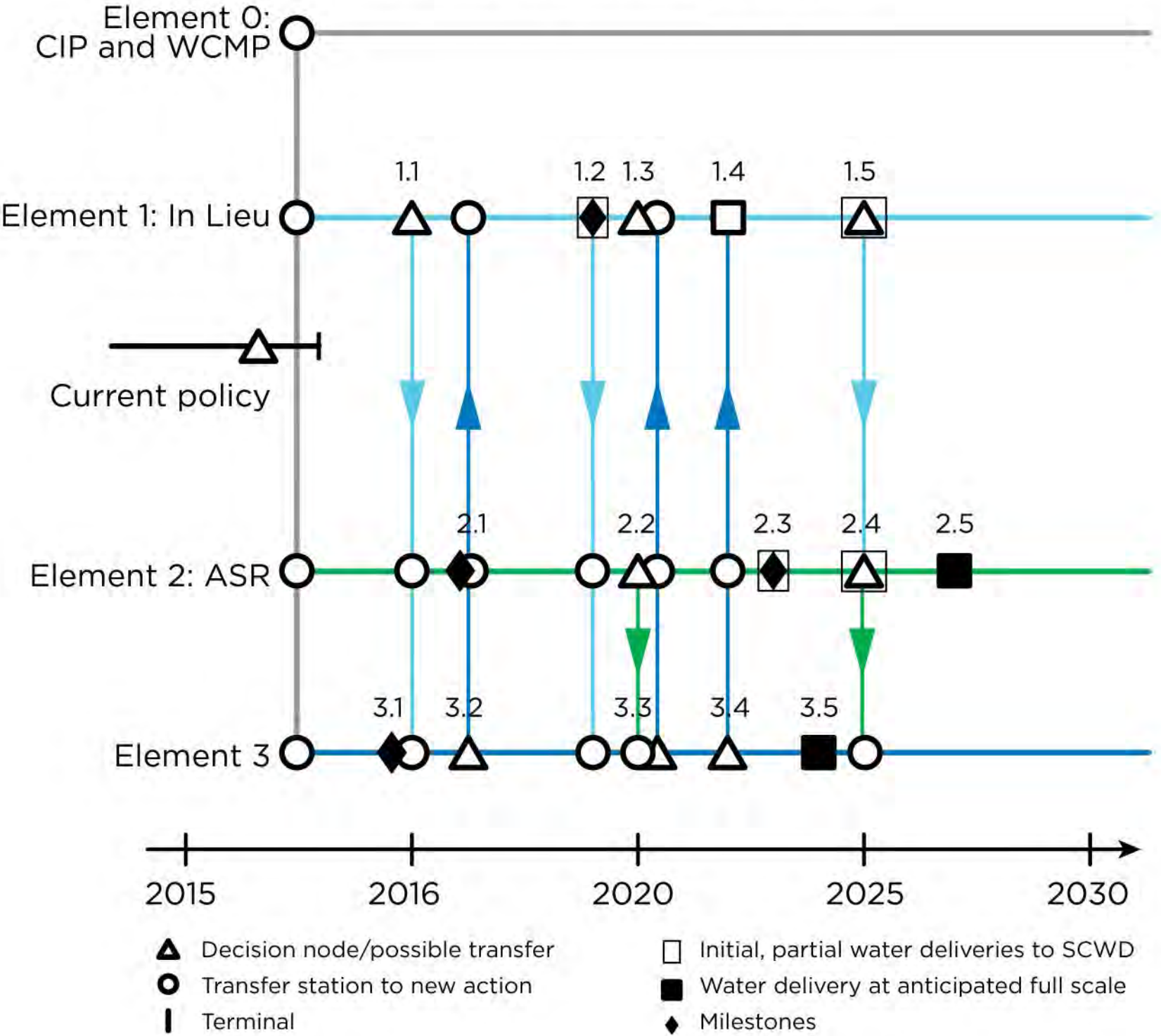
WSAC Adaptive Pathway Diagram



WSAC Adaptive Pathway Diagram



WSAC Adaptive Pathway Diagram





Water Shortage Contingency Plan



Prepared by:
City of Santa Cruz Water Department
March 2009



City of Santa Cruz Water Department

Water Shortage Contingency Plan

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Executive Summary

This report constitutes the first comprehensive review and update of the City's Water Shortage Contingency Plan since the early 1990's. The project is an outgrowth of the City's 2005 Urban Water Management Plan, which recognized the many changes in regional conditions and local water supply planning that had taken place over the previous decade, and identified the need to better prepare for the possibility of future water shortages in advance of the next major drought.

Introduction

This section provides background information about the City water system and the City's Integrated Water Plan, explains the purposes and goals of this plan, summarizes state regulations that pertain to water shortage contingency planning, and describes the process and principles that were used to guide the preparation of this document.

The last time the Santa Cruz area was confronted with a serious water shortage was during a statewide drought that lasted from 1987 through 1992. The exceptional drought of 1976-77, however, remains the most severe event on record. In 2003, the City adopted a long range planning document known as the "Integrated Water Plan", the goal of which was to reduce near term drought shortages and provide a more reliable public water supply through the year 2030. One component of this plan deliberately involves cutting back or "curtailing" system water demand by 15 percent in dry years when water is in short supply.

This plan was developed to fulfill two fundamental purposes:

1. To establish the procedures and actions necessary to achieve the up to 15 percent cutback in system-wide demand established in the City's Integrated Water Plan, and
2. To describe how the City would respond if faced with much larger shortages in water supply ranging as high as 50 percent (not only because, as a public water supplier, the City is required to do so by state law, but also because the City remains vulnerable in the near term to a critical water shortage of this magnitude until it secures a new source of supply for drought protection).

Whatever magnitude of shortfall the City may experience, the overarching goals of this plan are as follows:

1. To conserve the water supply of the City for the greatest public benefit,
2. To mitigate the effects of a water supply shortage on public health and safety, economic activity, and customer lifestyle, and
3. To budget water use so that supply will be available for the most essential purposes for the entire duration of the water shortage.

Development of this plan was a collaborative effort among the City Water Department staff, the City's Water Commission, City Council, and the public. The process included reviewing the City's existing ordinance and water shortage plans from many other water agencies, addressing various planning and policy issues, and taking into account state regulations. The Water Commission provided its input and recommendations throughout the entire process. The final step will be to prepare an ordinance that incorporates the structure and policy recommendations embodied in this plan. This ordinance would then be adopted and go into effect only if necessary in an actual water shortage following appropriate public notification and public hearing before City Council.

Assessing Water Supply and Demand

This section describes the key hydrologic factors affecting the City's water supply and discusses the process staff uses to determine whether a water shortage is expected in the year ahead.

The City of Santa Cruz relies on surface flows in coastal streams and the San Lorenzo River for most of its annual water supply needs. The yield of these sources in any given year is directly related to the amount of rainfall received and runoff generated during the winter season.

After an unusually dry winter or period of consecutive dry years, when a lack of supply appears possible, the Water Department undertakes an analysis to determine whether water supplies will be deficient relative to estimated water needs for the coming dry season. This analysis involves first comparing projected water supply and demand on a monthly basis, assuming no restriction on water

use, to forecast the end of season water level and storage volume in Loch Lomond Reservoir. The Department then evaluates whether the amount of carryover storage in Loch Lomond at the end of the year will be sufficient to meet essential health and safety needs in case the dry weather pattern continues into the following year. If this analysis shows that Loch Lomond Reservoir would be depleted to a dangerously low level, then a decision is made regarding how much reservoir water is available to use in the current year and how much should be banked as a safeguard against the possibility of another dry year. The amount of cutback in demand needed to reduce the rate of reservoir depletion and end the year at a safer level of storage is then determined. If necessary, cutbacks would go into effect in late April or early May and span the entire dry season through the end of October.

The degree of shortage is normally defined as the supply deficiency in relation to normal water use over a given period of time, and expressed as a percentage. For example, a 25 percent shortage means the City has one-quarter less water supply available than what is normally used during the seven month long dry season.

Demand Reduction Program

This section describes the five-stage approach and overall strategy for dealing with water shortages, explains how available water would be allocated among various customer categories according to priority of use, and presents the recommended menu of actions for cutting back water demand during a declared water shortage. This section also covers policies and recommendations regarding enforcement methods, exceptions, and appeals.

Table ES-1. Five Stage Structure to Water Shortage Contingency Plan

Stage	Magnitude of Water Shortage	Stage Title
1	0-5%	Water Shortage Alert
2	5-15%	Water Shortage Warning
3	15-25%	Water Shortage Emergency
4	25-35%	Severe Water Shortage Emergency
5	35-50%	Critical Water Shortage Emergency

The updated Water Shortage Contingency Plan uses a staged approach that classifies a shortage event into one of five levels spanning a range from less than 5 percent up to 50 percent. The overall concept is that water shortages of different magnitudes require different measures to overcome the deficiency. Because there is so little the City can do in the short run to increase the supply of water, the focus of this plan is primarily on measures that reduce demand. Each stage includes a set of demand reduction measures that become progressively more stringent as the shortage condition escalates. Normally, only one of these five stages would be put into effect early in the year at the recommendation of the Water Director and remain in force for the entire dry season.

There is an important distinction between Stages 1 and 2, designated above in shades of yellow, and the upper three stages. The lower two stages represent a level of curtailment that is envisioned as being necessary to balance water supply and demand from time to time under the City's Integrated Water Plan. Shortages of 15 percent or less, while inconvenient, do not directly threaten public safety or pose undue economic impact. The upper three stages (3-5) are characterized as emergency water shortages since they result in more widespread hardships being felt throughout the community, may threaten public health and welfare, and cause more economic harm. The intent of the City's Integrated Water Plan, however, is to limit future water shortages to no more than 15 percent.

Customer reduction goals for all but the first stage were derived by evaluating the composition of demand for each major group and dividing it into three usage priorities. These priorities are, from highest to lowest, 1) health/safety, i.e., all domestic and sanitary uses, 2) business and industrial uses and, 3) irrigation and other outdoor uses). Normal demands were then scaled back in accordance with the schedule below. The recommended allocation is presented in Table ES-3.

Table ES-2. Reduction in Water Delivery by Usage Priority
(percent of normal deliveries)

Stage	Magnitude of Water Shortage:	Health/Safety	Business	Irrigation
2	15%	95	95	64
3	25%	95	90	34
4	35%	90	85	12
5	50%	75	67	0

Table ES-3. Water Supply Allocation and Customer Reduction Goals

Normal Peak Season Demand = 2,473 mil gal	No Deficiency		Stage 2 15% Deficiency		Stage 3 25% Deficiency		Stage 4 35% Deficiency		Stage 5 50% Deficiency	
	Delivery		Delivery		Delivery		Delivery		Delivery	
	%	Volume (mil gal)	%	Volume (mil gal)	%	Volume (mil gal)	%	Volume (mil gal)	%	Volume (mil gal)
Single Family Residential	100	1,031	84%	864	73%	753	62%	639	48%	495
Multiple Residential	100	524	87%	454	78%	411	69%	361	55%	287
Business	100	438	95%	416	92%	402	87%	381	70%	307
UC Santa Cruz	100	132	85%	113	76%	100	66%	87	52%	68
Other Industrial	100	23	95%	22	90%	21	85%	20	67%	15
Municipal	100	48	76%	36	57%	27	41%	20	28%	14
Irrigation	100	110	64%	70	34%	37	12%	13	0%	0
Golf Course Irrigation	100	106	73%	78	51%	54	34%	36	20%	21
Coast Agriculture	100	59	95%	56	90%	53	85%	50	67%	40
Other	100	2	95%	2	90%	2	50%	1	50%	1
Total	100	2,473	85%	2,111	75%	1,861	65%	1,607	50%	1,247
Demand Reduction %, Million gallons	0	0	15%	-362	25%	-612	35%	-866	50%	-1,226

In essence, this allocation system strives to balance available supplies in times of drought as much as possible through cutbacks in outdoor water use. At each level of shortfall, public health and sanitation usage is afforded the highest priority by cutting back on interior usage the least. The importance of water in protecting the City's employment base is also acknowledged through proportionately modest cutbacks to the commercial sector as compared to the overall system shortfall. Irrigation and other outdoor uses in all cases is cut back the most. The larger the water shortage, the greater the cutbacks, but this system of priorities is maintained throughout the range of potential shortages. The heavy reliance on outdoor use reductions makes sense, both from a water system perspective because it reduces peak demands, which is important to preserving storage in Loch Lomond Reservoir, and from a public health and welfare perspective, because irrigation and other outdoor uses are the most discretionary of all uses when drinking water is in short supply.

The remainder of this section discusses the demand reduction measures, communications, publicity, and operational activities that apply to each stage.

The primary demand reduction measures used in **Stage 1** are to restrict all landscape irrigation to certain hours of the day and to prohibit various uses deemed to be non-essential.

The recommended approach to reducing water use **Stage 2** involves expanding mandatory water restrictions and limiting landscape irrigation to specified days and times. Large landscape users would be required to adhere to water budgets.

A **Stage 3** water shortage constitutes an emergency situation. The three primary measures being recommended to meet this emergency reduction goal are 1) residential water rationing, 2) mandatory water shortage signage in all commercial buildings, and 3) reduced water budgets for large landscapes.

A **Stage 4** water shortage requires expanding water rationing to cover all water customers, including business, and reducing residential allocations. At this severe level of shortage, only minimal water is available for outdoor purposes.

Stage 5 represents an extraordinary crisis threatening health, safety, and security of the community. It would involve reduced rationing levels for all customers and a ban on outdoor uses to cut back normal water use by half.

Table ES-4. Summary of Demand Reduction Actions and Measures

Water Shortage Condition	Key Water Department Communication and Operating Actions	Customer Demand Reduction Measures
Stage 1: Water Shortage Alert (0-5%)	• Initiate public information and advertising campaign • Publicize suggestions and requirements to reduce water use • Adopt water shortage ordinance prohibiting nonessential uses • Step up enforcement of water waste • Coordinate conservation actions with other City Departments, green industry	• Voluntary water conservation requested of all customers • Adhere to water waste ordinance • Landscape irrigation restricted to early morning and evening • Non-essential water uses banned • Shutoff nozzles on all hoses used for any purpose • Encourage conversion to drip, low volume irrigation
Stage 2: Water Shortage Warning (5-15%)	• Intensify public information campaign • Send direct notices to all customers • Establish conservation hotline • Conduct workshops on large landscape requirements • Optimize existing water sources; intensify system leak detection and repair; suspend flushing • Increase water waste patrol • Convene and staff appeals board	• Continue all Stage 1 measures • Landscape irrigation restricted to designated watering days and times • Require large landscapes to adhere to water budgets • Prohibit exterior washing of structures • Require large users to audit premises and repair leaks • Encourage regular household meter reading and leak detection
Stage 3: Emergency Water Shortage (15-25%)	• Expand, intensify public information campaign • Provide regular media briefings; publish weekly consumption reports • Modify utility billing system and bill format to accommodate residential rationing, add penalty rates • Convert outside-City customers to monthly billing • Hire additional temporary staff in customer service, conservation, and water distribution • Give advance notice of possible moratorium on new connections if shortage continues	• Institute water rationing for residential customers • Reduce water budgets for large landscapes • Require all commercial customers to prominently display "save water" signage and develop conservation plans • Maintain restrictions on exterior washing • Continue to promote regular household meter reading and leak detection
Stage 4: Severe Water Shortage Emergency (25-35%)	• Contract with advertising agency to carry out major publicity campaign • Continue to provide regular media briefings • Open centralized drought information center • Promote gray water use to save landscaping • Scale up appeals staff and frequency of hearings • Expand water waste enforcement to 24/7 • Develop strategy to mitigate revenue losses and plan for continuing/escalating shortage	• Reduce residential water allocations • Institute water rationing for commercial customers • Minimal water budgets for large landscape customers • Prohibit turf irrigation, installation in new development • Prohibition on on-site vehicle washing • Rescind hydrant and bulk water permits
Stage 5: Critical Water Shortage Emergency (35-50%)	• Continue all previous actions • Implement crisis communications plan and campaign • Activate emergency notification lists • Coordinate with CA Department of Public Health regarding water quality, public health issues and with law enforcement and other emergency response agencies to address enforcement challenges • Continue water waster enforcement 24/7	• Further reduce residential water allocations • Reduce commercial water allocations • Prohibit outdoor irrigation • No water for recreational purposes, close pools • Continue all measures initiated in prior stages as appropriate

The City's existing water shortage emergency ordinance contains several provisions for enforcing water use rules and regulations, and a process for issuing exceptions and hearing appeals. These provisions were reviewed by staff and the Water Commission, which put forth several recommendations to be incorporated into the updated water shortage ordinance. Recommendations include revised penalty fees and excess use fees, adding specified findings for authorizing exceptions, and adding an alternative enforcement approach to reduce the likely caseload of appeals.

Implementation

This section describes the essential elements of implementing the updated Water Shortage Contingency Plan, discusses the approximate lead time needed to prepare for and activate a demand reduction program, outlines the process for declaring a water shortage, and identifies areas where additional ongoing efforts are necessary to address critical gaps.

Although the Water Department closely monitors rainfall, runoff and reservoir storage all winter, it is not usually until the end of March that the water supply outlook for the year ahead becomes certain. This leaves very little lead time to prepare for implementing the water shortage contingency plan.

Formal action declaring a water shortage is taken by City Council. The legal requirements for such action are covered in Section 350 et.seq. of the California Water Code. The code requires the following process be followed:

- That City Council hold a public hearing on the matter;
- That the public hearing be properly noticed (minimum of publishing once in newspaper at least seven days prior to the date of the hearing);
- Upon determining and declaring the existence of a water shortage, City Council may then adopt regulations and restrictions governing the use and delivery of water.

By municipal code, rules adopted by the City Council establishing water use regulations become effective immediately after their publication in the newspaper.

Effective communication is essential to the success of any water shortage contingency plan in achieving the desired water use reductions. All customers need to be adequately informed about water supply conditions, understand the need to conserve, and know what actions they are being requested or required to take to mitigate the shortage. Even before formal declaration of a water shortage, a public information/media program should be activated to provide customers with as much advance notice as possible. Following Council action, all residents and businesses, not just customers of record, would need to be provided notice of water shortage rules and regulations via a variety of media and communications methods, including print and television media, internet, utility newsletter, and other methods. Public notification and communication will be provided in Spanish language for non-English speakers.

The additional staff needed to carry out this contingency plan and personnel costs are estimated according to stage. These may consist of existing staff reassigned from regular duties in the Water or other City departments, new part-time temporary employees, interns, or some combination of the above. Additional office space and equipment needs are also addressed.

The financial impact of short-term demand reduction was estimated to range from just under \$0.6 million in a Stage 1 water shortage alert situation to almost \$5.8 million in a Stage 5 critical water shortage emergency. Compared to 2007 revenues of just over \$22 million, the Department's net revenue would be reduced to approximately \$21.5 million in Stage 1 to less than \$16.4 million in Stage 5. Options to lessen or overcome the revenue shortfall include the following:

- Tapping into the Department's Rate Stabilization Fund (currently \$2.2 million)
- Deferring planned capital improvements
- Considering possible rate adjustments or surcharges

Implementing this Water Shortage Contingency Plan will require utility billing system software that provides the necessary capabilities and flexibility to quickly shift from normal billing practices to water rationing mode. The newly installed EDEN utility billing module appears to be able to handle the type of computations needed to implement the recommended method for rationing residential customers. It does not, however, have the capability or flexibility to handle large landscape water budgets, or commercial water rationing which is based on some

percentage of past use. This capability will have to be custom developed over time.

Another key challenge involves implementing large landscape water budgets. This is the next major work priority scheduled for the City's Water Conservation Office. These programs have a long development time (1-2 years) due to the need to measure landscape areas, differentiate among plant materials, and integrate water budget data into the billing system. This latter task requires changing the bill design and layout to show water budget information and tying performance relative to the water budget to water pricing. If the City were confronted with a water shortage before large landscape water budgets and budget-based pricing could be implemented, alternative methods to curtail water in the large landscape sector would have to be considered.

The final tasks in updating the City's Water Shortage Contingency Plan include the following steps:

- Involving the community and soliciting public review and input on this document;
- Finalizing and presenting the plan to City Council for adoption;
- Preparing an updated water shortage ordinance;
- Preparing and mailing a Proposition 218 notice about proposed changes to penalty and excess use fees.

As far as critical gaps that require ongoing work, the most important recommendations are to:

1. Continue to work on the new utility billing system so that the database is able to meet the City's requirements for use in water rationing if it becomes necessary, and
2. Focus on developing the large landscape program so that water budgets described above can be used to professionally manage large irrigation accounts the next time a water shortage arises.
3. As much as possible, prepare water shortage notices, announcements, materials, and mailing lists in advance, including bilingual materials for non-English speakers.

Section 1 INTRODUCTION

This report constitutes the first comprehensive review and update of the City's Water Shortage Contingency Plan since the early 1990's. The project is an outgrowth of the City's 2005 Urban Water Management Plan, which recognized the many changes in regional conditions and local water supply planning that had taken place over the previous decade, and identified the need to better prepare for the possibility of future water shortages in advance of the next major drought.

1.1 Background

The City of Santa Cruz water system serves a geographic area that includes the entire City of Santa Cruz, adjoining unincorporated areas of Santa Cruz County, a small part of the City of Capitola, and coastal agricultural lands north of the City. The water service area includes about 90,000 people, some 35,000 households, and an employment base of 45,000 jobs.

The City water system draws almost exclusively on local surface water sources, whose yield varies from year to year depending on the amount of rainfall received and runoff generated during the winter season. In normal and wet years, when rainfall and runoff are abundant, the water system is capable of meeting the community's current total annual water requirements. The system is highly vulnerable to shortage, however, in extended dry periods or critically dry years, when the flow in local streams and river sources runs low. Moreover, like other communities on California's central coast, the Santa Cruz water system is physically and geographically isolated. There are no interconnections with other water suppliers in place to transfer water among adjacent water districts or import emergency supplies from outside the region.

The last time the Santa Cruz area was confronted with a serious water shortage was during a statewide drought that lasted from 1987 through 1992. While this event was notable for its extended duration, the most severe event on record was the critical drought of 1976-77. Both situations were considered to be emergencies whose magnitude or duration had been unanticipated prior to their occurrence and for which little preparation had been made. Operations modeling shows **if an event similar to one in 1976-77 were to recur now, the system would barely be able to meet half the community's normal water requirements in the second year of that drought.**

In 2003, the City adopted a long range document known as the “Integrated Water Plan”, the goal of which was to reduce near term drought shortages and provide a more reliable public water supply through the year 2030. The preferred water supply strategy that evolved from that process consists of 3 components:

1. Reduce water demand in all years through water conservation measures,
2. Increase the water supply through seawater desalination, and
3. Cut back water demand temporarily in drought years

This approach, of cutting back on demand in dry years when water is in short supply, is becoming more commonplace in virtually every region of the country that is faced at times with emergency shortages of deliverable water. Rather than strive to meet 100 percent of customer water demand during periods of extreme drought, more and more urban water utilities are beginning to anticipate and plan for a certain degree of water shortage from time to time, and respond with programs that temporarily reduce water use. Whether for financial, political, or environmental reasons, or simply the recognition that public water systems can never be totally drought-proof, water agencies are deliberately incorporating short-term demand management or “use curtailment” as part of their overall water management strategy.

The City’s Integrated Water Plan envisions satisfying 85 percent of normal water needs during a worst-case scenario like the 1976-77 event, thereby reducing the potential shortfall from the current almost 50 percent to no more than 15 percent. This reliability goal was considered to be the best overall balance between ensuring public health and safety, cost, and impact on the environment, given the many public policy tradeoffs involved. Now, instead of treating any shortage as a water supply emergency situation and responding reactively, the City has effectively accepted the risk of incurring relatively modest shortages every so often, which drives the need for having a fully developed contingency plan and well-defined, measured responses in place.

1.2 Purpose and Goals

This Water Shortage Contingency Plan describes the conditions which constitute a water shortage and provides guidelines, actions, and procedures for managing

water supply and demands during a declared water shortage. The primary focus of the plan is on measures that reduce customer demand for water, but it also covers actions that can be implemented to stretch or increase the water supply.

This plan was developed to fulfill two fundamental purposes:

1. To establish the procedures and actions necessary to achieve the up to 15 percent cutback in system-wide demand established in the City's Integrated Water Plan, and
2. To describe how the City would respond if faced with much larger shortages in water supply ranging as high as 50 percent.

There are several reasons why it is necessary to consider and plan for shortfalls larger than 15 percent. First, the City remains vulnerable in the near term to a critical water shortage of that scale until it secures an additional source of supply for drought protection. The City is currently implementing a broad set of water conservation programs and is testing the feasibility of seawater desalination before proceeding with the design, permitting, and construction of a full scale plant. Commissioning of a new water source, though, remains years away and is by no means a certainty. Much planning remains to be done and project approvals have yet to be secured. In the meantime, the City is potentially at risk of experiencing a major water shortage, as demonstrated by the exceptionally dry conditions experienced during the 2007 water year and by the Governor's declaration of a statewide drought in 2008. Second, state law requires all public water suppliers to develop contingency plans for situations of up to a 50 percent shortage in water supply. Finally, the City's long range water supply planning is predicated on past hydrologic records which focused on the two year, 1976-77 event as a worst case scenario. No one can predict how the future will unfold, especially in light of the emerging science of global climate change, which some predict could bring more frequent, longer, or more intense water shortages across the state, and which compounds the uncertainty and risk going forward at the local government level.

Whatever magnitude of shortfall the City may experience, the overarching goals of this plan are as follows:

1. to conserve the water supply of the City for the greatest public benefit,

2. to mitigate the effects of a water supply shortage on public health and safety, economic activity, and customer lifestyle, and
3. to budget water use so that supply will be available for the most essential purposes for the entire duration of the water shortage.

1.3 State Regulations and Planning Requirements

For California water agencies, there are two main provisions of the California Water Code that pertain to water shortage contingency planning.

Sections 350-359 provide the authority for the governing body of a water agency to declare a water shortage emergency. Once having done so, the local agency is provided with broad powers to implement and enforce regulations and restrictions for managing a water shortage. Water needed for domestic, sanitation and fire protection purposes is given priority and discrimination between consumers using water for the same purpose or purposes is not allowed.

Section 10632 requires water agencies to provide a water shortage contingency analysis as part of their Urban Water Management Plans. The code requires agencies plan for shortages up to a 50 percent reduction in water supply, and to describe the actions and consumption reduction methods that apply to each stage of the plan.

The full text of these two code sections is included in Appendix A.

1.4 Planning Process and Water Shortage Management Principles

Development of this plan was a collaborative effort among the City Water Department staff, the City's Water Commission, City Council, and the public.

The project was initiated in 2006 with a work plan that organized the job into 12 individual tasks covering specific topics or issues (Table 1-1). For each task, staff prepared a written report for review and input by the Water Commission at its regularly scheduled meetings. These reports reviewed one or more aspects of the City's existing water shortage emergency ordinance, described alternative methods or approaches used by other water agencies, analyzed the different

Table 1-1. Water Shortage Contingency Plan Update Work Plan

Task	Description
Task 1	Identify Laws, Goals, and Principles
Task 2	Determining Water Supply Availability
Task 3	Declaration of Water Shortage Emergency
Task 4	Review Stages and Associated Terms
Task 5	Allocation of Water
Task 6	Review Allotment Methods
Task 7	Consumption Reduction Methods
Task 8	Water Department Actions
Task 9	Enforcement and Appeals Procedures
Task 10	Draft New Water Shortage Contingency Plan
Task 11	Present Recommended Plan to Water Commission and City Council
Task 12	Draft, Review New Ordinance

options, and presented a recommendation on the topic for inclusion in this plan. The Water Commission provided its input and recommendations throughout the process. Helpful guidance was obtained from the California Department of Water Resources' recently updated Urban Drought Guidebook. In addition, research involved reviewing the water shortage plans of 21 other urban water utilities from throughout California, and from selected cities in the western United States and across the country (Appendix B).

The subject that generated the most public interest, input, and debate was how to allocate the available water when supplies run short. The issue was discussed before City Council and negotiated with several large customers before reaching a final recommendation.

This document synthesizes the results of that process into a single report. It was presented to the Water Commission for review in January 2009, revised, distributed throughout the community, presented again at a public hearing before City Council, and adopted on March 10, 2009. The final plan was then redrafted in the form of an ordinance that was adopted in May 2009 and revised in June 2010. The final, approved water shortage contingency ordinance would then

become effective only as necessary in an actual water shortage following appropriate public notification and public hearing before City Council.

The plan is based on lessons learned here and from other water agencies during past droughts. Nevertheless, it is important to note that every drought will evolve differently and that it is not practical to develop a set of hard and fast rules that apply to all situations. The plan should be thought of as a general framework that will need to be adjusted and refined based on actual conditions.

Early in the planning process, staff and the Water Commission developed a set of principles to guide this planning process. These principles are as follows:

- **Shared contribution.** All customers will be asked to save their share in order to meet necessary reduction goals during water shortages.
- **Reduce non-essential uses first.** The plan concentrates on the elimination of non-essential water uses and on outdoor reductions, and gives the highest priority to essential health and safety uses.
- **Preserve jobs and protect the local economy.** The plan minimizes actions that would have substantial impact on the community's economy and provides large users the flexibility to determine their own reduction strategies within a water budget.
- **Existing conservation measures recognized.** Customers that have already implemented water conservation measures are acknowledged to have less potential for reduction and should not be penalized for conserving.
- **Communication at every stage.** A public information campaign at every level of shortage is essential for customer preparation and will encourage confidence in the City's ability to respond to water shortages.
- **Public participation.** Public participation in the development and implementation of the plan will help to ensure fairness, encourage cooperation, and facilitate implementation and with demand reduction measures in times of shortage.

1.5 Relationship Between This Document and Other Plans

This Water Shortage Contingency Plan, as described above, represents one of the three components in the City's Integrated Water Plan. It also constitutes one of several elements in the City's Urban Water Management Plan, as required by State law.

Water supply interruptions and shortages may result from a variety of causes, including facility failure, such as a major pipeline break, earthquake, flood, or other natural disaster. This plan specifically addresses longer-term water shortages that occur as a result of drought conditions that may extend several months or span several years in duration. For shorter term emergency incidents or disasters, the Water Department maintains a separate General Emergency Plan, which is subordinate to and complements the Citywide Emergency Operations Plan, to guide emergency operations response and recovery for shorter term water supply interruptions and outages.

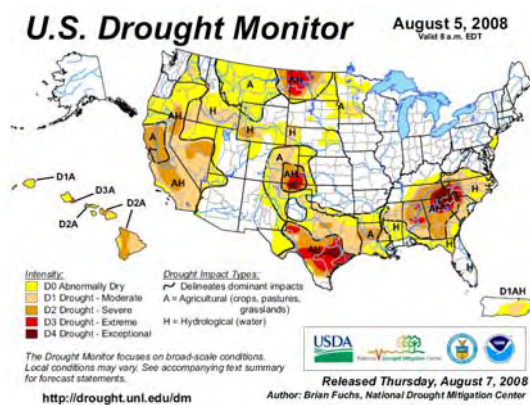
Section 2 ASSESSING WATER SUPPLY AND DEMAND

Rainfall, runoff, and reservoir storage are the key hydrologic indicators used by the City to evaluate water conditions. This section describes these factors affecting the City's water supply and discusses the forecasting process and management considerations used in dry years to determine whether a water shortage is expected for the year ahead and how much water use must be cut back systemwide in response. As a preface, this section includes a brief discussion on the distinction between the terms drought and water shortage.

2.1 Drought vs. Water Shortage

Drought is a normal, naturally occurring but unpredictable climatic phenomenon of varying frequency, duration and severity. Droughts differ from other natural hazards in that they are not distinct weather events, like floods, hurricanes, or tornados. They may have a slow onset, persist and evolve over a period of years, affect a large spatial region, but cause little structural damage. The most difficult aspect of a drought is that no one can tell how long it will last.

Figure 2-1. National Drought Map



Five degrees of drought intensity are recognized nationally, including abnormally dry, moderate, severe, extreme, and exceptional.

The California Department of Water Resources describes drought as:

“A deficiency of precipitation over an extended period of time resulting in a water shortage for some activity, group, or environmental sector.”

A water shortage, on the other hand, occurs when a particular utility's water supply is insufficient to meet its customers' ordinary drinking water needs.

Besides weather conditions, there are a number of factors that affect water supply availability, including:

- Source yield and reliability
- Infrastructure capacity and operating constraints
- Access to alternative sources
- System demand characteristics

In Santa Cruz, a water shortage occurs when the combination of low surface flows in the coast and river sources and depleted surface water storage in Loch Lomond Reservoir reduces the available supply to a level that cannot support existing demand.

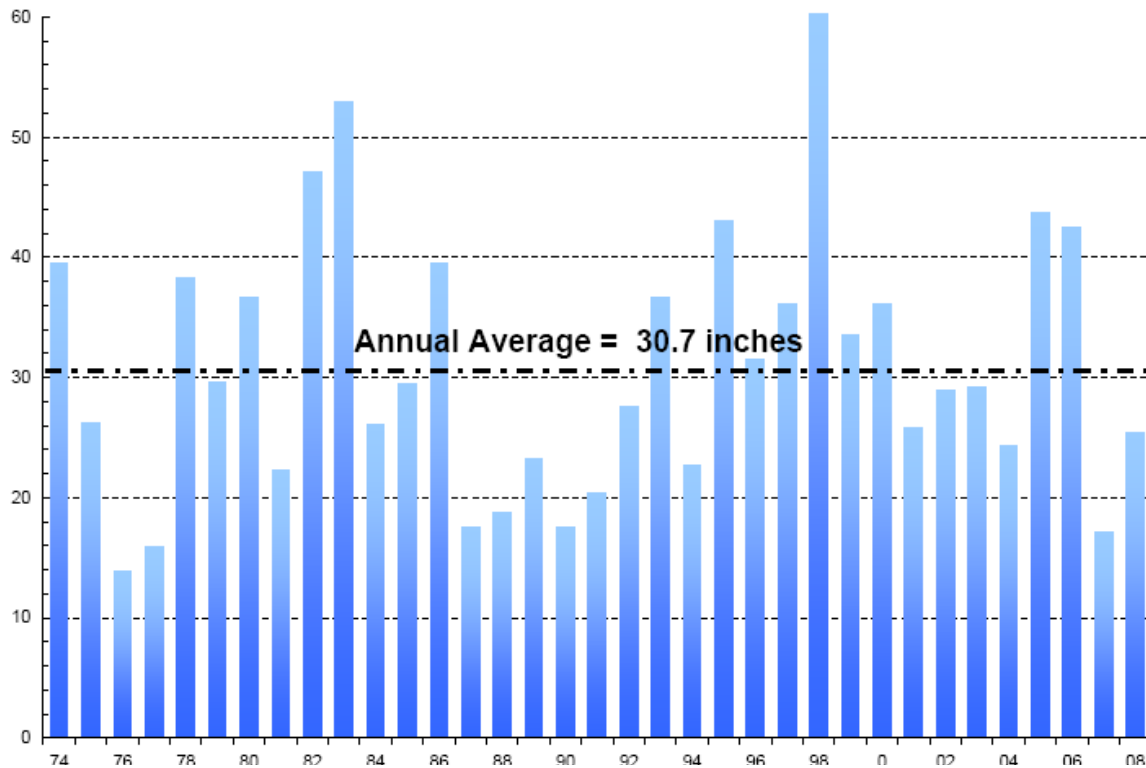
Ordinarily, one abnormally dry year does not create a water shortage in Santa Cruz. Usually there is sufficient storage in Loch Lomond Reservoir, even after one dry winter, to carry the system through the following summer. Based on past experience, however, a shortage is likely to occur when the central coast region experiences **two or more** dry winter seasons in a row.

2.2 Precipitation

The water supply of the City of Santa Cruz all originates from precipitation that falls in the form of rain on the Pacific Ocean side of the Santa Cruz Mountains during the fall, winter, and early spring. The majority of rainfall normally occurs in a five-month period between November and March. The amount of precipitation that falls is one basic indicator of whether the city is experiencing a wet or dry year. Rainfall amounts on the central coast vary widely from year to year.

Daily rainfall data is collected for water supply purposes at various sites in the Newell Creek watershed, at Ben Lomond, and in the City of Santa Cruz. The Ben Lomond and Santa Cruz sites are both official National Oceanographic and Atmospheric Administration (NOAA) weather observation stations with extended rainfall records.

Annual variation in rainfall at Santa Cruz is illustrated below in Figure 2-2. Long-term average rainfall in the Santa Cruz area is about 30 inches. In the 1987-92 drought, annual rainfall ranged from 17 to 23 inches, and in the 1976-77 drought, annual rainfall amounts in the City measured 14 to 16 inches.

Figure 2-2. Annual Rainfall at Santa Cruz, 1974-2008 (inches)

In Ben Lomond, rainfall averages about 49 inches per year. In the 1987-92 drought, annual rainfall ranged from 25 to 32 inches, and in the 1976-77 drought, annual rainfall amounts measured 19 to 21 inches.

The pattern in both timing and distribution of rainfall can be as important in determining water supply availability as the total amount of rainfall received. Years in which the majority of rainfall occurs early in the rainy season or is concentrated in a short time frame tend to produce lower river and stream flows during the peak summer season. Conditions where storms are spread out through the winter season or occur late into spring help sustain higher base flows in the coastal streams and the San Lorenzo River later into the year.

2.3 Runoff

Under normal operating conditions, the north coast and San Lorenzo River flows provide about 80 percent of the City's total annual water supply. Accordingly, runoff is a key parameter used to assess the City's water supply condition.

Stream flow in the San Lorenzo River is monitored at two locations using the U.S. Geological Survey (USGS) gauges located at Henry Cowell Redwoods State Park near Felton and downstream next to the Tait Street intake. The gauge in Felton is particularly important for assessing water supply conditions because the river is the City's single largest source and because of the long historic record that exists for the site. Real time flow records are available on the USGS website, <http://waterdata.usgs.gov/ca/nwis/uv?11160500>. The USGS also prepares printed reports that provide a record of average daily and monthly flows, in cubic feet per second (cfs), and stream discharge, expressed in acre-feet (ac-ft). Monthly flows are charted by the Water Department and compared with the long-term averages and the previous year's flow to assess trends.

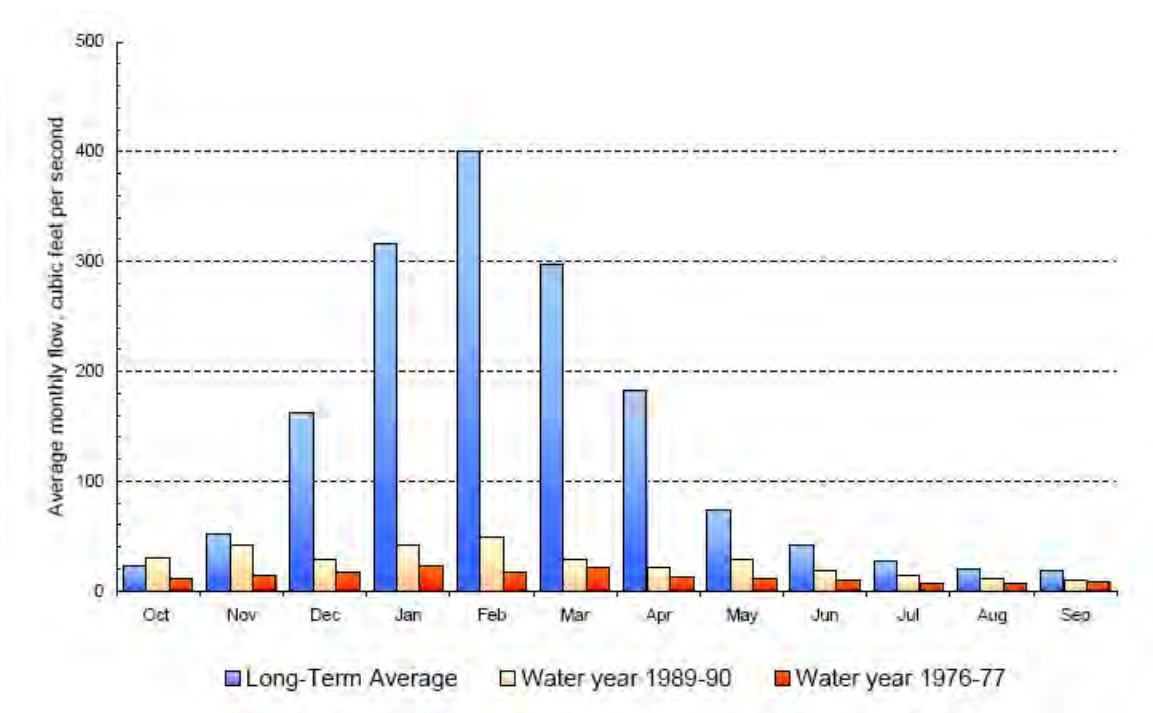
On the north coast sources, there were no stream gauges until a few years ago. Flow records are now being gathered for these sources, which will become valuable in future years for assessing water conditions on the north coast.

In the San Lorenzo River, runoff fluctuates annually and seasonally, depending on the amount and timing of rainfall. The majority of runoff typically occurs over a three month period from January through March, once the watershed becomes saturated. After the rainy season ends, stream flow in the San Lorenzo River gradually declines over the course of the summer dry season.

In normal years, average monthly runoff ranges from 300 to 400 cfs in winter, and then drops from 70 cfs to 18 cfs over the course of the dry season. As long as the flow in the channel continuously exceeds 12 - 14 cfs, which it typically does in normal years, the water system is capable of making full production within its water rights from the San Lorenzo River all season long.

In dry years, runoff is substantially lower. Figure 2-3 below illustrates the difference between average monthly flow and the flow in the San Lorenzo River during two drought years. Under these conditions, when stream flow in summer declines below 12-14 cfs, production from the river must be scaled back to avoid damaging pumps. In the 1977 drought, the flow in the river dropped to a historic low of about 6 cfs, significantly reducing water production.

The same is true, even more so, for the north coast sources. The stream flow in Laguna and Majors creeks dwindles to extremely low levels in dry years. Liddell Spring is a steadier, more reliable source in dry years than either Laguna or

Figure 2-3. Monthly Stream Flow in the San Lorenzo River at Felton

Majors Creek, but does exhibit some decline in flow during dry periods. As such, the spring is a crucial component of the City's water supply in drought years.

2.4 Water Year Type

The City uses a water year classification system as a primary index of its water supply conditions. Under this classification system, the water year, which runs from October 1 to September 30, is designated as one of four types, depending on the total annual stream discharge of the San Lorenzo River, measured at Felton, and expressed in acre-feet¹.

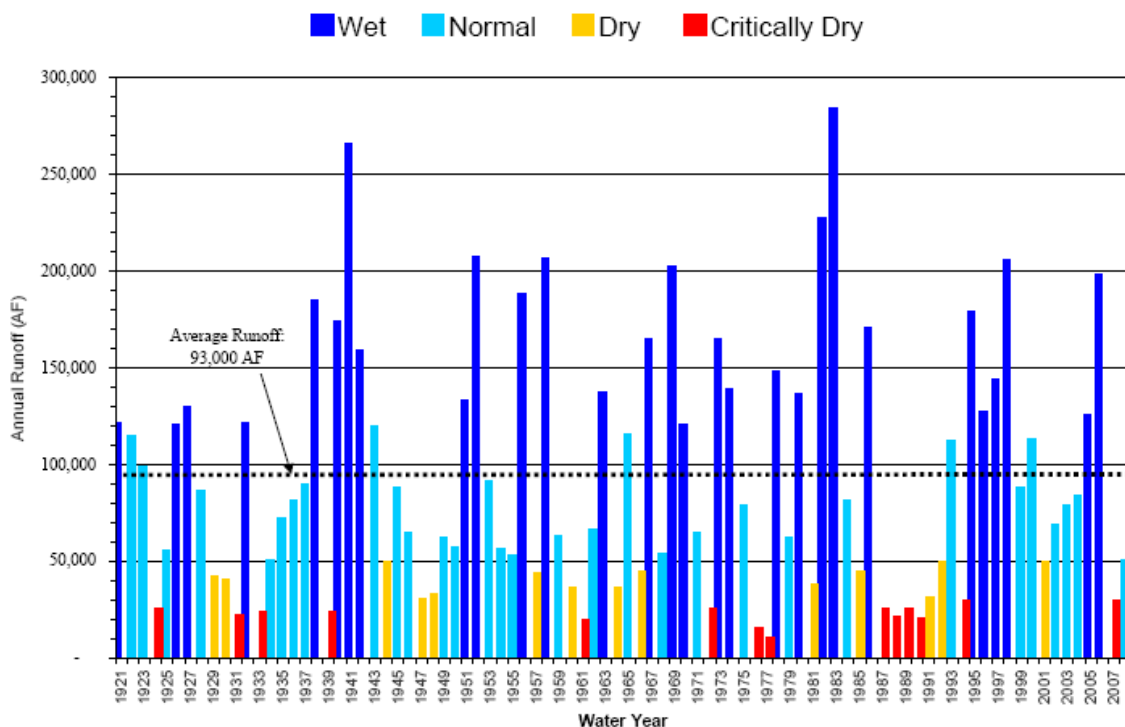
Table 2-1. Water Year Classification System

Classification	Total annual discharge (ac-ft)
Wet	> 119,000
Normal	49,000 - 119,000
Dry	29,000 – 49,000
Critically Dry	< 29,000

¹ An acre-foot of water is equal to 325,851 gallons. One million gallons equals 3.07 acre-feet.

Figure 2-4 below shows the total annual discharge for the San Lorenzo River over the 87 year period from 1921 to 2008, and the classification for each water year. The graph illustrates the dramatic variation in discharge from year to year. Long-term average annual discharge for the San Lorenzo River at Felton is 93,000 acre-feet or almost 30 billion gallons per year. In the long 1987-92 drought, total annual discharge measured between 20,000 and 30,000 acre-feet, and in the 1976-77 drought - the most critical on record - the total annual discharge in the San Lorenzo River dropped to between 10,000 and 14,000 acre-feet.

Figure 2-4. Total Annual Stream Discharge from San Lorenzo River



While the current water year type is of primary consideration in assessing water conditions, the previous water year type also has some influence on summer water supply availability. An antecedent year that is classified as wet will help sustain river base flows longer into the year, whereas a previous dry year can cause river flows to decline sooner and lower than would otherwise be expected.

2.5 Reservoir Storage

Loch Lomond Reservoir is the City's only source of stored water and has a total storage capacity of 2.8 billion gallons. In normal and wet years, reservoir storage

Figure 2-5. Loch Lomond Reservoir

refills naturally to full capacity with runoff from the Newell Creek watershed, usually by February or March. Storage can also be supplemented in dry years with water pumped up to the reservoir from the San Lorenzo River via the Felton booster station when natural runoff is low.

In a normal year, the reservoir will start the dry

season full with 2.8 billion gallons in storage. In the 1987-92 drought, reservoir storage at the beginning of April ranged from 1.5 to 1.7 billion gallons (53 to 61 percent of capacity). In the 1976-77 drought, reservoir storage at the beginning of April 1976 measured 1.6 billion gallons or 57 percent of capacity. In April 1977, beginning season storage was only 1.0 billion gallons or 36 percent of capacity.

2.6 Determining If a Water Shortage is Imminent

In normal or wet years when the water supply outlook is favorable, there is generally a surplus of water available from the various sources to meet existing demand. A general rule of thumb is that if Loch Lomond Reservoir is at full capacity by spring, it is not necessary for the City to institute any short-term demand reduction measures the following summer.

After an unusually dry winter or period of consecutive dry years, though, when a lack of supply appears possible, the Water Department undertakes an analysis to forecast whether water supplies will be deficient relative to estimated water needs for the coming dry season. This calculation must be made before the end of rainy season in time to decide on appropriate actions and to provide adequate notice to the public. There is always the chance that late winter rains will change the water supply outlook. Thus, the situation remains dynamic through the end of April.

The peak season from roughly May 1 through October 31 is considered the critical period for the purpose of defining the degree of water supply shortfall, and for selecting the appropriate demand reduction goal. This is the period when water availability in the City's flowing sources is generally lowest and water demand normally would be at its highest, creating a summer water supply "crunch".

Past experience indicates that, even in water short years, there is generally adequate water in the City's flowing sources to meet system demands during the off-peak months between November and April, and that there is little if any need to reduce water demand this time of year when consumption is low.

There is no one single criterion, trigger, or definition that is used to determine if a water shortage exists. The determination of a shortfall involves consideration of all the parameters mentioned previously, as well as expected system demand. To determine the degree of shortfall, the Department follows a three-step process, described below:

1. Develop a monthly forecast of supply available from flowing sources and wells.
2. Compare the supply available from flowing sources and wells to the expected water demand and estimate production needed from Loch Lomond. Calculate the monthly and seasonal drawdown on Loch Lomond Reservoir.
3. Evaluate whether the amount of water in Loch Lomond Reservoir is adequate to meet expected demand for the coming dry season and for the following year in case the dry weather pattern continues through the next winter.

2.6.1 Forecasting Water Production from Flowing Sources and Wells

Of primary importance to the system operation is the ability to know at the end of a winter season how the San Lorenzo River, the City's most important source, will flow through the coming summer and into the dry fall season. In wet and normal years, the river flows at the Tait Street diversion are sustained consistently above the 12.2 cfs level that the City is authorized to divert under the City's water rights. The three river pumps normally make a steady 7.5 million

gallons per day from this source, or between 225 and 232 million gallons per month, all season long.

In dry and critically dry years, natural flows can drop below the 12 cfs level at the intake during summer, requiring pumping from the San Lorenzo River to be scaled back. Once the water year type has been established, statistical tables are used to forecast the mean monthly flow in the San Lorenzo River through the remainder of the dry season (Appendix C). This technique helps to identify at what point in the year river production will be reduced and by how much.

Forecasting supplies available from coastal sources involves less certainty due to the lack of historic stream flow information. The technique used to forecast supplies on the north coast is to find historic water years with a similar pattern in rainfall amount and timing. The production records from those years are examined to assess the likely yield of those sources for the coming season, while taking into account any operational rules, capacity constraints, or in-stream flow releases that may have changed from those previous years. Water production from the City's Live Oak well field is projected as a function of the production capacity for any wells in operation and duration that the wells will be operated.

The Department necessarily uses a conservative estimate of yield to ensure the supply forecast for flowing sources and groundwater production is reliable.

2.6.2 Calculating Drawdown on Loch Lomond Reservoir

Once the forecast of supply available from surface diversions and wells is made, supplies are compared with expected water demand to determine how much lake water would be needed to meet unrestricted system demand. The amount of water lost from the reservoir to evaporation and released for downstream fisheries preservation is then factored in. From this analysis, a projection can be made about:

- the expected rate of drawdown of the reservoir over the dry season;
- the lake level at the end of October; and
- the expected carryover storage for the following year.

Table 2-2 below presents an example with the City's current sources of supply to illustrate the forecast technique. This situation represents a hypothetical year in

which the lake does not refill over winter and begins the season on April 1 with 2.1 billion gallons in storage, or 73 percent of capacity. Flow in the San Lorenzo River is projected to drop below 12 cfs during the month of July, reducing river production. Without any constraint on water demand, a total of 680 million gallons of water would be needed from the lake to meet normal system demand over the dry season, which, along with other losses and outflows, would result in an end of season reservoir volume of about 1.2 billion gallons, or just under 42 percent of capacity.

**Table 2-2. Example of Water Storage Forecast
with Unrestricted Water Demand**

SCWD Production Forecast (million gallons)	April	May	June	July	Aug	Sep	Oct	Total
North Coast (gross production) ²	82	74	64	50	50	49	35	404
North Coast (net production)	61	55	48	38	38	37	26	303
San Lorenzo River	207	232	225	212	200	175	160	1,411
Live Oak Wells	24	24	24	24	24	24	24	168
Total Production without Lake	293	311	297	274	262	236	210	1,882
Projected System Demand	295	344	388	410	415	365	345	2,562
Lake Production Needed to Meet Demand	2	33	91	136	153	129	135	680
Evaporation (feet)	0.2	0.3	0.3	0.4	0.4	0.3	0.2	2.1
Evaporation (mil gal)	11	14	14	18	16	11	6	90
Fish Release (mil gal)	21	21	21	21	21	21	21	147
Beginning Lake Volume	2,100	2,066	1,998	1,872	1,696	1,506	1,345	
End of Month Lake Volume	2,066	1,998	1,872	1,696	1,506	1,345	1,183	
End of Month Lake Elevation (ft above msl)	562.8	561.2	558.5	554.3	549.3	544.6	539.6	
Monthly change in elevation	-0.8	-1.6	-2.7	-4.2	-5.0	-4.7	-5.0	
Cumulative change in elevation	-0.8	-2.4	-5.1	-9.3	-14.3	-19.0	-24.0	
Percent of capacity of Loch Lomond (%)	73.0	70.6	66.1	59.9	53.2	47.5	41.8	

2.6.3 Evaluating Adequacy of Supply

The determination of whether a shortage exists essentially boils down to a risk assessment regarding the predicted end of season lake level and carryover storage needed in Loch Lomond Reservoir. The Water Department's main considerations in undertaking this assessment include the following:

- Would allowing unrestricted water use in the current year leave insufficient reserves if drought conditions continue into next year?

² Gross production refers to the amount of water entering the system at the source, while net production is the amount reaching the City's water treatment plant. The difference is due to coast irrigation sales, leakage, and maintenance.

- Knowing that another dry year could mean the City's flowing sources would drop even lower, how much water should be withheld in the reservoir for the following year to be prudent?

The key decision thus revolves around how much Loch Lomond water to allocate in spring for the current year, whose tradeoffs are summarized in Table 2.3 below.

Table 2.3 Tradeoffs of Alternative Allocations from Loch Lomond Reservoir

Allocation	Frequency	Revenue Impact	Consequence
Large	Shortages occur less frequently	Less impact on water sales and revenue	Would require a smaller cutback in the current year, but would draw down the reservoir faster and potentially would require much more draconian cutbacks if the drought persisted into the following year
Small	Shortages occur more frequently	Lower sales and reduced revenue	Would mean customers would be required to cut back more in the current year, but would preserve storage enabling the City to withstand more prolonged drought before running out of stored water

There is no set formula to determine the optimal allocation. Rule curves were developed for operations modeling purposes as part of the City's Integrated Water Plan to mimic how lake resources theoretically would be allocated under various water conditions. Under these rule curves, no shortage is indicated if lake storage is above 2.4 billion gallons (85 percent of capacity) on April 1 and as long as the lake is forecast to remain above 1.8 billion gallons (64 percent of capacity) through the end of September. Below these levels, a shortage is assumed to occur. The lower the lake level, the greater the shortage. One important rule regarding utilization of lake storage established during the development of the Integrated Water Plan was to always regard the bottom 1.0 billion gallons (35 percent of capacity) in the reservoir as unusable, so there is always some limited amount of supply preserved in storage for the following year.

In the real world, though, with imperfect information about both supply and demand, and no ability to tell when the drought will end, prudent management dictates that the long-term welfare of the City and its residents outweighs the short-term benefit to the community and higher revenues that would be realized by setting a higher allocation. This means generally favoring a smaller allocation and

calling for larger cutbacks than may actually be necessary in retrospect to avoid the possibility of experiencing more critical water shortages if drought conditions continue to worsen. **Ideally, the carryover storage amount will be enough, along with other sources, to meet essential health and safety needs if the subsequent winter is as dry as the driest year on record.** According to the literature, the main lesson from other utilities that have been through droughts is that they would have acted earlier to save more water, in retrospect, in order lessen the impact of implementing more severe cutbacks later on.

Going back to the example in Table 2-2, it is logical to assume that a season-end level of less than 1.2 billion gallons (42 percent of capacity) would be regarded as unsafe and leaving the system vulnerable in case of another dry year. In this example, it is not unreasonable to assume that a decision would be made to curtail water use with the goal of retaining somewhere between 1.5 and 1.6 billion gallons of water in storage (55 percent of capacity) at the end of the season as a hedge against a subsequent dry year. To achieve that target storage, lake withdrawals would need to be reduced from 680 to less than 300 million gallons and customers would be required to cut back by 15 percent or 387 million gallons compared to the normal demand of 2,562 million gallons. Table 2-4 shows the effect a 15 percent cutback would have in terms of increasing carryover storage and lake level at the end of the dry season.

**Table 2-4. Example of Water Storage Forecast
with 15 Percent Demand Reduction**

SCWD Production Forecast (million gallons)	April	May	June	July	Aug	Sep	Oct	Total
North Coast (gross production)	82	74	64	50	50	49	35	404
North Coast (net production)	61	55	48	38	38	37	26	303
San Lorenzo River	207	232	225	212	200	175	160	1,411
Live Oak Wells	24	24	24	24	24	24	24	168
Total Production without Lake	293	311	297	274	262	236	210	1,882
Reduced System Demand	295	315	320	330	320	300	295	2,175
Allowable Lake Production	2	4	23	56	58	64	85	293
Evaporation (feet)	0.2	0.3	0.3	0.4	0.4	0.3	0.2	2.1
Evaporation (mil gal)	11	14	14	18	16	11	6	90
Fish Release (mil gal)	21	21	21	21	21	21	21	147
Beginning Lake Volume	2,100	2,066	2,027	1,969	1,873	1,778	1,682	
End of Month Lake Volume Goal	2,066	2,027	1,969	1,873	1,778	1,682	1,570	
End of Month Lake Elevation (ft above msl)	562.8	561.9	560.6	558.5	556.3	553.9	551.1	
Monthly change in elevation	-0.8	-0.9	-1.3	-2.1	-2.2	-2.4	-2.8	
Cumulative change in elevation	-0.8	-1.7	-3.0	-5.1	-7.3	-9.7	-12.5	
Percent of capacity of Loch Lomond (%)	73.0	71.6	69.6	66.2	62.8	59.4	55.5	

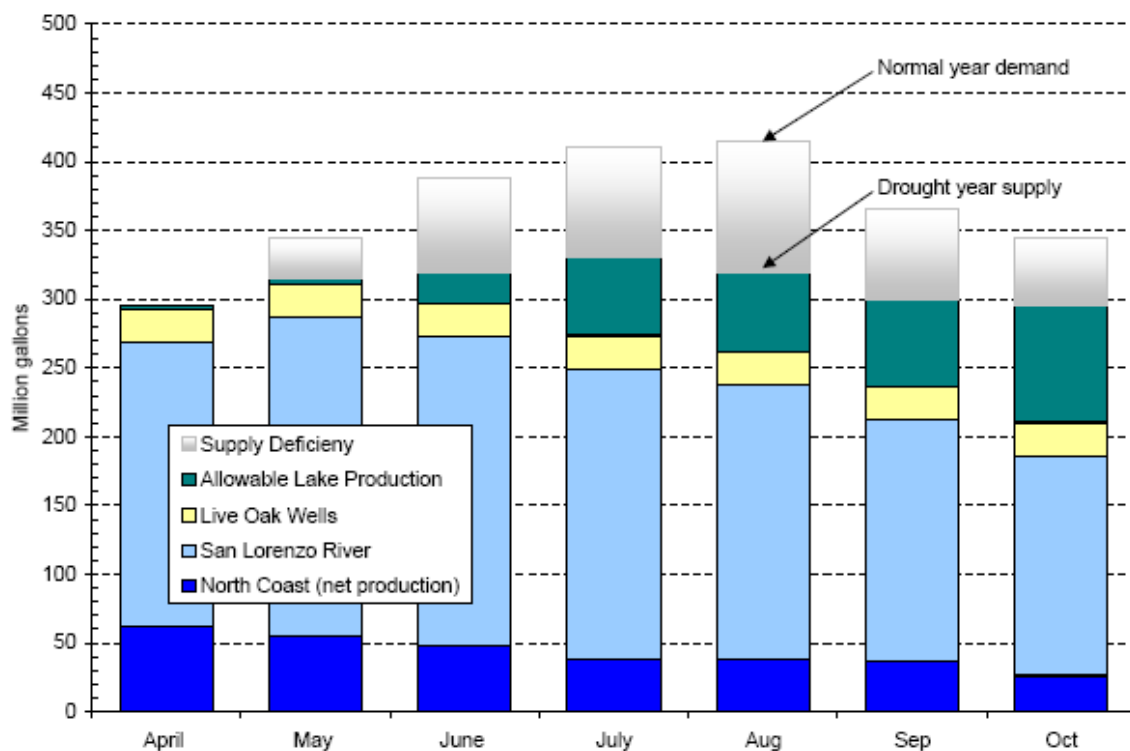
In this case, the reservoir at the end of the dry season stays over half full and 13 feet higher than it would have without any reduction in demand.

The overall water shortage is calculated simply by dividing the supply deficiency for the seven month period from April to October (387 million gallons), by the total unrestricted demand during the same period, expressed as a percentage:

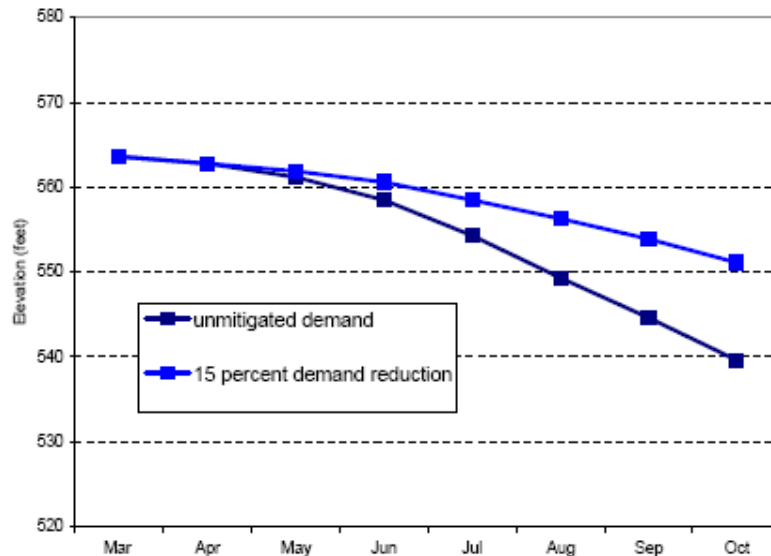
$$\begin{array}{rcl} \text{Supply deficiency (mg):} & & 387 \\ \text{Unrestricted demand (mg):} & & \div 2,562 \\ \hline \text{Water shortage:} & = & 0.15 \text{ or } \mathbf{15\%} \end{array}$$

Figure 2-6 below illustrates the 15 percent supply deficiency relative to available supplies on a month to month basis.

Figure 2-6. Example of a 15 Percent Water Shortage



The difference in the drawdown rate between the two scenarios is illustrated in Figure 2-7. This chart shows the effect reducing water demand has on slowing the depletion rate of the City's stored water supply.

Figure 2- 7. Reservoir Drawdown

The ultimate decision about whether supplies are adequate in Santa Cruz for a given dry year are thus dependent not just how much water is available in that year from the City's sources of supply, but also on the level of demand exerted by customers over the coming season and management's comfort level with predicted carry over storage. In the last few years, systemwide water demands have experienced a noticeable downturn which means the City can better withstand dry conditions like the current 2008 water year and have a lower seasonal impact on lake levels than in the past. The one caveat, though, is that because at present use is so conservative, there is a declining ability for "belt tightening" when the next shortage arises.

2.7 New Water Sources and Potential Changes to Existing Supplies

There are several major projects currently under way that are intended to improve the City water system reliability in drought years.

The City and Soquel Creek Water District are jointly pursuing seawater desalination as a supplemental water source, which is expected to become available sometime around 2015. As currently envisioned, this facility would add 2.5 mgd capacity to the City water system, which could provide upwards of 500 million gallons over the dry season as a backup supply in times of drought. The operation of such a facility between the two agencies is yet to be determined, but

the process of evaluating the City's dry year supply and demonstration of need by the City for use of the plant would be similar to the example shown above.

The other major capital improvement project affecting the City's water supply is the renovation of the Live Oak well system, which includes upgrades to wells, treatment plant, and the distribution system to restore production capacity back to its full 2 mgd level that it was in operation during the 1987-92 drought. This assumes the entire groundwater basin is not compromised by continued regional over-pumping of the Purisima aquifer.

Another possible long-term project currently being pursued that may have some minor beneficial effect on City water supplies by reducing summertime peak demand is an exchange of water with the Scotts Valley Water District. The District is exploring ways to provide recycled water from the City of Scotts Valley to the Pasatiempo golf course, which now uses water obtained from the City of Santa Cruz. The District would receive in exchange surplus water from the City during winter to reduce its groundwater pumping and restore groundwater levels in the Scotts Valley area. While net water production by the City would remain unchanged, the project would shift demands from the peak to off-peak season and shift production away from the lake toward the City's flowing supplies.

In addition to these projects, there are also several uncertainties facing the City's existing sources, particularly along the north coast, that have the very real potential to reduce water supply in dry years.

The City is pursuing an Endangered Species Act Section 10 permit and habitat conservation plan. Long-term requirements for in-stream flow releases affecting the City's surface water diversions have yet to be determined and are pending the outcome of further data collection, analysis, and negotiations with federal and state regulatory authorities. However, preliminary voluntary releases are now being made on all three North Coast sources (Laguna and Majors Creeks, and Liddell Spring) and expectation is that the City will lose more water as a result of regulatory actions at the state or federal level for the protection of listed species. The City is also involved in two water rights matters pending before the State Water Resources Control Board that could affect future operations of the Felton diversion and Loch Lomond Reservoir.

The net effect of all these projects and issues is unclear at this time, but the likelihood is that the City stands to lose some portion of its existing supply before it gains any new source. Those changes will have to be factored into the assessment of supply and demand the next time the City is confronted with a potential water shortage.

Section 3 DEMAND REDUCTION PROGRAM

This section describes how the City will respond to future water shortages and discusses the various actions it would take to reduce water demand under different shortage scenarios.

3.1 Staged Demand Reduction Approach

The recommended Water Shortage Contingency Plan uses a staged approach that classifies a shortage event into one of five levels spanning a range from less than 5 percent up to 50 percent. Each stage has been ascribed a specific title to describe and convey the severity of the water shortage to the public.

Table 3-1. Five Stage Structure to Water Shortage Contingency Plan

Stage	Magnitude of Water Shortage	Stage Title
1	0-5%	Water Shortage Alert
2	5-15%	Water Shortage Warning
3	15-25%	Water Shortage Emergency
4	25-35%	Severe Water Shortage Emergency
5	35-50%	Critical Water Shortage Emergency

To put these different levels into context, the City water system normally produces a total of about 2.5 to 2.6 billion gallons of water from April through October. This is the time period when water production is typically the most constrained by shortages and when consumption would need to be reduced. Normal daily usage during this period varies seasonally from 10 to 14 mgd and averages about 12 mgd. Table 3-2 below shows the amount of reduction in demand that would need to be achieved system-wide, on both a seasonal and a daily basis, which corresponds with the upper end of each stage.

The overall concept of this approach is that water shortages of different magnitudes require different measures to overcome the deficiency. As explained in further detail below, each stage includes a set of demand reduction actions and measures which become progressively more stringent as the shortage condition escalates.

Table 3-2. System-wide Demand Reduction Volumes

Stage	Magnitude of Water Shortage	Seasonal Demand Reduction (million gallons)	Average Daily Demand Reduction (mgd)
1	5%	125	0.6
2	15%	375	1.8
3	25%	625	3.0
4	35%	875	4.2
5	50%	1,250	6.0

Normally, only one of these five stages would be put into effect early in the year at the recommendation of the Water Director and remain in force for the entire dry season. Which one would depend on the water supply outlook at the beginning of the dry season. However, conditions and circumstances will vary with each shortage event. Although it would not be desirable to do so for sake of consistency, the City might be forced to transition to the next higher stage mid-season if the reduction efforts at the initial stage do not achieve the needed result.

There is an important distinction between the lower two stages (1 and 2), designated above in shades of yellow, and the upper three stages (3, 4, and 5) designated in shades of red, with the break point occurring at the 15 percent shortage level. The lower two stages (1 and 2) represent the **anticipated curtailment** that is envisioned as being necessary to balance water supply and demand from time to time under the City's Integrated Water Plan. Shortages of 15 percent or less, while inconvenient, do not directly threaten public safety or pose undue economic impact.

The upper three stages (3, 4 and 5), conversely, are all characterized as **emergency water shortages** since they result in more widespread hardships being felt throughout the community, may threaten public health and welfare, and cause considerably more economic harm. For these reasons, the City is making considerable effort and investing substantial capital to avoid shortages of this magnitude in the future. Nevertheless, as a public water supplier, the City must still prepare and plan for the possibility of experiencing such large deficits under state law.

3.2 Overview of Demand Reduction Strategy

The City's strategy for dealing with water shortages of all levels involves the following four interrelated components:

- An allocation system to establish reduction goals for different customer groups
- Demand reduction measures
- Publicity and communications
- Operating actions

These four components are summarized below.

3.2.1 Allocation System

A fundamental issue any water supplier faces in managing a water shortage involves the allocation of water and how to distribute the available supply among customer categories when supplies fall short. In the process of updating this plan, staff and the City Water Commission examined various options and alternatives and selected a priority-based system. This allocation system produces specific demand reduction goals for each major customer category at various levels of shortfall based on the unique usage characteristics of each customer category. It is one of the key mechanisms to ensure that the overarching goals of: 1) conserving the water supply of the City for the greatest public benefit and 2) mitigating the effects of a water shortage on public health, safety, and economic activity, are achieved. It also provides the means for determining whether demand reduction goals are being met or, if not, making needed adjustments. The allocation system is described in more detail below.

3.2.2 Demand Reduction Measures

There are a variety of demand reduction techniques that can be used to curtail customer water use during a supply shortfall. These techniques fall into the following general categories:

Voluntary Water Use Reductions This approach would include issuing guidelines and suggestions to conserve water, encouraging installation or active distribution of conservation devices, stepping up financial incentives for fixtures and

appliances that reduce per capita water use, discouraging installation of new landscape, or encouraging replanting with low water materials. Offering technical assistance in the form of water audits for various types of customers would fall into this category.

Prohibitions on Certain Uses This technique includes banning nonessential uses not required for protection of public health and safety that are not normally prohibited by definition under the city's water waste ordinance. Examples include prohibition on the use of potable water for washing sidewalks and paved surfaces, dust control, or the draining and refilling of private swimming pools. Included in this category would be serving of water in restaurants or other places where food is served unless expressly requested by the customer.

Limits on Certain Uses This approach involves placing mandatory restrictions such as watering only between certain hours or on specific days, watering of landscape only by certain methods (sprinkler ban), or restricting the manner in which vehicles or buildings may be washed.

Mandatory Requirements This technique includes adopting regulations mandating that certain measures be taken by selected customers ranging from the posting of signage in various establishments to save water to requiring the preparation and filing of site-specific conservation plan or requiring an audit of company water use demonstrating conservation efforts.

Rationing This approach involves establishing a fixed volume or allocation for individual customers or for groups of customers that is intended to reduce water use to a certain level commensurate with the seriousness of the situation. Possible methods that can be used to assign customer allotments include setting a uniform or flat amount, applying a percentage reduction from past use (or other benchmark), establishing a ration on a unit basis (per capita, per dwelling unit, per connection) or using a hybrid approach that is based on a combination of factors.

In updating this plan, staff and the City's Water Commission identified and reviewed available options for application to various customer groups and inclusion at different stages, and took into consideration the following factors:

- Water savings
- Seasonality
- Time frame and procedural requirements to implement the measure
- Administrative burden
- Applicable sector (residential, commercial, irrigation)
- Measures used by other water agencies

3.2.3 Publicity and Communications

Effective communication is essential to the success of any water shortage contingency plan in achieving the desired water use reductions. All customers need to be adequately informed about water supply conditions, understand the need to conserve, and know what actions they are being requested or required to take to mitigate the shortage. The Water Department naturally assumes a central role in publicizing the extent of the water shortage problem and in advising and assisting customers to conserve. The more severe the shortage, the more vigorous the public information campaign will need to be. No matter what the situation though, any public communications strategy undertaken in connection with water shortage ideally should contain the following fundamental attributes:

Timely – information should be disseminated well in advance of voluntary and mandatory actions that are to take effect, repeated often, and updated at regular intervals.

Credible – public information efforts should strive to be clear, professional, consistent, straightforward, reasoned, and honest to build trust and community support.

Multimodal – information should be made available to the public using a variety of methods, including the internet, newsletters and newspapers, radio, television, special events, visual displays, public meetings, speaking engagements, and other techniques to maximize reach.

Open – the Department will actively listen to, engage, and involve its customers, solicit feedback, address identified concerns, and respond to public input in a manner that is respectful, appreciative, welcome to creative solutions, and acknowledges each individual's sacrifice, inconvenience, and contribution to the situation.

Coordinated – the Department should collaborate with other City departments, affected public agencies and organizations, its own employees, interest groups, and the news media to ensure that everyone is on the same page and working together.

Action Oriented – information should always contain positive action steps people can take to help foster a spirit of cooperation and create an overall atmosphere that encourages the public to save water for the common good.

There are a number of **key groups** to whom water shortage communications will need to be aimed. These include, but are not limited to the following:

City Council and other local elected officials The Council authorizes the use of emergency powers and funds, adopts water shortage regulations, and makes appointments to a special appeals board. As the City's governing body, it will have to deal with frequent inquiries from the media and constituents. It will need to know about possible impacts on citizens and the City's own municipal water use. The City Council will be provided in-depth information for its decision-making. The Water Commission, which advises City Council, is a primary forum where policy issues are discussed and the public is able to make its voice heard. The County Board of Supervisors, Capitola City Council, and governing bodies of adjoining water districts also will need to be kept informed.

City Departments and other governmental bodies All City departments, including Parks, Fire, Public Works, as well as other public institutions will be asked to provide leadership and present a good example to the community by reducing their own water demand. The Water Department will need to work closely to promote and ensure such interdepartmental and government cooperation.

News media The media has a key role to play in helping communicate timely and accurate information to the public, especially when water restrictions or regulations are initially announced. The Water Director or Water Conservation Manager (as alternate) serve as official spokespersons to television and print media, answering questions and explaining reasons for certain actions. Because the news media is such a powerful force, care always must be given to deliver accurate and consistent messages and to maintain good relationships with the media. Feature reporters and editors can also be instrumental in writing about personal interest stories and alternative approaches to help people deal with water shortage in a positive way.

Large water users and groups most affected by water shortage The local landscaping and hospitality industries, along with other high water using businesses, University, and special needs customers (hospitals, nursing care facilities, etc) will need additional information about water shortage restrictions or regulations that affect their business or clients more than average.

City water customers/general public All 90,000 City water users, regardless of whether they are the customer of record, will need to be properly notified so that everyone understands the reasons for voluntary or mandatory cutbacks, what is expected in terms of usage restrictions, and the consequences of failing to abide by any adopted regulations. The Department will need to step up distribution of conservation tips and water saving ideas and respond to an increasing number of individual customer contacts. Special efforts also will need to be made to translate copies of all public notices, regulations, and outreach materials into Spanish and other appropriate languages for non-English speakers.

There are various methods the Department could employ to carry out added communications and public outreach responsibilities that become necessary in a water shortage situation. The menu of possible techniques is listed in Table 3-3.

Table 3.3 Communications and Public Outreach Methods

• Press releases • Press conferences • Opinion page coverage • Paid advertising (print, radio, television) • Community television • Radio interviews • Public service announcements • Internet • Bill inserts • Utility bill messages • Revisions to utility bill layout • Direct mail • Printed material (posters, banners, signage) • E-mail • Utility newsletter	• Public meetings, forums • Publish figures and charts of actual water supply and demand on graph, comparing system use against daily, weekly, or monthly water budgets • Presentations at neighborhood, homeowner's associations, service, and community meetings • Telephone hotline • Fliers at schools, churches, libraries, grocery markets, and other social gathering places • Outdoor signs for visitors • Conservation events, contests, booths • Lead or participate in regional drought awareness media campaigns

In reviewing other agency's contingency plans, one feature that was considered valuable to have prepared in advance was a concise public message for each

stage of the Water Shortage Contingency Plan. These statements, set forth below, are intended to help communications stay on message and set the tone for subsequent communications through the duration of the incident.

A working list of contacts for major public agencies, media contacts, business organizations, landscape interests, and large customers is provided in Appendix D for reference.

3.2.4 Operating Actions

The Water Department must be flexible in the use of its own workforce and adaptable in realigning its priorities when a water shortage arises. The added responsibilities change what must be done in both field and office operations on a daily basis compared to usual duties under normal water supply conditions. These actions begin early in the water year with monitoring and forecasting water supply conditions and quickly ramp up in spring as the likelihood of a shortage increases. Many will represent increased costs to the Department for additional personnel, services, and supplies.

An important initial step is to designate a working group consisting of the Water Director and senior staff to lead and manage the Department's internal and external water shortage response. The size and composition of the group and frequency of meetings (monthly, weekly, daily) would vary depending on the severity of the shortage.

The Water Department must then mobilize the necessary personnel, resources, and equipment to undertake the various activities that are critical to implementing an effective response. These initial actions may include, among other things:

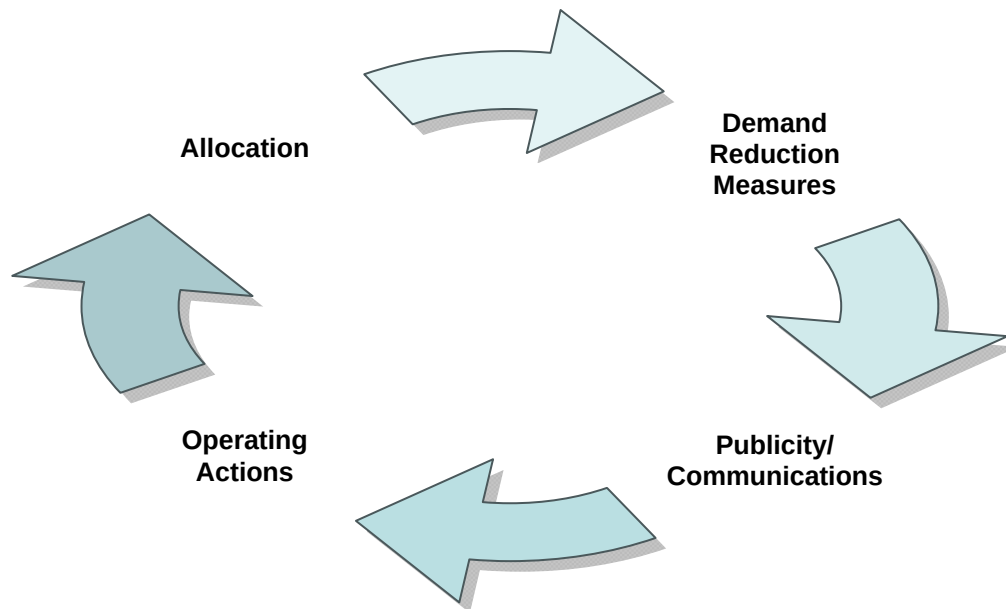
- Establishing water production budgets
- Coordinating with other city departments and affected public agencies
- Establishing a public communications program to publicize use restrictions and to engage and involve the community and key water-using sectors in curtailing their demand
- Ensuring adequate staff and training to effectively respond to customer inquiries and enforce water shortage regulations
- Adapting utility billing format and database capabilities
- Expanding water conservation assistance, outreach, and education

- Instituting a system for processing exception requests and appeals
- Addressing policy issues and updating status with decision makers
- Implementing monitoring mechanisms to track actual usage and measure performance

These and other operating actions are described further below and in Section 4 covering plan implementation.

Together, these four demand reduction strategy components can be thought of as a system whose parts function together to accomplish change; change in customer understanding and awareness, change in their behavior and actions, and fundamentally change in how much water residents, businesses, and visitors use in times of water shortage. As illustrated in Figure 3-1, these interrelated components provide the standards and feedback mechanism to ensure that water consumption is reduced to the level that the system can safely support.

Figure 3-1. Demand Reduction Strategy



3.3 Priority-Based Water Shortage Allocation

The recommended allocation system is based on the premise that, when water is in short supply, certain end uses should have a higher priority than others. Using a priority-based approach, the normal water demands of each major customer category are first classified into three basic priorities, as follows:

- 1. Health and safety.** This is the highest priority use, which includes residential and non-residential interior domestic and sanitary uses.
- 2. Business.** This category is the second highest priority and includes all non-sanitary usage related to commercial and industrial activity.
- 3. Irrigation.** This is the lowest priority and includes all irrigation and outdoor usage in the single family, multiple residential, UC and irrigation categories.

Table 3-4 shows the normal water use for each of the City's major customer groups during the April to October peak season and the composition of that demand according to usage priority. These figures are based on an analysis of actual consumption records for the three-year period from 2002 through 2004, which was selected as being representative of typical water consumption patterns in a stable period marked by normal weather and water conditions.

Table 3-4. Composition of Peak Season Water Use, by Usage Priority
(Million gallons)

Customer Class:	Usage Priority:			Total	Percent of Total
	1 Health/ Safety	2 Business	3 Irrigation		
Single Family Residential	660		371	1,031	42%
Multiple Residential	382		142	524	21%
Business	165	273		438	18%
University of California	91		41	132	5%
Other Industrial		23		23	1%
Municipal	18		30	48	2%
Irrigation			110	110	4%
Golf Course Irrigation		32	74	106	4%
Coast Agriculture		59		59	2%
Other		2		2	0%
SUBTOTAL	1,316	389	768	2,473	100%
Percent of Total	53%	16%	31%	100%	
System uses/losses				168	
TOTAL SYSTEM PRODUCTION (million gallons)				2,641	

Metered water use by all customers during this 7-month period averages 2,473 million gallons, or roughly 2.5 billion gallons. In terms of the breakdown by usage priority, water used for health and safety purposes amounts to 1.3 billion gallons or just over half (53%) of the total demand during the peak season. Water used for business-related purposes amounts to less than 400 million gallons (16%) and the volume of water used for irrigation and associated outdoor purposes totals 768 million gallons (31%). Expressed on a daily basis, this breakdown equates to an average of 6.3 mgd for to satisfy health and safety needs, 1.9 mgd for business activities, and 3.7 mgd for irrigation/outdoor purposes.

To arrive at demand reduction goals for each customer group, the normal year demands shown in Table 3-4 are scaled back by usage priority in accordance with the schedule shown in Table 3-5.

Table 3-5. Reduction in Water Delivery by Usage Priority
(percent of normal deliveries)

Stage	Overall System Shortfall:	Health/Safety	Business	Irrigation
2	15%	95	95	64
3	25%	95	90	34
4	35%	90	85	12
5	50%	75	67	0

In essence, this allocation system strives to balance available supplies in times of drought as much as possible through cutbacks in outdoor water use. At each level of shortfall, public health and sanitation usage is afforded the highest priority by cutting back on interior usage the least¹. The importance of water in protecting the City's employment base is also acknowledged through proportionately modest cutbacks to the commercial sector as compared to the overall system shortfall. Irrigation and other outdoor uses in all cases is cutback the most. The larger the water shortage, the greater the cutbacks, but this system of priorities is maintained throughout the range of potential shortages. The heavy reliance on outdoor use reductions makes sense, both from a water system perspective because it reduces peak demands, which is important to preserving storage in Loch Lomond Reservoir, and from a public health and

¹ No separate allocation was developed for Stage 1 shortfall due to the minimal level of demand reduction needed, voluntary nature of conservation measures requested, and regulations that affect all customer groups equally.

welfare perspective, because irrigation and other outdoor use are the most discretionary of all uses when drinking water is in short supply.

Under this system, a systemwide water shortage of 15 percent - the maximum unserved demand envisioned in the Integrated Water Plan - can be addressed through modest cutbacks (5%) in both indoor and business water uses, combined with an approximately one-third reduction in outdoor water use. Emergency water shortages would involve far deeper cutbacks. A 25 percent systemwide shortage requires slightly greater reduction in business water use combined with a harsher two-thirds reduction in outdoor watering. A 35 percent systemwide shortage requires reducing health/safety and business uses somewhat more, combined with drastic reductions, amounting to almost 90 percent, in outdoor water use. To achieve a 50 percent reduction would take nothing less than a significant reduction in both health/safety and business usage, combined with the elimination of all outdoor water use.

The resulting water supply allocation is shown in Table 3-6. The figures are expressed as a percent of normal delivery and by volume in million gallons for each sector. For example, an allocation of 80 percent means a 20 percent cutback from normal use. Single family residential customers are cut back in all stages slightly more than the overall system shortfall and more than the multifamily customers due to their relatively higher proportion of outdoor to indoor use. Business and industrial customers are also cut back, but by less than the system deficit. The University's cutback would be equal or close to system shortfall, while municipal facilities would be cut back substantially greater due to the high percentage of water use that goes to outdoor purposes. Dedicated landscape/irrigation customers suffer the deepest cutbacks of any single group.

The contribution of each customer category to the overall demand reduction goal is shown in Table 3-7. Approximately two-thirds of the total cutback would be realized through reductions at single and multifamily residential accounts, which is roughly proportional to their overall percentage of normal system demand.

This allocation system is the one recommended by the City's Water Commission after considering several options, and is based on current patterns and composition of water consumption. As demand level changes over time, it should be reviewed and possibly revised. In addition, alternative allocations may always be considered at the time a given stage is implemented.

Table 3-6. Water Supply Allocation and Customer Reduction Goals

Normal Peak Season Demand = 2,473 mg	No Deficiency		Stage 2 15% Deficiency		Stage 3 25% Deficiency		Stage 4 35% Deficiency		Stage 5 50% Deficiency	
	Delivery		Delivery		Delivery		Delivery		Delivery	
	%	Volume (mil gal)	%	Volume (mil gal)	%	Volume (mil gal)	%	Volume (mil gal)	%	Volume (mil gal)
Single Family Residential	100	1,031	84%	864	73%	753	62%	639	48%	495
Multiple Residential	100	524	87%	454	78%	411	69%	361	55%	287
Business	100	438	95%	416	92%	402	87%	381	70%	307
UC Santa Cruz	100	132	85%	113	76%	100	66%	87	52%	68
Other Industrial	100	23	95%	22	90%	21	85%	20	67%	15
Municipal	100	48	76%	36	57%	27	41%	20	28%	14
Irrigation	100	110	64%	70	34%	37	12%	13	0%	0
Golf Course Irrigation	100	106	73%	78	51%	54	34%	36	20%	21
Coast Irrigation	100	59	95%	56	90%	53	85%	50	67%	40
Other	100	2	95%	2	90%	2	50%	1	50%	1
Total	100	2,473	85%	2,111	75%	1,861	65%	1,607	50%	1,247
Demand Reduction %, Million gallons	0	0	15%	-362	25%	-612	35%	-866	50%	-1,226

Table 3-7. Contribution of Each Customer Category to Toward Overall Cutback Goal

Demand Reduction:	Stage 2 15% Deficiency		Stage 3 25% Deficiency		Stage 4 35% Deficiency		Stage 5 50% Deficiency	
	Million gallons	Percent of total	Million gallons	Percent of total	Million gallons	Percent of total	Million gallons	Percent of total
Single Family Residential	167	46%	278	45%	392	45%	536	44%
Multiple Residential	70	19%	113	18%	163	19%	238	19%
Business	22	6%	36	6%	57	7%	131	11%
UC Santa Cruz	19	5%	32	5%	45	5%	64	5%
Other Industrial	1	0%	2	0%	3	0%	8	1%
Municipal	12	3%	21	3%	28	3%	35	3%
Irrigation	40	11%	73	12%	97	11%	110	9%
Golf Course Irrigation	28	8%	52	9%	70	8%	85	7%
Coast Irrigation	3	1%	6	1%	9	1%	19	2%
Other	0	0%	0	0%	1	0%	1	0%
Total Demand Reduction	362	100%	612	100%	866	100%	1,226	100%

A prime concern of any water shortage contingency plan is maintaining sufficient water for public health and sanitation. Table 3-8 below presents the health and safety allocation for residential customers in terms of gallons per person per day under the four deficit conditions. Current indoor water use averages 58 gallons per person per day for single residential accounts and about 50 gallons per person per day for multifamily accounts. In all but the most extreme case, there is enough water to meet essential health and safety needs, which is considered to be between 45 and 50 gallons per person per day for single family homes, assuming they have been fitted with water conserving fixtures and leakage is minimized. At a 50 percent deficiency, even highly water-efficient households would have to take additional actions to get their usage down to the upper 30 or low 40 gallons per person per day.

Table 3-8. Health & Safety Indoor Residential Use

Deficiency condition	Health / Safety Allocation	Single Residential (gal/person/day)	Multiple Residential (gal/person/day)
No deficiency	100%	58	50
15%, 25%	95%	55	47
35%	90%	52	45
50%	75%	43	37

3.4 Water Shortage Response Actions

The allocation system described above serves to establish demand reduction goals for each of the City's major customer groups. The challenge in crafting this contingency plan is to select the most appropriate set of measures that logically correlate with these targets for each sector and stage of shortfall, acknowledging the inherent uncertainties involved and difficulty in predicting their effectiveness in advance.

The recommended menu of actions to cut water use is presented below. It is meant primarily to help inform the public and decision-makers about the types of measures the Water Department would take under various water shortage scenarios and to aid in structuring an updated water shortage ordinance, but should not be construed as limiting other possible options. Specific circumstances will vary with each shortage and decisions about the most appropriate response should be based on the water supply and demand

conditions at the time, and the collective judgment of staff, Water Commission, and City Council, with ample public input. These actions are thus intended as a list of probable measures for advance preparation purposes rather than a set script to be strictly followed, recognizing that as supply and demand change over time, or as a shortage evolves, the ultimate choice of options and actions to best address the shortage also may change.

It is also important to recognize that flexibility in selecting the most appropriate stage may be needed. In the case of a borderline situation, for instance, where there is reasonable likelihood that system demand could be curtailed sufficiently with the lesser restrictions, it may be advantageous to initially choose the lower stage, conditioned with a well publicized caveat that, if water use exceeds targets, the more restrictive regulations would kick in.

Each section that follows includes:

- an overview of the response,
- a discussion of any key issues involved in that stage,
- the prepared public message, and
- a list of the recommended demand reduction measures, communications actions, and operating actions applicable to that stage

3.4.1 Stage 1 – Water Shortage Alert

Stage 1 applies to relatively minor water shortages that can be accommodated with a combination of voluntary conservation measures and minimal usage restrictions, combined with enhanced enforcement of the City's ongoing ordinance prohibiting water waste. Except for a few instances, all demand reduction measures apply uniformly to nearly all customers, therefore no specific allocation is proposed during this stage.

A Stage 1 response may also be appropriate in other situations. It may be prudent as a precautionary measure during an unusually dry year in advance of a declared water shortage to help preserve reservoir storage, or during the winter season following an actual shortage event if needed to maintain a continuing level of awareness among customers until normal water conditions are restored.

The Stage 1 public message is as follows:

“Due to abnormally dry conditions this winter, we’re asking all customers to voluntarily cut back water use this summer by 5 percent to stretch the available water supply. City water users should stop using water for non-essential purposes and conserve where possible in case the dry period experienced this past winter continues into next year. If everyone cooperates, we may avoid imposing more stringent watering restrictions. As always, wasting water is prohibited by law”

Table 3-9. Stage 1 Water Shortage Alert Response Measures

System-wide Reduction Goal: 0-5% 0.6 mgd or less
Demand Reduction Measures: • Request voluntary water conservation by all customers • Step up enforcement of water waste • Restrict the time of landscape irrigation to early morning and evening • Prohibit non-essential water use: - serving drinking water by restaurant or food service establishments except upon request - use of potable water for washing driveways, patios, parking lots or other paved surfaces - require hotel, motel, and other commercial lodging establishments to offer option of not laundering towels and linen daily - draining and refilling of swimming pools • Require hoses used for any purpose to have shut off nozzles • Encourage use of drip and other low volume irrigation systems Publicity/Communications • Conduct press conference to announce water conditions, request cooperation • Initiate public information campaign through media, utility newsletter, website • Develop regular advertising campaign to remind consumers of the need to conserve water • Prepare and disseminate suggestions/requirements to reduce water use • Inform large landscape/property managers/green industry of irrigation restrictions • Implement customer meter reading program Operating Actions • Coordinate water conservation actions with other City Departments and public agencies • Adopt water shortage ordinance prohibiting non-essential water use • Eliminate system water uses deemed non-essential • Delegate water waste patrol duties to all field personnel • Institute regular monitoring and reporting of water production and consumption • Undertake contingency planning for continuing/escalating shortage

3.4.2 Stage 2 – Water Shortage Warning

Stage 2 applies to moderate water shortages. This condition requires more vigorous public information and outreach and an expansion of mandatory water restrictions and prohibitions, particularly on outdoor water uses. The primary methods to meet target consumption levels are to limit irrigation to specified days of the week and to institute water budgets for large landscapes and parks.

The recommended approach to reducing outdoor water use in this stage would be to restrict watering of all lawns and established landscapes to twice weekly during specified hours and to disallow any watering with automatic sprinkler systems on certain days to maximize reduction. Exact schedules would be developed with public input.

Large landscape users, including parks, residential and commercial landscapes, and golf courses with separate irrigation accounts would be required to complete on-site water audits, adhere to monthly water budgets based on their irrigated area and plant materials, and modify their irrigation schedules to achieve the equivalent of a one-third reduction in site water use. The lead time to develop landscape water budgets is long due to the need to collect site specific information, implement billing system changes, and to educate people and transform standard irrigation practices. However, development of water budgets for large users is the next major priority for the City's long-term conservation program, and once they become implemented as an ongoing program, they may be quickly adapted as a shortage management tool. Professional water budgets for dedicated irrigation accounts are typically tied to real-time weather data and tiered pricing systems or surcharges to be effective.

Other measures that would be imposed under Stage 2 would include mandatory leak inspection and repair for large customers and to expand restrictions on exterior washing to dwellings, buildings, and structures.

The Stage 2 public message is as follows:

"It is necessary to impose mandatory restrictions on water use to ensure that throughout the duration of this water shortage an adequate supply of water is maintained for public health and safety purposes. Our overall goal is to reduce water use by 15 percent, which can be achieved if everyone cuts back their

outdoor watering by one-third the normal amount. We are relying on cooperation and support of all water users to abide by all restrictions and to reach this goal. Otherwise, the shortage could deteriorate into a more serious emergency that requires rationing household water use to avoid depleting the available water supply.”

Table 3-10. Stage 2 Water Shortage Warning Response Measures

System-wide Reduction Goal: 5-15% 0.6 to 1.8 mgd
Demand Reduction Measures: • Continue all measures initiated at Stage 1 • Restrict landscape irrigation to designated watering days and times • Require large landscapes to adhere to water budgets • Prohibit exterior washing of dwellings, buildings, or structures (with exceptions for window washing or in preparation for painting) • Reduce time allowed to resolve water waste • Require large users audit premises and repair leaks • Continue to promote meter reading and regular leak detection by all customers Publicity/Communications • Intensify public information campaign with regular media updates, direct notices to all customers, paid advertising, billing inserts. • Generate publicity about individuals and businesses demonstrating leadership to save water • Consult with major customers to develop conservation plans • Publish weekly consumption graph in daily newspaper • Inform large landscape/property managers/green industry of additional irrigation restrictions • Conduct workshops on large landscape requirements for property owners, contractors, maintenance personnel Operating Actions • Coordinate with all City Departments and public agencies to reduce water use • Optimize existing sources (increase groundwater production, reduce transmission losses) • Suspend main flushing except as required for emergency and essential operations • Intensify distribution system leak detection and repair • Hire, train, dispatch water waste patrol • Establish water conservation “hot line” to respond to questions and reports of waste • Expand home water survey program and offer large landscape water audits • If necessary, use City Water Commission to process requests for exceptions • Continue regular monitoring and reporting of water production and consumption • Undertake contingency planning for continuing/escalating shortage • Develop strategy to mitigate revenue losses

3.4.3 Stage 3 – Water Shortage Emergency

This level of water shortage constitutes an emergency situation requiring significant actions by the public to achieve up to a 25 percent reduction in normal water use to avoid depleting limited water storage. It requires the equivalent of 5 to 10 percent reduction in all indoor use and a drastic two-thirds reduction in outdoor use systemwide. The three primary measures being recommended to meet this emergency reduction goal are:

1. Residential water rationing
2. Required water shortage signage in all nonresidential establishments
3. Reduced landscape water budgets for large landscapes

The basic concept of water rationing is that each utility customer is given a certain allocation of water, expressed in billing units, to use in a billing period². If they use the amount they are allocated or less, charges for water are calculated at the normal rate. If they exceed their allocation, the portion in excess of their allocation is charged a penalty rate. The penalty rate may be broken into multiple tiers so the more the excess usage, the higher the penalty price per CCF used. The purpose is not to generate revenue but rather to use water pricing as a way to motivate the customer to modify their usage to stay within their allocation and avoid being penalized, which most customers do. Those that don't reduce are charged for their overuse at the penalty rates.

The method to allocate water when rationing is instituted varies according to customer type. It may be based on the number of people in a home, the number of dwelling units in a multifamily complex, or set as a percentage of past use during some prior year. Staff and the Water Commission reviewed the water shortage contingency plans of many other water agencies to identify the methods used elsewhere to ration water and considered the advantages and disadvantages of various methods.

For single family residential customers, the **per capita approach** is probably the fairest practical method, easiest to communicate, would be best understood and accepted by the general public, and is effective in achieving cutbacks where they are needed most, in outdoor water use. In addition, past experience

² One billing unit equals one hundred cubic feet (CCF) or 748 gallons.

demonstrates that this method was very successful in reducing outdoor water demand for the single residential category when rationing was last instituted in 1990 and in 1977.

One of the key challenges to implementing water rationing using a pure per capita approach is the need to perform a census of household size at over 18,000 single family accounts and to maintain information on household size as number of residents changes over time. In lieu of performing a census, Staff and the Water Commission recommend using a modified per capita rationing system developed by the Goleta Water District. Under this system, all households are given a default allocation sufficient for a family of 4 persons. Households that have more than four persons would be required to contact the Water Department and verify household size in order to be granted an increased allocation, which would depend on the actual number of persons living at the residence.

Recent census data for the City of Santa Cruz indicate that only 17 percent of all occupied households within the City have four or more persons per household. Assuming this figure is similar for the unincorporated part of the City's water service area, establishing a default allocation for a family of four would more than satisfy the 83 percent majority of households that have three or fewer persons per household. This method is similar to that last used by the City to ration water in 1990, which provided a baseline allocation for households of three or less, except that a census was undertaken then to survey the actual number of persons living at each household.

The Goleta rationing model is considered to be preferable because it eliminates the significant work associated with carrying out an occupancy census and alleviates concerns about potential for inaccurate responses. The principle drawback is the problem of equity, since there will be less "cushion" in the allocation for households with four residents than there is for homes with fewer number of residents, and an increased possibility of exceeding their allocation. Whatever method is selected, allocation disagreements are to be expected and procedures need to be put in place to handle valid appeals and exceptions.

Table 3-11 below shows a typical rationing calculation for a single family residence in Stage 3.

**Table 3-11. Water Rationing Schedule:
Single Family Residential Account**

	<u>Ccf/month</u>	<u>Gallons per day:</u>
Up to four persons:	11	265
Each additional person:	2	50
<i>Example monthly allocation for a 6-person household:</i>		
Base allocation:	11 ccf	
2 additional persons x 2 ccf per person	<u>+ 4 ccf</u>	
Monthly Allocation	= 15 ccf	= 374 or 62 gpcd ³

What makes multifamily customers more challenging for developing a water rationing system are the large differences in housing types, the presence or absence of irrigation meters at a complex, and the fact that many larger accounts are handled by an independent property management firm on behalf of the homeowner's association. These companies typically do not track how many people reside in each unit or in the complex as a whole.

It is recommended that multiple-residential accounts be rationed based on the **number of dwelling units** associated with the water service account. The number of dwelling units is the best starting point since that data is available on the utility billing system and, in the absence of information about the number of people living on the property, it is the next best driver for indoor water demand. It is further recommended that multiple-residential accounts be allowed alternative rationing options that reflect the heterogeneous nature of building types on multifamily properties and the fact that some of these properties have separate irrigation accounts while others don't. These wide differences in user characteristics cause inequities in allocation based solely on the number of dwelling units. Offering alternatives allows the customer choose for themselves the option that works best in their particular case. These options include:

- an allocation based on the number of persons residing at the property
- an allocation based partly on the number of persons residing at the property and partly on landscape water needs at the property that reflect the same cutback to irrigation that other customers would experience (for properties without irrigation accounts)

³ gpcd = gallons per capita per day

- the same allocation per dwelling unit as single family accounts would receive for certain properties that resemble single family lots in terms of lot coverage

Recommended rationing allotments for single and multiple residential accounts are presented in Appendix E.

If water rationing becomes necessary, it is also recommended that all outside city customers be converted from bimonthly to monthly billing. This change will enhance the customer's ability to monitor their water usage, enable them to detect and repair leaks quicker, and help them stay within their allocation.

The main obstacle in implementing water rationing at this time is the uncertainty about the capability of the new EDEN utility billing system. The system has been in use only since September 2008 and its ability to calculate rationing allocations and excess use charges is unknown. In the event rationing becomes necessary before the billing system can be adequately programmed and tested, other options could be considered to achieve substantial outdoor use reductions in the residential sector in lieu of water rationing. Although not ideal, these include:

- Restricting watering to once weekly, or
- Banning sprinkler irrigation

This problem is discussed further in Section 4.

It should be reiterated that **water rationing is a situation that the City is seeking to avoid** through long-term conservation efforts and the development of an additional water supply. It is, however, necessary to have a contingency plan in place should the need arise.

Commercial customers would be exempted from individual water rationing in Stage 3. Instead they would be expected to meet their collective 8 percent reduction goal by adhering to continuing water restrictions, and by being required to prominently post **"SAVE WATER – REPORT LEAKS AND WATER WASTE"** signs at the entrance and in every bathroom of commercial, industrial and institutional buildings, including:

- Hotels, motels, lodging
- Restaurants, cafeterias, cafes, and all food service establishments

- Offices and government buildings
- Hospitals and health care centers
- Schools

Large landscape customers would be held to water budgets as described in Stage 2, reduced in accordance with the allocation for irrigation customers in Stage 3.

One charged policy issue that often arises in connection with a water shortage emergency is the question of whether or not to continue allowing new connections on the system. In the past, it has been the City's policy to continue allowing new connections mainly because the demand they add in any one year is so negligible. The water that would be made available to existing customers by banning new water connections, therefore, would not make any real difference in terms of increasing the existing customers' allocation. This issue is typically driven by customers who are called on to make sacrifices and feel that water agencies should concentrate on fulfilling present obligations rather than accepting new customers. A number of agencies, however, do have provision for a temporary ban or place a low priority on new connections in later stages of their drought plans.

The Water Commission considered this issue carefully and recommended giving the public a one-year advance notice, beginning in Stage 3, stating that a temporary water service connection ban would be strongly considered if the shortage emergency continues or escalates into the following year. This notice would allow those people with plans and projects already underway time to complete work or make arrangements, and those considering future construction projects to make timely decisions about proceeding with the knowledge that they risk not being able to secure a water service connection until the shortage is over.

The Stage 3 public message is as follows:

"The City faces a serious water shortage emergency due to prolonged drought. To conserve the available water supply for the greatest public benefit while minimizing impacts on our local economy, it has become necessary to institute a water rationing program for all residential customers. Our goal is to reduce system water demand by ____%. While rationing amounts are adequate for

normal domestic needs, significant cuts to outdoor water use may be necessary to remain within set allocations. All customers are urgently asked to make every effort to conserve water and abide by watering restrictions or face further reductions in water allotments.”

Table 3-12. Stage 3 Water Shortage Emergency Response Measures

System-wide Reduction Goal: 15-25% 1.8 to 3.0 mgd
Demand Reduction Measures: • Institute water rationing for residential customers • Continue landscape irrigation restrictions to designated watering days and times • Require large landscapes to adhere to reduced water budgets • Require all commercial customers to prominently display “save water” signage with specified language at specified locations • Maintain restrictions on exterior washing of surfaces and structures • Continue to promote meter reading and regular leak detection by all customers Publicity/Communications • Expand, intensify public information campaign focused on 2/3 reduction in outdoor use • Provide regular media briefings, manage media coverage • Provide regular information reports to Water Commission, City Council and other agencies • Consult with major customers to develop conservation plans • Publish weekly consumption graph in daily newspaper • Enlist support of business groups: chamber, CVC, lodging association, etc. • Inform large landscape/property managers/green industry of reduced allocations • Conduct workshops on large landscape requirements for property owners, contractors, maintenance personnel • Prepare public notice regarding possible future service connection moratorium Operating Actions • Modify utility billing system and bill format to compare actual use with customer allocation • Adopt penalty rates • Increase customer service training to address high bills, irate customers • Convene and staff appeals board to process requests for exceptions and appeals of penalties • Expand size and coverage of water waste patrol • Expand, strengthen water conservation education, activities, and program • Continue all operating actions listed under Stage 2 • Increase frequency of monitoring and reporting of water production and consumption • Convert outside City customers from bimonthly to monthly billing • Undertake contingency planning for continuing/escalating shortage • Develop strategy to mitigate revenue losses

3.4.4 Stage 4 – Severe Water Shortage Emergency

The water supply conditions that would trigger Stage 4 parallel the difficult situation the City experienced in the drought of late 1970s. Under this scenario, virtually all available water must be reserved either for health and safety purposes or to sustain local business.

Achieving a 35 percent systemwide reduction would require expanding water rationing to cover all water customers, including business. Residential customers would continue to be rationed as described in Stage 3, but with reduced monthly allotments.

Unfortunately, there is no practical way to assign a commercial water budget based on variables like the number of employees, square footage, etc. given the variety of usage characteristics in this sector. Every business (or group of businesses sharing a single water account, as is often the case in shopping centers) is unique. They include laundries, restaurants, health care facilities, retail outlets, hotels, car washes, and office buildings. We see no choice other than to ration business customers individually based on a **percent of prior use in a normal year** that is consistent with the overall allocation for Stage 4. Where essential water use at a business establishment involves a public health service, including hospitals, doctor's offices, medical laboratories, and skilled nursing facilities, or where a business can demonstrate it has already achieved maximum practical water conservation, provision for additional water could be made on a case by case basis through an exceptions process.

Other actions/restrictions that likely would be necessary in a severe water shortage emergency, in addition to those previously described, include the following:

- Prohibition on lawn/turf irrigation and on installation of new landscaping in new development
- Prohibition on potable water in fountains and ornamental water features
- Prohibition on on-site vehicle washing, including dealer lots, company fleets
- Rescinding hydrant and bulk water permits
- Suspending water main replacement program

Gray water use can be allowed and should be promoted for saving valuable landscape trees and shrubs. It includes drain water from showers, bathtubs,

bathroom sinks, and clothes washers. It does not include water that has come in contact with toilet waste, water from kitchen sinks and dishwashers, or laundry water used for washing diapers. There are no restrictions on the use of gray water if it is carried in a bucket. Plumbed gray water systems can also be built to convey drain water and provide subsurface irrigation to trees and shrubs.

The Stage 4 public message is as follows:

“Due to continuing deterioration in storage and overall scarcity of available supply, all customers, residential and business alike, are now unavoidably subject to water rationing. The current water shortage is among the most severe ever faced in modern times. We must all continue to conserve water to the maximum extent possible and strive to maintain water use within our established rationing limits as long as the drought endures in order to avert a water crisis.”

Table 3-13. Stage 4 Severe Water Shortage Emergency Response Measures

System-wide Reduction Goal: 25-35% 3.0 to 4.2 mgd
Demand Reduction Measures: • Reduce residential water allocations • Institute water rationing for commercial customers • Minimize water use by large landscape customers – only for most valuable plant and tree survival • Prohibition on lawn/turf irrigation and on installation of new landscaping in new development • Prohibition on on-site vehicle washing, including dealer lots, company fleets • Rescind hydrant and bulk water permits, prohibit use except by special permission Publicity/Communications • Contract with outside advertising agency to carry out major publicity campaign • Continue to provide regular media briefings, manage media coverage • Provide regular information reports to Water Commission, City Council and other agencies • Publish daily consumption graph in all local newspapers • Prepare public notice regarding possible service connection moratorium • Publish information on ways to minimize most valuable landscape damage and loss, including promote appropriate use of gray water Operating Actions • Scale up administrative appeals staff and increase frequency of hearings • Expand water waste enforcement to 24/7

- Delegate field staff to assist in enforcement (shut offs, flow restrictors)
- Open separate, centralized drought information center
- Hire temporary staff to conduct conservation training
- Continue all applicable operating actions listed under Stage 3
- Increase frequency of monitoring and reporting of water production and consumption
- Undertake contingency planning for continuing/escalating shortage
- Revise Department operating budget to address revenue shortfall
- Defer portions of capital improvement program
- Consider surcharges, rate changes

3.4.5 Stage 5 – Critical Water Shortage Emergency

Stage 5 represents an imminent and extraordinary crisis threatening health, safety, and security of the entire community. Under this dire situation, extreme measures are necessary to cut back water use by up to half the normal amount. Not enough water would exist even to meet the community's full health and safety needs, the top priority. All water should be reserved for human consumption, sanitation, and fire protection purposes and any remaining amount allocated to minimize economic harm. A shortage of this severity could be expected to generate stress, confusion, and chaos much the same as any major emergency and at some point could transform into a full blown natural disaster that can no longer be governed by local ordinance and may need to be managed by the same basic principles and command structure under the state Standardized Emergency Management System that other natural disasters are. The City has experienced water shortages in the past but never one of such large proportion.

This fifth stage would involve nothing less than rationing all customer groups and instituting a prohibition on residential outdoor use for any reason (e.g., garden, car-washing, cleaning, maintenance, etc.) It may also require shutting down or severely restricting use at certain public facilities, like local parks and school play fields. Some businesses may be forced or required to either partially or completely close.

The planned response for a shortage of this magnitude would involve reducing rationing allocations for residential customers to minimal levels and reducing commercial rationing amounts in accordance with their overall allocation. All

outdoor irrigation would be prohibited (other than by hand-held container and what has been captured or collected from another non-prohibited use). No water would be available for public showers or private, community, or public pools and hot tubs. These facilities likely would be forced to close.

A shortage of this magnitude could affect other local water suppliers as people substitute normal activities, such as laundry, showers, etc. from their home to other locations not so affected. The City's response would therefore involve greater coordination at a regional and perhaps even statewide level.

The Stage 5 public message is as follows:

"The City of Santa Cruz is confronted with a critical water shortage emergency of unprecedented proportions. At this time, there exists barely enough drinking water for the most essential human health, sanitation, and safety needs. As a result, all outdoor watering is now prohibited. We understand the hardship this extraordinary condition poses to every resident and business in the City and appreciate the sacrifices people are making to ensure that water system does not run dry. Everyone is urgently requested to do whatever necessary to maintain water use within or below their allotted amount."

Table 3-14. Stage 5 Critical Water Shortage Emergency Response Measures

System-wide Reduction Goal: 35-50% 4.2 to 6.0 mgd
Demand Reduction Measures: • Further reduce residential water allocations • Reduce commercial water allocation • Prohibit all outdoor irrigation • No water for outdoor washing or recreational purposes; close pools, public showers • Continue all measures initiated in prior stages as appropriate Publicity/Communications • Contract with crisis/emergency communications consultant to develop crisis communications plan and major publicity campaign • Assign Public Information Officer to communicate with media • Set up emergency notification lists for medical/dental facilities, public facilities, large users, food and beverage facilities, and critical businesses • Promote appropriate use of gray water for reuse

Operating Actions

- Consider shifting to EOC model of command management for overall policy guidance and coordination
- Coordinate with CA Dept of Public Health, District Engineer and other emergency response agencies regarding water quality, public health issues
- Coordinate with law enforcement agencies to address enforcement challenges
- Continue water waste enforcement 24/7
- Delegate field staff to assist in enforcement (shut offs, flow restrictors)
- Continue all applicable operating actions listed under Stage 4
- Coordinate with local sanitation agencies regarding sewer line maintenance
- Continue close monitoring and reporting of water production and consumption
- Investigate potential for reduced in-stream release
- Procure resources to utilize dead storage, if needed
- Undertake emergency planning for continuing/escalating shortage

3.5 Enforcement, Exceptions, and Appeals

An important part of a water shortage plan is to have the appropriate authority and a combination of methods to enforce mandatory measures such as water restrictions or rationing in order to protect public health and safety. General authority and powers of the City to enforce ordinances is contained in Chapter 4 of the Santa Cruz Municipal Code. In addition, the City's water shortage ordinance contains specific language regarding enforcement of water use rules and regulations and includes provisions for issuing exceptions and hearing appeals. These provisions were reviewed by staff and the Water Commission, which put forth several recommendations to be incorporated into the updated water shortage ordinance.

3.5.1 Enforcement Methods

Enforcement is carried out in a number of ways during a water shortage. In cases such as a report of water waste, the first step is to communicate with the customer by telephone, letter, door tag, or by making personal contact in the field to educate them about regulations. Many times this contact is all that is required to get the problem resolved. If not, enforcement progresses to a written notice of violation. Beyond this, there are several methods in the City's existing water conservation and water shortage ordinances that can be used to enforce water restrictions and rationing regulations. These methods are described below.

Penalty fees This method would apply in situations involving violation of water restrictions, if, after multiple warnings had been given, a violation continued to occur at an account. The fee would be added to a customer's utility bill along with a written notice sent to the customer in advance. The penalty fee would increase with subsequent violations, as follows:

- 1st Violation \$100
- 2nd Violation \$250
- 3rd Violation \$500
- 4th Violation \$1,000

The Water Commission recommended that additional, higher penalty fees also be established and applied to large users that willfully violate water restrictions.

Excess use fees Excess use fees are the primary method for enforcing water rationing and are imposed on customers whose water use exceeds their allocation when rationing is in effect. The purpose of the excess use fee is to make the consequences of exceeding one's rationing allocation so severe that the customer is induced to keep their water use within their allocation and avoid being fined. Like water rates, there are two components to setting excess use fees: 1) the way they are structured, and 2) the dollar amount.

Staff and the Water Commission looked at several models from other agencies and recommend maintaining the same excess use fee structure as in the existing water shortage ordinance, for billing reasons and for clarity in communicating penalties to the public. It is, however, recommended that the penalty amount be increased to bring it more in line with current rates, as shown below:

Table 3-15. Proposed Excess Use Fees

Excess Use Range	Percent of water used in Excess of Allotment	Excess Use Charge per 100 Cubic Feet for all Water Used in Excess of Allotment (in addition to ordinary water consumption charges)
A	0% to 10% over allotment	\$25.00
B	More than 10% over allotment	\$50.00

For example, in Table 3-11 above, a 4-person household is provided an allocation of 11 CCF per month in Stage 3. At 2008 rates, the normal water charges for an inside city customer using 11 CCF would total \$51.37, including the \$16.58 readiness-to-serve charge for a 5/8" meter. Under water rationing, if that same customer used 18 CCF, their normal water charges would amount to \$92.88, and excess use fees would cost \$325 (1 ccf @\$25 and 6 ccf @ \$50), for a total of \$417.88.

The purpose of a two-tier excess use structure is to avoid very large penalties for households that make a good faith effort to stay within their allocation but wind up going over a little. If a customer's water use exceeds one's allocation by a large amount, though, the penalty should be very steep.

Flow restriction Some customers will continue to exceed their allotment regardless of the amount of their water bill. In such instances, the Water Department is authorized to install a flow restricting device to provide minimal water flow, just enough for health and safety purposes. In these cases the customer is charged a fee to cover the staff time needed to install the flow restrictor and another fee for its removal. The Water Department would not use this method where fire suppression sprinklers are on the same supply line as domestic water.

Disconnection/reconnection fees Water suppliers have the legal authority to enforce water shortage regulations by terminating service for egregious violations. In such cases, the customer would be charged for both disconnection and reconnection.

Citation Finally, the City's water shortage ordinance authorizes staff to issue citations that would have to be paid or challenged in court. This method could be used in cases like a multifamily property where terminating service or restricting flow to all households may not be an option.

3.5.2 Exceptions

No water shortage plan can account for all situations. The exception procedure allows the Water Department to provide for special or exceptional circumstances that otherwise would create undue hardship for an individual customer or class of customers.

An exception allows a customer to be relieved of a particular regulation or receive an increased allocation for the duration of the shortage. Therefore, it should be granted only when justified on specific grounds that warrant allocating more water than other similarly situated customers and when consistent with the intent of the water shortage regulations, while providing equal treatment of all customers.

The City's existing ordinance includes an exception process. Some of its features are as follows:

- Under water restrictions, an exception application is not accepted unless the customer alleges unfair treatment.
- Under water rationing, an exception application is not accepted unless an excess use fee has been assessed.
- Leaks do not qualify for an exception.
- It allows a resident who is not an account holder to force the customer of record to appeal.
- The process is administered by the Water Director.

This policy is to make the customer first demonstrate the demand reduction efforts taken to meet the restriction or allocation, and places responsibility for managing and monitoring water use on the customer, where it belongs. It also serves to minimize the number of exception applications from those merely seeking more water without having gone to the effort to try to live within their given allocation.

Recommendations Regarding Exceptions

It is recommended that the updated water shortage contingency ordinance be amended to include a process that requires the Director make a formal finding to authorize an exception. This change is proposed to better articulate the standard that must be met in order to receive relief. The suggested language for such findings is as follows:

- Failure to do so would cause a condition affecting the health, sanitation, fire protection, or safety of the applicant or the public;

- Strict application of the allotment provisions imposes a severe or undue hardship on a particular business, or render it infeasible for a business or class of business to remain in operation;
- Alternative restrictions which achieve the same level of demand reduction as the restrictions from which an exception is being sought are available and are binding and enforceable;
- The customer has demonstrated to the Director's satisfaction that circumstances have changed warranting a change in the customer's allocation.
- Hospitals and health care facilities using industry best management practices are eligible for an exception.
- Demonstration by a business of actions already taken to increase environmental sustainability that have reduced water consumption to the maximum extent feasible, as determined by the Water Director.

Additional recommendations regarding the exception process are as follows:

- That the denial of an exception may be appealed to an Appeals Board;
- The Department adopt administrative procedures similar to those used by the City of Tampa Bay for including appropriate information on an exception application, including the requirement that the applicant must demonstrate maximum practical reduction in water consumption;
- That a policy be added allowing the Director to impose conditions requiring long-term water efficiency changes from customers as part of the exception process.

3.5.3 Appeals

The City's existing ordinance allows any water service customer who considers an enforcement action to have been erroneously undertaken to appeal their case before a City Council appointed ad hoc Drought Appeals Board. The Appeals

Board considers the evidence presented by the customer and decides whether to uphold the enforcement action or to provide relief.

The difference between an exception and an appeal is that an appeal gives an individual the opportunity to challenge an official decision about an enforcement action. It is not the primary means to secure a larger allocation or get an exception to a water use regulation. However, as mentioned above, customers should be able to appeal a denial by the Water Director of such an exception request to the Appeals Board.

From past experience, the most common reason for filing an appeal was to contest large excess use fees that were levied while under water rationing, often due to a leak in the customers' plumbing fixture or system. This resulted in a large and difficult backlog of cases for the Appeals Board. The Water Department would continue to follow its existing water leak rebate policy that provides administrative relief, including forgiveness of excess use fees, for certain types of leaks that are considered to be beyond the customer's control, such as a leak that develops in an underground pipeline serving a property. Common maintenance items, such as a leaking toilet or failing automatic irrigation valve, that are considered to be customer's responsibility to control, are not eligible for such forgiveness.

One feature of the existing ordinance was to allow a resident who is not a customer of record to force the account customer to appeal the excess water use fee. The ordinance also allowed a customer to request to use a portion of the excess use fee, on a one-time only basis, toward the installation of water conservation equipment in lieu of paying it to the Water Department.

Recommendations Regarding Appeals

It is recommended that the provisions included in the existing ordinance regarding appeals be continued. The Water Commission felt that a formal Appeals Board would not need to be convened until Stage 3, and felt it could serve in that capacity instead during the early stages (1 and 2), if necessary. Furthermore, as an alternative enforcement approach, we recommend adding a new process that would provide one-time forgiveness of excess use charges while under water rationing. To be considered for such forgiveness, the customer would be required to sign up and complete a short weekend or evening course

covering basic meter reading, leak detection, and other topics relevant to the water restrictions in place at the time. This approach (like traffic school) would help reduce the number cases heard by the Appeals Board, provide financial relief to customer receiving the high bill, and most importantly, would give them the opportunity, education, and tools they need to achieve ongoing compliance with water use rules and regulations for the remainder of the shortage.

3.6 Water Shortage Recovery and Plan Termination

A water shortage ends when local rainfall, runoff, and reservoir storage levels improve to the point where the water system is once again capable of supporting unrestricted water demand. Any water use rules and regulations in effect at the time are officially rescinded by City Council and public notice is given that the water shortage is over. The Water Director would then oversee any remaining termination and plan review activities. These activities could include:

- Publicize gratitude for the community's cooperation
- Restore water utility operations, organization, and services to pre-event levels
- Document the event and response and compile applicable records for future reference
- Continue to maintain liaison as needed with external agencies
- Collect cost accounting information, assess revenue losses and financial impact, and review deferred projects or programs
- Debrief staff to review effectiveness of actions, to identify the lessons learned, and to enhance response and recovery efforts in the future
- Complete a detailed evaluation of affected facilities and services to prepare an "after action" report
- Update the water shortage contingency plan as needed.

Section 4 IMPLEMENTATION

This section describes the essential elements of implementing the updated Water Shortage Contingency Plan and discusses the approximate lead time needed to prepare for and activate a demand reduction program. The elements discussed below differ in the amount of staff time, effort, priority, and funding that is required for implementation; some steps can be taken relatively quickly and inexpensively while others will require substantial ongoing work and expense before they are able to be set up and applied as shortage management tools. The primary purpose of this section is to map out the major tasks and timelines required to implement the demand reduction program described in Section 3 and to identify where additional ongoing efforts are necessary to address critical gaps.

4.1 Timeline for Declaring Water Shortage

The table below indicates the approximate times of the year when the City evaluates water supply conditions and, if necessary, declares a water shortage. Planning for a water shortage may begin earlier in winter, and should commence early if conditions that winter are unusually dry or are preceded by a dry year, but it is not usually until the end of March that the water supply outlook for the year ahead becomes certain. This leaves very little lead time to prepare for implementing the water shortage contingency plan.

Table 4-1. Calendar for Declaring Water Shortage

Target Date	Action
Months of Oct -Dec	Monitor rainfall, reservoir level, and runoff amounts
Late January	Prepare written status report on water supply conditions
Early February	Present initial estimate of water supply availability for year ahead
Early March	Present revised estimate of water supply availability for year ahead
Mid-March	SCWD announces existence of water shortage (if applicable)
Mid to late March	SCWD determines monthly water production budget and need for voluntary or mandatory response.
Early April	Present shortage response recommendation to Water Commission; notice of public hearing published
Mid-April	City Council formally declares water supply shortage, adopts emergency ordinance
Mid to late April	Water shortage regulations become effective

Long-range weather forecasting has not yet advanced to the point where it is possible to know in advance with certainty whether the City will experience a water shortage. Therefore, it is not practical to plan more than one season at a time, other than to prepare possible scenarios using multiple dry years for modeling purposes.

4.2 Process for Declaring Water Shortage

Once the water shortage condition has been defined (as soon as reasonably certain), recommendations regarding water shortage rules and regulations consistent with this contingency plan are discussed with the City Water Commission. Monthly Water Commission meetings serve as a public forum for discussing water conditions and for hearing issues associated with implementation of the water shortage ordinance throughout the entire duration of the water shortage event.

Following consideration by the Water Commission, formal action declaring a water shortage is taken by City Council. The legal requirements for such action are covered in Section 350 et.seq. of the California Water Code. The code requires the following process be followed:

- That City Council hold a public hearing on the matter;
- That the public hearing be properly noticed (minimum of publishing once in newspaper at least seven days prior to the date of the hearing);
- Upon determining and declaring the existence of a water shortage, City Council may then adopt regulations and restrictions governing the use and delivery of water.

In accordance with Municipal Code section 16.04.480, rules adopted by the City Council establishing water use regulations become effective immediately after their publication in a newspaper of general circulation published in the City of Santa Cruz.

4.3 Public Notification and Coordination

Even before formal declaration of a water shortage, a public information/media program should be activated to provide customers with as much advance notice as possible. Following Council action, all residents and businesses, not just

customers of record, would need to be provided notice of water shortage rules and regulations via a variety of media and communications methods, including print and television media, internet, and other methods. The timeline for getting information out to the public on television, radio, and through newspaper articles is very short. Additional notification would occur through the City's utility newsletter, which requires a longer lead time of six to eight weeks to produce and mail. It is also recommended that a separate website be designed in advance if rationing becomes necessary to provide basic information about the program, conservation information, forms related to the program, contact information, etc., which then can be modified and expanded as necessary. Large water users and those businesses that are most likely to be seriously affected should be contacted directly in writing. Public notification will be provided in Spanish language for non-English speakers.

Coordination with other City departments and other public agencies can begin prior to formal declaration of a water shortage and can be accomplished through regular meetings, e-mail group updates, and presentations.

Getting the public involved and keeping them informed will require a significant expansion of existing water conservation public information and outreach efforts. Contracting with an advertising agency to assist with a communications campaign and mass media advertising is one way to expand outreach efforts quickly. A substantial amount of printed information on how to conserve water during a water shortage has already been developed and tailored to various types of water customers and is available for immediate use.

4.4 Personnel, Office Space, and Equipment

The estimated additional staff needed to carry out this contingency plan is shown below in Table 4-2. Program staff may consist of existing staff reassigned from regular duties in the Water or other City departments, new limited-term employees, interns, or some combination of the above.

The role of the administrative and office assistants would be to help with the processing of customer appeal and exception requests, administration of the appeals board meetings, and related correspondence. The field utility representatives would be responsible for patrolling the service area for violations of watering rules and restrictions and public contact, while the office utility

representatives would deal with the greatly increased customer contact (in person and by telephone) and would help with utility billing issues. The meter technician's role would be to support the additional customer service workload related to verifying meter reads, data-logging, and other field activities. The water conservation representative's role would be to assist customers with on-site water audits, provide conservation education, and publicity. Distribution personnel (or possible contractor) would provide leak detection and repair services as well as functions related to meters and flow restriction. The programmer analyst position would provide utility billing system software services when water rationing is in effect.

Table 4-2. Potential Additional Staff Positions

Section/Position	Water Shortage Stage:			
	2	3	4	5
Water Administration: 105 Administrative Assistant I		1	1	2
Customer Services: 199 Utility Service Representative (field) 199 Utility Service Representative (office) 212 Water Meter Technician 333 Utility Supervisor	1 1	2 2 1	4 3 1	6 4 1 1
Water Conservation: 208 Water Conservation Representative	1	2	2	3
Water Distribution: 209 Water Distribution Worker	1	2	2	2
Other Temporary: 229 Programmer Analyst II 914 Office Assistant		1	1 1	1 2
Total Positions	4	11	15	22
Estimated personnel costs* (\$000)	\$113	\$324	\$425	\$622

**assuming seven months, including overhead*

The timeline associated with recruiting and hiring new or additional staff varies from several weeks to several months depending on the type of employment

opportunity, whether there is an existing recruitment list to draw from, or whether a new job announcement would need to be advertised.

Any newly hired staff would need to be quickly integrated into the organization with basic training in the following areas:

- Water Department functions, organization, facilities, and service area boundary,
- Customer service standards, City policies, and safety responsibilities,
- Computer equipment and the utility billing system,
- Water rates and charges and meter reading,
- Water shortage regulations and enforcement processes.

In addition, all existing Water Department personnel would need to understand water shortage rules and regulations in effect at the time to be able to respond to customer questions wherever they may come into contact with the public on the job.

Additional staff, particularly during stages when rationing is in effect, means expanded office space and additional equipment also would be needed to carry out office and field functions. Even though the Water Department recently moved to a new, larger office, the Customer Service section of the office is currently unable to accommodate any additional office personnel. The Water Department office would need to be reconfigured or new temporary workspace acquired, or vacant storefront property rented. In addition, the Water Department would need to purchase or lease the following equipment:

Office personnel:

- Furniture
- Telephones
- Computers

Field personnel:

- Automobiles
- Cell phones
- Digital cameras

4.5 Effect of Water Shortages on Revenue

One of the negative consequences of using demand reduction to deal with water shortages is the corresponding reduction in revenue that occurs to the City's Water Fund as a result of reduced water sales. To better understand the magnitude of revenue losses that the Water Fund might experience, a

spreadsheet model was developed based on 2007 calendar year revenues, the most recent year for which complete revenue data is available. The model assumes the “ready-to-serve” or fixed monthly service charge that is based on meter size would remain unaffected while the volumetric portion of the Department’s revenue derived from water sales would vary by customer class in accordance with the allocation presented in Table 3-6 over the seven month period in which water shortage regulations are likely to be in effect. Results are summarized in Table 4-3.

Table 4-3. Revenue Losses Associated with Various Water Shortages

Customer Category:	2007 Revenue (\$000)			Revenue Losses due to Reduced Water Sales (\$000):				
	From service charges	From water sales	Total	Stage 1 (5%)	Stage 2 (15%)	Stage 3 (25%)	Stage 4 (35%)	Stage 5 (50%)
Single Family Residential	3,770	6,027	9,797	-229	-687	-1,236	-1,740	-2,381
Multi-Family Residential	1,069	3,742	4,810	-126	-329	-556	-784	-1,137
Business	917	3,207	4,124	-111	-111	-177	-288	-665
UC Santa Cruz	99	1,022	1,121	-33	-99	-158	-224	-317
Other Industry	44	130	174	-4	-4	-8	-13	-28
Municipal	149	301	450	-13	-62	-112	-153	-187
Irrigation	234	682	916	-29	-207	-379	-505	-574
Golf	32	581	614	-27	-148	-268	-361	-437
Coast	34	36	70	-1	-1	-3	-4	-9
Other	19	43	62	-1	-1	-3	-13	-13
Total 2007 Revenue	\$6,366	\$15,770	\$22,137					
Total Revenue Losses				-\$575	-\$1,649	-\$2,900	-\$4,085	-\$5,749
Estimated Net Revenue				\$21,562	\$20,488	\$19,236	\$18,051	\$16,388

Table 4-3 shows revenue losses ranging from just under \$0.6 million in a 5 percent water shortage situation to almost \$5.8 million in a critical 50 percent water shortage. Compared to 2007 revenues of just over \$22 million, the Department’s net revenue would be reduced to approximately \$21.5 million in Stage 1 to less than \$16.4 million in Stage 5. These estimates of losses are ballpark figures only and probably underestimate the problem. Actual losses would be different for the following reasons:

- The spreadsheet did not model the effect of tiered pricing in the single family residential category, which would exacerbate revenue losses from this group;
- It is unlikely that system water use would immediately recover to normal levels in the months following a period of curtailment as modeled, thereby further depressing income;
- The table above does not include added operating costs of staff, equipment, and materials related to the water shortage response.

On the other hand, the time of year in which regulations would take effect includes parts of two fiscal years, so the full effect of revenue losses would not impact the Department's annual budget to such a large degree. In addition, there would be relatively minor cost savings associated with reduced power and chemical usage at the Graham Hill water treatment plant, ranging from <\$0.1 million in Stage 1 to about \$0.4 million in Stage 5. Finally, some of the revenue loss would be offset by penalty and/or excess use fees.

Whatever the situation, one element of implementing this Water Shortage Contingency plan involves examining the Water Department's proposed budget for the coming year and recommending action(s) to lessen or overcome the revenue shortfall. Options include the following:

- Tapping into the Department's Rate Stabilization Fund (currently \$2.2 million)
- Deferring planned capital improvements
- Considering possible rate adjustments or surcharges

As a matter of policy, since the City's Integrated Water Plan anticipates occasional water shortages of up to 15 percent, it is recommended that the Rate Stabilization Fund be maintained at least at a level that would fully mitigate expected revenue losses associated with that level of shortfall. The Rate Stabilization Fund would now fully cover the losses of a 15 percent shortfall lasting one year, but may need to be increased in the future, either to keep pace with expected revenue losses, or to mitigate revenue losses from water shortages lasting more than a single year.

Another implementation issue associated with pricing is the Proposition 218 procedure for increasing water rates, fees, and charges. It is assumed that the

proposed changes to both penalty fees and excess use fees discussed in Section 3 would require written notice to all customers, a public hearing, and consideration of written protests and comments before implementing the new fees. Given the minimum 45 day protest period, the entire Prop 218 process can take several months to complete.

4.6 Household Survey

To implement water rationing for single residential customers in Stages 3 through 5, it is recommended that the City of Santa Cruz use the system developed by Goleta Water District in lieu of performing a household census or survey. The advantages are that it is simpler, easy to understand, more likely to be feasible with the new utility billing system, avoids having to perform a household survey or census, allows adjustments for larger households, and achieves the fundamental goal of reducing peak season water use, particularly outdoor use. Goleta also required that, for households larger than four, certain efficiency steps be taken before authorizing a larger allocation.

For the majority of households that have fewer than four residents, little opposition to this approach is expected. However, the one downside to this approach is that it does afford somewhat unequal amounts of water on a per person basis to households of different sizes, and so some may object to the City adopting this system. If, based on public input, a true per capita rationing system becomes the preferred approach to ration water instead of the Goleta model, the following describes the work involved to update the number of people residing at each account on the billing system. In the past this survey has been done by mail and is based fundamentally on the honor system. There are currently over 18,700 accounts classified as single residential customers on the water system. This task would involve data processing personnel to prepare data files for mailing, a mailing service vendor to provide printing and mailing services and to provide return envelopes, and two additional temporary staff to handle data input. The task would also involve maintaining census data on a daily basis as household sizes change and new utility accounts are established. The estimated cost for postage and services related to performing such a survey is about \$20,000, not counting data entry. The lead time necessary to conduct the survey and enter data is approximately 3 months.

The other major work item involved in a census-based approach to rationing involves configuring the utility billing system to calculate allotments based on household size, discussed below.

4.7 Utility Billing/Data Processing Capabilities

Implementing this Water Shortage Contingency Plan will require utility billing system software that provides the necessary capabilities and flexibility to quickly shift from normal billing practices to water rationing mode. To manage a water shortage as outlined in this plan, the billing system must eventually be able, at a minimum, to do the following:

- Integrate penalty fees into the utility bill,
- Change billing frequency, as needed, to monthly from bimonthly for outside City customers,
- Calculate rationing allocations, whether determined by per capita, per dwelling unit, or percentage of past use method,
- Maintain long-term water usage history,
- Calculate excess use fees,
- Address special needs customers (overwrite default allocation to handle rationing exceptions),
- Handle special cases, such as multiple meters serving a single property,
- Calculate seasonally varying landscape water budgets.

In addition, the utility bill format and the data files that are generated to create the utility bills must be modified to incorporate water restrictions, water budgets, and rationing requirements.

The newly installed EDEN utility billing module appears to be able to handle the type of computations needed to implement both the Goleta rationing model for single family residential customers and the per dwelling unit method for multi-family accounts. It currently does not have the capability or flexibility to handle a census-based approach to rationing, large landscape water budgets, or commercial water rationing which is based on some percentage of past use. Acquiring this capability is a top priority but it will have to be custom developed over time. The Customer Service Manager indicates that such programming would likely take in excess of one year to complete. The Department's FY 09 budget includes \$25,000 for utility billing software development expenses.

4.8 Customer Exceptions and Appeals

One of the actions that is triggered when City Council adopts the water shortage ordinance is the establishment of an Appeals Board. Part of implementing this plan involves providing administrative support to the Appeals Board, including processing requests, preparing recommendations, posting agendas, attending meetings, preparing meeting minutes, and handling correspondence. After the Board's membership has been established and approved by City Council, the Appeals Board function can be implemented quickly, but depending on the stage of water shortage and number of appeals filed, may require substantial staff time over the course of the water shortage to address the resulting caseload.

4.9 Large Landscape Water Budgets

The next major work priority scheduled for the City's Water Conservation Office involves implementing a large landscape program. The program will consist of developing water budgets for over 400 large landscape sites served by dedicated irrigation meters, offering water audits, and supporting activities (financial incentives, education, and possible separation of large landscapes currently on mixed use meters). These programs have a long development time (1-2 years) due to the need to measure landscape areas, differentiate among plant materials, and integrate water budget data into the billing system. This latter task requires changing the bill design and layout to show water budget information and tying performance relative to the water budget to water pricing. The project will be designed so that water budgets can be quickly adapted for use as a water shortage management tool in Stages 2-5. If the City were confronted with a water shortage before large landscape water budgets and budget based pricing could be implemented, however, alternative methods to curtail water in the large landscape sector would have to be considered.

4.10 Monitoring Water Supply and Demand

Under normal water supply conditions, water production and gross consumption are recorded daily and monthly by treatment plant operators and reported to the Production Superintendent. Metered water consumption is reported on a monthly basis through automated sales reports generated by the utility billing system.

During a water shortage, a monthly production forecast and budget are developed for each source of supply. Actual production and the lake level are closely monitored on a daily and weekly basis to verify that the budgeted goals are being met. Consumption by large users is monitored on a frequent basis. In severe stages of a water shortage, production and consumption data would be evaluated daily and the status reported to the Water Director's office. If the trend in consumption is such that the rate of drawdown at Loch Lomond is greater than anticipated, the City Manager and Council are notified so that corrective action (such as increased publicity and enforcement or consideration of declaring the next higher stage) can be taken.

An example of a monthly water supply and demand monitoring report is presented in Appendix F.

4.11 Ongoing Implementation Steps

The final tasks in updating the City's Water Shortage Contingency Plan include the following steps:

- Involving the community and soliciting public review and input on this document;
- Finalizing and presenting the plan to City Council for adoption;
- Preparing an updated water shortage ordinance;
- Preparing and mailing a Proposition 218 notice about proposed changes to penalty and excess use fees.

As far as critical gaps that require ongoing work, the most important recommendations are to:

1. Continue to work on the new utility billing system so that the database is able to meet the City's requirements for use in water rationing if it becomes necessary, and
2. Focus on developing the large landscape program so that water budgets described above can be used to professionally manage large irrigation accounts the next time a water shortage arises.

3. As much as possible, prepare water shortage notices, announcements, materials, and mailing lists in advance, including bilingual materials for non-English speakers.

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Appendix A

California Water Code Sections 350-359 and 10632

Water Code Section 350-359

350. The governing body of a distributor of a public water supply, whether publicly or privately owned and including a mutual water company, may declare a water shortage emergency condition to prevail within the area served by such distributor whenever it finds and determines that the ordinary demands and requirements of water consumers cannot be satisfied without depleting the water supply of the distributor to the extent that there would be insufficient water for human consumption, sanitation, and fire protection.

351. Excepting in event of a breakage or failure of a dam, pump, pipe line or conduit causing an immediate emergency, the declaration shall be made only after a public hearing at which consumers of such water supply shall have an opportunity to be heard to protest against the declaration and to present their respective needs to said governing board.

352. Notice of the time and place of hearing shall be published pursuant to Section 6061 of the Government Code at least seven days prior to the date of hearing in a newspaper printed, published, and circulated within the area in which the water supply is distributed, or if there is no such newspaper, in any newspaper printed, published, and circulated in the county in which the area is located.

353. When the governing body has so determined and declared the existence of an emergency condition of water shortage within its service area, it shall thereupon adopt such regulations and restrictions on the delivery of water and the consumption within said area of water supplied for public use as will in the sound discretion of such governing body conserve the water supply for the greatest public benefit with particular regard to domestic use, sanitation, and fire protection.

354. After allocating and setting aside the amount of water which in the opinion of the governing body will be necessary to supply water needed for domestic use, sanitation, and fire protection, the regulations may establish priorities in the use of water for other purposes and provide for the allocation, distribution, and delivery of water for such other purposes, without discrimination between consumers using water for the same purpose or purposes.

355. The regulations and restrictions shall thereafter be and remain in full force and effect during the period of the emergency and until the supply of water available for distribution within such area has been replenished or augmented.

356. The regulations and restrictions may include the right to deny applications for new or additional service connections, and provision for their enforcement by discontinuing service to consumers willfully violating the regulations and restrictions.

357. If the regulations and restrictions on delivery and consumption of water adopted pursuant to this chapter conflict with any law establishing the rights of individual consumers to receive either specific or proportionate amounts of the water supply available for distribution within such service area, the regulations and restrictions adopted pursuant to this chapter shall prevail over the provisions of such laws relating to water rights for the duration of the period of emergency; provided, however, that any distributor of water which is subject to regulation by the State Public Utilities Commission shall before making such regulations and restrictions effective secure the approval thereof by the Public Utilities Commission.

358. Nothing in this chapter shall be construed to prohibit or prevent review by any court of competent jurisdiction of any finding or determination by a governing board of the existence of an emergency or of regulations or restrictions adopted by such board, pursuant to this chapter, on the ground that any such action is fraudulent, arbitrary, or capricious.

359. (a) Notwithstanding any other provision of law that requires an election for the purpose of authorizing a contract with the United States, or for incurring the obligation to repay loans from the United States, and except as otherwise limited or prohibited by the California Constitution, a public water agency, as an alternative procedure to submitting the proposal to an election, upon affirmative vote of four-fifths of the members of the governing body thereof, may apply for, accept, provide for the repayment together with interest thereon, and use funds made available by the federal government pursuant to Public Law 95-18, pursuant to any other federal act subsequently enacted during 1977 that specifically provides emergency drought relief financing, or pursuant to existing federal relief programs receiving budget augmentations in 1977 for drought assistance, and may enter into contracts that are required to obtain those federal funds pursuant to the provisions of those federal acts if the following conditions exist:

- (1) The project is undertaken by a state, regional, or local governmental agency.
- (2) As a result of the severe drought now existing in many parts of the state, the agency has insufficient water supply needed to meet necessary agricultural, domestic, industrial, recreational, and fish and wildlife needs within the service area or area of jurisdiction of the agency.

- (3) The project will develop or conserve water before October 31, 1978, and will assist in mitigating the impacts of the drought.
 - (4) The agency affirms that it will comply, if applicable, with Sections 1602, 1603, and 1605 of the Fish and Game Code
 - (5) The project will be completed on or before the completion date, if any, required under the federal act providing the funding, but not later than March 1, 1978.
- (b) Any obligation to repay loans shall be expressly limited to revenues of the system improved by the proceeds of the contract.
- (c) No application for federal funds pursuant to this section shall be made on or after March 1, 1978.
- (d) Notwithstanding the provisions of this section, a public agency shall not be exempt from any provision of law that requires the submission of a proposal to an election if a petition requesting such an election signed by 10 percent of the registered voters within the public agency is presented to the governing board within 30 days following the submission of an application for federal funds.
- (e) Notwithstanding the provisions of this section, a public water agency that applied for federal funds for a project before January 1, 1978, may make application to the Director of the Drought Emergency Task Force for extension of the required completion date specified in paragraph (5) of subdivision (b). Following receipt of an application for extension, the Director of the Drought Emergency Task Force may extend the required completion date specified in paragraph (5) of subdivision (b) to a date not later than September 30, 1978, if the director finds that the project has been delayed by factors not controllable by the public water agency. If the Drought Emergency Task Force is dissolved, the Director of Water Resources shall exercise the authority vested in the Director of the Drought Emergency Task Force pursuant to this section.
- (f) For the purposes of this section, "public water agency" means a city, district, agency, authority, or any other political subdivision of the state, except the state, that distributes water to the inhabitants thereof, is otherwise authorized by law to enter into contracts or agreements with the federal government for a water supply or for financing facilities for a water supply, and is otherwise required by law to submit those agreements or contracts or any other project involving long-term debt to an election within that public water agency.

Water Code Section 10632

10632. The plan shall provide an urban water shortage contingency analysis which includes each of the following elements which are within the authority of the urban water supplier:

- (a) Stages of action to be undertaken by the urban water supplier in response to water supply shortages, including up to a 50 percent reduction in water supply, and an outline of specific water supply conditions which are applicable to each stage.
- (b) An estimate of the minimum water supply available during each of the next three water years based on the driest three-year historic sequence for the agency's water supply.
- (c) Actions to be undertaken by the urban water supplier to prepare for, and implement during, a catastrophic interruption of water supplies including, but not limited to, a regional power outage, an earthquake, or other disaster.
- (d) Additional, mandatory prohibitions against specific water use practices during water shortages, including, but not limited to, prohibiting the use of potable water for street cleaning.
- (e) Consumption reduction methods in the most restrictive stages. Each urban water supplier may use any type of consumption reduction methods in its water shortage contingency analysis that would reduce water use, are appropriate for its area, and have the ability to achieve a water use reduction consistent with up to a 50 percent reduction in water supply.
- (f) Penalties or charges for excessive use, where applicable.
- (g) An analysis of the impacts of each of the actions and conditions described in subdivisions (a) to (f), inclusive, on the revenues and expenditures of the urban water supplier, and proposed measures to overcome those impacts, such as the development of reserves and rate adjustments.
- (h) A draft water shortage contingency resolution or ordinance.
- (i) A mechanism for determining actual reductions in water use pursuant to the urban water shortage contingency analysis.

Appendix B

Cities and Agencies whose Water Shortage Contingency Plans or Ordinances were Reviewed

Alameda County Water District

Contra Costa Water District

Denver Water, Colorado

East Bay Municipal Utilities District (EBMUD)

El Paso Water Utilities, Texas

Marin Municipal Water District

Monterey Peninsula Water Management District

New York City, New York

Salt Lake City Department of Public Works, Utah

San Diego County Water Authority

San Francisco Public Utilities Commission (SFPUC)

San Luis Obispo, City of

Santa Barbara, City of

Santa Monica, City of

Santa Rosa, City of

Seattle Public Utilities, Washington

Sonoma County Water Agency

Southern Nevada Water Authority, Nevada

St. Helena, City of

Tampa, Florida, City of

Yuba City, City of

Appendix C

Exceedance Probabilities for San Lorenzo River at Felton

Month	Exceedance Probability	Wet	Normal	Dry	Critically Dry	Month	Exceedance Probability	Wet	Normal	Dry	Critically Dry
Jan.	100	120	34.2	13.8	20.5	Feb.	100	126	75.7	20.9	16.6
	90	244	56.4	28.6	22.4		90	218	102	34.9	21.6
	75	386	92.2	35.2	30.6		75	337	123	63.2	25.3
	50	656	181	57.3	35.9		50	637	301	141	47.3
	25	831	271	108	43.3		25	1177	466	220	77.5
Mar.	10	1153	600	139	57.5	April	10	1318	573	256	124.0
	100	113	70.1	54.9	21.4		100	67.9	58.0	36.7	12.3
	90	237	87.7	58.5	22.3		90	106	63.3	42.7	20.6
	75	308	99.9	71.1	28.3		75	140	77.6	43.3	25.5
	50	462	219	126	37.1		50	246	112	60.3	28.9
May	25	705	303	197	75.9		25	459	149	70.0	32.8
	10	842	494	229	93.1		10	849	170	75.4	35.5
	100	43.9	34.5	21.9	11.6	June	100	33.6	23.1	15.4	9.4
	90	65.9	40.2	27.2	15.7		90	42.5	26.1	17.3	11.6
	75	82.1	45.1	27.9	19.9		75	49.0	29.7	19.4	13.3
	50	105	58.5	31.7	21.3		50	60.5	36.1	22.7	14.7
	25	154	72.0	44.3	22.7		25	77.2	44.8	28.5	17.2
July	10	185	87.2	77.5	29.4		10	93.0	51.6	34.8	17.8
	100	24.1	16.5	10.6	6.7	Aug.	100	18.5	12.7	8.4	6.5
	90	25.9	18.2	12.9	8.7		90	21.3	15.4	10.1	8.3
	75	33.2	20.1	13.4	9.8		75	23.0	16.2	11.0	9.2
	50	40.1	24.1	15.5	10.5		50	27.4	18.7	12.0	10.1
	25	46.6	28.8	20.6	12.1		25	34.2	22.3	15.6	10.8
Sept.	10	56.7	33.2	23.9	13.2		10	40.2	25.3	18.7	11.5
	100	16.9	13.6	8.3	8.3	Oct.	100	8.3	9.8	10.1	9.3
	90	19.1	14.1	8.9	8.8		90	12.0	14.4	15.3	11.3
	75	21.1	14.6	10.8	9.3		75	15.7	16.1	17.5	12.7
	50	23.3	16.1	12.5	10.2		50	21.1	21.0	25.4	15.8
	25	26.1	20.0	14.9	10.9		25	28.0	24.6	27.3	23.2
Nov.	10	32.9	22.7	16.8	11.5		10	32.1	29.0	28.4	30.0
	100	12.8	11.8	11.4	14.5	Dec.	100	15.3	24.4	14.7	16.4
	90	22.6	15.2	15.0	18.2		90	52.4	26.7	21.8	22.4
	75	27.0	24.1	20.3	20.9		75	77.3	31.0	28.3	25.4
	50	32.9	36.4	28.1	23.7		50	168	65.1	36.3	33.7
	25	65.7	53.0	67.6	25.3		25	272	238	43.1	53.3
Dec.	10	173	73.5	110	34.5		10	501	376	85.5	82.4

Table 1: Exceedance probabilities for San Lorenzo River at Big Trees from 1936-2002 (USGS Gage ID #11160500). Wet, average, dry and drought years are classified by the total flow for the water year (Method A)

Appendix D

Public Agency and Major Customer Contact List

FACILITY	CONTACT NAME(S)	TELEPHONE	Email
Water Districts:			
CA Dept of Public Health	Jan Sweigert	831-655-6939	After hours/emergency 831-236-4311
Soquel Creek Water District	Laura Brown	831-475-8500	
Scotts Valley Water District	Charlie McNeish	831-438-2363	contact@svwd.org
San Lorenzo Valley Water District	Jim Mueller	831-338-2153	jmueller@slvwd.com
County of Santa Cruz/City of Capitola:			
County CAO	Dinah Phillips	831-454-2100	dinah.phillips@co.santa-cruz.ca.us
County Public Health Officer	Poki Namkung	831-454-4000	poki.namkung@co.santa-cruz.ca.us
County Director of Environmental Health	Bob Kennedy	831-454-2022	bob.kennedy@co.santa-cruz.ca.us
County OES	Paul Horvat	831-458-7109	oes014@co.santa-cruz.ca.us
Santa Cruz County Public Works	John Presleigh	831-454-2160	dpwwweb@co.santa-cruz.ca.us
Emergency/General Services	Nancy Carr-Gordon	831-454-2714	nancy.gordon@co.santa-cruz.ca.us
NETCOMM	Scotty Douglas	831-471-1000	scotty@sccecc.org
County Safety Officer	Josh Riley	831-454-4820	josh.reilly@co.santa-cruz.ca.us
County Parks	Gretchen Iliff Maintenance Supt.	831-454-7908 Office 831-247-2615 Cell	prc043@scparks.com
County Redevelopment Agency	Anita Kane	831 454-2776	red017@co.santa-cruz.ca.us
City of Capitola	Richard Hill	831-475-7300	rhill@ci.capitola.ca.us
Capitola Public Works	Steve Jesberg	831-475-7300 x217	sjesberg@ci.capitola.ca.us

Appendix D

Public Agency and Major Customer Contact List

FACILITY	CONTACT NAME(S)	TELEPHONE	Email
Medical Facilities:			
Dominican Hospital Main phone: 462-7700	Tom Bruce	831-462-7550	tbruce@chw.edu
Sutter Main phone: 477-2200	Facilities Office	831-477-2299	
Santa Cruz Medical Clinic Main phone: 423-4111	Brian Crispell Facilities Director	831-227-7110	
University of California, Santa Cruz:			
Campus Dispatch		831-459-4856	
Physical Plant (Non-Emergency)	Jim Dunne	831-459-4444	jfdunne@ucsc.edu
Physical Planning and Construction	Dean Fitch	831-459-4936	drfitch@ucsc.edu
University Relations	Donna Blitzer	831-459-3938	dblitzer@ucsc.edu
School Districts:			
City Schools Main phone: 429-3837	John Bramlett	831-429-3968 Office 831-251-6803 Cell	bram@sccs.santacruz.k12.ca.us
Live Oak School Dist. Main phone: 475-6333	Keith Houchen Director of Maint.	831-475-6095 Office 831-212-4862 Cell	khouchen@santacruz.k12.ca.us
Other:			
PG&E	Phil Furnas	831-479-5892 831-915-8168	24 Hour emergency service: 1(800) PGE-5000
Pasatiempo Golf Course Corporate Office: 459-9169	Paul Chojnacky	831-459-9713 Office 415-336-5099 Cell	paul@pasatiempo.com
DeLaveaga Golf Course	Miles Hicks Alt. Contact: Steve Pacheco 831-236-0700	831-420-6121 Office 831-212-8699 Cell	mhicks@cityofsantacruz.com

Appendix D

Public Agency and Major Customer Contact List

FACILITY	CONTACT NAME(S)	TELEPHONE	Email
Santa Cruz Memorial, Oakwood Cemeteries	Randy Krassow	831-426-1601	rkrassow@scmemorial.com
Chaminade Main phone: 831-475-5600	Al Hittle Facilities Director	831-465-3451 Office 831-212-1616 Cell	
SC Beach Boardwalk Main phone: 423-5590	Security Head of Maint.	831-345-5590 Supv. 831-818-3336 Cell	Also: Ted Whiting: 460-1610 Carl Henn, Facility Manager 460-3364
City Parks	Steve Hammack	831-420-5366 Office 831-212-5687 Cell	shammack@cityofsantacruz.com
Port District	Rick Smith	831-475-6161	scpd@santacruzharbor.org
IT Main phone: 420-5555 Operators for SCADA systems: 420-5457, 24 hrs	Carlos Silva Network Administrator	831-420-5093 Office 831-227-0635 Cell	csilva@cityofsantacruz.com
Capitola Mall	Steve Bettencourt	831-901-8618	SMS1257@smsclean.com

Appendix E

Residential Water Rationing Allotments

(Monthly allotment, in ccf or billing units)

	Stage 3 15–25% Deficiency	Stage 4 25-35% Deficiency	Stage 5 35-50% Deficiency
Single Residential Accounts Up to 4 persons: Each Additional person:	11 2	9 2	7 2
Multiple Residential Accounts Allotment is <u>per dwelling unit</u> based on number of dwelling units on account: 2-4: 5-20: Over 20:	Separate irrigation meter serving property? No Yes		All multiple residential accounts, regardless of whether there is a separate irrigation meter serving the property or not:
	7 6 5	6 5 4	5 4 3
Multiple Residential Accounts Alternative A Allotment is in gallons per person per day (gpcd) based on the number of permanent residents at the account:	47 gpcd	45 gpcd	37 gpcd
Multiple Residential Accounts Alternative B (not applicable to 2-unit accounts) Where lot coverage, by dwelling units is <35% of entire property	Same allotment as single residential accounts		

Appendix F

Example of Monthly Water Supply and Demand Monitoring Report

SCWD Production Forecast	April			May				Sep			Oct			Total		
(million gallons)	Projected	Actual	Variance	Projected	Actual	Variance		Projected	Actual	Variance	Projected	Actual	Variance			
North Coast (gross production)																
North Coast (net production)																
San Lorenzo River																
Live Oak Wells																
Total Production without Lake																
Projected System Demand																
Lake Production Needed to Meet Demand																
Evaporation (feet)																
Evaporation (mil gal)																
Fish Release (mil gal)																
Beginning Lake Volume (mil gal)																
End of Month Lake Volume (mil gal)																
End of Month Lake Elevation (ft above msl)																
Monthly change in elevation (ft)																
Cumulative change in elevation (ft)																
Percent of capacity (%)																
Previous Year Water Consumption																
Current Year Water Consumption																
Difference																

Notes:

North Coast gross production based on ...

North Coast net production assumed to be ...

San Lorenzo River forecast assumes ____ year type, ____ percent exceedance probability

Projected system demand based on ...

Assumptions for Loch Lomond Reservoir include: starting elev: ____ no additional pumping from Felton Diversion, & no natural inflow.

Appendix G

RESOLUTION NO. NS-28,024

RESOLUTION OF THE CITY COUNCIL OF THE CITY OF SANTA CRUZ ADOPTING THE 2009 WATER SHORTAGE CONTINGENCY PLAN

WHEREAS, the City Council of the City of Santa Cruz in 2003 adopted a long range planning document known as the Integrated Water Plan, which was intended to provide a flexible, phased approach for reducing near-term drought year shortages and to provide a reliable supply that meets long-term needs while ensuring protection of public health and safety; and

WHEREAS, in addition to implementing water conservation programs to reduce average daily water use and pursuing a cooperative desalination project to increase the supply of water, the Integrated Water Plan includes a curtailment component calling for temporary cutbacks of water use by up to 15 percent to help balance available water supply against demand in drought years; and

WHEREAS, the need to better prepare for the possibility of future water shortages in advance of the next major drought was identified as a top priority in the city's 2005 Urban Water Management Plan; and

WHEREAS, California Water Code section 10632 requires water agencies to plan for water shortages of up to 50 percent as part of their Urban Water Management Plan; and,

WHEREAS, development of the Water Shortage Contingency Plan was a collaborative, open, and public process among the City Water Department staff, the City's Water Commission, City Council and the public; and

WHEREAS, the Water Commission has reviewed the Water Shortage Contingency Plan and unanimously recommended that City Council adopt it to provide a framework for guiding the City's response to future droughts; and

WHEREAS, the State of California is now in its third consecutive year of drought and despite the recent rain, water conditions in Santa Cruz remain below normal; and

WHEREAS, because stream flows that constitute the City's primary drinking water source of supply are projected to run lower than usual this year, voluntary and mandatory actions to temporarily reduce water demand will likely be needed this summer to help preserve valuable reservoir storage in case dry conditions continue beyond 2009.

NOW, THEREFORE, BE IT RESOLVED by the City Council of the City of Santa Cruz that it hereby adopts the 2009 Water Shortage Contingency Plan, authorizes the Water Director to file a copy with the California Department of Water Resources as an amendment to the City's 2005 Urban Water Management Plan, and directs staff to develop a water shortage ordinance that is consistent with the recommendations outlined in the plan.

RESOLUTION NO. NS-28,024

PASSED AND ADOPTED this 10th day of March, 2009, by the following vote:

AYES: Councilmembers Coonerty, Robinson, Lane, Madrigal, Beiers, Vice Mayor
Rotkin; Mayor Mathews.

NOES: None.

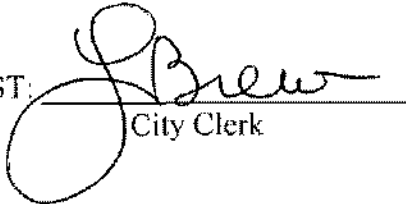
ABSENT: None.

DISQUALIFIED: None.

APPROVED


Mayor

ATTEST:


City Clerk

Appendix H

ORDINANCE NO. 2010-12

AN ORDINANCE OF THE CITY OF SANTA CRUZ REPEALING ORDINANCE 2009-14 AND ADDING A NEW CHAPTER 16.01 OF THE MUNICIPAL CODE PROHIBITING AND REGULATING CERTAIN USES OF WATER FROM THE CITY WATER SUPPLY SYSTEM NOT ESSENTIAL TO THE PUBLIC HEALTH AND SAFETY FOR WATER CONSERVATION PURPOSES, PRESCRIBING PENALTIES FOR VIOLATIONS, AND ESTABLISHING A WATER SHORTAGE APPEAL BOARD

BE IT ORDAINED by the City Council of the City of Santa Cruz as follows:

SECTION 1: Ordinance 2009-14 is hereby repealed.

SECTION 2: Chapter 16.01 of the Santa Cruz Municipal Code is hereby enacted to read as follows:

“Chapter 16.01

Water Shortage Regulations and Restrictions

Sections:

- 16.01.010 Findings.
 - 16.01.020 Declaration of Water Shortage.
 - 16.01.030 Application of Regulations.
 - 16.01.040 Precedence of Regulations.
 - 16.01.050 Definitions.
 - 16.01.060 Water Waste Prohibitions.
 - 16.01.070 Stage 1: Water Shortage Alert.
 - 16.01.080 Stage 2: Water Shortage Warning.
 - 16.01.090 Stage 3: Water Shortage Emergency.
 - 16.01.100 Stage 4: Severe Water Shortage Emergency.
 - 16.01.110 Stage 5: Critical Water Shortage Emergency.
 - 16.01.120 Exceptions.
 - 16.01.130 Water Shortage Appeal Board.
 - 16.01.140 Administrative Enforcement.
 - 16.01.150 Additional Enforcement Authority.
 - 16.01.160 Severability.
- 16.01.010 FINDINGS.

WHEREAS, the City of Santa Cruz water system draws almost exclusively on local surface water sources, whose yield varies from year to year depending on the amount of rainfall received and runoff generated during the winter season; and

WHEREAS, the City water system is susceptible to water shortages in dry and critically dry years or in periods of prolonged regional drought when water conditions characterized by low surface flows in the north coast streams and San Lorenzo River sources, depleted storage in Newell Creek Reservoir, or both, reduce the available supply to a level that cannot support seasonal water demand; and

WHEREAS, on March 10, 2009, the City Council of the City of Santa Cruz adopted an updated Water Shortage Contingency Plan that describes how the City will respond to future water shortages and lists the various actions the City would take to reduce water demand under different water shortage scenarios ranging from 5 percent or less up to and including a 50 percent seasonal water supply deficiency; and

WHEREAS California Water Code sections 350 et seq. authorize water suppliers, after holding a properly noticed public hearing and after making certain findings, to declare a water shortage (emergency) and to adopt such regulations and restrictions to conserve the water supply for the greatest public benefit with particular regard for domestic use, sanitation, and fire protection; and

WHEREAS, the voluntary and mandatory water conservation measures and progressive restrictions on water use and method of use set forth herein provide an effective and immediately available means of conserving water which is essential during periods of water shortage to ensure a reliable and sustainable minimum supply of water for the public health, safety, and welfare and to preserve valuable limited reservoir storage, avoid depleting water storage to an unacceptably low level, and thereby lessen the possibility of experiencing more critical shortages if dry conditions continue or worsen; and

WHEREAS, the usage allotments hereinafter established will equitably spread the burden of restricted and prohibited usage in a manner prescribed by the City's Water Shortage Contingency Plan over all City Water Department customers and other consumers of City water; and

WHEREAS, the purposes of this chapter are to conserve the water supply of the City of Santa Cruz for the greatest public benefit, to mitigate the effects of a water supply shortage on public health and safety and economic activity, and to budget water use so that a reliable and sustainable minimum supply of water will be available for the most essential purposes for the entire duration of the water shortage.

16.01.020 DECLARATION OF WATER SHORTAGE.

The provisions of this chapter shall take effect whenever the Director, upon engineering analysis of City water supplies, finds and determines that a water shortage exists or is imminent within the City of Santa Cruz water service area and a declaration of a water shortage is made by a resolution of the City Council, and they shall remain in effect for the duration of the water shortage set forth in the resolution.

16.01.030 APPLICATION OF REGULATIONS.

The provisions of this chapter shall apply to all persons using or consuming water both inside and outside the City and within the City water service area, and regardless of whether any person using water shall have a contract for water service with the City.

16.01.040 PRECEDENCE OF REGULATIONS.

Where other provisions of the Municipal Code, whether enacted prior or subsequent to this chapter, are inconsistent with this the provisions of this chapter, the provisions of this chapter shall supersede and control for the duration of the water shortage set forth in the resolution of the City Council.

16.01.050 DEFINITIONS.

- (a) "Director" refers to the Director of the City of Santa Cruz Water Department.
- (b) "Water" refers to water produced and served by the City of Santa Cruz Water Department.
- (c) "City" refers to the City of Santa Cruz.
- (d) "Water Department" refers to the City of Santa Cruz Water Department.
- (e) "Seasonal water demand" refers to the demand, measured in gallons, placed by customers on the City water supply between April 1 and October 31 each calendar year.
- (f) "Issue"/"Declare". Whenever this chapter references the Director's issuance or declaration of an alert, warning, emergency, or regulation, said alert, warning, emergency or regulation shall be put into effect by the placement of a legal advertisement in a newspaper of general circulation, by a posting on the City's internet website and by a posting in the following public places: Santa Cruz City Hall, 809 Center Street, Santa Cruz; Santa Cruz Water Department Office, 212 Locust Street, Santa Cruz; Capitola City Hall, 420 Capitola Avenue, Capitola, and the Santa Cruz County Governmental Center, 701 Ocean Street, Santa Cruz. Any such alert, warning, emergency or regulation shall take effect upon the date of its publication in the Santa Cruz Sentinel.
- (g) "Customer" shall refer to any account customer of the City of Santa Cruz Water Department as well as to any consumer of City water who may not be City of Santa Cruz Water Department account customer.
- (h) "Dry Year" refers to the type of water year under the City's water year classification system, which begins October 1 and ends September 30, in which the total annual discharge of the San Lorenzo River at Felton measures between 29,000 and 49,000 acre-feet.
- (i) "Critically Dry Year" refers to the type of water year under the City's water year classification system, which begins October 1 and ends September 30, in which the total annual discharge of the San Lorenzo River at Felton measures less than 29,000 acre-feet.

16.01.060 WATER WASTE PROHIBITIONS.

It shall be unlawful during any water shortage stage for any person, firm, partnership, association, corporation, political entity (including the City) or any other Water Department customer to use water for any of the following:

- (a) Fire Hydrants. Use of water from any fire hydrant unless specifically authorized by permit from the City, except by regularly constituted fire protection agencies for fire suppression purposes, or for other authorized uses, including distribution system flushing, fire flow testing, and filling of approved vehicles for sewer system flushing, storm drain maintenance, and street sweeping purposes.
- (b) Watering/Irrigation. The watering of grass, lawn, groundcover, shrubbery, open ground, crops and trees, including agricultural irrigation, in a manner or to an extent that causes

or allows excessive water flow or runoff onto an adjoining sidewalk, driveway, street, gutter or ditch.

(c) Plumbing Leaks. The escape of water through leaks, breaks, or other malfunctions within the water user's plumbing or distribution system for any period of time after such break or leak should have reasonably been discovered and corrected. It shall be presumed that a period of twenty-four hours after the water user discovers such break, leak or malfunction, or receives notice from the City of such condition, whichever occurs first, is a reasonable time within which to correct such condition or to make arrangements for correction.

(d) Washing of Exterior Surfaces. The washing of sidewalks, walkways, driveways, parking lots, patios, or other exterior surfaces unless the hose is equipped with an automatic shutoff nozzle.

(e) Cleaning of Structures and Vehicles. The cleaning of building exteriors, mobile homes, cars, boats, and recreational vehicles unless the hose is equipped with an automatic shutoff nozzle.

(f) Fountains and Decorative Water Features. The operation of a water fountain or other decorative water feature that does not use re-circulated water.

(g) Commercial Car Washes. The washing of vehicles at a commercial car wash unless the facility utilizes water recycling equipment, or operates on a timer for a limited time period and shuts off automatically at the expiration of the time period.

(h) Construction. The use of potable water for dust control or soil compaction purposes in construction activities where there is a reasonably available source of reclaimed water appropriate for such use.

(i) The indiscriminate running of water or washing with water not otherwise prohibited in this section, which is wasteful, and without reasonable purpose.

16.01.070 STAGE 1: WATER SHORTAGE ALERT.

(a) The Director is empowered to issue a Water Shortage Alert and to enforce the water shortage restrictions in this Section upon finding that the magnitude of an anticipated water shortage, per the criteria delineated in the City's adopted Water Shortage Contingency Plan, will be five percent (5%) and a minimal consumer demand reduction is necessary to make more efficient use of water and appropriately respond to existing water supply conditions. In a Stage 1 water shortage, the City will enforce the following water shortage restrictions with the objective of realizing a seasonal water demand reduction of 125 million gallons or an average daily water demand reduction of 600,000 gallons.

(b) During Stage 1, it shall be unlawful for any person, firm, partnership, association, corporation, political entity (including the City) or any other Water Department customer:

1. to water or irrigate lawn, landscape, or other vegetated area between the hours of 10:00 a.m. and 5:00 p.m., except when performed with a bucket or watering can, or by use of a drip irrigation system or similar low-volume, non-spray irrigation equipment, or for very short periods of time for the express purpose of allowing landscape contractors to adjust or repair an irrigation system;

2. to use a hose that is not equipped with a shut off nozzle;

3. to use potable water to wash down hard or paved surfaces, including but not limited to sidewalks, walkways, driveways, parking lots, tennis courts, patios, or other paved surfaces, except when it is necessary to alleviate safety or sanitation hazards or to prepare paved surfaces for sealing;

4. to initially fill or to drain and refill residential swimming pools;
5. to serve water in a restaurant or other commercial food service establishment except upon the request of a patron; and/or
6. to operate a hotel, motel or other commercial lodging establishment without offering patrons the option to forego the daily laundering of towels, sheets and linens.

16.01.080 STAGE 2: WATER SHORTAGE WARNING.

(a) The Director is empowered to issue a Water Shortage Warning and to enforce the water shortage restrictions in this Section upon finding that the magnitude of an anticipated water shortage, per the criteria delineated in the City's adopted Water Shortage Contingency Plan, will be between five percent (5%) and fifteen percent (15%) and a moderate consumer demand reduction is necessary to make more efficient use of water and appropriately respond to existing water supply conditions. In a Stage 2 water shortage, the City will enforce the following water shortage restrictions with the objective of realizing a seasonal water demand reduction of up to 375 million gallons and an average daily water demand reduction of up to 1.8 million gallons.

(b) During Stage 2, it shall be unlawful for any person, firm, partnership, association, corporation, political body (including the City) or other Water Department customer:

1. to water or irrigate lawn, landscape, or other vegetated area between the hours of 10:00 a.m. and 5:00 p.m., except when performed with a bucket or watering can, or by use of a drip irrigation system or similar low-volume, non-spray irrigation equipment, or for very short periods of time for the express purpose of allowing landscape contractors to adjust or repair an irrigation system;
2. to use a hose that is not equipped with a shut off nozzle;
3. to use potable water to wash down hard or paved surfaces, including but not limited to sidewalks, walkways, driveways, parking lots, tennis courts, patios, or other paved surfaces, except when it is necessary to alleviate safety or sanitation hazards or to prepare paved surfaces for sealing;
4. to initially fill or to drain and refill residential swimming pools;
5. to serve water in a restaurant or other commercial food service establishment except upon the request of a patron;
6. to operate a hotel, motel or other commercial lodging establishment without offering patrons the option to forego the daily laundering of towels, sheets and linens;
7. to water or irrigate lawn, landscape, or other vegetated area on days of the week other than the two days of the week authorized and publicized by the Director, except when performed with a bucket or watering can, or by use of a drip irrigation system or similar low-volume, non-spray irrigation equipment, or for very short periods of time for the express purpose of allowing landscape contractors to adjust or repair an irrigation system. Hourly restrictions set forth in subsection (1) above continue to apply on authorized watering days. This provision shall not apply to commercial growers/nurseries or to residential vegetable gardens/edible plantings watered with a hose equipped with a shut off nozzle;
8. to water or irrigate lawn, landscape, or other vegetated area using an automatic irrigation system for more than fifteen minutes per watering station per assigned day. This provision shall not apply to automatic irrigation systems exclusively using low output sprinkler equipment, including rotors, stream rotors, or micro-spray systems;
9. to wash the exterior of dwellings, buildings or structures (with the exception of window washing and preparation of property for painting or for sale);

10. to irrigate or water landscapes in a manner that conflicts with a customer's landscape irrigation water budget when such a budget is required by the Director per the criteria delineated in the City's adopted Water Shortage Contingency Plan; and/or

11. to disobey Water Department direction to large commercial, industrial or irrigation customers using 1,337 or more billing units (one million gallons) per year to conduct water use audits, to prepare water conservation plans and to submit progress reports, or to immediately repair water system leaks, including leaks attributable to faulty pipes or fixtures.

16.01.090 STAGE 3: WATER SHORTAGE EMERGENCY.

(a) The Director is empowered to declare a Water Shortage Emergency and to enforce the water shortage restrictions in this Section upon finding that the magnitude of an anticipated water shortage, per the criteria delineated in the City's adopted Water Shortage Contingency Plan, will be between fifteen percent (15%) and twenty five percent (25%) and a significant consumer demand reduction is necessary to make more efficient use of water and appropriately respond to existing water supply conditions. In a Stage 3 water shortage, the City will enforce the following water shortage restrictions with the objective of realizing a seasonal water demand reduction of up to 625 million gallons and an average daily water demand reduction of up to 3.0 million gallons.

(b) During Stage 3, it shall be unlawful for any person, firm, partnership, association, corporation, political body (including the City) or other Water Department customer:

1. to water or irrigate lawn, landscape, or other vegetated area between the hours of 10:00 a.m. and 5:00 p.m., except when performed with a bucket or watering can, or by use of a drip irrigation system or similar low-volume, non-spray irrigation equipment, or for very short periods of time for the express purpose of allowing landscape contractors to adjust or repair an irrigation system;

2. to use a hose that is not equipped with a shut off nozzle;

3. to use potable water to wash down hard or paved surfaces, including but not limited to sidewalks, walkways, driveways, parking lots, tennis courts, patios, or other paved surfaces, except when it is necessary to alleviate safety or sanitation hazards or to prepare paved surfaces for sealing;

4. to initially fill or to drain and refill any swimming pools, outdoor spas, wading pools, and ornamental water features;

5. to serve water in a restaurant or other commercial food service establishment except upon the request of a patron;

6. to operate a hotel, motel or other commercial lodging establishment without offering patrons the option to forego the daily laundering of towels, sheets and linens;

7. to water or irrigate lawn, landscape, or other vegetated area on days of the week other than the specified day(s) of the week authorized and publicized by the Director, except when performed with a bucket or watering can, or by use of a drip irrigation system or similar low-volume, non-spray irrigation equipment, or for very short periods of time for the express purpose of allowing landscape contractors to adjust or repair an irrigation system. Hourly restrictions set forth in subsection (1) above continue to apply on authorized watering days. This provision shall not apply to commercial growers/nurseries or to residential vegetable gardens/edible plantings watered with a hose equipped with a shut off nozzle;

8. to water or irrigate lawn, landscape, or other vegetated area using an automatic irrigation system for more than ten minutes per watering station per assigned day. This

provision shall not apply to automatic irrigation systems exclusively using low output sprinkler equipment, including rotors, stream rotors, or micro-spray systems;

9. to wash the exterior of dwellings, buildings or structures (with the exception of window washing and preparation of property for painting or for sale);

10. to irrigate or water landscapes in a manner that conflicts with a customer's landscape irrigation water budget when such a budget is required by the Director per the criteria delineated in the City's adopted Water Shortage Contingency Plan; and/or

11. to disobey Water Department direction to large commercial, industrial or irrigation customers using 1,337 or more billing units (one million gallons) per year to conduct water use audits, to prepare water conservation plans and to submit progress reports, or to immediately repair water system leaks, including leaks attributable to faulty pipes or fixtures;

12. to violate residential customer water rationing regulations, including regulations intended to preclude excessive water usage and specifying maximum water usage limitations, issued by the Director in accordance with guidelines set forth in the City's adopted Water Shortage Contingency Plan; and/or

13. to disobey Water Department directives issued to commercial customers requiring the prominent placement of "Save Water" signage at specified locations at the customer's premises.

16.01.100 STAGE 4: SEVERE WATER SHORTAGE EMERGENCY.

(a) The Director is empowered to declare a Severe Water Shortage Emergency and to enforce the water shortage restrictions in this Section upon finding that the magnitude of an anticipated water shortage, per the criteria delineated in the City's adopted Water Shortage Contingency Plan, will be between twenty five percent (25%) and thirty five percent (35%) and an extraordinary consumer demand reduction is necessary to make more efficient use of water and appropriately respond to existing water supply conditions. In a Stage 4 water shortage, the City will enforce the following water shortage restrictions with the objective of realizing a seasonal water demand reduction of up to 875 million gallons and an average daily water demand reduction of up to 4.2 million gallons.

(b) During Stage 4, it shall be unlawful for any person, firm, partnership, association, corporation, political body (including the City) or other Water Department customer:

1. to water or irrigate landscape or other vegetated area between the hours of 10:00 a.m. and 5:00 p.m., except when performed with a bucket or watering can, or by use of a drip irrigation system or similar low-volume, non-spray irrigation equipment, or for very short periods of time for the express purpose of allowing landscape contractors to adjust or repair an irrigation system;

2. to use a hose that is not equipped with a shut off nozzle;

3. to use potable water to wash down hard or paved surfaces, including but not limited to sidewalks, walkways, driveways, parking lots, tennis courts, patios, or other paved surfaces, except when it is necessary to alleviate safety or sanitation hazards or to prepare paved surfaces for sealing;

4. to fill or to top off any swimming pools, outdoor spas, wading pools, and ornamental water features;

5. to serve water in a restaurant or other commercial food service establishment except upon the request of a patron;

6. to operate a hotel, motel or other commercial lodging establishment without offering patrons the option to forego the daily laundering of towels, sheets and linens;

7. to water or irrigate landscape or other vegetated area on days of the week other than the specified day(s) of the week authorized and publicized by the Director, except when performed with a bucket or watering can, or by use of a drip irrigation system or similar low-volume, non-spray irrigation equipment, or for very short periods of time for the express purpose of allowing landscape contractors to adjust or repair an irrigation system. Hourly restrictions set forth in subsection (1) above continue to apply on authorized watering days. This provision shall not apply to commercial growers/nurseries or to residential vegetable gardens/edible plantings watered with a hose equipped with a shut off nozzle;

8. to water landscapes using automatic irrigation systems for more than ten minutes per watering station per assigned day. This provision does not apply to automatic irrigation systems using water efficient devices, including but not limited to weather-based controllers, drip/micro-irrigation systems and stream rotor sprinklers.

9. to wash the exterior of dwellings, buildings or structures (with the exception of window washing and preparation of property for painting or for sale);

10. to irrigate or water landscapes in a manner that conflicts with a customer's landscape irrigation water budget when such a budget is required by the Director per the criteria delineated in the City's adopted Water Shortage Contingency Plan; and/or

11. to disobey Water Department direction to large commercial, industrial or irrigation customers using 1,337 or more billing units (one million gallons) per year to conduct water use audits, to prepare water conservation plans and to submit progress reports, or to immediately repair water system leaks, including leaks attributable to faulty pipes or fixtures;

12. to violate residential customer water rationing regulations, including regulations intended to preclude excessive water usage and specifying maximum water usage limitations, issued by the Director in accordance with guidelines set forth in the City's adopted Water Shortage Contingency Plan;

13. to disobey Water Department directives issued to commercial customers requiring the prominent placement of "Save Water" signage at specified locations at the customer's premises;

14. to violate commercial customer water rationing regulations, including regulations intended to preclude excessive water usage and specifying maximum water usage limitations, issued by the Director in accordance with guidelines set forth in the City's adopted Water Shortage Contingency Plan;

15. to disobey a Water Department order to customers identified as "dedicated irrigation accounts" directing those customers to further limit their landscape irrigation and watering activity so as to preserve only the customers' most valuable trees and plants;

16. to water lawns or turf, unless such watering is authorized by the Director in accordance with a landscape irrigation water budget and is consistent with the guidelines set forth in the City's adopted Water Shortage Contingency Plan;

17. to install new landscaping which requires any irrigation or watering;

18. to wash or clean vehicles, including but not limited to automobile, truck, van, bus, motorcycle, boat, or trailer including the washing of fleet vehicles and the washing of vehicles on dealer lots. This restriction will not apply to commercial car wash businesses which use recycled water; and/or

19. to exercise any rights conferred by hydrant and bulk water permits that were issued prior to the Severe Water Shortage Emergency declaration absent special permission

granted by the Director. Said special permission may be granted only for projects necessary to protect the public health, safety and welfare where no alternative to potable water exists and for emergency response purposes.

16.01.110 STAGE 5: CRITICAL WATER SHORTAGE EMERGENCY.

(a) The Director is empowered to declare a Critical Water Shortage Emergency and to enforce the water shortage restrictions in this Section upon finding that the magnitude of an anticipated water shortage, per the criteria delineated in the City's adopted Water Shortage Contingency Plan, shall be between thirty five percent (35%) and fifty percent (50%) and an extreme consumer demand reduction is necessary to make more efficient use of water and appropriately respond to existing water supply conditions. In a Stage 5 water shortage, the City will enforce the following water shortage restrictions with the objective of realizing a seasonal water demand reduction of up to 1,250 million gallons and an average daily water demand reduction of up to 6.0 million gallons.

(b) During Stage 5, it is unlawful for any person, firm, partnership, association, corporation, political body (including the City) or other Water Department customer:

1. to water or irrigate any outdoor landscaping, unless such watering is authorized by the Director and is consistent with the guidelines set forth in the City's adopted Water Shortage Contingency Plan;
2. to use a hose that is not equipped with a shut off nozzle;
3. to use water for any outdoor washing purpose including commercial car washing, window washing, and paint preparation;
4. to fill or to top off any swimming pools, outdoor spas, wading pools, and ornamental water features;
5. to serve water in a restaurant or other commercial food service establishment except upon the request of a patron;
6. to operate a hotel, motel or other commercial lodging establishment without offering patrons the option to forego the daily laundering of towels, sheets and linens;
7. to use water for recreational purposes;
8. to operate public swimming pools;
9. to operate public showers;
10. to disobey Water Department direction to large commercial, industrial or irrigation customers using 1,337 or more billing units (one million gallons) per year to conduct water use audits, to prepare water conservation plans and to submit progress reports, or to immediately repair water system leaks, including leaks attributable to faulty pipes or fixtures;
11. to violate residential customer water rationing regulations, including regulations intended to preclude excessive water usage and specifying maximum water usage limitations, issued by the Director in accordance with guidelines set forth in the City's adopted Water Shortage Contingency Plan;
12. to violate commercial customer water rationing regulations, including regulations intended to preclude excessive water usage and specifying maximum water usage limitations, issued by the Director in accordance with guidelines set forth in the City's December 2008 Water Shortage Contingency Plan;
13. to disobey Water Department directives issued to commercial customers requiring the prominent placement of "Save Water" signage at specified locations at the customer's premises;

14. to install new landscaping which requires any irrigation or watering;
and/or

15. to exercise any rights conferred by hydrant and bulk water permits that were issued prior to the Critical Water Shortage Emergency declaration absent special permission granted by the Director. Said special permission may be granted only for projects necessary to protect the public health, safety and welfare where no alternative to potable water exists and for emergency response purposes.

16.01.120 EXCEPTIONS.

(a) The Director, upon application made in writing by a customer on a form promulgated by the Water Department and accompanied by supporting documentation, shall be authorized to issue an exception from the strict application of any restriction, regulation or prohibition enforced pursuant to this chapter, upon the customer's production of substantial evidence demonstrating the existence of one or more of the following circumstances that are particular to that customer and which are not generally shared by other Water Department customers:

1. Failure to approve the requested exception would cause a condition having an adverse effect on the health, sanitation, fire protection, or safety of the customer or members of the public served by the customer;

2. Strict application of the subject restriction, regulation or prohibition would impose a severe or undue hardship on a particular business customer or render it infeasible for a particular business customer or class of business customers to remain in operation;

3. Alternative restrictions to which the customer is willing to adhere are available that would achieve the same level of demand reduction as the restriction for which an exception is being sought and such alternative restrictions are enforceable by the Water Department;

4. Circumstances concerning the customer's property or business have changed since the implementation of the subject restriction warranting a change in the customer's water usage allocation; or

5. A hospital or health care facility customer using industry best management practices is eligible for an exception upon demonstrating that the subject restriction, regulation or prohibition is interfering with or preventing it from providing health care service to its customers in accordance with industry hygiene, sanitation and health care standards.

6. A business customer has already implemented environmental sustainability measures that have reduced water consumption to the maximum extent feasible. As used in this subsection the term "environmental sustainability measures" refers to installation of high efficiency plumbing fixtures, devices, equipment, and appliances, recycled water systems, and landscaping consisting exclusively of low water using plant materials using drip or similar high efficiency, non-spray irrigation systems, or to buildings that are designed, built, and continuously operated according to Leadership in Energy and Environmental Design (LEED) certification standards.

(b) In order to qualify for an exception, a customer must first complete a self water audit pursuant to standards and procedures promulgated by the Water Department. This audit shall be made part of the customer's exception application and water conservation measures indicated by the audit may be incorporated as conditions of approval to an exception in addition

to any other conditions of approval imposed by the Director in connection with the Director's approval of the customer's exception application.

16.01.130 WATER SHORTAGE APPEAL BOARD.

(a) A Water Shortage Appeal Board is hereby established and shall be eligible to convene upon the Director's issuance of any water shortage declaration and the implementation of water shortage restrictions pursuant to Sections 16.010.070 through 16.01.110. Thereafter the Water Shortage Appeal Board will remain available to convene for as long as the water shortage remains in effect.

(b) Under water shortage Stages 1 and 2, the Water Shortage Appeal Board will be comprised of members of the City Water Commission. Under water shortage Stages 3, 4, and 5, the Water Shortage Appeal Board will be appointed by City Council and will be comprised of one member of the Water Commission, one business customer, one landscape industry customer, one residential customer, and two at-large members who reside within the City's water service area.

(c) Any customer who considers an action taken by the Director or an enforcement official under the provisions of this chapter, including actions on exception applications and the assessment of administrative penalties, to have been erroneously taken or issued, may appeal that action or penalty to the Water Shortage Appeal Board in the following manner:

1. The appeal shall be made in writing, shall state the nature of the appeal specifying the action or penalty that is being appealed and the basis upon which the action or penalty is alleged to be in error. Penalty appeals shall include a copy of the Notice of Violation;

2. An appeal, to be effective, must be received by the Director not later than ten (10) business days following the date of the Notice of Violation or the date that the Director took the action which is the subject to the appeal;

(A) A water service resident who is not an account customer may notify the Water Department of his or her intention to file a petition to force the resident's account customer to appeal an excess water use penalty within ten (10) business days following the penalty;

(B) If the Water Department has been given a notice of intention to file a petition per subsection 2(A) by a water service area resident who is not an account customer, the appeal from the account customer must be received within fifteen (15) business days after the account customer has been petitioned by the resident.

3. The Director shall schedule the appeal for consideration by the Water Shortage Appeal Board at a Water Shortage Appeal Board meeting. The Water Shortage Appeal Board shall hear the appeal within 90 days of the date of the appeal and issue its decision within 30 days of the date of the hearing.

4. The decision of the Water Shortage Appeal Board shall be final. In ruling on appeals, the Water Shortage Appeal Board shall strictly apply the provisions of this chapter, and shall not impose or grant terms and conditions not authorized by this chapter.

(d) The Chair of the Water Shortage Appeal Board shall have the discretion to divide the Board into two-three member hearing panels. Each hearing panel shall have the same authority to hear and rule upon appeals as the entire Water Shortage Appeal Board. A hearing panel shall have no more than one at-large appointee as a member. The decision of any hearing panel shall be final.

16.01.140 ADMINISTRATIVE ENFORCEMENT.

(a) Any person firm, partnership, association, corporation, political entity or other Water Department customer violating any provision of this chapter may be assessed an administrative penalty.

(b) Each and every day a violation of this chapter exists constitutes a separate and distinct offense for which an administrative penalty may be assessed.

(c) Penalties. The purpose of the administrative penalties assessed pursuant to this Section is to assure future chapter compliance by the cited customer through the imposition of increasingly significant penalties so as to create a meaningful disincentive to commit future chapter violations. In acknowledgment of the fact that the City's water is a scarce and irreplaceable commodity and that this chapter is intended to equitably distribute that commodity among Water Department customers and to assure that, to the extent feasible, City water is conserved and used only for purposes deemed necessary for public health and safety, the penalty schedule herein prescribed is not to be construed as creating a "water pricing" structure pursuant to which customers may elect to pay for additional water at significantly higher rates. To this end, a customer's repeated violation of the chapter shall result in either the installation of a flow restriction device or disconnection of the customer's property from the City's water service system at the customer's cost.

(d) Administrative penalties for failure to comply with water waste prohibitions requirements in Section 16.01.060 or mandatory water use restrictions and regulations commencing with Stage 1 in Section 6 are as follows:

1. First Offense: Written notice of violation and opportunity to correct violation.
2. Second Offense: A second violation within the preceding twelve (12) calendar months is punishable by a fine not to exceed one hundred dollars (\$100).
3. Third Offense: A third violation within the preceding twelve (12) calendar months is punishable by a fine not to exceed two hundred fifty dollars (\$250).
4. Fourth Offense: A fourth violation within the preceding twelve (12) calendar months is punishable by a fine not to exceed five hundred dollars (\$500). In addition to any fines, the Director may order a water flow restrictor device be installed.
5. Large customers. Administrative penalties for customers that use an average of 1,337 billing units (one million gallons) or more per calendar year shall be triple the amounts listed above.
6. Discontinuing Service. In addition to any fines and the installation of a water flow restrictor, the Director may disconnect a customer's water service for willful violations of mandatory restrictions and regulations in this chapter. Upon disconnection of water service, a written notice shall be served upon the customer which shall state the time, place, and general description of the prohibited or restricted activity and the method by which reconnection can be made.

(e) Excessive Water Use Penalties. An excessive use penalty shall be assessed where the customer, during any given billing cycle, uses more than the customer's water allotment per the Director's water rationing regulations issued pursuant to this chapter commencing with Stage 3 in Section 16.01.090. Excess use penalties shall be in addition to ordinary water consumption charges, as follows:

1. 1% to 10% over customer rationing allotment: \$25.00/CCF
2. More than 10% over customer rationing allotment: \$50.00/CCF

3. In addition to any excess use penalties, the Director may order a water flow restrictor device be installed and/or may disconnect a customer's water service for willful violations of the water rationing regulations in this chapter. Upon disconnection of water service, a written notice shall be served upon the customer which shall state the time, place, and general description the prohibited or restricted activity and the method by which reconnection can be made.

(f) Cost of Flow Restrictor and Disconnecting Service: A person or entity that violates this chapter is responsible for payment of charges for installing and/or removing any flow restricting device and for disconnecting and/or reconnecting service in accordance with the City's Miscellaneous Water Service Fee Resolution then in effect. The charge for installing and/or removing any flow restricting device must be paid before the device is removed.

Nonpayment will be subject to the same remedies as nonpayment of basic water rates.

(g) Notice and Hearing. The Director will issue a Notice of Violation by mail or personal delivery at least ten (10) business days before taking any enforcement action described in subsection 13D. Such notice must describe the violation and the date by which corrective action must be taken. A customer may appeal the Notice of Violation by filing a written notice of appeal with the City no later than the close of business day before the date scheduled for enforcement action accompanied by a \$25 appeal fee. Any Notice of Violation not timely appealed will be final. Upon receipt of a timely appeal, a hearing on the appeal will be scheduled, and the City will mail written notice of the hearing date to the customer at least ten (10) days before the date of the hearing. Pending receipt of a written appeal or pending a hearing pursuant to an appeal, the Director may take appropriate steps to prevent the unauthorized use of water as appropriate to the nature and extent of the violation and the current declared water shortage condition.

16.01.150 ADDITIONAL ENFORCEMENT AUTHORITY.

In addition to the remedies referenced above, the Director is empowered to pursue any additional remedies necessary, including criminal, civil and administrative remedies listed in Title 4 of the Santa Cruz Municipal Code, to correct a violation of this chapter.

16.01.160 SEVERABILITY.

If any portion of this chapter is held to be unconstitutional, it is the intent of the City Council that such portion of the chapter be severable from the remainder and that the remainder be given full force and effect."

SECTION 3: This ordinance shall take effect 30 days after final adoption.

ORDINANCE NO. 2010-12

PASSED FOR PUBLICATION this 25th day of May, 2010, by the following vote:

AYES: Councilmembers Lane, Beiers, Madrigal, Robinson; Mayor Rotkin.

NOES: None.

ABSENT: Councilmember Mathews, Vice Mayor Coonerty.

DISQUALIFIED: None.

APPROVED: _____



Mayor

ATTEST: _____



City Clerk

PASSED FOR FINAL ADOPTION on this 8th day of June, 2010, by the following vote:

AYES: Councilmembers Lane, Beiers, Robinson; Vice Mayor Coonerty;
Mayor Rotkin.

NOES: None.

ABSENT: Councilmembers Mathews, Madrigal.

DISQUALIFIED: None.

APPROVED: _____



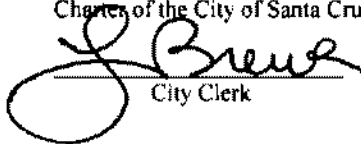
Mayor

ATTEST: _____



City Clerk

This is to certify that the above
and foregoing document is the
original of Ordinance No. 2010-12
and that it has been published or
posted in accordance with the
Charter of the City of Santa Cruz.



City Clerk

Chapter 16.01 WATER SHORTAGE REGULATIONS AND RESTRICTIONS

Sections:

16.01.010	Findings.
16.01.020	Declaration of water shortage.
16.01.030	Application of regulations.
16.01.040	Precedence of regulations.
16.01.050	Definitions.
16.01.055	Water department customer classifications/allocations.
16.01.060	Water waste prohibitions.
16.01.070	Stage 1: Water shortage alert.
16.01.080	Stage 2: Water shortage warning.
16.01.090	Stage 3: Water shortage emergency.
16.01.100	Stage 4: Severe water shortage emergency.
16.01.110	Stage 5: Critical water shortage emergency.
16.01.120	Exceptions.
16.01.130	Water shortage appeals.
16.01.140	Administrative enforcement.
16.01.150	Additional enforcement authority.
16.01.160	Severability.

16.01.010 FINDINGS.

Whereas, the city of Santa Cruz water system draws almost exclusively on local surface water sources, whose yield varies from year to year depending on the amount of rainfall received and runoff generated during the winter season; and

Whereas, the city water system is susceptible to water shortages in dry and critically dry years or in periods of prolonged regional drought when water conditions characterized by low surface flows in the north coast streams and San Lorenzo River sources, depleted storage in Newell Creek Reservoir, or both, reduce the available supply to a level that cannot support seasonal water demand; and

Whereas, on March 10, 2009, the city council of the city of Santa Cruz adopted an updated water shortage contingency plan that describes how the city will respond to future water shortages and lists the various actions the city would take to reduce water demand under different water shortage scenarios ranging from five percent or less up to and including a fifty percent seasonal water supply deficiency; and

Whereas California Water Code Sections [350](#) et seq. authorize water suppliers, after holding a properly noticed public hearing and after making certain findings, to declare a water shortage (emergency) and to adopt such regulations and restrictions to conserve the water supply for the greatest public benefit with particular regard for domestic use, sanitation, and fire protection; and

Whereas, the voluntary and mandatory water conservation measures and progressive restrictions on water use and method of use set forth herein provide an effective and immediately available means of

conserving water which is essential during periods of water shortage to ensure a reliable and sustainable minimum supply of water for the public health, safety, and welfare and to preserve valuable limited reservoir storage, avoid depleting water storage to an unacceptably low level, and thereby lessen the possibility of experiencing more critical shortages if dry conditions continue or worsen; and

Whereas, the usage allotments hereinafter established will equitably spread the burden of restricted and prohibited usage in a manner prescribed by the city's water shortage contingency plan over all city water department customers and other consumers of city water; and

Whereas, the purposes of this chapter are to conserve the water supply of the city of Santa Cruz for the greatest public benefit, to mitigate the effects of a water supply shortage on public health and safety and economic activity, and to budget water use so that a reliable and sustainable minimum supply of water will be available for the most essential purposes for the entire duration of the water shortage.

(Ord. 2010-12 § 2 (part), 2010).

16.01.020 DECLARATION OF WATER SHORTAGE.

The provisions of this chapter shall take effect whenever the director, upon engineering analysis of city water supplies, finds and determines that a water shortage exists or is imminent within the city of Santa Cruz water service area and a declaration of a water shortage is made by a resolution of the city council, and they shall remain in effect for the duration of the water shortage set forth in the resolution.

(Ord. 2010-12 § 2 (part), 2010).

16.01.030 APPLICATION OF REGULATIONS.

The provisions of this chapter shall apply to all persons using or consuming water both inside and outside the city and within the city water service area, and regardless of whether any person using water shall have a contract for water service with the city.

(Ord. 2010-12 § 2 (part), 2010).

16.01.040 PRECEDENCE OF REGULATIONS.

Where other provisions of the municipal code, whether enacted prior or subsequent to this chapter, are inconsistent with the provisions of this chapter, the provisions of this chapter shall supersede and control for the duration of the water shortage set forth in the resolution of the city council.

(Ord. 2010-12 § 2 (part), 2010).

16.01.050 DEFINITIONS.

- (a) "Director" refers to the director of the city of Santa Cruz water department.
- (b) "Water" refers to water produced and served by the city of Santa Cruz water department.
- (c) "City" refers to the city of Santa Cruz.

- (d) "Water department" refers to the city of Santa Cruz water department.
- (e) "Seasonal water demand" refers to the demand, measured in gallons, placed by customers on the city water supply between April 1st and October 31st each calendar year.
- (f) Issue/Declare. Whenever this chapter references the director's issuance or declaration of an alert, warning, emergency, or regulation, said alert, warning, emergency or regulation shall be put into effect by the placement of a legal advertisement in a newspaper of general circulation, by a posting on the city's Internet website and by a posting in the following public places: Santa Cruz City Hall, 809 Center Street, Santa Cruz; Santa Cruz Water Department Office, 212 Locust Street, Santa Cruz; Capitola City Hall, 420 Capitola Avenue, Capitola; and the Santa Cruz County Governmental Center, 701 Ocean Street, Santa Cruz. Any such alert, warning, emergency or regulation shall take effect upon the date of its publication in the Santa Cruz Sentinel.
- (g) "Customer" shall refer to any account customer of the city of Santa Cruz water department as well as to any consumer of city water who may not be a city of Santa Cruz water department account customer.
- (h) "Dry year" refers to the type of water year under the city's water year classification system, which begins October 1st and ends September 30th, in which the total annual discharge of the San Lorenzo River at Felton measures between twenty-nine thousand and forty-nine thousand acre-feet.
- (i) "Critically dry year" refers to the type of water year under the city's water year classification system, which begins October 1st and ends September 30th, in which the total annual discharge of the San Lorenzo River at Felton measures less than twenty-nine thousand acre-feet.
- (j) "Independent hearing officer" refers to a person appointed by the city to preside at administrative hearings pursuant to Title [4](#) of this code.

(Ord. 2015-07 § 1, 2015: Ord. 2010-12 § 2 (part), 2010).

16.01.055 WATER DEPARTMENT CUSTOMER CLASSIFICATIONS/ALLOCATIONS.

For determining a water department customer's water allocation during a declared water shortage under this chapter and for all other purposes under this title, the following customer classification definitions shall apply based on the customer's ownership or occupation of the following types of property served by the water department:

- (a) 1. Single-Family Residential. Individually metered residential dwelling units (regardless of housing type). This classification shall apply whether or not the residential dwelling unit is being put to a use other than, or in addition to, residential use, and whether or not the residential use is permanent or transient in nature including use as a vacation rental unit. A residential dwelling unit is considered an occupant's permanent residence when, on average, the occupant resides in the unit for at least twenty-one days within each monthly water service period.
- 2. Multiple-Family Residential. Any residential account with more than one residential dwelling unit served by one water meter. This classification shall apply whether or not the residential dwelling units are being put to a use other than, or in addition to, residential use and whether or

not the residential use is permanent or transient in nature including use as a vacation rental unit. A residential dwelling unit is considered an occupant's permanent residence when, on average, the occupant resides in the unit for at least twenty-one days within each monthly water service period.

3. Business. Commercial establishments including restaurants, hotel/motel, retail, medical, schools, offices, churches and mixed-use buildings. This category also includes county and state government accounts.
4. Industry/UCSC. This category is comprised of one primary customer, the University of California, Santa Cruz, and a small number of manufacturing businesses.
5. Municipal. This category is comprised of city-owned and operated facilities such as city offices, parks, police and fire stations, water and wastewater treatment plants, street medians, and parking lots.
6. Irrigation. Dedicated water services for landscape irrigation associated with large multiple residential complexes and homeowners associations, or with commercial, industrial, and institutional sites, including schools, churches, and parks.
7. Golf Irrigation. Accounts serving the two golf courses in the water service area.
8. Coast Irrigation. Agricultural accounts receiving untreated water on the north coast.
9. Miscellaneous. Other uses such as temporary construction accounts, hydrant meters, and bulk water sales.

(b) Residency. For the purpose of determining residential water rationing allotments under water shortage Stages 3, 4 or 5 of this chapter, the number of persons in each household shall be determined by calculating the number of that household's permanent residents. A permanent resident is an occupant who resides in the subject residential dwelling unit, on average, for at least twenty-one days within each monthly water service period.

(Ord. 2015-07 § 2, 2015).

16.01.060 WATER WASTE PROHIBITIONS.

It shall be unlawful during any water shortage stage for any person, firm, partnership, association, corporation, political entity (including the city) or any other water department customer to use water for any of the following:

- (a) Fire Hydrants. Use of water from any fire hydrant unless specifically authorized by permit from the city, except by regularly constituted fire protection agencies for fire suppression purposes, or for other authorized uses, including distribution system flushing, fire flow testing, and filling of approved vehicles for sewer system flushing, storm drain maintenance, and street sweeping purposes.
- (b) Watering/Irrigation. The watering of grass, lawn, groundcover, shrubbery, open ground, crops and trees, including agricultural irrigation, in a manner or to an extent that causes or allows excessive water flow or runoff onto an adjoining sidewalk, driveway, street, gutter or ditch.

- (c) Plumbing Leaks. The escape of water through leaks, breaks, or other malfunctions within the water user's plumbing or distribution system for any period of time after such break or leak should have reasonably been discovered and corrected. It shall be presumed that a period of twenty-four hours after the water user discovers such break, leak or malfunction, or receives notice from the city of such condition, whichever occurs first, is a reasonable time within which to correct such condition or to make arrangements for correction.
- (d) Washing of Exterior Surfaces. The washing of sidewalks, walkways, driveways, parking lots, patios, or other exterior surfaces unless the hose is equipped with an automatic shutoff nozzle.
- (e) Cleaning of Structures and Vehicles. The cleaning of building exteriors, mobile homes, cars, boats, and recreational vehicles unless the hose is equipped with an automatic shutoff nozzle.
- (f) Fountains and Decorative Water Features. The operation of a water fountain or other decorative water feature that does not use re-circulated water.
- (g) Commercial Car Washes. The washing of vehicles at a commercial car wash unless the facility utilizes water recycling equipment, or operates on a timer for a limited time period and shuts off automatically at the expiration of the time period.
- (h) Construction. The use of potable water for dust control or soil compaction purposes in construction activities where there is a reasonably available source of reclaimed water appropriate for such use.
- (i) The indiscriminate running of water or washing with water, not otherwise prohibited in this section which is wasteful and without reasonable purpose.

(Ord. 2010-12 § 2 (part), 2010).

16.01.070 STAGE 1: WATER SHORTAGE ALERT.

- (a) The director is empowered to issue a water shortage alert and to enforce the water shortage restrictions in this section upon finding that the magnitude of an anticipated water shortage, per the criteria delineated in the city's adopted water shortage contingency plan, will be five percent and a minimal consumer demand reduction is necessary to make more efficient use of water and appropriately respond to existing water supply conditions. In a Stage 1 water shortage, the city will enforce the following water shortage restrictions with the objective of realizing a seasonal water demand reduction of one hundred twenty-five million gallons or an average daily water demand reduction of six hundred thousand gallons.
- (b) During Stage 1, it shall be unlawful for any person, firm, partnership, association, corporation, political entity (including the city) or any other water department customer:
 - 1. To water or irrigate lawn, landscape, or other vegetated area between the hours of 10:00 a.m. and 5:00 p.m., except when performed with a bucket or watering can, or by use of a drip irrigation system or similar low volume, nonspray irrigation equipment, or for very short periods of time for the express purpose of allowing landscape contractors to adjust or repair an irrigation system;

2. To use a hose that is not equipped with a shutoff nozzle;
3. To use potable water to wash down hard or paved surfaces, including but not limited to sidewalks, walkways, driveways, parking lots, tennis courts, patios, or other paved surfaces, except when it is necessary to alleviate safety or sanitation hazards or to prepare paved surfaces for sealing;
4. To initially fill or to drain and refill residential swimming pools;
5. To serve water in a restaurant or other commercial food service establishment except upon the request of a patron; and/or
6. To operate a hotel, motel or other commercial lodging establishment without offering patrons the option to forego the daily laundering of towels, sheets and linens.

(Ord. 2010-12 § 2 (part), 2010).

16.01.080 STAGE 2: WATER SHORTAGE WARNING.

(a) The director is empowered to issue a water shortage warning and to enforce the water shortage restrictions in this section upon finding that the magnitude of an anticipated water shortage, per the criteria delineated in the city's adopted water shortage contingency plan, will be between five percent and fifteen percent and a moderate consumer demand reduction is necessary to make more efficient use of water and appropriately respond to existing water supply conditions. In a Stage 2 water shortage, the city will enforce the following water shortage restrictions with the objective of realizing a seasonal water demand reduction of up to three hundred seventy-five million gallons and an average daily water demand reduction of up to one million eight hundred thousand gallons.

(b) During Stage 2, it shall be unlawful for any person, firm, partnership, association, corporation, political body (including the city) or other water department customer:

1. To water or irrigate lawn, landscape, or other vegetated area between the hours of 10:00 a.m. and 5:00 p.m., except when performed with a bucket or watering can, or by use of a drip irrigation system or similar low volume, nonspray irrigation equipment, or for very short periods of time for the express purpose of allowing landscape contractors to adjust or repair an irrigation system;
2. To use a hose that is not equipped with a shutoff nozzle;
3. To use potable water to wash down hard or paved surfaces, including but not limited to sidewalks, walkways, driveways, parking lots, tennis courts, patios, or other paved surfaces, except when it is necessary to alleviate safety or sanitation hazards or to prepare paved surfaces for sealing;
4. To initially fill or to drain and refill residential swimming pools;
5. To serve water in a restaurant or other commercial food service establishment except upon the request of a patron;

6. To operate a hotel, motel or other commercial lodging establishment without offering patrons the option to forego the daily laundering of towels, sheets and linens;
7. To water or irrigate lawn, landscape, or other vegetated area on days of the week other than the two days of the week authorized and publicized by the director, except when performed with a bucket or watering can, or by use of a drip irrigation system or similar low volume, nonspray irrigation equipment, or for very short periods of time for the express purpose of allowing landscape contractors to adjust or repair an irrigation system. Hourly restrictions set forth in subsection (b)(1) continue to apply on authorized watering days. This provision shall not apply to commercial growers/nurseries or to residential vegetable gardens/edible plantings watered with a hose equipped with a shutoff nozzle;
8. To water or irrigate lawn, landscape, or other vegetated area using an automatic irrigation system for more than fifteen minutes per watering station per assigned day. This provision shall not apply to automatic irrigation systems exclusively using low output sprinkler equipment, including rotors, stream rotors, or micro-spray systems;
9. To wash the exterior of dwellings, buildings or structures (with the exception of window washing and preparation of property for painting or for sale);
10. To irrigate or water landscapes in a manner that conflicts with a customer's landscape irrigation water budget when such a budget is required by the director per the criteria delineated in the city's adopted water shortage contingency plan; and/or
11. To disobey water department direction to large commercial, industrial or irrigation customers using one thousand three hundred thirty-seven or more billing units (one million gallons) per year to conduct water use audits, to prepare water conservation plans and to submit progress reports, or to immediately repair water system leaks, including leaks attributable to faulty pipes or fixtures.

(Ord. 2010-12 § 2 (part), 2010).

16.01.090 STAGE 3: WATER SHORTAGE EMERGENCY.

- (a) The director is empowered to declare a water shortage emergency and to enforce the water shortage restrictions in this section upon finding that the magnitude of an anticipated water shortage, per the criteria delineated in the city's adopted water shortage contingency plan, will be between fifteen percent and twenty-five percent and a significant consumer demand reduction is necessary to make more efficient use of water and appropriately respond to existing water supply conditions. In a Stage 3 water shortage, the city will enforce the following water shortage restrictions with the objective of realizing a seasonal water demand reduction of up to six hundred twenty-five million gallons and an average daily water demand reduction of up to three million gallons.
- (b) During Stage 3, it shall be unlawful for any person, firm, partnership, association, corporation, political body (including the city) or other water department customer:
 1. To water or irrigate lawn, landscape, or other vegetated area between the hours of 10:00 a.m. and 5:00 p.m., except when performed with a bucket or watering can, or by use of a drip

irrigation system or similar low volume, nonspray irrigation equipment, or for very short periods of time for the express purpose of allowing landscape contractors to adjust or repair an irrigation system;

2. To use a hose that is not equipped with a shutoff nozzle;
3. To use potable water to wash down hard or paved surfaces, including but not limited to sidewalks, walkways, driveways, parking lots, tennis courts, patios, or other paved surfaces, except when it is necessary to alleviate safety or sanitation hazards or to prepare paved surfaces for sealing;
4. To initially fill or to drain and refill swimming pools;
5. To serve water in a restaurant or other commercial food service establishment except upon the request of a patron;
6. To operate a hotel, motel or other commercial lodging establishment without offering patrons the option to forego the daily laundering of towels, sheets and linens;
7. To water or irrigate lawn, landscape, or other vegetated area on days of the week other than the specified day(s) of the week authorized and publicized by the director, except when performed with a bucket or watering can, or by use of a drip irrigation system or similar low volume, nonspray irrigation equipment, or for very short periods of time for the express purpose of allowing landscape contractors to adjust or repair an irrigation system. Hourly restrictions set forth in subsection (b)(1) continue to apply on authorized watering days. This provision shall not apply to commercial growers/nurseries or to residential vegetable gardens/edible plantings watered with a hose equipped with a shutoff nozzle;
8. To water or irrigate lawn, landscape, or other vegetated area using an automatic irrigation system for more than ten minutes per watering station per assigned day. This provision shall not apply to automatic irrigation systems exclusively using low output sprinkler equipment, including rotors, stream rotors, or micro-spray systems;
9. To apply potable water to outdoor landscapes during and within forty-eight hours after measurable rainfall;
10. To wash the exterior of dwellings, buildings or structures (with the exception of window washing and preparation of property for painting or for sale);
11. To irrigate or water landscapes in a manner that conflicts with a customer's landscape irrigation water budget when such a budget is required by the director per the criteria delineated in the city's adopted water shortage contingency plan;
12. To disobey water department direction to large commercial, industrial or irrigation customers using one thousand three hundred thirty-seven or more billing units (one million gallons) per year to conduct water use audits, to prepare water conservation plans and to submit progress reports, or to immediately repair water system leaks, including leaks attributable to faulty pipes or fixtures;

13. To violate residential customer water rationing regulations, including regulations intended to preclude excessive water usage and specifying maximum water usage limitations, issued by the director in accordance with guidelines set forth in the city's adopted water shortage contingency plan; and/or

14. To disobey water department directives issued to commercial customers requiring the prominent placement of "Save Water" signage at specified locations at the customer's premises.

(Ord. 2015-07 § 3, 2015: Ord. 2010-12 § 2 (part), 2010).

16.01.100 STAGE 4: SEVERE WATER SHORTAGE EMERGENCY.

(a) The director is empowered to declare a severe water shortage emergency and to enforce the water shortage restrictions in this section upon finding that the magnitude of an anticipated water shortage, per the criteria delineated in the city's adopted water shortage contingency plan, will be between twenty-five percent and thirty-five percent and an extraordinary consumer demand reduction is necessary to make more efficient use of water and appropriately respond to existing water supply conditions. In a Stage 4 water shortage, the city will enforce the following water shortage restrictions with the objective of realizing a seasonal water demand reduction of up to eight hundred seventy-five million gallons and an average daily water demand reduction of up to four million two hundred thousand gallons.

(b) During Stage 4, it shall be unlawful for any person, firm, partnership, association, corporation, political body (including the city) or other water department customer:

1. To water or irrigate landscape or other vegetated area between the hours of 10:00 a.m. and 5:00 p.m., except when performed with a bucket or watering can, or by use of a drip irrigation system or similar low volume, nonspray irrigation equipment, or for very short periods of time for the express purpose of allowing landscape contractors to adjust or repair an irrigation system;
2. To use a hose that is not equipped with a shutoff nozzle;
3. To use potable water to wash down hard or paved surfaces, including but not limited to sidewalks, walkways, driveways, parking lots, tennis courts, patios, or other paved surfaces, except when it is necessary to alleviate safety or sanitation hazards or to prepare paved surfaces for sealing;
4. To fill or to top off any swimming pools, outdoor spas, wading pools, and ornamental water features;
5. To serve water in a restaurant or other commercial food service establishment except upon the request of a patron;
6. To operate a hotel, motel or other commercial lodging establishment without offering patrons the option to forego the daily laundering of towels, sheets and linens;
7. To water or irrigate landscape or other vegetated area on days of the week other than the specified day(s) of the week authorized and publicized by the director, except when performed with a bucket or watering can, or by use of a drip irrigation system or similar low volume,

nonspray irrigation equipment, or for very short periods of time for the express purpose of allowing landscape contractors to adjust or repair an irrigation system. Hourly restrictions set forth in subsection (b)(1) continue to apply on authorized watering days. This provision shall not apply to commercial growers/nurseries or to residential vegetable gardens/edible plantings watered with a hose equipped with a shutoff nozzle;

8. To water landscapes using automatic irrigation systems for more than ten minutes per watering station per assigned day. This provision does not apply to automatic irrigation systems using water-efficient devices, including but not limited to weather-based controllers, drip/micro-irrigation systems and stream rotor sprinklers;

9. To wash the exterior of dwellings, buildings or structures (with the exception of window washing and preparation of property for painting or for sale);

10. To irrigate or water landscapes in a manner that conflicts with a customer's landscape irrigation water budget when such a budget is required by the director per the criteria delineated in the city's adopted water shortage contingency plan;

11. To disobey water department direction to large commercial, industrial or irrigation customers using one thousand three hundred thirty-seven or more billing units (one million gallons) per year to conduct water use audits, to prepare water conservation plans and to submit progress reports, or to immediately repair water system leaks, including leaks attributable to faulty pipes or fixtures;

12. To violate residential customer water rationing regulations, including regulations intended to preclude excessive water usage and specifying maximum water usage limitations, issued by the director in accordance with guidelines set forth in the city's adopted water shortage contingency plan;

13. To disobey water department directives issued to commercial customers requiring the prominent placement of "Save Water" signage at specified locations at the customer's premises;

14. To violate commercial customer water rationing regulations, including regulations intended to preclude excessive water usage and specifying maximum water usage limitations, issued by the director in accordance with guidelines set forth in the city's adopted water shortage contingency plan;

15. To disobey a water department order to customers identified as "dedicated irrigation accounts" directing those customers to further limit their landscape irrigation and watering activity so as to preserve only the customers' most valuable trees and plants;

16. To water lawns or turf, unless such watering is authorized by the director in accordance with a landscape irrigation water budget and is consistent with the guidelines set forth in the city's adopted water shortage contingency plan;

17. To install new landscaping which requires any irrigation or watering;

18. To wash or clean vehicles, including but not limited to automobiles, trucks, vans, buses, motorcycles, boats, or trailers, including the washing of fleet vehicles and the washing of vehicles on dealer lots. This restriction will not apply to commercial car wash businesses which use recycled water; and/or

19. To exercise any rights conferred by hydrant and bulk water permits that were issued prior to the severe water shortage emergency declaration absent special permission granted by the director. Said special permission may be granted only for projects necessary to protect the public health, safety and welfare where no alternative to potable water exists and for emergency response purposes.

(Ord. 2010-12 § 2 (part), 2010).

16.01.110 STAGE 5: CRITICAL WATER SHORTAGE EMERGENCY.

(a) The director is empowered to declare a critical water shortage emergency and to enforce the water shortage restrictions in this section upon finding that the magnitude of an anticipated water shortage, per the criteria delineated in the city's adopted water shortage contingency plan, shall be between thirty-five percent and fifty percent and an extreme consumer demand reduction is necessary to make more efficient use of water and appropriately respond to existing water supply conditions. In a Stage 5 water shortage, the city will enforce the following water shortage restrictions with the objective of realizing a seasonal water demand reduction of up to one billion two hundred fifty million gallons and an average daily water demand reduction of up to six million gallons.

(b) During Stage 5, it is unlawful for any person, firm, partnership, association, corporation, political body (including the city) or other water department customer:

1. To water or irrigate any outdoor landscaping, unless such watering is authorized by the director and is consistent with the guidelines set forth in the city's adopted water shortage contingency plan;
2. To use a hose that is not equipped with a shutoff nozzle;
3. To use water for any outdoor washing purpose including commercial car washing, window washing, and paint preparation;
4. To fill or to top off any swimming pools, outdoor spas, wading pools, and ornamental water features;
5. To serve water in a restaurant or other commercial food service establishment except upon the request of a patron;
6. To operate a hotel, motel or other commercial lodging establishment without offering patrons the option to forego the daily laundering of towels, sheets and linens;
7. To use water for recreational purposes;
8. To operate public swimming pools;
9. To operate public showers;

10. To disobey water department direction to large commercial, industrial or irrigation customers using one thousand three hundred thirty-seven or more billing units (one million gallons) per year to conduct water use audits, to prepare water conservation plans and to submit progress reports, or to immediately repair water system leaks, including leaks attributable to faulty pipes or fixtures;
11. To violate residential customer water rationing regulations, including regulations intended to preclude excessive water usage and specifying maximum water usage limitations, issued by the director in accordance with guidelines set forth in the city's adopted water shortage contingency plan;
12. To violate commercial customer water rationing regulations, including regulations intended to preclude excessive water usage and specifying maximum water usage limitations, issued by the director in accordance with guidelines set forth in the city's December 2008 water shortage contingency plan;
13. To disobey water department directives issued to commercial customers requiring the prominent placement of "Save Water" signage at specified locations at the customer's premises;
14. To install new landscaping which requires any irrigation or watering; and/or
15. To exercise any rights conferred by hydrant and bulk water permits that were issued prior to the critical water shortage emergency declaration absent special permission granted by the director. Said special permission may be granted only for projects necessary to protect the public health, safety and welfare where no alternative to potable water exists and for emergency response purposes.

(Ord. 2010-12 § 2 (part), 2010).

16.01.120 EXCEPTIONS.

(a) The director, upon application made in writing by a customer on a form promulgated by the water department and accompanied by supporting documentation, shall be authorized to issue an exception from the strict application of any restriction, regulation or prohibition enforced pursuant to this chapter, upon the customer's production of substantial evidence demonstrating the existence of one or more of the following circumstances that are particular to that customer and which are not generally shared by other water department customers:

1. Exceptions Applicable to All Water Department Customers:
 - A. Failure to approve the requested exception would cause a condition having an adverse effect on the health, sanitation, fire protection, or safety of the customer or members of the public served by the customer;
 - B. Alternative restrictions to which the customer is willing to adhere are available that would achieve the same level of demand reduction as the restriction for which an exception is being sought and such alternative restrictions are enforceable by the water department;

- C. Circumstances concerning the customer's property or business have changed since the implementation of the subject restriction warranting a change in the customer's water usage allocation.
2. Exceptions Applicable Only to Water Department Nonresidential Customers. For purposes of this subsection a residential dwelling unit which is used as a vacation rental shall not be classified as a business.
- A. Strict application of the subject restriction, regulation or prohibition would impose a severe or undue hardship on a particular business customer or render it infeasible for a particular business customer or class of business customers to remain in operation;
 - B. A hospital or health care facility customer using industry best management practices is eligible for an exception upon demonstrating that the subject restriction, regulation or prohibition is interfering with or preventing it from providing health care service to its customers in accordance with industry hygiene, sanitation and health care standards; or
 - C. A business customer has already implemented environmental sustainability measures that have reduced water consumption to the maximum extent feasible. As used in this subsection the term "environmental sustainability measures" refers to installation of high efficiency plumbing fixtures, devices, equipment, and appliances, recycled water systems, and landscaping consisting exclusively of low-water-using plant materials using drip or similar high efficiency, nonspray irrigation systems, or to buildings that are designed, built, and continuously operated according to Leadership in Energy and Environmental Design (LEED) certification standards.

(b) In order to qualify for an exception, a customer must first complete a self water audit pursuant to standards and procedures promulgated by the water department. This audit shall be made part of the customer's exception application and water conservation measures indicated by the audit may be incorporated as conditions of approval to an exception in addition to any other conditions of approval imposed by the director in connection with the director's approval of the customer's exception application.

(Ord. 2015-07 § 4, 2015: Ord. 2010-12 § 2 (part), 2010).

16.01.130 WATER SHORTAGE APPEALS.

- (a) A water shortage appeal procedure is hereby established which shall apply upon the director's issuance of any water shortage declaration and the implementation of water shortage restrictions pursuant to Sections [16.01.070](#) through [16.01.110](#). Thereafter during the declared water shortage, independent hearing officers shall be appointed to hear and rule upon water shortage appeals filed in accordance with this section.
- (b) Any customer who considers an action taken by the director or an enforcement official under the provisions of this chapter, including actions on exception applications and the assessment of administrative penalties, to have been erroneously taken or issued may appeal that action or penalty in the following manner:

1. The appeal shall be made in writing, shall state the nature of the appeal specifying the action or penalty that is being appealed and the basis upon which the action or penalty is alleged to be in error. Penalty appeals shall include a copy of the notice of violation;
2. An appeal, to be effective, must be received by the director not later than ten business days following the date of the notice of violation or the date that the director took the action which is the subject of the appeal;
 - (A) A water service resident who is not an account customer may notify the water department of his or her intention to file a petition to force the resident's account customer to appeal an excess water use penalty within ten business days following the penalty;
 - (B) If the water department has been given a notice of intention to file a petition per subsection (b)(2)(A) by a water service area resident who is not an account customer, the appeal from the account customer must be received within fifteen business days after the account customer has been petitioned by the resident;
3. The director shall schedule the appeal for consideration by an independent hearing officer. The independent hearing officer shall hear the appeal within ninety days of the date of the appeal and issue its decision within thirty days of the date of the hearing;
4. The decision of the independent hearing officer shall be final. In ruling on appeals, the independent hearing officer shall strictly apply the provisions of this chapter, and shall not impose or grant terms and conditions not authorized by this chapter.

(Ord. 2015-07 § 5, 2015: Ord. 2010-12 § 2 (part), 2010).

16.01.140 ADMINISTRATIVE ENFORCEMENT.

- (a) Any person, firm, partnership, association, corporation, political entity or other water department customer violating any provision of this chapter may be assessed an administrative penalty.
- (b) Each and every day a violation of this chapter exists constitutes a separate and distinct offense for which an administrative penalty may be assessed.
- (c) Penalties. The purpose of the administrative penalties assessed pursuant to this section is to assure future chapter compliance by the cited customer through the imposition of increasingly significant penalties so as to create a meaningful disincentive to commit future chapter violations. In acknowledgment of the fact that the city's water is a scarce and irreplaceable commodity and that this chapter is intended to equitably distribute that commodity among water department customers and to assure that, to the extent feasible, city water is conserved and used only for purposes deemed necessary for public health and safety, the penalty schedule herein prescribed is not to be construed as creating a "water pricing" structure pursuant to which customers may elect to pay for additional water at significantly higher rates. To this end, a customer's repeated violation of this chapter shall result in either the installation of a flow restriction device or disconnection of the customer's property from the city's water service system at the customer's cost.

(d) Administrative penalties for failure to comply with water waste prohibition requirements in Section [16.01.060](#) or mandatory water use restrictions and regulations commencing with Stage 1 in Section [16.01.070](#) are as follows:

1. First Offense. Written notice of violation and opportunity to correct violation.
2. Second Offense. A second violation within the preceding twelve calendar months is punishable by a fine not to exceed one hundred dollars.
3. Third Offense. A third violation within the preceding twelve calendar months is punishable by a fine not to exceed two hundred fifty dollars.
4. Fourth Offense. A fourth violation within the preceding twelve calendar months is punishable by a fine not to exceed five hundred dollars. In addition to any fines, the director may order a water flow restrictor device be installed.
5. Large Customers. Administrative penalties for customers that use an average of one thousand three hundred thirty-seven billing units (one million gallons) or more per calendar year shall be triple the amounts listed above.
6. Discontinuing Service. In addition to any fines and the installation of a water flow restrictor, the director may disconnect a customer's water service for willful violations of mandatory restrictions and regulations in this chapter. Upon disconnection of water service, a written notice shall be served upon the customer which shall state the time, place, and general description of the prohibited or restricted activity and the method by which reconnection can be made.

(e) Excessive Water Use Penalties. An excessive use penalty shall be assessed where the customer, during any given billing cycle, uses more than the customer's water allotment per the director's water rationing regulations issued pursuant to this chapter commencing with Stage 3 in Section [16.01.090](#). Excess use penalties shall be in addition to ordinary water consumption charges, as follows:

1. One percent to ten percent over customer rationing allotment: not to exceed twenty-five dollars/CCF.
2. More than ten percent over customer rationing allotment: not to exceed fifty dollars/CCF.
3. In addition to any excess use penalties, the director may order a water flow restrictor device be installed and/or may disconnect a customer's water service for willful violations of the water rationing regulations in this chapter. Upon disconnection of water service, a written notice shall be served upon the customer which shall state the time, place, and general description of the prohibited or restricted activity and the method by which reconnection can be made.
4. The director is authorized to develop administrative policies and procedures for the waiver of excessive water use penalties.

(f) Cost of Flow Restrictor and Disconnecting Service. A person or entity that violates this chapter is responsible for payment of charges for installing and/or removing any flow-restricting device and for disconnecting and/or reconnecting service in accordance with the city's miscellaneous water service

fee resolution then in effect. The charge for installing and/or removing any flow restricting device must be paid before the device is removed. Nonpayment will be subject to the same remedies as nonpayment of basic water rates.

(g) Notice and Hearing. The director will issue a notice of violation by mail or personal delivery at least ten business days before taking any enforcement action described in subsection (d). Such notice must describe the violation and the date by which corrective action must be taken. A customer may appeal the notice of violation by filing a written notice of appeal with the city no later than the close of the business day before the date scheduled for enforcement action, accompanied by a twenty-five-dollar appeal fee. Any notice of violation not timely appealed will be final. Upon receipt of a timely appeal, a hearing on the appeal will be scheduled, and the city will mail written notice of the hearing date to the customer at least ten days before the date of the hearing. Pending receipt of a written appeal or pending a hearing pursuant to an appeal, the director may take appropriate steps to prevent the unauthorized use of water as appropriate to the nature and extent of the violation and the current declared water shortage condition.

(Ord. 2015-07 § 6, 2015: Ord. 2010-12 § 2 (part), 2010).

16.01.150 ADDITIONAL ENFORCEMENT AUTHORITY.

In addition to the remedies referenced above, the director is empowered to pursue any additional remedies necessary, including criminal, civil and administrative remedies listed in Title [4](#) of the Santa Cruz Municipal Code, to correct a violation of this chapter.

(Ord. 2010-12 § 2 (part), 2010).

16.01.160 SEVERABILITY.

If any portion of this chapter is held to be unconstitutional, it is the intent of the city council that such portion of the chapter be severable from the remainder and that the remainder be given full force and effect.

(Ord. 2010-12 § 2 (part), 2010).

The Santa Cruz Municipal Code is current through Ordinance 2016-07, passed May 24, 2016.

Disclaimer: The City Clerk's Office has the official version of the Santa Cruz Municipal Code. Users should contact the City Clerk's Office for ordinances passed subsequent to the ordinance cited above.

RESOLUTION NO. NS-29,012

RESOLUTION OF THE CITY COUNCIL OF THE CITY OF SANTA CRUZ AMENDING
RESOLUTION NO. NS-28,836 CONCERNING DROUGHT COST RECOVERY FEE

WHEREAS, Title 16 of the Santa Cruz Municipal Code Provides rules governing the administration and operation of the City's Water System, including identification of the various sources of authority to establish and amend rates, fees, and system development charges by Resolution; and

WHEREAS, on September 23, 2014, the City Council adopted Resolution No. NS-28,836 establishing new water rates and ready-to-serve charges; and

WHEREAS, this resolution pertains to Section 1, number 4, Drought Cost Recovery Fee rates only; and

WHEREAS, the City Council recognized the need to replenish water sales revenues lost due a water shortage declaration and instituted a Drought Cost Recovery Fee on September 23, 2014; and

WHEREAS, the maximum amount of revenue which can be collected through the Drought Cost Recovery Fee is tied to estimated annual revenue shortfalls effected by a water shortage stage declared by the City Council; and

WHEREAS, the language contained in the resolution regarding the Drought Cost Recovery Fee needs further clarification to be consistent with prior noticing and intent; and

WHEREAS, the City Council further finds that the rates established by Resolution No. NS-26,836 and as hereinafter set forth do not exceed the amount of the estimated costs required to provide the services for which the rates are levied; and

WHEREAS, the City Council further finds that the rates previously established to cover the estimated annual shortfall caused by a drought declaration are reasonable and required for the proper operation of the water system, and are exempt from the California Environmental Quality Act, pursuant to Section 21080(b)(8) of the Public Resources Code, because they are for the purposes of (1) meeting operating expenses, (2) purchasing or leasing supplies, equipment and materials, (3) meeting financial reserve requirements, and (4) obtaining funds for capital projects necessary to maintain service within existing service areas.

NOW, THEREFORE, BE IT RESOLVED by the City Council of the City of Santa Cruz as follows:

Section 1: WATER RATES AND CHARGES

The water rates for customers inside and outside of the City Limits are hereby amended to read as follows:

RESOLUTION NO. NS-29,012

4. The Drought Cost Recovery Fee maximum amounts set forth below are a fixed fee and are hereby established and shall be applicable for the full fiscal year (twelve months) following the water shortage declaration made by City Council. The maximum targeted cost recovery amount is indicated below and is linked to the water shortage stage declared by the City Council.

Service Size	Stage 1 – 5% Shortage	Stage 2 – 15% Shortage	Stage 3 – 25% Shortage	Stage 4 – 35% Shortage	Stage 5 – 50% Shortage
Maximum Targeted Cost Recovery	\$ 1,000,000	\$ 2,500,000	\$ 4,000,000	\$ 5,500,000	\$ 7,500,000
5/8-in	\$ 2.45	\$ 6.12	\$ 9.79	\$ 13.46	\$ 18.35
3/4-in	\$ 2.45	\$ 6.12	\$ 9.79	\$ 13.46	\$ 18.35
1-in	\$ 6.13	\$ 15.30	\$ 24.48	\$ 33.65	\$ 45.88
1 1/2-in	\$ 12.25	\$ 30.60	\$ 48.95	\$ 67.30	\$ 91.75
2-in	\$ 19.60	\$ 48.96	\$ 78.32	\$ 107.68	\$ 146.80
3-in	\$ 36.75	\$ 91.80	\$ 146.85	\$ 201.90	\$ 275.25
4-in	\$ 61.25	\$ 153.00	\$ 244.75	\$ 336.50	\$ 458.75
6-in	\$ 122.50	\$ 306.00	\$ 489.50	\$ 673.00	\$ 917.50
8-in	\$ 281.75	\$ 703.80	\$ 1,125.85	\$ 1,547.90	\$ 2,110.25
10-in	\$ 347.90	\$ 869.04	\$ 1,390.18	\$ 1,911.32	\$ 2,605.70

BE IT FURTHER RESOLVED that, except as amended by this resolution, all water-related fees and charges established by Resolution No. NS-28,836 and not amended herein shall not be affected by this Resolution.

Section 2. EFFECTIVE DATE.

This Resolution shall be in force and effect so as to appear in all billings from and after October 27, 2015.

RESOLUTION NO. NS-29,012

PASSED AND ADOPTED this 27th day of October, 2015, by the following vote:

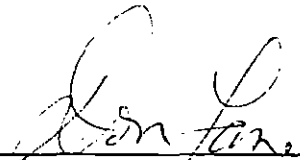
AYES: Councilmembers Chase, Terrazas, Comstock, Posner, Noroyan; Vice Mayor Mathews; Mayor Lane.

NOES: None.

ABSENT: None.

DISQUALIFIED: None.

APPROVED: _____


Mayor

ATTEST: _____


City Clerk Administrator

Chapter 16.02 WATER CONSERVATION

Sections:

- [16.02.010](#) Purpose.
- [16.02.020](#) Application of regulations.
- [16.02.030](#) Definitions.
- [16.02.040](#) Regulations.
- [16.02.050](#) Disconnection.
- [16.02.060](#) Reconnection.
- [16.02.070](#) Appeal.
- [16.02.080](#) Violation.
- [16.02.090](#) Enforcement.

16.02.010 PURPOSE.

The purpose of this chapter is to ensure that the water supply of the city of Santa Cruz is put to maximum beneficial use and that waste or unreasonable use or unreasonable method of use of water be prevented.

(Ord. 2003-13 § 2 (part), 2003).

16.02.020 APPLICATION OF REGULATIONS.

The provisions of this chapter shall apply to all persons using water, both in and outside the city and within city water service areas, and regardless of whether any person using water shall have a contract for water service with the city. Notwithstanding other code provisions inconsistent with this chapter, the provisions of this chapter shall supersede and prevail until termination of this chapter.

(Ord. 2003-13 § 2 (part), 2003).

16.02.030 DEFINITIONS.

For the purpose of this chapter, the following words shall have the meanings set forth below:

- (a) "Director" is the director of the water department of the city of Santa Cruz, or his or her designated representative.
- (b) "Drip irrigation" shall mean low-flow point specific irrigation systems that apply water directly to plant root zones through emitters, low volume micro-spray devices that are components of a drip irrigation system, and soaker hoses.
- (c) "Person" shall mean any individual, firm, partnership, association, corporation, or political entity.
- (d) "Water" shall mean any water obtained from the water department of the city of Santa Cruz.

(Ord. 2003-13 § 2 (part), 2003).

16.02.040 REGULATIONS.

It is unlawful for any person to use water for any of the following:

- (a) Fire Hydrants. Use of water from any fire hydrant unless specifically authorized by permit from the city, except by regularly constituted fire protection agencies for fire suppression purposes, or for other authorized uses, including distribution system flushing, fire flow testing, and filling of approved vehicles for sewer system flushing, storm drain maintenance, and street sweeping purposes.
- (b) Watering/Irrigation. The watering of grass, lawn, groundcover, shrubbery, open ground, crops and trees, including agricultural irrigation, in a manner or to an extent which allows excess water to run to waste.
- (c) Plumbing Leaks. The escape of water through leaks, breaks, or malfunction within the water user's plumbing or distribution system for any period of time within which such break or leak should reasonably have been discovered and corrected. It shall be presumed that a period of twenty-four hours after the water user discovers such break, leak or malfunction, or receives notice from the city of such condition, whichever occurs first, is a reasonable time within which to correct such condition or to make arrangements for correction.
- (d) Washing of Exterior Surfaces. The washing of sidewalks, walkways, driveways, parking lots, patios, or other exterior surfaces unless the hose is equipped with an automatic shutoff nozzle.
- (e) Cleaning of Structures and Vehicles. The cleaning of building exteriors, mobile homes, cars, boats, and recreational vehicles unless the hose is equipped with an automatic shutoff nozzle.
- (f) Fountains. The operation of an ornamental fountain, unless such water is recycled in the fountain.
- (g) Cooling. The use of water in new ice-making machines and any other new mechanical equipment that utilizes a single pass cooling system to remove and discharge heat to the sanitary sewer. Water used for all cooling purposes shall be recycled.
- (h) Commercial Car Washes. The washing of vehicles at a commercial car wash unless the facility utilizes water recycling equipment, or operates on a timer for a limited time period and shuts off automatically at the expiration of the time period.
- (i) Construction. The use of potable water for dust control or soil compaction purposes in construction activities where there is a reasonably available source of reclaimed water appropriate for such use.
- (j) Clothes Washing. Water for new non-recirculating industrial clothes wash systems.
- (k) The indiscriminate running of water or washing with water not otherwise prohibited in this section, which is wasteful, and without reasonable purpose.
- (l) Any other nonessential uses of water, as determined and publicly announced by the director, in response to below average water supply conditions that could result in carryover storage in Loch Lomond Reservoir being drawn down to levels that would trigger the declaration of a water supply emergency in the event of a subsequent dry year, including, but not limited to:

1. Use of potable water to irrigate turf, lawns, gardens, or ornamental landscaping between 10:00 a.m. and 5:00 p.m. unless by drip irrigation, or by hand watering with a quick acting positive shut off nozzle. (Exceptions may be made by the director for professional gardeners where there is no ability to not water between 10:00 a.m. and 5:00 p.m.).
2. Serving drinking water to any customer, unless expressly requested, by a restaurant, hotel, cafe, cafeteria, or other public place where food is sold, served, or offered for sale.

The water director shall provide notification to city council and the public before any such restrictions are put into effect.

(Ord. 2003-13 § 2 (part), 2003).

16.02.050 DISCONNECTION.

Any person in violation of the provisions of this chapter who failed to take corrective action within fifteen days of receiving the first notification of the violation shall be subject to disconnection of water service. Upon disconnection of water service a written notice shall be served upon the violator, or conspicuously posted at the entrance of the violator's premises, and shall state the time, place and general description of the violation and the method by which reconnection can be accomplished.

(Ord. 2003-13 § 2 (part), 2003).

16.02.060 RECONNECTION.

Where water service is disconnected, as authorized above, it shall be immediately reconnected upon correction of the condition or activity and the payment of the reconnection charge in an amount specified by resolution of the city council.

(Ord. 2003-13 § 2 (part), 2003).

16.02.070 APPEAL.

Any person who feels that the activity or condition, which resulted in the disconnection of water service pursuant to this chapter, did not constitute a violation of this chapter may appeal the disconnection to the city council in the manner specified in Chapter 1.16 of the Santa Cruz Municipal Code. If the city council finds that the activity or conduct did not constitute a violation of this chapter, the reconnection charge will be refunded.

(Ord. 2003-13 § 2 (part), 2003).

16.02.080 VIOLATION.

Any person violating this chapter shall be deemed guilty of an infraction. Any person violating this chapter shall be subject to criminal, civil, and/or administrative enforcement action as provided in Title 4 of the Santa Cruz Municipal Code. Each and every day a violation of this chapter exists constitutes a separate and distinct offense for which enforcement action may be taken.

(Ord. 2003-13 § 2 (part), 2003).

16.02.090 ENFORCEMENT.

All peace officers and persons authorized by law to issue citations within the water service area shall, in conjunction with duties imposed by the law, diligently enforce the provisions of this chapter.

Pursuant to the provisions of Section 836.5 of the State Penal Code, the following officers and employees of the city of Santa Cruz are hereby designated and authorized to issue citations for enforcement of this chapter:

Director of the water department;

Deputy director/Operations manager;

Water quality manager;

Customer service manager;

Utility supervisor;

Production superintendent;

Water conservation coordinator;

Utility service representative;

Water department employees designated by the director.

(Ord. 2003-13 § 2 (part), 2003).

The Santa Cruz Municipal Code is current through Ordinance 2016-07, passed May 24, 2016.

Disclaimer: The City Clerk's Office has the official version of the Santa Cruz Municipal Code. Users should contact the City Clerk's Office for ordinances passed subsequent to the ordinance cited above.



Information About Proposed Water Rate Increases

To Fund Water System Upgrades
August 2014

Learning From the Past; Preparing for the Future

The mission of the City of Santa Cruz Water Department is to provide a safe, clean and continuous supply of water that meets or exceeds local, State and Federal standards for public health and environmental quality, and to provide courteous, responsive and efficient service in the most cost-effective manner to our customers. The Department provides water to 93,000 customers, 24 hours a day, 365 days per year and there hasn't been a lapse in our service delivery in over 100 years.

There have been a lot of changes to the process of producing and delivering water. A century ago, Santa Cruz's water pipes were hollowed out redwood logs.

Raw water from local rivers and creeks was piped directly to homes, without any treatment. Water was taken from rivers and creeks without concern that there wouldn't be enough left for fish.

A lot has been learned from the past to help us now prepare for the future. Our past tells us that our water sources aren't always plentiful, so we need to conserve what we have. With dramatically increased regulations to treat and store water, we've learned how critical it is for us to maintain and improve the facilities we have. We've learned that our consumption of water has had negative impacts on critical habitat for endangered

species. And we've learned that our local rainfall, which provides 100% of our water supply, isn't as predictable as it was in years past.

Our community's health, safety, economy and quality of life rely on our water supply. Local water infrastructure needs to be updated so we don't waste precious drops of water and to ensure continued service efficiency. The water treatment plant needs to be retrofitted so we are prepared to comply with changing processes and regulations to effectively treat water. And pipes and delivery systems that have far outlived their lifespans need to be replaced.

www.cityofsantacruz.com/waterrates



Proposed Rate Increases

Collecting, treating and delivering water is a capital-intensive service. We're proposing a rate increase over the next five years.

What will the proposed rate increases look like?

Customers currently pay a monthly "Ready to Serve" charge, which is a service charge to cover part of the fixed costs of delivering water. This service charge is currently approximately \$17 to \$22 per month for residential customers and we are proposing to increase it by 10% each year for the next five years. Customers also pay for the volume of water consumed, which is currently in the range of \$1.50 to \$9.00 per unit (a unit is 748 gallons of water) for residential customers. The rate for the volume of water is proposed to increase 10% each year for the next five years. (See enclosed proposed rate and fee schedules.)

The City is also proposing a Drought Cost Recovery fee for the next two years. Under curtailment and rationing, customers use less

water and the Water Department earns less revenue. However, it still costs the Department just as much to operate the water delivery system – those costs don't decrease because most of the expense for delivering water is in system infrastructure.

For each stage of water shortage during drought conditions, Water Department revenue declines over \$1 million dollars, combined with increased costs for implementing curtailment and rationing, while most Water Department costs for continued operations, maintenance and capital replacement of the water system remain fairly constant. The current Stage 3 water shortage, for example, has resulted in approximately \$3 million dollars in lost revenue, combined with additional costs related to implementing Stage 3 rationing. In order to cover the cost of Department operations, maintenance and capital depreciation during periods of reduced consumption, the proposed rate increase includes

Drought Cost Recovery fee that is progressively higher for each stage of water shortage, as shown on the proposed fee schedule below.

The proposed Drought Cost Recovery Fee will be assessed on a monthly basis and would be implemented for the full fiscal year.

What will you get for your money?

In addition to funding ongoing Water Department operations, administration and future planning, during the next five years, the Water Department proposes to make significant investments in upgrading and rehabilitating your water delivery system. While still functional, most of the system is many decades old and things are wearing out. In addition, there are many new regulations for treating water that didn't exist when our system was built. You can think of our system like a classic car; still a solidly built machine, but continually requiring replacements and upgrades to keep it running smoothly.

The projects that the water department will be undertaking to upgrade, improve and maintain the water system are as follows. These projects are proposed to be funded through a rate increase.

PROJECT	FY 2015	FY 2016	FY 2017	PROJECT TOTALS 2008-2017
North Coast System Rehabilitation	\$8.9 million		\$1 million	\$14.1 million
Graham Hill Water Treatment Plant Upgrades	\$14.4 million			\$15.8 million
Bay Street Reservoir Tank Construction	\$6.1 million			\$26.3 million
Water Main Replacement Projects	\$2.6 million	\$2.6 million	\$2.6 million	\$12.1 million
Other: Storage Tank Rehab, Well and Pump Station Rehab, Facility Improvements	\$7.7 million			\$47.9 million

Water System Upgrade Projects

North Coast System Rehabilitation

The Santa Cruz Water Department has operated and maintained the 18-mile-long North Coast system since the 1880s. Diversion structures ranging in age from approximately 80 years to over 120 years direct flows from North Coast sources (including Liddell Springs and Reggiardo, Laguna and Majors creeks,) into a pipe system, which conveys water by gravity to the Coast Pump Station adjacent to the City's San Lorenzo River intake. The Coast Pump Station lifts water to the Graham Hill Water Treatment Plant where it is treated and delivered to customers. The North Coast sources rely on rainfall and groundwater to furnish up to 30% of the City's overall water production and this water is the City's highest quality water. A significant portion of the 18-miles of pipeline is approaching, or has exceeded, its lifespan. This aging infrastructure is prone to higher levels of maintenance and an increased potential for failure. This \$45 million project is segmented into 6 phases to be completed over approximately 15 years. Phases 1 and 2 were completed between 2006 and 2012; the City is currently working on Phase 3.

Graham Hill Water Treatment Plant Upgrades

The Graham Hill Water Treatment Plant (GHWTP) was commissioned in 1960 and has undergone expansion and improvements over the last five decades. A series of recent studies have identified a number of projects that are

necessary to meet complex water quality regulations and plant reliability goals. The priority project includes rehabilitation of the existing filters and filter bays. Valued at \$4.5 million, this project consists of structural improvements to the filter and drain system infrastructure and associated piping, valve, and electrical and instrumentation improvements. Construction of the project is scheduled to begin in fall 2014. The project is tentatively scheduled to be completed by October 2015. Future proposed projects include rehabilitation of various other tanks and basins as well as their mechanical, electrical and communications components.

Bay Street Reservoir

The Bay Street Reservoir was originally constructed in 1924 to hold untreated water from North Coast water sources. The reservoir originally held approximately 35 million gallons of water. The reservoir was converted to store treated water and a roof was added in 1976 to protect finished drinking water from airborne contaminants. Due to growing risks of the aging infrastructure and the management practice of reducing the overall volume of stored treated water to reduce stagnation and byproduct build-up the Water Department demolished the original Bay Street Reservoir in fall 2007. A \$26 million project to construct two replacement 6-million gallon tanks at the facility is currently underway, with the first tank placed into service in October 2013. The second tank is under construction and expected to be complete in spring of 2015.

Water Main Replacement

The Santa Cruz water delivery system is made up of over 300 miles of water mains. This includes over 30 miles of large diameter mains from the City's water sources, such as Loch Lomond Reservoir, and more than 250 miles of water mains within City and County streets, which deliver treated drinking water to customers. Guided by water industry standards, the Water Department reserves funds to replace 2-4 miles of aging water mains each year. Many factors guide replacement priority including the need to maintain water system reliability and water quality, deliver adequate fire flows, improve circulation, and reduce maintenance costs by coordinating street paving with other planned projects.

Storage Tank Rehabilitation, Facilities Improvements, Well and Pump Station Rehabilitation

These projects will include the rehabilitation of a storage tank for treated water located on Empire Grade, an evaluation of the intake system on the San Lorenzo River, replacement of several pumps and motors throughout the system and completion of the Beltz 12 well project.



Rates Inside the City of Santa Cruz

Inside City Ready-to-Serve Rates (fixed)

Meter Size	Current Rates	FY 2015 Effective October 2014	FY 2016 Effective July 2015	FY 2017 Effective July 2016	FY 2018 Effective July 2017	FY 2019 Effective July 2018
5/8-in	\$17.41	\$19.16	\$21.08	\$23.19	\$25.51	\$28.07
3/4-in	\$17.41	\$19.16	\$21.08	\$23.19	\$25.51	\$28.07
1-in	\$43.52	\$47.88	\$52.67	\$57.94	\$63.74	\$70.12
1 1/2-in	\$87.05	\$95.76	\$105.34	\$115.88	\$127.47	\$140.22
2-in	\$139.27	\$153.20	\$168.52	\$185.38	\$203.92	\$224.32
3-in	\$261.14	\$287.26	\$315.99	\$347.59	\$382.35	\$420.59
4-in	\$435.24	\$478.77	\$526.65	\$579.32	\$637.26	\$700.99
6-in	\$870.46	\$957.51	\$1,053.27	\$1,158.60	\$1,274.46	\$1,401.91
8-in	\$2,002.05	\$2,202.26	\$2,422.49	\$2,664.74	\$2,931.22	\$3,224.35
10-in	\$2,472.09	\$2,719.30	\$2,991.23	\$3,290.36	\$3,619.40	\$3,981.34

Inside City Commodity Rates (volumetric)

	Current Rates	FY 2015 Effective October 2014	FY 2016 Effective July 2015	FY 2017 Effective July 2016	FY 2018 Effective July 2017	FY 2019 Effective July 2018
SFR	\$ / ccf	\$ / ccf	\$ / ccf	\$ / ccf	\$ / ccf	\$ / ccf
Tier 1	\$1.57	\$1.73	\$1.91	\$2.11	\$2.33	\$2.57
Tier 2	\$4.00	\$4.40	\$4.84	\$5.33	\$5.87	\$6.46
Tier 3	\$5.14	\$5.66	\$6.23	\$6.86	\$7.55	\$8.31
Tier 4	\$7.05	\$7.76	\$8.54	\$9.40	\$10.34	\$11.38
Tier 5	\$8.79	\$9.67	\$10.64	\$11.71	\$12.89	\$14.18
Uniform (Non-SFR)	\$4.00	\$4.40	\$4.84	\$5.33	\$5.87	\$6.46
North Coast	\$1.27	\$1.40	\$1.54	\$1.70	\$1.87	\$2.06

Rates Outside the City of Santa Cruz

Outside City Ready-to-Serve Rates (fixed)

Meter Size	Current Rates	FY 2015 Effective October 2014	FY 2016 Effective July 2015	FY 2017 Effective July 2016	FY 2018 Effective July 2017	FY 2019 Effective July 2018
5/8-in	\$22.20	\$24.42	\$26.87	\$29.56	\$32.52	\$35.78
3/4-in	\$22.20	\$24.42	\$26.87	\$29.56	\$32.52	\$35.78
1-in	\$55.50	\$61.05	\$67.16	\$73.88	\$81.27	\$89.40
1 1/2-in	\$110.98	\$122.08	\$134.29	\$147.72	\$162.50	\$178.75
2-in	\$177.56	\$195.32	\$214.86	\$236.35	\$259.99	\$285.99
3-in	\$332.95	\$366.25	\$402.88	\$443.17	\$487.49	\$536.24
4-in	\$554.92	\$610.42	\$671.47	\$738.62	\$812.49	\$893.74
6-in	\$1,109.83	\$1,220.82	\$1,342.91	\$1,477.21	\$1,624.94	\$1,787.44
8-in	\$2,553.34	\$2,808.68	\$3,089.55	\$3,398.51	\$3,738.37	\$4,112.21
10-in	\$3,151.92	\$3,467.12	\$3,813.84	\$4,195.23	\$4,614.76	\$5,076.24

Outside City Commodity Rates (volumetric)

	Current Rates	FY 2015 Effective October 2014	FY 2016 Effective July 2015	FY 2017 Effective July 2016	FY 2018 Effective July 2017	FY 2019 Effective July 2018
SFR	\$ / ccf	\$ / ccf	\$ / ccf	\$ / ccf	\$ / ccf	\$ / ccf
Tier 1	\$2.00	\$2.20	\$2.42	\$2.67	\$2.94	\$3.24
Tier 2	\$5.10	\$5.61	\$6.18	\$6.80	\$7.48	\$8.23
Tier 3	\$6.55	\$7.21	\$7.94	\$8.74	\$9.62	\$10.59
Tier 4	\$8.98	\$9.88	\$10.87	\$11.96	\$13.16	\$14.48
Tier 5	\$11.21	\$12.34	\$13.58	\$14.94	\$16.44	\$18.09
Uniform (Non-SFR)	\$5.10	\$5.61	\$6.18	\$6.80	\$7.48	\$8.23

Drought Cost Recovery Fees & Water Rate Comparison

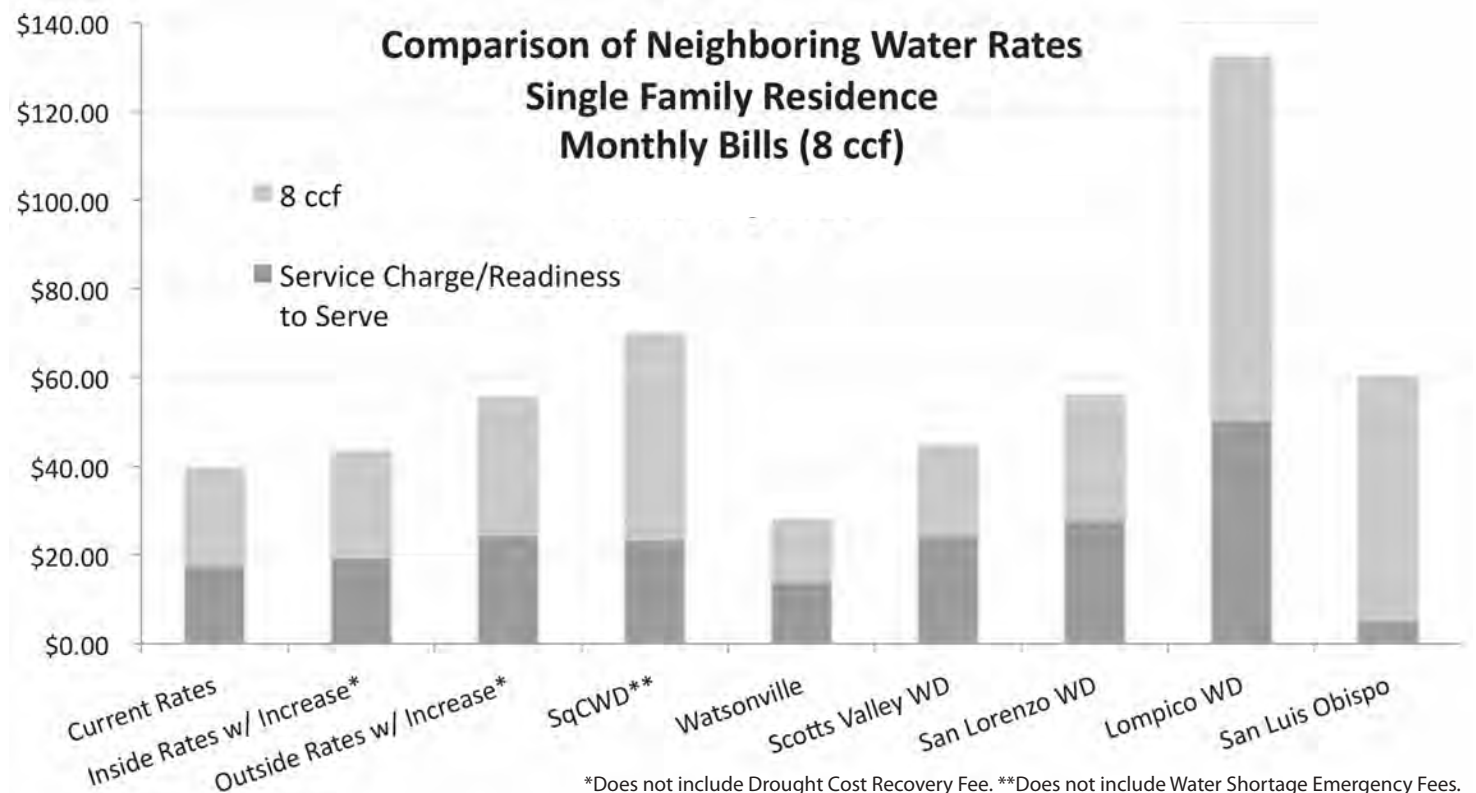
Proposed Drought Cost Recovery Fees

DROUGHT STAGE	CUTBACK REQUIRED	MAXIMUM TARGETED COST RECOVERY	3/4-INCH OR 5/8-INCH DROUGHT RECOVERY FEE
Stage 1	5%	\$1,000,000	\$2.45
Stage 2	15%	\$2,500,000	\$6.12
Stage 3	25%	\$4,000,000	\$9.79
Stage 4	35%	\$5,500,000	\$13.46
Stage 5	50%	\$7,500,000	\$18.35

The proposed Drought Cost Recovery Fee will be assessed on a monthly basis and would be implemented for the full fiscal year

Inside and Outside City Drought Cost Recovery Fee Ready-to-Serve Rates (fixed)

DROUGHT FEES	FY 2015 – EFFECTIVE OCTOBER 2014	FY 2016 – EFFECTIVE JULY 2015
ON RTS		
5/8-IN	\$7.37	\$2.45
3/4-IN	\$7.37	\$2.45
1-IN	\$18.43	\$6.13
1 1/2-IN	\$36.85	\$12.25
2-IN	\$58.96	\$19.60
3-IN	\$110.55	\$36.75
4-IN	\$184.25	\$61.25
6-IN	\$368.50	\$122.50
8-IN	\$847.55	\$281.75
10-IN	\$1,046.54	\$347.90
COMMODITY	\$0 / CCF	\$0 / CCF



Notice of Public Hearing

The City Council for the City of Santa Cruz will hold a Public Hearing Tuesday, September 23, 2014, during the regular meeting of the City Council at 7:00 pm.

The City Council will consider adoption of a proposed water rate increase affecting all water customers. Interested persons are encouraged to attend and comment on the issues being discussed. The meeting will be held in City Council Chambers at 809 Center Street.

Written protests: Any property owner or a tenant who is a customer of the Water Department may protest the proposed water rates. Only one written protest per parcel, filed by an owner or a tenant who is a customer, will be counted. Only written and signed protests that include the writer's address and/or assessor parcel number will be counted to determine whether a majority protest to the proposed water rate increase exists. Written protests may be mailed or hand delivered to the Mayor and Council of Santa Cruz at 809 Center Street, Room 10, Santa Cruz, CA 95060.

If you oppose the proposed rate increases, your protest must be submitted in writing to be counted, even if you plan to attend the Public Hearing. To be counted, the protest must: 1) be in writing; 2) state opposition to the proposed rate increase; 3) identify the parcel by assessor's parcel number or street address; 4) include the original signature of the owner of record or a tenant who is a customer of the Water Department submitting the protest; 5) be received before the conclusion of the Public Hearing on September 23, 2014. The meeting will be held in City Council Chambers at 809 Center Street.

For more information, visit www.cityofsantacruz.com/waterrates.



Santa Cruz Water District
212 Locust Street
Santa Cruz, CA 95060

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Notice of Public Hearing
Proposed Water Rates
Affecting Your Area



CITY OF SANTA CRUZ WATER DEPARTMENT

LONG RANGE FINANCIAL PLAN



JUNE 2016

LONG RANGE FINANCIAL PLAN

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Executive Summary

The Long Range Financial Plan (LRFP or Financial Plan) was developed to ensure the financial sustainability of the City of Santa Cruz's Water Enterprise Fund during the ten year period 2016 – 2026. This Financial Plan is specifically designed to support the continued operations and maintenance of the water system and its ability to serve the community with a high quality and reliable water supply, and to lay out the funding strategy that will be needed to finance major capital investments in water system infrastructure and the construction of a water supply augmentation project.

To prepare this Financial Plan, the Water Department and its consultants Raftelis Financial Consultants and Public Financial Management developed a series of financial planning inputs and outputs including:

- Prepared annual Operations and Maintenance Budgets for the Water Department;
- Developed a 10 Year Capital Improvement Plan;
- Integrated the Department's financial planning with existing Financial Policies and Goals, including developing a new financial policy on debt service coverage ratios and providing a strategy for fully funding all reserves;
- Projected revenue requirements for the 10 year period July 1, 2016 through June 30 2026;
- Completed a comprehensive Cost of Service Analysis;
- Identified a financing strategy that combines debt financing and pay-as-you-go investments to support the implementation of the 10 Year Capital Improvement Program;
- Updated Water Rate Structures, including considering the impacts to customers or a range of rate structure options; and
- Developed recommended Water Rates to implement the recommended water rate structure and meet the identified revenue requirements.

Capital investments of \$127.9 million are planned for the next five years from Fiscal Year (FY) 2017 through FY 2021, with 33% of those costs (\$42 Million) required to comply with state regulatory requirements. The CIP for FY 2022 through FY 2026 requires an additional investment of \$169 million for a ten year CIP total of \$296.9 million.

Using the revenue requirements data developed as part of the financial planning work, a five-year schedule of water rates is proposed for implementation. The proposed water rate structure includes the following assumptions and provisions:

- For the purposes of rate development, assume that the amount of water to be sold during the five-years covered by the proposed rates is 2.5 billion gallons per year.
- Adopt a rate structure that collects enough fixed fee revenue to recover the revenue necessary to cover the cost of meter reading, meter maintenance, billing preparation and distribution, and customer service. For FY 2017 this amounts to about 10% of total operating costs. Adopt volume-based user rates to collect the remaining revenues.
- Create a new fee called the Infrastructure Reinvestment Fee (IRF). The purpose of this fee is to help communicate to customers what their rate dollars are paying for which, in this case, involves major reinvestments in existing water system infrastructure. This fee would generate the revenues needed to pay for “pay-as-you-go” capital investments and debt service for capital projects. The cost to customers of this fee would be based on customer water use which, again, supports achievement of high priority pricing objectives.
- Acknowledge and mitigate for the risks to revenue stability associated with moving to a more volume based rate using two strategies:
 1. Maintaining the conservative assumption at 2.5 billion gallons per year;
 2. Beginning with the planned July 1, 2018 rate increase, apply a \$1.00 surcharge per unit of water consumption (a hundred cubic feet or CCF) to increase the amount of the Rate Stabilization Reserve from the current minimum level of \$2.3 million to a total of \$10 million. In any normal water year where 2.5 billion gallons of water is not sold, the revenue shortfall associated with this situation would be covered by resources from this fund.

This Financial Plan lays out a road map for the Department and informs policy makers and the community about what it will take for the Department to develop and operate the water system needed to deliver service to 95,000 customers in northern Santa Cruz county.

In addition to three appendices that provide some additional details, a Glossary of terms can be found at the end of the Plan.

1. INTRODUCTION

This Long Range Financial Plan includes a ten year financing strategy with a specific financial plan for the first five year period. Overall, the Financial Plan is intended to support the City of Santa Cruz Water Department in achieving the following goals:

- **Address the repair and rehabilitation of critical infrastructure and the needed augmentation of the City's available water supply;**
- **Establish and maintain financial policies, reserve levels, and stable revenues needed to ensure financial sustainability and provide flexibility to adapt to unforeseen circumstances or challenges;**
- **Maintain the credit rating needed to support the Department's ability to debt finance the major capital investments and reinvestments needed to ensure supply and system reliability;**
- **Maintain reasonable rates in the near and medium term;**
- **Achieve an equitable allocation of capital costs/charges between current and future system users; and**
- **Manage rates in a predictable and reasonably stable manner.**

Working together with its consultants, Public Financial Management (PFM) and Raftelis Financial Consultants (Raftelis), a financial planning model was created to allow the Department to project operating and capital budgets and forecast annual revenue requirements. These projections include:

- **Revenues needed to cover debt service payments for the financing expected to be used to fund capital investments;**
- **Assumptions about how much of the capital program will be cash (pay-as-you-go funding) financed versus debt financed; and**
- **Funds required to meet financial reserve targets.**

Raftelis developed proposed water rates using these revenue projections, the Cost of Service Analysis, and Rate Structure Redesign work they completed during the fall and winter of 2015. Based on input received from the Water Commission and City Council in March 2015, priority objectives for pricing water were established to include:

- Revenue sufficiency,
- Promotes efficiency;
- Perceived to be fair by the public;

- Affordable for essential uses,
- Revenue stability,
- Understandable by customers,
- Promotes conservation, and
- Rate stability.

2. BACKGROUND

The Santa Cruz Water Department is an entirely self-funded operation. User rates, fees, and charges are the source of all revenues used to support the ongoing operation, maintenance, planning, management, and capital investments needed to deliver water to some 95,000 water users every day.

The unrestricted fund balance of the Water Operating fund (Fund 711) has historically been strong, but has been declining during the past four fiscal years. A major cause of this decline is cash funding of large Capital Improvement Program (CIP) projects such as the \$26 million reconstruction of the Bay Street Reservoir.

The customer base is stable, primarily residential and reasonably diverse with the top 10 customers accounting for only 11% of total operating revenues. The service area economy is also stable and anchored by the University of California at Santa Cruz.

The three primary cost drivers of the LRFP include the following;

- **Capital projects to comply with State regulatory requirements;**
- **Capital projects to address infrastructure reinvestment and rehabilitation of major elements of the water system; and**
- **One or more capital projects to augment water supply that will result from implementing the recommendations of the Water Supply Advisory Committee.**

1.1 PLANNED CAPITAL INVESTMENTS

Capital investments of \$127.9 million are planned for the next five years from Fiscal Year (FY) 2017 through FY 2021, with 33% of those costs (\$42 Million) required to comply with state

regulatory requirements. The CIP for FY 2022 through FY 2026 requires an additional investment of \$169 million¹ for a ten year CIP total of \$296.9 million.

Capital projects planned for over the ten year period include:

- **PROJECTS FOCUSED ON EITHER REHABILITATING OR REPLACING EXISTING FACILITIES:**
 - Felton Diversion Dam and Pump Station
 - Laguna Dam
 - Majors Creek Diversion
 - San Lorenzo River Diversion and Tait Wells
 - Newell Creek Pipeline (between Newell Creek Dam and the Graham Hill Water Treatment Plant via Felton)
 - Newell Creek Dam Inlet/Outlet Pipeline – a project required to meet state regulatory requirements
 - Additional Phases of the North Coast Pipeline Replacement Project
 - Graham Hill Water Treatment Plant Concrete Tanks
 - Graham Hill Water Treatment Plant Solids Handling
 - Distribution System Water Main Replacements
 - Recoating of University Reservoir Tanks No. 4 and 5
 - Pressure Regulating Stations
 - Beltz 11 Well Replacement
 - Water Treatment Upgrades
- **PROJECTS FOCUSED ON UPGRADING OR IMPROVING EXISTING FACILITIES:**
 - Advanced Metering Infrastructure
 - Loch Lomond Recreation ADA Improvements
 - Photovoltaic/Solar Projects
 - Building for Water Resources Staff
 - Security Camera and Building Access Upgrades
- **PROJECTS FOCUSED ON IMPLEMENTING THE RECOMMENDATIONS OF THE WATER SUPPLY ADVISORY COMMITTEE TO IMPROVE WATER SUPPLY RELIABILITY:**
 - Winter water harvest strategies including in lieu recharge and studies to evaluate and pilot test aquifer storage and recovery

¹ These figures are in inflation adjusted 2015 dollars

- o Study of options for the development and use of recycled water
- o Source water quality evaluation related to future potential water treatment requirements, especially as changing source water characteristics might affect water treatment requirements
- o Construction of one or some combination of water supply augmentation projects as needed to either increase available stored water by 2.4 billion gallons or provide an additional 3 to 4 million gallons per day source of supply to meet community needs during drought conditions.

The Department proposes to fund these projects with a combination of annual pay-as-you-go revenues and long-term debt.

The total capital investment for the 10 year planning horizon equals \$296.9 million.

1.2 CURRENT FINANCIAL PROFILE

In the spring of 2014, the Water Department worked with the City's Finance Department staff to refinance its one existing debt issue from 2006. This step was undertaken to deal with a declining fund balance and the looming impacts of drought-required reductions in water use. The goal of the refinancing was to lower the interest rate and establish a less constraining debt service coverage requirement.

Standard and Poor's Rating Service and Fitch Ratings were asked to provide credit ratings for the Water Department as part of the 2014 refinancing of its debt. A credit rating is useful when an agency needs to access capital markets and issue debt at lower interest rates than would be available without a credit rating. Higher credit ratings can reduce borrowing costs and generate more competition from investors.

The Department's historical credit rating has been AA (high quality). Following the credit rating agency review, Standard and Poor's Rating Service downgraded the utility's credit rating to AA- with a Negative Rating Outlook. Fitch Ratings went farther, providing a rating of A+ (upper medium grade), two steps down from the Department's former AA rating. Both Rating Agencies cited the lack of a recent rate increase, the Department's declining fund balance, in insufficient debt service coverage, and the pending drought as reasons for their views of the Department's creditworthiness.

In the summer of 2015, Standard & Poor's revisited the Water Department's rating. This review took into account the City's action on a five-year program of rate increases in September 2014,

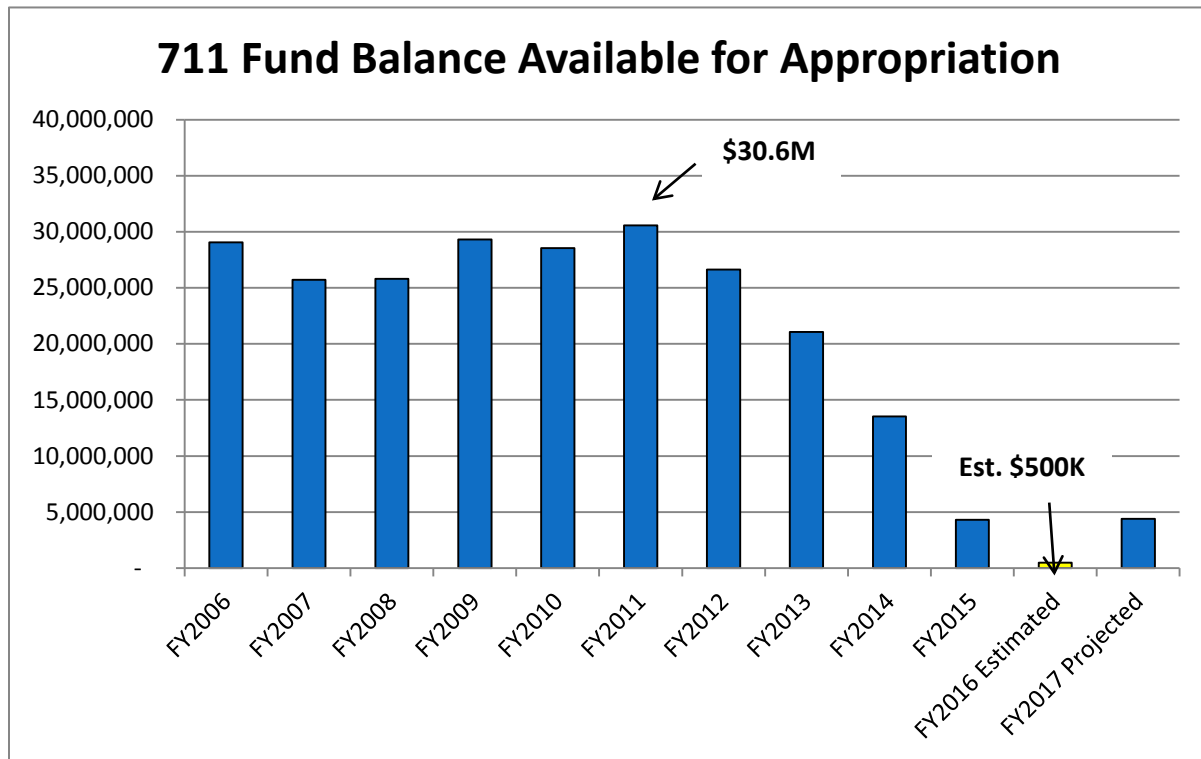
the utility's and the community's positive response to required water rationing, and the progress being made on the community-based water supply planning process. Standard and Poor's chose to retain the previous AA- rating but revised its rating outlook from Negative to Stable. Fitch Ratings is scheduled to revisit its rating for the Water Department in June of this year.

Annual rate increases of 10% have been approved through 2018. Water rate structure redesign and rate-setting work are currently underway and revised rates will be proposed for action by the Water Commission and the City Council during the winter and spring of 2016. The redesigned rates will replace and extend the original five-year rate increase program adopted in 2014.

For planning purposes, it has been assumed that the first year of any revised rate structure and increase will be applied on October 1, 2016. However, to address the immediate issue of declining cash and fund balance it is recommended that the originally planned 10% increase be implemented on July 1, 2016 and be replaced when the new structure is implemented in October. Remaining rate increases for years two through five of the new five-year rate program would be applied on July 1, in each year 2017, 2018, 2019, and 2020.

Figure 1 shows the Department's fund balance in Water Enterprise Operating Fund (Fund 711) demonstrating a high of \$30.6 Million in 2011 that has steadily declined in the last five years and is estimated to approach \$500,000 by end of FY 2016. The cause of the steady decline in this fund balance is cash financing the Department's Capital Improvement Program, reduced revenues resulting from restricting water use in the summers of 2014 and 2015, and rates not being set high enough to recover ongoing operating costs, even when water use is not restricted.

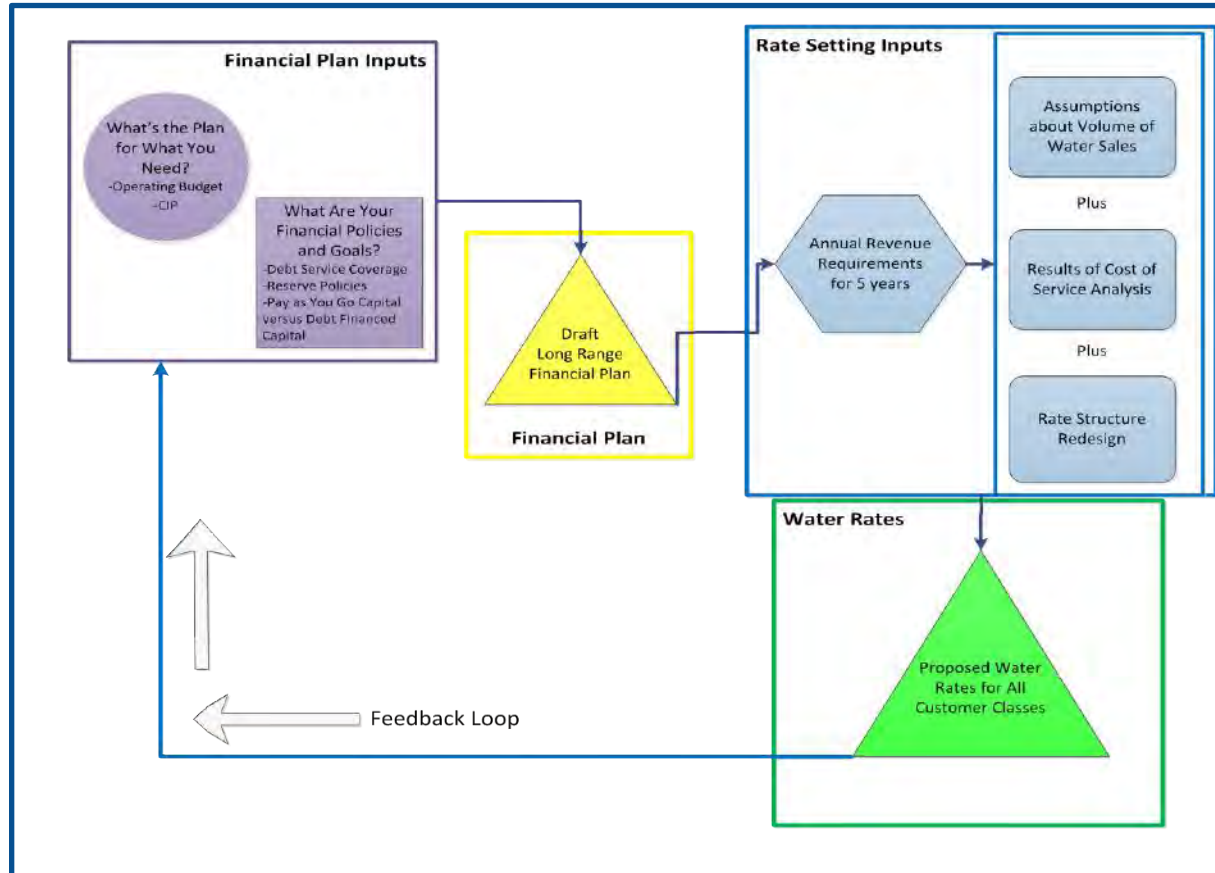
Figure 1
Operating Fund Balance



3. CONCEPTUAL MODEL FOR UTILITY FINANCIAL PLANNING

Financial planning and rate making for today's water utility involves a multi-stepped process depicted in Figure 2 below. The figure shows the inputs and outputs of the utility financial planning and rate making processes. It also shows the feedback loop between proposed rates, the end product of the process, and the organization's budget and CIP, which are key inputs to the beginning of the process.

Figure 2
Conceptual Model of Utility Financial Planning and Rate Making



Financial policies and financial indicators are a second key input in the financial planning process. These policies and indicators help measure financial performance. An organization's financial performance is a key factor in establishing its credit rating, which affects the interest rate that will be charged on borrowed funds.

4. INPUTS TO THE FINANCIAL PLAN

The draft Financial Plan and ten-year Pro Forma shown in Appendix A have been prepared using an Excel-based capital planning model developed by PFM. Briefly, the model uses as inputs the following financial data:

1. **The beginning fund balance for the Department’s Operating Fund (Fund 711),**
2. **Multi-year operating expenses, as modified by specific inflation factors,**
3. **Multi-year capital costs, including specific inflation factors, and**
4. **Multi-year debt service costs.**

The model then produces the following outputs:

1. **Multi-year revenue projections,**
2. **Financial performance metrics related to the debt service coverage ratio and financial reserve goals, and**
3. **The sizing and timing of new debt issues.**

4.1 KEY FINANCIAL POLICIES AND GOALS

Having and meeting goals for key financial performance indicators is central to good financial management. This Financial Plan is purposefully focused on defining and creating a clear and achievable method to meet a set of financial policies and performance indicators that will be necessary for the Department’s financial success.

4.1.1 UTILITY CREDIT RATINGS

One typical measure of a Utility’s financial performance is its credit rating. Table 1 below describes the factors considered by Credit Rating Agencies in assigning credit ratings.

Table 1
Rating Agency Factors Used in Assigning an Agency Credit Rating

Rating Factor	Rating Sub-Factors & Description
System Characteristics	• asset condition • service area wealth (median family income) • gross county product • unemployment rate • annual utility bill as a % of median family income • system size (O&M)
Financial Strength	• annual debt service coverage • days cash on hand • debt to operating revenues • debt to capitalization ratio
Management	• rate management • regulatory compliance • capital planning • financial planning (debt & investment policies) • operational risk (water supply adequacy)
Legal Provisions	• rate covenant • debt service reserve requirement

Credit rating agencies consider a variety of factors in assigning a credit rating, and utilities that have the best credit ratings typically will include policies that specifically address the financial strength metrics listed in Table 1.

4.1.2 FINANCIAL GOALS AND PERFORMANCE INDICATORS

Over the years, the City Council has established some financial performance metrics for the Water Utility, including a Rate Stabilization Reserve in 1993, and Operating and Emergency Reserves in 2014. As of June 30, 2015, the Rate Stabilization Reserve Fund balance was \$2.4 million and the Emergency Reserve Fund balance was \$600,000. A 90 Day Operating Reserve Fund was also created in September 2014, but was not funded at June 30, 2015.

The Council's intent in creating the Rate Stabilization Reserve² in 1993 was to "shield the Water Fund from the financial effects of extraordinary circumstances." As originally approved by the Council at the time, the rate stabilization reserve would have been used to help the Department deal with one or a combination of the following conditions:

- **Increased CIP or capital outlay expenditures due to an extraordinary non-recurring need or circumstance;**
- **A fluctuation in water consumption revenues creating an unanticipated shortfall, or**
- **Catastrophic losses as the result of a natural disaster.**

In the 23 years since the City Council created this \$2.3 million reserve, infrastructure and operating costs have increased substantially and in 2014 the Department recommended and the Council approved creating additional reserves. These additional reserves, one for 90 days of operating cash, and one to address natural disaster types of emergency conditions, effectively replaced the first and third purposes intended to be served by the original Rate Stabilization Reserve. These more substantial reserves also begin the process of moving the utility to a stronger financial position, which better prepares it to deal with future costs.

This Financial Plan incorporates and, in the Financial Plan implementation section later in this document, proposes a method to fund the following goals for key financial performance metrics:

- **Maintain the Rate Stabilization Reserve (Fund 713) of \$2.3 million;**
- **Maintain a Water Emergency Reserve Fund (Fund 717) at minimum level of \$3 million; and**
- **Create additional operating reserves equal to 180 days of operating expenses. This would be accomplished by Maintaining the new Water Operating Cash Reserve Fund (Fund 716) at the equivalent of 90 days of operating cash and maintaining a minimum fund balance in Operating Fund (Fund 711) at a minimum of an additional 90 days of operating cash.³**

Another key financial performance metric is a target for debt service coverage ratio (DSCR). The DSCR is a measure of net operating revenues to annual debt payments. The Water Department has issued relatively little debt over the past 20 years so hasn't formally established or used a debt service coverage ratio (DSCR) target in its financial planning. The

² See <http://www.cityofsantacruz.com/home/showdocument?id=3255>

³ In Fiscal 2017, 90 days of operating cash is equivalent to \$6.5 Million

bond covenant for utility debt issued in 2006 included a 1.25 DSCR. When that debt was refinanced in 2014, the DSCR was reduced to 1.15.

A financial plan that only supports meeting the legal minimum figure can put the utility at risk of technical default on its bonds if revenues are reduced by, say, drought conditions when water use restrictions are put into place. Establishing a target that is above the minimum legal requirement is a good idea because it builds into the system needed flexibility that makes the utility more financially resilient in the face of uncertainty. The LRFP specifically includes the following debt service coverage ratio target:

- **Maintain a minimum debt service coverage ratio target of 1.5, requiring that a ratio of 1.5 be maintained between annual net revenues and annual debt service.**

Typically the calculation of the debt service coverage ratio does not include funds held in reserve as including reserves in calculating the ratio could result in masking a structural problem in the way rates are set.

4.2 PROJECTED OPERATING BUDGETS

Table 2 shows anticipated operating and capital expenses for FYs 2017 through 2021. Appendix A includes the complete ten year Pro Forma from which the information in Table 2 was excerpted.

Table 2
Anticipated Expenses FY 2017 – 2021

Operating Expenses	2017	2018	2019	2020	2021
Personnel	\$12,741,984	\$13,868,008	\$15,086,021	\$15,882,276	\$16,733,349
Services, Supplies & Other	12,616,410	13,247,231	13,909,592	14,605,072	15,335,325
Capital Outlay	965,000	1,013,250	1,063,913	1,117,108	1,172,964
Total Operating	\$26,323,394	\$28,128,488	\$30,059,525	\$31,604,455	\$33,241,638

Operating costs have been developed based on very modest changes to staffing and departmental operations over time. The changes in Operating costs are based on the annual inflation factors shown in Table 3. These inflation factors are based on actual historical experience and long term industry trends.

Table 3⁴
Operating Budget Inflation Factors

Expense Category	Annual Inflation Factors (percent)		
	2017	2018	2019-2026
Salaries & Wages	3.0	3.0	3.0
Employee Benefits	9.0	9.0	9.0
Operating Supplies and Chemicals	9.2	5.0	5.0
Energy	9.1	5.0	5.0
All Other Categories	3.0	3.0	3.0

1.3 CAPITAL IMPROVEMENT PLAN

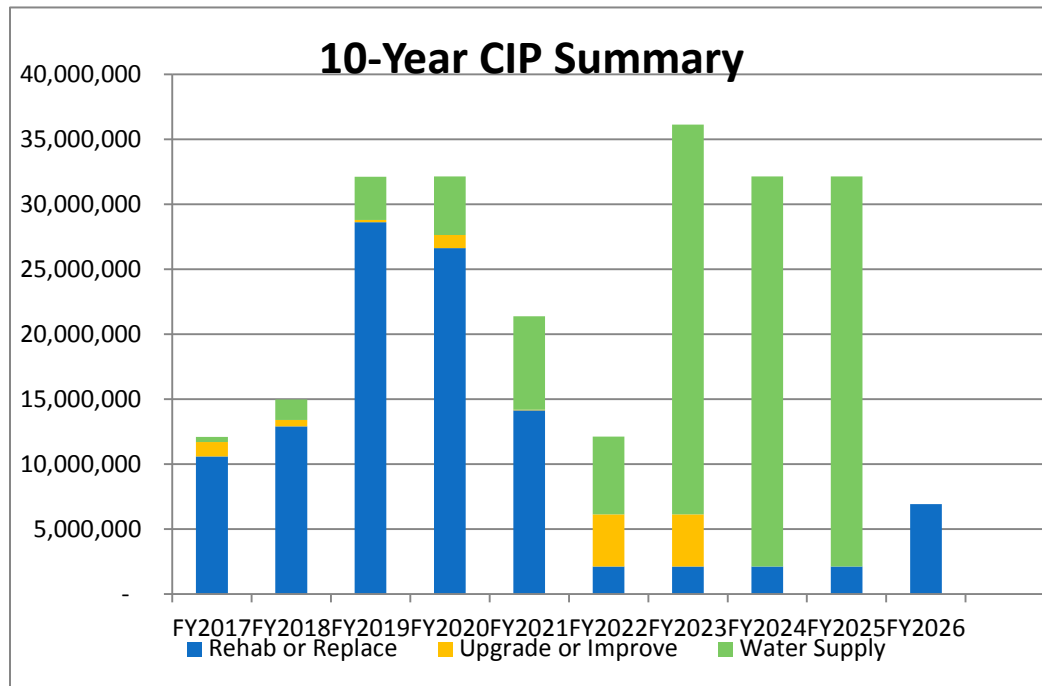
Section 1.1 describes the Department's anticipated capital spending of \$127.9 million during the first five years covered by the Financial Plan. Capital projects during the first five years will be focused on system rehabilitation and replacement projects. Major expenses to implement the Water Supply Augmentation Strategy⁵ are anticipated to occur in the second five years of the financial planning horizon. Figure 3 summarizes the planned capital spending in the three categories described in Section 1.1 Planned Capital Expenditures. Those categories are:

- **Rehabilitation and Replacement, including projects to meet regulatory requirements**
- **Upgrades and Improvements**
- **Water Supply Augmentation**

⁴ Inflation factors were developed using a combination of actual historical experience (Energy and Chemicals), City projections (salaries and benefits) and industry trends for everything else. The Handy Whitman Index, which focuses on the inflation of construction cost for projects using significant quantities of concrete and steel, and is particularly applicable for water utilities, has been used to escalate the cost of projects in the Capital Improvement Program.

⁵ The Water Supply Augmentation Strategy is the result of the community-based water supply planning process completed by the City Council appointed Water Supply Advisory Committee in October 2015.

Figure 3
10 Year CIP



Appendix B provides the details of the Ten Year Capital Improvement Plan, including both brief project descriptions and a ten year plan of spending.

5. LONG RANGE FINANCIAL PLAN RECOMMENDATIONS

This LRFP has been developed based on a specific five year forecast within a ten year planning horizon. The purpose of using the 10 year time frame is to ensure that steps taken during the first five years don't unduly constrain what financial capacity the Department has to address the financial investments needed during the second five years when it expects to construct one or more projects to augment water supply. The specific recommendations are limited to the first five years because that is as far ahead as the Department can establish rates under the limits set by California's Proposition 218.

\$113 M

The elements of the Long Range Financial Plan integrate the key financial plan inputs included in Section 4 above, as well as a Capital Financing Strategy, a forecast of Revenue Requirements, and Water Rates needed to meet the Revenue Requirements.

5.1 CAPITAL FINANCING STRATEGY

The Financial Plan recommends that the identified CIP be funded with a combination of rate revenue and debt financing. Over the next five years, pay-as-you-go rate revenue would cover an average of 33% of capital costs, with debt financing covering 67%. Using debt financing to fund a major portion of the CIP provides for inter-generational equity and, by spreading these costs over time, helps to moderate and stabilize near term adjustments to water rates.

In a preliminary way, implementation of this recommendation has already begun. The Department's request for a loan of \$25 million from the California Infrastructure and Economic Development Bank (I-Bank) was approved on March 22, 2016. Funding from the I-Bank is expected to be disbursed following completion of the anticipated Proposition 218 notification process planned for August 2016.

The I-Bank loan provides for the retro-active debt financing of significant capital expenditures that have resulted in depletion of the utility's fund balance in its main operating fund (Fund 711). This approach was authorized by the Council when it adopted a reimbursement resolution on April 8, 2014. Of the \$25 Million I-Bank loan, the Department expects to replenish its fund balances by reimbursing itself for \$22 Million in already expended capital costs. As discussed later in this Financial Plan, once the department has been reimbursed for prior capital costs, available funding will provide the resources needed to fully fund reserves. The remainder of the I-Bank funds would support additional capital projects planned to be completed in FY 2017 and 2018.

One of the reasons for developing the LRFP was to be able to assess the Department's capacity to use debt financing for major elements of its CIP. A measure of the Department's financial capacity is what portion of its revenues would be used for debt service. For example, the amount of financial flexibility of an organization is substantially reduced as the percent of its revenue dedicated to paying debt service rises.

During the first five years, the Department anticipates issuing debt totaling \$85.9 million. The annual average debt service is not expected to exceed 8% of annual rate revenue during the first five years, but it would continue to rise to a maximum of about 24% of annual revenues at the end of the 10 year period. These figures are obviously significantly greater than the Department's figure of less than 5% of its revenues being currently dedicated to debt service, but the Department's financial advisors are satisfied that the Department has the debt capacity needed to support the implementation of the LRFP capital financing strategy, as long as the

Department is able to increase rates and charges as outlined in the LRFP, and is able to meet key financial targets, including maintaining financial reserves and meeting the 1.5 debt service coverage ratio.

5.2 REVENUE REQUIREMENTS FOR FY 2017 – FY 2021

As shown in Figure 2, a significant output of financial planning is the revenue requirements that inform the rate making process. Based on the recommendations and assumptions described in Section 4, the Department was able to calculate revenue requirements. Table 4 summarizes the revenue requirements, operating and capital costs, and debt service coverage in the first five years of the financial plan.

Table 4
FY 2017 – FY 2021 Projected Revenue Requirements

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Infrastructure Reinvestment Fee Amount	\$5,990,512	\$8,700,797	\$9,166,040	\$10,169,506	\$11,239,068
Rate Stabilization Reserve Amount	-	\$3,342,224	\$3,342,224	\$3,342,224	\$3,342,224
O&M Revenue Requirement	\$26,323,394	\$28,128,488	\$30,059,525	\$31,604,455	\$33,241,638
TOTAL	\$32,313,906	\$40,171,529	\$42,567,809	\$45,116,205	\$47,822,950

Revenue requirements have been set at a level needed to ensure that both a minimum 1.50 debt service coverage ratio and a minimum of 180 days of operating cash are maintained.

A more complete version of this table which provides the Department's detailed Financial Pro Forma can be found in Appendix A.

5.3 WATER RATES

Using the revenue requirements data developed as part of the financial planning work and shown in Table 4 above, a five-year schedule of water rates is proposed for implementation. The proposed water rate structure includes the following assumptions and provisions:

- **For the purposes of rate development, assume that the amount of water to be sold during the five-years covered by the proposed rates is 2.5 billion gallons per year⁶.**
- **Adopt a rate structure that collects enough fixed fee revenue to recover the revenue necessary to cover the cost of meter reading, meter maintenance, billing preparation and distribution, and customer service. For FY 2017 this amounts to about 10% of total operating costs. Adopt volume-based user rates to collect the remaining revenues.**
- **Create a new fee called the Infrastructure Reinvestment Fee (IRF). This fee would generate the revenues needed to pay for “pay-as-you-go” capital investments and debt service for capital projects. The cost to customers of this fee would be based on customer water use which, again, supports achievement of high priority pricing objectives.**

The IRF is designed specifically to help focus and support customer communication about what water rates are paying for, particularly during the first five years of the CIP, which is emphasizing system rehabilitation and replacement projects for major elements of the system’s backbone infrastructure.

- **Acknowledge and mitigate for the risks to revenue stability associated with moving to a more volume based rate using two strategies:**
 1. **Maintaining the conservative assumption at 2.5 billion gallons per year;**
 2. **Beginning with the planned July 1, 2018 rate increase, apply a \$1.00 surcharge per unit of water consumption (a hundred cubic feet or CCF) to increase the amount of the Rate Stabilization Reserve from the current minimum level of \$2.3 million to a total of \$10 million. In any normal water year where 2.5 billion gallons of water is not sold, the revenue shortfall associated with this situation would be covered by resources from this fund.⁷**

In addition to the water rate structure changes and described above, the revenue requirements shown in Table 4 require a significant increase in FY 2017 to begin to fund the capital program, maintain operations, and establish the financial foundation described in Section 4. On a simple

⁶ Note: Water sales in calendar year 2013 equaled 3 billion gallons, in calendar year 2014 equaled 2.5 billion gallons and in calendar year 2015 equaled 2.25 billion gallons.

⁷ The Rate Stabilization Reserve Fund would be used to augment revenues during “normal” water years if the amount of water sold falls below 2.5 billion gallons. In water years where water restrictions are required due to inadequate supply, a Drought Cost Recovery charge would be used to ensure revenues are adequate to meet system costs and debt service obligations.

year over year basis, revenues need to increase 21% between FY 2016 and FY 2017, followed by a 24% increase in FY 2108, a by 6% a year in FY 2019, FY 2020 and FY 2021. The big driver of rate increases in FY 17 is capital spending, which is reflected in the Infrastructure Reinvestment Fee. In 2018, the big drivers are additional capital spending and initiating the effort to increase the Rate Stabilization Reserve Fund from the current \$2.4 million to \$10 million.

These percent increases in revenues are not translated directly to customer bills because of different use patterns and the recommended rate structures. For example, one impact of the recommended rate structure that emphasizes volume based rates is that it will tend to stabilize the cost of water for those whose use of water is very low. Conversely, customers whose use of water contributes to peaking will experience greater increases. And inside city customer will experience a greater increase than outside city customers due to the reduction in the outside city surcharge from 27.5% to 14.5%.

Additional details about the recommended rate structure and water rates can be found in Appendix C.

5.4 REVIEW AND REVISION OF THE LRFP

The LRFP is designed to be used as an ongoing guide for the Water Department as the plan is implemented. The financial planning and rate models that from the analytical basis of the LRFP are effective tools for support the Department's financial decision-making, and will be used and updated as new information is available. In 2021, the Department would expect to complete a new Cost of Service Analysis to use in setting rates of FY 2022 through FY 2026. Using these results as well as updated information on revenue requirements, the Department will comprehensively review and revise the LRFP to guide the next five years.

6. IMPLEMENTING THE LONG RANGE FINANCIAL PLAN

The LRFP is intended to be a living document that will provide a financial foundation for the Department to use in annual budget planning and management activities. A major review and revision of the LRFP will occur at the five year mid-point and, along with other relevant work such as an updated cost of service analysis, revisions to the Financial Plan and water rates will be developed as needed. The LRFP will also be used to measure progress toward meeting LRFP goals during each five year segment covered by the plan.

Working with its consultant team, Department staff has created a Financial Plan that is realistic and implementable. Details of the approaches needed to implement the Plan are presented in the following sections.

6.1 FUND BALANCE RESERVE GOALS

Reserve policies are particularly important to manage risks to an agency's financial condition. In addition, they help an organization establish and maintain a good bond rating, thereby reducing the cost of borrowing.

Beginning in 1993, the Department has built and maintained a Rate Stabilization Reserve Fund (Fund 713). In 2014, the City Council approved two additional reserve funds; a 90-Day Operating Cash Reserve Fund (716) and an Emergency Reserve Fund (717).

Apart from the Rate Stabilization Fund, the remaining reserves have not been fully funded as the utility's financial condition did not enable it to address this important goal. A major driver of the Department's inability to fund these new reserves was the drought, which had a significant negative impact on the Department's revenues. Table 5 provides information on the status at 6-30-2015 and goals of each of the Department's reserve funds.

Table 5
Fund Balance Reserve Goals

Fund		Fund Balance (6-30-2015)	Funding Goal
711	Water Operations & Maintenance	\$4,321,718	90 Days Operating Cash \$6.5M in 2017
713	Water Rate Stabilization Reserve ⁸	\$2,447,938	\$10,000,000
716	Water 90-Day Operating Cash Reserve	\$0	90 Days Operating Cash \$6.5 M in 2017
717	Water Emergency Reserve	\$600,000	\$3,000,000

⁸ Once implemented in FY 2018, the expectation is that it would take two years to achieve the \$10 million goal for the Rate Stabilization Reserve. For further discussion of how funds in the Rate Stabilization Reserve would be accrued and used, please see section 6.5.2.2.

Establishing the 90-Day Operating Cash Reserve Fund was an important step, however for bond rating purposes a 180-day reserve is preferable. To that end, the financial plan also envisions keeping a 90-day reserve in the operating fund (711) in addition to the 90-Day Operating Cash Reserve Fund (716). Providing a reserve equal to 180-days of operating expenses (between balances in Fund 711 and 716) is considered to be the minimum reserve to maintain a strong bond rating (AA category) and access to capital markets. Increasing these reserves above 180-days operating cash may be pursued if and when resources become available.

The Rate Stabilization Reserve Fund has been maintained at the historic \$2.3 million level and seeks to provide a cushion to cover one-time situations where expenses exceed rate revenue. At 6-30-2015, this fund had increased to \$2.4 million including interest income. As noted above, the \$1/CCF surcharge will be used to help increase this fund to \$10 million, as part of the mitigation for moving to a more volume based rate structure. This approach is discussed in greater detail in Section 6.5.2 below.

Initial funding of \$600,000 for the Emergency Reserve Fund was made possible by using drought related one-time excessive use penalty revenue accrued during calendar year 2014. An additional \$500,000 was accrued from penalty revenue in calendar year 2015 and is expected to be used to increase this reserve for a total of \$1.1 Million. The goal for the Emergency Reserve Fund is to maintain a \$3 million funding level that would provide funds in the event of an extreme event or natural disaster.

6.2 APPROACH TO FULLY FUNDING RESERVES

In April of 2014, the Water Department recommended that the City Council approve a reimbursement resolution that would allow the Department to debt finance capital improvement work already in construction. The purpose of this request was to allow the Department to reimburse the Department's main operating fund for cash expenditures for capital projects such as the \$26 Million Bay Street Reservoir replacement project once a bond issue was completed.

From the \$25 Million I-Bank loan mentioned previously, the Department expects to receive reimbursement of \$22 million in past capital expenditures from the Department's fund balance. Resources from this cash balance would be used to fund the Department's reserves as follows:

- **\$6.5 Million to fully fund the 90-Day Operating Cash Reserve Fund (716)**
- **\$2.0 Million to bring the existing \$1.1 Million in cash (from excess water use penalties received in FY 2014 and 2015) to \$3.1 Million (Fund 717); and**

- **Additional resources needed to maintain a fund balance in the Department's Operating Fund (711) at 90 days of operating cash**

6.3 DEBT FINANCING ASSUMPTIONS

In evaluating future financing needs, the LRFP includes assumptions on the initial and ongoing costs associated with issuing debt. Table 6 shows the projected current interest rate and terms for various debt issuance mechanisms that would most likely be used in debt funding the planned CIP.

Table 6
Debt Mechanism Estimated Rates & Terms

Debt Mechanism	Assumed Interest Rate (percent)	Term (years)
Tax-Exempt Financing (Bonds)	5.0	30
California Infrastructure & Economic Development Bank (I-Bank)	3.24	30
Drinking Water State Revolving Loan Fund	1.6	30

For planning purposes, additional debt issuance is assumed to be tax-exempt bonds issued in seven series. In addition to borrowing, the Department will work to acquire grant funding for capital investments if and as available. Grant funds may most likely be an option to defray some of the costs of the projects included in the Water Supply Augmentation Strategy. The Department will also pursue below market Drinking Water State Revolving Loan Fund loans for rehabilitation and replacement projects that would score well in meeting that program's competitive criteria.

The size and timing of debt issues to finance these capital projects are summarized in Table 7. The draft LRFP envisions three debt issue series from FY 2017 through FY 2021 for a total of \$85.9 million. Another four debt issues series are shown from FY 2022 to FY 2025 for a total of \$140 million. The total for all seven series is \$226 million.

Table 7
Size and Timing of Debt Issues Needed to Fund Capital Program

Debt Issuance Assumptions								7 Series Total
Series	Series 2018	Series 2020	Series 2021	Series 2022	Series 2024	Series 2025	Series 2026	
Assumptions								
Debt Proceeds	\$ 37,515,936	\$ 29,775,262	\$ 18,648,772	\$ 51,733,379	\$ 39,162,683	\$ 42,572,248	\$ 6,798,552	\$ 226,206,832
Term of Debt	30 Years	30 Years	30 Years	30 Years	30 Years	30 Years	30 Years	
Call Date	3/1/2028	3/1/2030	3/1/2031	3/1/2032	3/1/2034	3/1/2035	3/1/2036	
Assumed Rate	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	
Project Fund Earnings	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	

6.4 CONSIDERATIONS IN THE TIMING AND SIZING OF DEBT

In order to effectively use a debt financing approach to minimize interest costs associated with borrowing, it is necessary to actively manage the timing and sizing of debt issues to avoid paying interest on cash sitting idle in a bank account. Given this concern, when issuing debt, it makes sense to take into account the following:

- **Set a minimum debt financing amount of \$15 million;**⁹
- **Consider the spending rate on current and near term capital projects;**¹⁰
- **Consider market conditions or interest rate changes that might be more or less favorable in the future;**
- **Explore the potential to use one or more bridge funding mechanisms such as a bank letter of credit or internal borrowing (from City reserve funds, for example) that would allow for debt issuance at a later date.**

The PFM model includes a debt sizing function that can be used to forecast capital expenditures and anticipate when additional borrowing is needed. The model uses both built in parameters, such as the minimum \$15 million in borrowing, and the opportunities to consciously consider

⁹ The reason for establishing a minimum issuance amount for a debt issue is based on reasoning that is similar to the advice of travel gurus regarding going to the ATM when you're on vacation in a foreign country. There are certain transaction costs associated with taking money out of the ATM that don't vary (or don't vary very much) with the size of the withdrawal. Therefore, it is more cost effective to go to the ATM fewer times and take out more money rather than doing the opposite. Issuing debt also has certain borrowing costs that accrue, and borrowing in bigger chunks helps manage and minimize the impact of some of these costs.

¹⁰ The Department's CIP shows spending patterns that reflect the staff's best estimate of how the project will play out. The environmental review, right-of-way, and regulatory climate in California is complex and project spending can be greatly influenced by this reality. In sizing and timing debt issues, it will be important to use the most up-to-date information about progress on projects.

the sizing and timing of debt. City staff will be actively using this model in ongoing financial analyses and management activities, and the timing and sizing of each debt issue may be revised based on market conditions at the time.

6.5 WATER RATES NEEDED TO MEET REVENUE REQUIREMENTS

During FY 2016, Water Department staff worked with Raftelis Financial Consultants and the Santa Cruz Water Commission to evaluate several options for rate structures, each of which would need to address the City's priority pricing objectives as identified by the Council and the Water Commission during the winter of 2015. These pricing objectives are shown in Table 8 below, in priority order:

Table 8
Priority Pricing Objectives

Composite Pricing Objectives for the City Council and Water Commission, March 2015	
1. Revenue sufficiency	5. Revenue stability
2. Promotes efficiency	6. Understandable by customers
3. Perceived to be fair by the public	7. Promotes conservation
4. Affordable for essential uses	8. Rate stability

In designing new rates for FY 2017 – FY 2021, the Department took into account these priorities and the very strong preference stated by customers in various forums to reduce the amount of revenue generated by fixed charges.

Santa Cruz's water customers are unusual in many respects, including their typically lower levels of water consumption. Even before the drought, 15% of single family customers used an average of 2 CCF or less per month. And 46% (15% + 31%) used an average of 5 or fewer CCF per month. Sixty-four percent used no more than 7 CCF per month.

In 2004, the Department changed its rate structure to increase the number of tiers for single family customers from three to five and also implemented a series of fairly significant price increases between 2004 and 2011. As a result of these actions, many single family residential customers were incentivized to reduce consumption of the more expensive blocks of water, contributing to the distribution patterns that were being observed prior to the drought. Included in this pattern was a shift of the total percent of annual consumption used between

May 1 and October 31 from 65% to 59%. Two years of water rationing for residential customers further reinforced these new use patterns.

Coupled with a strong conservation ethic in Santa Cruz is the concern for affordability of water for those customers using very low amounts of water. Fixed charges are viewed as diluting the conservation incentive that rates can provide as well as raising the cost of water for those routinely using small amounts of water.

6.5.1 CHANGES TO THE RATE STRUCTURE

The Department is recommending moving from its current rate structure in which about 35% of revenue is collected through fixed charges and 65% is collected through volume or commodity charges to one that collects substantially more of the total revenue through volume charges. Roughly 10% of operating costs would be collected in fixed costs based on meter size, with the remainder being collected in the form of charges related to the amount of water used.

Tiered rates for single family residential customer would be retained with the number of tiers being reduced from five to four¹¹. Revised tiers would be as follows:

- **0 – 5 CCF = Tier 1 (average winter use)**
- **6 – 7 CCF = Tier 2 (average spring and fall use)**
- **8 – 9 CCF = Tier 3 (average summer use)**
- **≥ 10 CCF = Tier 4**

Multi-family residential rates would also be tiered using the same tiers as for single family but multiplying the tier allocations by the number of dwelling units in a master metered complex.¹²

Landscape irrigation accounts would be billed based on a simplified water budget system that would establish an allocation for each account. Usage up to that water budget allocation would be billed at tier 1 of the irrigation rates, up to 150% of the allocation would be billed at tier 2 of the irrigation rates, and all usage above 150% of the allocation would be billed at tier 3 of the landscape irrigation rates.

¹¹ The change in the number of tiers was the result of the analysis done by Raftelis Financial Consultants as part of the Cost of Service Study and was based on evolving water use patterns for residential customers.

¹² Master metered systems may include irrigation or have irrigation on a separate meter. For water utility billing purposes, individually metered multi-family units are treated as single family residential properties.

The remaining customer classes would be billed using uniform rates established for each class based on the Cost of Service Analysis. For example, this means that the University of California at Santa Cruz, whose water use includes some seasonal peaking, would pay a higher uniform rate than those customer classes that do not.

6.5.2 MITIGATING THE POTENTIAL REVENUE STABILITY RISKS OF MOVING TO A MORE VOLUME BASED RATE STRUCTURE

Moving to a more volume-based rate structure creates inherent revenue stability risks for a utility. In making a decision to move in this direction, Water Department staff carefully considered how this risk might influence revenues by evaluating the character and water use consumption patterns in the City's service area.

Even before the recent drought, Santa Cruz water customers were among the lowest water users in the state on both system-wide and residential gallons per capita per day metrics. During the drought, that pattern continued. Anecdotally, staff is observing some continuing shifts in water use that may reflect some long-term changes in use patterns that will ultimately be attributed to the drought becoming permanent. One very likely candidate for this kind of change is residential landscape irrigation.

Revenue streams that depend on the volume of water sold are particularly susceptible to weather driven changes in consumption, and changes in consumption due to price effects. The Department's recent experiences make it keenly aware of this dynamic. The challenges of managing ongoing operations and management of the water utility while simultaneously planning for and implementing major capital improvements aren't insurmountable with a more volume based rate structure, but certainly introduce an element of uncertainty that should be carefully considered before proceeding. This is what Department staff has done.

Rather than avoid recommending a rate structure that seems well-suited to the community's and policy maker's values and priorities, Department staff recommends planning for and implementing as part of the rate structure the mechanisms needed to mitigate these potential risks.

These risks come in two basic forms: drought risks, and non-drought risks. The risk mitigation approaches being recommended to address each is discussed in more detail below.

6.5.2.1 DROUGHT RISKS

In 2014, the Water Department instituted a drought cost recovery fee mechanism that is put in place as a fixed charge. Table 9 shows the Drought Cost Recovery Fee revenue recovery target for each stage of the City's Water Shortage Contingency Plan and provides the amount charged for a typical single family residential customer using a 5/8th or 3/4th inch meter.

Table 9
Drought Cost Recovery Fee Financial Targets and
Example Fixed Charge for 5/8th and 3/4th inch Meters

Drought Stage	Cutback Required	Targeted Cost Recovery	Fixed Charge per 5/8 th or 3/4 th inch meter
Stage 1	5%	\$1.0 Million	\$2.45
State 2	15%	\$2.5 Million	\$6.12
Stage 3	25%	\$4.0 Million	\$9.79
Stage 4	35%	\$5.5 Million	\$13.46
Stage 5	50%	\$7.5 Million	\$18.35

Additional Details on the Drought Cost Recovery Fees for other meter sizes can be found in Appendix C.

A Drought Cost Recovery Fee was levied in Santa Cruz from October 1, 2014 through June 30, 2016. Levying the fee is explicitly linked to an action by the Santa Cruz City Council to declare a drought and establish curtailment stage in advance of each year's dry season (May through October).

The Department's 2014 Proposition 218 notice included the Drought Cost Recovery Fee Schedule. The planned summer 2016 Proposition 218 notice will also include publication of this fee.

6.5.2.2 NON-DROUGHT RELATED RISKS

In the earlier discussion of rates in Section 5.3 above, the basic risk mitigation approach for non-drought years was described. It involved two basic strategies:

- 1 Setting the assumption about how much water will be sold at a conservative 2.5 billion gallons per year;**
- 2 Beginning in July 2018, apply a \$1.00 per unit of water consumption surcharge to increase the amount of the Rate Stabilization Reserve from the current level of \$2.3 million to a total of \$10 million. In any “normal” year where 2.5 billion gallons of water is not sold, use revenues from the rate stabilization reserve to cover the resulting revenue shortfall.**

The planned \$1.00 surcharge is not being designed to be an “on-off” mechanism but is currently proposed to be permanent. Use of these funds once the Rate Stabilization Reserve reaches \$10 million is recommended to be used as follows:

- Once the Rate Stabilization Reserve reaches its target level of \$10 Million, funds from this surcharge would be allocated as needed to ensure that Operating Cash and Emergency Reserves are fully funded and then directed to fund “pay-as-you-go” capital expenditures, reducing the need to issue debt.**

6.5.3 ALLOCATIONS OF REVENUES THAT ARE HIGHER THAN EXPECTED

A reasonable question is what to do if revenue stability does not turn out to be an issue because consumption is either stable at 2.5 billion gallons per year or is greater than 2.5 billion gallons. The Department proposes the following conditional approach to addressing this situation if it occurs:

If....

- the minimum debt service coverage ratio target of 1.5 is being consistently met, and**
- reserves are fully funded, and**
- “pay-as-you-go” capital is being funded at an average over the previous 3 years of at least 25%;**

Then either...

- additional planned rate increases will be adjusted to the level needed to produce required revenues without any excess,¹³ or**

¹³ The public notices required under Proposition 218 are required to identify (and justify based on the cost of service) the maximum amount that will be charged for a service. A utility has the option of charging less than the maximum amount published in the required notices. The obverse, however, is not true, which is the major reason for building into a more heavily volumetric rate structure a mechanism to mitigate for lower than anticipated revenues due to lower than forecasted water sales.

- **The Water Department will ask the City Council for additional direction regarding adjusting the amount of funding in the Emergency Reserve and the Rate Stabilization Reserve to be an established percent of the Operating budget (rather than a fixed dollar amount), accelerating capital reinvestment in system infrastructure, or increasing the proportion of capital that is being paid for with “pay-as-you-go” funding.**

Glossary

- **Bond covenant** – A legally binding term of an agreement between a bond issuer and a bond holder. Bond covenants are designed to protect the interests of both parties. Bond covenants are commitments that the City makes to the bondholders to ensure timely payment of principal and interest.
- **Capital Improvement Plan** – A multi-year plan that lists the rehabilitation, replacement, major maintenance, and new water system facilities and systems that are needed to maintain reliable and high quality water service or meet regulatory requirements;
- **CCF** (One Hundred cubic feet of water) – 748 gallons of water. A CCF is the unit used by the Santa Cruz Water Department as the basis for charges to customers based on water use.
- **Debt service coverage ratio** – The ratio of net operating revenue to annual debt payments.
- **Emergency reserve fund** – A reserve fund specifically designed to provide resources to address the consequences of natural disasters on water system facilities or resources or a catastrophic failure of a water system facility;
- **Pro forma** (financial statement) - A pro forma financial statement is a forecast of the utility's revenues and expenditures based on certain assumptions and projections;
- **Ninety-day operating cash reserve fund** – A reserve created to help ensure the utility's ability to meet operating expenses, provide financial stability, and resilience and support establishing and maintaining a good credit rating.
- **Operating budget** – The portion of the Department's overall budget that pays for ongoing operations of the utility, including the costs related to personnel, materials and services such as water treatment chemicals, and energy resources, and non-capital improvement project professional and technical services;
- **Pay-as-you-go capital funding** – paying for capital improvement projects using current year or accumulated rate revenues rather than the use of short or long term debt;
- **Proposition 218** – a 1996 California Constitutional Amendment that established the "cost-of-service" requirements for utility rates as well as certain noticing and public review process requirements related to water rate increases;¹⁴
- **Rate structure design** – Characteristics of water rates that provides for the amount of revenue produced by fixed and variable charges, the use of different tiers for different amounts of water use, etc.;

¹⁴ Proposition 218 also includes other provisions that aren't relevant to water rates and finances.

- **Rate stabilization reserve** – a financial reserve specifically intended to provide a hedge against revenue variability resulting from weather conditions, such as a cool wet spring that results in less water than projected being used for outdoor irrigation.
- **Reimbursement resolution** – A Council action that authorizes the Department to reimburse itself for funds expended on capital projects using proceeds from future debt issues.
- **Water Supply Augmentation Strategy** – This is the plan developed by the Council appointed Water Supply Advisory Committee and accepted by the City Council for implementation in November 2015.

APPENDIX A – FINANCIAL PRO FORMA

This Appendix includes a 10 year Pro Forma from the Department's financial Model.

City of Santa Cruz Water Department FY 2017 – FY 2026 Financial Pro-Forma

City of Santa Cruz Water Department Pro-Forma Projections												
Year	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026		
Revenues												
Rate Revenue												
Fixed Fee Revenue	\$ 4,655,461	\$ 2,960,622	\$ 3,153,062	\$ 3,358,011	\$ 3,576,282	\$ 3,808,740	\$ 4,056,308	\$ 4,319,968	\$ 4,600,766	\$ 4,899,816		
Volumetric Revenue	\$ 27,555,340	\$ 33,747,904	\$ 35,941,518	\$ 38,277,717	\$ 40,765,768	\$ 43,415,543	\$ 46,237,553	\$ 49,242,994	\$ 52,443,789	\$ 55,852,635		
Elevation Surcharges	\$ 103,105	\$ 120,759	\$ 130,985	\$ 138,233	\$ 138,656	\$ 139,242	\$ 139,830	\$ 140,421	\$ 141,015	\$ 141,611		
Rate Stabilization Surcharge	\$ -	\$ 3,342,244	\$ 3,342,244	\$ 3,342,244	\$ 3,342,244	\$ 3,342,244	\$ 3,342,244	\$ 3,342,244	\$ 3,342,244	\$ 3,342,244		
Total Rate Revenue	\$ 32,313,906	\$ 40,171,529	\$ 42,567,809	\$ 45,116,205	\$ 47,822,950	\$ 50,705,769	\$ 53,775,936	\$ 57,045,628	\$ 60,527,814	\$ 64,236,306		
Non-Rate Revenue												
Other Income	\$ 203,600	\$ 203,600	\$ 203,600	\$ 203,600	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		
Investment Income	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		
Total Non-Rate Revenue	\$ 203,600	\$ 203,600	\$ 203,600	\$ 203,600	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		
Total Revenues	\$ 32,517,506	\$ 40,375,129	\$ 42,771,409	\$ 45,319,805	\$ 47,822,950	\$ 50,705,769	\$ 53,775,936	\$ 57,045,628	\$ 60,527,814	\$ 64,236,306		
Operating Expenses												
Personnel	\$ 12,741,984	\$ 13,868,008	\$ 15,086,021	\$ 15,882,276	\$ 16,733,349	\$ 17,643,670	\$ 18,618,048	\$ 19,661,714	\$ 20,780,352	\$ 21,980,139		
Services, Supplies & Other	\$ 12,616,410	\$ 13,247,231	\$ 13,909,592	\$ 14,605,072	\$ 15,335,325	\$ 16,102,091	\$ 16,907,196	\$ 17,752,556	\$ 18,640,184	\$ 19,572,193		
Capital Outlay	\$ 965,000	\$ 1,013,250	\$ 1,063,913	\$ 1,117,108	\$ 1,172,964	\$ 1,231,612	\$ 1,293,192	\$ 1,357,852	\$ 1,425,745	\$ 1,497,032		
Other Operating Expenses	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		
Total Operating Expenses	\$ 26,323,394	\$ 28,128,488	\$ 30,059,525	\$ 31,604,455	\$ 33,241,638	\$ 34,977,373	\$ 36,818,437	\$ 38,772,122	\$ 40,846,280	\$ 43,049,364		
Net Operating Revenues	\$ 6,194,112	\$ 12,246,641	\$ 12,711,884	\$ 13,715,350	\$ 14,581,312	\$ 15,728,396	\$ 16,957,500	\$ 18,273,506	\$ 19,681,534	\$ 21,186,943		
Capital Expenditures	\$ 12,457,850	\$ 15,886,978	\$ 35,774,344	\$ 37,574,757	\$ 26,251,158	\$ 15,635,558	\$ 48,913,507	\$ 45,672,352	\$ 47,955,970	\$ 10,854,470		
Grant Funded	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		
SRF Funded	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		
Currently Funded	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		
Pay-Go Funded	\$ 12,457,850	\$ 9,092,599	\$ 5,052,786	\$ 7,799,495	\$ 7,602,387	\$ 7,467,490	\$ 5,348,196	\$ 6,509,669	\$ 5,383,722	\$ 4,055,918		
Debt Funded	\$ -	\$ 6,794,378	\$ 30,721,558	\$ 29,775,262	\$ 18,648,772	\$ 8,168,068	\$ 43,565,311	\$ 39,162,683	\$ 42,572,248	\$ 6,798,552		
Debt Service	\$ 1,110,238	\$ 2,089,418	\$ 3,364,562	\$ 4,286,397	\$ 6,171,547	\$ 7,404,928	\$ 10,701,862	\$ 10,800,876	\$ 13,275,920	\$ 16,046,053		
Net Income	\$ (7,373,976)	\$ 1,064,624	\$ 4,294,536	\$ 1,629,457	\$ 807,378	\$ 855,979	\$ 907,441	\$ 962,961	\$ 1,021,892	\$ 1,084,972		
Total Cash Balances												
Beginning Total Cash Balance	\$ 4,071,118	\$ 18,697,143	\$ 22,761,766	\$ 27,056,302	\$ 28,685,759	\$ 29,493,137	\$ 30,349,115	\$ 31,256,557	\$ 32,219,518	\$ 33,241,410		
I-Bank Reimbursements	\$ 22,000,000	\$ 3,000,000	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		
Calculated Change to Cash Balances	\$ (7,373,976)	\$ 1,064,624	\$ 4,294,536	\$ 1,629,457	\$ 807,378	\$ 855,979	\$ 907,441	\$ 962,961	\$ 1,021,892	\$ 1,084,972		
Ending Total Cash Balance	\$ 18,697,143	\$ 22,761,766	\$ 27,056,302	\$ 28,685,759	\$ 29,493,137	\$ 30,349,115	\$ 31,256,557	\$ 32,219,518	\$ 33,241,410	\$ 34,326,381		
Beginning Cash Balances by Fund												
Fund 717 (Emergency Reserve)	\$ 1,100,000	\$ 3,100,000	\$ 3,100,000	\$ 3,100,000	\$ 3,100,000	\$ 3,100,000	\$ 3,100,000	\$ 3,100,000	\$ 3,100,000	\$ 3,100,000		
Fund 713 (Rate Stabilization)	\$ 2,447,939	\$ 2,447,939	\$ 5,790,183	\$ 9,132,427	\$ 10,000,000	\$ 10,000,000	\$ 10,000,000	\$ 10,000,000	\$ 10,000,000	\$ 10,000,000		
Fund 716 (90 Day Operating Reserve)	\$ -	\$ 6,490,700	\$ 6,935,792	\$ 7,411,938	\$ 7,792,879	\$ 8,196,568	\$ 8,624,558	\$ 9,078,519	\$ 9,560,249	\$ 10,071,685		
Fund 711 (Water Operations)	\$ 523,179	\$ 6,658,504	\$ 6,935,792	\$ 7,411,938	\$ 7,792,879	\$ 8,196,568	\$ 8,624,558	\$ 9,078,038	\$ 9,559,269	\$ 10,069,724		
Changes to Cash Balances by Fund												
Fund 717 (Emergency Reserve)	\$ 2,000,000	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		
Fund 713 (Rate Stabilization)	\$ -	\$ 3,342,244	\$ 3,342,244	\$ 867,573	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		
Fund 716 (90 Day Operating Reserve)	\$ 6,490,700	\$ 445,092	\$ 476,146	\$ 380,942	\$ 403,689	\$ 427,989	\$ 453,961	\$ 481,731	\$ 511,436	\$ 543,226		
Fund 711 (Water Operations)	\$ 6,135,324	\$ 277,288	\$ 476,146	\$ 380,942	\$ 403,689	\$ 427,989	\$ 453,480	\$ 481,231	\$ 510,456	\$ 541,746		
Ending Cash Balances by Fund												
Fund 717 (Emergency Reserve)	\$ 3,100,000	\$ 3,100,000	\$ 3,100,000	\$ 3,100,000	\$ 3,100,000	\$ 3,100,000	\$ 3,100,000	\$ 3,100,000	\$ 3,100,000	\$ 3,100,000		
Fund 713 (Rate Stabilization)	\$ 2,447,939	\$ 5,790,183	\$ 9,132,427	\$ 10,000,000	\$ 10,000,000	\$ 10,000,000	\$ 10,000,000	\$ 10,000,000	\$ 10,000,000	\$ 10,000,000		
Fund 716 (90 Day Operating Reserve)	\$ 6,490,700	\$ 6,935,792	\$ 7,411,938	\$ 7,792,879	\$ 8,196,568	\$ 8,624,558	\$ 9,078,519	\$ 9,560,249	\$ 10,071,685	\$ 10,614,912		
Fund 711 (Water Operations)	\$ 6,658,504	\$ 6,935,792	\$ 7,411,938	\$ 7,792,879	\$ 8,196,568	\$ 8,624,558	\$ 9,078,038	\$ 9,559,269	\$ 10,069,724	\$ 10,611,470		
Coverage and Targets												
Debt Service Coverage (W/Out Reserves)	5.58x	4.26x	2.78x	3.00x	2.36x	2.12x	1.58x	1.69x	1.48x	1.32x		
Debt Service Coverage Target	1.50x	1.50x	1.50x	1.50x	1.50x	1.50x	1.50x	1.50x	1.50x	1.50x		
Debt Service Coverage (W/Reserves)	22.42x	16.76x	11.82x	9.89x	7.14x	6.22x	4.51x	4.67x	3.99x	3.46x		
Days' Cash (Includes only Funds 711 & 716)	182	180	180	180	180	180	180	180	180	180		
Days' Cash Target	180	180	180	180	180	180	180	180	180	180		

APPENDIX B – 10 YEAR CIP

This Appendix includes a spreadsheet listing projects, funding and schedules and project descriptions

Water Department FY 2017 – FY 2018 Capital Improvement Program

10-Year CIP by Primary Driver										
	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025	FY2026
Rehabilitate or Replace										
Felton Diversion Replacement & Pump Station		1,500,000	1,500,000	1,500,000						
Laguna Dam										500,000
Majors Creek Diversion										300,000
San Lorenzo River Diversion & Tait Wells										
Newell Creek Pipeline Rehabilitation	1,000,000	1,000,000	8,000,000	8,000,000						
Newell Creek Dam I/O Pipeline & Aerators	2,000,000	2,000,000	14,000,000	12,000,000	12,000,000					
North Coast System Rehab	4,150,000									4,000,000
WTP Concrete Tank Evaluation & Replacement	600,000	3,000,000	3,000,000	3,000,000						
WTP Solids Handling	500,000									
Water Main Replacements - City Engineering	1,395,000	1,440,000	1,440,000	1,440,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
Water Main Replacements - Outside Agency	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000
Water Main Replacements - Customer Initiated	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Water Main Replacements - Distribution	325,000	325,000	325,000	325,000	325,000	325,000	325,000	325,000	325,000	325,000
Pressure Regulating Stations	10,000	60,000	60,000	60,000						
Recoat University Reservoir No. 4	75,000	1,300,000								
Recoat University Reservoir No. 5	75,000	1,675,000								
Beltz 11	70,000	300,000								
Water Treatment Upgrades	100,000									
Subtotal	10,600,000	12,900,000	28,625,000	26,625,000	14,125,000	2,125,000	2,125,000	2,125,000	2,125,000	6,925,000
With inflation	10,918,000	13,685,610	31,886,676	31,141,725	17,347,257	2,740,252	2,877,265	3,021,128	3,172,185	10,854,470
Upgrade or Improve										
Advance Metering Infrastructure (AMI)					50,000	4,000,000	4,000,000			
Loch Lomond Rec Improvements			165,000	1,000,000						
Photovoltaic/SolarProjects		500,000								
Water Resources Building	1,000,000									
Security Camera & Building Access Upgrades	95,000									
Subtotal	1,095,000	500,000	165,000	1,000,000	50,000	4,000,000	4,000,000	-	-	-
With inflation	1,127,850	530,450	183,801	1,169,642	61,406	5,158,122	5,416,028	-	-	-
Water Supply Reliability										
Aquifer Storage & Recovery		1,075,000	325,000	300,000						
Recycled Water										
Water Supply- WSAS Implementation				1,200,000	7,200,000	6,000,000	30,000,000	30,000,000	30,000,000	
Source Water Evaluation & Implementation	400,000	500,000	3,000,000	3,000,000						
Subtotal	400,000	1,575,000	3,325,000	4,500,000	7,200,000	6,000,000	30,000,000	30,000,000	30,000,000	-
With inflation	412,000	1,670,918	3,703,867	5,263,390	8,842,495	7,737,183	40,620,213	42,651,224	44,783,785	-
Total Projects w/o Inflation	12,095,000	14,975,000	32,115,000	32,125,000	21,375,000	12,125,000	36,125,000	32,125,000	32,125,000	6,925,000
Handy-Whitman Construction Inflation Factor	3%	3%	5%	5%	5%	5%	5%	5%	5%	5%
Total Projects with Cumulative Inflation	12,457,850	15,886,978	35,774,344	37,574,757	26,251,158	15,635,558	48,913,507	45,672,352	47,955,970	10,854,470

Water Department FY 2017 – FY 2018 Capital Improvement Program Project Descriptions

REHABILITATE OR REPLACE
Felton Diversion Replacement & Pump Station (c701602) This project consists of evaluating the existing dam and pump station with recommendations to rehabilitate or replace existing facilities. Alternate diversions to be considered will include horizontal collector wells and other subsurface intake(s). This project will replace aging facilities and evaluate potentially more efficient ways to divert water from the San Lorenzo River at Felton. Additional funding for construction in FY2019.
Laguna Dam (c70xxxx) Evaluate condition of dam and make recommended modifications. The project will follow completion of anadromous Habitat Conservation Plan.
Majors Creek Diversion (c701302) Majors Creek Diversion is nearly 100 years old. This project will evaluate the condition of the structure, make recommendations to replace or repair, and complete the construction. Evaluation of facility to occur in FY2017 with scheduling of rehabilitation TBD.
San Lorenzo River Diversion & Tait Wells (c709872) Conduct a condition assessment of the existing diversion and wells including consideration of sanding issues, potential dam replacement, the potential use of infiltration gallery, and relocation of existing wells. Project will ensure reliable and efficient diversion of water from the San Lorenzo River at Tait St. Condition assessment followed by recommended intake modifications and/or new wells. Current project consists of replacing 2 wells, rehabilitating 1 existing well, and abandoning 1 well. (Project title modified from San Lorenzo Tait Intake.)
Newell Creek Pipeline Rehabilitation (c701701) Conduct a condition assessment and program level environmental review followed by full or partial replacement of the pipeline between the base of Loch Lomond Reservoir and the Graham Hill Water Treatment Plant. This pipeline was constructed in the 1960s. This project is intended to ensure continued reliability of this water supply transmission main. (Project title modified from Newell Creek Supply Main Rehabilitation.)
Newell Creek Dam I/O Pipeline & Aerators (c701606) The Newell Creek Dam was installed in the 1960's. A pipeline runs through the base of the dam to deliver water to the reservoir from Felton Diversion and from the reservoir to the Graham Hill Water Treatment Plant. The pipeline rehabilitation includes inspection of the pipeline and its appurtenances which will result in rehabilitation or replacement of all or parts of the facility.
North Coast System Rehab (c709835) Springs and streams along the coast north of the City limits supply approximately 25% of the City's raw water. Some of the facilities related to these water supplies are reaching the end of their useful life. This program consists of multiple projects over the next 15 to 20 years to evaluate, rehabilitate, and replace portions of the existing infrastructure to ensure continued reliability. Engineering, environmental review, and permitting for the coast segment (Phase 3) began in FY 2013 and continues through FY 2017. Construction scheduled to begin in FY 2016.
WTP Concrete Tank Evaluation & Replacement (c701501) As part of an overall plan to ensure compliance with changing water quality regulations, improvements are needed at the Graham Hill Water Treatment Plant. This project will evaluate

the condition of four concrete tanks located at the site (as well as an off-site concrete tank), make improvement recommendation, and construction. Project title modified from WTP Filter Water Tank. Includes \$145,000 endowment for MHJB HCP mitigation.
WTP Solids Handling (c701605) Solids produced at the Graham Hill Water Treatment Plant are currently disposed of in the City's sewer collection system. Treatment and disposal of these solids needs to be evaluated with the existing Water Treatment Plant Concrete Tank Assessment and Rehabilitation project (c701501) with improvements made accordingly.
Water Main Replacements - City Engineering (c700002, c709833, and c700017) Recurring program to replace deteriorated or undersized mains as identified and prioritized by the Department. Priorities are based on the need to maintain water system reliability, deliver adequate fire flows, improve circulation and water quality, and reduce maintenance costs. These projects focus on pipes less than 10" in diameter and are typically installed by contractors according to bid plans and specifications.
Water Main Replacements - Outside Agency (c700003) Water main, service line, valve, or water meter relocation necessitated by County or other Agency road improvement, storm drain improvement projects, and/or other projects that conflict with existing water infrastructure.
Water Main Replacements - Customer Initiated (c700004) Recurring program similar to the other Main Replacement Projects; however, these projects are initiated on an as-needed basis to accommodate customer-requested service connections to undersized or inadequate mains. Funds, to the extent of the appropriation, are disbursed to customers on a first-come, first-served basis. This project is funded by System Development Charges (100% SDC – Fund 715).
Water Main Replacements – Distribution (c701507) Recurring program to replace deteriorated or undersized water mains, as identified and prioritized by the Department and implemented by the Distribution Section. Projects are typically based on leak history, but also address water quality and fire flow issues.
Pressure Regulating Stations (c701703) Evaluation and replacement of pressure regulating stations (PRS). A PRS maintains (sustains or reduces) downstream pressure in order to deliver sufficient water pressure. The water distribution system contains 15 PRS and they vary in age from 66 years old to 8 years old. This project will evaluate the condition of each PRS and prioritize rehabilitation or replacement.
Recoat University Reservoir No. 4 (c701505) Perform engineering analysis and condition assessment of the aging University 4 tank to ensure continued reliable service. Establish scope of work for recoating/rehabilitation project. Acquire construction easements from UCSC and perform environmental analysis to install temporary tank for use during construction. Create plans and specifications for recoating/rehabilitation project.

Recoat University Reservoir No. 5 (c701506) Perform engineering analysis and condition assessment of the aging University 5 tank to ensure continued reliable service. Establish scope of work for recoating/rehabilitation project. Create plans and specifications for recoating/rehabilitation project. Install temporary tank and variable speed pumps for use during construction. Construct recoating/rehabilitation project.
Beltz 11 (c700026) This project would convert an existing monitoring well to a production well, renamed Beltz 11. Beltz 11 would pump from the Santa Margarita aquifer. The project would reduce pumping from the Purisima Formation which is impacted by pumping by the City and other users. Project includes feasibility study, pump test, CEQA and construction efforts.
Water Treatment Upgrades (c700025) Upgrades to the Graham Hill Water Treatment Plant are necessary to meet new and planned regulatory requirements, and increase overall system reliability. This is a recurring project to prioritize needs and make smaller improvements. The current project includes upgrades to the bulk chemical storage area.
UPGRADE OR IMPROVE
Advance Metering Infrastructure (AMI) (c701603) Evaluate the use of AMI as replacement to the current AMR metering (Automatic Meter Reading). AMR provides 1-way communication between a meter and the City and AMI provides two-way communication between a meter and the City as well as between a meter and the customer. Benefits include early leak detection, customer conservation affect, and workflow management. Implementation to occur in future years.
Loch Lomond Rec Improvements (c701301) Complete facilities assessment and improvement program at Loch Lomond. A Use study was completed in FY 2013 which resulted in a number of planned projects to enhance the recreation area usability for its visitors. Several ADA and other recreational improvements are being pursued over the next 5 years.
Photovoltaic/Solar Projects (c701607) Ongoing project to evaluate, design and construct PV systems on various water department facilities. The current project is at the Bay Street Tank Site. Once installed, each project will add to the departments and City's green energy portfolio and work towards meeting and exceeding our climate action goals.
Water Resources Building (c701702) The Watershed Resources Division is currently housed in temporary trailers. This project consists of a needs assessment, design, and construction. The needs assessment portion of the project has been completed; FY 2016 will focus on site selection and design; FY 2017 will be construction.
Security Camera & Building Access Upgrades (c701704) Evaluation and implementation of security camera and building access upgrades at various Water facilities. Current security equipment is proprietary and could be improved. A transition to a new system will require camera replacement and additional video storage equipment.

WATER SUPPLY RELIABILITY
Aquifer Storage & Recovery (c701609 and c701610) Evaluate the feasibility of Aquifer Storage and Recovery as per the recommendations of the Water Supply Advisory Committee. Funds in FY 2016 and 2017 will be used for Phase 1 of the proposed study. Phase 2 will include pilot work and be funded in FY 2018. Project would potentially provide additional potable water to City and other agency customers, addressing part or all of water supply deficiencies.
Recycled Water (c701611 and c701612) Evaluate the feasibility of using advanced treated wastewater for beneficial uses as per the recommendations of the Water Supply Advisory Committee. The project will be collaboration amongst the Water and Public Works Departments. The project would potentially provide additional water to City and other agency customers, addressing all or part of water supply deficiencies.
Water Supply- WSAS Implementation (c70xxxx) Funding tentatively scheduled for FY2020.
Source Water Evaluation & Implementation (c701608) Evaluate source water quality, operational and infrastructure alternatives to maximize use of surface water. This project was prompted in part by the recommendations of the Water Supply Advisory Committee, accepted by Council in Nov 2015, to evaluate use of additional winter flows in the San Lorenzo River for various purposes to solve the regional water supply issues.

APPENDIX C – PROPOSED WATER RATES AND FEES FOR FY 2017-FY 2021

The tables below were excerpted from a more complete presentation on water rates and charges prepared for and presented to the Santa Cruz Water Commission on June 6, 2016. That presentation can be accessed online at the Water Commission's website. (see <http://www.cityofsantacruz.com/departments/water/city-water-commission/meetings-and-agenda>)

Table C-1
Inside City Customer Fixed Monthly Charges

Inside		FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Meter Size	# of Meters	Proposed Ready-to-Serve (\$/Meter)	9%	7%	5%	5%
5/8-in	14,348	\$ 8.78	\$ 9.53	\$ 10.18	\$ 10.71	\$ 11.26
3/4-in	150	\$ 9.01	\$ 9.78	\$ 10.45	\$ 10.99	\$ 11.56
1-in	748	\$ 9.70	\$ 10.53	\$ 11.25	\$ 11.83	\$ 12.44
1 1/2-in	294	\$ 10.61	\$ 11.52	\$ 12.31	\$ 12.94	\$ 13.61
2-in	250	\$ 13.14	\$ 14.26	\$ 15.24	\$ 16.02	\$ 16.85
3-in	35	\$ 31.74	\$ 34.45	\$ 36.82	\$ 38.71	\$ 40.71
4-in	15	\$ 38.63	\$ 41.93	\$ 44.81	\$ 47.11	\$ 49.55
6-in	6	\$ 54.70	\$ 59.37	\$ 63.45	\$ 66.71	\$ 70.16
8-in	3	\$ 73.07	\$ 79.31	\$ 84.76	\$ 89.11	\$ 93.73
10-in	3	\$ 93.74	\$ 101.75	\$ 108.73	\$ 114.32	\$ 120.24

Table C-2
Inside City Customer Volume Rates

Inside	FY 2017 Commodity Rate (\$/ccf)	FY 2018 Commodity Rate (\$/ccf)	FY 2019 Commodity Rate (\$/ccf)	FY 2020 Commodity Rate (\$/ccf)	FY 2021 Commodity Rate (\$/ccf)
SFR & MFR					
Tier 1	\$ 7.30	\$ 8.97	\$ 9.49	\$ 10.03	\$ 10.60
Tier 2	\$ 8.75	\$ 10.56	\$ 11.18	\$ 11.86	\$ 12.59
Tier 3	\$ 10.28	\$ 12.25	\$ 12.97	\$ 13.78	\$ 14.64
Tier 4	\$ 12.65	\$ 14.85	\$ 15.73	\$ 16.75	\$ 17.84
COM					
Uniform	\$ 8.84	\$ 10.67	\$ 11.29	\$ 11.97	\$ 12.70
UCSC					
Uniform	\$ 9.11	\$ 10.96	\$ 11.60	\$ 12.31	\$ 13.06
North Coast AG					
Uniform	\$ 6.63	\$ 8.29	\$ 8.74	\$ 9.34	\$ 9.99
Landscape					
Tier 1	\$ 9.68	\$ 11.59	\$ 12.27	\$ 13.04	\$ 13.86
Tier 2	\$ 13.38	\$ 15.65	\$ 16.58	\$ 17.67	\$ 18.83
Tier 3	\$ 14.54	\$ 16.91	\$ 17.93	\$ 19.10	\$ 20.33
Elevation Surcharge					
Elevation Surcharge	\$ 0.42	\$ 0.46	\$ 0.49	\$ 0.51	\$ 0.54

Table C-3
Outside City Customer Fixed Monthly Charges

Outside		FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Meter Size	# of Meters	Proposed Ready-to-Serve (\$/Meter)	9%	7%	5%	5%
5/8-in	7,507	\$ 10.05	\$ 10.91	\$ 11.66	\$ 12.26	\$ 12.89
3/4-in	65	\$ 10.32	\$ 11.20	\$ 11.97	\$ 12.59	\$ 13.24
1-in	574	\$ 11.11	\$ 12.06	\$ 12.89	\$ 13.55	\$ 14.25
1 1/2-in	164	\$ 12.16	\$ 13.20	\$ 14.10	\$ 14.83	\$ 15.60
2-in	157	\$ 15.05	\$ 16.34	\$ 17.46	\$ 18.35	\$ 19.30
3-in	14	\$ 36.36	\$ 39.47	\$ 42.17	\$ 44.34	\$ 46.64
4-in	9	\$ 44.25	\$ 48.03	\$ 51.33	\$ 53.96	\$ 56.76
6-in	5	\$ 62.66	\$ 68.01	\$ 72.68	\$ 76.42	\$ 80.37
8-in	1	\$ 83.71	\$ 90.86	\$ 97.10	\$ 102.09	\$ 107.38
10-in	-	\$ 107.38	\$ 116.55	\$ 124.55	\$ 130.95	\$ 137.74

Table C-4
Outside City Customer Volume Rates

Outside	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
	Commodity Rate (\$/ccf)	Commodity Rate (\$/ccf)	Commodity Rate (\$/ccf)	Commodity Rate (\$/ccf)	Commodity Rate (\$/ccf)
SFR & MFR					
Tier 1	\$ 8.38	\$ 10.15	\$ 10.75	\$ 11.37	\$ 12.03
Tier 2	\$ 10.05	\$ 12.00	\$ 12.70	\$ 13.49	\$ 14.32
Tier 3	\$ 11.85	\$ 13.96	\$ 14.79	\$ 15.73	\$ 16.72
Tier 4	\$ 14.60	\$ 16.98	\$ 18.01	\$ 19.18	\$ 20.43
COM					
Uniform	\$ 10.13	\$ 12.07	\$ 12.79	\$ 13.57	\$ 14.40
Landscape					
Tier 1	\$ 11.09	\$ 13.13	\$ 13.91	\$ 14.79	\$ 15.73
Tier 2	\$ 15.32	\$ 17.78	\$ 18.85	\$ 20.10	\$ 21.42
Tier 3	\$ 16.66	\$ 19.23	\$ 20.40	\$ 21.73	\$ 23.14
Elevation Surcharge					
Elevation Surcharge	\$ 0.48	\$ 0.52	\$ 0.56	\$ 0.59	\$ 0.62

Table C-5
Drought Cost Recovery Fees

Meter Size	Stage 1 – 5% cutback	Stage 2 – 15% cutback	Stage 3 – 25% cutback	Stage 4 – 35% cutback	Stage 5 – 50% cutback
5/8-in	\$2.45	\$6.12	\$9.79	\$13.46	\$18.35
3/4-in	\$2.45	\$6.12	\$9.79	\$13.46	\$18.35
1-in	\$6.13	\$15.30	\$24.48	\$33.65	\$45.88
1 1/2-in	\$12.25	\$30.60	\$48.95	\$67.30	\$91.75
2-in	\$19.60	\$48.96	\$78.32	\$107.68	\$146.80
3-in	\$36.75	\$91.80	\$146.85	\$201.90	\$275.25
4-in	\$61.25	\$153.00	\$244.75	\$336.50	\$458.75
6-in	\$122.50	\$306.00	\$489.50	\$673.00	\$917.50
8-in	\$281.75	\$703.80	\$1,125.85	\$1,547.90	\$2,110.25
10-in	\$347.90	\$869.04	\$1,390.18	\$1,911.32	\$2,605.70

Back Cover



Water Department Prop. 218 Notice Proposed Rates

July 2016

Building a Water System for Our Future

The mission of the City of Santa Cruz Water Department is to provide a safe, clean and continuous supply of water that meets or exceeds local, state and federal standards for public health and environmental quality, and to provide courteous, responsive and efficient service in the most cost-effective manner to our customers. We provide service to about 95,000 customers, 24 hours a day, 365 days a year.

The City of Santa Cruz Water Department is proposing a rate increase and changes to rate structures.

The nation's water utilities face a significant challenge due to a need to repair and replace aging water

systems, a decrease in water sales due to increased conservation, a changing climate that creates supply instability, and changes in regulatory requirements. The Santa Cruz water system faces all of these challenges and our current rates will not support the work needed to be done to respond to them. We are proposing increases to water rates and a change to the current rate structures, and new fees that will go directly to support projects that both maintain existing back-bone infrastructure and build critical new infrastructure.

When we raised rates in fall 2014, we committed to use the increased rates to fund ongoing Water Department projects and operations, as well as to complete several critical infrastructure

projects. As promised, by the end of 2016 we will have completed:

- The \$25 million Bay Street Tanks;
- A \$6 million rehabilitation of six filter basins at the Graham Hill Water Treatment Facility;
- The \$4.9 million Beltz 12 Well and Water Treatment Facility;
- The \$10.3 million Phase 3 of the North Coast System; and
- Replacement of the \$267,000 Ocean Street trunk main valve.

In addition, we have completed both the rate studies and financial planning work directed by the City Council in 2014, which results in this proposal to increase current rates, change current rate structures, and add new fees to directly support new infrastructure reinvestment.



Proposed Rate Changes

Historically, capital projects have been financed on a “pay-as-you-go” basis and in consequence, have depleted the Department’s available funds. Now, with several new capital projects facing the water system with significantly higher price tags than past projects, it would be impossible for the Department to continue to fund projects through “pay-as-you-go” without ongoing and unacceptably large increases to current rates. Accordingly, the Department will begin issuing debt to finance about two-thirds of planned capital spending. In addition to the financial constraints of “pay-as-you-go,” there is also an equity consideration; it is more equitable to spread costs of major system improvements out over time because projects funded and built today continue to benefit water users and rate payers for decades to come.

The proposed rate changes reflect the strong conservation values of the community by shifting away from collecting a large portion of water service costs from fixed charges (such as the Ready-to-Serve charge), to collecting over 90% of revenues through volumetric-pricing based on customer use. Though customers will see a decrease in their Ready-to-Serve charge, the proposed cost per unit of water will increase on all types of

accounts and depending upon the amount of water used, customers may see a big jump in their water bill. Changes to rate structures are also proposed so that multi-family accounts will now pay the same per-unit costs as single families, and proposed changes to irrigation accounts include an assigned water budget that reflects efficient irrigation practices for each property.

The costs to treat and distribute drinking water are fixed; the shift to collect needed revenue through fluctuating water sales comes with some risk. To mitigate that risk while still implementing a more volume-based rate structure that encourages conservation, a \$1 per unit of water Rate Stabilization fee will be charged beginning in 2017.

The newest change proposed to your water bill is an Infrastructure Reinvestment Fee that will support reinvestment in critical infrastructure projects. Since the rate increase in 2014, infrastructure projects have been added to the Water Department’s work plan at significantly greater costs than past projects: a state-required rehabilitation of the inlet-outlet pipeline in the Newell Creek dam for \$42 million; rehabilitation of the pipeline between Loch Lomond and

Felton for \$18 million; replacement and improvements to the pump station at the Felton diversion dam for \$4.5 million; replacement of several concrete tanks at the Graham Hill Water Treatment Plant for \$9 million; and initial feasibility work on a water supply project, as directed by the Council-approved work of the Water Supply Advisory Committee, which was completed in fall 2015.

We are also proposing a continuation of the Drought Cost Recovery fee, which will only go into effect in the event that the Council imposes restrictions on water use due to drought.

For those customers who...

Are charged an Elevation Surcharge for the increased energy used to pump water to homes in higher elevations – the proposed new surcharge will be \$0.42.

Have private fire protection/sprinkler service – there is a proposed new \$1 per fire-service meter charge, per month, to cover the costs for maintaining separate fire protection meters. There is no charge for water used to respond to a fire, but leaking fire services will be charged at the commercial per-unit rate for water, which is intended to incentivize prompt repairs to leaks.



Inside City Rates

Inside City Fixed Rates - Ready to Serve

Meter Size	Ready to Serve (\$/Meter)				
	As of 10/1/16	As of 7/1/17	As of 7/1/18	As of 7/1/19	As of 7/1/20
5/8-in	\$ 8.78	\$ 9.53	\$ 10.18	\$ 10.71	\$ 11.26
3/4-in	\$ 9.01	\$ 9.78	\$ 10.45	\$ 10.99	\$ 11.56
1-in	\$ 9.70	\$ 10.53	\$ 11.25	\$ 11.83	\$ 12.44
1 1/2-in	\$ 10.61	\$ 11.52	\$ 12.31	\$ 12.94	\$ 13.61
2-in	\$ 13.14	\$ 14.26	\$ 15.24	\$ 16.02	\$ 16.85
3-in	\$ 31.74	\$ 34.45	\$ 36.82	\$ 38.71	\$ 40.71
4-in	\$ 38.63	\$ 41.93	\$ 44.81	\$ 47.11	\$ 49.55
6-in	\$ 54.70	\$ 59.37	\$ 63.45	\$ 66.71	\$ 70.16
8-in	\$ 73.07	\$ 79.31	\$ 84.76	\$ 89.11	\$ 93.73
10-in	\$ 93.74	\$ 101.75	\$ 108.73	\$ 114.32	\$ 120.24
Fire Service - All Sizes *	\$1 /month	\$1.09 /month	\$1.15 /month	\$1.21 /month	\$1.26 /month

Inside City Volume (Commodity) Rates - Consumption

	As of 10/1/16	As of 7/1/17	As of 7/1/18	As of 7/1/19	As of 7/1/20
Single Family Residential and Multi-Family Residential (calculation is based upon the number of dwelling units multiplied by the tier width)					
Tier 1 (0-5 ccf**)	\$ 5.75	\$ 6.24	\$ 6.66	\$ 7.01	\$ 7.37
Tier 2 (6-7 ccf)	\$ 6.42	\$ 6.97	\$ 7.45	\$ 7.83	\$ 8.24
Tier 3 (8-9 ccf)	\$ 7.41	\$ 8.05	\$ 8.60	\$ 9.04	\$ 9.51
Tier 4 (10 ccf & above)	\$ 8.79	\$ 9.54	\$ 10.20	\$ 10.72	\$ 11.28
Commerical: Business, Industrial, Restaurant, Hotel, Golf, Municipal, Bulk, Fire Service Leaks					
Uniform	\$ 6.57	\$ 7.13	\$ 7.62	\$ 8.01	\$ 8.43
UCSC					
Uniform	\$ 6.70	\$ 7.27	\$ 7.77	\$ 8.17	\$ 8.60
Landscape / Irrigation (tiers based on percent of water budget)					
Tier 1 (≤100% of budget)	\$ 6.86	\$ 7.44	\$ 7.95	\$ 8.36	\$ 8.80
Tier 2 (101% - 150%)	\$ 9.15	\$ 9.93	\$ 10.62	\$ 11.16	\$ 11.74
Tier 3 (150% & above)	\$ 10.27	\$ 11.14	\$ 11.91	\$ 12.52	\$ 13.17
Elevation Surcharge					
As Applicable	\$ 0.42	\$ 0.46	\$ 0.49	\$ 0.51	\$ 0.54

Inside City Volume (Commodity) Rates - Infrastructure Reinvestment Fee

	As of 10/1/16	As of 7/1/17	As of 7/1/18	As of 7/1/19	As of 7/1/20
Single Family Residential and Multi-Family Residential (calculation is based upon the number of dwelling units multiplied by the tier width)					
Tier 1 (0-5 ccf**)	\$ 1.55	\$ 1.73	\$ 1.82	\$ 2.02	\$ 2.23
Tier 2 (6-7 ccf)	\$ 2.32	\$ 2.59	\$ 2.73	\$ 3.03	\$ 3.34
Tier 3 (8-9 ccf)	\$ 2.86	\$ 3.20	\$ 3.37	\$ 3.74	\$ 4.13
Tier 4 (10 ccf & above)	\$ 3.85	\$ 4.30	\$ 4.53	\$ 5.02	\$ 5.55
Commerical: Business, Industrial, Restaurant, Hotel, Golf, Municipal, Bulk					
Uniform	\$ 2.27	\$ 2.53	\$ 2.66	\$ 2.96	\$ 3.27
UCSC					
Uniform	\$ 2.40	\$ 2.68	\$ 2.82	\$ 3.13	\$ 3.46
Landscape / Irrigation (tiers based on percent of water budget)					
Tier 1 (≤100% of budget)	\$ 2.82	\$ 3.14	\$ 3.31	\$ 3.67	\$ 4.06
Tier 2 (101% - 150%)	\$ 4.22	\$ 4.71	\$ 4.96	\$ 5.50	\$ 6.08
Tier 3 (150% & above)	\$ 4.27	\$ 4.77	\$ 5.02	\$ 5.57	\$ 6.16

Inside City Volume (Commodity) Rates - Rate Stabilization Fee

	As of 10/1/16	As of 7/1/17	As of 7/1/18	As of 7/1/19	As of 7/1/20
All accounts (Per ccf)	\$ -	\$ 1.00	\$ 1.00	\$ 1.00	\$ 1.00

*This amount may be billed annually and will be added to any other applicable water use fixed and volume charges. **ccf equals 100 cubic foot of water.

Outside City Rates

Outside City Fixed Rates - Ready to Serve

Meter Size	Ready to Serve (\$/Meter)				
	As of 10/1/16	As of 7/1/17	As of 7/1/18	As of 7/1/19	As of 7/1/20
5/8-in	\$ 10.05	\$ 10.91	\$ 11.66	\$ 12.26	\$ 12.89
3/4-in	\$ 10.32	\$ 11.20	\$ 11.97	\$ 12.59	\$ 13.24
1-in	\$ 11.11	\$ 12.06	\$ 12.89	\$ 13.55	\$ 14.25
1 1/2-in	\$ 12.16	\$ 13.20	\$ 14.10	\$ 14.83	\$ 15.60
2-in	\$ 15.05	\$ 16.34	\$ 17.46	\$ 18.35	\$ 19.30
3-in	\$ 36.36	\$ 39.47	\$ 42.17	\$ 44.34	\$ 46.64
4-in	\$ 44.25	\$ 48.03	\$ 51.33	\$ 53.96	\$ 56.76
6-in	\$ 62.66	\$ 68.01	\$ 72.68	\$ 76.42	\$ 80.37
8-in	\$ 83.71	\$ 90.86	\$ 97.10	\$ 102.09	\$ 107.38
10-in	\$ 107.38	\$ 116.55	\$ 124.55	\$ 130.95	\$ 137.74
Fire Service - All Sizes *	\$1.15 /month	\$1.23 /month	\$1.30 /month	\$1.35 /month	\$1.40 /month

Outside City Volume (Commodity) Rates - Consumption

	As of 10/1/16	As of 7/1/17	As of 7/1/18	As of 7/1/19	As of 7/1/20
Single Family Residential and Multi-Family Residential (calculation is based upon the number of dwelling units multiplied by the tier width)					
Tier 1 (0-5 ccf**)	\$ 6.59	\$ 7.16	\$ 7.65	\$ 8.04	\$ 8.46
Tier 2 (6-7 ccf)	\$ 7.37	\$ 8.00	\$ 8.55	\$ 8.99	\$ 9.46
Tier 3 (8-9 ccf)	\$ 8.54	\$ 9.27	\$ 9.90	\$ 10.41	\$ 10.95
Tier 4 (10 ccf & above)	\$ 10.15	\$ 11.02	\$ 11.78	\$ 12.38	\$ 13.02
Commerical: Business, Industrial, Restaurant, Hotel, Golf, Municipal, Bulk, Fire Service Leaks					
Uniform	\$ 7.53	\$ 8.17	\$ 8.73	\$ 9.18	\$ 9.66
North Coast AG					
Uniform	\$ 3.58	\$ 3.88	\$ 4.15	\$ 4.36	\$ 4.59
Landscape / Irrigation (tiers based on percent of water budget)					
Tier 1 (≤100% of budget)	\$ 7.85	\$ 8.53	\$ 9.11	\$ 9.58	\$ 10.08
Tier 2 (101% - 150%)	\$ 10.48	\$ 11.38	\$ 12.16	\$ 12.79	\$ 13.45
Tier 3 (150% & above)	\$ 11.76	\$ 12.77	\$ 13.64	\$ 14.34	\$ 15.09
Elevation Surcharge					
As Applicable	\$ 0.48	\$ 0.52	\$ 0.56	\$ 0.59	\$ 0.62

Outside City Volume (Commodity) Rates - Infrastructure Reinvestment Fee

	As of 10/1/16	As of 7/1/17	As of 7/1/18	As of 7/1/19	As of 7/1/20
Single Family Residential and Multi-Family Residential (calculation is based upon the number of dwelling units multiplied by the tier width)					
Tier 1 (0-5 ccf**)	\$ 1.78	\$ 1.99	\$ 2.10	\$ 2.33	\$ 2.57
Tier 2 (6-7 ccf)	\$ 2.68	\$ 2.99	\$ 3.15	\$ 3.49	\$ 3.86
Tier 3 (8-9 ccf)	\$ 3.30	\$ 3.69	\$ 3.88	\$ 4.31	\$ 4.76
Tier 4 (10 ccf & above)	\$ 4.44	\$ 4.96	\$ 5.22	\$ 5.80	\$ 6.41
Commerical: Business, Industrial, Restaurant, Hotel, Golf, Municipal, Bulk					
Uniform	\$ 2.59	\$ 2.90	\$ 3.05	\$ 3.38	\$ 3.74
North Coast AG					
Uniform	\$ 3.05	\$ 3.40	\$ 3.58	\$ 3.98	\$ 4.39
Landscape / Irrigation (tiers based on percent of water budget)					
Tier 1 (≤100% of budget)	\$ 3.23	\$ 3.60	\$ 3.79	\$ 4.21	\$ 4.65
Tier 2 (101% - 150%)	\$ 4.83	\$ 5.39	\$ 5.68	\$ 6.30	\$ 6.97
Tier 3 (150% & above)	\$ 4.89	\$ 5.46	\$ 5.75	\$ 6.38	\$ 7.05

Outside City Volume (Commodity) Rates - Rate Stabilization Fee

	As of 10/1/16	As of 7/1/17	As of 7/1/18	As of 7/1/19	As of 7/1/20
All accounts (Per ccf)	\$ -	\$ 1.00	\$ 1.00	\$ 1.00	\$ 1.00

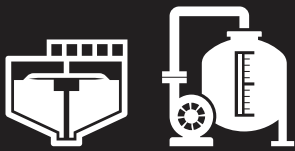
*This amount may be billed annually and will be added to any other applicable water use fixed and volume charges. **ccf equals 100 cubic foot of water.

Drought Cost Recovery Fee (DCRF)

	Stage 1 – 5% Shortage	Stage 2 – 15% Shortage	Stage 3 – 25% Shortage	Stage 4 – 35% Shortage	Stage 5 – 50% Shortage
Maximum Targeted Cost Recovery	\$ 1,000,000	\$ 2,500,000	\$ 4,000,000	\$ 5,500,000	\$ 7,500,000
5/8-in	\$ 2.45	\$ 6.12	\$ 9.79	\$ 13.46	\$ 18.35
3/4-in	\$ 2.45	\$ 6.12	\$ 9.79	\$ 13.46	\$ 18.35
1-in	\$ 6.13	\$ 15.30	\$ 24.48	\$ 33.65	\$ 45.88
1 1/2-in	\$ 12.25	\$ 30.60	\$ 48.95	\$ 67.30	\$ 91.75
2-in	\$ 19.60	\$ 48.96	\$ 78.32	\$ 107.68	\$ 146.80
3-in	\$ 36.75	\$ 91.80	\$ 146.85	\$ 201.90	\$ 275.25
4-in	\$ 61.25	\$ 153.00	\$ 244.75	\$ 336.50	\$ 458.75
6-in	\$ 122.50	\$ 306.00	\$ 489.50	\$ 673.00	\$ 917.50
8-in	\$ 281.75	\$ 703.80	\$ 1,125.85	\$ 1,547.90	\$ 2,110.25
10-in	\$ 347.90	\$ 869.04	\$ 1,390.18	\$ 1,911.32	\$ 2,605.70

The Drought Cost Recovery Fee maximum amounts set forth above are a fixed fee and are hereby established and shall be applicable for the full fiscal year (twelve months) following the water shortage declaration made by City Council. The maximum targeted cost recovery amount is indicated below and is linked to the water shortage stage declared by the City Council.

How Your Money Has Been Spent



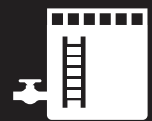
Beltz Well #12 and
Treatment Plant
\$4.9 million



Ocean Street Trunk
Main Valve Replacement
\$267K



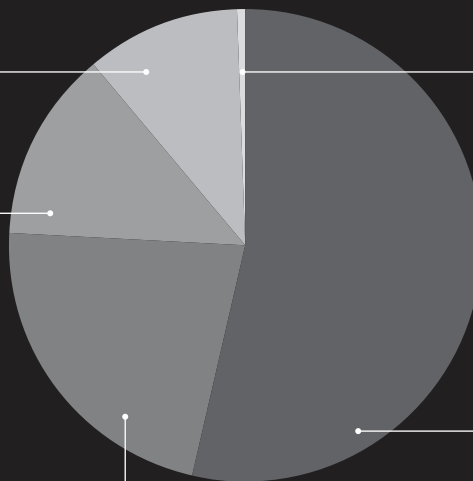
Filters at Graham Hill
Treatment Plant
\$6 million



Bay Street Reservoir
\$25 million



North Coast System – Phase 3
\$10.3 million





What is the need to increase water rates?

Much of the City's water infrastructure has reached or is reaching the end of its functional lifespan. Therefore the Water Department is planning a major infrastructure reinvestment program, with \$128 million needed for projects over the next five years.

What are the proposed changes to rates?

The Water Department is proposing changes to both how rates are structured and to the per-unit costs. Water rates are currently structured so that about 1/3 of revenue comes from fixed rates, such as the Ready-to-Serve charge. The new rate structure will collect less from fixed charges and more from the volume of water used. Because fixed-fee revenues are going down, per unit water rates will be going up to produce needed revenues. This design is more in line with the values expressed by the community, which is to encourage less water use.

How much more will customers pay with the proposed rate increases?

It depends on how much water a customer uses. Very low water users will actually pay less than they currently pay; very high users will pay substantially more.

Customers were told to conserve water, but are now being told that the drop in water sales is causing the need to raise rates. That doesn't seem fair?

It's true that the loss in revenue from selling less water is part of the need to increase rates. However it's a small part. The driving force behind raising rates is the need to reinvest in the City's drinking water treatment and delivery infrastructure.

What will customers get for their money?

Major rehabilitation of the inlet-outlet pipeline in the dam at Loch Lomond; rehabilitation or replacement of the Felton Diversion Dam and Pump Station and the Felton-to-Loch Lomond pipeline; and additional rehabilitation of the Graham Hill Water Treatment Plant are all projects that will be completed.

What's the difference between the current Ready-to-Serve charge and the proposed new Infrastructure Reinvestment Fee?

The Ready-to-Serve charge pays for ongoing operations, such as meter reading and maintenance, producing and delivering bills, and customer service. The proposed Infrastructure Reinvestment Fee is specifically for pay-as-you-go capital investment and debt service for capital expenditures.

What's the difference in the Rate Stabilization Fee proposed and the Drought Cost Recovery Fee?

The Drought Cost Recovery Fee will only be levied during an official declaration of water restrictions. The Rate Stabilization Fee was created to mitigate the risk inherent in basing so much revenue on the volume of water sold.

Will there be a "lifeline" rate for those on fixed and low incomes?

Proposition 218 requires that all customers be charged only for the costs of service provided – no more; no less. Unfortunately it therefore does not make allowances for "lifeline" rates.

Notice of Public Hearing

The City Council for the City of Santa Cruz will hold a Public Hearing Tuesday, August 23, 2016, during the regular meeting of the City Council at 7:00 pm.

The City Council will consider adoption of a proposed water rate increase affecting all water customers. Interested persons are encouraged to attend and comment on the issues being discussed. The meeting will be held in City Council Chambers at 809 Center Street.

Written protests: Any property owner or a tenant who is a customer of the Water Department may protest the proposed water rates. Only one written protest per parcel, filed by an owner or a tenant who is a customer, will be counted. Only written and signed protests that include the writer's address and/or assessor parcel number will be counted to determine whether a majority protest to the proposed water rate increase exists. Written protests may be mailed or hand delivered to the Mayor and Council of Santa Cruz at 809 Center Street, Room 10, Santa Cruz, CA 95060.

If you oppose the proposed rate increases, Proposition 218 requires that your protest be submitted in writing to be counted, even if you plan to attend the Public Hearing. To be counted, the protest must: 1) be in writing; 2) state opposition to the proposed rate increase; 3) identify the parcel by assessor's parcel number or street address; 4) include the printed name and original signature of the owner of record or a tenant who is a customer of the Water Department; 5) be received before the conclusion of the Public Hearing on August 23, 2016.

For more information, visit www.cityofsantacruz.com/h2orates.



Santa Cruz Water District
212 Locust Street
Santa Cruz, CA 95060

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Notice of Public Hearing
**Proposed Water Rates
Affecting Your Area**





Technical Memorandum

Prepared for: The City of Santa Cruz

Project Title: Water Conservation Master Plan, Phase 2

Subject: Overview of Current Findings from Water Conservation Master Planning Effort

Date: March 30, 2016

To: Toby Goddard, City of Santa Cruz Water Department

From: Lisa Maddaus, Maddaus Water Management Inc.
Bill Maddaus, Maddaus Water Management Inc.

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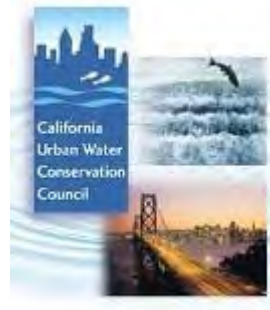
1. INTRODUCTION

This technical memorandum provides an overview of current findings from the water conservation master planning effort.

1.1 Background

Water is a precious natural resource that is vital to the health and welfare and to the economy of the Central Coast region. The City of Santa Cruz relies entirely on local sources for the community's drinking water supply. Because water supplies are limited, it is important that everyone uses water efficiently. The City of Santa Cruz has had a long-standing commitment to water conservation and offers a variety of programs, informational materials, and incentives to help City water customers become more water-efficient.

In 2000, the City adopted a Water Conservation Plan, the goal of which was to reduce water demand system-wide by 282 million gallons per year in 2010. Through plumbing fixture and appliance rebate programs, technical assistance, regulations, and other strategies, residential and commercial customers have saved over 330 million gallons of water per year so far. The City is also a member of the California Urban Water Conservation Council (CUWCC) and is active in promoting water conservation statewide.



In 2013, the Water Conservation Office contracted with Maddaus Water Management (MWM) to develop an updated Water Conservation Master Plan. The goal of the updated plan is to define the next generation of water conservation activities and serve as a roadmap to help our community achieve maximum, practical water use efficiency. Strengthening water conservation efforts has been identified as top priority by the City Council, the City's Water Commission, and more recently by the City's Water Supply Alternatives Committee in its effort aimed at delivering a safe, adequate, affordable, and environmentally sustainable water supply.

1.2 Need and Plan Objectives

The City of Santa Cruz's Water Conservation Master Plan (WCMP or Plan) strives to maximize the community's efficient use of water in the most equitable and cost-effective manner to the extent practical for implementation by City staff.

Key priorities of the WCMP include the following:

- Capitalize on opportunities to meet the future water needs of the Santa Cruz Water Department customers through cost-effective and sustained water conservation and water use efficiency efforts
- Demonstrate environmental stewardship and foster innovative, responsible and efficient practices
- Commit to and implement a water conservation program that supports the health of rivers, streams, and groundwater integral to the region's quality of life and economy
- Monitor and measure performance to ensure conservation potential is being met as forecasted

Achieving these goals will allow the Water Department to:

- Maintain and exceed the water savings already achieved by the City of Santa Cruz as well as identify the best path to achieve those savings and to monitor commitments to the CUWCC Memorandum of Understanding (MOU) Regarding Urban Water Conservation;
- Maintain a long-term plan for compliance with SB X7-7 to meet the gallons per capita per day (GPCD) target by 2020; and
- Meet the City's integrated water resource management goals to reduce peak season demands.

1.3 WSAC Recommended Approach to Demand Management

The City's Water Supply Advisory Committee (WSAC) was supported by City staff and Maddaus Water Management in its review of remaining conservation potential to future goals for the City's Conservation Program. In the WSAC's Final Report

published in October 2015, the following key assumptions about the demand management program (Recommended Program) were presented:

- “The Econometric Demand Forecast [building on previous assumptions prepared by MWM in the DSS Model] includes significant demand reductions associated with the implementation of existing plumbing and building codes, the continuation of existing demand management programs (as a baseline) and as a function of the effect on demand of expected increases in water rates.
- “A focus of new demand management programs will be on peak season demand reduction, which is also a significant focus of the expected demand reduction associated with anticipated price increases.
- “New and enhanced demand management programs will be developed to build on the Water Department’s current program that has contributed to reducing per capita demand in Santa Cruz to one of the lowest levels in the state.
- “The programs to be implemented in the coming decade[s] are a mix of lower cost and some higher cost measures. Those higher cost measures are meant as small-scale experiments that may be broadened if they prove popular and their costs decline over time. Together these measures incur an average total program cost of no more than \$10,000 per million gallons of water saved. This figure is lower than the expected cost of supply augmentation projects recommended to be pursued as a result of WSAC’s work.”

2. PLAN DEVELOPMENT (SUMMARY OF PROCESS)

Work on the Water Conservation Master Plan began with a kick-off meeting in January 2013. Since that time, the Water Commission has developed the goals of the planning effort; identified and selected a suite of potential quantifiable conservation measures for technical analysis; and evaluated system-wide conservation potential through selection of a recommended program scenario.

In preparation for this project, the City completed a Residential and Commercial Baseline Water Use Survey in May 2013 to assess the current status of plumbing fixtures, appliances, and landscape characteristics present in the City’s water service area.

There have been two (2) main phases in the City’s planning process separated by an intervening year that included an in-depth review of the work by WSAC. The process followed in the Plan is summarized as follows:

Phase 1: January 2013-October 2014

- Analyze water use and review City’s Baseline Survey for remaining conservation potential
- Identify, screen, and prioritize measures, with significant public input via Water Commission Meetings and workshops
- Model measures
- Formulate programs, leading to a recommended Program “C” to maximize total annual water savings based on conservation potential
- Present outcomes to Water Commission on October 6, 2014

WSAC Review: October 2014-September 2015

- Review prior Phase 1 analytical results from the Least Cost Decision Support System Model (DSS Model – Model described in Appendix A) and seek to answer additional questions with City and MWM technical assistance
- Shift conservation program emphasis to peak season (April-October) water savings rather than maximizing overall higher annual volume and/or more cost-effective water efficiency savings to better address the City’s supply-demand gap.
- Prepare and adopt a new econometric-based demand forecast

- Produce recommendations for additional conservation measures to be included in the Final Water Conservation Master Plan

Phase 2: October 2015-present

- Recalibrate model to updated econometric demand forecast and reset planning horizon to 2015-2035
- Incorporate input (changes to existing measures and adding new measures) from WSAC process, with focus on peak season demand reduction
- Incorporate new plumbing code changes based on the State’s Emergency Drought Regulations, effective December 1, 2015
- Formulate the “Recommended Program” into the DSS Model and evaluate results

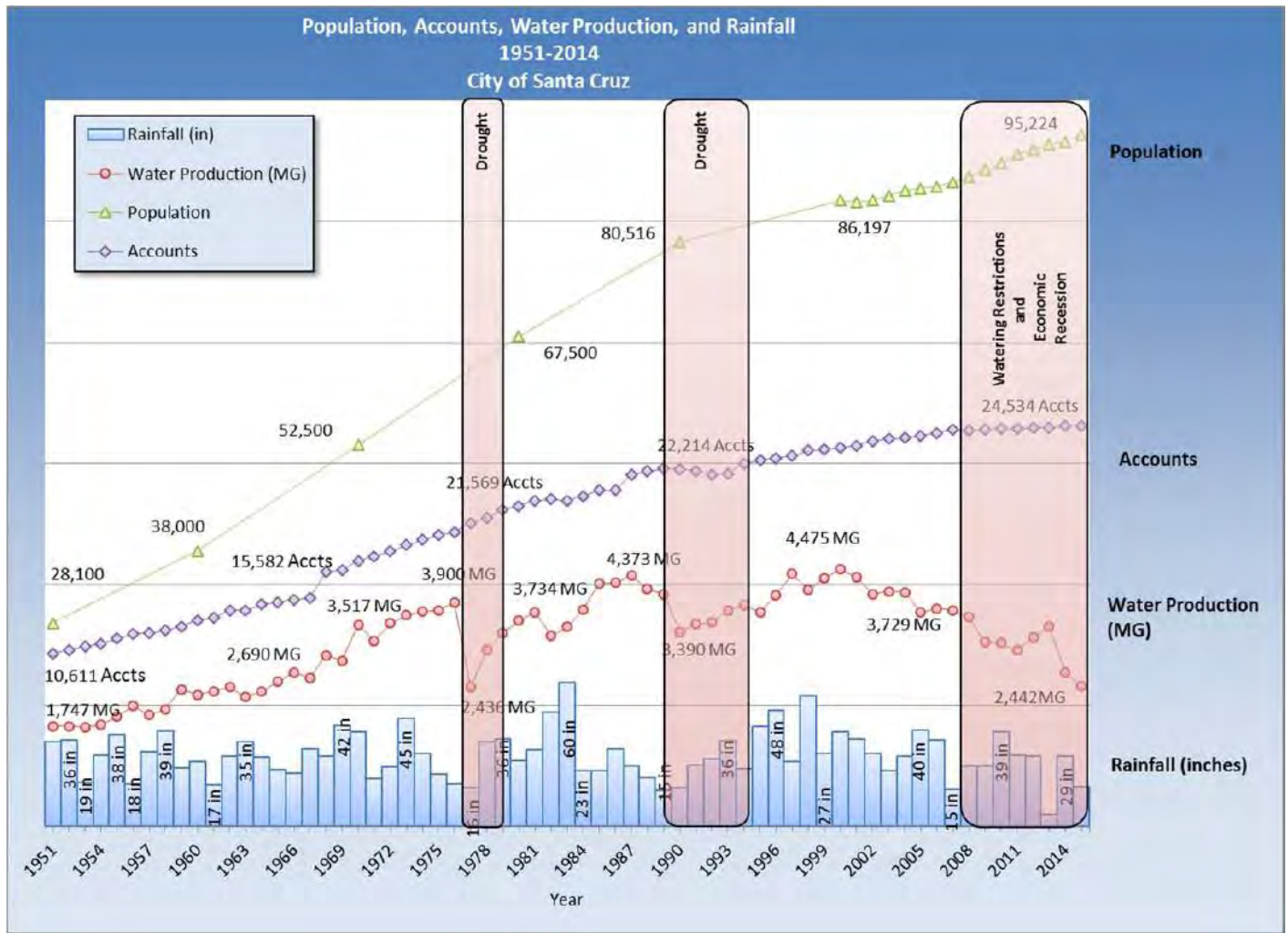
3. BASELINE DEMANDS

The WCMP process comprises four distinct steps: 1) input/analysis of system-wide demand projections to establish demand planning baseline with and without plumbing and building codes; 2) evaluation of system-wide conservation potential; 3) identification and study of potential conservation measures; and 4) deliberation and adoption of preferred long-term conservation program. Each of these steps is described in more detail in the following sections. This section presents a summary of the City’s historical demand trends as well as the basis for the demand forecast.

3.1 Historical Trends

As seen in Figure 3-1, the historic trend in system water use paralleled account growth and population, except during two major drought periods. Around 2000, the pattern changed and system demand began a long period of decline, accelerated in 2009 by drought, economic downturn, and other influencing factors. The City has not seen a full demand recovery since the recent economic recession due to the ongoing drought. In 2013 system-wide demand was 3,364 million gallons per year, with Stage 1 water shortage regulations and restrictions in effect. In 2015 with the full rationing scheme in place, the City reduced production to 2,442 million gallons on the level not seen since the drought in the 1970s. Water demands are projected to remain depressed after the year 2015 due to persistent drought conditions and long-term behavioral changes related to water use. While it is prudent to assume that future demands will eventually recover when rainfall patterns/drought conditions and the economy normalize, it might not be to the same level as before due to widespread, long-term conservation measures taken in response to drought and ongoing adjustments in water rates.

Figure 3-1. Historical Trends for City of Santa Cruz



3.2 Basis for Demand Forecast

Maddaus Water Management (MWM) employed its Least Cost Planning Decision Support System Model (DSS Model) for the technical analysis. In addition to considering historical demand trends based on billing consumption data, the DSS Model takes into account the following parameters: total population, single family population, multifamily population, UC Santa Cruz population, commercial employment, business-industrial growth, and municipal growth.

In the M.Cubed August 2015 “City of Santa Cruz Water Demand Forecast,” David Mitchell conducted an econometric analysis of water demand and forecasts of class-level customer demands and total system production through 2035. The report was commissioned by the City of Santa Cruz Water Department and the City’s Water Supply Advisory Committee. Its purpose was to update the Department’s existing demand forecast adopted as part of the 2010 UWMP to reflect current information on water usage and to account for effects of current conservation (using DSS Model Program A), water rates, and other factors expected to impact the future demand for water. With the start of Phase 2, MWM’s DSS Model was carefully updated to incorporate this econometric analysis by inputting the regression equations and data sets used by M.Cubed and calibrated to ensure consistency between the two demand forecast models.

The updated DSS model starts with a “baseline” demand forecast, which is not the same forecast as presented by M.Cubed. It differs in that it backs out the earlier estimates for plumbing code savings and the estimated future water saving associated with the City’s current water conservation program that were provided by MWM to M.Cubed in 2015 and embedded in that final demand forecast. All other variables, including average water use per account, forecasts of account growth, and economic factors used to forecast water use in the M.Cubed report, were taken directly from that model and used to populate the DSS model.

Table 3-1 below compares the primary water demand forecast presented by M.Cubed without the code savings and program savings that were previously generated from the DSS Model analysis completed in October 2014 compared to the updated DSS “baseline” demand completed in February 2016.

Table 3-1. Comparison of M.Cubed Demand Forecast and DSS “Baseline” Forecast (MG)

Demand (MG)	2020	2025	2030	2035
M.Cubed Final Demand Forecast, October 2015	3,385	3,351	3,388	3,442
2014 Estimate of Plumbing Code Savings (Prior DSS Model version)	65	132	197	235
2014 Estimate of Conservation Program Savings – Program “A” (Prior DSS Model version)	110	143	139	134
M.Cubed Final Demand Forecast without Plumbing Code or Conservation Program Savings	3,560	3,626	3,724	3,811
DSS Model “Baseline” Demand	3,560	3,636	3,743	3,838
Difference, MG	0	10	19	27
Difference, %	0.0%	0.3%	0.5%	0.7%

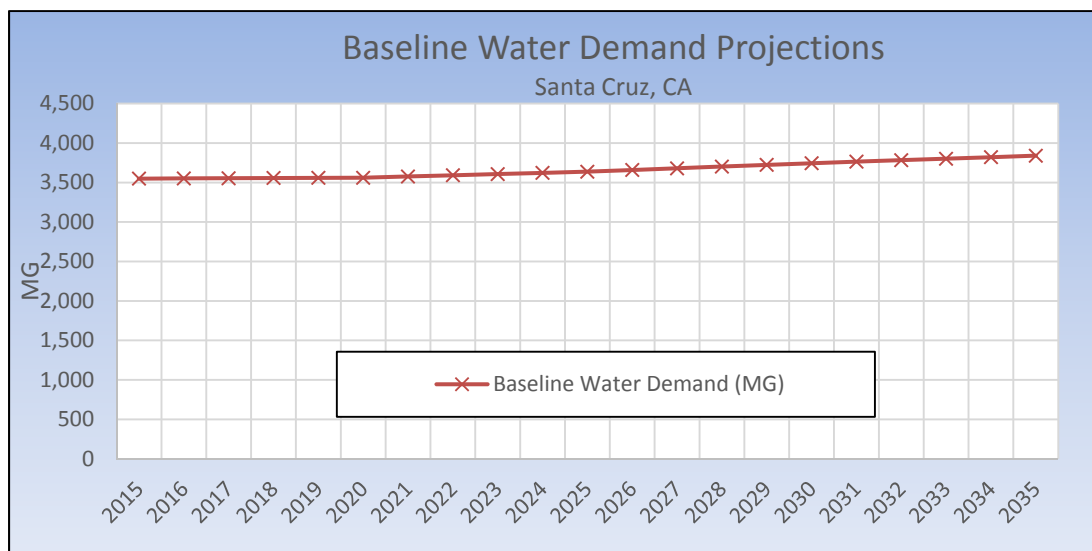
Note: Plumbing code and program savings: M.Cubed, 2015, Attachment 8, were originally based on results from the DSS Model prior work in 2014 by Maddaus Water Management, which are updated with the most recent DSS Model results from February 2016.

As can be seen in the above table, the two models are in close agreement and in all years differ by less than 1%.

The baseline demand forecast is shown in the following Figure 3-2. As referenced in the M Cubed report, the baseline forecast is predicated on average weather and normal economic conditions and is not expected to match realized demand, especially in the short term. City staff will continue to monitor production and consumption through and following the drought.

The next step involves calculating the effect of passive savings against the “baseline” demand. The results differ from earlier estimates of plumbing code savings presented in 2014-15 for two reasons: 1) lower baseline demand and 2) additional passive savings due to recent changes in California codes resulting from 2015 emergency conservation regulations adopted in California, effective December 1, 2015 (after the publication of the M.Cubed report).

Figure 3-2. Baseline Demand Forecast Without Plumbing Code Savings



Source: City of Santa Cruz. DSS Model, Section: Demand Analysis, Feb 16, 2016.

4. BASELINE DEMANDS WITH PASSIVE SAVINGS 2015-2035

Future community-wide conservation savings will be achieved by implementing both passive and active measures. Passive measures are federal and state codes and standards that increase conservation savings as older appliances and fixtures are replaced over time naturally with more water efficient models. Active measures are those in which the City will invest to promote water conservation, such as incentives and educational programs.

4.1 Basis for Plumbing Code Savings

Since it is beneficial to model the impact of the natural changes in the mix of types of appliances, the DSS Model forecasts service area water fixture use. In the codes and standards part of the DSS Model, specific fixture end-use type (point of use fixture or appliance), average water use, and lifetime are compiled. Additionally, state and national plumbing codes and appliance standards for toilets, urinals, showers, and clothes washers are modeled by customer category. These fixtures and plumbing codes can be added to, edited, and/or deleted by the user. This yields two demand forecasts – one with and one without plumbing code savings.

A key input in the model is fixture water use and life, as well as the initial proportions of individual fixtures in each customer class. The following Figure 4-1 presents an example of the initial proportions used in existing single family accounts. Table 4-1 on the following page provides the list of fixtures, average water use, and assumptions for fixture life used in this analysis.

Figure 4-1. Initial Fixture Proportions for Single Family Toilets (screen shot from the DSS Model)

Initial Fixture Proportions - Single Family Toilets	
1.28 gpf HET Residential	7.2%
1.6 gpf ULFT Residential	82.7%
High Use Toilet Residential	10.1%
<1.0 gpf Toilet Residential	0.0%
Total	100.0%

Data collected from the recently completed City of Santa Cruz Water Use Baseline Survey was used for this purpose. Other input parameters include estimates for annual replacement rate and assumed market share for both replacement and new equipment at various points in the planning horizon.

The scope of analysis involved assessing the rate of change of toilets, shower heads, lavatory and non-lavatory/kitchen faucets, and clothes washers in both existing single family and multifamily accounts, and toilets, urinals, and lavatory and non-lavatory/kitchen faucets in commercial accounts. Fixture characteristics are also tracked in new accounts, which are subject to the requirements of the 2015 California Green Building Code and 2015 California Code of Regulations Title 20 Appliance Efficiency Regulations adopted by the California Energy Commission (CEC) on September 1, 2015. This was an update in Phase 2, from the prior work in Phase 1, of preparing the DSS Model.

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

Standards for **residential clothes washers** fall under the regulations of the U.S. Department of Energy. Even though both front loading and top loading models will still be available for the foreseeable future, national water efficiency standards for both types are becoming more stringent over time, in steps. In March 2015, the federal standard reduced the maximum water factor for non-Energy Star certified top- and front-loading washing machines to 8.4 and 4.7, respectively. In 2018, the maximum water factor for standard top-loading machines will be further reduced to 6.5. Beginning in 2015, the maximum water factor for Energy Star certified washers was 4.3 for top-loading machines and 3.7 for front-loading.

Showerhead flow rates are newly regulated under the 2015 California Code of Regulations Title 20 Appliance Efficiency Regulations adopted by the CEC, which requires the exclusive sale in California of 2.0 gpm showerheads at 80 psi as of July 1, 2016 and 1.8 gpm showerheads at 80 psi as of July 1, 2018. The WaterSense specification applies to showerheads that have a

maximum flow rate of 2.0 gallons per minute (gpm) or less. This represents a 20% reduction in showerhead flow rate over the current federal standard of 2.5 gpm, as specified by the Energy Policy Act of 1992.

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

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

Table 4-1. List of Fixtures

Fixture Name	End Use	Average Water Use	Units	Fixture Life (yrs.)
Efficient Front Loader	Clothes Washers	13.0	gal per use	10
Medium Efficient Front Loader	Clothes Washers	19.0	gal per use	10
Top Loader	Clothes Washers	34.0	gal per use	10
0.5 gpm Non-Residential Lavatory Faucet	Lavatory Faucets	0.1	gal per use	15
1.2 gpm Residential Lavatory Faucet	Lavatory Faucets	0.3	gal per use	10
2.2 gpm Residential Lavatory Faucet	Lavatory Faucets	0.6	gal per use	10
2.2 gpm Non-Residential Lavatory Faucet	Lavatory Faucets	0.6	gal per use	15
2.5 gpm Residential Lavatory Faucet	Lavatory Faucets	0.6	gal per use	10
2.5 gpm Non-Residential Lavatory Faucet	Lavatory Faucets	0.6	gal per use	15
>2.5 gpm Residential Lavatory Faucet	Lavatory Faucets	0.9	gal per use	10
>2.5 gpm Non-Residential Lavatory Faucet	Lavatory Faucets	0.9	gal per use	15
1.8 gpm Residential Non-Lavatory/Kitchen Faucet	Non-Lavatory/Kitchen Faucets	1.8	gal per use	10
1.8 gpm Non-Residential Non-Lavatory/Kitchen Faucet	Non-Lavatory/Kitchen Faucets	1.8	gal per use	15
2.2 gpm Residential Non-Lavatory/Kitchen Faucet	Non-Lavatory/Kitchen Faucets	2.2	gal per use	10
2.2 gpm Non-Residential Non-Lavatory/Kitchen Faucet	Non-Lavatory/Kitchen Faucets	2.2	gal per use	15
2.5 gpm Residential Non-Lavatory/Kitchen Faucet	Non-Lavatory/Kitchen Faucets	2.5	gal per use	10
2.5 gpm Non-Residential Non-Lavatory/Kitchen Faucet	Non-Lavatory/Kitchen Faucets	2.5	gal per use	15
>2.5 gpm Residential Non-Lavatory/Kitchen Faucet	Non-Lavatory/Kitchen Faucets	3.5	gal per use	10
>2.5 gpm Non-Residential Non-Lavatory/Kitchen Faucet	Non-Lavatory/Kitchen Faucets	3.5	gal per use	15
High Efficiency 1.5 gpm	Showers	10.4	gal per use	25
High Efficiency 1.8 gpm	Showers	12.5	gal per use	25
High Efficiency 2 gpm	Showers	13.9	gal per use	25
Low Flow 2.5 gpm	Showers	18.3	gal per use	25
High Flow > 3 gpm	Showers	23.5	gal per use	25

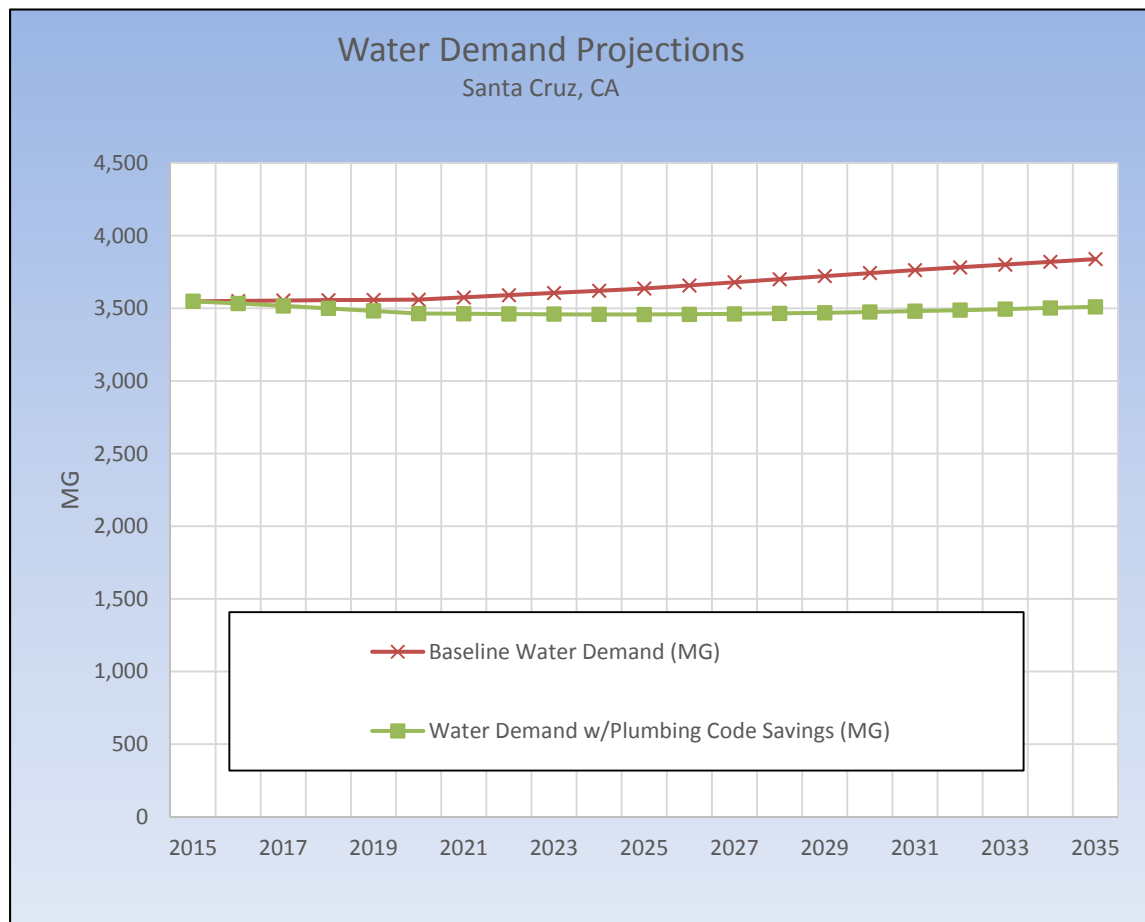
Table 4-1. List of Fixtures (continued)

Fixture Name	End Use	Average Water Use	Units	Fixture Life (yrs.)
<1.0 gpf Toilet Non-Residential	Toilets	1.0	gpf	50
1.28 gpf HET Residential	Toilets	1.3	gpf	50
1.28 gpf HET Non-Residential	Toilets	1.3	gpf	50
1.6 gpf ULFT Residential	Toilets	1.8	gpf	33
1.6 gpf ULFT Non-Residential	Toilets	1.8	gpf	50
High Use Toilet Residential	Toilets	3.5	gpf	25
High Use Toilet Non-Residential	Toilets	3.5	gpf	33
Waterless Urinal	Urinals	0.0	gpf	50
Pint Urinal	Urinals	0.1	gpf	50
Quart Urinals	Urinals	0.3	gpf	50

4.2 Baseline Demands with Passive Savings 2015-2035

The DSS Model estimates total cumulative plumbing code savings of 329 million gallons/year in 2035. As seen in Figure 4-2 below, water savings from fixture and appliance codes alone is expected to reduce total water demand (without plumbing code) from approximately 3.8 million gallons per year to about 3.5 million gallons by 2035, a reduction of about 8.6% due to plumbing code savings. Table 6-3 in section 6.1 shows the water savings in 5-year increments due to plumbing codes. Table 6-4 in section 6.2 presents projected water demands with plumbing code savings in 5-year increments.

Figure 4-2. Demand Forecast With and Without Plumbing Code Savings



Source: City of Santa Cruz. DSS Model, Section: Demand Analysis, Feb 16, 2016.

5. RECOMMENDED MEASURES

Maddaus Water Management (MWM) employed its Least Cost Planning Decision Support System Model (DSS Model) for the technical analysis. The following sections describe key elements used in the analysis that were reviewed during past Water Commission Meetings with public input along with both a webinar and two in-person workshops, including interested local community stakeholders, Water Commission members, and Water Supply Advisory Committee members. This section also presents a summary of the proposed measures, including their descriptions and estimated water savings. Background information on MWM's DSS Model can be found in Appendix A.

The initial process to identify and thoroughly evaluate potential conservation measures was iterative. First, an extensive list of more than 90 potential measures was generated based on input from City staff, consultants, Water Commissioners, and the public. This task included a review of the current active water conservation measures and the identification of new measures that may be appropriate for the City's service area. Next, the list of potential measures was screened to set aside measures that may not be appropriate for myriad reasons to seek those that would be included in the future program. The following criteria were used to narrow the list of potential measures:

- Water Saving Potential – emphasize measures that reduce average daily water use the most within the Santa Cruz community
- Sustainable Water Savings – emphasize measures that have long-term reliability
- Quantifiable Water Savings – emphasize measures where water savings can be accurately predicted
- Widespread Community and Social Acceptance – emphasize measures with high participation rates, low out-of-pocket expenses, and are equitable across customer type and social demographics
- Feasibility of Implementation/Secondary Impacts – emphasize measures that can achieve objectives
- Ancillary Benefits – emphasize measures that achieve additional goals, such as reducing energy/greenhouse gases (GHGs), reducing peak-season use, providing valuable customer service, and other non-quantifiable benefits (behavioral change, public awareness, etc.)

Further details about this process as well as a list of all the 90 potential measures are available from City staff. From the screening, the Water Commission added to and approved the recommended list of measures for the technical analysis phase of the project.

During the WSAC Report development, several additional measures were considered and added to the program. The result of the WSAC work on demand management was to shift the focus more toward reducing peak season use to increase supply reliability. It did so by considering measures to reduce outdoor use in residences and large landscapes, but also by enhancing base or indoor measures that lessen overall demand or that target specific uses, including visitor-serving uses, and thereby help reduce the City's peak season water use. The recommended program now matches the recommended measures list published in the October 2015 Water Supply Advisory Committee Final Report on Agreements and Recommendations, Table 14. The following table presents a basic description of each measure and the types of customers each measure targets. More detailed information and assumptions are described in the DSS Model.

Table 5-1. Basic Measure Descriptions

No.	Measure Name	Type of Customer	Description
1	System Water Loss Reduction	System	This measure's purpose is to identify and reduce water losses in the City's water system. The City is currently doing a water loss control study to review its annual water audit, look at water losses, and design a cost-effective water loss control program. The City currently loses an average of 7.5% of all treated water due to leaks, meter inaccuracies, and other problems. The goal of this measure is to reduce the City's system water losses on a long-term basis by an average of 1%. A new state law passed in 2015 that will require water suppliers to conduct water system audits, verify, and report water losses every year to the state beginning in 2017.
2	Advanced Metering Infrastructure (AMI)	Single Family (SF), Multifamily (MF), Commercial (COM)	This measure involves a major investment to upgrade meter reading technology and data management abilities. The City currently uses an Automatic Meter Reading system (AMR) in which water meters are read monthly by radio equipment that then transmits the information back to the City. This system may increase the frequency of meter reading from once a month to once an hour. The main water conservation (savings) benefits are for customer in-home or outdoor leak detection and increased customer awareness of water use. Other benefits include more action in enforcing the drought restrictions and more efficient customer service. Utility billing would continue to be on a monthly basis.
3	Large Landscape Budget-Based Water Rates	Irrigation (IRR)	This measure includes the development of individual monthly water budgets for irrigation customers. Water budgets are connected to a water rate schedule where water rates increase when a customer goes above their landscape water budget, or decreases if they are below budget. Budgets are typically based on factors like the size of the irrigated area, plant material and changes in weather conditions.
4	General Public Information	SF	This measure addresses opportunities to use public information programs as an effective tool to inform customers about the need for water conservation and conservation-related benefits. The current campaign is called " <i>Surf City Saves</i> " program. This measure includes paid and public service advertising, newsletters, bill inserts, information on the utility bill, a website, flyers and brochures, media campaigns, community meetings, direct mailings, community engagement at local activities, and other techniques. Public information is often carried out and coordinated with other agencies, groups, and schools.
5	Public Information (Home Water Use Report)	SF	This measure involves contracting with a firm to produce a detailed water billing report for high use customers that is in addition to their normal utility bill. This billing report compares water use in the neighborhood and offers suggestions to customers on ways to reduce water use.
6	Residential Leak Assistance	SF, MF	Customer leaks can go uncorrected at homes where owners are not able to pay the costs of repair. This measure would involve the City either paying part of the repair or paying the entire cost of the repair with funds that are paid back from customer water bills over time. This measure may also include an option to replace inefficient plumbing fixtures at low-income residences.
7	Single Family Residential Surveys	SF	This measure provides an outdoor water survey for existing single family residential customers. High water users will be targeted. This measure may include giving away water-efficient showerheads, faucet aerators, and toilet devices. This measure would provide a basic outdoor survey (look for leaks, irrigation problems and scheduling, plant information, etc.) and promote landscape and irrigation programs and improvements to reduce peak season water use.
8	Plumbing Fixture Giveaway/ Opt	SF, MF	The City would buy large amounts of efficient showerheads, kitchen and lavatory faucet aerators, shower timers and hose timers. Hose nozzles and leak detection tablets would be available for distribution at the Utility office and at community events.
9	Residential Ultra High Efficiency Toilet Rebates	SF, MF	This measure provides a rebate or voucher for the installation of an ultra-high efficiency toilet (UHET) that uses 1.0 gallons of water or less per flush (gpf).
10	High Efficiency Clothes Washer Rebates	SF, MF	The City would provide a rebate for high-efficiency clothes washing machines (HECW) to single family homes and in-unit condo/apartment complexes that do NOT have common laundry rooms. This program would be similar to the City's current program, except that higher rebate amounts would be increased for qualifying machines that are listed as Energy Star "Most Efficient" Clothes Washers.
11	High Efficiency Clothes Washer - New Development	SF, MF, COM	This measure would involve amending the City's building regulations to require building developers to install an efficient clothes washer (meeting certain water efficiency standards, such as gallons per load). Inspections would be coordinated with City and County building departments to make sure that an efficient washer is installed before the new home or building is occupied.
12	Hot Water On Demand - New Development	SF, MF, COM	The City would work to pass an ordinance requiring developers and major building remodels (for example, 50% of value of improvements) to equip new homes or buildings with efficient hot-water-on-demand systems. These systems use a pump placed under the sink to recycle water sitting in the hot water pipes to the water heater or to move the water heater into the center of the house and/or reduce hot water waiting times by having an on-demand pump on a recirculation line looping back to the hot water heater.
13	Toilet Retrofit at Time of Sale	SF, MF, COM	This measure involves tracking real estate sales within the City's water service area and working with buyers, sellers, and the real estate industry to retrofit older, inefficient toilets, showerheads, and urinals are upgraded with the most efficient fixtures when real estate is sold. A property inspection by either City staff or a licensed plumbing/general building would be required to verify compliance with the regulation.

No.	Measure Name	Type of Customer	Description
14	COM MF Common Laundry Room High Efficiency Clothes Washer	MF, COM	This measure provides a rebate for the installation of a high efficiency commercial washer (HEW) in COM laundromats and MF common area laundry rooms.
15	COM Incentives	MF, COM	After getting a free water use survey (Measure 17), the City will analyze the survey recommendations and determine if the MF or COM site qualifies for a financial incentive (reward). Financial incentives will be provided after analyzing the cost-benefit ratio of each proposed project. Incentives are designed to fit each individual site as each site has varying water savings potentials. Incentives will be given based on the decisions of the City specifically and while the money lasts.
16	Pre-Rinse Spray Nozzle Installation	COM	The City will provide free 1.3 gpm (or lower) pre-rinse spray nozzles, and possibly free installation of nozzles, in restaurants and other commercial kitchens.
17	COM Surveys	MF, COM	This measure will offer top MF and COM water customers a professional water survey that would evaluate ways for the site to save water and money. The surveys would be for large accounts (accounts that use more than 5,000 gallons of water per day, or the top 3%), such as hotels, restaurants, stores, and schools.
18	High Efficiency Urinal Program	COM, Municipal (MUN), Industrial (IND)	The City will provide a rebate or voucher for the replacement of older, high use urinals with high efficiency urinals (HEU) and flush valves using 0.125 gpf (1 pint) or less.
19	Public Restroom Faucet Retrofit - MUN	MUN	This measure includes the direct installation of high efficiency (0.5 gpm) sensor faucet fixtures in institutional (public) buildings, such as schools, hospitals, etc. High-use municipal building will be focused on first.
20	Public Restroom Faucet Retrofit - COM	COM	This measure includes the direct installation of high efficiency (0.5 gpm) sensor faucet fixtures in commercial buildings, such as businesses. High-use commercial buildings will be focused on first.
21	School Retrofit	MUN	This school retrofit program involves a school receiving funding to replace non-efficient fixtures, retrofit mixed use meters to dedicated irrigation meters, and upgrade irrigation systems.
22	Water Efficient Landscape Ordinance	SF, MF, COM, MUN, IND	This measure accounts for the lower irrigation water use that new accounts have due to their more efficient landscape designs, which are a result of the City's Landscape Code (implementation of Statewide Model Landscape Ordinance). The City is in the process of updating this code to keep up with new state regulations and technology for irrigation controllers and irrigation equipment.
23	Single Family Residential Turf Removal	SF	This measure provides a per-square-foot incentive to SF customers to remove and replace turf (grass) with low-water-use plants or permeable hardscape (pavers, concrete, etc. that allows water to soak through and into the ground). This is modeled after the City's current program. The rebate is currently \$0.50 per square foot and capped at \$500 per year for a single family residence. To increase participation, this measure would increase the rebate to \$1 per square foot and a \$1,000 maximum per year, or more in both cases.
24	Multifamily Residential/CII Turf Removal	MF, COM, MUN, IRR	This measure provides a per-square-foot incentive to MF, COM, MUN, and IRR customers to remove and replace turf with low-water-use plants or permeable pavers (or other permeable hardscape). The rebate is currently \$0.50 per square foot of turf removed and capped at \$2,500 per year for multifamily or commercial residences. This measure would increase the rebate to \$1 per square foot and a \$5,000 maximum per year, or more to increase participation.
25	Expand Large Landscape Survey/Water Budgets	IRR	This measure expands on the City's existing landscape water budget program to include more dedicated irrigation accounts. Outdoor water audits will be offered for existing customers with problems of overwatering or water waste. Normally those with high water use are focused on and provided a customized report telling them how to save water. All multifamily residential, CII, and public irrigators of large landscapes would be eligible for free landscape water audits upon request. This measure is connected to Measure 3 above, Large Landscape Budget-Based Water Rates.
26	Sprinkler Nozzle Rebates	SF, MF, COM	The City will provide rebates to replace standard spray sprinkler nozzles with more efficient rotating nozzles. Nozzles cost about \$6 each.
27	Gray Water Retrofit	SF	The City will hold a workshop to support a Gray Water Challenge or similar program. A rebate will be offered that will help to cover a portion of the cost to single family homeowners per year who install gray water systems. A gray water kit/package, available from local hardware stores, would be supported by this City rebate.
28	Residential Rain Barrels	SF	The City will provide an incentive for the installation of rain barrels. This could involve rebates, purchasing rain barrels in high quantities, and giveaways of barrels, as well as workshops on proper installation and use of captured rain water for landscape irrigation.
29	Climate Appropriate Landscaping	SF, MF, COM, MUN	This measure will provide incentives for the installation of climate-appropriate and rainwater infiltration landscape (soaks up water on-property as opposed to running off-property). This measure will provide rebates to Home Owners Associations (HOAs), businesses, and institutions that increase their outdoor water use efficiency.

No.	Measure Name	Type of Customer	Description
	and Rainwater Infiltration		by replacing qualifying high water use landscape and/or upgrading to qualifying high efficiency irrigation equipment or climate appropriate landscape. To qualify, sites must participate in a pre-inspection before beginning their project or purchasing materials. Single family homes, multifamily homes, and business properties with qualifying irrigated landscape (i.e., irrigated turf or a functional swimming pool) can receive rebates for replacing high-water-use landscape (e.g., irrigated turf grass) with a minimum of 50% plant coverage consisting of low-water-use plants from the Approved Plant List. Recommendations from the Water Supply Alternatives Committee (WSAC) Report include: • Increase turf conversion rebate • Require conversion of spray to drip for shrub irrigation • Discourage runoff through rainwater infiltration features (i.e., permeable pavers) • Support local actions for climate-appropriate landscaping • Focus on landscape narrower than 10 feet – no spray irrigation and/or next to hardscapes
30 SF	SF Conservation Pricing - Water and Sewer	SF	This measure is awaiting the results of an ongoing rate study conducted by Rafetlis Financial Consultants, Inc. in 2016.
30 MF	MF Conservation Pricing - Water and Sewer	MF	This measure is awaiting the results of an ongoing rate study conducted by Rafetlis Financial Consultants, Inc. in 2016.
30 COM	COM Conservation Pricing - Water and Sewer	COM	This measure is awaiting the results of an ongoing rate study conducted by Rafetlis Financial Consultants, Inc. in 2016.
31	Single Family Multifamily Dishwasher Rebates	SF, MF	This measure provides incentives for the purchase of water efficient dishwashers (Residential WF of 6.25 or less).
32	Hot Water Recirculation Systems	SF, MF, COM	This measure provides incentives for the installation of a hot water recirculation system. Having hot water discharge promptly is important for energy and water use efficiency. A hot water recirculating system enables the cold water in the hot water pipes to be continually returned to the water heater and reheated before the hot water faucet is turned on. Rebates would be available to the following water customer groups: - single family dwellings, including townhomes and mobile homes - apartment complexes - commercial institutions - commercially zoned businesses or institutions Maximum rebates allowable: (a) \$300 per single family account and (b) \$3,000 per commercial, industrial, or institutional account (e.g., as laundromats and apartments).
33	Rewarding Businesses For Adopting Best Practices	COM	This measure offers commercial customers who employ best practices an increased water supply reliability and a lower price. For a business, the difficulty of rationing water during severe drought years can have a negative effect on its profits. This measure proposes that the City's Water Shortage Contingency Plan be changed so that businesses who adopt best practices, such as efficient plumbing fixtures, hotel laundry recycling, and climate-appropriate landscaping, would get a lower level of water usage reduction during a severe drought. For example, in a Stage 4 drought, with a system-wide goal of 35% reduction, the current plan is to have the water allotment of businesses be 87% of their normal year water use. Under this measure, businesses adopting best practices would be expected to cut back to only 95% of normal use, rather than 87%. These businesses could also be rewarded with a lower rate for their water use.
34	Additional Building Code Requirements for New Development	SF, MF, COM, MUN, IND	New CalGreen Building Codes already included in DSS Model (see Section 4 above) already takes many of the items recommended by WSAC into account. This measure currently cannot be measured with regard to future additional CalGreen updates and water savings. This measure involves the coming together of a working group of planners, builders, conservation groups, and Water Department personnel to evaluate possible additions to current codes and fee structures that would encourage water conservation. Some examples include: (1) requiring high efficiency washers in new development and (2) requiring hot water on demand/structured plumbing in new development. It is also intended that the work group track and incorporate new technologies in future City codes.
35	Innovation Incubator Program	SF, MF, COM, MUN	This measure would establish an Innovation Incubator Program allowing Santa Cruz to continue its leadership in water management by creating a program that supports new developments in: • New technologies, customer financing programs, and customer outreach programs; and • Pilot projects to promote popular adoption of rainwater for toilets & washers, new technology toilets in institutional buildings, onsite recycling of graywater, rainwater irrigated lawns, and promotion of native plant landscapes. Small grants would be offered to local businesses and/or working with state and national organizations like California Urban Water Conservation Council, California Water Foundation, California Urban

No.	Measure Name	Type of Customer	Description
			Water Agencies, University of California (Santa Cruz or Davis), Alliance for Water Efficiency, Water Research Foundation, US Bureau of Reclamation, or other coalitions of utilities or research-focused organizations.
Notes: AMI – Advance Metering Infrastructure AMR – Automatic Meter Reading System COM – commercial gpf – gallons per flush gpm – gallons per minute			HECW – high efficient clothes washing machine HEU – high efficiency urinal HEW – high efficiency commercial washer HOA – Home Owners Association IND – industrial IRR – irrigation
			MF – multifamily MUN – municipal SF – single family UHET – ultra-high efficiency toilet WF – water factor, gallons per cubic foot WSAC – Water Supply Alternatives Committee

A total of 35 individual measures are evaluated in the current Santa Cruz DSS Model. This number counts the three pricing measures as one measure (which is yet to be fully defined until the City's Water Rate Study is complete). For each measure selected to be modeled, a measure description, as well as details on each measure's utility and customer costs, time period, and targets can be found in the DSS Model's measure inputs. More detailed information on model inputs for each measure is available from City staff. Some of the key assumptions used in evaluating the water savings, benefits, and costs include the following:

- Applicable customer class
- Applicable end use
- Estimated annual account participation rates
- Evaluation start and end year
- Measure length, years
- Measure life, years
- Utility unit cost, \$
- Customer unit cost, \$
- Estimated annual administration and marketing overhead, %

These measures listed in Table 5-1 make-up the City's Recommended Program which consists of both passive and active elements. Plumbing code measures account for 53% of the future conservation potential achieved and are independent of any program – the savings are based on customers following applicable current local, state and federal laws, building codes and ordinances. Recommended Program active measures fall within one of four categories: 1) general measures, 2) residential measures (indoor), 3) commercial measures (indoor), and 4) irrigation measures (outdoor).

6. RECOMMENDED PROGRAM RESULTS

This section presents the Recommended Program water savings as well as projected demand and per capita water use with these savings. The Recommended Program's overall cost of water saved and proposed schedule is also shown.

6.1 Total Water Savings

Table 6-1 below presents each Recommended Program measure's water savings in million gallons (MG) per year for year 2035 as a result of each measure's design and implementation schedule. Year 2035 savings include ongoing savings still valid since the measure's start. Savings per measure presented in the Table assume the measures are implemented on a stand-alone basis (i.e., without interaction or overlap from other measures that might address the same end use or uses).

It is important to understand that the savings from measures presented in the table, which address the same end use(s) are not simply additive. The DSS Model uses impact factors to avoid double counting in estimating the water savings from programs of measures. For example, if two measures are planned to address the same end use and both save 10% of the prior water use, then the net effect is not the simple sum (20%). Rather it is the cumulative impact of the first measure reducing the use to 90% of what it was without the first measure in place and then reducing the use another 10% to result in the use being 81% of what it was originally. In this example the net savings is 19%, not 20%. Using impact factors, the model computes the reduction as follows, $0.9 \times 0.9 = 0.81$ or 19% water savings.

Since interaction between measures has not been accounted for in Table 6-1 below, it is not appropriate to include a total in the bottom row. However, the table is useful to give a close approximation of the savings of each individual measure.

Table 6-1. Recommended Program Individual Measure Cost of Water Saved and 2035 Water Savings (MGY)

No.	Measure Name	Cost of Water Saved (\$/MG)	2035 Water Savings (MG)
1	System Water Loss Reduction	\$3,923	34.87
2	Advanced Metering Infrastructure	\$1,269	45.94
3	Large Landscape Budget-Based Water Rates	\$194	12.83
4	General Public Information	\$8,334	5.73
5	Public Information (Home Water Use Report)	\$2,518	11.39
6	Residential Leak Assistance	\$2,117	22.03
7	Single Family Residential Surveys	\$7,735	2.78
8	Plumbing Fixture Giveaway/Opt	\$1,479	2.03
9	Residential Ultra High Efficiency Toilet Rebates	\$5,316	2.91
10	High Efficiency Clothes Washer Rebates	\$2,794	36.20
11	High Efficiency Clothes Washer - New Development	\$1,368	12.53
12	Hot Water On Demand - New Development	\$7,849	4.46
13	Toilet Retrofit at Time of Sale	\$1,516	8.70
14	CII MF Common Laundry Room High Efficiency Clothes Washer	\$4,258	3.07
15	CII Incentives	\$533	18.39
16	Pre-Rinse Spray Nozzle Installation	\$153	9.16
17	CII Surveys	\$4,056	19.24
18	High Efficiency Urinal Program	\$5,220	3.22
19	Public Restroom Faucet Retrofit - MUN	\$23,467	0.29
20	Public Restroom Faucet Retrofit - COM	\$9,780	8.47
21	School Retrofit	\$1,883	2.88
22	Water Efficient Landscape Ordinance	\$602	6.66
23	Single Family Residential Turf Removal	\$22,157	4.18
24	Multifamily Residential/CII Turf Removal	\$32,186	2.39
25	Expand Large Landscape Survey/Water Budgets	\$20,948	1.97
26	Sprinkler Nozzle Rebates	\$13,643	3.35
27	Gray Water Retrofit	\$15,742	0.24
28	Residential Rain Barrels	\$4,672	3.42
29	Climate Appropriate Landscaping and Rainwater Infiltration	\$33,221	8.26
30SF	SF Conservation Pricing - Water and Sewer ¹	N/A	N/A
30MF	MF Conservation Pricing - Water and Sewer ¹	N/A	N/A
30COM	COM Conservation Pricing - Water and Sewer ¹	N/A	N/A
31	Single Family Multifamily Dishwasher Rebates	\$29,602	0.20
32	Hot Water Recirculation Systems	\$15,650	1.38
33	Rewarding Businesses For Adopting Best Practices	\$6,030	3.64
34	Additional Building Code Requirements for New Development ²	N/A	N/A
35	Innovation Incubator Program	N/A	N/A

¹Pricing measure costs and savings are not yet available. These measures are awaiting the results of an ongoing rate study scheduled to be completed in 2016.

² New CalGreen Building codes, effective as of January 2016, are already modeled. This measure is awaiting support from a Working Group yet to be formed.

Notes:

1. This table does not contain a total in the bottom row intentionally. It is not applicable since interaction between measures has not been accounted for in this table but is at the program level.
2. Source: City of Santa Cruz. DSS Model, Section: Conservation Analysis, Feb 16, 2016.

Table 6-2 presents the benefit cost analysis summary for the Recommended Program, which includes all the measures listed in the previous Table 6-1.

Cost categories are defined as follows:

- Utility Costs – those costs that the City as a water utility will incur to operate the measure including administrative costs

- Utility Benefits – the avoided cost of producing water

The column headings in Table 6-2 are defined as follows:

- Average Cost of Water Saved (\$/MG) = average cost to implement the program divided by the water savings over the life of the conservation measure.
- Water Savings in 2035 (MGY) = water saved in million gallons. The year 2035 is presented as this represents the end of the planning horizon for both the 2015 UWMP and this analysis effort.

Table 6-2. Recommended Program Costs and Savings

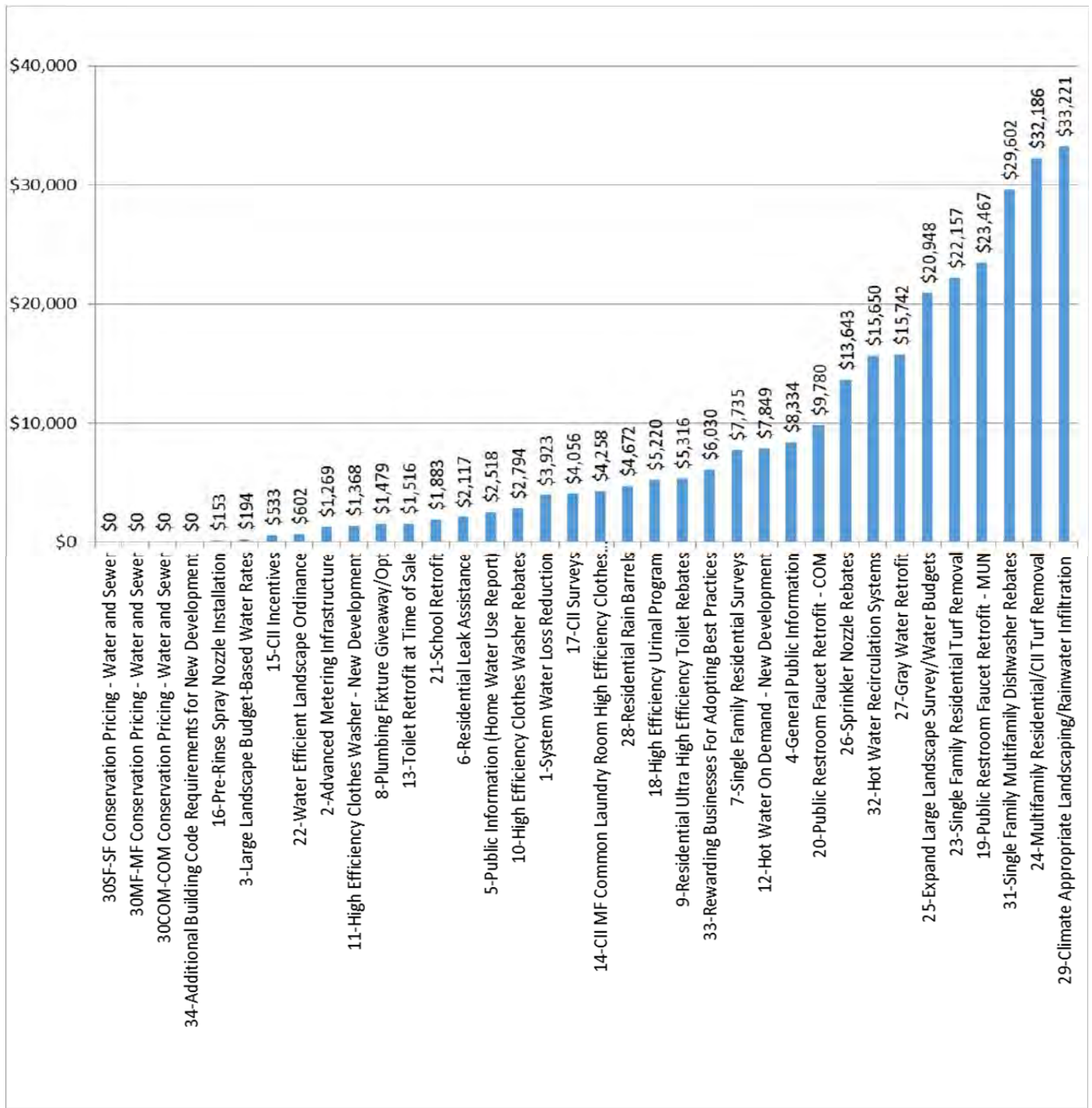
Conservation Program	Average Cost of Water Saved \$/MG	Water Savings over “Baseline” Demand in 2035 (MGY)
Recommended Program with Plumbing Code Savings	\$4,572/MG	619

Notes:

1. Across the modeling time period of 2015-2035, administrative costs average approximately 22% of total utility costs annually.
2. Source: City of Santa Cruz. DSS Model, Section: Results, Feb 16, 2016.

Figure 6-1 shows the costs of water saved for individual measures ranked from lowest to highest. The measures to be implemented in the next several years are a mix of some lower cost and some higher cost measures. Several of the measures addressing peak season water use have the highest unit costs, but, together as a package, the Recommended Program is \$4,572/MG, well below the \$10,000/MG the maximum level established by the WSAC which is lower than the expected unit cost of supply augmentation projects recommended to be pursued as a result of the WSAC’s work.

Figure 6-1. Conservation Measures Unit Cost of Water Saved (\$/MG)



Source: City of Santa Cruz. DSS Model, Section: Results, Feb 16, 2016.

Table 6-3 below shows the savings in 5-year increments for the plumbing codes, Recommended Program, and the Recommended Program with plumbing code savings.

Table 6-3. Long Term Conservation Program Savings over “Baseline” Demand (MG/Year)

Conservation Program	2020	2025	2030	2035
Plumbing Code	96	179	269	329
Recommended Program	137	232	269	291
Recommended Program with Plumbing Code Savings	233	411	538	619

Source: City of Santa Cruz. DSS Model, Section: Results, Feb 16, 2016.

The Recommended Program consists of both passive (plumbing codes which include state and Federal legislation for efficient fixture requirements for customers served by the City) and active elements. Plumbing code measures account for 53% of the future conservation potential achieved and are independent of any active conservation program.

6.2 Water Demand with Projected Savings

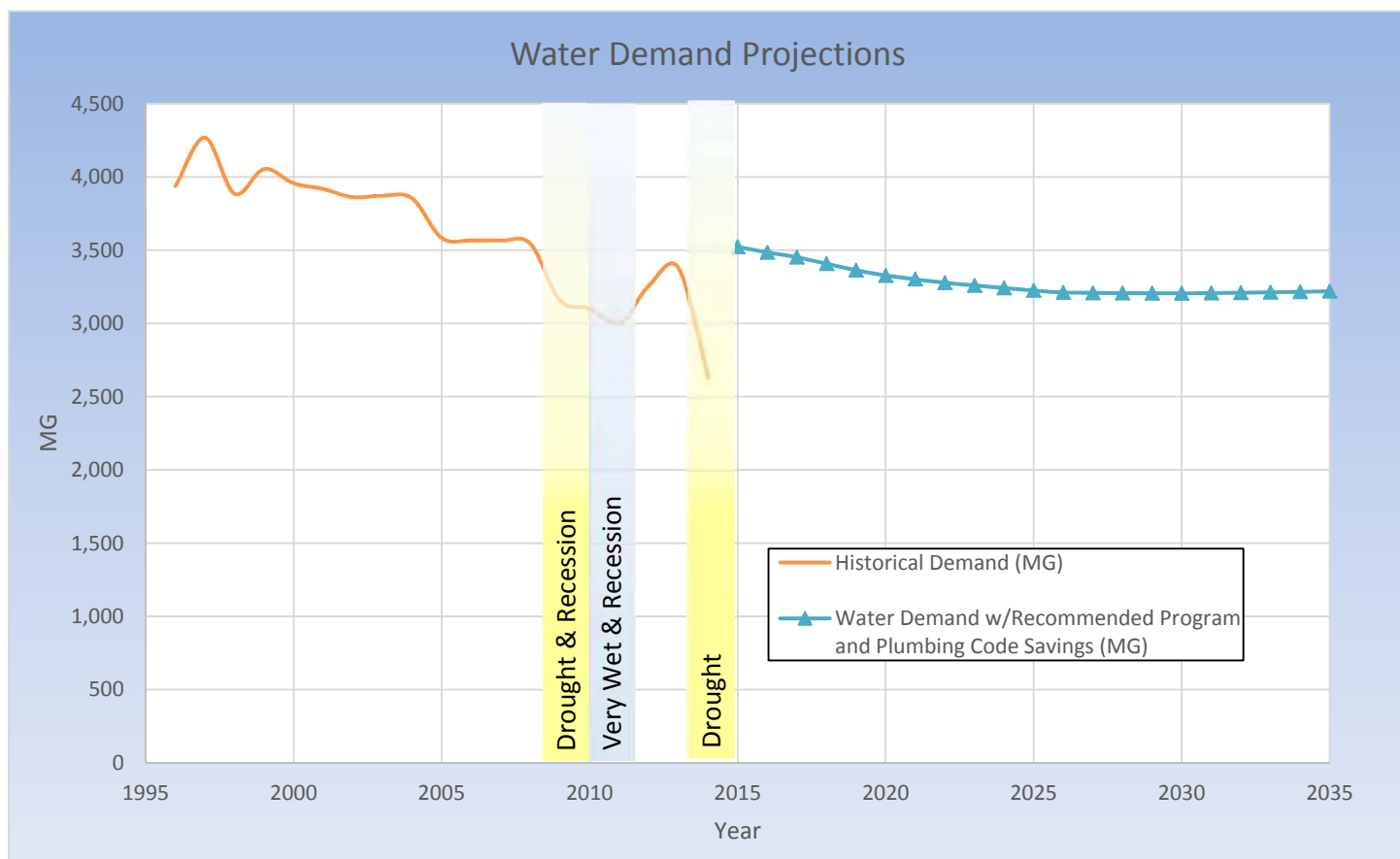
The Recommended Plan is envisioned to include strong customer participation to support additional planned growth while keeping total water use relatively constant for the next 20 years. New development will be built to water efficient standards following the 2015 CalGreen Plumbing Code, 2015 CEC Code, and other local ordinances (e.g., City's landscape ordinance). Water use in new homes should be less and more efficient than existing homes on comparable lot sizes. Table 6-4 and Figure 6-2 below present the Recommended Program projected water demands. Note that the Recommended Program with Plumbing Code is lower than the Demand Forecast by M.Cubed shown in Table 3-1. The Recommended Program forecast is 222 MGY lower (6%) than the M.Cubed forecast in 2035. This is due to increased savings by the new plumbing codes and new conservation programs that would be added over time.

Table 6-4. Water Use Projections (MG/Year)

	2020	2025	2030	2035
Demand with Plumbing Code (MGY)	3,464	3,456	3,474	3,510
Demand with Plumbing Code and Recommended Program (MGY)	3,327	3,225	3,205	3,220

Source: City of Santa Cruz. DSS Model, Section: Results, Feb 16, 2016.

Figure 6-2. Recommended Program Projected Water Demands



Source: City of Santa Cruz. DSS Model, Section: Results, Feb 16, 2016.

6.3 Per Capita Water Use

With two possible conservation target tracks to follow, the City has selected to aim to achieve SB X7-7 Method 3: 95% of State Hydrological Region Target by 2020. The City's baseline and target GPCD are as follows:

- Baseline GPCD = 113 GPCD
- 2015 Interim Target = 111 GPCD
- 2020 target = 110 GPCD
- CUWCC 2018 target = 101 GPCD

Table 6-5 below shows the projected per capita water use in gallons per day per person (GPCD) in 5-year increments for the projected demand with no plumbing code savings, projected demand with plumbing code savings, and projected demand with Recommended Program implementation and plumbing code savings.

Table 6-5. Projected Population and Per Capita Water Use (GPCD)¹

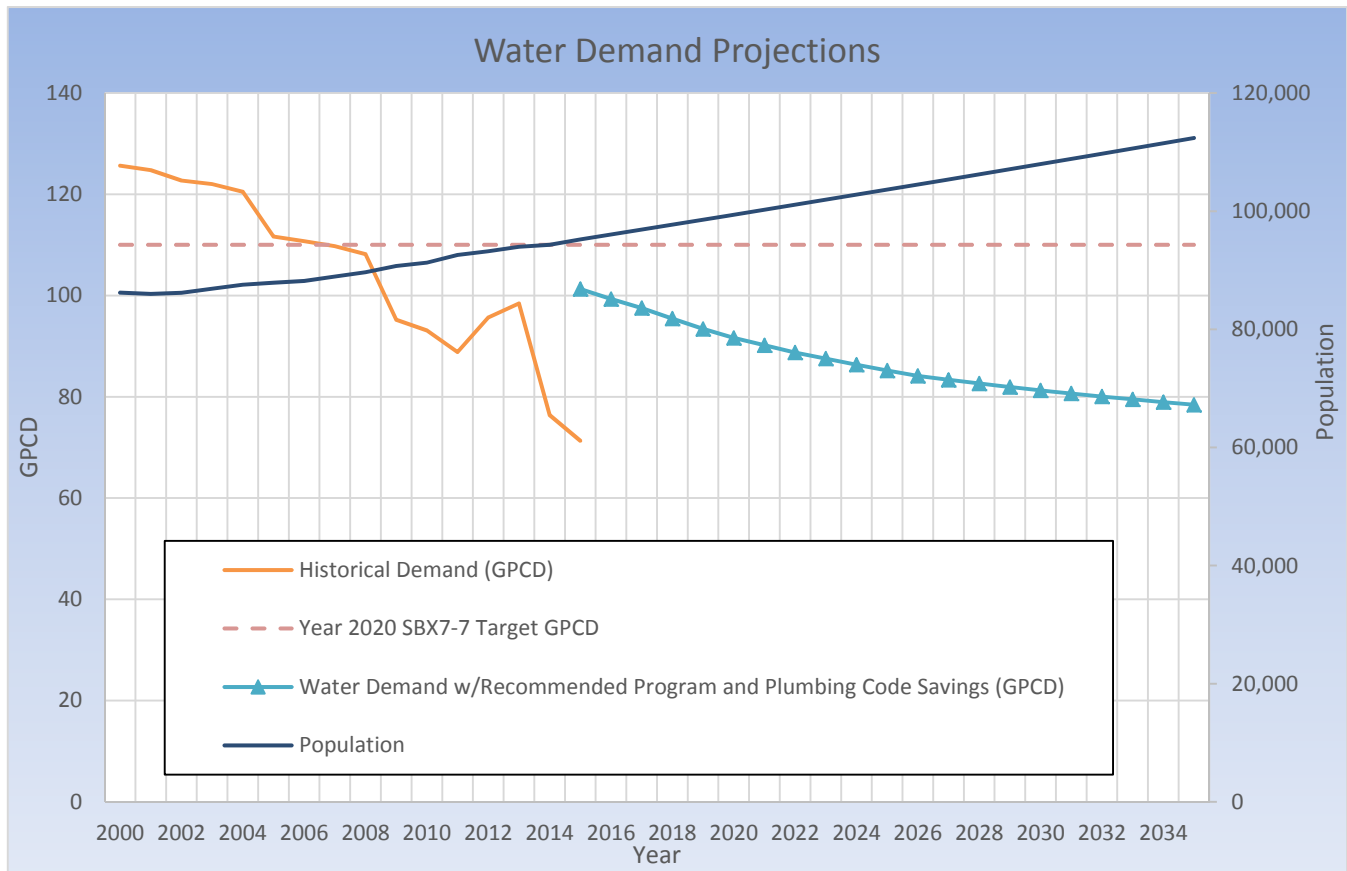
	2020	2025	2030	2035
Population ²	99,403	103,620	107,989	112,390
“Baseline” Demand without Plumbing Code (GPCD)	98	96	95	94
Demand with Plumbing Code (GPCD)	95	91	88	86
Demand with Plumbing Code and Recommended Program (GPCD)	92	85	81	78

¹ City of Santa Cruz. DSS Model, Section: Results, Feb 16, 2016.

² WSAC Final Report, October 2015.

The following Figure 6-3 presents the SB X7-7 year 2020 GPCD target and historical and projected GPCD estimates with plumbing codes and Recommended Program savings. As seen below, the City has already met its state-mandated 2020 target and surpassed its voluntary CUWCC 2018 goal. The goal of the City’s plan is to press beyond these state targets and instead maximize conservation savings to help meet local resource needs for current and future water demands.

Figure 6-3. Water Conservation Program Savings Projections – SB X7-7 Target, GPCD



Source: City of Santa Cruz. DSS Model, Section: Results, Feb 16, 2016.

6.4 Overall Cost of Water Saved

The cost of water saved per unit volume (\$/MG) for the Recommended Program is \$4,572/MG. This is below the Water Supply Alternatives Committee’s recommended threshold for overall cost of water saved, which is \$10,000/MG.

The cost of water saved for the Recommended Program can be compared to the City’s avoided cost of water as one indicator of the cost effectiveness of the conservation program. It should be noted that the cost of water saved value somewhat undervalues the cost of savings because program costs are discounted to present value and the water benefit is not.

6.5 Key Findings

As a result of this comprehensive analysis here are some summary observations and conclusions:

1. The additional, incremental water savings from the Recommended Program, compared to the City’s recent demand forecast, amount to about 220 million gallons in 2035.
2. The estimated annual demand will decline over time to about 3.2 billion gallons per year (bg) in 2035, versus about 3.4 bg estimated in the demand study. That estimate is comparable to the actual level of water production experienced in the late 1960s, when the service area population was around 50,000.
3. The impact on water savings from 2015 changes in the fixture plumbing codes prompted by the emergency conservation regulations (which would not have been factored in but for the delay associated with the Water Supply Advisory Committee’s process) is over 100 million gallons more than previously estimated.
4. The overall cost of water saved by the Recommended Program is about half of what the WSAC set as a recommended threshold.
5. Gross per capita water use is expected to gradually decline to a level of less than 80 GPCD in 2035.

6.6 Proposed Schedule

The following Figure 6-4 presents the proposed Recommended Program implementation schedule.

Figure 6-4. Recommended Program Proposed Implementation Schedule

No.	Measure	Time Period	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
1	System Water Loss Reduction	2015 - 2035																					
2	Advanced Metering Infrastructure	2021 - 2035																					
3	Large Landscape Budget-Based Water Rates	2018 - 2020																					
4	General Public Information	2015 - 2035																					
5	Public Information (Home Water Use Report)	2018 - 2035																					
6	Residential Leak Assistance	2018 - 2035																					
7	Single Family Residential Surveys	2015 - 2035																					
8	Plumbing Fixture Giveaway/Opt	2015 - 2017																					
9	Residential Ultra High Efficiency Toilet Rebates	2015 - 2020																					
10	High Efficiency Clothes Washer Rebates	2015 - 2026																					
11	High Efficiency Clothes Washer - New Development	2021 - 2035																					
12	Hot Water On Demand - New Development	2021 - 2035																					
13	Toilet Retrofit at Time of Sale	2015 - 2019																					
14	CII MF Common Laundry Room High Efficiency Clothes Washer	2015 - 2024																					
15	CII Incentives	2021 - 2026																					
16	Pre-Rinse Spray Nozzle Installation	2015 - 2016																					
17	CII Surveys	2021 - 2026																					
18	High Efficiency Urinal Program	2015 - 2018																					
19	Public Restroom Faucet Retrofit - MUN	2021 - 2023																					
20	Public Restroom Faucet Retrofit - COM	2021 - 2030																					
21	School Retrofit	2021 - 2030																					
22	Water Efficient Landscape Ordinance	2015 - 2035																					
23	Single Family Residential Turf Removal	2015 - 2035																					
24	Multifamily Residential/CII Turf Removal	2015 - 2035																					
25	Expand Large Landscape Survey/Water Budgets	2018 - 2035																					
26	Sprinkler Nozzle Rebates	2018 - 2035																					
27	Gray Water Retrofit	2015 - 2035																					
28	Residential Rain Barrels	2015 - 2035																					
29	Climate Appropriate Landscaping and Rainwater Infiltration	2018 - 2035																					
30SF	SF Conservation Pricing - Water and Sewer	2018 - 2035																					
30MF	MF Conservation Pricing - Water and Sewer	2018 - 2035																					
30COM	COM Conservation Pricing - Water and Sewer	2018 - 2035																					
31	Single Family Multifamily Dishwasher Rebates	2018 - 2022																					
32	Hot Water Recirculation Systems	2018 - 2022																					
33	Rewarding Businesses For Adopting Best Practices	2020 - 2035																					
34	Additional Building Code Requirements for New Development	2018 - 2035																					
35	Innovation Incubator Program	2021 - 2035																					

Source: City of Santa Cruz. DSS Model. Section: Conservation Analysis, Feb 16, 2016.

6.7 Monitoring

The Plan is intended to be dynamic and changes and adjustments are expected. Monitoring progress on implementing recommended programs should be a priority. Costs, participation rates, and water use should be tracked to ensure that the plan is on target to meet goals. As new promising technologies emerge, they should be tested and possibly replace programs that are underachieving. Summary reports should be issued citing progress and recommending changes in program content. Comprehensive review of the plan every five years will ensure the plan reflects current technology and codes, and will provide an opportunity to check success and progress in meeting conservation goals.

7. NEXT STEPS

Obtain Commission approval and support to gain City Council direction to proceed with completion of writing the Water Conservation Master Plan document.

8. REFERENCES

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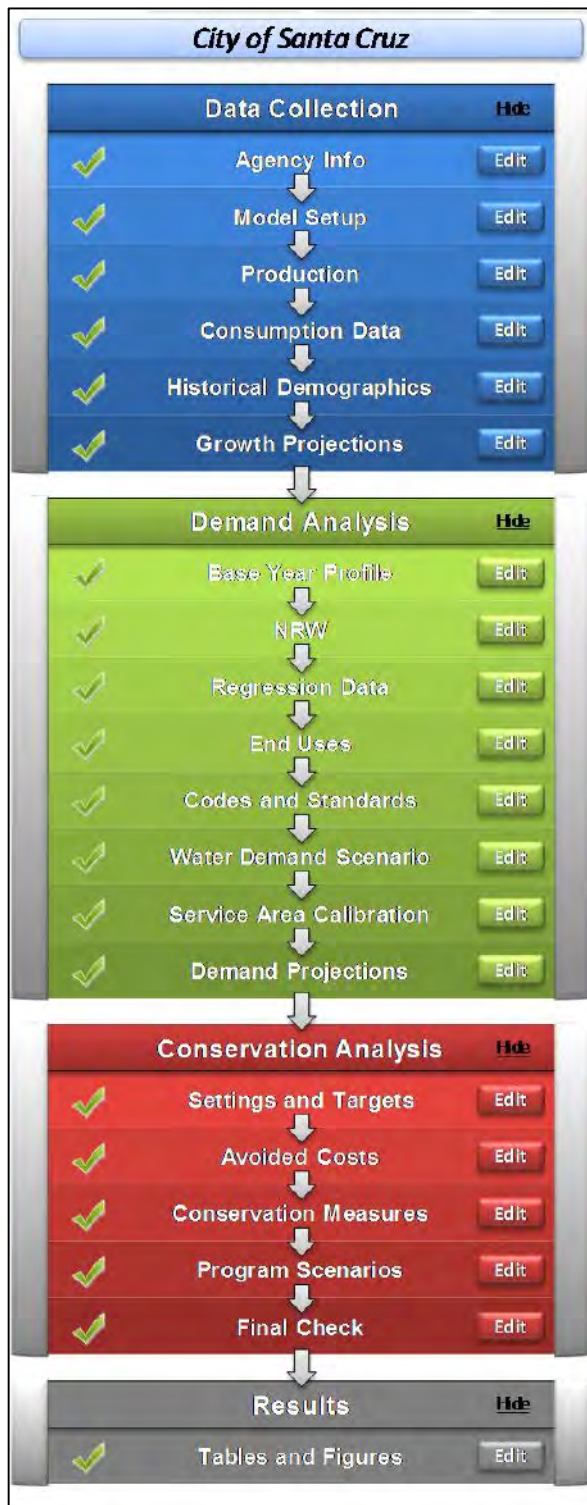
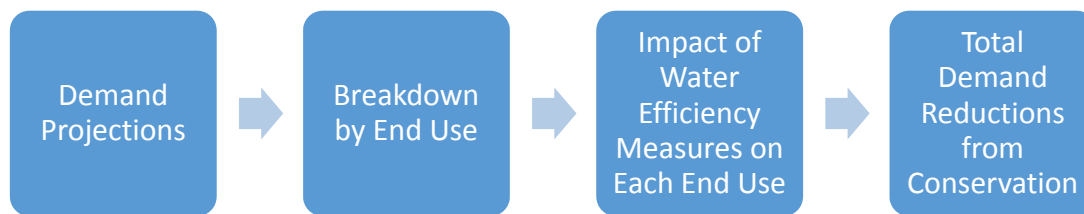
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Ibid. Water supply Advisory Committee. Water Supply Advisory Committee Final Report on Agreements and Recommendations, Table 14. October 2015.

M.Cubed. City of Santa Cruz Water Demand Forecast, prepared by David Mitchell, August 2015. Online: <http://www.santacruzwatersupply.com/file/972/download?token=dNx08zIf>

Western Policy Research. BMP Cost and Savings Study Update, A Guide to Data and Methods for Cost-Effectiveness Analysis of Urban Water Conservation Best Management Practices, prepared for the California Urban Water Conservation Council, July 2014 update. Online: <http://cuwcc.org/Portals/0/Document%20Library/Resources/Publications/Cost%20and%20Savings%20Studies/BMP%20Cost%20and%20Savings%20Report%20Update%202014%20-%20%20Phase%201.pdf>

APPENDIX A: DESCRIPTION OF THE DSS MODEL



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

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

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

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

The DSS Model has been used for practical applications of conservation planning in over 230 service areas representing 20 million people, including extensive efforts nationally in California, Colorado, Hawaii, Utah, Georgia, Florida, North Carolina, Oregon, and Ohio, and internationally in Australia, New Zealand, and Canada.



CUWCC BMP Retail Coverage Report 2013

Foundational Best Management Practices for Urban Water Efficiency

BMP 1.1 Operation Practices

ON TRACK

6270 City of Santa Cruz Water Department

1. Conservation Coordinator provided with necessary resources to implement BMPs?

Name: Toby Goddard
Title: Water Conservation Manager
Email: tgoddard@cityofsantacruz.com

2. Water Waste Prevention Documents

WW Document Name	WWP File Name	WW Prevention URL	WW Prevention Ordinance Terms Description
Option A Describe the ordinances or terms of service adopted by your agency to meet the water waste prevention requirements of this BMP.		http://www.codepublishing.com/CA/SantaCruz/html/SantaCruz16/SantaCruz16.html	See Santa Cruz Municipal Code Chapter 16 for the following: a) 16.01 Water Shortage Regulations and Restrictions b) 16.02 Water Conservation/Water Waste Prohibition Ordinance c) 16.16 Water Efficient Landscape Ordinance
Option B Describe any water waste prevention ordinances or requirements adopted by your local jurisdiction or regulatory agencies within your service area.			
Option C Describe any documentation of support for legislation or regulations that prohibit water waste.			
Option D Describe your agency efforts to cooperate with other entities in the adoption or enforcement of local requirements consistent with this BMP.			
Option E Describe your agency support positions with respect to adoption of legislation or regulations that are consistent with this BMP.			
Option F Describe your agency efforts to support local ordinances that establish permits requirements for water efficient design in new development.			

At Least As effective As

No



CUWCC BMP Retail Coverage Report 2013
Foundational Best Management Practices for Urban Water Efficiency

BMP 1.1 Operation Practices

ON TRACK

Exemption

No

Comments:

The City of Santa Cruz declared a Stage 1 Water Shortage Alert effective May 1, 2013 and insitituted water restrictions throughout the year. Two temporary staff were hired to patrol the service area leading to 731 water waste enforcement actions.



CUWCC BMP Coverage Report 2013

Foundational Best Management Practices For Urban Water Efficiency

BMP 1.2 Water Loss Control

NOT ON TRACK

6270 City of Santa Cruz Water Department

Completed Standard Water Audit Using AWWA Software? Yes

AWWA File provided to CUWCC? Yes

City of Santa Cruz 2013 Annual Water Audit.xls

AWWA Water Audit Validity Score? 65

Complete Training in AWWA Audit Method Yes

Complete Training in Component Analysis Process? No

Component Analysis? No

Repaired all leaks and breaks to the extent cost effective? Yes

Locate and Repair unreported leaks to the extent cost effective? No

Maintain a record keeping system for the repair of reported leaks, including time of report, leak location, type of leaking pipe segment or fitting, and leak running time from report to repair. Yes

Provided 7 Types of Water Loss Control Info

Leaks Repairs	Value Real Losses	Value Apparent Losses	Miles Surveyed	Press Reduction	Cost Of Interventions	Water Saved (AF)
267	100884	320768		False		

At Least As effective As

No

Exemption

No

Comments:

To CUWCC Staff: Please note that the operational efficiency indicators from the AWWA water audit software did not automatically populate the BMP database after uploading and saving. We tried converting format from .xlsx to .xls. We are using V5.0



CUWCC BMP Coverage Report 2013

Foundational Best Management Practices For Urban Water Efficiency

BMP 1.3 Metering With Commodity

ON TRACK

6270 City of Santa Cruz Water Department

Numbered Unmetered Accounts	No
Metered Accounts billed by volume of use	Yes
Number of CII Accounts with Mixed Use Meters	737
Conducted a feasibility study to assess merits of a program to provide incentives to switch mixed-use accounts to dedicated landscape meters?	Yes
Feasibility Study provided to CUWCC?	Yes
Date:	12/16/2013
Uploaded file name:	
Completed a written plan, policy or program to test, repair and replace meters	Yes

At Least As effective As

No

Exemption

No

Comments:

1) The City bills all inside City and some large outside City customers on a monthly basis; outside City customers are billed bi-monthly. 2) Recent analysis of CII accounts shows 940 accounts with no outdoor water use, and 737 with mixed use.



CUWCC BMP Coverage Report 2013

Foundational Best Management Practices For Urban Water Efficiency

BMP 1.4 Retail Conservation Pricing

6270 City of Santa Cruz Water Department

Implementation (Water Rate Structure)

ON TRACK

Customer Class	Water Rate Type	Conserving Rate?	(V) Total Revenue Commodity Charges	(M) Total Revenue Fixed Charges
Single-Family	Increasing Block	Yes	5918548.95	4472338.86
Multi-Family	Uniform	Yes	4107973.04	1268495.67
Commercial	Uniform	Yes	3379123.99	1074308.13
Industrial	Uniform	Yes	1320577.7	164488.08
Institutional	Uniform	Yes	313841.02	165728.5
Dedicated Irrigation	Uniform	Yes	1423156.26	325452.27
Agricultural	Uniform	Yes	39245.11	35365.59
Other	Uniform	Yes	36483.72	12810.98
			16538949.79	7518988.08

Calculate: $V / (V + M)$ 69 %

Implementation Option: Use Canadian Water Wastewater Association Rate Design Model

☐ Use 3 years average instead of most recent year

Canadian Water and Wastewater Association

Upload file:

Agency Provide Sewer Service: Yes

NOT ON TRACK

Customer Class	Rate Type	Conserving Rate?
Single-Family	Non-Volumetric Flat Rate	No
Multi-Family	Non-Volumetric Flat Rate	No
Commercial	Uniform	Yes
Industrial	Uniform	Yes
Institutional	Uniform	Yes
Dedicated Irrigation	Service Not Provided	No

At Least As effective As Exemption

Comments:

Note to CUWCC staff: We are using Option 3 for BMP 1.4. Coverage calculator does not seem to work; the City earned 37 points in our matrix score.



CUWCC BMP Coverage Report 2013

Foundational Best Management Practices For Urban Water Efficiency

BMP 2.1 Public Outreach

ON TRACK

6270

City of Santa Cruz Water Department

Retail

Does your agency perform Public Outreach programs? Yes

The list of wholesale agencies performing public outreach which can be counted to help the agency comply with the BMP

The name of agency, contact name and email address if not CUWCC Group 1 members

Did at least one contact take place during each quarter of the reporting year? Yes

Public Outreach Program List	Number
Newsletter articles on conservation	8
Flyers and/or brochures (total copies), bill stuffers, messages printed on bill, information packets	4
Website	12
Landscape water conservation media campaigns	2
General water conservation information	6
Total	32

Did at least one contact take place during each quarter of the reporting year? Yes

Number Media Contacts	Number
Articles or stories resulting from outreach	12
News releases	12
Newspaper contacts	24
Total	48

Did at least one website update take place during each quarter of the reporting year? Yes

Public Information Program Annual Budget

Annual Budget Category	Annual Budget Amount
Public Information and Outreach	28000
Total Amount:	28000

Public Outreach Additional Programs

Stage 1 Water Shortage Alert and associated water restrictions

Description of all other Public Outreach programs

Green Gardener program

Comments:



CUWCC BMP Coverage Report 2013

Foundational Best Management Practices For Urban Water Efficiency

BMP 2.1 Public Outreach

ON TRACK

In addition to Water Conservation, there was considerable public outreach about future water supply. In late 2013, the City created a citizen's Water Supply Advisory Committee. The Water Department also hired its first Community Relations Specialist

At Least As effective As

No

Exemption

No

0



CUWCC BMP Coverage Report 2013

Foundational Best Management Practices For Urban Water Efficiency

BMP 2.2 School Education Programs

ON TRACK

6270 City of Santa Cruz Water Department

Retail

Does your agency implement School Education programs? Yes

The list of wholesale agencies performing public outreach which can be counted to help the agency comply with the BMP

Materials meet state education framework requirements? Yes

15 local 4th and 5th grade classes participated in the Wetlands and Watersheds program. The program includes a teacher workshop and day-long field trip to the City's reservoir and the San Lorenzo River to learn about water supply and water quality.

Materials distributed to K-6? Yes

Each student receives a copy of "Our Water Works in Santa Cruz County" booklet and a journal they complete at the river. Teachers receive a county watershed map and background material to support watershed education in the classroom.

Materials distributed to 7-12 students? Yes (Info Only)

As part of the Watershed Academy, described below, materials include scientific literature, news articles, hydrographs, data sheets, etc.

Annual budget for school education program: 27000.00

Description of all other water supplier education programs

Watershed Academy: City staff teaches a small group of 10th grade students in the San Lorenzo Valley about watershed processes, fisheries, land use and drinking water source protection, both in the classroom and through a series of field trips

Comments:

Budget figure above is for the Coastal Watershed Council contract managed by Water Resources section.

At Least As effective As

No

Exemption

No

0



CUWCC BMP Retail Coverage Report 2014

Foundational Best Management Practices for Urban Water Efficiency

BMP 1.1 Operation Practices

ON TRACK

6270 City of Santa Cruz Water Department

1. Conservation Coordinator provided with necessary resources to implement BMPs?

Name:

Toby Goddard

Title:

Administrative Services Manager

Email:

tgoddard@cityofsantacruz.com

2. Water Waste Prevention Documents

WW Document Name	WWP File Name	WW Prevention URL	WW Prevention Ordinance Terms Description
Option A Describe the ordinances or terms of service adopted by your agency to meet the water waste prevention requirements of this BMP.		http://www.codepublishing.com/CA/SantaCruz/html/SantaCruz16/SantaCruz16.html	See Santa Cruz Municipal Code Chapter 16 for the following: a) 16.01 Water Shortage Regulations and Restrictions b) 16.02 Water Conservation/Water Waste Prohibition Ordinance c) 16.16 Water Efficient Landscape Ordinance
Option B Describe any water waste prevention ordinances or requirements adopted by your local jurisdiction or regulatory agencies within your service area.			
Option C Describe any documentation of support for legislation or regulations that prohibit water waste.			
Option D Describe your agency efforts to cooperate with other entities in the adoption or enforcement of local requirements consistent with this BMP.			
Option E Describe your agency support positions with respect to adoption of legislation or regulations that are consistent with this BMP.			
Option F Describe your agency efforts to support local ordinances that establish permits requirements for water efficient design in new development.			

At Least As effective As

No



CUWCC BMP Retail Coverage Report 2014
Foundational Best Management Practices for Urban Water Efficiency

BMP 1.1 Operation Practices

ON TRACK

Exemption

No

Comments:

The City of Santa Cruz declared a Stage 3 Water Shortage Emergency effective May 1, 2014 and instituted water rationing for all residential and irrigation accounts, drought regulations for CII accounts, and outdoor water restrictions for all users.



CUWCC BMP Coverage Report 2014

Foundational Best Management Practices For Urban Water Efficiency

BMP 1.2 Water Loss Control

NOT ON TRACK

6270 City of Santa Cruz Water Department

Completed Standard Water Audit Using AWWA Software? Yes

AWWA File provided to CUWCC? Yes

City of Santa Cruz 2014 Annual Water Audit.xls

AWWA Water Audit Validity Score? 66

Complete Training in AWWA Audit Method Yes

Complete Training in Component Analysis Process? No

Component Analysis? No

Repaired all leaks and breaks to the extent cost effective? Yes

Locate and Repair unreported leaks to the extent cost effective? No

Maintain a record keeping system for the repair of reported leaks, including time of report, leak location, type of leaking pipe segment or fitting, and leak running time from report to repair. Yes

Provided 7 Types of Water Loss Control Info

Leaks Repairs	Value Real Losses	Value Apparent Losses	Miles Surveyed	Press Reduction	Cost Of Interventions	Water Saved (AF)
227	119438.04	244565		False		

At Least As effective As

No

Exemption

No

Comments:

The City of Santa Cruz has contracted with Water Systems Optimization, Inc to conduct a water loss control project. The contract is for FY16, but the test period to be validated is 2014. See comment in 2013 re: AWWA OEI data not uploading properly



CUWCC BMP Coverage Report 2014

Foundational Best Management Practices For Urban Water Efficiency

BMP 1.3 Metering With Commodity

ON TRACK

6270 City of Santa Cruz Water Department

Numbered Unmetered Accounts No

Metered Accounts billed by volume of use Yes

Number of CII Accounts with Mixed Use Meters 737

Conducted a feasibility study to assess merits of a program to provide incentives to switch mixed-use accounts to dedicated landscape meters? Yes

Feasibility Study provided to CUWCC? Yes

Date: 12/16/2013

Uploaded file name:

Completed a written plan, policy or program to test, repair and replace meters Yes

At Least As effective As

No

Exemption

No

Comments:

The City instituted water rationing in 2014 in response to a water shortage emergency and migrated all its customers to monthly billing effective April 2014. Previously most outside City accounts were billed bimonthly.



CUWCC BMP Coverage Report 2014

Foundational Best Management Practices For Urban Water Efficiency

BMP 1.4 Retail Conservation Pricing

6270 City of Santa Cruz Water Department

Implementation (Water Rate Structure)

ON TRACK

Customer Class	Water Rate Type	Conserving Rate?	(V) Total Revenue Commodity Charges	(M) Total Revenue Fixed Charges
Single-Family	Increasing Block	Yes	4097421.24	4674757.04
Multi-Family	Uniform	Yes	3615070.34	1333880.79
Commercial	Uniform	Yes	3178492.82	1131061.45
Industrial	Uniform	Yes	1178030.78	168046.78
Institutional	Uniform	Yes	183173.76	168907.53
Dedicated Irrigation	Uniform	Yes	853359.46	338205.43
Agricultural	Uniform	Yes	35224.07	37459.42
Other	Uniform	Yes	33070.92	12069.64
			13173843.39	7864388.08

Calculate: $V / (V + M)$ 63 %

Implementation Option: Use Canadian Water Wastewater Association Rate Design Model

☐ Use 3 years average instead of most recent year

Canadian Water and Wastewater Association

Upload file:

Agency Provide Sewer Service: Yes

NOT ON TRACK

Customer Class	Rate Type	Conserving Rate?
Single-Family	Non-Volumetric Flat Rate	No
Multi-Family	Non-Volumetric Flat Rate	No
Commercial	Uniform	Yes
Industrial	Uniform	Yes
Institutional	Uniform	Yes
Dedicated Irrigation	Service Not Provided	No

At Least As effective As Exemption

Comments:

Note to CUWCC staff: The City of Santa Cruz is using Option 3 for BMP 1.4. Coverage calculator does not seem to work; City earned 39 points in its matrix score.



CUWCC BMP Coverage Report 2014

Foundational Best Management Practices For Urban Water Efficiency

BMP 2.1 Public Outreach

ON TRACK

6270 City of Santa Cruz Water Department

Retail

Does your agency perform Public Outreach programs? Yes

The list of wholesale agencies performing public outreach which can be counted to help the agency comply with the BMP

The name of agency, contact name and email address if not CUWCC Group 1 members

Did at least one contact take place during each quarter of the reporting year? Yes

Public Outreach Program List	Number
Newsletter articles on conservation	8
Flyers and/or brochures (total copies), bill stuffers, messages printed on bill, information packets	24
Website	100
Landscape water conservation media campaigns	2
General water conservation information	100
Total	234

Did at least one contact take place during each quarter of the reporting year? Yes

Number Media Contacts	Number
Articles or stories resulting from outreach	50
News releases	24
Newspaper contacts	100
Total	174

Did at least one website update take place during each quarter of the reporting year? Yes

Public Information Program Annual Budget

Annual Budget Category	Annual Budget Amount
Public Information and Outreach	28000
Total Amount:	28000

Public Outreach Additional Programs

Stage 3 Water Shortage Emergency and associated water restrictions

Water Supply Advisory Committee

Description of all other Public Outreach programs

Green Gardener program

Comments:



CUWCC BMP Coverage Report 2014

Foundational Best Management Practices For Urban Water Efficiency

BMP 2.1 Public Outreach

ON TRACK

In addition to Water Conservation, there was considerable public outreach about future water supply. The City created a citizen's Water Supply Advisory Committee which met twice a month during 2014.

At Least As effective As

No

Exemption

No

0



CUWCC BMP Coverage Report 2014

Foundational Best Management Practices For Urban Water Efficiency

BMP 2.2 School Education Programs

ON TRACK

6270 City of Santa Cruz Water Department

Retail

Does your agency implement School Education programs? Yes

The list of wholesale agencies performing public outreach which can be counted to help the agency comply with the BMP

Materials meet state education framework requirements? Yes

12 local 4th and 5th grade classes participated in the Wetlands and Watersheds program. The program includes a teacher workshop and day-long field trip to the City's reservoir and the San Lorenzo River to learn about water supply and water quality.

Materials distributed to K-6? Yes

Each student receives a copy of "Our Water Works in Santa Cruz County" booklet and a journal they complete at the river. Teachers receive a county watershed map and background material to support watershed education in the classroom.

Materials distributed to 7-12 students? Yes (Info Only)

As part of Watershed Academy, described below, materials include scientific literature, news articles, hydrographs, data sheets, etc.

Annual budget for school education program: 27000.00

Description of all other water supplier education programs

Watershed Academy: City staff teaches a small group of 10th grade students in the San Lorenzo Valley about watershed processes, fisheries, land use and drinking water source protection, both in the classroom and through a series of field trips

Comments:

Budget figure above is for the Coastal Watershed Council contract managed by Water Resources section.

At Least As effective As

No

Exemption

No

0



CUWCC BMP Coverage Report 2014

6270 City of Santa Cruz Water Department

Baseline GPCD: 123.83

GPCD in 2014 75.8

GPCD Target for 2018: 101.50

Biennial GPCD Compliance Table

ON TRACK

Year	Report	Target		Highest Acceptable Bound	
		% Base	GPCD	% Base	GPCD
2010	1	96.4%	119.40	100%	123.80
2012	2	92.8%	114.90	96.4%	119.40
2014	3	89.2%	110.50	92.8%	114.90
2016	4	85.6%	106.00	89.2%	110.50
2018	5	82.0%	101.50	82.0%	101.50



W A T E R D E P A R T M E N T

212 Locust Street, Santa Cruz, CA 95060 • (831) 420-5200 • Fax (831) 420-5201 • www.cityofsantacruz.com

July 19, 2016

Susan Mauriello, County Administrative Officer
County of Santa Cruz
Santa Cruz County Governmental Center
701 Ocean Street, Room 520
Santa Cruz, CA 95060

SUBJECT: 2015 Urban Water Management Plan Update

Dear Ms. Mauriello,

This letter is to notify you that the City of Santa Cruz has recently completed an update of its 2015 Urban Water Management Plan. The draft plan is available online at the City's website for your review: <http://www.cityofsantacruz.com/2015UWMP>. We welcome comments and input from you and from applicable County departments on the draft plan.

The Santa Cruz Water Commission will review and discuss the plan at its meeting on Monday, August 1, 2016 at 7:00 p.m. in the City Council Chambers.

A public hearing on the proposed plan has been scheduled for Tuesday, August 9, 2016 at 2:30 p.m. in the City Council Chambers at Santa Cruz City Hall, 809 Center Street, Santa Cruz, California. The plan will be brought back to City Council at its following meeting August 23, 2016 for adoption, barring any substantial modifications.

Written comments on the plan may be received up to the date of the public hearing and should be sent to:

Santa Cruz Water Department
Attn: Mr. Toby Goddard
212 Locust Street, Suite B
Santa Cruz, CA 95060

Please contact Toby Goddard, Water Conservation Manager at 420-5232, or via email tgoddard@cityofsantacruz.com if you have any questions or wish to discuss the information contained in report.

Sincerely,

Rosemary Menard
Water Director

cc: Ms. Kathleen Previsich, Director of Planning
Mr. John Ricker, Water Resources Division Director
Mr. John Presliegh, Director of Public Works



WATER DEPARTMENT

212 Locust Street, Santa Cruz, CA 95060 • (831) 420-5200 • Fax (831) 420-5201 • www.cityofsantacruz.com

July 19, 2016

Jamie Goldstein, City Manager
City of Capitola
420 Capitola Ave.
Capitola, CA 95010

SUBJECT: 2015 Urban Water Management Plan Update

Dear Mr. Goldstein,

This letter is to notify you that the City of Santa Cruz has recently completed an update of its 2015 Urban Water Management Plan. The draft plan is available online at the City's website for your review: <http://www.cityofsantacruz.com/2015UWMP>. We welcome your comments and input on the draft plan.

The Santa Cruz Water Commission will review and discuss the plan at its meeting on Monday, August 1, 2016 at 7:00 p.m. in the City Council Chambers.

A public hearing on the proposed plan has been scheduled for Tuesday, August 9, 2016 at 2:30 p.m. in the City Council Chambers at Santa Cruz City Hall, 809 Center Street, Santa Cruz, California. The plan will be brought back to City Council at its following meeting August 23, 2016 for adoption, barring any substantial modifications.

Written comments on the plan may be received up to the date of the public hearing and should be sent to:

Santa Cruz Water Department
Attn: Mr. Toby Goddard
212 Locust Street, Suite B
Santa Cruz, CA 95060

Please contact Toby Goddard, Water Conservation Manager at 420-5232, or via email tgoddard@cityofsantacruz.com if you have any questions or wish to discuss the information contained in report.

Sincerely,

Rosemary Menard
Water Director

cc: Mr. Richard Grunow, Community Development Director

Santa Cruz Sentinel

1800 Green Hills Rd., Ste. 210
Scotts Valley, CA 95066
831-429-2415
scslegals@santacruzsentinel.com

3487424

SANTA CRUZ WATER DEPARTMENT
RENEE COLETTA
212 LOCUST ST
STE A
SANTA CRUZ, CA 95060

Proof of Publication (2015.5 C.C.P.)

STATE OF CALIFORNIA

SS.

COUNTY OF SANTA CRUZ

Public Notice

I, the undersigned, declare:

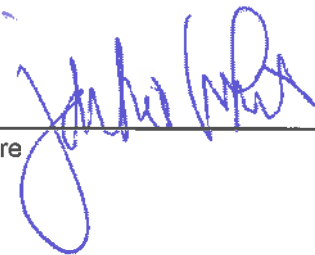
That I am over the age of eighteen and not interested in the herein-referenced matter; that I am now, and at all times embraced in the publication herein mentioned was, a principal employee of the printer of the Santa Cruz Sentinel, a daily newspaper printed, published and circulated in the said county and adjudged a newspaper of general circulation by the Superior Court of California in and for the County of Santa Cruz, under Proceeding No. 25794; that the advertisement (of which the annexed is a true printed copy) was published in the above-named newspaper on the following dates, to wit:

07/31/2016, 08/07/2016

I declare under penalty of perjury that, the foregoing is true and correct to the best of my knowledge.

This 8th day of August, 2016 at Santa Cruz, California.

Signature



Legal No. **0005767616**



Notice of Public Hearing

The City Council of the City of Santa Cruz will hold a public hearing on the draft

2015 Urban Water Management Plan

on Tuesday, August 9, 2016 at 2:30 p.m.
or soon thereafter
at City Council Chambers
809 Center Street, Santa Cruz

State-law requires water suppliers to prepare an Urban Water Management Plan and to update it every five years. The plan describes the City's water supply resources and projected needs through the year 2035 and covers related subjects including conservation, supply reliability, system sources, and water shortage management. The public hearing will also address the integration of the Final Report on Agreements and Recommendations, as developed by the Water Supply Advisory Committee, into the Plan.

The draft plan is available for review at:

- Water Department Office
- Online at www.cityofsantacruz.com/2015UWMP
- Central Library

Interested members of the public and local businesses are encouraged to provide comments to the City of Santa Cruz and participate in the plan review process.

For additional information please contact:
City of Santa Cruz Water Department
212 Locust St, Suite B
Santa Cruz, CA
(831) 420-5200

or email: tgoddard@cityofsantacruz.com

STATE OF CALIFORNIA)
) ss.
County of Santa Cruz)

EXCERPT OF MINUTES

I, Bren Lehr, City Clerk Administrator of the City of Santa Cruz, California, do hereby certify that the following is a true excerpt of the draft minutes showing the action taken at the August 9, 2016 Regular City Council Meeting:

PUBLIC HEARING ITEM:

11. 2015 Urban Water Management Plan Update (WT)

Associate Planner II K. Moore and Water Administrative Services Manager T. Goddard gave a presentation and responded to Councilmember questions.

Director of Water R. Menard briefly discussed this item.

Mayor Mathews opened the public comment period. The following person spoke:

Nate Kennedy

Mayor Mathews closed the public comment period.

MOTION: Councilmember Lane moved, seconded by Councilmember Terrazas, to direct staff to bring back to Council the final plans for adoption.

ACTION: The motion carried unanimously with the following vote.

AYES: Councilmembers Noroyan, Lane, Terrazas, Posner, Comstock; Vice Mayor Chase; Mayor Mathews.

NOES: None.

ABSENT: None.

DISQUALIFIED: None.

Bren Lehr
City Clerk Administrator
City of Santa Cruz

Written Comments Received from the Public

Water Commission Members

Doug Engfer

Thanks again for making time for me to discuss the UWMP in advance of Monday's meeting. This is the first time I've been involved in the review cycle, so I'm sure I have much to learn!

I'll say at the outset that I found the document clear and useful. I think that your strategy of "building on" the State's foundational organizational structure, specifically by including many and detailed documents as appendices, makes the package complete. As a recovering member of the WSAC, I will also note that I'm gratified to see that the committee's recommendations are adopted in the whole here. Yay!

As you'd expect, I have a number of questions and comments, as well as suggested copy edits. The attached Word file has all of my questions, comments, and suggestions. It's organized and formatted as follows:

- "State Act Questions"
 - o Questions I have relating to our compliance with the State Act.
 - o I would expect that we would discuss these during Friday's call. I may bring them up on Monday, depending upon our Friday conversation.
- "UWMP Draft"
 - o "Questions, comments, suggestions"
 - I've identified these items by page number (both according to document pagination, and to relative page within the PDF).
 - Where you see ~~strikethrough~~ text, I've found the answer already, elsewhere in the document, or in the Act. You may ignore the strikethrough text.
 - I would expect that we would spend the bulk of our time on Friday on these items.
 - Items in this list would be candidates for me to bring up during the SCWC review of the document on Monday (though I may change my mind about the salience of individual items between now and Monday)
 - o "Typos and stylistic suggestions"
 - I've identified these items by page number (both according to document pagination, and to relative page within the PDF).
 - Where you see ~~strikethrough~~ text, I've found the answer already, elsewhere in the document, or in the Act. You may ignore the strikethrough text.
 - I would expect these items to be non-controversial. I offer them here by way of helping you make the document the best it can be. I would not expect that you and I would spend any time on them on Friday's call. However, if something here seems controversial to you and you'd like to talk about it on Friday, that's fine with me.

- I've highlighted the text in the DRAFT that corresponds to these items. If you'd like, I can upload the document to Dropbox so that you can use that highlighting to find the typos.

Anyway, thanks again for making some time for me. Looking forward to our call tomorrow!

UWMP

State Act Questions

- [page 4] 10621(a) – UWMP is due by 31 July following years ending in 5 and 0. We appear to be late with our plan. There are consequences outlined in the Act (can't receive certain State funding).
 - Has this been an issue for the Department?
 - Have we or will we suffer any consequences for our (apparently) late filing of the UWMP?
 - The Plan itself does not acknowledge that it's late. Should it?
- The Act directs us specifically to describe our efforts relating to both recycling and desalination. The Draft is pretty thorough on recycling. It is pretty terse on desalination. That may be appropriate, given (1) our history with desal, and (2) the fact that it is the lowest-priority option for a supplemental supply.
 - That said, do you think that the State would want us to "beef up" the desalination discussion?

UWMP DRAFT

- Questions, comments, suggestions
 - [page 2-2 (15)] – units as MG (not AF) – thank you!
 - [page 3-4 (21)] – what is process for updating the GP2030 to reflect the Department's new strategy relating to supply augmentation? There seem to be several items that need to be updated...
 - [page 3-8 (25)] – ~~why are we looking at lower income?~~ [State requirement.]
 - Wouldn't it also be interesting from a water-use perspective to look at SFR v MFR?
 - [page 3-9 (26)] – while past 5 years are interesting, they are likely not representative (Great Recession). What construction is currently in review, permitted and/or under construction?
 - [page 4-2 (30)] – add some per-capita historical data (SFR and MFR) to show trend for the service area
 - [page 4-7 (35)] – Table 4-4 should make clear that the values are MGY
 - [page 4-8 (36)] – please explain "cumulative" (seems to me it's more like "aggregate"). Cumulative would mean to me that we would have saved a *total* of 329MG by 2035, against our *total* demand between now and then.
 - Aren't these **MGY** figures (that is, demand will be reduced by 329MG in 2035, compared to what it would have been without code changes)?
 - 329MG represents 8.6% of what?
 - [page 4-8 (36)] – "these units" refers to the low-income component (414) or the full 1000 units? You should be clearer.

- Also, what is your estimated consumption for lower-income units? How arrived at? Won't state require some data here? ("Estimate the projected use" section 4-5, page 4-15 of guidelines)
- o [page 4-8/9 (36/37)] – this discussion would profit from including the estimated increase in monthly average daily high temperature for our area, so that the reader can determine the magnitude of the impact of climate change (say, by 2100).
- o [page 5-4 (41)] should insert "the City's" before "gross per capita", in order to clarify that we are talking about use in our service area, not some other region
- ~~o [page 5-4 (41)] the 2015 and 2020 targets are almost the same (111 and 110, respectively). Are these the correct values?~~
- o [page 5-8 (45)] Makes sense to choose Method 3. That said, SC would have achieved its target goals irrespective of Method chosen (we were under the Method 3 target already). Should we explain why we chose Method 3? Should we take credit for even beating Method 1?
- o [page 6-3 (53)] What is import of "bordered area" in the text? I don't see any part of the image in the Figure that is "bordered".
- o [page 6-4 (54)] "annual" suggests that the document is updated annually (each year). If that is not the case, then strike "annual".
- o [page 6-7 (57)] Table 6-1 should include an average (164 mgd) showing that our average use over the subject period was within the 170 mgd self-imposed deemed-sustainable limit.
- o [page 6-11 (61)] Could add an amplifying sentence making clear that the service area for the wastewater treatment plant is a superset of the service area of the water department (that is, all water department folks are in the wastewater service area, but some folks in the wastewater service area are not served by the water system) – assuming that that is an accurate statement, of course!
 - You actually say this on page 6-14 – perhaps move that statement up here?
- o [page 6-15 (65)] What are peak actual wet weather flows that we've seen (capacity is 81 mgd)?
- o [page 6-15 (65)] Is the pipeline actually 12250 ft underwater, or does that include run from plant to shoreline?
- o [page 6-18,19 (68,69)] Does it make sense to "do the math" to show an "average mgd" value for these two mgd values, and the seasonal ranges, so that we can see just how much could be offset by the tertiary treated volumes?
- o [page 6-23 (73)] Table 6-10 has some issues:
 - Purisima is mis-spelled
 - Need to make clear that volumes are in mgd
 - The potential transfer volume to Soquel is capped at 100mgd (per the current interim agreement), which is far below what may be possible in the future. Since we don't know the maximum perhaps we should say instead that while current agreement stipulates a cap of 100 mgd, the maximum available for transfer has yet to be determined.
- o [page 7-1 (74)] Reference to our Stage 3 determination should include a link to how the City defines its stages of curtailment (since these are our policy standards, not the State's)
 - This could be a pointer to that section of the document that describes our curtailment policies.

- o [page 7-2 (75)] Why not just say Soquel, instead of “an adjacent utility”? We’ve identified them elsewhere as potential collaborators for conjunctive use, and as pumpers from Purisima.
- o [page 7-5 (78)] Water rights discussion says that we would not ask for any place-of-use changes. My understanding is that we want place-of-use changes at Newell, Tait, and Felton, to maximize our operational flexibility and to support regional solutions.
- o [page 7-12 (85)] Reference to increased storage by 1.2BG. I think that the correct figure is 2.4BG of accessible supply, with up to 1.2BG deliverable in a given year (peak season). See WSAC recommendations and LRFP.
- ~~o [page 8-11 (106)] Table doesn’t include reference to “Water School” (probably among other things). Should we take credit for this, though, given its novelty and the amount of press coverage we received for it? (addressed on page 8-14)~~
- o [page 9-8 (126)] I believe that folks could attend Water School only once. Assuming that’s correct, probably useful to include that fact in your discussion.
- o [page 9-9 (127)] In the discussion of water system losses (both real and apparent), the percentage is less interesting than the amount, given that even if the amount stays the same, the percentage will vary up and down based on overall system demand. I suggest that you include both the average volume (~250MG) and the average percentage.
 - Over the past several years, demand has been depressed, and the % loss ratio has gone up at the same level of losses, making it look like we are doing worse. Going forward we expect demand to rebound (barring another drought cycle and concomitant curtailments), so the percentage will go down even if losses don’t change, making it look like we’re doing better.
- o [9-22 (140)] What are City’s plans for conservation pricing of sewer services?
- o [Appendices in general]
 - Need to have the appendices properly annotated in the document, so that folks know which one is which (perhaps by inserting a “title page” before each one?).
 - Also, would be useful if the document TOC allowed navigation to the individual appendices by clicking on the corresponding TOC item.
 - Does it make sense to include the Soquel/City agreement on transfers as an Appendix?
- o [Appendix K– WSAC report]
 - This appendix is incomplete; it must include the WSAC report’s appendices, which are important components of the report (in particular, Appendix 8 and its footnotes).
- Typos and stylistic suggestions
 - o [page 1-4 (11)] should read “recently designated by the state to be...”
 - o [page 2-1 (14)] “an UWMP” should be “a UWMP”
 - o [page 2-3 (16)] “representing a diverse” should be “representing diverse”
 - o [page 3-5 (22)] “Similarly” should be “Conversely”
 - o [page 3-8 (25)] “through 2014” should be “through 2023”, presumably
 - o [page 4-8 (36)] “about almost 1000 new housing” should be “nearly 1000 new housing”
 - o [page 4-8 (36)] “per a 1 degree F in” should be “per a 1 degree F increase in”
 - o [page 4-9 (37)] “in demand to change” should be “in demand due to change”
 - o [page 4-9 (37)] “by about 0.45 percent” should read “by about 0.45 percent per one degree F increase in average daily high temperature”
 - o [page 5-1 (38)] “summarized Figure 5-1” should read “summarized in Figure 5-1”
 - o [page 5-2 (39)] “water use water use”

- o [page 5-5 (42)] “10-baseline” should read “10-year baseline”
- o [page 5-8 (45)] “States’” should be “State’s”
- o [page 5-12 (49)] “target would” should be “targets would”
- o [page 6-1 (51)] “in below in” should be “below in”
- o [page 6-2 (52)] “underlying entire” should be “underlying the entire”
- o [page 6-4 (54)] “Districts’” should be “District’s”
- o [page 6-4 (54)] “by in 1996” should be “in 1996”
- o [page 6-5 (55)] “for entire management” should be “for the entire management”
- o [page 6-6 (56)] “Basin shown” should be “Basin, as shown”
- o [page 6-6 (56)] “proportion” should be “portion”
- o [page 6-8 (58)] “provides an illustration of” could be “illustrates”, which would also eliminate the repetitive “provides”
- o [page 6-10 (60)] “the city’s” should be “the City’s” (should confirm appropriate capitalization of the word throughout the document)
- o [page 6-11 (61)] “Department maintains” should be “Department_ maintains”
- o [page 6-12 (62)] “the feasibility recycled water again though” should be “the feasibility of recycled water ~~again-through~~”, eliminating redundant “again”
- o [page 6-13 (63)] “working the” should be “working with the”
- o [page 6-14 (64)] Table 6-2 should make clear that the volumetric units are MGY. Same with table 6-3 on 6-16. Same with 6-5 on 6-19. And with table 7-1 on page 7-7. I’m going to stop mentioning this now; you should just make sure that each table includes volumetric units.
- o [page 6-16 (66)] “City of Scotts Valley Water” should be “City of Scotts Valley” (no “Water”)
- o [page 6-16 (66)] “plant of and” should be “plant and”
- o [page 6-16 (66)] “currently...at this time” – pick one or the other; don’t need both phrases in the same sentence.
- o [page 6-17 (67)] There is an open quote with no closing quote in the first sentence of section 6.5.4.1.
- o [page 6-17 (67)] “in included” should be “is included”
- o [page 6-21 (71)] “to allow the further study and determine” should be “to further study and determine”
- o [page 6-21 (71)] “as to the project(s) to be carried out” should be “which project(s) will be carried out”
- o [page 6-21 (71)] The sentence beginning “The Final Report summarized...” should be re-written. It is not at all clear or grammatical.
- o [page 6-22 (72)] “source that” should be “source_ that”
- o [page 6-23 (73)] “recharged by the natural” should be “recharged by natural”
- o [page 7-1 (74)] “held in the grips” should be “held in the grip”
- o [page 7-3 (76)] “a HCP” should be “an HCP”. Make sure to make the change throughout.
- o [page 7-6 (79)] section numbering should be 7.1.4.2 (not 7.4.1.2 as currently)
- o [page 7-7 (80)] “recent supply” should be amplified to include “WSAC”, to make clear that you are referring to the previously-mentioned (and later discussed) WSAC process.
- o [page 7-11 (84)] “single dry year, is the” should be “single dry year, the”
- o [page 7-11 (84)] “difference” should be “differences”
- o [page 7-12 (85)] reference to “Tables 7-4” should be to “Table 7-4”
- o [page 7-13 (86)] “regions’” should be “region’s”

- o [page 7-13 (86)] “to relevance” should be “to the relevance” (or could be “relative importance” instead of “relevance”)
- o [page 8-2 (97)] The link to the Water Code does not display or retrieve a document on MacOS under Chrome.
- o [page 8-7 (102)] “uses)” should be “uses” – eliminate stray trailing close-parenthesis.
- o [page 8-7 (102)] Table 8-3 has some issues:
 - It should include the measures taken in response to Stage 1 (even if they are essentially moot), if only for the sake of completeness
 - The table title is “Reduction” but the values in the table communicate the amount of normal supply that is allocated (that is, the amount left *after* reduction). Change title to “Proportion of Normal Allocation” or something like that?
- o [page 8-12 (107)] “restrictions and includes” should be “restrictions include”
- o [page 8-18 (113)] “of two fiscal years” should be “two fiscal years”
- o [page 8-18 (113)] “Stage 5 (however” should be “Stage 5” – looks like you tried to delete a parenthetical comment but didn’t get all of it.
- o [page 8-18 (113)] “loch Lomond” should be “Loch Lomond”.
- o [page 8-19 (114)] The link to the 2009 Water Shortage report does not work on MacOS under Chrome. Comes up with an “err-not-found” error.
- o [page 8-20 (115)] “City is a within the” should be “City is within the”.
- o [page 8-20 (115)] “City has it own” should be “City has its own”.
- o [page 8-20 (115)] “form possible” should be “from possible”.
- o [page 8-20 (115)] “roles responsibilities” should be “roles and responsibilities”.
- o [page 8-23 (118)] “Finally, Water Department” should be “Finally, the Water Department”
- o [page 9-3 (121)] Utilities” should be Utilities₂”
- o [page 9-6 (124)] “supply outlook supply” – should be “supply outlook”
- o [page 9-7 (125)] “personable” – should be “personal”
- o [page 9-8 (126)] “stay at their” – should be “stay within their”
- o [page 9-9 (127)] In your brief WSAC discussion here, you may want to reference the previous section where you discussed the committee, its processes, and its findings in more detail.
- o [page 9-11 (129)] “The current Water Conservation Manager” – should be “The Water Conservation Manager”; you could add “currently” to that if you expect job-responsibility changes.
- o [page 9-12 (130)] The last sentence on the page (ending with “are described below”) needs a period at the end.
- o [page 9-13 (130)] “Residential water use comprises” – should be “Residential water use constitutes”.
- o [page 9-14 (132)] “Laundry to Landscape rebate program \$150” – should be “Laundry to Landscape rebate of \$150”.
- o [page 9-15 (133)] “replaced like” – should be “replaced₂ like”.
- o [page 9-15 (133)] “In the last five year” – should be “In the last five years₂”.
- o [page 9-16 (134)] “i.e. low flow spray” – should be “e.g. low flow spray”.
- o [page 9-16 (134)] “to makes them” – should be “to make them”.
- o [page 9-17 (135)] “in the future better” – should be “in the future to better”.
- o [page 9-19 (137)] “saw dramatic increase” – should be “saw a dramatic increase”.
- o [page 9-19 (137)] “identified as top priority” – should be “identified as a top priority”.

- o [page 10-3 (143)] “the incorporation of” – should be “that”.

David Baskin

I only have a few comments, which are set forth below:

1. Why are we calling this the 2015 UWMP? Shouldn't it be the 2016 Plan? Plans/ordinances, etc. are usually referred to by the year of their adoption.
2. Page 7-14. Listing of WSAC Members appears to be in alphabetical order, except that it incorrectly reflects that my last name is Green Baskin. Please correct, as Green is my middle name. Baskin is my last name.
3. Page 9-3 Conservation Pricing. Our discussion of the new rate structure should reflect that it has been approved, as it will have been by the time of the final report being adopted.
4. 9.2.4.2 could also state the WSAC made a series of demand management recommendations that are being incorporated into our Master Conservation Plan as appropriate.

My compliments on a very well drafted document, at least to the extent that I am qualified to so state. I am not familiar with the statutory scheme or the guidebook. I am confident that you have made the plan compliant.

Andy Schiffrin

- Page 7-9, Table 7-2 – Since it is expected that the ultimate agreement with the regulators will reduce the City's ability to divert water from the North Coast streams, why does the table project increased diversions after 2020?
- Page 8-18 – There's a typo in the first full paragraph – “(however.”
- Page 10-1 – Water Commission Changes – Assuming that the Commission does recommend changes, shouldn't they be summarized after this paragraph.

COMMENTS ON UWMP CHAPTERS 1 TO 6

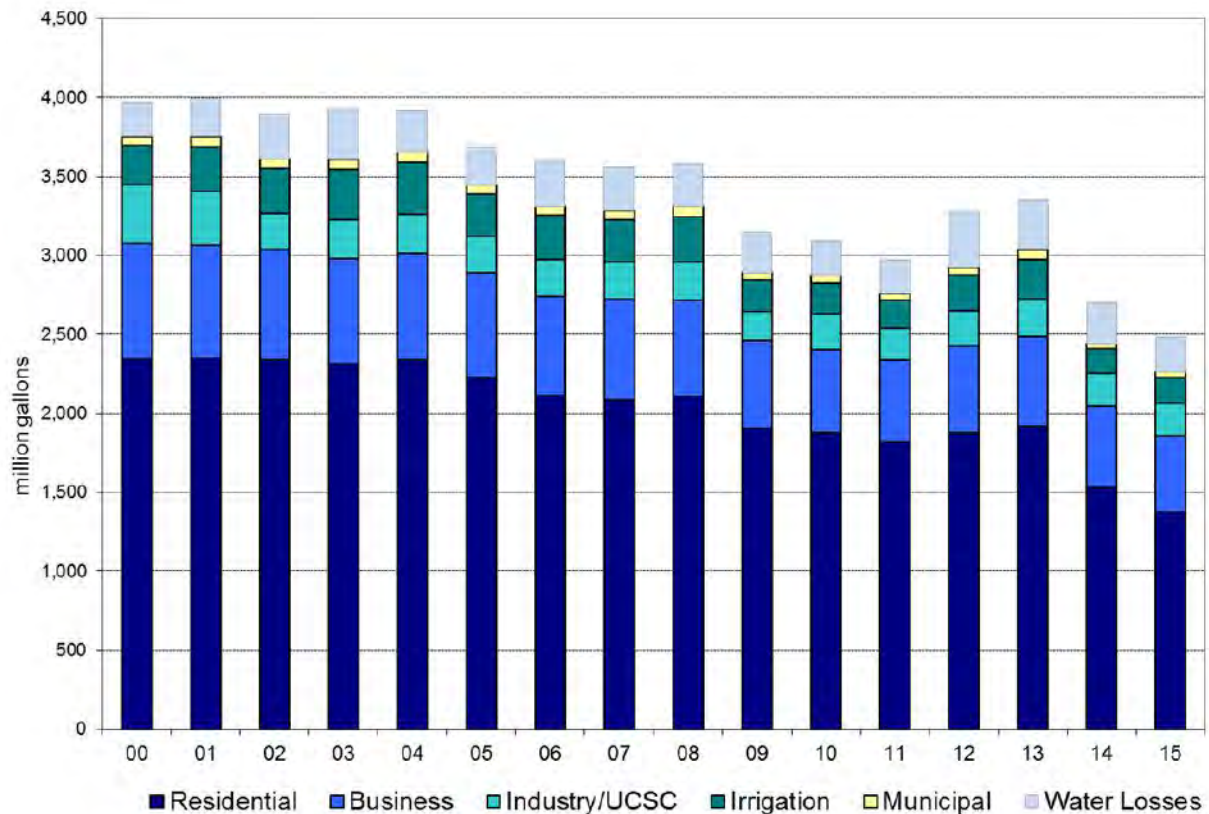
Following are my comments, in **bold**, on the draft Plan:

1. New Vision for the City's Water Supply. The City of Santa Cruz has long faced challenges with the reliability of its water supply and had been actively pursuing ocean desalination as a supplemental water source for more than a decade. In spring 2014, the Santa Cruz City Council changed course and appointed a committee of 14 residents representing diverse viewpoints to take an exhaustive look at the City's water issues and ways to address them. The Water Supply Advisory Committee (WSAC) worked for 18 months in an open, public, and transparent process to develop recommendations to ensure a more stable and reliable water supply. In addition to more conservation, the WSAC recommended the City embark on a program to enhance regional

groundwater storage using in-lieu water exchanges and/or aquifer storage and recovery with neighboring water districts. Advanced treated recycled water was recommended as a backup plan.

Shouldn't it mentioned that Desal is still an option if other approaches fail, especially since this is discussed later?

2.



The decline in Residential consumption is pretty amazing, if I understand it correctly. It was about 2.4 BGY in 2000 and in 2015 it was about 1.4 BGY, a decline of over 40%, and at a time when the service population was increasing, though of course there was the drought.)

3.

Table 4-3. Demands for Potable Water - Projected						
Use Type	Additional Description	Projected Water Use (mgd)				
		2020	2025	2030	2035	2040-opt
Single Family	Individually meter dwellings	1,277	1,223	1,191	1,170	n/a
Multi-Family	2 or more dwelling units	772	714	690	678	n/a
Commercial		574	541	525	519	n/a
Industrial		56	59	60	61	n/a
Institutional/ Governmental	Municipal (city) accounts	46	42	40	40	n/a
Landscape	Dedicated Irrigation	112	119	134	144	n/a
Landscape	Golf Irrigation	58	52	47	47	n/a
Other	UC Santa Cruz	196	234	271	308	n/a
Water Losses		236	241	247	253	n/a
TOTAL		3,327	3,225	3,205	3,220	n/a
NOTES: David Mitchell, M Cubed, October 2015, and by Maddaus Water Management, February 2016						

From Table 4-1, total residential demand in 2015 was 1.373 BGY. In Table 4-3, it is projected to be 2.049 BGY, an increase of about 50%. Yet beyond 2020, demand is projected to decline. This significant increase to 2020 needs to be explained.

4.

Table 6-10. Water Supplies — Projected						
Water Supply	Additional Detail on Water Supply	Projected Water Supply <i>Report To the Extent Practicable</i>				
		2020	2025	2030	2035	2040 (opt)
		Reasonably Available Volume	Reasonably Available Volume	Reasonably Available Volume	Reasonably Available Volume	Reasonably Available Volume
Surface water	North Coast Sources	637	642	671	671	n/a
Surface water	San Lorenzo River	1,882	1,842	1,829	1,834	n/a
Surface water	Loch Lomond Reservoir	595	551	540	547	n/a
Groundwater	Live Oak/Beltz Wells	138	129	127	128	n/a
Transfers		Potential transfer to Soquel Creek Water District may be up to 100 mgd to assist with recovery of the western purisma basin and may result in future exchange to the City during peak season				
Exchanges						
Recycled Water		Recycled water feasibility study investigating options including regional partnership opportunities for a recycled water project to provide drought resistant supply and options for groundwater management strategies due to overdraft conditions of local basins				
Desalinated Water				Potential project to expand recycled water supply or investigate desalination		
Other						
Total		3,252	3,164	3,167	3,180	0
NOTES:						

This may be discussed in later chapters but should there be an explanation here for why the percentage of water from the North Coast Streams is projected to decline, from the 24% cited earlier to the slightly less than 20% indicated in Table 6-10?

From the General Public

To: Toby Goddard
 Water Conservation Manager
 City of Santa Cruz
 RE: Draft 2015 Urban Water Management Plan

Dear Toby,

I am interested in submitting comments to the draft 2015 Urban Water Management Plan. Please advise if this email is sufficient and timely or if I need to submit elsewhere.

In section 3.6 Community Growth and Development, no mention or discussion is made about the City of Santa Cruz's application that is currently on file with LAFCO to expand its urban services boundary line to include the upper UCSC campus. If the City of Santa Cruz were to proceed with this application, it could have significant impacts to the 2015 UWMP.

On page 3-10, the draft states: "Any proposed changes to the City's service area boundary that do come forward are subject to approval by both City Council and the Santa Cruz Local Agency Formation Commission (LAFCO)." This sentence is misleading because of the existing proposed change to the service area boundary that is not mentioned. Members of the public should be made aware of this and given the opportunity to consider and comment about it. Therefore, the draft should be changed to

state that the City has applied to LAFCO to change its service area boundary and should include details about the application and what effects it could have upon the 2015 UWMP.

Since the City's LAFCO application was made a number of years ago, I think it would be helpful if the following questions could be answered in the 2015 UWMP:

1. Does the City have any intention of proceeding with its application to LAFCO?
2. If not, might the City decide to proceed with its application at a later date?
3. If the City does decide to consider proceeding with its LAFCO application, either during the time frame of the 2015 UWMP or at a later date, would that be a public process and would the City Council allow comments from the public before making any such decision?
4. Does the City have any intention of withdrawing its application to LAFCO? If not, please provide a detailed explanation of why not.

Of course, if the City decided to withdraw its application to LAFCO in the very near future, it would not be necessary to include all of the needed changes to the draft 2015 UWMP necessitated by the existing LAFCO application.

Thank you so much for your attention to these comments.

Sincerely,
Don Stevens
Habitat And Watershed Caretakers

RESOLUTION NO. NS-29,133

RESOLUTION OF THE CITY COUNCIL OF THE CITY OF SANTA CRUZ
ADOPTING THE 2015 URBAN WATER MANAGEMENT PLAN AND AUTHORIZING THE
DIRECTOR OF THE WATER DEPARTMENT TO FILE A COPY WITH
THE CALIFORNIA DEPARTMENT OF WATER RESOURCES

WHEREAS, the California Legislature enacted Assembly bill 797 (Water Code Section 10610 et seq., known as the Urban Water Management Planning Act) during the 1983-84 Regular session, and as amended subsequently, which mandates that every supplier providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually, prepare an Urban Water Management Plan; and

WHEREAS, the City of Santa Cruz is an urban water supplier providing service to over 24,000 customers and is required to review and update the Plan every five years; and,

WHEREAS, the Urban Water Management Planning Act requires water agencies to evaluate and describe their water resource supplies and projected needs over a twenty-year planning horizon, and to address a number of related subjects including water conservation, water service reliability, water recycling, opportunities for water transfers, and contingency plans for drought events; and,

WHEREAS, beginning with the 2010 plans, Senate Bill X7-7 of 2009 (California Water Code Section 10608) requires each urban retail water supplier to include information on its baseline daily per capita water use and future water use targets to support the goal of reducing the state's per capita urban water consumption by 20 percent; and,

WHEREAS, the City of Santa Cruz exceeded its interim water use target for 2015 and fully complies with all requirements of Senate Bill X7-7; and,

WHEREAS, a completed Urban Water Management Plan is required in order for a water supplier to be eligible for California Department of Water Resources administered State grants, loans, and drought assistance; and,

WHEREAS, a Plan must be made available for public review and a public hearing held prior to adopting the Plan, and then filed with the California Department of Water Resources within thirty days of adoption; and,

WHEREAS, the City has therefore prepared and circulated for public review a draft 2015 Urban Water Management Plan, and a properly noticed public hearing regarding the subject Plan was held by the City Council on August 9, 2016,

NOW, THEREFORE, BE IT RESOLVED by the City Council of the City of Santa Cruz that it hereby adopts the 2015 Urban Water Management Plan and authorizes the Director of Water to file a copy with the California Department of Water Resources.

RESOLUTION NO. NS-29,133

BE IT FURTHER RESOLVED that the Water Supply Advisory Committee's Final Report on Agreements and Recommendations as accepted by the City Council of Santa Cruz on November 24, 2015, the City's Water Shortage Contingency Plan, and the Water Conservation Master Plan approved by City Council on April 12, 2016 are hereby adopted by reference in their entirety as part of the City's 2015 Urban Water Management Plan.

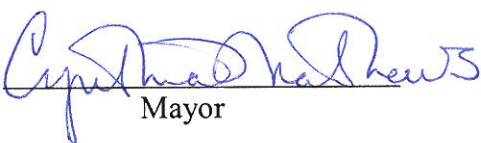
PASSED AND ADOPTED this 23rd day of August, 2016, by the following vote:

AYES: Councilmembers Noroyan, Lane, Terrazas, Posner, Comstock; Vice Mayor Chase; Mayor Mathews.

NOES: None.

ABSENT: None.

DISQUALIFIED: None.

APPROVED: 
Mayor

ATTEST: 
City Clerk Administrator

**COOPERATIVE WATER TRANSFER PILOT PROJECT FOR GROUNDWATER RECHARGE
AND WATER RESOURCE MANAGEMENT
BETWEEN CITY OF SANTA CRUZ AND SOQUEL CREEK WATER DISTRICT**

The parties to this Agreement are the CITY OF SANTA CRUZ, hereafter referred to as "CITY", and the SOQUEL CREEK WATER DISTRICT", hereafter referred to as "DISTRICT".

RECITALS

- A. The CITY of Santa Cruz is a charter city which owns and operates a municipal water system in the City of Santa Cruz and in portions of the County of Santa Cruz adjoining the District water system.
- B. The DISTRICT is a special district which operates a water system, adjacent to the eastern service boundary of the CITY, and provides water service to a significant portion of mid-Santa Cruz County.
- C. A shared groundwater basin that the DISTRICT relies upon for a significant portion of its water supply, and from which the CITY obtains a small portion of its water supply, has been in a state of overdraft since the 1980s and is at risk of additional seawater intrusion.
- D. The DISTRICT and the CITY cooperatively manage groundwater in the over-drafted basin and would benefit from this agreement.
- E. The CITY and the DISTRICT have established three metered interties located at the DISTRICT's O'Neill Ranch well site, at Jade Street and at Bain Street.
- F. During the winter and spring, the CITY may have available surface water from its pre-1914 North Coast water rights that could be treated and delivered to the DISTRICT for purchase.
- G. Purchasing and using this treated surface water to meet some part of the DISTRICT's demand would enable the DISTRICT to reduce its groundwater pumping, reduce the potential for accelerating seawater intrusion, and contribute to the beginnings of a longer term process to ameliorate the overdraft condition of the groundwater basin that impacts both entities and other pumpers of groundwater from the Soquel-Aptos basin.
- H. The period during which this agreement operates can be viewed as an opportunity to begin to assess the effects of reduced pumping of the basin by the DISTRICT on the shared groundwater basin. During this pilot project, the CITY and the DISTRICT intend to use this opportunity to collect information related to:
 - 1) the physical operating system issues;
 - 2) system water quality;
 - 3) response of groundwater levels from in-lieu recharge; and
 - 4) the potential opportunity of developing a longer term agreement in which the groundwater basin would be used for a combined in lieu and aquifer storage and recovery program that would help resolve the basin overdraft that would protect CITY and DISTRICT wells from addition seawater intrusion and provide needed drought storage for the CITY.

- I. The CITY and DISTRICT recognize that a fair and appropriate agreement can benefit both parties, the community, and provide better management of locally available water resources.

NOW, THEREFORE, IT IS HEREBY AGREED:

1. AGREEMENT TERM:

Except as provided in Paragraph 11 hereafter, the term of this Agreement shall be for the period commencing at the completion of the CEQA process or November 1, 2015, whichever date is later and ending approximately five years later on December 31, 2020. This Agreement shall not extend beyond said date unless the governing bodies of both the CITY and the DISTRICT so agree in writing.

2. TERMS AND CONDITIONS FOR PROVIDING WATER:

Contingent upon the CITY securing all necessary permits and completion of the environmental review process in accordance with Paragraphs 4 and 5 below, water supplied by the CITY will be made available to the DISTRICT for purchase within the scope of the CITY's valid pre-1914 appropriative water rights and changes thereto in compliance with the law. The quantity and availability of water supplied by the CITY under the terms of this agreement shall be based on the following conditions and at the sole discretion of the Director of the Water Department of the CITY. In determining whether supply can be provided, the CITY may take into account any or all of the following factors:

- a. The CITY has not declared, and is not operating under, any mandatory water curtailment stage of its 2009 Water Shortage Contingency Plan, as it may be amended, updated, or replaced by the CITY from time to time.¹
- b. Loch Lomond Reservoir is full and is spilling, or if not spilling is projected to be full by April 1 of the water year during which water will be provided to the DISTRICT. The calculation of the potential for the Loch Lomond Reservoir to fill shall be based on the City's short term streamflow modeling tools used to conduct the City's annual water supply forecast, as those tools or other measures to forecast water supply may be amended, updated, or replaced from time to time by CITY.
- c. The CITY is providing flow for aquatic resources that meet regulatory requirements, or other requirements agreed to in writing with the fisheries agencies.
- d. The City Beltz Wells are off, and not needed to meet daily demand.
- e. The planned operation is in compliance with the project as described in the CEQA documents, including the general provision that the water transfer may occur when water is available as described in these terms and conditions between the months of November to April
- f. On a monthly basis, the volume of water delivered to the DISTRICT shall be less than or equal to the amount diverted from the CITY's Liddell Springs and/or Majors Creek supplies as reported to the state of California.

¹ Mandatory curtailments begin with Stage 2 of the 2009 plan.

- g. The daily volume of water supplied shall not exceed the hydraulic capacity of the interties between the CITY's system and the DISTRICT's system located at the District's O'Neill Ranch well site and at Jade Street and Bain Street. The hydraulic capacity of these interties is estimated to be 1.5 million gallons per day (mgd) during normal operations and up to 2 mgd on an emergency basis, and is a function of the pressure difference between the CITY and DISTRICT water systems at that point.
- h. The CITY has not determined, in its discretion, that the supply of water to DISTRICT must be suspended or discontinued due to unusual or unanticipated circumstances, which suspension or discontinuation shall not be implemented without providing at least 3 days' advance written notice, except in the case of an emergency, in which event the City shall endeavor to provide DISTRICT notice as soon as reasonably possible after the emergency determination has been made.

3. PRICE

The CITY agrees to sell to the DISTRICT treated water delivered to the CITY-DISTRICT interties located on the DISTRICT's O'Neill Ranch well site and at Jade Street and Bain Street under the terms and conditions described hereof at a price that is equal to \$1,000 per million gallons, or a pro rata amount thereof based on actual volume provided.

The CITY shall bill the DISTRICT on a monthly basis for water delivered to the DISTRICT based on the meter installed at the above specified intertie connections between the CITY and the DISTRICT. The pricing specified above is for this pilot project only. Future water deliveries made outside of this agreement will be subject to a pricing structure developed under any future water transfer or exchange agreement.

4. REGULATORY COMPLIANCE – CEQA

The CITY shall be the designated lead agency for the purposes of California Environmental Quality Act (CEQA) compliance. Cost of CEQA compliance, including preparation of an initial study and any negative declaration, mitigated negative declaration or environmental impact report, and implementation of mitigation measures identified therein and agreed to by the CITY will be equally split between the parties, with the DISTRICT's share shall be billed on a quarterly basis for the duration of this agreement.

CEQA compliance shall address the agreement herein to implement pilot testing of the transfer of water under certain conditions from the CITY to the DISTRICT commencing approximately November 1, 2015 and ending approximately five years later on December 31, 2020. Given that the agreement may potentially be extended beyond said date if both the CITY and the DISTRICT so agree in writing, CEQA shall also address the long-term transfer of water that may occur under such an extended agreement.

5. REGULATORY COMPLIANCE -- PERMITTING

The CITY shall be responsible for obtaining any other permits or approvals required to support providing water to the DISTRICT under this agreement, and shall be responsible for compliance with all laws, as necessary to make water available for purchase or to transfer pursuant to this Agreement.

6. REGULATORY COMPLIANCE – TREATED WATER DELIVERIES

Delivered water shall be in compliance with all drinking water regulatory requirements at the intertie point of delivery. Once the water has been delivered the DISTRICT shall be responsible in all respects for that water, and its delivery and use, including without limitation compliance with any distribution system requirements, and any relevant water quality regulations.

7. OPERATIONS PLAN

Prior to initiating the proposed water transfer, the CITY and the DISTRICT agree to jointly prepare and then implement an Operations Plan as the basis for joint operation. The CITY and the DISTRICT may amend the Operations Plan by written joint consent without needing to otherwise amend this agreement.

8. NOTIFICATION OF STARTING AND STOPPING WATER DELIVERIES

The water to be delivered hereunder shall be delivered to the DISTRICT on an interruptible basis, depending upon the availability of water and the terms and conditions described in paragraph 2 of this agreement. A determination that the delivery of water to the DISTRICT must be interrupted shall be at the sole discretion of the CITY Water Director, which determination shall be conclusive upon the DISTRICT. The CITY shall give the DISTRICT notice of interruption or cessation of the transfer of water in accordance with Paragraph 2(g), above.

9. DATA COLLECTION, MONITORING, AND ANALYSIS

The CITY and the DISTRICT shall jointly share the cost to develop, and implement, a data collection, monitoring, and analysis program to further characterize the benefits of the proposed water transfer and identify any potential issues. This program shall include, but not be limited to, monitoring and analyzing groundwater levels from existing wells in the vicinity of wells that the DISTRICT takes offline due to the available of water from an alternate water source, and distribution system water quality to assess any impacts from surface water being distributed through pipes that have only been used solely for groundwater distribution in the past. The plan shall be developed and implemented by the CITY and DISTRICT prior to commencing any sale of water.

10. NOTIFICATIONS AND RECORD KEEPING

For the purposes of this agreement, the parties shall abide by the record keeping and notification provisions in the Operations Plan.

11. NATURE OF AGREEMENT

It is understood and acknowledged by the DISTRICT and the CITY that this Agreement is only for the term specified herein, that no obligations are imposed on the parties beyond the term hereof, that the

water rights of the CITY are not impacted, and that the water during the term hereof is solely dependent on the availability of surplus water as stated in this agreement.

This agreement makes no assumption about the availability or quantity of water to be delivered back to the CITY for use as a drought supply.

12. EFFECTIVE DATE:

This Agreement shall become effective only upon its approval by the governing bodies of each party hereto.

13. TERMINATION ON THIRTY-DAY NOTICE

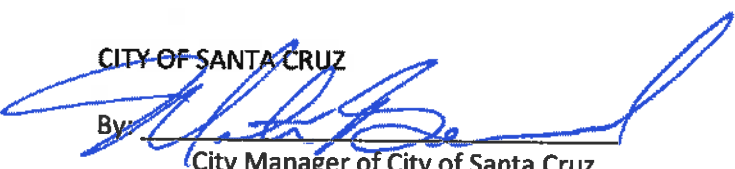
This Agreement may be terminated by either party hereto upon the furnishing to the other party by United States Mail, first class, a thirty (30) day notice of intent to terminate or with an email notification that is acknowledged by the receiving party provided, however that DISTRICT'S obligations to pay for water delivered and indemnify, defend and hold CITY harmless pursuant to paragraph 14, below, shall survive termination.

14. RELEASE AND INDEMNITY

DISTRICT agrees to indemnify, defend and hold harmless CITY, and any agency or instrumentality thereof, and its elected and appointed officials, officers, employees and agents from and against all liabilities, claims, actions, causes of action, proceedings, suits, damages, judgments, liens, levies, costs and expenses of whatever nature, including reasonable attorneys' fees and disbursements (collectively "Claims") arising out of any actions taken by the City in the implementation of this agreement, or any environmental review conducted under the California Environmental Quality Act (CEQA) in connection with this agreement.

Dated: 8-4-16

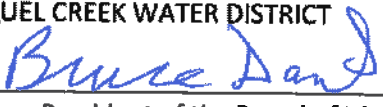
CITY OF SANTA CRUZ

By: 

City Manager of City of Santa Cruz

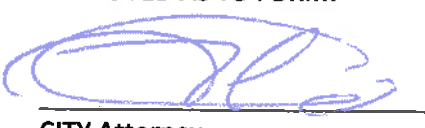
Dated: July 25, 2016

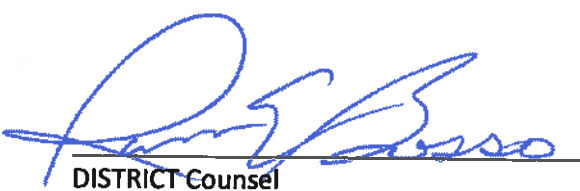
SOQUEL CREEK WATER DISTRICT

By: 

President of the Board of Directors

APPROVED AS TO FORM:


CITY Attorney


DISTRICT Counsel