FINAL

2015 Urban Water Management Plan

Prepared for
City of Brentwood
Brentwood, CA
June 2016

This page intentionally left blank.

201 North Civic Drive
Suite 115
Walnut Creek, California 94523

T: 925.937.9010
F: 925.937.9026

June 17, 2016

Ms. Diana Williford
Water Conservation Specialist
Public Works/ Operations
City of Brentwood
2201 Elkins Way
Brentwood, California 94513-7344

1011-148731

Subject: 2015 Urban Water Management Plan

Dear Ms. Williford:

In completion of the City of Brentwood 2015 Urban Water Management Plan authorization dated December 15, 2015, we are pleased to submit this 2015 Urban Water Management Plan (UWMP). We have updated your 2010 UWMP to incorporate more recent data and information as well as new requirements in the law and from the California Department of Water Resources (DWR).

Please let me know if you have any questions.

Very truly yours,

Brown and Caldwell

Erin Mackey, P.E., Ph.D.
Project Manager

RG/EM:dem

Enclosure: 2015 Urban Water Management Plan for the City of Brentwood

This page intentionally left blank.

FINAL

2015 Urban Water Management Plan

Prepared for
City of Brentwood
Brentwood, CA
June 2016

148731

Erin Mackey, PhD, PE
CA License C81498

Brown AND Caldwell

201 North Civic Drive, Suite 115
Walnut Creek, CA 94596

This page intentionally left blank.

Project Participants

Brown and Caldwell

Erin Mackey, Project Manager

William Faisst, Senior Technical Specialist

Rene Guillen, Staff Engineer

Kelsi Oshiro, Staff Engineer

City of Brentwood

Diana Williford, Water Conservation Specialist

Eric Brennan, Water Operations Manager

Chris Ehlers, Assistant Director of Public Works

This page intentionally left blank.

Table of Contents

List of Figures

List of Tables

List of Abbreviations

AB	Assembly Bill
AF	acre-feet
AF/yr	acre-feet per year
BMP	Best Management Practice
CASGEM	California Statewide Groundwater Elevation Monitoring
CCWD	Contra Costa Water District
CDPH	California Department of Public Health
CII	commercial, industrial, and institutional
CIMIS	California Irrigation Management Information System
City	City of Brentwood
COBWTP	City of Brentwood Water Treatment Plant
CUWCC	California Urban Water Conservation Council
CWC	California Water Code
DDW	State Water Resources Control Board Division of Drinking Water
DMM	Demand Management Measure
DRU	California Department of Finance Demographic Research Unit
DWR	California Department of Water Resources
ECCID	East Contra Costa Irrigation District
ET_o	evapotranspiration
ºF	degrees Farenheit
GPCD	gallons per capita per day
gpd	gallons per day
GSA	Groundwater Sustainability Agencies
GSP	Groundwater Sustainability Plan
in	inches
IPR	indirect potable reuse
MG	million gallons
mgd	million gallons per day
mg/L	milligrams per liter
MGY	million gallons per year
MOU	Memorandum of Understanding
N/A	not available
NA	not active
NPDES	National Pollutant Discharge Elimination System
RBWTP	Randall-Bold Water Treatment Plant
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SGMA	Sustainable Groundwater Management Act
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
UWMP	Urban Water Management Plan
WSCP	Water Shortage Contingency Plan
WWTP	Wastewater treatment plant

Section 1

Introduction

This Urban Water Management Plan (UWMP) was prepared for the City of Brentwood's (City's) water system in cooperation with the City staff. This UWMP addresses the City's water system and includes a description of the service area, water use, and water supply sources. It provides a comparison of water supply and water demands during normal, single dry, and multiple-dry years. Also described is the City's water conservation program. This UWMP is the year 2015 UWMP as required by the Urban Water Management Planning Act of 1983 (Act). The Act is described in California Water Code Division 6, Part 2.6, Sections 10610 through 10657.

This section provides an overview of the Act, the basis for preparing this UWMP, coordination and outreach, public participation, plan implementation, and organization. In order to aid the reader in understanding the context of the UWMP content, text at the beginning of some sections and subsections in this UWMP is italicized quoting specific portions of the Act that are relevant to the particular UWMP sections.

1.1 Urban Water Management Planning Act

The Act became part of the California Water Code with the passage of Assembly Bill 797 during the 1983–1984 regular session of the California legislature. Subsequently, assembly bills (AB) between 1990 and 2003 amended the Act. The Act was amended in November 2009 with the adoption of SBX 7-7 and was most recently amended in 2014. The Act is described in California Water Code (CWC) Division 6, Part 2.6, Sections 10610 through 10657.

The Act requires 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 to adopt and submit an UWMP every five years to the California Department of Water Resources (DWR). The Act describes the contents of the UWMP as well as how urban water suppliers should adopt and implement the UWMP.

1.2 Plan Implementation

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

This 2015 UWMP updates the water conservation implementation plan and projected schedules in the City's 2010 UWMP. The UWMP describes the availability of water and discusses water use, reclamation, and water conservation activities. The UWMP concludes that the water supplies available to the City's treated water customers are adequate over the next 25-year planning period through 2040.

The City will implement this 2015 UWMP so that the projected water conservation activities are fulfilled to help meet the City's gallons per capita per day (GPCD) target for 2020. The City will also track actual recycled water use and compare it to the projected use in this UWMP. The City implemented the 2010 UWMP in accordance with the information that was projected in that document.

1.3 Plan Organization

This report is organized into the following sections as outlined in the 2015 Guidebook:

- Section 1(this section) provides an overview of the Act and a summary of the sections in this UWMP.
- Section 2 provides an overview of the UWMP preparation.

- Section 3 provides a description of the service area, climate, water supply facilities, distribution system, and historical and projected population.
- Section 4 presents historical and projected water use.
- Section 5 describes baselines and targets for per capita water use.
- Section 6 describes system water supplies including recycled water.
- Section 7 addresses water supply reliability.
- Section 8 describes the City's water shortage contingency plan.
- Section 9 describes demand management measures employed by the City.
- References provides a list of references.
- Appendices provide relevant supporting documents.

DWR has provided a checklist of the items that each UWMP must address based upon the Act. This checklist makes it simple to identify exactly where in the UWMP each item has been addressed. The City has completed the checklist for this UWMP and provided it in Appendix A. It references the sections and appendices where specific items can be found.

Section 2

Plan Preparation

This section presents the basis for preparing the UWMP, UWMP identification number, units of measure, and coordination and outreach efforts.

2.1 Basis for Preparing the Plan

The City is a retail urban water supplier. Table 2-1 presents the Public Water System name and number.

Table 2-1. (DWR Table 2-1) Retail: Public Water Systems

Public water system number	Public water system name	Number of municipal connections 2015	Volume of water supplied 2015 (MG)
CA0710004	City of Brentwood	18,417	3,036
	Total	18,417	3,036

Source: DWR, 2015

The City has selected individual reporting for this UWMP, as identified in Table 2-2. This UWMP is reporting on a calendar year basis using million gallons (MG) as the unit of measure as noted in Table 2-3.

Table 2-2. (DWR Table 2-2) Plan Identification

✓	Individual UWMP
	Regional UWMP *(checking this triggers the next line to appear)*
No	Does this Regional UWMP include a Regional Alliance?

Table 2-3. (DWR 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

Table 2-3. (DWR Table 2-3) Agency Identification	
Units of measure used in UWMP (select one)	
	Acre Feet (AF)
✓	Million Gallons (MG)
	Hundred Cubic Feet (CCF)

2.2 Coordination and Outreach

"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.

[…] Each urban water suppler 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 its plan" (CWC §§ 10620(d)(2)–10642).

The Act requires the City to coordinate the preparation of its UWMP 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. The City has informed its wholesale water supplier, Contra Costa Water District (CCWD), of the City's projected water use, as shown in Table 2-4.

Table 2-4. (DWR Table 2-4) Retail: Water Supplier Information Exchange
The retail supplier has informed the following wholesale supplier(s) of projected water use in accordance with CWC 10631.
Wholesaler water supplier name:
Contra Costa Water District

The City has also coordinated this UWMP with other agencies and community as summarized in Table 2-5. Coordination efforts were conducted to: (1) inform other agencies of the activities of the City, (2) gather high-quality data for use in developing the UWMP, and (3) coordinate planning activities with other related regional plans and initiatives.

Table 2-5. Coordination and Notification for Plan Preparation							
Organization/ agency name	Participated in developing the UWMP	Commented on the draft	Attended public meetings	Was contacted for assistance	Was sent a copy of the draft UWMP	Was sent a notice of intention to adopt	Not involved / no information
CCWD					x	x	
ECCID					x	x	
Diablo Water District					x	x	
City of Antioch					x	x	
Brentwood	x	x		x	x	x	

Table 2-5. Coordination and Notification for Plan Preparation							
Organization/ agency name	Participated in developing the UWMP	Commented on the draft	Attended public meetings	Was contacted for assistance	Was sent a copy of the draft UWMP	Was sent a notice of intention to adopt	Not involved / no information
WWTP							
General Public		x	x				
Other						x	

Notes:
Coordination and notification includes planned actions (e.g., sharing draft).
CCWD = Contra Costa Water District.
ECCID = East Contra Costa Irrigation District.
WWTP = wastewater treatment plant.

This page intentionally left blank.

Section 3

System Description

This section describes the City's water supply system, its service area, climate, and projected population.

3.1 Description of Service Area

"Describe the service area of the supplier" (CWC §§ 10631(a)).

The City of Brentwood lies in Eastern Contra Costa County and was incorporated in 1948. Incorporated boundary currently totals 14.8 square miles (9,502 acres), with a sphere of influence totaling 17.4 square miles (11,129 acres) (City of Brentwood, 2016). Figure 3-1 shows the service area and its surroundings. Brentwood is bounded to the north by the City of Oakley, to the west by the City of Antioch, and to the south and east by unincorporated portions of Contra Costa County.

The City provides water treatment and distribution services as well as wastewater collection, treatment, and treated disposal services for its residents and businesses. The City's water distribution system consists of three pressure zones, one potable water treatment plant, nine groundwater wells (seven of which are active), six water reservoirs, seven water booster pump stations, and 172 miles of water mains within the city limits (City of Brentwood, 2013a). The City also has one wastewater treatment plant (WWTP). Figure 3-2 shows the locations of these features within the water service area.

The City lies in the Marsh Creek watershed and is surrounded by the foothills of Mount Diablo and the rich farmlands of the Sacramento-San Joaquin Delta, which drains into the San Francisco Bay. The Marsh Creek watershed drains to the east side of Mount Diablo. It covers about 128 square miles of rangeland, farmland, protected parkland, and urban land (City of Brentwood, 2011). The creek flows approximately 30 river miles from its headwaters in the Morgan Territory Preserve through Brentwood and Oakley to empty into the Delta at Big Break near the confluence of the Sacramento and San Joaquin Rivers. Deer Creek, Dry Creek, and Sand Creek are all smaller creek systems that join Marsh Creek within the City of Brentwood. All three of these systems flow from the west to the east (City of Brentwood, 2013a).

The geological setting of Contra Costa County is composed of surficial (Quaternary) deposits that overlie fault-bounded bedrock assemblages. East Contra Costa County has four groundwater regions. The City occupies the largest region, an area where groundwater occurs in material that was deposited by streams that originate in the coast ranges to the west. Aquifer materials capable of yielding quantities of water suitable for municipal and/ or agricultural purposes extend to depths of 600 feet below the ground surface.

Local development began in the late 19th century. The area that would eventually become the City of Brentwood began as a farming community that is still today known throughout the Bay Area for its agricultural products, primarily its cherries, corn, and peaches. Since 1990, many of the old farms and orchards have been replaced by suburban developments. The predominant land use is now residential with the majority of residential development being single family. Concurrent with the housing boom of the early and mid-2000's, the City experienced a substantial increase in retail services uses, as well as moderate growth in the light industrial sector (City of Brentwood, 2013a).

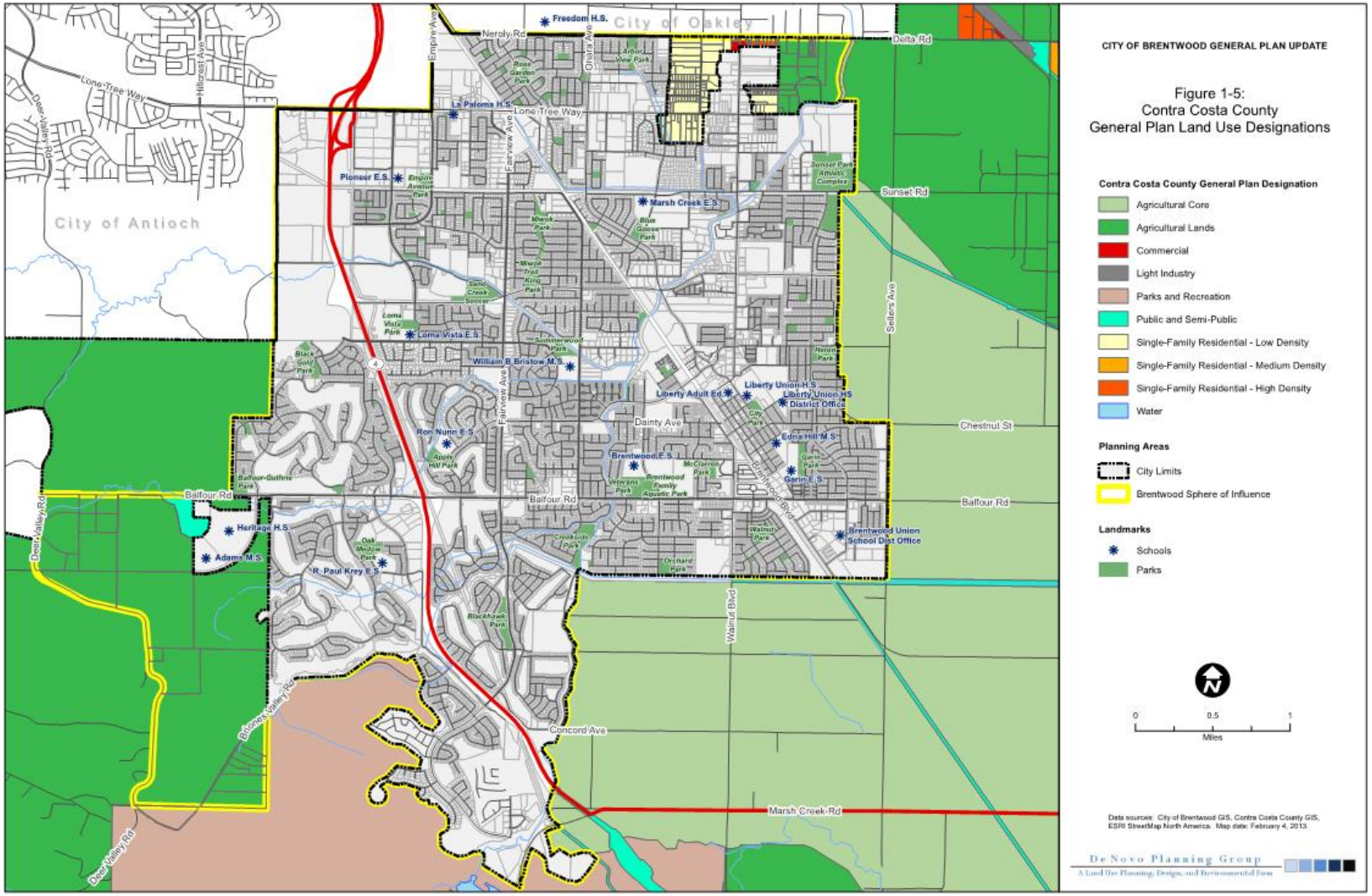


Figure 3-1. City of Brentwood planning and service area

Source: City of Brentwood, 2013a

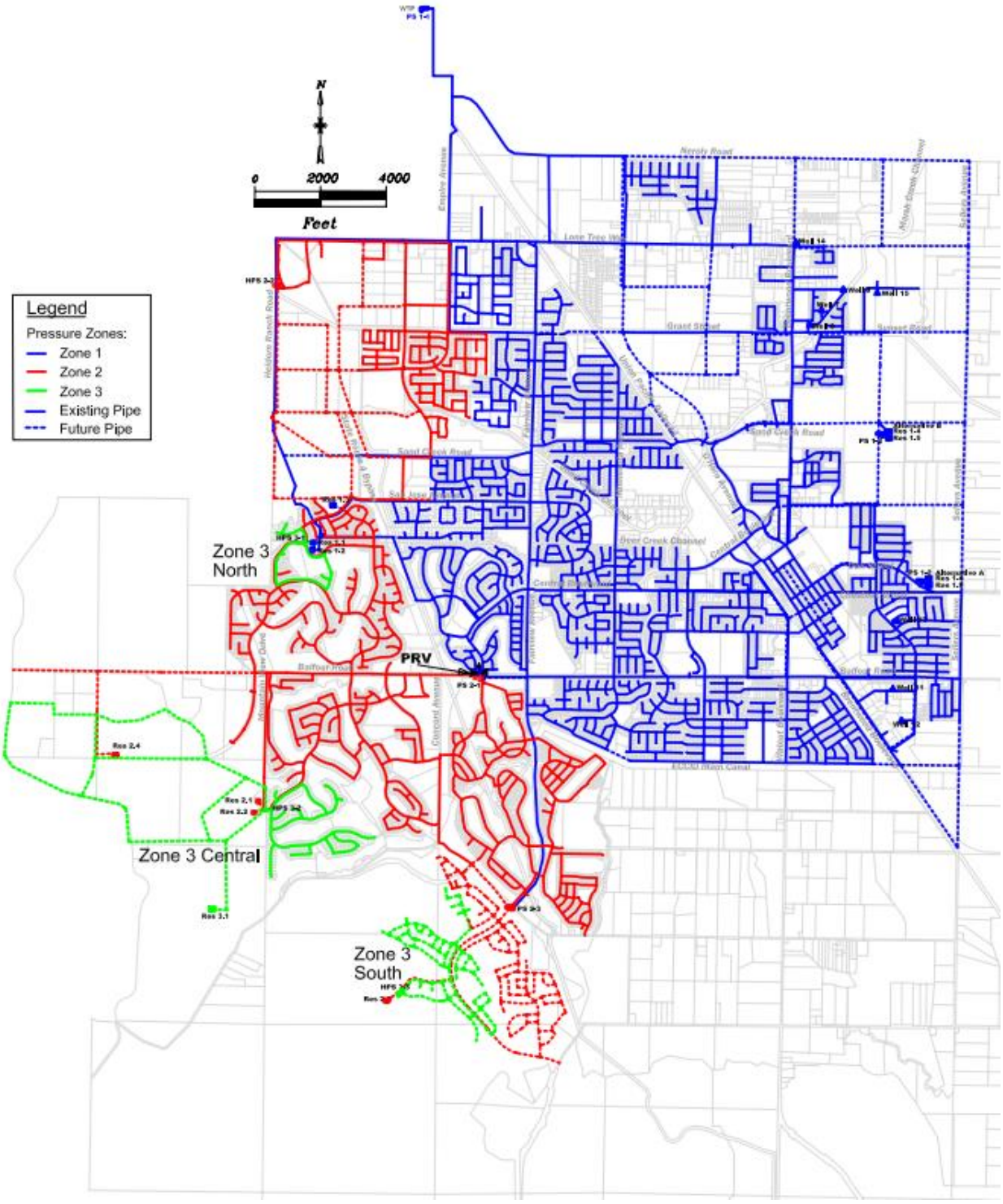


Figure 3-2. City of Brentwood water service area

Source: City of Brentwood, 2013a

3.2 Service Area Climate

"[Describe the service area] climate" (CWC §§ 10631(a)).

The City has cool, humid winters, and hot, dry summers. Historical climate data for the City were obtained from the California Irrigation Management Information System (CIMIS). Based on the historical data obtained from CIMIS, the City's average daily temperature ranges from 37 to 90ºF; the extreme low and high temperatures have been 11 and 109ºF, respectively over the time period January 1986 to December 2015. The rainy season typically begins in November and ends in March. Table 3-1 summarizes the City's average climate conditions. Average monthly precipitation during the winter months is about two to three inches, but records show that the monthly winter precipitation has been as high as eight inches (in February 1998) and as low as zero inches (multiple months). Water demands during the winter are low relative to summer months (May to September). The combination of hot and dry weather during the summer results in high water demands during these periods. Landscape irrigation, including turf irrigation in the summer, significantly contributes to the higher summer demands. Evapotranspiration (ET_o) records, which measure the loss of water from the soil both by evaporation and by transpiration from the plants growing thereon, indicate average monthly values ranging from 1.2 inches in the City's wet Januarys to 8.1 inches in much drier Julys.

Table 3-1. City Service Area Climate Characteristics

Month	Standard Monthly Average ET_o (inches)	Average Total Rainfall (inches)	Average Temperature (°F)	
			Max	Min
January	1.17	2.34	55.49	39.19
February	1.93	2.31	59.24	40.22
March	3.67	1.32	64.91	43.19
April	5.25	0.74	69.48	44.76
May	6.93	0.56	75.76	48.45
June	7.77	0.29	82.62	51.04
July	8.11	0.10	87.59	54.61
August	7.26	0.13	89.94	55.60
September	5.69	0.26	86.11	53.89
October	3.87	0.74	77.35	48.92
November	1.97	1.22	64.73	41.87
December	1.19	2.40	54.95	37.17

Notes:
Source: DWR, 2016d – Data recorded January 1986 to December 2015 from Brentwood Station 47, CIMIS www.cimis.water.ca.gov.

3.3 Historical and Projected Population

"Describe the service area of the supplier, including current and projected population [...] 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" (CWC §§ 10631(a)).

The City of Brentwood was among the fastest growing cities in California during the early and mid-2000's. In 2015, the City's water system served a population of 56,493 (DWR, 2015). According to the DWR

methodology for estimating service area population (DWR, 2011b), the City is considered to be a Category 1 water supplier because its actual distribution area overlaps substantially (≥95 percent) with the boundaries of the City during baseline and compliance years.

When the City was incorporated it had a population of 1,700. During the late 1990's and early 2000's its population increased significantly. These growth trends since have tapered substantially mirroring economic trends in the City. The City underwent a dramatic economic boom from 2000 through 2008. This growth stalled in 2009, paralleling changes in the U.S. economy, particularly the real estate market collapse in California. As a result, the City experienced a one percent decrease in population from 2009 to 2010 (City of Brentwood, 2010). Since then, the annual growth rate has averaged 1.6 percent before peaking in 2015 at 2.8 percent (City of Brentwood, 2015b). Moving forward the annual growth rate is expected to average approximately 1.5 percent with the City's population projected to reach 64,089 by 2024 (City of Brentwood, 2015b). It is estimated that the City will have a total population of approximately 80,917 citizens at build out (City of Brentwood, 2013a).

Current and historical population data for the City came from the California Department of Finance Demographic Research Unit (DRU) as control totals for each jurisdiction. The City uses historical population estimates in its annual fiscal model reports to evaluate historical growth. Data from DRU also were used to project population growth. Economic and demographic mathematical models are used to drive population projections. These models can be adjusted and constrained by examining local governments' plans, policies, and regulations that affect land development.

Population projections are used by the annual fiscal model developed by the City's Finance Department. The department uses the City's growth model, which is based on projected residential and commercial growth. Projections consider historical and present trends, taking into account available vacant land, redevelopment activities, and current land use policies and plans. Residential and commercial projections indicate that the worst of the development slowdown is over. The total number of new single-family houses projected through 2024 is 2,675. Combined with the 120-multi-family permits, the City is expecting 9,348 new residents over the next decade (City of Brentwood, 2015b). Commercial growth (in square feet), which declined over the past several years, is forecasted to see modest activity during the middle part of the decade (City of Brentwood, 2015b). Office development is expected to be limited as vacant building availability in other cities can, in most cases, be attained at a lower cost than constructing new office buildings (City of Brentwood, 2015b). Table 3-2 provides the estimated 2015 population and projected future population through 2040.

Table 3-2. (DWR Table 3-1) Retail: Population - Current and Projected – Used for this UWMP

Population served	2015	2020	2025	2030	2035	2040
	56,493	60,702	65,225	70,084	75,306	80,917

Notes:
Source: Population data for 2015 and 2040 was obtained from the 2015 Public Water System Statistics Report (DWR, 2015) and City's General Plan (City of Brentwood, 2013a), respectively.
The 2040 population is the City's population projection at build-out. The law of growth was used to project population numbers between 2020 and 2035.

Other demographic factors that affect water management planning include the uncertainty in estimating future population growth and per capita water use. Affordability of housing has many people choosing to reside in Brentwood. Even though population and employment rates in the City continue to grow, nearly 75 percent of the Brentwood residents commute to jobs outside of the City, primarily to employment opportunities in San Francisco, Oakland, Concord, Walnut Creek, Antioch, and Pittsburgh (City of Brentwood, 2013a). The largest employers within the City are community-service retail and government employers

(e.g., school districts). While agriculture remains important to the local economy it has declined in relative importance as the City has become more suburban. The City has no heavy industry and only a small light industry area in the northeastern part of the City. Changes in the economy can have a strong impact on growth.

Section 4

System Water Use

This section describes the urban water system demands and the resulting projections for future water demands for the City.

4.1 Water Use by Sector

"Quantify, to the extent records are available, past and current water use, and projected water use (over the same five-year increments described in subdivision (a)), 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; (I) Agricultural.

[…] The water use projections shall be in the same five-year increments described in subdivision (a)" (CWC §§ 10631(e)(1)–10631(e)(2)).

Water demands for potable water by water sector for 2015 are from metered customer use. The City meters all water deliveries. The City's water system serves more than 18,000 connections. Historical water deliveries were obtained from the City's annual reports sent to DWR and the California Department of Public Health (CDPH)/State Water Resources Control Board Division of Drinking Water (DDW).[1] The City provides water treatment and distribution services as well as wastewater collection, treatment, and treated water disposal services to the following water sectors:

- **Single-Family Residential** – This sector refers to single-family residences in an identifiable suburban residential neighborhood or cluster-style development designed with open space and other amenities.
- **Multi-Family Residential** – This sector refers to families living in apartments and condominiums in structures of two or three stories with off-street parking and other requirements for higher density living.
- **Commercial/Institutional/Industrial** – This sector includes commercial, government, and industrial uses. It primarily includes uses associated with commercial buildings (e.g., landscaping; toilets; heating, ventilation, air conditioning, etc.) and commercial uses (e.g., car washes, laundries, nurseries, etc.).
- **Landscape** – This sector primarily includes raw water (untreated) use for irrigation at parks, schools, cemeteries, churches, residences, or public facilities. This sector also includes recycled water at various parkways and landscaped medians throughout the City.
- **Other** – This sector includes metered water used for construction and unmetered water used for fire response from fire hydrants throughout the City. Hydrant meters are read quarterly.

Table 4-1 presents the current 2015 water uses by sector. Several assumptions were used in calculating actual water use and water use projections. The industrial and institutional/government water sector volumes are blank in the DWR tables because the City includes them in the commercial water sector when tracking and reporting. The City has no agriculture deliveries; deliveries to agricultural users are made by the East Contra Costa Irrigation District (ECCID). The City land use plan includes numerous parks, large areas of agriculture conservation, and special planning areas that are underdeveloped.

[1] The CDPH was transferred to the SWRCB and renamed the DDW in July 2014.

Table 4-1. (DWR Table 4-1) Retail: Demands for Potable and Raw Water - Actual			
	2015 Actual		
Use type	Additional description (as needed)	Level of treatment when delivered	Volume
Single Family		Drinking Water	1,726
Multi-Family		Drinking Water	95
Commercial[a]		Drinking Water	187
Institutional	Included with commercial use data	Drinking Water	
Industrial	Included with commercial use data	Drinking Water	
Landscape[b]	From potable water supply	Drinking Water	296
Landscape[b]	From untreated water supply	Raw Water	268
Other[b]		Drinking Water	12
Losses		Drinking Water	323
TOTAL			2,906

Notes:
Source: Water delivery data compiled using 2015 Public Water System Statistics Report (DWR, 2015).
Units: million gallons per year (MGY)
a. Institutional and Industrial data included in Commercial totals.
b. Landscape and Other use types also use recycled water. The amount of recycled water within the Other use type cannot be accurately quantified, as such it is assumed that all recycled water was utilized for the Landscape sector. The City's recycled water use is quantified in Table 6-6 and is not included in this table.

Figure 4-1 shows the total potable and raw water demand breakdown by sector. According to the 2015 water delivery data from the City, the single-family residential sector had the highest demand for water at 59 percent. Landscape water use has the second highest demand for water at 19 percent. The multi-family residential and commercial water sectors only total to 10 percent. Potable and raw water deliveries in 2015 totaled approximately 2,906 MG.

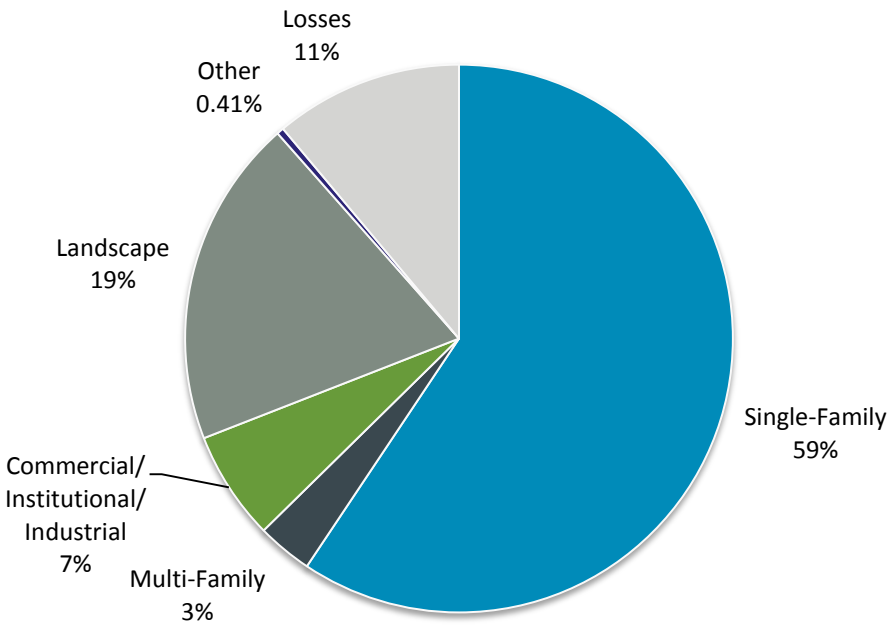


Figure 4-1. 2015 City of Brentwood potable and raw water demand by water use sector

Table 4-2 presents the projected water use by water use sector in five-year increments through 2040. Based on the City's General Plan, the projected average annual water use at buildout is approximately 7,100 million gallons per year (MGY) (City of Brentwood, 2013a). The City's General Plan tabulated this buildout demand using the City's average per capita baseline water use of 241 GPCD that occurred from 2001 through 2010. With the onset of the drought, the City's per capita demand has decreased substantially. While a rebound in per capita water use from drought to pre-drought levels is expected, water use is not likely to increase back to the 241 GPCD baseline. Instead, normal year water demands through 2040 are projected based on assuming per capita demands will increase back to approximately 90 percent of the 2012 GPCD and the projected population (see Table 3-2). This approach is based on the assumption that 2012 was a normal water demand year and that some conservation measures implemented by the City and its customers during the drought are permanent and will result in some level of continued reduced water demands into the future.

The resulting water demand projections come close (90 percent of 2012 per capita demand is 194 GPCD) to meeting the City's 2020 water use target of 193 GPCD (See Section 5). It is expected that the City will meet its GPCD target through the occurrence of "passive water savings" (see Section 4.3) and from additional recycled water use into the future that will offset potable demands in the Landscape water use sector. The projected demand breakdown by customer category for the City's potable and raw water customers is based on the 2015 demand breakdown by customer category.

Table 4-2. (DWR Table 4-2) Retail: Demands for Potable and Raw Water - Projected						
Use type	Additional description (as needed)	Projected water use *Report to the extent that records are available*				
		2020	2025	2030	2035	2040
Single Family		2,556	2,747	2,952	3,171	3,408
Multi-Family		140	151	162	174	187
Commercial[a]		277	298	320	344	369
Institutional	Included with commercial use data					
Industrial	Included with commercial use data					
Landscape		835	897	964	1,035	1,112
Other		17	18	20	21	23
Losses		478	513	552	593	637
TOTAL		4,303	4,624	4,968	5,338	5,736

Notes:
Units: MGY
a. Institutional and Industrial data included in Commercial totals.

Water use varies continuously throughout the day and fluctuates year round based primarily on seasonal climate changes. System production facilities must be sized to meet the demand on the maximum day of the year, not just the average. Maximum daily water demand projections provide the basis for sizing and staging future water facilities. The City has projected total annual water demand up to 2040 based on a maximum build out water demand of 41 million gallons per day (mgd), with water supplied from all sources of supply (surface and groundwater) (pp. 2-6, City of Brentwood, 2006b). Maximum daily water demand was assessed using two distinct growth-rate scenarios: 1) a high growth rate curve and 2) a straight-line growth rate. The high growth rate curve provides a scenario in which water demands are high until 2020 and then slow from 2020 to 2040. Under the straight-line growth rate scenario, water demands are expected to increase at a constant rate until 2040. Table 4-3 summarizes the projected maximum daily demands for both scenarios. Actual water demands are expected to fall in between these two projections.

Table 4-3. Current and Projected Maximum Daily Water Demands (2015-2040) for the City of Brentwood				
Year	Total maximum daily demand – high growth rate scenario (mgd)	Total maximum daily demand – straight-line growth rate scenario (mgd)	Well supply (mgd)	RBWTP and COBWTP (mgd)
2020	35	26	5	17-24
2025	36.5	30	5	21-24
2030	38	33.5	5	28.5-31.5
2035	39.5	37	5	32-34.5
2040	41	41	5	36

Notes:
Source: City of Brentwood, 2013a.
RBWTP = Randall-Bold Water Treatment Plant
COBWTP = City of Brentwood Water Treatment Plant

Table 4-4 summarizes the current and projected demands for potable, recycled, and raw water usage by the City. The City's current and projected use of recycled water is described in Section 6.

Table 4-4. (DWR Table 4-3) Retail: Total Water Demands

	2015	2020	2025	2030	2035	2040
Potable and raw water (From DWR Tables 4-1 and 4-2)	2,906	4,303	4,624	4,968	5,338	5,736
Recycled water demand (From DWR Table 6-4)	130	206	282	357	433	508
Total water demand	3,036	4,509	4,905	5,325	5,771	6,244

Notes:
Units: MGY

4.2 Distribution System Water Losses

"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: […] (J) Distribution system water loss.

[…] For the 2015 urban water management plan update, the distribution system water loss shall be quantified for the most recent 12-month period available. For all subsequent updates, the distribution system water loss shall be quantified for each of the five years preceding the plan update.

[…] The distribution system water loss quantification shall be reported in accordance with a worksheet approved or developed by the department through a public process. The water loss quantification worksheet shall be based on the water system balance methodology developed by the American Water Works Association" (CWC §§ 10631 (e)(1) and (2)–10631(e)(3)(A) and (B)).

The City's water distribution system consists of approximately 172 miles of distribution pipelines and transmission mains. Appendix E provides a detailed distribution system water loss analysis following the DWR Water Audit Manual (DWR, 2016b). The water audit is an accounting exercise that tracks all sources and uses of water within a water system over a specified period.

Table 4-5. (DWR Table 4-4) Retail: 12 Month Water Loss Audit Reporting

Reporting period start date (mm/yyyy)	Volume of water loss
01/2015	19.175

Notes:
Units: MGY

4.3 Estimating Future Water Savings

"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.

[…] 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" (CWC §§ 10631(e)(4)(A) and (B)).

Water savings from codes, standards, ordinances, or transportation and land use plans also are known as "passive savings." These various factors generally decrease the water use for new and future customers, compared to historical customers. Below is a summary of the applicable state codes and ordinances that could reduce the City's water demand in the future based on information provided in the DWR 2015 UWMP Guidebook (DWR, 2016b).

- **Model Water Efficient Landscape Ordinance –** Effective on December 1, 2015, this new ordinance is projected to reduce the typical residential outdoor landscape demands for new construction by up to 20 percent from the estimated demand using the prior ordinance provisions. Commercial landscape for new construction may reduce outdoor water demand by up to 35 percent over the prior ordinance.
- **California Energy Commission Title 20 appliance standards for toilets, urinals, faucets, and showerheads –** This standard will impact both new construction and replacement fixtures in existing homes. This savings is included in the CALGreen assumption for new construction described below. Assume up to five percent reduction in indoor water use of existing homes.
- **CALGreen Building Code** – Requires residential and non-residential water efficiency and conservation measures for new buildings and structures. It is assumed that this code will reduce residential and non-residential indoor water use by new construction by up to 20 percent.

The water use projections in this analysis do not account for these passive water savings that may be realized from these codes and ordinances, as stated in Table 4-6.

Table 4-6. (DWR Table 4-5) Retail Only: Inclusion in Water Use Projections

Future water savings Included Y/N	No
If "Yes" to above, state the section or page number where citations of the codes, ordinances, etc…utilized in demand projections are found.	Location in UWMP_____
Lower income residential demands included	Yes

4.4 Water Use for Lower Income Households

"The water use projections required by Section 10631 shall include projected water use for single-family and multifamily residential housing needed for lower income households, as defined in Section 50079.5 of the Health and Safety Code, as identified in the housing element of any city, county, or city and county in the service area of the supplier" (CWC §§ 10631.1(a)).

Lower income residential demands are included in the City's demand projections, as shown in Table 4-7. To estimate water demands from lower income households, the percent of the population that is low income is estimated from the *Housing Element* of the General Plan. In State housing law, extremely low (0 to 50 percent of the area median income), low (51 to 80 percent of the area median income), moderate (81 to 120 percent of the area median income), and above moderate (more than 120 percent of the area median income) incomes are based on the county's median income: moderate income means average income for the county, and low income is simply below average (City of Brentwood, 2014a). Since Contra Costa County has a relatively high median household income ($93,000 as of 2013), a family of four with a household

income of less than $66,250 is considered to be “low income” in Contra Costa County (City of Brentwood, 2014a). *The Housing Element* indicates that 28.2 percent of households in the City are considered “low income” (City of Brentwood, 2014a). For low income water use projections, it is assumed that low income residents are 10 percent of the single-family residents and 20 percent of the multi-family residents. The total percentage equals out to 30 percent which is close to the 28.2 percent identified in the *Housing Element* of the General Plan.

Table 4-7. Projected Low-Income Water Demands

Low income water demands	2020	2025	2030	2035	2040
Single-family residential	256	275	295	317	341
Multi-family residential	28	30	32	35	37
Total	284	305	328	352	378

Notes:
Units: MGY

4.5 Reduced Water Demand Due to Drought

Based on an Executive Order from the Governor, a statewide mandate to reduce aggregate statewide potable urban water use by 25 percent was adopted on April 1, 2015. The State adopted emergency water conservation regulations and required water agencies to report water production monthly. In response to the Governor’s Executive Order and the subsequent State Water Resources Control Board (SWRCB) drought regulations, the City adopted a Resolution at their April 28, 2015 Council meeting requiring customers to reduce potable water use by 35 percent relative to the amounts they used in 2013. Besides implementing the mandatory restrictions set by the State, The City increased the frequency of their water conservation workshops and disseminated additional information to the public encouraging water conservation. Penalties were levied to those customers that were non-compliant with the mandatory 35 percent reduction. Water use in 2015 reflects water conservation efforts as a result of the Governor’s Executive Order precipitated by a four-year drought in California.

This page intentionally left blank.

Section 5

Baselines and Targets

This section describes the City's SBX7-7 GPCD baseline and targets as updated from the analysis conducted as part of the 2010 UWMP. Compliance with the 2015 interim target is also discussed.

5.1 Overview of SBX7-7 Baseline and Target GPCD

Per the law as adopted in SBx7-7, the City must establish per capita water use targets using one of four methods

1. Method 1 - Eighty percent of the urban retail supplier's baseline per capita daily water use.
2. Method 2 - The per capita daily water use that is estimated using the sum of several defined performance standards.
   a) 55 gallons per day (gpd) for indoor residential water use.
   b) Water efficiency equivalent to the standards of the Model Water Efficient Landscape Ordinance for landscape irrigated through dedicated or residential meters or connections.
   c) A 10 percent reduction in commercial, industrial, and institutional (CII) uses from the baseline CII water use by 2020.
3. Method 3 - Ninety-five percent of the applicable state hydrologic region target, as set forth in the State's draft 20x2020 Water Conservation Plan.
4. Method 4 - Calculated water savings based on indoor residential water savings, metering savings, CII savings, and landscape and water loss savings, as set forth in DWR's Provisional Method 4 for Calculating Urban Water Use Targets, released February 2011.

Regardless of which of the four methods is adopted by the City, the target is compared to 95 percent of the City's five-year baseline to achieve a minimum water use GPCD target. If the five-year baseline water use is more than 100 GPCD, the City must compare two values:

1. Ninety-five percent of the five-year baseline daily per capita water use, and
2. The target determined by the target method the City selects from the four methods allowed.

The 2020 target is the lower of the two values.

In 2010, the City selected Method 1 to determine its urban water use target. Based on Method 1 in the 2010 UWMP, the City's 2020 target was 191 GPCD with an interim 2015 target of 214 GPCD. In the 2015 UWMP GPCD analysis, with the updated historical population analysis incorporating the 2010 Census data, the City has selected to continue with Method 1, which now provides a 2020 target of 193 GPCD with an interim 2015 target of 217 GPCD.

5.2 Updating Calculations from 2010 UWMP

"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 CWC §§10610).

Daily per capita water use, or GPCD water use as defined in this UWMP, is the amount of water used per person per day. This value is total water use within a service area including commercial, industrial, and irrigation uses, minus allowable exclusions, divided by population and measured in gallons. This value is different from the R-GPCD used in drought reporting to the State Water Resources Control Board. R-GPCD is

residential water use in a service area divided by population. The residential water use includes single-family and multi-family residential water uses.

The City's 2010 UWMP provided calculations and a resulting 2015 and 2020 GPCD targets based on the DWR methodology (DWR, 2011b). Since the 2010 UWMP, DWR has developed additional forms and tools the City must use for this updated SBX7-7 analysis. DWR developed SBX7-7 verification forms tables for City to complete to determine the updated SBX7-7 baseline and target GPCD. Appendix F provides the City's completed verification forms.

5.3 Baseline Periods

"An urban retail water supplier shall include in its urban water management plan due in 2010 [...] the baseline daily per capita water use [...] along with the basis for determining those estimates, including references to supporting data.

[...] 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)" (CWC §§ 10608.20(e)–10608.20(g)).

In the 2015 UWMP, the City may change the years selected for its baseline period as compared to its 2010 UWMP based on changes to the City's calculated population. Water use GPCD must be calculated and reported for two baseline periods, a 10-year or 15-year baseline (baseline GPCD) and a 5-year baseline (target confirmation).

5.3.1 Ten- to 15-Year Baseline Period (Baseline GPCD)

" "Base daily per capita water use" means any of the following:

(1) The urban retail water suppliers estimate of its average grows water use, reported in GPCD 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 retail water 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" (CWC §§ 10608.12(b)).

The City must define a 10- to 15-year baseline period ending between December 31, 2004 and December 31, 2010 for water use and calculate the average water use, in GPCD, over that time period. Whether an agency uses a 10-year baseline period or 15-year baseline period is dependent upon the amount of recycled water use in 2008. Since the City's 2008 recycled water deliveries were less than 10 percent (0.55 percent) of the total water deliveries, the City must use a 10-year baseline period. The City's 10-year baseline period is now 2001-2010, as shown in SBX7-7 Table 1, located in Appendix F. This period is the 10-year period with the highest average GPCD. This 10-year baseline period is the same as the 2010 UWMP analysis, that also used a baseline period from 2001 to 2010.

5.3.2 Five-Year Baseline Period (Target Confirmation)

"For the purposes of Section 10608.22, the urban retail water supplier's estimate of its average gross water use, reported in GPCD and calculated over a continuous five-year period ending no earlier than December 31, 2007, and no later than December 31, 2010" (CWC §§ 10608.12(b)(3)).

The City also must calculate water use, in GPCD, for a 5-year baseline period. This output is used to confirm that the selected 2020 target meets the minimum water use reduction requirements. This period is a continuous 5-year period that ends no earlier than December 31, 2007 and no later than December 31,

2010. This result is used as a check against the City's selected GPCD target method. If the City's selected GPCD target method results in a GPCD target that is greater than 95 percent of the 5-year base daily per capita range, then the City's target shall be 95 percent of its 5-year base daily per capita range. The City's 5-year baseline period is 2005-2009 as shown in SBX7-7 Table 1, located in Appendix F. This 5-year period had the highest average GPCD. This period is the same 5-year baseline period used in the 2010 UWMP.

5.4 Service Area Population

"An urban retail water supplier shall include in its urban water management plan due in 2010 [...] the baseline per capita water use, [...] along with the bases for determining those estimates, including references to supporting data.

[...] 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" (CWC §§ 10608.20(e)–10608(f)).

To calculate the annual GPCD, the City must determine the population that it served for each baseline year in both the baseline periods and for the 2015 compliance year. The City conducted this baseline population analysis as part of the 2010 UWMP based on the year 2000 census. Year 2010 census data were not available until after the 2010 UWMP submittal deadline. For the 2015 UWMP, the City updated its baseline population using the 2010 Census data. The historical population served by the City is modified as shown in Table SBX7-7 Table 3, located in Appendix F.

5.5 Gross Water Use

" "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.

California Code of Regulations Title 23 Division 2 Chapter 5.1 Article Section 596 (a) An urban retail water supplier that has a substantial percentage of industrial water use in its service area is eligible to exclude the process water use of existing industrial water customers from the calculation of its gross water use to avoid a disproportionate burden on another customer sector" (CWC §§ 10608.12(g)).

Gross water use is the measure of water that enters the City's distribution system over a 12-month period with certain allowable exclusions. The allowable exclusions are recycled water delivered within the service area, indirect recycled water, water placed into long-term storage, water conveyed to another urban supplier, water delivered for agricultural use, and process water. Recycled water deliveries were excluded. The City's gross water use is shown in Table SBX7-7 Table 4 located in Appendix F.

5.6 Per Capita Water Use

This section describes the City's baseline and target per capita water use.

5.6.1 Baseline Daily Per Capita Water Use

The daily per capita water use for each year from 2001 through 2010 is calculated by dividing the gross water use for each year by the service area population for each year, respectively. The City's historical gross water and population are used to calculate the baseline daily per capita use in GPCD in Table SBX7-7 Table 5, located in Appendix F. A summary of the resulting 5-year and 10-year baselines is shown in Table SBX7-7 Table 6, located in Appendix F.

5.6.2 2015 and 2020 GPCD Targets

"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)).

[...] An urban retail water supplier may update its 2020 urban water use target in its 2015 urban water management plan [...]" (CWC §§ 10608.20(e)–10608.20(g)).

As described above, the City has selected Method 1. Table 5-1 presents a summary of the City's baseline and targets. The City's interim urban water use target is the value halfway between the 10-year baseline GPCD (from Table SBX7-7 Table 5, located in Appendix F) and the confirmed 2020 GPCD target (from Table SBX7-7 Table 7, located in Appendix F).

Table 5-1. (DWR Table 5-1) Baselines and Targets Summary
Retail Agency or Regional Alliance Only

Baseline period	Start years	End years	Average GPCD	2015 interim target	Confirmed 2020 target
10-15 year	2001	2010	241	217	193
5 Year	2005	2009	243		

Notes:
Units: All values are in gallons per capita day (GPCD)

5.6.3 City Adjustments to 2015 Gross Water Use

In 2015 (and 2020) there are several allowable adjustments that the City can make to the City's gross water use for extraordinary events, economic adjustments, or weather normalization. The City did not adjust its 2015 gross water use, as shown in Table 5-2. Table 5-2 also shows that the City achieved the targeted reduction for 2015. It is expected that the City's actual GPCD will increase some from the 2015 actual values in the future assuming drought conditions do not continue. The City is on track to meet its 2020 target.

Table 5-2. (DWR Table 5-2) 2015 Compliance Retail Agency or Regional Alliance Only

2015 actual GPCD	2015 Interim target GPCD	Optional adjustments to 2015 GPCD Enter "0" for adjustments not used *From Methodology 8*					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		
141	217	0	0	0	0	141	141	Yes

Notes:
Units: All values are in GPCD

Section 6

Water Supplies

This section describes the sources of water available to the City for distribution and services. It includes a description of each water source, source limitations, water quality, and other water opportunities, including recycled water. The City's current supply consists of both surface water from the Delta and groundwater from existing wells located in the San Joaquin Groundwater Basin.

6.1 Purchased Water

The City has purchased a permanent capacity share of 6 mgd at the Randall-Bold Water Treatment Plant (RBWTP) and may use additional capacity on an as-need basis (CCLAFCO, 2007, p. 3-9). The City uses the entire 6 mgd (2,190 MGY), but does not project to use additional capacity in future years. CCWD has operated the RBWTP since 1992. The RBWTP has a design capacity to treat up to 40 mgd. The RBWTP is jointly owned by DWD and CCWD. The City receives water from the CCWD portion of the facility. Raw water is pumped to the RBWTP from the Rock Slough intake via the Contra Costa Canal, which is operated by CCWD, for treatment prior to distribution as a public water supply. Water can also be stored in the off-stream Los Vaqueros Reservoir from the Old River and Middle River intakes. During periods of low salinity in the Delta, raw water is pumped into the Los Vaqueros Reservoir and stored for future use. This stored water is supplied to the Contra Costa Canal and blended with raw water from the Rock Slough intake as needed.

6.2 Groundwater

"(Is) groundwater [...] identified as an existing or planed source of water available to the supplier" (CWC §§ 10631(b)).

The City pumps groundwater from an alluvial basin underlying the City. The City has nine permitted groundwater wells within its service area, seven of which are active wells. The total design capacity of the wells is 6.63 mgd. The firm design capacity of the wells, where firm capacity is the capacity of all the wells minus the capacity of the largest well, is 5.19 mgd. Table 6-1 presents the City's permitted wells and their design capacities.

The City treats groundwater with chloramines at the wellheads prior to delivery to the drinking water distribution system. The City has two main well fields. Wells 6, 7, 8, 14, and 15, are located in the northeast part of the City, and Wells 12 and 13 are in the south part of the City. Of the two wells that are not in use, Well 9 does not have a disinfection system, and Well 11 is not used because of high nitrate concentrations at this location. This section provides a description of the groundwater basin, water quality, and the groundwater management framework.

Table 6-1. Permitted Wells for the City of Brentwood

Well number	Start-up year	Current actual capacity (mgd)	Well design capacity (mgd)
6	1987	1.13	1.15
7	1987	1.03	1.01
8	1994	1.30	1.44
9	2000	NA	NA

Table 6-1. Permitted Wells for the City of Brentwood			
Well number	Start-up year	Current actual capacity (mgd)	Well design capacity (mgd)
11	1995	NA	NA
12	1997	0.33	0.58
13	1997	0.36	0.36
14	2001	1.60	1.44
15	2006	0.59	0.65
	Total	6.34	6.63

Notes:
Source: Current actual capacities were provided by City staff, the well design capacities were taken from the 2010 UWMP (City of Brentwood, 2011).
NA: not active

6.2.1 Basin Description

The City's wells are located within the northwest part of the Tracy Subbasin of the San Joaquin Valley Groundwater Basin. The Tracy Subbasin (5-22.15) is not adjudicated and there are no legal restrictions to groundwater pumping. The Tracy Subbasin has a total surface area of 539 square miles and is bounded by the Diablo Range of the Coast Range foothills to the west, the San Joaquin and Mokelumne Rivers on the north, the San Joaquin-Stanislaus county line to the south. Figure 6-1 shows a map of the San Joaquin Valley Groundwater Basin boundary with county lines. The Tracy Subbasin is comprised of continental deposits of Late Tertiary to Quaternary age; Figure 6-2 shows the subbasin boundaries. Deposits include the Tulare Formation, Older Alluvium, Flood Basin Deposits, and Younger Alluvium (DWR, 2006). The cumulative thickness of these deposits increases from a few hundred feet near the Coast Range foothills on the west to about 3,000 feet along the eastern margin of the basin (City of Brentwood, 2013a).

The City's wells range in depth from 200 to 660 feet, and draw from the Tulare Formation. The Tulare is exposed in the Coast Range foothills along the western margin of the basin and dips eastward toward the valley's axis. It consists of semi-consolidated, poorly sorted, discontinuous deposits of clay, silt, and gravel. Corcoran clay occurs near the top of the Tulare Formation and confines the underlying fresh water deposits. The eastern limit of the Corcoran clay is near the eastern boundary of the basin. The Tulare formation is moderately permeable, with most of the larger agricultural, municipal and industrial extractions coming from below the Corcoran clay layer. Wells completed in this zone produce up to 3,000 gallons per minute. Small domestic wells often obtain their supply from above the Corcoran clay. However, groundwater above the Corcoran clay is often of poor quality. The total thickness of the Tulare Formation is about 1,400 feet (DWR, 2006).

The older alluvium deposit consists of loosely to moderately compacted sand, silt, and gravel deposited in alluvial fans during the Pliocene and Pleistocene. The older alluvium is widely exposed between the Coast Range foothills and the Delta. The thickness of the older alluvium is about 150 feet. It is moderately to locally highly permeable (DWR, 2006).

Flood basin deposits occur in the Delta portion of the subbasin, in the northern two-thirds of the basin. They are the distal equivalents of the Tulare Formation and older and younger alluvial units and consist primarily of silts and clays. Occasional inter-beds of gravel occur along the present waterways. Due to their fine-grained nature, the flood basin deposits have low permeability and generally yield low quantities of water to wells. Occasional zones of fresh water are found in the basin deposits, but they generally contain poor quality groundwater. The maximum thickness of the unit is about 1,400 feet (DWR, 2006).

Figure 6-1. Alluvial groundwater basins and subbasins within the San Joaquin River Hydrologic Region

Source: DWR, 2013b

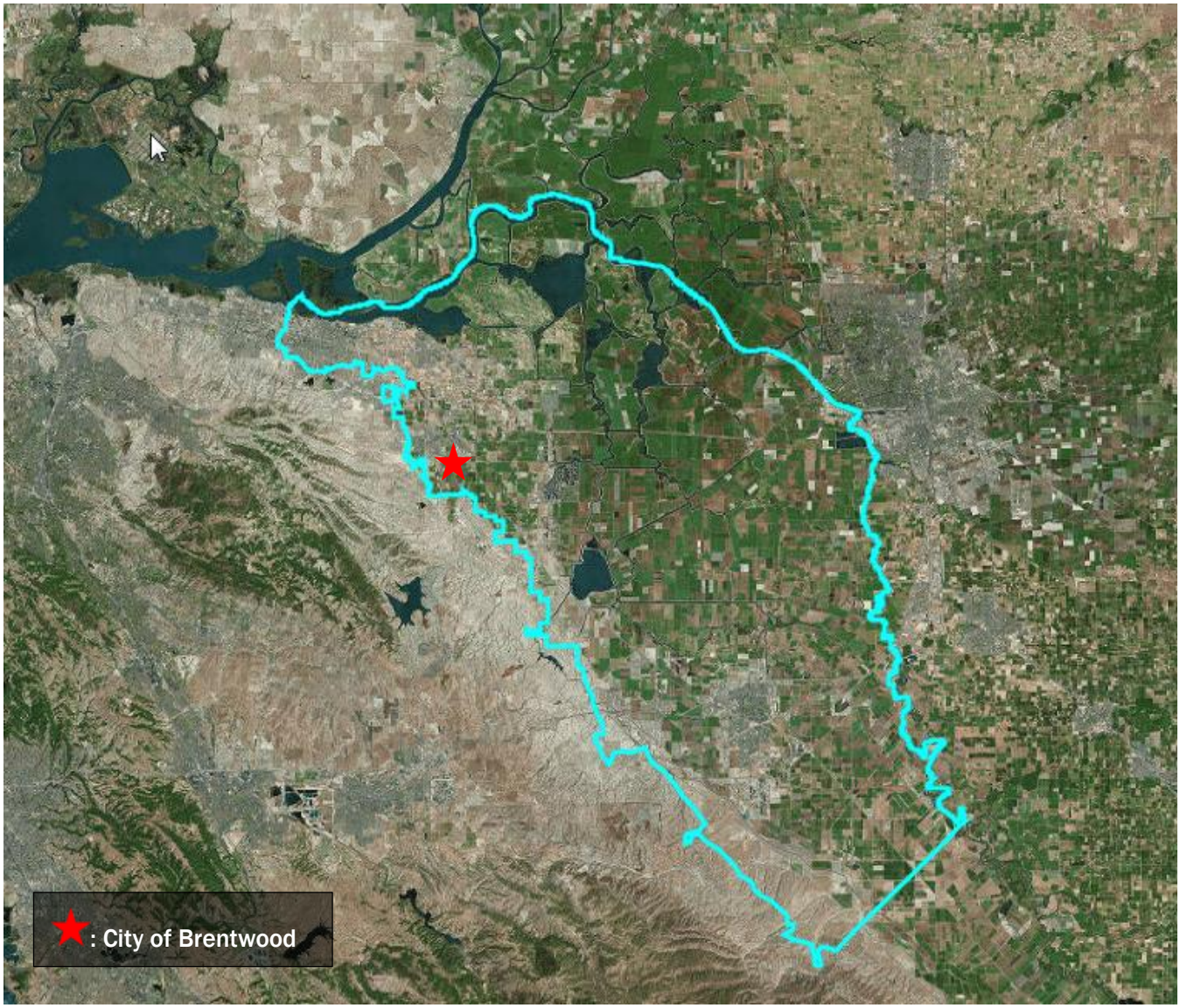


Figure 6-2. Tracy subbasin (5-22.15) boundary

Source: DWR, 2016a

The younger alluvium deposits include those deposits that are accumulating or would be accumulating under natural conditions. It includes sediments deposited in the channels of active streams as well as overbank deposits and terraces of those streams. They are present along the channel of Corral Hollow Creek and have a consistency very similar to the older alluvium layer. Sand and gravel zones in the younger alluvium are highly permeable and, where saturated, yield significant quantities of water to wells. The thickness of the younger alluvium in the Tracy Subbasin is less than 100 feet (DWR, 2006).

6.2.2 Groundwater Management

The City does not currently have a groundwater management plan but has several ongoing investigations on both groundwater supply and quality within the City's service area. This section describes the City's activities pertaining to the California Statewide Groundwater Elevation Monitoring (CASGEM) and the Sustainable Groundwater Management Act (SGMA).

6.2.2.1 Sustainable Groundwater Management Act

In 2014 the legislature enacted SGMA and adopted amendments in 2015. SGMA requires groundwater management in priority groundwater basins, which includes the formation of Groundwater Sustainability Agencies (GSAs) and the development of Groundwater Sustainability Plans (GSPs) for groundwater basins or subbasins that DWR designates as medium or high priority.

The designation of priority of groundwater basins was done as part of the CASGEM Program. The CASGEM Groundwater Basin Prioritization is a statewide ranking of groundwater basin importance that incorporates groundwater reliance and focuses on basins producing greater than 90 percent of California's annual groundwater. The CASGEM Program has ranked the Tracy Subbasin (5-22.15) as medium priority (DWR, 2014a).

SGMA directs DWR to identify groundwater basins and subbasins in conditions of critical overdraft. The DWR identified such basins in Bulletin-118, 1980 and Bulletin 118, Update 2003 (DWR, 2003). DWR issued an updated final list of critically overdrafted basins in January 2016 (DWR, 2016c). The Tracy Subbasin is not on that list.

A GSA must be established formally by June 30, 2017. The GSA will have enforcement authority over its designated portion of the basin. The State defines three options for preparing GSPs and forming GSAs:

- A single GSP covering the entire basin developed and implemented by one GSA.
- A single GSP covering the entire basin developed and implemented by multiple GSAs.
- Multiple GSPs implemented by multiple GSAs and coordinated pursuant to a single coordination agreement that covers the entire basin.

Currently the City is working to form a GSA with several East Contra Costa agencies that will have a single GSP. As part of these efforts, the City recently submitted a request to DWR for a basin boundary modification on the Tracy Subbasin. The proposed modification would create a separate subbasin that comprises the portion of the Tracy Subbasin that lies within Contra Costa County. The proposed GSP would apply to this separate subbasin. Figure 6-3 presents the proposed subbasin in relation to the existing Tracy subbasin boundaries. The current subbasin substantially consists of areas of San Joaquin County and east Contra Costa County, with a small portion of Alameda County. The Contra Costa County Line along Old River is proposed as the new eastern boundary of the new subbasin. The Contra Costa-Alameda County Line would be the new southern boundary. The new subbasin would be bounded by the Coast Ranges to the west (unchanged), Old River to the east (new), San Joaquin River to the north (unchanged), and Alameda County Line to the south (new). The proposed boundary modifications are consistent in nature with existing Bulletin 118 boundaries: Old River replaces the San Joaquin River (river) and Alameda County Line replaces the Stanislaus County line (political) to form the new subbasin within Contra Costa County.

Eastern Contra Costa County has diverse sources of water supplies including surface water and groundwater, which are used for agricultural and municipal/domestic purposes. The proposed subdivision would affect no existing or historic water supply coordination with other local agencies in the subbasin. There are no published studies or agency reports that indicate a hydrogeological connection between the east Contra Costa County portion of the subbasin and the San Joaquin/Alameda County portions. Recently published east Contra Costa Agency reports indicate no undesirable results affecting sustainable groundwater use in the area. These studies included a Groundwater Management Plan prepared for the Diablo Water District (DWD) (Diablo Water District, 2007), a Water Master Plan for the Town of Discovery Bay (Town of Discovery Bay, 2012), a groundwater monitoring report for the DWD (Diablo Water District, 2011), and an Integrated Regional Water Management Plan (ECCC, 2015).

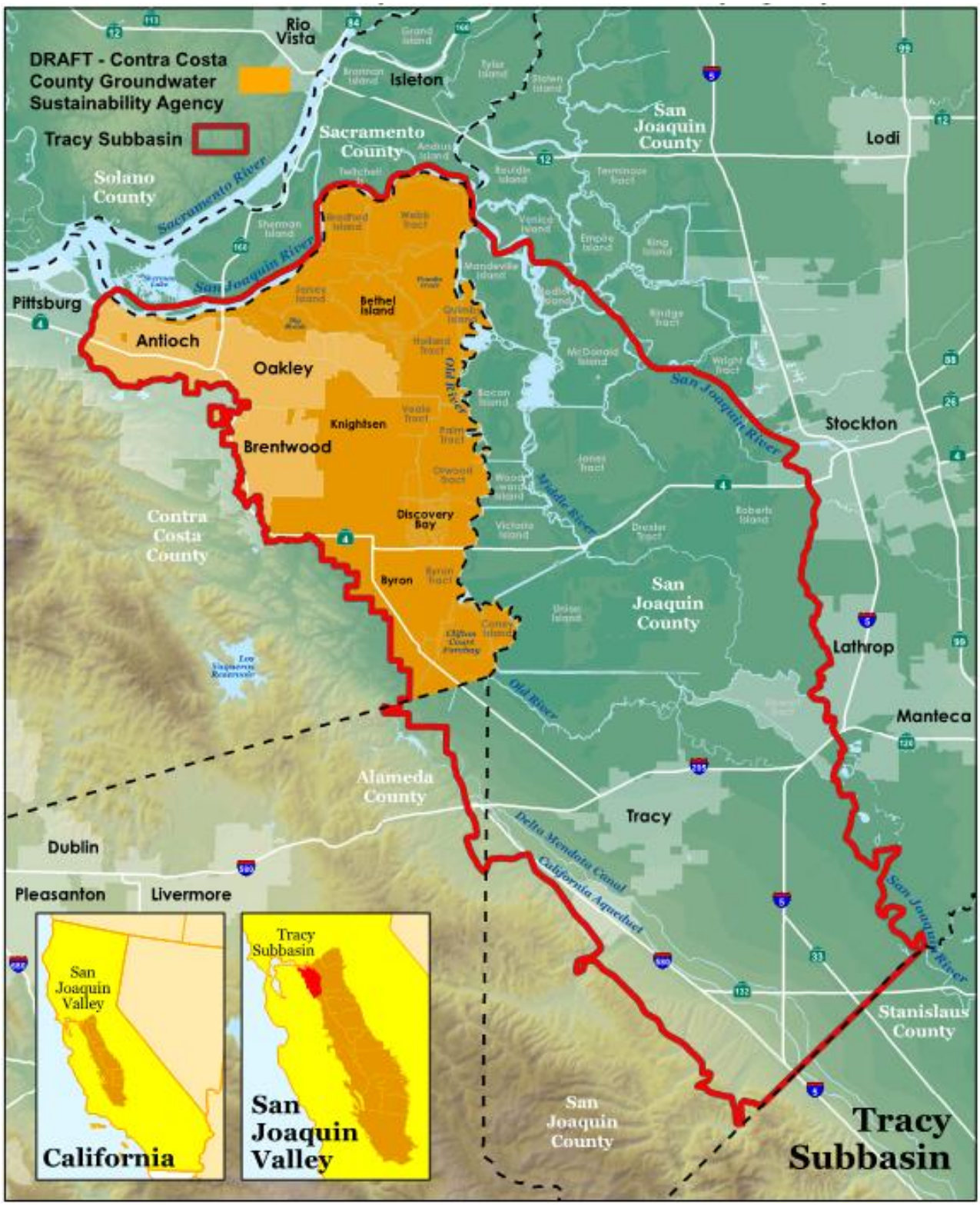


Figure 6-3. Proposed modifications to Tracy subbasin (5-22.15) boundary

Source: CCCDCD, 2015

6.2.3 Overdraft Conditions

A DWR review of hydrographs for the Tracy Subbasin indicate that the majority of the water levels in wells remained relatively stable over at least the 10-year period prior to 2006 (City of Brentwood, 2013a). Seasonal variation resulting from recharge and pumping was evident, but levels were stable overall. In general, conditions since the late 1950's compared to present indicate that the groundwater system has no apparent overdraft, suggesting that historical extraction patterns have not exceeded the safe yield of the basin. A groundwater budget, estimating the subbasin inflows and outflows, has not been prepared for the subbasin.

No published groundwater storage values for the entire basin exist. The estimated groundwater storage capacity for the Tracy-Patterson Storage Unit is 4,040,000 AF (Hotchkiss and Balding, 1971). This storage unit includes the southern portion of the currently defined Tracy Subbasin from approximately one-mile north of Tracy to the San Joaquin-Stanislaus County line. Since the Tracy Subbasin comprises roughly one third of the Tracy-Patterson Storage Unit, it can be inferred that the approximate storage capacity of the southern portion of the Tray Subbasin is on the order of 1,300,000 AF (DWR, 2006).

No published data document the amount of groundwater in storage for the Tracy Subbasin (DWR, 2006).

6.2.4 Historical Groundwater Pumping

The amount of groundwater pumped in 2011-2015 is shown in Table 6-2. The City wells are located within the northwest part of the Tracy Subbasin of the San Joaquin Valley Groundwater Basin.

Table 6-2. (DWR Table 6-1) Retail: Groundwater Volume Pumped

Groundwater type	Location or basin name	2011	2012	2013	2014	2015
Alluvial basin	San Joaquin Valley Basin (Tracy Subbasin)	883	1,002	1,668	1,467	828
	Total	883	1,002	1,668	1,467	828

Notes:
Source: DWR, 2011a, DWR, 2012; DWR, 2013a; DWR, 2014b; DWR, 2015
Units: MGY

6.3 Surface Water

In 1999, the City entered into an agreement with ECCID that provides the City with a permanent entitlement to purchase 14,800 AF/yr (4,823 MGY) of surplus irrigation water from the Delta. ECCID has pre-1914 water rights, which are not subject to delivery reductions during water shortages, including regulatory restricted and drought years. The water purchased by the City may only be used by the City and its retail customers within the City limits or within the ECCID service area (CCLAFCO, 2007). Surface water supplies for the City originate from Rock Slough. The supply is transported through the Contra Costa Canal for treatment at the City of Brentwood Water Treatment Plant (COBWTP).

The COBWTP was built in 2008 to serve the City. The City and CCWD constructed the COBWTP as a joint venture. The completed first phase of the COBWTP, which has been constructed and is in operation, can treat up to 16.5 mgd (6,023 MGY) of surface water. However, the COBWTP is designed so that it can be expanded to an ultimate capacity of 33 mgd (12,045 MGY) to serve a portion of the City's projected water demands through 2040. COBWTP processes include flocculation, sedimentation, ozonation, filtration, and disinfection.

The City also obtains raw surface water for non-potable landscape irrigation from the ECCID Canal. Water is pumped to the non-potable irrigation system via the Roddy Ranch Pump Station, located on the canal. Current users include golf courses, parks, schools, and commercial landscape areas. The City purchased 268 million gallons (0.73 mgd average daily use) in 2015 (DWR, 2015). The City projects a purchase of about 500 million gallons per year by 2035 (City of Brentwood, 2011).

6.4 Stormwater

The City neither captures nor reuses stormwater now and has no plans to capture and reuse stormwater.

6.5 Wastewater and Recycled Water

"The plan shall provide, to the extent available, information on recycled water and its potential for use as a water source in the service area of the urban water supplier. The preparation of this plan shall be coordinated with local water, wastewater, groundwater, and planning agencies that operate within the supplier's service area" (CWC §§ 10633).

Municipal recycled water is municipal wastewater that has been treated to a specified quantity to enable it to be used again for a beneficial purposes. For the purpose of this UWMP, recycled water means only municipal recycled water, that is, water that has been treated and discharged from a municipal wastewater facility. This section describes the wastewater collection, treatment, and disposal and recycled water coordination within the City's water service area.

6.5.1 Recycled Water Coordination

The City's WWTP receives, treats, and discharges municipal wastewater that is generated, collected, and treated within the City's service area. The WWTP produces tertiary filtered and disinfected water suitable for non-potable reuse.

6.5.2 Wastewater Collection, Treatment, and Disposal

> [Describe] the wastewater collection and treatment systems in the supplier's service area, including a quantification of the amount of wastewater collected and treated and the methods of wastewater disposal. (CWC §§ 10633(a)).

This section describes how wastewater in the City's water service area is collected, treated, as well as discharged.

6.5.2.1 Wastewater Collected within Service Area

Wastewater is collected by gravity in a series of mains, trunks, and interceptors that transport wastewater from its source to the WWTP. Table 6-3 summarizes key information about wastewater generated in the City sewer service area.

Table 6-3. (DWR Table 6-2) Retail: Wastewater Collected Within Service Area in 2015						
N/A	There is no wastewater collection system. The supplier will not complete the table below.					
100%	Percentage of 2015 service area covered by wastewater collection system (optional)					
100%	Percentage of 2015 service area population covered by wastewater collection system (optional)					
Wastewater collection			Recipient of collected wastewater			
Name of wastewater collection agency	Wastewater volume *Metered or estimated?*	Volume of wastewater collected in 2015	Name of wastewater treatment agency receiving collected wastewater	Treatment plant name	Is WWTP located within UWMP area? *Drop down list*	Is WWTP operation contracted to a third party? (optional) *Drop down list*
City of Brentwood	Metered	1,189	City of Brentwood Wastewater Treatment Plant	City of Brentwood Wastewater Treatment Plant	Yes	No
Total Wastewater Collected from Service Area in 2015:		1,189				

Notes:
Units: MGY

6.5.2.2 Wastewater Treatment and Discharge within Service Area

The City's WWTP is a tertiary treatment plant that provides recycled water for a variety of landscape and industrial uses. The WWTP has an average dry weather flow capacity of 5 mgd and was designed to be expendable to an average dry weather flow capacity of 10 mgd. The treatment system consists of a headworks (screening and grit removal), oxidation ditches and denitrification basins providing biological treatment, secondary clarification, tertiary filtration, chlorine disinfection, dechlorination, and a cascade aeration system (RWQCB, 2013). Wastewater from the City that is not reused is treated and discharged to Marsh Creek, which drains to Big Break in the Delta. Periodically, on-site percolation ponds may be used for land disposal of a limited amount of secondary treated effluent. Table 6-4 presents the City's WWTP wastewater treated volumes and the amount of water recycled for non-potable reuse.

Table 6-4. (DWR Table 6-3) Retail: Wastewater Treatment and Discharge within Service Area in 2015

N/A	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			
							Wastewater treated	Discharged treated wastewater	Recycled within service area	Recycled outside of service area
City of Brentwood Wastewater Treatment Plant	Marsh Creek	Creek, within the Sacramento San Joaquin Delta	Order R5-2013-0106-01	River or creek outfall	No	Tertiary	1,189	967	130	0
						Total	1,189	967	130	0

Notes:
Units: MGY

6.5.3 Recycled Water System

"[Describe] the recycled water currently being used in the supplier's service area, including, but not limited to, the type, place, and quantity of use" (CWC §§ 10633).

Recycled water is an important part of the City's water resources. Recycled water allows the City to conserve potable water, thereby ensuring a reliable water supply for current and future demand. Figure 6-4 presents the City's recycled water distribution system.

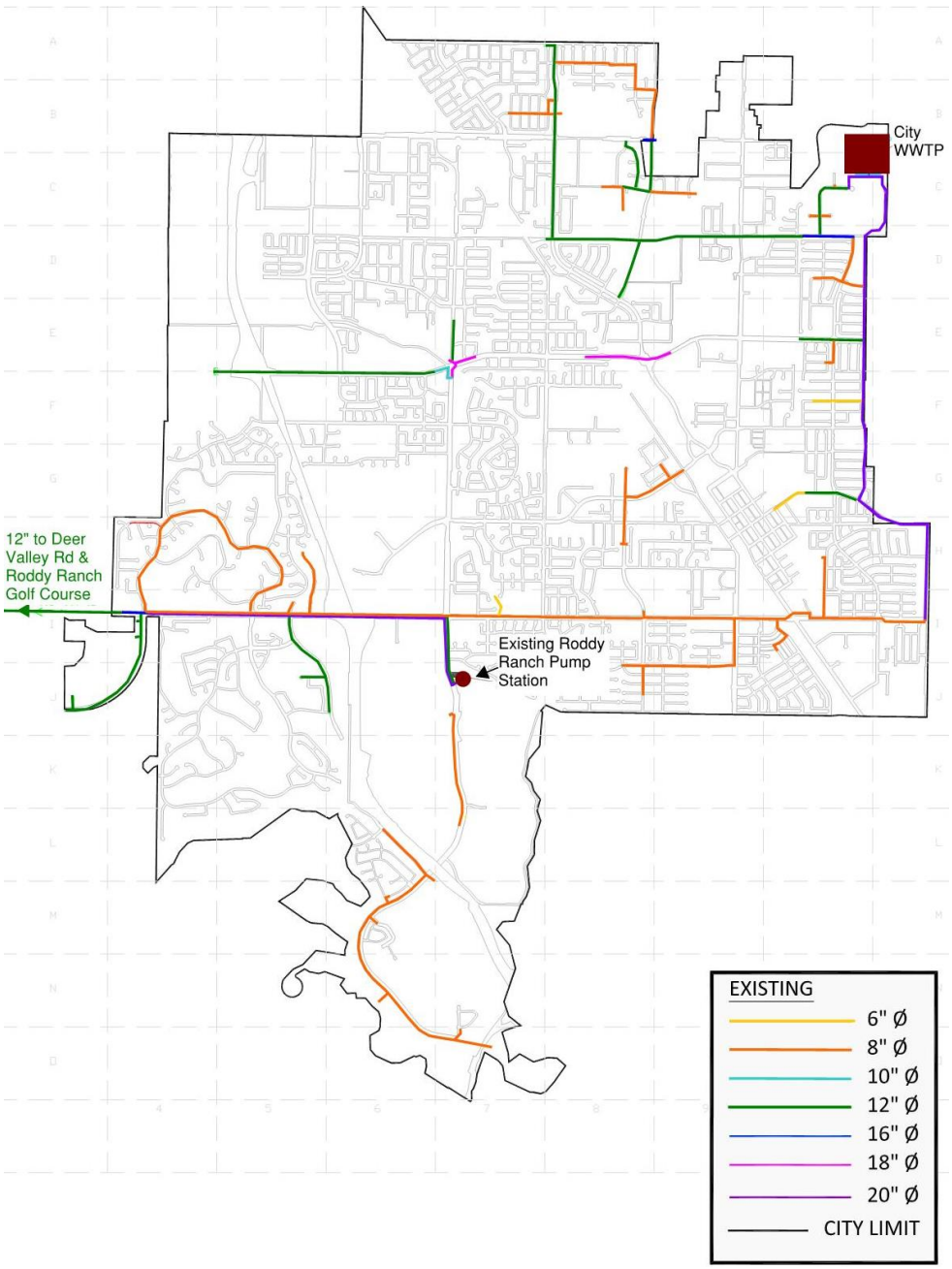


Figure 6-4. City of Brentwood recycled water distribution system

Source: City of Brentwood, 2013b

The City's WWTP's tertiary treatment and disinfection provides recycled water for landscaping as well as processes at the Antioch Building Materials concrete batch plant. The City is a producer and distributer of Title 22 tertiary recycled water for unrestricted reuse (i.e., unrestricted non-potable reuse) during the seasonally dry summer months. The City's recycled water is distributed through its non-potable water supply system. This system includes both recycled water and raw water supplied by ECCID. The system delivers water for irrigation and includes a network of transmission and distribution pipelines and pump stations. The production and distribution of recycled water is covered in the City's Master Reclamation Permit (Order No. R5-2004-0132). City data indicates that the City's WWTP supplied 130 million gallons of recycled water for landscape irrigation in 2015 (DWR, 2015).

6.5.4 Recycled Water Beneficial Uses

"[…] [Describe and quantify] the potential uses of recycled water, including, but not limited to, agricultural irrigation, landscape irrigation, wildlife habitat enhancement, wetlands, industrial reuse, groundwater recharge, indirect potable reuse (IPR), and other appropriate uses, and a determination with regard to the technical and economic feasibility of serving those uses.

[…] [Describe] the projected use of recycled water within the supplier's service area at the end of 5, 10, 15, and 20 years" (CWC §§ 10633 (c) and (d)).

This section presents the projected potential use and planned versus actual use of recycled water in 2015.

6.5.4.1 Projected Future Use of Recycled Water

Unrestricted non-potable recycled water is defined as wastewater that has been treated to tertiary standards (via filtration and disinfection) that meet Title 22 of the California Code of Regulations (CDPH, 2014). Recycled water treated to this level can be used for all outdoor irrigation demands in a community, including parks, schools, street medians, residential front and backyard landscaping, public open space, as well as industrial uses such as cooling water. Additionally, recycled water is commonly used for environmental purposes such as wetland and habitat restoration.

The City has developed preliminary planning documents to identify uses for recycled wastewater at both existing and future sites. The recycled wastewater will be used for the irrigation of parks and landscape amenities. The City already has constructed a portion of the recycled water distribution system and will continue to expand the system as the City grows. The City has identified several parks that have the potential to be served with recycled water. Recycled water demands are estimated to be 2,111 AF (688 MGY) at buildout (City of Brentwood, 2013b). However, expansion of the recycled water system to meet the demand for some of these customers will likely come at a high cost per acre foot of demand added (City of Brentwood, 2013b). A buildout demand totaling 1,560 AF (508 MGY is deemed more feasible (City of Brentwood, 2013b).

Table 6-5 provides a summary of current and projected recycled water use within the service area.

Table 6-5. (DWR Table 6-4) Projected Future Use of Recycled Water									
N/A	Recycled water is not used and is nog 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 Brentwood						
Name of agency operating the recycled water distribution system:			City of Brentwood						
Supplemental water added in 2015			N/A						
Source of 2015 supplemental water			N/A						
Beneficial use type		General description of 2015 uses	Level of treatment	2015	2020	2025	2030	2035	2040
Agricultural irrigation				0	0	0	0	0	0
Landscape irrigation (excludes golf courses)		Currently being used, has the potential for increased use	Tertiary	130	206	282	357	433	508
Golf course irrigation				0	0	0	0	0	0
Commercial use				0	0	0	0	0	0
Industrial use				0	0	0	0	0	0
Geothermal and other energy production				0	0	0	0	0	0
Seawater intrusion barrier				0	0	0	0	0	0
Recreational impoundment				0	0	0	0	0	0
Wetlands or wildlife habitat				0	0	0	0	0	0
Groundwater recharge (IPR)				0	0	0	0	0	0
Surface water augmentation (IPR)				0	0	0	0	0	0
Direct potable reuse				0	0	0	0	0	0
Other[a]	Type of use	Metered hydrants	Tertiary	0	0	0	0	0	0
			Total	130	206	282	357	433	508

Notes:
Source: City of Brentwood, 2013b; DWR, 2015.
IPR – Indirect Potable Reuse
Units: MGY
a. A very small portion of the total recycled water use goes into the "Other" beneficial use type, total amount could not be quantified.

6.5.4.2 Planned Versus Actual Use of Recycled Water

"[…] [Provide] a description of the actual use of recycled water in comparison to uses previously projected pursuant to this subdivision" (CWC §§ 10633 (e)).

Table 6-6 provides a comparison of the recycled water use projected to occur in 2015 in the 2010 UWMP with the actual 2015 recycled water use. Actual recycled water use in 2015 was much higher than what was projected in the 2010 UWMP. The existing drought led to increased efforts to conserve potable water and made recycled water a more attractive and necessary option for customers in the landscape irrigation sector.

Table 6-6. (DWR Table 6-5) Retail: 2010 UWMP Recycled Water Use Projection Compared to 2015 Actual			
Use type		2010 Projection for 2015	2015 Actual use
Agricultural irrigation		0	0
Landscape irrigation (excluded golf courses)		17	130
Golf course irrigation		0	0
Commercial use		0	0
Industrial use		1	0
Geothermal and other energy production		0	0
Seawater intrusion barrier		0	0
Recreational impoundment		0	0
Wetlands or wildlife habitat		0	0
Groundwater recharge (IPR)		0	0
Direct potable reuse		0	0
Other	Required for this use	0	0
	Total	18	130

Notes:
Source: City of Brentwood, 2011; DWR 2015.
Units: MGY

6.5.5 Actions to Encourage and Optimize Future Recycled Water Use

"[Describe the] actions, including financial incentives, which may be taken to encourage the use of recycled water, and the projected results of these actions in terms of acre-feet of recycled water use per year.

[…] [Provide a] plan for optimizing the use of recycled water in the supplier's service area, including actions to facilitate the installation of dual distribution systems to promote recirculating uses, to facilitate the increased use of treated wastewater that meets recycled water standards, and to overcome any obstacles to achieving that increased use" (CWC §§ 10633 (f) and (g)).

The City encourages recycled water use by providing financial incentives. The City currently offers potable water at $2.49 to $6.52 per 1,000 gallons (effective June 1, 2016). This rate is almost three times that of recycled water, which is $1.31 per 1,000 gallons (effective June 1, 2016). The City plans on maintaining recycled water cost proportionally lower than of potable water in the future. The City hopes to increase recycled use among the number of large-volume customers in the future as they realize that operating costs can be reduced from the use of recycled water. Potential customers include roadway irrigation and parks.

The City currently has three projects aimed at increasing the use of recycled water. The first is a capital improvement project (CIP), the Non-Potable Water Distribution System project, which will expand the non-potable water distribution system that will improve access to recycle water supplies. The second project is a Recycled Water Fill Station the City has opened up at the WWTP. City customers may bring containers (up to 300 gallons) to fill with recycled water and take for appropriate use. The recycled water is free of charge but customers must complete a training program prior to gaining access to the resource.

The City also is considering expanding the use of recycled water during construction by encouraging local contractors to use recycled water for dust control and earth compaction when available. This change would require the adoption of a City ordinance and the addition of non-potable fire hydrants.

Table 6-7. (DWR Table 6-6) Retail: Methods to Expand Future Recycled Water Use			
N/A	Supplier does not plan to expand recycled water use in the future. Supplier will not complete the table below but will provide narrative explanation		
Name of action	**Description**	**Planned implementation year**	**Expected increase in recycled water use**
Financial Incentives	Recycled water at a decreased rate reduces potable and raw water use.	2016	N/A
Recycled Water Fill Station	The City has opened a recycled water fill station at the WWTP for customers in the City.	2016	N/A
Increased Recycled Water Access Opportunities	Expansion of the non-potable water distribution system.	2016	N/A
Regulatory Incentives	City ordinance to encourage recycled water use for dust control and earth compaction for construction projects.	2016	N/A

Notes:
All of these actions are ongoing, as such, the year 2016 was input for the planned implementation year.
N/A – Not available

6.6 Desalinated Water Opportunities

"Describe the opportunities for development of desalinated water, including, but not limited to, ocean water, brackish water, and groundwater, as a long-term supply" (CWC §§ 10631(h)).

The City has no sources of ocean water, brackish water, or groundwater that provide viable opportunities for development of desalinated water as a long term supply. The distance to the Pacific Ocean or the San Francisco Bay is a limiting factor.

6.7 Exchanges or Transfers

"Describe the opportunities for exchanges or transfers of water on a short-term or long-term basis" (CWC §§ 10631(d)).

The City does not participate in any transfer or exchange programs and does not have any such programs planned for the future.

6.8 Future Water Projects

"[…] The urban water supplier shall include a detailed description of expected future projects and programs […] that the urban water supplier may implement to increase the amount of the water supply available to the urban water supplier in average, single-dry, and multiple-dry water years. The description shall identify specific projects and include a description of the increase in water supply that is expected to be available from each project. The description shall include an estimate with regard to the implementation timeline for each project or program" (CWC §§ 10631(g)).

The City's primary future water supply projects are described in the City's 2015/16–2019/20 Capital Improvement Program (City of Brentwood, 2015a). The following projects also are listed in the Water Improvements and Wastewater Improvements sections of the City's capital improvement program. Table 6-8 summarizes the City's existing and future projects that will improve existing and future water supplies for the City. Potential water supply benefits during various water supply year types have not been estimated. Water improvements include items such as major transmission mains, new water sources, booster stations, water wells, reservoirs, and treatment facilities.

Table 6-8. (DWR Table 6-7) Retail: Expected Future Water Supply Projects or Programs	
N/A	No expected future water supply projects or programs that provide a quantifiable increase to the agency's water supply. Supplier will not complete the table below.
N/A	Some or all of the supplier's future water supply projects or programs are not compatible with this table and are described in narrative format. LOCATION OF THE NARRATIVE_____

Name of future projects or programs	Joint project with other agencies?	Description (*if needed*)	Planned implementation year	Planned for use in year type (*drop down menu*)	Expected increase in water supply to agency
COBWTP Maintenance and Capital Upgrades	No	This project will maintain, upgrade or replace existing plant facilities, or installation of new facilities, due to wear and tear or new treatment standards. Projects will consist of treatment plant restoration, filter media replacement and upgrade of the distributed control system.	2016	Average Year Single-Dry Year Multiple-Dry Year	--
Permanent Long-Term Water Conveyance	Yes, CCWD	This project will involve a partnership with CCWD to purchase a permanent share of water conveyance capacity and includes the initial buy-in to existing infrastructure and the City's proportional share of the local costs for future phases of the Canal Replacement Project (Segments 3-5).	2016	Average Year Single-Dry Year Multiple-Dry Year	--
RBWTP Maintenance and Capital Upgrades	Yes, CCWD	This project will maintain, upgrade or replace existing plant facilities, or install new facilities, due to wear and tear or new treatment standards.	2016	Average Year Single-Dry Year Multiple-Dry Year	--
Water Distribution System Blending Facility	No	This project encompasses the planning, design and construction of a Water Distribution System Blending Facility. The Water Distribution System Blending Facility will blend surface water from the City's water treatment plant with groundwater pumped from production wells, to generate up to 6 million gallons per day of more aesthetically-acceptable blended drinking water.	2017	Average Year Single-Dry Year Multiple-Dry Year	--
Water Distribution System Rehabilitation	No	Replacement of leaking or non-operable valves; installation and construction of tie-ins and loops; and installation and repair of fire hydrants, air reducing valves and sample stations as well as other distribution system components.	2016	Average Year Single-Dry Year Multiple-Dry Year	--
Zone I Equalization Storage Reservoirs	No	A buried equalization basin, totaling 5 million gallons of storage, is expected to be constructed. It will consist of a buried, reinforced concrete reservoir, piping, pumps and related equipment, electrical service and control system.	2016	Average Year Single-Dry Year Multiple-Dry Year	--
Neroly Road Non-Potable (Recycled) Water Conversion	No	Construct 3,500 feet of 10-inch diameter non-potable water line along Neroly Road, and 2,400 feet of 8-inch diameter non-potable water line along the Union Pacific Railroad, with the necessary appurtenant structures.	2017	Average Year Single-Dry Year Multiple-Dry Year	--
Non-Potable Storage Facility	No	Installation of a non-potable storage facility for raw and recycled water, including appurtenances such as pumps, valves, power supplies, access roads, pipes, and associated improvements.	2016	Average Year Single-Dry Year Multiple-Dry Year	--
Non-Potable Water Distribution System—Phase III	No	Installation of a trunk, recycled (non-potable) water distribution system throughout the City to provide recycled water for irrigation of parks, parkways, medians, and other applicable uses.	2016	Average Year Single-Dry Year Multiple-Dry Year	--

Table 6-8. (DWR Table 6-7) Retail: Expected Future Water Supply Projects or Programs					
Wastewater Treatment Plant Expansion—Phase II	No	The existing 5 MGD tertiary treatment facility was planned and constructed to accommodate future expansions, of up to 10 MGD, by adding oxidation ditches, secondary clarifiers, converting chlorine contact facilities to ultra violet disinfection, bar screens, belt filter presses, utility pumps, sand filters and all related appurtenances. Phase II is an incremental expansion of 2.5 MGD based on current rate of growth. Phase III expansion, when necessary, will service the final buildout population of the City.	2016	Average Year Single-Dry Year Multiple-Dry Year	--

Notes:
Source: City of Brentwood, 2015a.
Where projects and programs are ongoing, the year 2016 was input. For projects and programs expected to be implemented during the 2017-2018 fiscal year, 2017 was input.

6.9 Summary of Existing and Planned Sources of Water

"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 10631(a).

[…] [Provide 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" (CWC §§ 10631(b) and (b)(4)).

Table 6-9 provides a summary of actual supply sources and quantities in 2015. Table 6-10 presents the water supplies projected from 2020 through 2040.

Table 6-9. (DWR Table 6-8) Water Supplies – Actual				
Water supply	Additional detail on water supply	2015		
		Actual volume	Water quality	Total right or safe yield
Groundwater	Tracy Subbasin 5-22.15	828	Drinking Water	1,825[a]
Surface water	COBWTP Supply (ECCID)	1,105	Drinking Water	2,370[b]
Purchased or Imported Water	RBWTP Supply (ECCID)	705	Drinking Water	2,190[c]
Surface Water	ECCID Non-Potable Supply	268	Raw Water	263[b]
Recycled Water	City WWTP Supply	130	Recycled Water	1,697[d]
Desalinated water		0		
Stormwater use		0		
Transfers		0		
Exchanges		0		
Total		3,036		8,345

Notes:
Source: DWR, 2015.
Units: MGY
a. The firm design capacity of the City's wells is 5.19 mgd, this total assumes wells are pumping 5 mgd.
b. The total ECCID purchase entitlement is that of 4,823 MGY (14,800 AF/yr). A portion of this water is treated at RBWTP (6mgd) and the rest of the total was split between potable and non-potable supplies based on actual 2012 water use. Ninety percent of the total supply was allotted for potable use and 10 percent was allotted for non-potable use.
c. The total stems from the City's permanent treatment capacity share of 6 mgd. The 6 mgd that is treated at RBWTP comes from the total ECCID purchase entitlement of 4,823 MGY.
d. The total recycled water supply is assumed to be 93% of the total WWTP capacity.

Table 6-10. (DWR Table 6-9) Water Supplies – Projected

Water supply	Additional detail on water supply	2020		2025		2030		2035		2040	
		Reasonably available volume	Total right or safe yield	Reasonably available volume	Total right or safe yield	Reasonably available volume	Total right or safe yield	Reasonably available volume	Total right or safe yield	Reasonably available volume	Total right or safe yield
Groundwater	Tracy Subbasin 5-22.15[a]	1,825	1,825	1,825	1,825	1,825	1,825	1,825	1,825	1,825	1,825
Surface water	COBWTP Supply (ECCID)[b]	2,370	2,370	2,370	2,370	2,370	2,370	2,370	2,370	2,370	2,370
Purchased or imported water	RBWTP Supply (ECCID)[c]	2,190	2,190	2,190	2,190	2,190	2,190	2,190	2,190	2,190	2,190
Surface water	ECCID Non-Potable Supply[b]	263	263	263	263	263	263	263	263	263	263
Recycled water	City WWTP supply[d]	2,546	2,546	3,395	3,395	3,395	3,395	3,395	3,395	3,395	3,395
Desalinated water		--	--	--	--	--	--	--	--	--	--
Stormwater use		--	--	--	--	--	--	--	--	--	--
Transfers		--	--	--	--	--	--	--	--	--	--
Exchanges		--	--	--	--	--	--	--	--	--	--
	Total	9,194	9,194	10,043	10,043	10,043	10,043	10,043	10,043	10,043	10,043

Notes:
Units: MGY
a. The firm design capacity of the City's wells is 5.19 mgd, this total assumes wells are pumping 5 mgd.
b. The total ECCID purchase entitlement is that of 4,823 MGY (14,800 AF/yr). A portion of this water is treated at RBWTP (6mgd) and the rest of the total was split between potable and non-potable supplies based on actual 2012 water use. Ninety percent of the total supply was allotted for potable use and 10 percent was allotted for non-potable use.
c. The total stems from the City's permanent treatment capacity share of 6 mgd. The 6 mgd that is treated at RBWTP comes from the total ECCID purchase entitlement of 4,823 MGY.
d. The total recycled water supply is assumed to be 93% of the total WWTP capacity. It is assumed the City will expand the WWTP capacity to 7.5 mgd by 2020 and up to 10 mgd by 2025.

Section 7

Water Supply Reliability Assessment

This section describes factors impacting long-term reliability of water supplies and provides a comparison of projected water supplies and demands.

7.1 Constraints on Water Sources

"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 DMMs, to the extent practicable.

[…] The plan shall include information, to the extent practicable, relating to the quality of existing sources of water available to the supplier over the same five-year increments as described in subdivision (a) of Section 10631, and the manner in which water quality affects water management strategies and supply reliability" (CWC §§ 10631(c)(2)–10634).

This section describes water quality and quantity constraints in the two water supply sources: groundwater and surface water.

7.1.1 Constraints on Surface Water Sources

The City's surface water supply is from the San Joaquin River Delta. Due to weather variations, storm events, and diurnal patterns, water quality for each of the three sources of surface water (Old River, Middle River, and Rock Slough) in the Contra Costa Canal can fluctuate from year to year, seasonally, daily, and even hourly. Raw water from the Delta is considered a high-quality source and characterized by low to moderate levels of turbidity, minerals, and natural organic matter. Pathogenic organisms tend to be present in low concentrations as well (City of Brentwood, 2011). Water from the Contra Costa Canal is routinely monitored for pesticides and other contaminants (e.g., synthetic organic compounds, nitrate, radionuclides, perchlorate, arsenic). These constituents are typically not detected (City of Brentwood, 2011). Both the COBWTP and RBWTP are amply equipped to handle the fluctuations in raw water quality and consistently produce a high quality effluent.

7.1.2 Constraints on Groundwater Sources

Contra Costa County does not regulate groundwater pumping with water rights, and the San Joaquin basin is not adjudicated. While DWR has not designated the San Joaquin Basin in overdraft and current groundwater levels and raw water delivery rates are assumed to be constant for the 2015 UWMP, the City is aware that future conditions may vary. Environmental factors, such as drought conditions, and water quality factors, such as groundwater contamination, have the potential to affect this resource adversely. The City is prepared to manage any changes that may occur due to extended drought or potential effects of climate change adaptively via conservation measures and an increased use of recycled water.

While water quality in the City aquifer is adequate, the water does have relatively high levels of TDS (total dissolved solids), chlorides, and nitrate. The TDS concentration in the groundwater is high, up to 1,100 milligrams per liter (mg/L) (City of Brentwood, 2014b). The occurrence of nitrate in groundwater in this area has generally been attributed to agricultural influences. However, the occurrence is limited to the upper sequences of aquifer materials. The nitrate concentrations decline appreciably for wells 200 feet or more below the ground surface (City of Brentwood, 2011). The City's seven active wells are below 20 mg/L

nitrate as NO_3; an inactive well (Well 11) is above 20 mg/L, but this is still below the limit of 45 mg/L. Chloride and TDS concentrations also decline with depth but less notably than nitrate concentrations. The decline suggests local anthropogenic influences on TDS, chloride, and other constituents in addition to nitrate. As shown in Table 6-1, two of the nine permitted wells are not in use because of issues related to water quality (i.e., one does not currently have a disinfection system [Well 9], and the other has high nitrate concentrations [Well 11]).

Table 7-1 summarizes legal, water quality, and climactic factors that may affect the reliability of the water supply for the City.

Table 7-1. Factors Affecting Water Supply

Water supply source	Source name (if any)	Limitation quantification	Legal	Environmental	Water quality	Climatic	Additional information
Purchased treated surface water from CCWD (RBWTP)	Raw water (ECCID)	The City has purchased a permanent 6 MGD right at the RBWTP	Permanent capacity share	Catastrophic levee breach could compromise surface water supply	High chlorides, TDS, and nitrate levels could compromise supply.	None	
Supplier-produced surface water (COBWTP)	Raw water (ECCID)	Portion of contracted 4,823 million gallons per year Plant capacity = 16.5 to 33 MGD	Permanent entitlement to purchase	Catastrophic levee breach could compromise surface water supply. Decreasing Delta water quality at Rock Slough Intake	High TDS and nitrate levels could compromise supply.	None	
Non-potable water	Roddy Ranch Pump Station	Portion of contracted 4,823 million gallons per year	Permanent entitlement to purchase	Catastrophic levee breach could compromise surface water supply	High TDS and nitrate levels could compromise supply.	None	East Contra Costa Canal Irrigation shutdowns and water supply will be coordinated between the City and ECCID as required.
Supplier-produced groundwater	San Joaquin Groundwater Basin	1,825 million gallons per year	Water rights	Significant subsidence could shift basin into overdraft and trigger need to restrict withdrawals	High TDS and nitrate levels could compromise supply.	None	
Recycled water	City WWTP	5 mgd (current) 10 mgd (future)	Master reclamation permit requirements		If tertiary-level water quality requirements are not met, flows are sent to a lined reclamation pond.	None	

7.2 Reliability by Type of Year

"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" (CWC §§ 10631(c)(1)).

This section describes the reliability of the City's various water supply sources and their vulnerability to seasonal or climatic shortages. The definitions of the three water-year types as described by DWR are provided below.

1. **Average year** is a year in the historical sequence that most closely represents median runoff levels and patterns. Average is defined as the median runoff over the previous 30 years or more.
2. **Single-dry year** is generally considered to be the lowest annual runoff for a watershed since the water year beginning of measurements in 1903.
3. **Multiple-dry year** period is generally considered to be the lowest average runoff for a consecutive multiple-year period (three years or more) for a watershed since 1903.

The City has always met system water demand, regardless of regional hydrology. The City expects no reductions from normal-year supply during single or multiple dry years. Appropriate base years for the City would be the same as they are for CCWD. These years are 2004 as an average year, 1977 as a single dry year, and 1990 to 1992 as multiple dry years. Table 7-2 presents the City's basis of water year data.

Table 7-2. (DWR Table 7-1) Retail: Bases of Water Year Data

Year type	Base year	Volume available, MGY	Percentage of average supply
Average year	2004	-	100%
Single-dry year	1977	-	100%
Multiple-dry years 1st year	1990	-	100%
Multiple-dry years 2nd year	1991	-	100%
Multiple-dry years 3rd year	1992	-	100%

Notes:
Units: MGY

7.3 Supply and Demand Assessment

"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" (CWC §§ 10635(a)).

This section provides a comparison of normal, single-dry, and multiple-dry water year supply and demand for the City. Section 4 previously addressed water demands and Section 6 addressed water supplies.

The comparison of current and projected water supply and demand demonstrates the ability of a supplier to accommodate a city's water demands during an average water year as well as those years with water shortages. in this UWMP, Section 4 addressed water demands and Section 6 addressed water supply. As shown in the tables, the supply is adequate to meet the projected demand during average water years.

Data presented in Table 7-3 compares the normal water year current and projected water supplies to the current and projected demand for the City.

Table 7-3. (DWR Table 7-2) Retail: Normal Year Supply and Demand Comparison					
	2020	2025	2030	2035	2040
Supply [a]	9,194	10,043	10,043	10,043	10,043
Demand totals [b]	4,509	4,905	5,325	5,771	6,244
Difference	4,685	5,137	4,717	4,272	3,798

Notes:
Units: MGY
a. Supply from Table 6-10
b. Demand from Table 4-4.

The current and projected water supplies are compared to the demands for a single dry year for the City in Table 7-4.

Table 7-4. (DWR Table 7-3) Retail: Single Dry Year Supply and Demand Comparison					
	2020	2025	2030	2035	2040
Supply totals	9,194	10,043	10,043	10,043	10,043
Demand totals	4,509	4,905	5,325	5,771	6,244
Difference	4,685	5,137	4,717	4,272	3,798

Notes:
Units: MGY

Table 7-5 presents projections for water supply compared to the demands for multiple dry years for the City.

Table 7-5. (DWR Table 7-4) Retail: Multiple Dry Years Supply and Demand Comparison						
		2020	2025	2030	2035	2040
First year	Supply totals	9,194	10,043	10,043	10,043	10,043
	Demand totals	4,509	4,905	5,325	5,771	6,244
	Difference	4,685	5,137	4,717	4,272	3,798
Second year	Supply totals	9,194	10,043	10,043	10,043	10,043
	Demand totals	4,509	4,905	5,325	5,771	6,244
	Difference	4,685	5,137	4,717	4,272	3,798
Third year	Supply totals	9,194	10,043	10,043	10,043	10,043
	Demand totals	4,509	4,905	5,325	5,771	6,244
	Difference	4,685	5,137	4,717	4,272	3,798

Notes:
Units: MGY

7.4 Regional Supply Reliability

"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" (CWC §§ 10620(f)).

Sections 4 and 6 of this UWMP discussed water management tools and options that are being implemented or planned for implementation to maximize the use of local water resources and minimize the need to import water from other regions.

This page intentionally left blank.

Section 8

Water Shortage Contingency Planning

"The plan shall provide an urban water shortage contingency analysis that includes each of the following elements that are within the authority of the urban water supplier" (CWC §§ 10632(a)).

This section describes the City's plans for responding to water shortages including stages of action, prohibitions, penalties, consumption reduction methods, mechanisms for determining actual reductions in use, revenue and expenditure impacts, a shortage contingency resolution, plans for catastrophic events, and the estimated multiple dry-year minimum water supply. Appendix G contains a copy of the City's Water Shortage Contingency Ordinance and Draft Water Shortage Contingency Plan (WSCP).

8.1 Stages of Action

"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" (CWC §§ 10632(a)).

This section describes the stages of action to be undertaken in response to water supply shortages. Per CWC Section 10632 (a), the City has developed four stages of action to be undertaken in response to water supply shortages, including up to a 50 percent reduction in water supply and an outline of specific water supply conditions that are applicable to each stage. The Director of Public Works/City Engineer will make the stage determination and declaration during a water supply shortage. Table 8-1 describes the water supply shortage levels, stages, and triggering conditions.

Table 8-1. (DWR Table 8-1) Retail: Stages of Water Shortage Contingency Plan

Stage	Percent supply reduction	Water supply condition
Normal operations	0	Normal
Stage I	5-10%	Minor drought
Stage II	10 – 20%	Moderate drought
Stage III	20 – 35%	Severe drought
Stage IV	35 – 50%	Critical drought

Stage I – During Stage I, of a water supply shortage, the shortage is minimum, up to 10 percent. Voluntary conservation is encouraged; this includes encouraging customers to limit the watering of lawn, landscape or other turf area with water supplied by the City. The City maintains an ongoing public information campaign consisting of distribution of literature, speaking engagements, bill inserts, and conversation messages printed in local newspapers and on the City's internet web page. The drought situation is explained to public and governmental bodies. The City explains other stages and forecast future actions. Also, the City requests voluntary water conservation. Educational programs in area schools are ongoing.

Stage II – During Stage II of a water supply shortage, the shortage is moderate, 10 to 20 percent, and conservation may be voluntary, consist of conservation goals, and/or include mandatory conservation rules; this includes encouraging customers to limiting the watering of lawn, landscape or other turf area with water

supplied by the City to any four days per week maximum. s. All steps taken in prior stages are intensified and production is monitored daily for compliance with necessary reductions. The severity of actions depends upon the percent shortage. The City aggressively continues it public information and education programs. The City asks for 10 to 20 percent voluntary or mandatory water use reductions. If necessary, the City also supports passage of drought ordinances.

Stage III – During Stage III of a water supply shortage, the shortage is severe, 20 to 35 percent, and conservation consists of conservation goals and mandatory conservation rules. This may include limiting the watering of lawn, landscape or other turf area with water supplied by the City to any three days per week maximum. All steps taken in prior stages are intensified and production is monitored daily for compliance with necessary reductions. This phase becomes effective upon notification by the City that water usage is to be reduced by a mandatory percentage. The City would adopt drought ordinances, implement mandatory reductions, and enforce fines and penalties for water waste. Rate changes may be implemented to penalize excess usage. Drought surcharges or rates may be applied based on Council direction. The City would restrict outdoor water usage at City facilities by reducing water times or using non-potable/recycled water. The City would implement the use of recycled water fill stations at the City wastewater treatment plant to offset potable water use. Water use restrictions are put into effect; i.e., prohibited uses can include, but are not limited to, restrictions on daytime hours for watering, excessive watering resulting in gutter flooding, using hoses without a shutoff device, non-recycling fountains, washing down sidewalks or patios, and unrepaired leaks. The City monitors monthly customer billing data and production weekly for compliance with necessary reductions.

Stage IV – During Stage IV of a water supply shortage, the shortage is critical, 35 to 50 percent. Conservation consists of conservation goals and mandatory conservation rules. This may include limiting the watering of lawn, landscape or other turf area with water supplied by the City to any two days per week maximum. All steps taken in prior stages are intensified and production is monitored daily for compliance with necessary reductions.

Triggering from one stage to the next is done at the recommendation of the Director of Public Works. Factors to take into consideration include decreases in water allotments from the water supply wholesaler such as CCWD or ECCID, from reductions in infrastructure capacity related to the water treatment plants, pipelines or water treatment plants, or climate or from state political conditions that would impact the allotment of water supply.

8.2 Prohibitions on End Users

“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.

[…] 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” (CWC §§ 10632(a) (4)–10632(a)(5)).

CWC Section 10632(a)(4) requires mandatory prohibitions against specific water use practices that may be considered excessive during water shortages. In 2011, the City adopted the current Municipal Code Section 17.630, which addresses landscaping and irrigation for new construction of homes, commercial, and industrial facilities. This code is a proactive means of reducing the water demand in the City. Should drought conditions warrant mandatory reductions, the City may adopt and implement an ordinance for mandatory conservation and water restriction plan. This ordinance may require additional tariffs levied by the City to enforce the plan. Municipal Code Section 8.36, which addresses property maintenance, including residential landscaping, is under review and is suspended by ordinance as it pertains to certain landscaping.

Should drought conditions warrant mandatory reductions, during Stage II of a water supply shortage, the City may adopt and implement an ordinance for mandatory conservation and water restriction plan. This ordinance may require a drought surcharge for the City to enforce the plan.

Types of restrictions and prohibitions can be categorized as landscape irrigation, commercial/institutional/industrial (CII), water features and swimming pools, and other. Table 8-2 provides a summary of possible restrictions and prohibitions that the City may impose.

Table 8-2. (DWR Table 8-2) Restrictions and Prohibitions on End Users

Stage	Restrictions and prohibitions to end users	Additional explanation	Penalty, charge, or other enforcement? Y/N
II, III, IV	Other – Prohibit use of potable water for washing hard surfaces	Cleaning of streets/ sidewalks/ walkways/ parking areas/ patios/ porches or verandas.	Yes
II, III, IV	Other – Prohibit vehicle washing except at facilities using recycled or recirculating water		Yes
II, III, IV	Landscape – Prohibit all landscape irrigation	Watering lawns and landscapes is prohibited at City facilities. Prohibitions on time and day for residential outdoor irrigation.	Yes
II, III, IV	Other	Irrigation of non – permanent agriculture is prohibited.	Yes
II, III, IV	Other – Customers must repair leaks, breaks, and malfunctions in a timely manner		Yes
II, III, IV	Other	Excessive watering resulting in gutter flooding is prohibited.	Yes
II, III, IV	Water Features – Restrict water use for decorative water features, such as fountains	Cleaning/ filling/ operating/ maintaining levels in non-recycling decorative fountains is prohibited.	Yes
III, IV	CII - Other CII restriction or prohibition	Car wash facilities must use recycled water.	Yes
III, IV	Other - Prohibit vehicle washing except at facilities using recycled or recirculating water		Yes
III, IV	CII - Other CII restriction or prohibition	Prohibit new car washes or laundries without recirculating water systems.	Yes
III, IV	Pools - Allow filling of swimming pools only when an appropriate cover is in place		Yes

8.3 Penalties, Charges, and Other Enforcement

"Penalties or charges for excessive use, where applicable" (CWC §§ 10632(a)(6)).

Section 10632(a)(6) of the CWC requires a water supplier to apply "penalties or charges for excessive use, where applicable." The City, after one written warning, may install a flow- restricting device on the service line of any customer observed by City personnel to be using water for any non-essential or unauthorized use defined in a City ordinance.

An excess use penalty per 100 cubic feet of water (sometimes referred to as one unit) used above the applicable allocation during each billing period may be charged by the City for all service rendered on and after the effective date of an ordinance. Repeated violations of unauthorized water use can result in discontinuance of water service. Table 8-3 lists penalties and charges and the stage during which they take effect.

Table 8-3. Penalties and Charges

Penalties or charges	Stage when penalty takes effect
Penalties for not reducing consumption	III,IV
Charges for excess use	III,IV
Flat fine	NA
Charge per unit over allotment	III,IV
Flow restriction	III,IV
Termination of service	III,IV

8.4 Consumption Reduction Methods

"10632(a)(5) 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 plan 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" (CWC §§ 10632(a)(5)).

Consumption reduction methods are actions that the City takes to reduce water demand within the service area, whereas prohibitions, addressed in Section 8.2, limit specific uses of water. Each urban water supplier has a choice regarding the types of consumption-reduction methods to use in its water shortage contingency analysis. The methods must be appropriate for the area and capable of reducing water use by up to 50 percent. CWC Section 10632(a)(5) requires the water supplier to implement consumption-reduction methods during the most restrictive stages of a water shortage. The City will implement the consumption-reduction methods listed in Table 8-4.

Table 8-4. (DWR Table 8-3) Retail: Stages of Water Shortage Contingency Plan – Consumption Reduction Methods

Stage	Consumption reduction methods by water supplier ***Drop down list*** *These are the only categories that will be accepted by the WUEdata online submittal tool*	Additional explanation or reference (*optional*)
All Stages	Expand public information campaign	Communication methods such as works shops, bill messages, Brentwood Press, or other communication methods.
III, IV	Offer water use surveys	Expand notification of the availability of free water use evaluations.
III, IV	Implement or modify drought rate structure or surcharge	Penalties and fines for excessive water use implemented.

Table 8-4. (DWR Table 8-3) Retail: Stages of Water Shortage Contingency Plan – Consumption Reduction Methods		
Stage	Consumption reduction methods by water supplier ***Drop down list*** *These are the only categories that will be accepted by the WUEdata online submittal tool*	Additional explanation or reference (*optional*)
III, IV	Other	Prohibit irrigation of turf of newly built homes and buildings if irrigation systems are in any manner inconsistent with regulations or other requirements established by the California Building Standards Commission and the Department of Housing and Community Development.
III, IV	Provide rebates for water efficiency products	Such as toilet rebates, pool cover rebates, lawn conversion rebates.
IV	Increase water waste patrols	
IV	Moratorium or net zero demand increase on new connections	

8.5 Determining Water Shortage Reductions

"A mechanism for determining actual reductions in water use pursuant to the urban water shortage contingency analysis" (CWC §§ 10632(a)(9)).

Water production data is recorded daily. It is monitored by the Public Works Director or designee during normal water supply conditions. Totals are reported monthly and are incorporated into water supply reports. The City maintains extensive water use records on individual customer accounts. Exceptionally high usage is identified at meter reading time by the City's electronic meter reading management system. City staff investigates these accounts for potential water loss or abuse problems. During all stages of water shortages, the Public Works Director or designee receives and monitors daily production figures.

8.6 Revenue and Expenditure Impacts

"An analysis of the impacts of each of the actions and conditions described in paragraphs (1) to (6), 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" (CWC §§ 10632(a)(7)).

Section 10632 (g) of the CWC requires an analysis of the impacts of each of the actions taken for conservation and water restriction on the revenues and expenditures of the water supplier. The City will establish memorandum accounts to track expenses and revenue shortfalls caused by both mandatory rationing and voluntary conservation efforts. The City will implement a surcharge to recover revenue shortfalls recorded in their drought memorandum accounts.

Currently the City is in the third year of a five-year rate study that the City Council approved in 2013; it sets water rates through June 2018. While in the middle of the current rate structure, the Water Enterprise Fund has been significantly impacted by the governor's conservation requirements. In response, the City completed a new rate study to address long-term fiscal impacts of the current rate structure. On April 12, 2016, the Brentwood City Council adopted a two-year rate adjustment. The approved revenue adjustment is an annual 6 percent increase in 2016 and in 2017 to standard rates, over the 3-percent adjustment already

in place per the five-year rate structure. Standard rates assume "non-drought" conditions and an optional Drought Surcharge is proposed during times of conservation. The City will undertake a five-year rate study in Fiscal Year 2018/19.

In addition, the City will evaluate increased costs due to increasing staffing levels and providing water rebates to customers that exceed water use reductions. The City's Director of Public Works or designee will evaluate revenues and reserves monthly during a prolonged water shortage event.

Tables 8-5 and 8-6 display the components of revenue and expenditure impacts and summarize if the various components were discussed. Every two years the City reviews its revenue and expenditures for water and adjusts the water rates.

Table 8-5. Proposed Measures to Overcome Revenue Impacts

Name of measures	Check if discussed
Review of water rate adjustments	X
Development of reserves	X
Change in quantity of sales	X
Impact on Customer's bill	X
Distribution of customer impacts between customer types	X
Impacts to water supplier of higher rates and penalties	X
Cost recovery reviews	X

Table 8-6. Proposed Measures to Overcome Expenditure Impacts

Name of measures	Check if discussed
Change in quantity of sales	X
Cost recovery reviews	X
Increased staff salaries/overtime	X
Increased costs of new supplies, transfers or exchanges	X
Distribution of customer impacts between customer types	X
Impacts to water supplier of higher rates and penalties	X

8.7 Resolution or Ordinance

"A draft water shortage contingency resolution or ordinance" (CWC §§ 10632(a)(8)).

Should drought conditions warrant mandatory reductions during Stage II of a water supply shortage, the City may adopt and implement an ordinance for mandatory conservation as well as a water restriction plan. This ordinance may require a drought surcharge through which the City will enforce the plan.

The ordinance may address prohibitions on various wasteful water uses, including washing sidewalks and driveways with potable water, cleaning or filling decorative fountains, or allowing plumbing leaks to go uncorrected for more than 72 hours.

Appendix G contains the City's updated Water Shortage Contingency Plan.

8.8 Catastrophic Supply Interruption Plan

"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" (CWC §§ 10632(a)(3)).

The CWC Section 10632(a)(3) requires actions to be undertaken by the water supplier to prepare for and implement during a catastrophic interruption of water supplies. The City has a Water Quality Emergency Notification Plan in place that coordinates overall response to a disaster.

A catastrophic event that constitutes a proclamation of a water shortage would be any event, either natural or manmade, that causes a severe shortage of water, synonymous with severity equal to or greater than the Stage III or Stage IV water supply shortage conditions. Facilities are inspected annually for earthquake safety. As part of its annual construction process, the City has budgeted for and installed auxiliary generators and made improvements to the water storage facilities to prevent loss of these facilities during an earthquake or any disaster causing an electric power outage.

Table 8-7 describes the actions taken to address each catastrophic event.

Table 8-7. Catastrophic Supply Interruption Actions

Potential Catastrophic Event	Summary of Actions
Earthquake/fault rupture, liquefaction	Emergency response plan procedures would be implemented. The City would ensure that any damaged sections of the distribution system would be isolated, customers would be notified of the need to reduce use, backup generators would be used for groundwater pumping, and the water supply would be supplemented by using stored surface water supplies from the City's five reservoirs.
Regional power outage	Customers would be notified of the need to reduce use, and backup generators would be used for groundwater pumping.
Flooding/levee breach/ dam failure	Emergency response plan procedures would be implemented. Depending on the level of flooding, flooded areas would be isolated to minimize the size of the area affected by the event; customers may be evacuated.
Fire	Affected customers would be notified and voluntary and mandatory rationing would be implemented in affected areas, if necessary.

Notes:
Source: City of Brentwood, 2011.

8.9 Three-Year Minimum Water Supply

"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" (CWC §§ 10632(a)(2)).

The Act requires the City to quantify the minimum water supply available for the next three years based on the driest 3-year historic sequence for the water supply. Based on historic groundwater and surface water conditions, the City's 3-year minimum supply, as shown in Table 8-8, will equal 100 percent of the average water year supply for the next three years. Recycled water demand is the exception, as it can use 93% of the WWTP capacity, which is 1,697 MGY. Demand and supply for 2016–2018 includes water conservation measures.

Table 8-8. (DWR Table 8-4) Retail: Three-Year Minimum Water Supply			
	2016	2017	2018
Available water supply	8,345	8,345	8,345

Notes:
Units: MGY

Section 9

Demand Management Measures

The narrative pursuant to this paragraph shall include descriptions of the following water demand management measures:

(i) Water waste prevention ordinances.

(ii) Metering.

(iii) Conservation pricing.

(iv) Public education and outreach.

(v) Programs to assess and manage distribution system real loss.

(vi) Water conservation program coordination and staffing support.

(vii) Other demand management measures that have a significant impact on water use as measured in gallons per capita per day including innovative measures, if implemented (CWC §§ 10631(f)(1)(B)).

The City conducts an ongoing water conservation program. The City has committed to implementing water conservation measures for all customer sectors. Water conservation can be achieved through managing the water supply and water demand. Supply management is used to improve the overall system efficiency and reduce waste within the production and delivery facilities. The City uses demand management to encourage water conservation by the consumer.

This section provides narrative descriptions addressing the nature and extent of each demand management measure (DMM) implemented over the past five years, from 2011 through 2015.

9.1 Members of the California Urban Water Conservation Council

The unpredictable water supply and ever increasing demand on California's complex water resources have resulted in a coordinated effort by DWR, water utilities, environmental organizations, and other interested groups to develop a list of urban DMMs for conserving water. This consensus-building effort resulted in a Memorandum of Understanding (MOU) Regarding Urban Water Conservation in California, as amended September 16, 1999, among parties, which formalizes an agreement to implement these DMMs and makes a cooperative effort to reduce the consumption of California's water resources. The California Urban Water Conservation Council (CUWCC) administers the MOU. The City is currently an MOU signatory and submits annual Best Management Practice (BMP) retail coverage reports each year (see Appendix H – 2013-2014 Report). The MOU requires a water utility to implement only the DMMs that are economically feasible. If a DMM is not economically feasible, the utility may request an economic exemption for that DMM. The DMMs in the MOU are generally recognized as standard definitions for water conservation measures.

The section of the CWC addressing DMMs was significantly modified in 2014, based on recommendations from the Independent Technical Panel to the legislature (DWR, 2016b). Retail agency requirements were streamlined from 14 specific measures to six more general requirements plus an "other" category. Table 9-1 presents the six DMMs.

Table 9-1. Water Conservation Demand Management Measures	
Number	DMM name
1	Water waste prevention ordinances
2	Metering
3	Conservation pricing
4	Public education and outreach
5	Programs to assess and manage distribution system real loss
6	Water conservation program and coordination staffing support
7	Other demand management measures that have a significant impact on water use as measured in gallons per capita day including innovative measures, if implemented

9.2 Water Waste Prevention Ordinances

The City conducts an ongoing water conservation program and has a water waste prevention ordinance in place at all times. The ordinance is Section 14.01.510 of the City's Municipal code, "Conservation – Water waste prohibited." The water waste ordinance states:

"As a condition of service, customers of the city must use water delivered through the city's system in a manner that promotes efficiency and avoids waste. Water waste is prohibited. Water waste includes: A) Allowing water provided by the city to flow or spray off the property; B)Failure to correct a malfunctioning device or supply line, where the customer or their agent has known of the problem for more than forty-eight hours; C) Noncompliance with regulations regarding washing of vehicles, equipment, driveways, parking lots, sidewalks, streets or other surfaces or objects; D) Discharging swimming pool or spa water drainage off the property where discharge into a public sanitary sewer is available; and E) Noncompliance with watering group assignments under a declaration of water shortage emergency" (Ord. 918 § 2, 2013).

Additionally, the City adopted the State's Model Water-Efficient Landscape Ordinance on January 1, 2010 (see Appendix I). This ordinance requires a landscape permit, plan check, or design review for new and rehabilitated landscaped areas of 2,500 square feet or greater. The City rewrote Municipal Code 17.630 (Landscaping and Screening ordinance adopted in 1992). The City Council adopted the rewrite on June 14, 2011 (see Appendix I).

Planned Implementation: The implementation of this DMM is ongoing. The City will continue to enforce water conservation and water waste prevention. To comply with the Model Water-Efficient Landscape Ordinance, the City will review landscape permit applications and grant permits.

Method to Estimate Expected Water Savings: The City cannot quantify water savings from this program directly. Future water savings from this DMM will likely be reflected in the landscape water sector.

9.3 Metering

The City of Brentwood is fully metered. All water delivered through a service connection must be metered and billed. Tampering with meters or the use of any device to allow delivery of unmetered water is prohibited.

Currently, data are collected monthly using an automated meter reading system. The City plans to upgrade the existing Sensus™ automated meter reading system to an automated meter reading/advanced metering infrastructure fixed-base system. The new system will allow meter data to be recorded on an hourly basis. This change will reduce water loss within the City because it will notify the staff of leaks, high consumption,

and water theft when they occur and improve the effectiveness of the High-Usage Notification Program (See Section 9.4).

Planned Implementation: This program is a multi-phase project that began in 2012. The first phase will evaluate system and communications requirements. The second phase will consist of upgrading the water meters citywide one zone at a time.

Method to Estimate Expected Water Savings: The City will evaluate the effectiveness of this DMM by comparing prior water use with future water use. This DMM could result in savings in all water use sectors because it is a programmatic system-wide upgrade.

9.4 Conservation Pricing

The City currently implements conservation pricing for all its metered customers. All of the City's customers are metered. The City implements tiered rates for residential and commercial customers.

Currently, the City has a High-Usage Notification Program. The City developed the notification program to identify homes that appear to use an above-average amount of water when compared with homes and lots of a similar size. If a resident's water usage is three times greater than the comparative average, the City sends the resident a notification, along with an invitation for a free residential water use survey. New meters will help the City notify residents sooner about tier exceedances.

Planned Implementation: The implementation of this DMM is ongoing. The City's Water Conservation staff implements this program each quarter.

Method to Estimate Expected Water Savings: The effectiveness of this DMM is evaluated according to the percentage and type of customers typically presented in the City's annual rate studies in each tier. Nearly half of all residential bills were at the Tier 1 rate, the lowest variable consumption rate. However, non-residential usage figures show that the majority of the water sold is billed at the higher Tier 2 rate. Future savings from this DMM are likely to be consistent with the change in tier rates each year. If no rate change occurs, the changes are not anticipated to be significant. The City evaluates this DMM's effectiveness by comparing the City's water use prior to and following the implementation of conservation pricing.

9.5 Public Education and Outreach

Public information is an ongoing component of the City's water conservation program. The City currently produces bill inserts and news articles in the City's quarterly newsletter. The City plans to expand its web site to include conservation information. Some of the public education and outreach efforts that are ongoing are discussed below.

9.5.1 Water Survey Programs for Single-Family and Multi-Family Residential Connections

The City conducts residential water use surveys as a free service to assist residents of single-family and multi-family units with identifying possible areas of water waste inside and outside their homes and educate them about water conservation techniques. Residential water use surveys consist of annual water audits, water use reviews, and surveys of past program participants. Trained auditors conducted audits and may install low-flow devices. Auditors will identify water use problems, recommend repairs, and offer instruction regarding landscape principles, irrigation timer use, and, when appropriate, meter reading. To provide further program incentives, the City is offering a free water saving devices for scheduling a residential water use survey.

Planned Implementation: The implementation of this program is ongoing. The City staff reviews online request forms submitted by residents and schedules a survey. Then the City conducts the survey. Results are entered into a database and provided to customers via mail.

Method to Estimate Expected Water Savings: The City will evaluate effectiveness of this DMM by analyzing program penetration and comparing an audited customer's prior water use with future water use. A 10 percent water use reduction per household has been recorded as a result of these surveys. Future surveys will result in a water use reduction in the single-family and multi-family residential sectors.

9.5.2 School Education Programs

School education is an ongoing component of the City's water conservation program. The program targets all grades, and includes offering Project WET (Water Education for Teachers) workshops for teachers, performing classroom demonstrations, displaying booths at science fairs, providing assemblies. The City also promotes student participation, such as providing bus transportation for grade-schoolers, in the annual Public Works Open House.

Planned Implementation: The City's school education program is an ongoing annual program.

Method to Estimate Expected Water Savings: The City cannot quantify savings from this DMM directly. The City will evaluate effectiveness of this DMM by the success of the City's water conservation program. An overall reduction in annual water use will reflect the success of this program.

9.6 Programs to Assess and Manage Distribution System Real Loss

The City's progress to asses and manage the system's real losses consists of ongoing leak detection and repair within the system, focused on the high probability leak areas. This program will also include an ongoing meter calibration and replacement program for all production and distribution meters.

Planned Implementation: The implementation of this DMM is ongoing. The City's conducts this program annually.

Method to Estimate Expected Water Savings: The City will evaluate this DMM's effectiveness by tracking leak detection and repair and comparing prior water use with future water use. Future savings from this DMM are expected to be 2 percent to 5 percent of total water use. Reductions will be reflected in the "other" water use sector volumes because that sector includes system losses.

9.7 Water Conservation Program Coordination and Staffing Support

The City has hired a conservation specialist as an ongoing component of the City's water conservation program. The conservation coordinator is responsible for implementing and monitoring the City's water conservation activities. The City water conservation coordinator continually works with other staff and stakeholders to implement activities in the water conservation program.

Planned Implementation: The implementation of this DMM is ongoing. The City conducts this program annually.

Method to Estimate Expected Water Savings: The City cannot quantify savings from this DMM directly. The City will evaluate effectiveness of this DMM by the success of the City's water conservation program. An overall reduction in annual water use will reflect the success of this program.

9.8 Other Demand Management Measures

In addition to the DMMs discussed in the previous sections, the City also implements large landscape conservation programs and incentives, and is planning to develop conservation programs for CII accounts, and provide retrofit, replacement, and rebate programs that help conserve water. These management measures are discussed below.

9.8.1 Convert for Cash Water Conservation Rebate Program

The City's Convert for Cash Water Conservation Rebate Program is designed to help water utility customers save water. The program offers rebates for landscape conversion, irrigation upgrades, and water-efficient appliance replacements. By converting lawns to sustainable landscapes and upgrading to high-efficiency irrigation equipment and appliances water supply is conserved and money can be saved on utility bills.

Planned Implementation: The implementation of this program is ongoing for those who want to participate.

Method to Estimate Expected Water Savings: The City will evaluate this DMM's effectiveness by comparing prior water use with future water use. This DMM could result in savings in the residential and commercial water use sectors.

9.8.2 Residential Plumbing Retrofit

The City provides a free low-flow showerheads to residents who schedule a residential water use survey. The City also can provide faucet aerators and toilet leak-detection tablets to customers. Since more than 75 percent of construction in the City occurred after 1992, most plumbing fixtures are already ultra low-flow units.

Planned Implementation: The implementation of this program is ongoing.

Method to Estimate Expected Water Savings: The City will evaluate this DMM's effectiveness by taking into consideration the number of customers who install low-flow showerheads and comparing an audited customer's prior water use with future water use.

This page intentionally left blank.

Section 10

Plan Adoption, Submittal, and Implementation

"Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days prior to the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that 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.

[…] 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 is provides water supplies no later than 60 days after the submission of its urban water management 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 the 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 own service area" (CWC §§ 10621(b)–10635(b)–10642).

This section describes actions taken by the City to address CWC requirements for a public hearing, UWMP adoption, submittal of an adopted UWMP, UWMP implementation, and the process for amending an adopted UWMP.

10.1 Inclusion of all 2015 Data

This UWMP includes the water use and planning data for the entire year of 2015, reporting on a calendar year basis.

10.2 Notice of Public Hearing

"Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days prior to the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that 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.

[…] 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 is provides water supplies no later than 60 days after the submission of its urban water management 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 the 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 own service area" (CWC §§ 10621(b)–10635(b)–10642).

The Act requires the encouragement of public participation and a public hearing as part of the UWMP development and approval process. As required by the Act, the City is making the UWMP available for public inspection and held a public hearing prior to adopting this UWMP. The City notified cities and counties within the service area more than 60 days before the public hearing (see Appendix B for documentation).

10.3 Public Hearing and Adoption

As mentioned in Section 2, per the requirements of Government Code Section 6066, a Notice of Public Hearing was published twice in the local newspaper 14 days prior to the hearing to notify all customers and local governments of the public hearing, and copies of the draft UWMP were made available for public inspection at the City's administration building and on-line. A copy of the published Notice of Public Hearing is included in Appendix C.

This UWMP was adopted by the Brentwood City Council on May 24, 2016. A copy of the adoption resolution is provided in Appendix D. The adopted UWMP was provided to DWR, the State library, and the appropriate cities and counties within 30 days of adoption. The adopted UWMP is available for public review during normal business hours at the City offices and online at http://www.brentwoodca.gov/gov/pw/water/reports.asp.

Table 10-1. (DWR Table 10-1) Retail: Notification to Cities and Counties

City name	60 day notice	Notice of public hearing
City of Brentwood	X	X
City of Antioch	X	X
County name	**60 day notice**	**Notice of public hearing**
Contra Costa County	X	X

10.4 Plan Submittal and Public Availability

The adopted UWMP was provided to DWR, the State library, and the appropriate cities and counties within 30 days of adoption. Appendix D includes a notice of public availability submitted to DWR. The adopted UWMP will be available for public review during normal business hours at the City offices and online at: http://www.brentwoodca.gov/gov/pw/water/reports.asp.

10.5 Amending an Adopted UWMP

Any future amendments or changes to this UWMP will be submitted to all the appropriate agencies as specified in CWC §§ 10621(a) and (c)(1).

Section 11

Limitations

Brown and Caldwell prepared this document solely for the City of Brentwood in accordance with professional standards at the time the services were performed and in accordance with the contract between the City of Brentwood and Brown and Caldwell dated December 15, 2015. This document is governed by the specific scope of work authorized by the City of Brentwood; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the City of Brentwood and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

This page intentionally left blank.

Section 12

References

California Department of Public Health (CDPH), 2014. Regulations Related to Recycled Water, June 18, 2014 (Revisions effective on June 18, 2014). Accessed at: http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/lawbook/RWregulations_20140618.pdf Accessed February 2016.

California Department of Water Resources (DWR), 2016a. Basin Boundary Assessment Tool. https://gis.water.ca.gov/app/bbat/ Accessed January 2016.

California Department of Water Resources (DWR), 2016b. Final Guidebook to Assist Urban Water Suppliers to Prepare a 2015 Urban Water Management Plan. January 2016.

California Department of Water Resources (DWR), 2016c. Final List of Critically Overdrafted Groundwater Basins. Prepared by the California Department of Water Resources, January, 2016. Accessed at: http://www.water.ca.gov/groundwater/sgm/pdfs/COD_BasinsTable.pdf

California Department of Water Resources (DWR), 2016d. Web Site: California Irrigation Management Information System. February 2016. Accessed at: http://www.cimis.water.ca.gov/

California Department of Water Resources (DWR), 2015. Public Water System Statistics. California Natural Resources Agency. 2015.

California Department of Water Resources (DWR), 2014a. Groundwater Basin Prioritization. Final CASGEM Basin Prioritization Results – June 2014. Prepared by California Department of Water Resources, June 2014. Accessed at: http://www.water.ca.gov/groundwater/casgem/pdfs/lists/StatewidePriority_Abridged_05262014.pdf

California Department of Water Resources (DWR), 2014b. Public Water System Statistics. California Natural Resources Agency. 2014.

California Department of Water Resources (DWR), 2013a. Public Water System Statistics. California Natural Resources Agency. 2013.

California Department of Water Resources (DWR), 2013b. California Water Plan, Update 2013. Mountain Counties Area.

California Department of Water Resources (DWR), 2012. Public Water System Statistics. California Natural Resources Agency. 2012.

California Department of Water Resources (DWR), 2011a. Public Water System Statistics. California Natural Resources Agency. 2011.

California Department of Water Resources (DWR). 2011b. Methodologies for Calculating Baseline and Compliance Urban Per Capita Water Use (For the Consistent Implementation of the Water Conservation Act of 2009). February.

California Department of Water Resources (DWR), 2006. California's Groundwater, Bulletin 118. The San Joaquin Valley Groundwater Basin, Tracy Subbasin. Prepared by California Department of Water Resources, January 20, 2006. Accessed at: http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/5-22.15.pdf

California Department of Water Resources (DWR), 2003. California's Groundwater Bulletin 118-Update 2003. October 2003.

California Regional Water Quality Control Board (RWQCB), 2013. Amended Waste Discharge Requirements/NPDES Permit CA0082660, Adopted on 26 July 2013 and amended by Order R5-2014-0122 on 9 October 2014 and Order R5-2015-0043 on 17 April 2015. 2013.

City of Brentwood, 2016. City of Brentwood, About Us webpage. Accessed at: http://www.brentwoodca.gov/about/default.asp Accessed February 2016.

City of Brentwood, 2015a. 2015/16–2019/20 Capital Improvement Program. May.

City of Brentwood, 2015b. 2014/15–2023/24 General Fund Fiscal Model. April.

City of Brentwood, 2014a. Housing Element, Public Review Draft. November 2014.

City of Brentwood, 2014b. City of Brentwood Annual Water Quality Report. Water Testing Performed in 2014. Public Works Department.

City of Brentwood, 2013a. Existing Conditions Report, City of Brentwood General Plan Update. April 9, 2013.

City of Brentwood, 2013b. Recycled Water Feasibility Study for the City of Brentwood, October 2013. Prepared by Robertson-Bryan, Inc.

City of Brentwood, 2011. 2010 Urban Water Management Plan, Final Report, May 24, 2011. Prepared by the City of Brentwood with assistance from ICF International.

City of Brentwood. 2010. 2009/10–2018/19 Fiscal Analysis Model. May.

City of Brentwood, 2006a. Brentwood Water Master Plan, Model Update, Water System Analysis, and Water System Facilities. Prepared by CDM. Adopted March 14, 2006.

City of Brentwood, 2006b. City of Brentwood 2005 Urban Water Management Plan. Prepared by Brown and Caldwell. January 2006.

Contra Costa County Department of Conservation and Development (CCCDCD), 2015. Draft Contra Costa County Groundwater Sustainability Agency Formation. Map created January 21, 2015 by CCCDCD GIS Group.

Contra Costa Local Agency Formation Commission (CCLAFCO), 2007. Water and Wastewater Services Municipal Services Municipal Services Review for East Contra Costa County, approved December 19, 2007. Prepared by Dudek for Contra Costa Local Agency Formation Commission.

Diablo Water District, 2011. Groundwater Monitoring Report, Diablo Water District, August 2011. Prepared by Luhdorff & Scalmanini Consulting Engineers.

Diablo Water District, 2007. Diablo Water District Groundwater Management Plan for AB 3030, May 2007. Prepared by Luhdorff & Scalmanini Consulting Engineers.

East Contra Costa County (ECCC), 2015. East Contra Costa County Integrated Regional Water Management Plan, Update 2015. September 2015.

Hotchkiss, W. R., and Balding, G. O., 1971. *"Geology, Hydrology, and Water Quality of the Tracy-Dos Palos Area, San Joaquin Valley, California."* Open-File Report., U.S. Department of the Interior. Geological Survey. Water Resources Division.

Town of Discovery Bay, 2012. Water Master Plan, Final Report, January 2012. Discovery Bay Community Services District. Prepared by Luhdorff & Scalmanini Consulting Engineers.

Appendix A: DWR Urban Water Management Plan Checklist

This page intentionally left blank.

Checklist Arranged by Subject

CWC Section	UWMP Requirement	Subject	Guidebook Location	UWMP Location *(Optional Column for Agency Use)*
10620(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.	Plan Preparation	Section 2.1	Section 2.1
10620(d)(2)	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.	Plan Preparation	Section 2.5.2	Section 2.2
10642	Provide supporting documentation that the water supplier has encouraged 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.	Plan Preparation	Section 2.5.2	Section 2.2 Appendix A Appendix B
10631(a)	Describe the water supplier service area.	System Description	Section 3.1	Section 3.1
10631(a)	Describe the climate of the service area of the supplier.	System Description	Section 3.3	Section 3.2
10631(a)	Provide population projections for 2020, 2025, 2030, and 2035.	System Description	Section 3.4	Section 3.3
10631(a)	Describe other demographic factors affecting the supplier's water management planning.	System Description	Section 3.4	Section 3.3
10631(a)	Indicate the current population of the service area.	System Description and Baselines and Targets	Sections 3.4 and 5.4	Section 3.3
10631(e)(1)	Quantify past, current, and projected water use, identifying the uses among water use sectors.	System Water Use	Section 4.2	Section 4.1
10631(e)(3)(A)	Report the distribution system water loss for the most recent 12-month period available.	System Water Use	Section 4.3	Section 4.2
10631.1(a)	Include projected water use needed for lower income housing projected in the service area of the supplier.	System Water Use	Section 4.5	Section 4.4
10608.20(b)	Retail suppliers shall adopt a 2020 water use target using one of four methods.	Baselines and Targets	Section 5.7 and App E	Section 5.6.2 and Appendix F
10608.20(e)	Retail suppliers shall provide baseline daily per capita water use, urban water use target,	Baselines and Targets	Chapter 5 and App E	Section 5.6.1

	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.			Appendix F
10608.22	Retail suppliers' per capita daily water use reduction shall be no less than 5 percent of base daily per capita water use of the 5 year baseline. This does not apply if the suppliers base GPCD is at or below 100.	Baselines and Targets	Section 5.7.2	Section 5.3.2 Appendix F
10608.24(a)	Retail suppliers shall meet their interim target by December 31, 2015.	Baselines and Targets	Section 5.8 and App E	5.6.3 Appendix F
10608.24(d)(2)	If the retail supplier adjusts its compliance GPCD using weather normalization, economic adjustment, or extraordinary events, it shall provide the basis for, and data supporting the adjustment.	Baselines and Targets	Section 5.8.2	N/A 5.6.3 Appendix F
10608.36	Wholesale suppliers shall include an assessment of present and proposed future measures, programs, and policies to help their retail water suppliers achieve targeted water use reductions.	Baselines and Targets	Section 5.1	N/A
10608.40	Retail suppliers shall report on their progress in meeting their water use targets. The data shall be reported using a standardized form.	Baselines and Targets	Section 5.8 and App E	5.6.3 Appendix F
10631(b)	Identify and quantify the existing and planned sources of water available for 2015, 2020, 2025, 2030, and 2035.	System Supplies	Chapter 6	Section 6.9
10631(b)	Indicate whether groundwater is an existing or planned source of water available to the supplier.	System Supplies	Section 6.2	Section 6.2
10631(b)(1)	Indicate whether a groundwater management plan has been adopted by the water supplier or if there is any other specific authorization for groundwater management. Include a copy of the plan or authorization.	System Supplies	Section 6.2.2	Section 6.2.2
10631(b)(2)	Describe the groundwater basin.	System Supplies	Section 6.2.1	Section 6.2.1
10631(b)(2)	Indicate if the basin has been adjudicated and include a copy of the court order or decree and a description of the amount of water the supplier has the legal right to pump.	System Supplies	Section 6.2.2	Section 6.2.1
10631(b)(2)	For unadjudicated basins, indicate whether or not the department has identified the basin as overdrafted, or projected to become overdrafted. Describe efforts by the supplier to eliminate the long-term overdraft condition.	System Supplies	Section 6.2.3	Section 6.2.2.1 and 6.2.3

10631(b)(3)	Provide a detailed description and analysis of the location, amount, and sufficiency of groundwater pumped by the urban water supplier for the past five years	System Supplies	Section 6.2.4	Section 6.2.4
10631(b)(4)	Provide a detailed description and analysis of the amount and location of groundwater that is projected to be pumped.	System Supplies	Sections 6.2 and 6.9	Sections 6.2 and 6.9
10631(d)	Describe the opportunities for exchanges or transfers of water on a short-term or long-term basis.	System Supplies	Section 6.7	Section 6.7
10631(g)	Describe the expected future water supply projects and programs that may be undertaken by the water supplier to address water supply reliability in average, single-dry, and multiple-dry years.	System Supplies	Section 6.8	Section 6.8
10631(h)	Describe desalinated water project opportunities for long-term supply.	System Supplies	Section 6.6	Section 6.6
10631(j)	Retail suppliers will include documentation that they have provided their wholesale supplier(s) – if any - with water use projections from that source.	System Supplies	Section 2.5.1	Section 2.2
10631(j)	Wholesale suppliers will include documentation that they have provided their urban water suppliers with identification and quantification of the existing and planned sources of water available from the wholesale to the urban supplier during various water year types.	System Supplies	Section 2.5.1	N/A
10633	For wastewater and recycled water, coordinate with local water, wastewater, groundwater, and planning agencies that operate within the supplier's service area.	System Supplies (Recycled Water)	Section 6.5.1	Section 6.5.1
10633(a)	Describe the wastewater collection and treatment systems in the supplier's service area. Include quantification of the amount of wastewater collected and treated and the methods of wastewater disposal.	System Supplies (Recycled Water)	Section 6.5.2	Section 6.5.2
10633(b)	Describe the quantity of treated wastewater that meets recycled water standards, is being discharged, and is otherwise available for use in a recycled water project.	System Supplies (Recycled Water)	Section 6.5.2.2	Section 6.5.2.1 and 6.5.2.2
10633(c)	Describe the recycled water currently being used in the supplier's service area.	System Supplies (Recycled Water)	Section 6.5.3 and 6.5.4	Section 6.5.3 and 6.5.4
10633(d)	Describe and quantify the potential uses of recycled water and provide a determination of the technical and economic feasibility of those uses.	System Supplies (Recycled Water)	Section 6.5.4	Section 6.5.4.1
10633(e)	Describe the projected use of recycled water within the supplier's service area at the end	System Supplies (Recycled	Section 6.5.4	Section 6.5.4.1

	of 5, 10, 15, and 20 years, and a description of the actual use of recycled water in comparison to uses previously projected.	Water)		
10633(f)	Describe the actions which may be taken to encourage the use of recycled water and the projected results of these actions in terms of acre-feet of recycled water used per year.	System Supplies (Recycled Water)	Section 6.5.5	Section 6.5.5
10633(g)	Provide a plan for optimizing the use of recycled water in the supplier's service area.	System Supplies (Recycled Water)	Section 6.5.5	Section 6.5.5
10620(f)	Describe water management tools and options to maximize resources and minimize the need to import water from other regions.	Water Supply Reliability Assessment	Section 7.4	Section 7.4
10631(c)(1)	Describe the reliability of the water supply and vulnerability to seasonal or climatic shortage.	Water Supply Reliability Assessment	Section 7.1	Section 7.1 and 7.2
10631(c)(1)	Provide data for an average water year, a single dry water year, and multiple dry water years	Water Supply Reliability Assessment	Section 7.2	Section 7.2
10631(c)(2)	For any water source that may not be available at a consistent level of use, describe plans to supplement or replace that source.	Water Supply Reliability Assessment	Section 7.1	N/A
10634	Provide information on the quality of existing sources of water available to the supplier and the manner in which water quality affects water management strategies and supply reliability	Water Supply Reliability Assessment	Section 7.1	Section 7.1
10635(a)	Assess the water supply reliability during normal, dry, and multiple dry water years by comparing the total water supply sources available to the water supplier with the total projected water use over the next 20 years.	Water Supply Reliability Assessment	Section 7.3	Section 7.3
10632(a) and 10632(a)(1)	Provide an urban water shortage contingency analysis that specifies stages of action and an outline of specific water supply conditions at each stage.	Water Shortage Contingency Planning	Section 8.1	Section 8.1
10632(a)(2)	Provide 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.	Water Shortage Contingency Planning	Section 8.9	Section 8.9
10632(a)(3)	Identify actions to be undertaken by the urban water supplier in case of a catastrophic interruption of water supplies.	Water Shortage Contingency Planning	Section 8.8	Section 8.8
10632(a)(4)	Identify mandatory prohibitions against specific water use practices during water shortages.	Water Shortage Contingency Planning	Section 8.2	Section 8.2
10632(a)(5)	Specify consumption reduction methods in the most restrictive stages.	Water Shortage Contingency Planning	Section 8.4	Section 8.4

10632(a)(6)	Indicated penalties or charges for excessive use, where applicable.	Water Shortage Contingency Planning	Section 8.3	Section 8.3
10632(a)(7)	Provide an analysis of the impacts of each of the actions and conditions in the water shortage contingency analysis on the revenues and expenditures of the urban water supplier, and proposed measures to overcome those impacts.	Water Shortage Contingency Planning	Section 8.6	Section 8.6 Appendix G
10632(a)(8)	Provide a draft water shortage contingency resolution or ordinance.	Water Shortage Contingency Planning	Section 8.7	Water Contingency Plan Appendix G
10632(a)(9)	Indicate a mechanism for determining actual reductions in water use pursuant to the water shortage contingency analysis.	Water Shortage Contingency Planning	Section 8.5	Section 8.5
10631(f)(1)	Retail suppliers shall provide a description of the nature and extent of each demand management measure implemented over the past five years. The description will address specific measures listed in code.	Demand Management Measures	Sections 9.2 and 9.3	Section 9
10631(f)(2)	Wholesale suppliers shall describe specific demand management measures listed in code, their distribution system asset management program, and supplier assistance program.	Demand Management Measures	Sections 9.1 and 9.3	N/A
10631(i)	CUWCC members may submit their 2013-2014 CUWCC BMP annual reports in lieu of, or in addition to, describing the DMM implementation in their UWMPs. This option is only allowable if the supplier has been found to be in full compliance with the CUWCC MOU.	Demand Management Measures	Section 9.5	Appendix H
10608.26(a)	Retail suppliers shall conduct a public hearing to discuss adoption, implementation, and economic impact of water use targets.	Plan Adoption, Submittal, and Implementation	Section 10.3	Section 10.3
10621(b)	Notify, at least 60 days prior to the public hearing, any city or county within which the supplier provides water that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan.	Plan Adoption, Submittal, and Implementation	Section 10.2.1	Section 10.2 Appendix A
10621(d)	Each urban water supplier shall update and submit its 2015 plan to the department by July 1, 2016.	Plan Adoption, Submittal, and Implementation	Sections 10.3.1 and 10.4	Section 10.4
10635(b)	Provide supporting documentation that Water Shortage Contingency Plan has been, or will be, provided to any city or county within which it provides water, no later than 60 days after the submission of the plan to DWR.	Plan Adoption, Submittal, and Implementation	Section 10.4.4	Section 10.4

10642	Provide supporting documentation that the urban water supplier made the plan available for public inspection, published notice of the public hearing, and held a public hearing about the plan.	Plan Adoption, Submittal, and Implementation	Sections 10.2.2, 10.3, and 10.5	Appendix B
10642	The water supplier is to provide the time and place of the hearing to any city or county within which the supplier provides water.	Plan Adoption, Submittal, and Implementation	Sections 10.2.1	Section 10.3 Appendix B
10642	Provide supporting documentation that the plan has been adopted as prepared or modified.	Plan Adoption, Submittal, and Implementation	Section 10.3.1	Section 10.3 Appendix C
10644(a)	Provide supporting documentation that the urban water supplier has submitted this UWMP to the California State Library.	Plan Adoption, Submittal, and Implementation	Section 10.4.3	Section 10.4
10644(a)(1)	Provide supporting documentation that the urban water supplier has submitted this UWMP to any city or county within which the supplier provides water no later than 30 days after adoption.	Plan Adoption, Submittal, and Implementation	Section 10.4.4	Section 10.4
10644(a)(2)	The plan, or amendments to the plan, submitted to the department shall be submitted electronically.	Plan Adoption, Submittal, and Implementation	Sections 10.4.1 and 10.4.2	Section 10.4
10645	Provide supporting documentation that, not later than 30 days after filing a copy of its plan with the department, the supplier has or will make the plan available for public review during normal business hours.	Plan Adoption, Submittal, and Implementation	Section 10.5	Section 10.4

Appendix B: Documentation of City/County Notification

This page intentionally left blank.

THE CITY OF
BRENTWOOD
HERITAGE • VISION • OPPORTUNITY

February 23, 2016

Mike Yeraka, General Manager
Diablo Water District
87 Carol Lane
Oakley, CA 94561

Re: Notification of Preparation of Urban Water Management Plan – 2015 Update

Dear Mr. Yeraka:

The City of Brentwood is currently in the process of updating its Urban Water Management Plan (UWMP) which was last prepared in 2010. The Urban Water Management Planning Act requires every urban water supplier 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 to prepare and adopt an UWMP and periodically update that plan at least every five years. The UWMP is a planning document and a source document which reports, describes and evaluates water deliveries and uses, water supply sources and conservation efforts.

As an urban water supplier, the City coordinates with water management agencies, relevant public agencies and other water suppliers on the preparation of the UWMP update. The City will be reviewing the UWMP and will make amendments and updates as appropriate.

If you wish to contact the City about the UWMP update, please direct any questions to Diana Williford, Water Conservation Specialist, at (925) 516-6045 or dwilliford@brentwoodca.gov.

Sincerely,

Chris Ehlers
Interim Director of Public Works

PUBLIC WORKS DEPARTMENT
150 City Park Way, Brentwood, CA 94513-1164
www.brentwoodca.gov

Operations Division
2201 Elkins Way, Brentwood, CA 94513-7344
Phone (925) 516-6000—Fax (925) 516-6001

Solid Waste Operations
2301 Elkins Way, Brentwood, CA 94513-7350
Phone (925) 516-6090—Fax (925) 516- 6091

Wastewater Operations
2251 Elkins Way, Brentwood, CA 94513-7344
Phone (925) 516-6060—Fax (925) 516-6061

THE CITY OF
BRENTWOOD
HERITAGE • VISION • OPPORTUNITY

February 23, 2016

Ron Bernal, Public Works Director/City Engineer
City of Antioch
200 H Street
Antioch, CA 94531

Re: Notification of Preparation of Urban Water Management Plan – 2015 Update

Dear Mr. Bernal:

The City of Brentwood is currently in the process of updating its Urban Water Management Plan (UWMP) which was last prepared in 2010. The Urban Water Management Planning Act requires every urban water supplier 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 to prepare and adopt an UWMP and periodically update that plan at least every five years. The UWMP is a planning document and a source document which reports, describes and evaluates water deliveries and uses, water supply sources and conservation efforts.

As an urban water supplier, the City coordinates with water management agencies, relevant public agencies and other water suppliers on the preparation of the UWMP update. The City will be reviewing the UWMP and will make amendments and updates as appropriate.

If you wish to contact the City about the UWMP update, please direct any questions to Diana Williford, Water Conservation Specialist, at (925) 516-6045 or dwilliford@brentwoodca.gov.

Sincerely,

Chris Ehlers
Interim Director of Public Works

PUBLIC WORKS DEPARTMENT
150 City Park Way, Brentwood, CA 94513-1164
www.brentwoodca.gov

Operations Division
2201 Elkins Way, Brentwood, CA 94513-7344
Phone (925) 516-6000—Fax (925) 516-6001

Solid Waste Operations
2301 Elkins Way, Brentwood, CA 94513-7350
Phone (925) 516-6090—Fax (925) 516- 6091

Wastewater Operations
2251 Elkins Way, Brentwood, CA 94513-7344
Phone (925) 516-6060—Fax (925) 516-6061

THE CITY OF
BRENTWOOD
HERITAGE • VISION • OPPORTUNITY

February 23, 2016

Supervisor Mary Nejedly-Piepho
County Supervisor, District III
3361 Walnut Blvd., Suite 140
Brentwood, CA 94513

Re: Notification of Preparation of Urban Water Management Plan – 2015 Update

Dear Supervisor Mary Nejedly-Piepho:

The City of Brentwood is currently in the process of updating its Urban Water Management Plan (UWMP) which was last prepared in 2010. The Urban Water Management Planning Act requires every urban water supplier 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 to prepare and adopt an UWMP and periodically update that plan at least every five years. The UWMP is a planning document and a source document which reports, describes and evaluates water deliveries and uses, water supply sources and conservation efforts.

As an urban water supplier, the City coordinates with water management agencies, relevant public agencies and other water suppliers on the preparation of the UWMP update. The City will be reviewing the UWMP and will make amendments and updates as appropriate.

If you wish to contact the City about the UWMP update, please direct any questions to Diana Williford, Water Conservation Specialist, at (925) 516-6045 or dwilliford@brentwoodca.gov.

Sincerely,

Chris Ehlers
Interim Director of Public Works

PUBLIC WORKS DEPARTMENT
150 City Park Way, Brentwood, CA 94513-1164
www.brentwoodca.gov

Operations Division
2201 Elkins Way, Brentwood, CA 94513-7344
Phone (925) 516-6000—Fax (925) 516-6001

Solid Waste Operations
2301 Elkins Way, Brentwood, CA 94513-7350
Phone (925) 516-6090—Fax (925) 516- 6091

Wastewater Operations
2251 Elkins Way, Brentwood, CA 94513-7344
Phone (925) 516-6060—Fax (925) 516-6061

THE CITY OF
BRENTWOOD
HERITAGE • VISION • OPPORTUNITY

February 23, 2016

Jerry D. Brown, General Manager
Contra Costa Water District
1331 Concord Avenue
Concord, CA 94520

Re: Notification of Preparation of Urban Water Management Plan – 2015 Update

Dear Mr. Brown:

The City of Brentwood is currently in the process of updating its Urban Water Management Plan (UWMP) which was last prepared in 2010. The Urban Water Management Planning Act requires every urban water supplier 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 to prepare and adopt an UWMP and periodically update that plan at least every five years. The UWMP is a planning document and a source document which reports, describes and evaluates water deliveries and uses, water supply sources and conservation efforts.

As an urban water supplier, the City coordinates with water management agencies, relevant public agencies and other water suppliers on the preparation of the UWMP update. The City will be reviewing the UWMP and will make amendments and updates as appropriate.

If you wish to contact the City about the UWMP update, please direct any questions to Diana Williford, Water Conservation Specialist, at (925) 516-6045 or dwilliford@brentwoodca.gov.

Sincerely,

Chris Ehlers
Interim Director of Public Works

PUBLIC WORKS DEPARTMENT
150 City Park Way, Brentwood, CA 94513-1164
www.brentwoodca.gov

Operations Division
2201 Elkins Way, Brentwood, CA 94513-7344
Phone (925) 516-6000—Fax (925) 516-6001

Solid Waste Operations
2301 Elkins Way, Brentwood, CA 94513-7350
Phone (925) 516-6090—Fax (925) 516- 6091

Wastewater Operations
2251 Elkins Way, Brentwood, CA 94513-7344
Phone (925) 516-6060—Fax (925) 516-6061

THE CITY OF
BRENTWOOD
HERITAGE • VISION • OPPORTUNITY

February 23, 2016

Virgil Koehne, Water Manager
Town of Discovery Bay
1800 Willow Lake Road
Discovery Bay, CA 94505

Re: Notification of Preparation of Urban Water Management Plan – 2015 Update

Dear Mr. Koehne:

The City of Brentwood is currently in the process of updating its Urban Water Management Plan (UWMP) which was last prepared in 2010. The Urban Water Management Planning Act requires every urban water supplier 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 to prepare and adopt an UWMP and periodically update that plan at least every five years. The UWMP is a planning document and a source document which reports, describes and evaluates water deliveries and uses, water supply sources and conservation efforts.

As an urban water supplier, the City coordinates with water management agencies, relevant public agencies and other water suppliers on the preparation of the UWMP update. The City will be reviewing the UWMP and will make amendments and updates as appropriate.

If you wish to contact the City about the UWMP update, please direct any questions to Diana Williford, Water Conservation Specialist, at (925) 516-6045 or dwilliford@brentwoodca.gov.

Sincerely,

Chris Ehlers
Interim Director of Public Works

PUBLIC WORKS DEPARTMENT
150 City Park Way, Brentwood, CA 94513-1164
www.brentwoodca.gov

Operations Division
2201 Elkins Way, Brentwood, CA 94513-7344
Phone (925) 516-6000—Fax (925) 516-6001

Solid Waste Operations
2301 Elkins Way, Brentwood, CA 94513-7350
Phone (925) 516-6090—Fax (925) 516- 6091

Wastewater Operations
2251 Elkins Way, Brentwood, CA 94513-7344
Phone (925) 516-6060—Fax (925) 516-6061

THE CITY OF
BRENTWOOD
HERITAGE • VISION • OPPORTUNITY

February 23, 2016

Patricia Corey, General Manager
East Contra Costa Irrigation District
1711 Sellers Avenue
Brentwood, CA 94513

Re: Notification of Preparation of Urban Water Management Plan – 2015 Update

Dear Ms. Corey:

The City of Brentwood is currently in the process of updating its Urban Water Management Plan (UWMP) which was last prepared in 2010. The Urban Water Management Planning Act requires every urban water supplier 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 to prepare and adopt an UWMP and periodically update that plan at least every five years. The UWMP is a planning document and a source document which reports, describes and evaluates water deliveries and uses, water supply sources and conservation efforts.

As an urban water supplier, the City coordinates with water management agencies, relevant public agencies and other water suppliers on the preparation of the UWMP update. The City will be reviewing the UWMP and will make amendments and updates as appropriate.

If you wish to contact the City about the UWMP update, please direct any questions to Diana Williford, Water Conservation Specialist, at (925) 516-6045 or dwilliford@brentwoodca.gov.

Sincerely,

Chris Ehlers
Interim Director of Public Works

PUBLIC WORKS DEPARTMENT
150 City Park Way, Brentwood, CA 94513-1164
www.brentwoodca.gov

Operations Division
2201 Elkins Way, Brentwood, CA 94513-7344
Phone (925) 516-6000—Fax (925) 516-6001

Solid Waste Operations
2301 Elkins Way, Brentwood, CA 94513-7350
Phone (925) 516-6090—Fax (925) 516- 6091

Wastewater Operations
2251 Elkins Way, Brentwood, CA 94513-7344
Phone (925) 516-6060—Fax (925) 516-6061

From: Ehlers, Chris
Sent: Monday, March 14, 2016 7:24 AM
To: =yCouncil Members
Cc: Vina, Gustavo; Brower, Damien
Subject: Urban Water Management Plan

Good morning Mayor and Council Members:

The City of Brentwood is currently in the process of updating its Urban Water Management Plan (UWMP) which was last updated in 2010. The Urban Water Management Planning Act requires every urban water supplier 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 to prepare and adopt an UWMP and periodically update that plan at least every five years. It also requires notification of the plan update be sent to neighboring agencies and direct Boards/Councils. The UWMP is a planning and a source document which reports, describes and evaluates water deliveries and uses, water supply sources, drought stages, and conservation efforts.

As an urban water supplier, the City coordinates with water management agencies, relevant public agencies and other water suppliers on the preparation of the UWMP update. City staff is currently reviewing the UWMP and making amendments and updates as appropriate and will be bringing the State accepted plan to the Council for adoption later this year. It probably won't come as a surprise to you that the state is behind in the guidance documents and the documents needed to prepare the plan have just been released for the 2015 update.

If you have any questions please contact me directly.

Thank you,

Chris

Chris Ehlers | Interim Director of Public Works
City of Brentwood | Public Works/Operations
2201 Elkins Way | Brentwood, CA 94513-7344
☎ (925) 516-6000 | 🖷 (925) 516-6001 | ✉ cehlers@brentwoodca.gov

Heritage – Vision – Opportunity

This page intentionally left blank.

Appendix C: Notice of Public Hearing

This page intentionally left blank.

PROOF OF PUBLICATION

THE PRESS

CITY OF BRENTWOOD
NOTICE OF PUBLIC HEARING

STATE OF CALIFORNIA
COUNTY OF CONTRA COSTA

Connie O'Neill of said County, does hereby certify:

That she is and was during all the times herein mentioned, a citizen of the United States, over the age of 21 years and neither a party to nor in any way interested in the matter or action herein set forth, and is and was competent to be a witness in said matter or action:

That she is now and at all times herein mentioned was the principal clerk of the **BRENTWOOD PRESS**, publishers of the **BRENTWOOD PRESS (No. 02-1273)**, which is and was at all times herein mentioned a newspaper of general circulation printed and published weekly in the City of Brentwood, County of Contra Costa, State of California, and as such principal clerk has now and at all of said times had charge of all legal notices and advertisements in said newspaper; that said **BRENTWOOD PRESS** is now and was at all times herein mentioned a newspaper of general circulation as that term is defined by Section 6000 of the Government Code, and as provided by said Section, is and at all of said times was published for the dissemination of local and telegraphic news and intelligence of a general character, having a bona fide subscription list of paying subscribers, and is not and at none of said times was devoted to the interests or published for the entertainment or instruction of a particular class, profession, trade, calling, race or denomination, or for any number of such classes, professions, trades, callings, races or denominations; that at all times said newspaper has been established, printed and published at regular intervals in said County and State, for more than one year preceding the date of the first publication of the notice herein mentioned; that said notice was set in type not smaller than nonpareil, and was preceded with words printed in black face type not smaller than nonpareil, describing and expressing in general terms the purport and character of the notice intended to be given.

THAT THE

NOTICE OF PUBLIC HEARING

of which the annexed is a printed copy, was published in said newspaper and not in any supplement thereof on the following dates, to-wit:

May 6, 13, 2016

I certify (or declare) under penalty of perjury that the foregoing is true and correct.
Dated this 13 day of May 2016

AD#: 69747

SIGNATURE C O'Neill

NOTICE OF PUBLIC HEARING

Notice is hereby given that the City Council of the City of Brentwood will, at **7:00 p.m.** or as soon thereafter as the normal course of business permits on **May 24, 2016,** hold a public hearing to consider the following: **Consideration of Adoption of a Resolution of the City Council of the City of Brentwood approving the Draft 2015 Urban Water Management Plan for submittal to the Department of Water Resources as prepared by City staff and Brown and Caldwell, Engineering Consultants. Said hearing will be held at the City Council Chambers, 150 City Park Way, Brentwood, California.** Further information may be obtained from City Hall, 150 City Park Way, Brentwood, California 94513, (925) 516- 5400. In any court challenge of City Council decisions, you may be limited to raising only those issues you or someone else raised at the public hearing described in this notice, or in written correspondence delivered to the Brentwood City Council at, or prior to, the public hearing. Brentwood Press No: 02- 1273/**69747** Publish Dates: May 6, 13, 2016.

This page intentionally left blank.

Appendix D: Adoption Resolution and Notice of Public Availability

This page intentionally left blank.

C.1 Approved the Minutes of the City Council/Successor Agency meeting of May 10, 2016. (M. Wimberly)

C.2 Adopted **Resolution 2016-57** required for securing State Revolving Fund funding for the Non-Potable Storage Facility and the Non-Potable Water Distribution System – Phase III, CIP Projects No.'s 592-59198 and 592-59170; and authorizing the City Manager or designee to take certain actions regarding the repayment of moneys owed the State of California for the financing of certain water and wastewater infrastructure projects; and repealing Resolutions 2015-85 and 2015-116. (M. Tsubota/C. Ehlers/C. Wichert)

C.3 Adopted **Resolution 2016-58** authorizing the City Manager or designee to amend the Purchase Order for Antioch Building Materials to increase the amount by $25,000, for a not to exceed amount of $75,000. (M. Tsubota/C. Ehlers/C. Ziemann)

C.4 Adopted **Resolution 2016-59** accepting the work performed by Alex Kushner General Contractor for the Police Building Improvements, CIP Project No. 337-37219 and directing the City Clerk to file a Notice of Completion with the County Recorder. (M. Evenson/W. Gomes)

C.5 Adopted **Resolution 2016-60** approving and authorizing the City Manager, or his designee, to execute Side Letters of Agreement between the City of Brentwood and 1) Supervisors and Professionals Employees' Association; and 2) Brentwood Employees' Association/ Miscellaneous Office Division. (K. Breen/P. Standley).

C.6 Adopted **Resolution 2016-61** accepting a 32,690 square-foot section of street landscape improvements for maintenance by the City along both sides of Armstrong Road, from Nunn Street south to Mills Drive on the west side, and one-half block past Mills Drive on the east side, for Phase II of Subdivision 9154 (Mission Grove), and directing the City Clerk to file this resolution with the Recorder of Contra Costa County (C. McCann/J. Zilm) **Council Member Clare abstained.**

C.7 Adopted **Resolution 2016-62** accepting the Fairview Avenue at Baldwin Drive Traffic Signal, CIP Project No. 336-31693 for maintenance; and

directing the City Clerk to file this Resolution with the Recorder of Contra Costa County for these improvements. (M. Tsubota/S. Kersevan)

C.8 Adopted **Resolution 2016-69** approving the contract documents, awarding the bid and authorizing the City Manager or designee to execute a construction contract and necessary documents for the 2016 Pavement Management Program and Trail Pavement Management, CIP Project Nos. 336-30836 and 352-52413 with Sierra Nevada Construction in the amount of $1,115,929.50, plus a 10% contingency of $111,592.95, for a total amount of $1,227,522.45. (M. Tsubota/J. Samuelson/L. Sanders) -

C.9 Adopted **Resolution 2016-63** adopting the 2016/17 Proposition 4 Appropriations Limit using the change in the State per capita income of 5.37% as the cost-of-living factor and the change in the City population factor of 3.00% to calculate the Limit. (K. Breen/C. Andrews)

C.10 Adopted **Resolution 2016-64** calling and giving notice of the holding of a general municipal election on Tuesday, November 8, 2016, for the election of one [1] Mayor and two [2] Council Members for four year terms; Adopted **Resolution 2016-65** requesting the Board of Supervisors of the County of Contra Costa to consolidate the election; and Adopted **Resolution 2016-66** adopting Regulations for candidates for elective office pertaining to candidate statements submitted to the voters at the election. (G. Vina/M. Wimberly)

C.11 Appointed of the following candidates to two-year terms as a City of Brentwood Youth Commissioner: Waley Ahmed, Kayley Phillips, Emily Strauss, and Olivia Terry. (B. Mulder/P. Scherff/S. Dempsey)

C.12 Adopted **Resolution 2016-67** approving and authorizing the City Manager or designee to execute a Revocable License Agreement between the City of Brentwood, Trilogy Vineyards, LLC, and Vineyards at Marsh Creek Homeowners Association to enter, construct and maintain agricultural parcels within the Trilogy Vineyards development. (B. Mulder/A. Wanden)

C.13 Adopted **Resolution 2016-68** approving and authorizing the City Manager or designee to execute Amendment No. 1 to an Agreement for Strategic Communications Consulting Services with APCO Worldwide Incorporated to include Phases III and IV; and increasing the Agreement amount by

$84,750, for a not to exceed amount of $134,250 (all of which will be reimbursed by the East Contra Costa Fire Protection District). (G. Vina/K. Reed)

C.14 Appointed Shurvone P. Wright to a term of the Brentwood Advisory Neighborhood Committee (BANC). (B. Mulder/P. Scherff)

D.1 Adopted **Resolution 2016-70** 1) Adopting the Negative Declaration; 2) Adopting the 2016/17 – 2020/21 Capital Improvement Program (CIP) and the associated budget for FY 2016/17 for the City of Brentwood including roadway, park, wastewater, water and other municipal improvements to be constructed during the next five years; and 3) Directing that a Notice of Determination be filed with the County Clerk. (K. Breen/S. Tonkel)

D.2 Adopted **Resolution 2016-71** approving the Draft 2015 Urban Water Management Plan for submittal to the Department of Water Resources as prepared by City staff and Brown and Caldwell, Engineering Consultants. (M. Tsubota/C. Ehlers/E. Brennan/D. Williford)

D.3 Waived first reading and introduced **Ordinances 971 and 922** for Rezones Initiated by the City of Brentwood to Amend Title 17 (Zoning) Of the Brentwood Municipal Code by Adding Chapter 17.780 and Chapter 17.790 Related To Wireless Facilities. (D. Brower/C. McCann)

This page intentionally left blank.

201 North Civic Drive
Suite 115
Walnut Creek, California 94523

T: 925.937.9010
F: 925.937.9026

June 14, 2016

Ms. Gwen Huff
Senior Environmental Scientist
Urban Water Use Efficiency Unit
Department of Water Resources
P.O. Box 942836
Sacramento, California 94236-0001

1011-148731

Subject: 2015 Urban Water Management Plan

Dear Ms. Huff:

On behalf of Mr. Eric Brennan, Water Operations Manager for the City of Brentwood, Brown and Caldwell has submitted this 2015 UWMP to the California State Library, and has made this 2015 UWMP available for public review during normal business hours at the City offices.

Please let me know if you have any questions.

Very truly yours,

Brown and Caldwell

Erin Mackey, P.E., Ph.D.
Project Manager

RG/EM:dem

This page intentionally left blank.

201 North Civic Drive
Suite 115
Walnut Creek, California 94523

T: 925.937.9010
F: 925.937.9026

June 17, 2016

Ms. Gwen Huff
Senior Environmental Scientist
Urban Water Use Efficiency Unit
Department of Water Resources
P.O. Box 942836
Sacramento, California 94236-0001

1011-148731

Subject: 2015 Urban Water Management Plan

Dear Ms. Huff:

On behalf of Mr. Eric Brennan, Water Operations Manager for the City of Brentwood, Brown and Caldwell has submitted this 2015 UWMP to the California State Library, and has made this 2015 UWMP available for public review during normal business hours at the City offices.

Please let me know if you have any questions.

Very truly yours,

Brown and Caldwell

Erin Mackey, P.E., Ph.D.
Project Manager

RG/EM:dem

This page intentionally left blank.

Appendix E: Distribution System Water Loss Audit

This page intentionally left blank.

AWWA Free Water Audit Software v5.0

This spreadsheet-based water audit tool is designed to help quantify and track water losses associated with water distribution systems and identify areas for improved efficiency and cost recovery. It provides a "top-down" summary water audit format, and is not meant to take the place of a full-scale, comprehensive water audit format.

Auditors are strongly encouraged to refer to the most current edition of AWWA M36 Manual for Water Audits for detailed guidance on the water auditing process and targetting loss reduction levels

The spreadsheet contains several separate worksheets. Sheets can be accessed using the tabs towards the bottom of the screen, or by clicking the buttons below.

Please begin by providing the following information

Name of Contact Person:	Diana Williford
Email Address:	dwilliford@brentwoodca.gov
Telephone | Ext.:	9255166045
Name of City / Utility:	City of Brentwood
City/Town/Municipality:	Brentwood
State / Province:	California (CA)
Country:	USA
Year:	2015 Calendar Year
Audit Preparation Date:	3/28/2016
Volume Reporting Units:	Million gallons (US)
PWSID / Other ID:	0710004

The following guidance will help you complete the Audit

All audit data are entered on the ***Reporting Worksheet***

- Value can be entered by user
- Value calculated based on input data
- These cells contain recommended default values

Use of Option (Radio) Buttons: Pcnt: 0.25% Value:

Select the default percentage by choosing the option button on the left

To enter a value, choose this button and enter a value in the cell to the right

The following worksheets are available by clicking the buttons below or selecting the tabs along the bottom of the page

Instructions
The current sheet. Enter contact information and basic audit details (year, units etc)

Reporting Worksheet
Enter the required data on this worksheet to calculate the water balance and data grading

Comments
Enter comments to explain how values were calculated or to document data sources

Performance Indicators
Review the performance indicators to evaluate the results of the audit

Water Balance
The values entered in the Reporting Worksheet are used to populate the Water Balance

Dashboard
A graphical summary of the water balance and Non-Revenue Water components

Grading Matrix
Presents the possible grading options for each input component of the audit

Service Connection Diagram
Diagrams depicting possible customer service connection line configurations

Definitions
Use this sheet to understand the terms used in the audit process

Loss Control Planning
Use this sheet to interpret the results of the audit validity score and performance indicators

Example Audits
Reporting Worksheet and Performance Indicators examples are shown for two validated audits

Acknowledgements
Acknowledgements for the AWWA Free Water Audit Software v5.0

If you have questions or comments regarding the software please contact us via email at: wlc@awwa.org

AWWA Free Water Audit Software:
Reporting Worksheet

WAS v5.0

? Click to access definition
+ Click to add a comment

Water Audit Report for: City of Brentwood (0710004)
Reporting Year: 2015 1/2015 - 12/2015

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

Master Meter and Supply Error Adjustments

WATER SUPPLIED

<---------- Enter grading in column 'E' and 'J' ---------->

					Pcnt:	Value:	
Volume from own sources:	10	1,963.074	MG/Yr	10	1.25%		MG/Yr
Water imported:	10	705.108	MG/Yr	10	1.25%		MG/Yr
Water exported:	n/a	0.000	MG/Yr				MG/Yr

Enter negative % or value for under-registration
Enter positive % or value for over-registration

WATER SUPPLIED: 2,635.241 MG/Yr

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

			Pcnt:	Value:	
Billed metered:	10	2,583.126	MG/Yr			
Billed unmetered:	10	0.000	MG/Yr			
Unbilled metered:	10	0.000	MG/Yr			
Unbilled unmetered:		32.941	MG/Yr	1.25%		MG/Yr

Default option selected for Unbilled unmetered - a grading of 5 is applied but not displayed

AUTHORIZED CONSUMPTION: 2,616.067 MG/Yr

Use buttons to select percentage of water supplied **OR** value

WATER LOSSES (Water Supplied - Authorized Consumption) 19.175 MG/Yr

Apparent Losses

			Pcnt:	Value:	
Unauthorized consumption:		6.588	MG/Yr	0.25%		MG/Yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies:	8	0.000	MG/Yr		MG/Yr
Systematic data handling errors:		6.458	MG/Yr	0.25%	MG/Yr

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

Apparent Losses: 13.046 MG/Yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: 6.129 MG/Yr

WATER LOSSES: 19.175 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 52.115 MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	10	283.0	miles	
Number of active AND inactive service connections:	10	18,417		
Service connection density:		65	conn./mile main	

Are customer meters typically located at the curbstop or property line? Yes

Average length of customer service line: (length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line has been set to zero and a data grading score of 10 has been applied

Average operating pressure:	10	60.0	psi	

COST DATA

Total annual cost of operating water system:	10	$21,728,851	$/Year	
Customer retail unit cost (applied to Apparent Losses):	10	$4.18	$/1000 gallons (US)	
Variable production cost (applied to Real Losses):	10	$583.00	$/Million gallons	☐ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 92 out of 100 *****

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Unauthorized consumption
2: Systematic data handling errors
3: Customer metering inaccuracies

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

Water Audit Report for: City of Brentwood (0710004)
Reporting Year: 2015 | 1/2015 - 12/2015

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 92 out of 100 ***

System Attributes:

	Apparent Losses:	13.046	MG/Yr
+	Real Losses:	6.129	MG/Yr
=	**Water Losses:**	**19.175**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	94.03	MG/Yr
	Annual cost of Apparent Losses:	$54,532	
	Annual cost of Real Losses:	$3,573	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	2.0%	
	Non-revenue water as percent by cost of operating system:	0.4%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	1.94	gallons/connection/day
	Real Losses per service connection per day:	0.91	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.02	gallons/connection/day/psi

	From Above, Real Losses = Current Annual Real Losses (CARL):	6.13	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:	0.07	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software:
User Comments

Use this worksheet to add comments or notes to explain how an input value was calculated, or to document the sources of the information used.

General Comment:	

Audit Item	Comment
Volume from own sources:	
Vol. from own sources: Master meter error adjustment:	
Water imported:	
Water imported: master meter error adjustment:	
Water exported:	
Water exported: master meter error adjustment:	
Billed metered:	
Billed unmetered:	
Unbilled metered:	

Audit Item	Comment
Unbilled unmetered:	
Unauthorized consumption:	
Customer metering inaccuracies:	
Systematic data handling errors:	
Length of mains:	
Number of active AND inactive service connections:	
Average length of customer service line:	
Average operating pressure:	
Total annual cost of operating water system:	
Customer retail unit cost (applied to Apparent Losses):	Average of tier unit costs (3.17 + 3.78 + 4.52 + 5.27)
Variable production cost (applied to Real Losses):	$583 is the average of Wells $386, Randall-Bold WTP $435, and the Brentwood WTP $829.

AWWA Free Water Audit Software: Water Balance

WAS v5.0

Water Audit Report for:	City of Brentwood (0710004)	
Reporting Year:	2015	1/2015 - 12/2015
Data Validity Score:	92	

<table>
<tr><td rowspan="10">Own Sources
(Adjusted for known errors)
1,938.839</td><td>Water Exported
0.000</td><td colspan="3">Billed Water Exported</td></tr>
<tr><td rowspan="9">Water Supplied
2,635.241</td><td rowspan="3">Authorized Consumption
2,616.067</td><td rowspan="2">Billed Authorized Consumption
2,583.126</td><td>Billed Metered Consumption (water exported is removed)
2,583.126</td><td rowspan="2">Revenue Water
2,583.126</td></tr>
<tr><td>Billed Unmetered Consumption
0.000</td></tr>
<tr><td rowspan="2">Unbilled Authorized Consumption
32.941</td><td>Unbilled Metered Consumption
0.000</td><td rowspan="3">Non-Revenue Water (NRW)
52.115</td></tr>
<tr><td>Unbilled Unmetered Consumption
32.941</td></tr>
<tr><td rowspan="5">Water Losses
19.175</td><td rowspan="3">Apparent Losses
13.046</td><td>Unauthorized Consumption
6.588</td></tr>
<tr><td>Customer Metering Inaccuracies
0.000</td></tr>
<tr><td>Systematic Data Handling Errors
6.458</td></tr>
<tr><td rowspan="3">Real Losses
6.129</td><td>Leakage on Transmission and/or Distribution Mains
Not broken down</td></tr>
<tr><td>Water Imported
696.403</td><td>Leakage and Overflows at Utility's Storage Tanks
Not broken down</td></tr>
<tr><td>Leakage on Service Connections
Not broken down</td></tr>
</table>

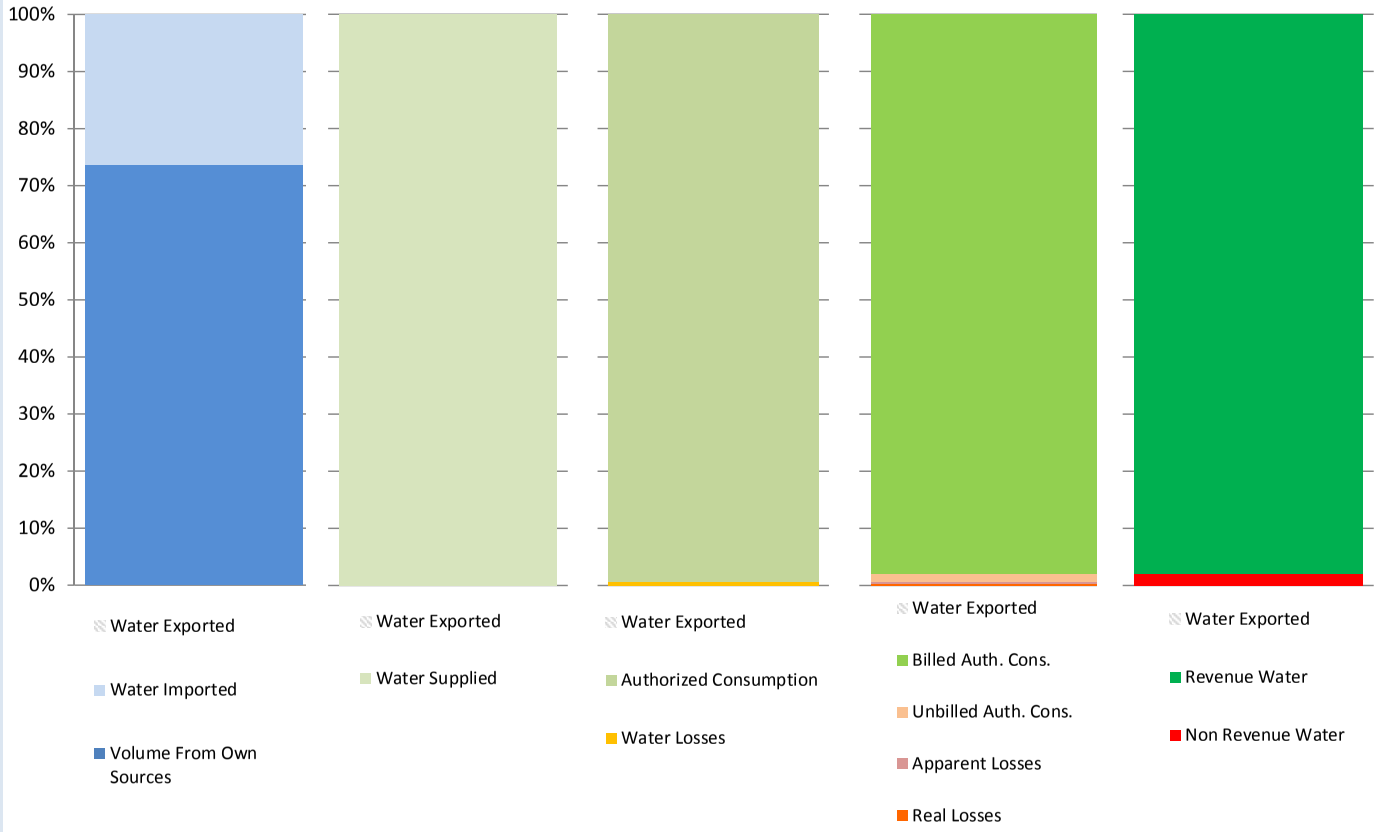
AWWA Free Water Audit Software:
Dashboard

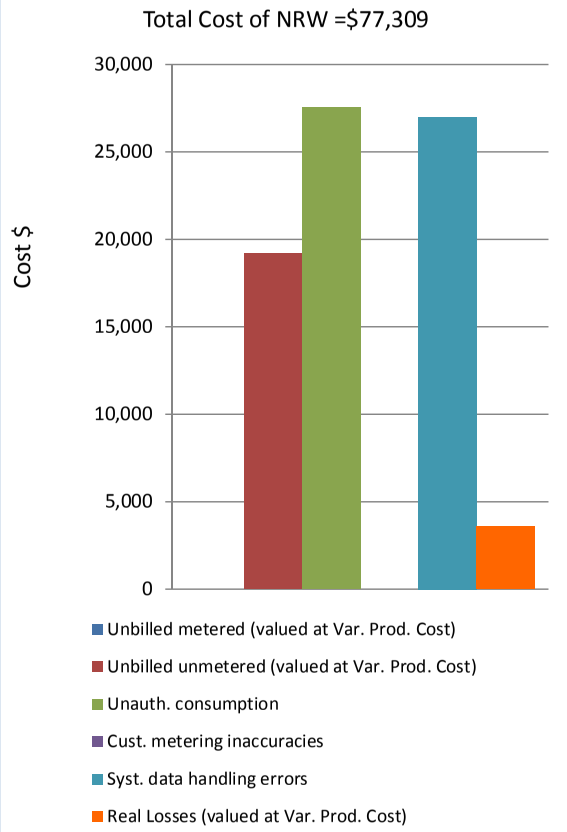
WAS v5.0

The graphic below is a visual representation of the Water Balance with bar heights propotional to the volume of the audit components

Water Audit Report for:	**City of Brentwood (0710004)**	
Reporting Year:	**2015**	**1/2015 - 12/2015**
Data Validity Score:	**92**	

○ Show me the VOLUME of Non-Revenue Water
◉ Show me the COST of Non-Revenue Water





AWWA Free Water Audit Software: Grading Matrix

WAS 5.0

The grading assigned to each audit component and the corresponding recommended improvements and actions are highlighted in yellow. Audit accuracy is likely to be improved by prioritizing those items shown in red

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
WATER SUPPLIED											
Volume from own sources:	Select this grading only if the water utility purchases/imports all of its water resources (i.e. has no sources of its own)	Less than 25% of water production sources are metered, remaining sources are estimated. No regular meter accuracy testing or electronic calibration conducted.	25% - 50% of treated water production sources are metered; other sources estimated. No regular meter accuracy testing or electronic calibration conducted.	Conditions between 2 and 4	50% - 75% of treated water production sources are metered, other sources estimated. Occasional meter accuracy testing or electronic calibration conducted.	Conditions between 4 and 6	At least 75% of treated water production sources are metered, or at least 90% of the source flow is derived from metered sources. Meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually. Less than 25% of tested meters are found outside of +/- 6% accuracy.	Conditions between 6 and 8	100% of treated water production sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of treated water production sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually, with less than 10% found outside of +/- 3% accuracy. Procedures are reviewed by a third party knowledgeable in the M36 methodology.
Improvements to attain higher data grading for "Volume from own Sources" component:		to qualify for 2: Organize and launch efforts to collect data for determining volume from own sources	to qualify for 4: Locate all water production sources on maps and in the field, launch meter accuracy testing for existing meters, begin to install meters on unmetered water production sources and replace any obsolete/defective meters.		to qualify for 6: Formalize annual meter accuracy testing for all source meters; specify the frequency of testing. Complete installation of meters on unmetered water production sources and complete replacement of all obsolete/defective meters.		to qualify for 8: Conduct annual meter accuracy testing and calibration of related instrumentation on all meter installations on a regular basis. Complete project to install new, or replace defective existing, meters so that entire production meter population is metered. Repair or replace meters outside of +/- 6% accuracy.		to qualify for 10: Maintain annual meter accuracy testing and calibration of related instrumentation for all meter installations. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to further improve meter accuracy.		to maintain 10: Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology.
Volume from own sources master meter and supply error adjustment:	Select n/a only if the water utility fails to have meters on its sources of supply	Inventory information on meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined	No automatic datalogging of production volumes; daily readings are scribed on paper records without any accountability controls. Flows are not balanced across the water distribution system: tank/storage elevation changes are not employed in calculating the "Volume from own sources" component and archived flow data is adjusted only when grossly evident data error occurs.	Conditions between 2 and 4	Production meter data is logged automatically in electronic format and reviewed at least on a monthly basis with necessary corrections implemented. "Volume from own sources" tabulations include estimate of daily changes in tanks/storage facilities. Meter data is adjusted when gross data errors occur, or occasional meter testing deems this necessary.	Conditions between 4 and 6	Hourly production meter data logged automatically & reviewed on at least a weekly basis. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and/or error is confirmed by meter accuracy testing. Tank/storage facility elevation changes are automatically used in calculating a balanced "Volume from own sources" component, and data gaps in the archived data are corrected on at least a weekly basis.	Conditions between 6 and 8	Continuous production meter data is logged automatically & reviewed each business day. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing. Tank/storage facility elevation changes are automatically used in "Volume from own sources" tabulations and data gaps in the archived data are corrected on a daily basis.	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically balances flows from all sources and storages; results are reviewed each business day. Tight accountability controls ensure that all data gaps that occur in the archived flow data are quickly detected and corrected. Regular calibrations between SCADA and sources meters ensures minimal data transfer error.
Improvements to attain higher data grading for "Master meter and supply error adjustment" component:		to qualify for 2: Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature.	to qualify for 4: Install automatic datalogging equipment on production meters. Complete installation of level instrumentation at all tanks/storage facilities and include tank level data in automatic calculation routine in a computerized system. Construct a computerized listing or spreadsheet to archive input volumes, tank/storage volume changes and import/export flows in order to determine the composite "Water Supplied" volume for the distribution system. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps.		to qualify for 6: Refine computerized data collection and archive to include hourly production meter data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Use daily net storage change to balance flows in calculating "Water Supplied" volume. Necessary corrections to data errors are implemented on a weekly basis.		to qualify for 8: Ensure that all flow data is collected and archived on at least an hourly basis. All data is reviewed and detected errors corrected each business day. Tank/storage levels variations are employed in calculating balanced "Water Supplied" component. Adjust production meter data for gross error and inaccuracy confirmed by testing.		to qualify for 10: Link all production and tank/storage facility elevation change data to a Supervisory Control & Data Acquisition (SCADA) System, or similar computerized monitoring/control system, and establish automatic flow balancing algorithm and regularly calibrate between SCADA and source meters. Data is reviewed and corrected each business day.		to maintain 10: Monitor meter innovations for development of more accurate and less expensive flowmeters. Continue to replace or repair meters as they perform outside of desired accuracy limits. Stay abreast of new and more accurate water level instruments to better record tank/storage levels and archive the variations in storage volume. Keep current with SCADA and data management systems to ensure that archived data is well-managed and error free.
Water Imported:	Select n/a if the water utility's supply is exclusively from its own water resources (no bulk purchased/ imported water)	Less than 25% of imported water sources are metered, remaining sources are estimated. No regular meter accuracy testing.	25% - 50% of imported water sources are metered; other sources estimated. No regular meter accuracy testing.	Conditions between 2 and 4	50% - 75% of imported water sources are metered, other sources estimated. Occasional meter accuracy testing conducted.	Conditions between 4 and 6	At least 75% of imported water sources are metered, meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually for all meter installations. Less than 25% of tested meters are found outside of +/- 6% accuracy.	Conditions between 6 and 8	100% of imported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of imported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually for all meter installations, with less than 10% of accuracy tests found outside of +/- 3% accuracy.
Improvements to attain higher data grading for "Water Imported Volume" component: *(Note: usually the water supplier selling the water - "the Exporter" - to the utility being audited is responsible to maintain the metering installation measuring the imported volume. The utility should coordinate carefully with the Exporter to ensure that adequate meter upkeep takes place and an accurate measure of the Water Imported volume is quantified.)*		to qualify for 2: Review bulk water purchase agreements with partner suppliers; confirm requirements for use and maintenance of accurate metering. Identify needs for new or replacement meters with goal to meter all imported water sources.	To qualify for 4: Locate all imported water sources on maps and in the field, launch meter accuracy testing for existing meters, begin to install meters on unmetered imported water interconnections and replace obsolete/defective meters.		to qualify for 6: Formalize annual meter accuracy testing for all imported water meters, planning for both regular meter accuracy testing and calibration of the related instrumentation. Continue installation of meters on unmetered imported water interconnections and replacement of obsolete/defective meters.		to qualify for 8: Complete project to install new, or replace defective, meters on all imported water interconnections. Maintain annual meter accuracy testing for all imported water meters and conduct calibration of related instrumentation at least annually. Repair or replace meters outside of +/- 6% accuracy.		to qualify for 10: Conduct meter accuracy testing for all meters on a semi-annual basis, along with calibration of all related instrumentation. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to improve meter accuracy.		to maintain 10: Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Continue to conduct calibration of related instrumentation on a semi-annual basis. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Water imported master meter and supply error adjustment:	Select n/a if the Imported water supply is unmetered, with Imported water quantities estimated on the billing invoices sent by the Exporter to the purchasing Utility.	Inventory information on imported meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined Written agreement(s) with water Exporter(s) are missing or written in vague language concerning meter management and testing.	No automatic datalogging of imported supply volumes; daily readings are scribed on paper records without any accountability controls to confirm data accuracy and the absence of errors and data gaps in recorded volumes. Written agreement requires meter accuracy testing but is vague on the details of how and who conducts the testing.	Conditions between 2 and 4	Imported supply metered flow data is logged automatically in electronic format and reviewed at least on a monthly basis by the Exporter with necessary corrections implemented. Meter data is adjusted by the Exporter when gross data errors are detected. A coherent data trail exists for this process to protect both the selling and the purchasing Utility. Written agreement exists and clearly states requirements and roles for meter accuracy testing and data management.	Conditions between 4 and 6	Hourly Imported supply metered data is logged automatically & reviewed on at least a weekly basis by the Exporter. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and to correct for error confirmed by meter accuracy testing. Any data gaps in the archived data are detected and corrected during the weekly review. A coherent data trail exists for this process to protect both the selling and the purchasing Utility.	Conditions between 6 and 8	Continuous Imported supply metered flow data is logged automatically & reviewed each business day by the Importer. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing. Any data errors/gaps are detected and corrected on a daily basis. A data trail exists for the process to protect both the selling and the purchasing Utility.	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically records data which is reviewed each business day by the Exporter. Tight accountability controls ensure that all error/data gaps that occur in the archived flow data are quickly detected and corrected. A reliable data trail exists and contract provisions for meter testing and data management are reviewed by the selling and purchasing Utility at least once every five years.
Improvements to attain higher data grading for "Water imported master meter and supply error adjustment" component:		<u>to qualify for 2:</u> Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature. Review the written agreement between the selling and purchasing Utility.	<u>to qualify for 4:</u> Install automatic datalogging equipment on Imported supply meters. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps. Launch discussions with the Exporters to jointly review terms of the written agreements regarding meter accuracy testing and data management; revise the terms as necessary.		<u>to qualify for 6:</u> Refine computerized data collection and archive to include hourly Imported supply metered flow data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Make necessary corrections to errors/data errors on a weekly basis.		<u>to qualify for 8:</u> Ensure that all Imported supply metered flow data is collected and archived on at least an hourly basis. All data is reviewed and errors/data gaps are corrected each business day.		<u>to qualify for 10:</u> Conduct accountability checks to confirm that all Imported supply metered data is reviewed and corrected each business day by the Exporter. Results of all meter accuracy tests and data corrections should be available for sharing between the Exporter and the purchasing Utility. Establish a schedule for a regular review and updating of the contractual language in the written agreement between the selling and the purchasing Utility; at least every five years.		<u>to maintain 10:</u> Monitor meter innovations for development of more accurate and less expensive flowmeters; work with the Exporter to help identify meter replacement needs. Keep communication lines with Exporters open and maintain productive relations. Keep the written agreement current with clear and explicit language that meets the ongoing needs of all parties.
Water Exported:	Select n/a if the water utility sells no bulk water to neighboring water utilities (no exported water sales)	Less than 25% of exported water sources are metered, remaining sources are estimated. No regular meter accuracy testing.	25% - 50% of exported water sources are metered; other sources estimated. No regular meter accuracy testing.	Conditions between 2 and 4	50% - 75% of exported water sources are metered, other sources estimated. Occasional meter accuracy testing conducted.	Conditions between 4 and 6	At least 75% of exported water sources are metered, meter accuracy testing and/or electronic calibration conducted annually. Less than 25% of tested meters are found outside of +/- 6% accuracy.	Conditions between 6 and 8	100% of exported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of exported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually for all meter installations, with less than 10% of accuracy tests found outside of +/- 3% accuracy.
Improvements to attain higher data grading for "Water Exported Volume" component: (*Note: usually, if the water utility being audited sells (Exports) water to a neighboring purchasing Utility, it is the responsibility of the utility exporting the water to maintain the metering installation measuring the Exported volume. The utility exporting the water should ensure that adequate meter upkeep takes place and an accurate measure of the Water Exported volume is quantified.*)		<u>to qualify for 2:</u> Review bulk water sales agreements with purchasing utilities; confirm requirements for use & upkeep of accurate metering. Identify needs to install new, or replace defective meters as needed.	<u>To qualify for 4:</u> Locate all exported water sources on maps and in field, launch meter accuracy testing for existing meters, begin to install meters on unmetered exported water interconnections and replace obsolete/defective meters		<u>to qualify for 6:</u> Formalize annual meter accuracy testing for all exported water meters. Continue installation of meters on unmetered exported water interconnections and replacement of obsolete/defective meters.		<u>to qualify for 8:</u> Complete project to install new, or replace defective, meters on all exported water interconnections. Maintain annual meter accuracy testing for all exported water meters. Repair or replace meters outside of +/- 6% accuracy.		<u>to qualify for 10:</u> Maintain annual meter accuracy testing for all meters. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to improve meter accuracy.		<u>to maintain 10:</u> Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology.
Water exported master meter and supply error adjustment:	Select n/a only if the water utility fails to have meters on its exported supply interconnections.	Inventory information on exported meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined Written agreement(s) with the utility purchasing the water are missing or written in vague language concerning meter management and testing.	No automatic datalogging of exported supply volumes; daily readings are scribed on paper records without any accountability controls to confirm data accuracy and the absence of errors and data gaps in recorded volumes. Written agreement requires meter accuracy testing but is vague on the details of how and who conducts the testing.	Conditions between 2 and 4	Exported metered flow data is logged automatically in electronic format and reviewed at least on a monthly basis, with necessary corrections implemented. Meter data is adjusted by the utility selling (exporting) the water when gross data errors are detected. A coherent data trail exists for this process to protect both the utility exporting the water and the purchasing Utility. Written agreement exists and clearly states requirements and roles for meter accuracy testing and data management.	Conditions between 4 and 6	Hourly exported supply metered data is logged automatically & reviewed on at least a weekly basis by the utility selling the water. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and to correct for error found by meter accuracy testing. Any data gaps in the archived data are detected and corrected during the weekly review. A coherent data trail exists for this process to protect both the selling (exporting) utility and the purchasing Utility.	Conditions between 6 and 8	Continuous exported supply metered flow data is logged automatically & reviewed each business day by the utility selling (exporting) the water. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and any error confirmed by meter accuracy testing. Any data errors/gaps are detected and corrected on a daily basis. A data trail exists for the process to protect both the selling (exporting) Utility and the purchasing Utility.	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically records data which is reviewed each business day by the utility selling (exporting) the water. Tight accountability controls ensure that all error/data gaps that occur in the archived flow data are quickly detected and corrected. A reliable data trail exists and contract provisions for meter testing and data management are reviewed by the selling Utility and purchasing Utility at least once every five years.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Water exported master meter and supply error adjustment" component:		to qualify for 2: Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature. Review the written agreement between the utility selling (exporting) the water and the purchasing Utility.	to qualify for 4: Install automatic datalogging equipment on exported supply meters. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps. Launch discussions with the purchasing utilities to jointly review terms of the written agreements regarding meter accuracy testing and data management; revise the terms as necessary.		to qualify for 6: Refine computerized data collection and archive to include hourly exported supply metered flow data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Make necessary corrections to errors/data errors on a weekly basis.		to qualify for 8: Ensure that all exported metered flow data is collected and archived on at least an hourly basis. All data is reviewed and errors/data gaps are corrected each business day.		to qualify for 10: Conduct accountability checks to confirm that all exported metered flow data is reviewed and corrected each business day by the utility selling the water. Results of all meter accuracy tests and data corrections should be available for sharing between the utility and the purchasing Utility. Establish a schedule for a regular review and updating of the contractual language in the written agreements with the purchasing utilities; at least every five years.		to maintain 10: Monitor meter innovations for development of more accurate and less expensive flowmeters; work with the purchasing utilities to help identify meter replacement needs. Keep communication lines with the purchasing utilities open and maintain productive relations. Keep the written agreement current with clear and explicit language that meets the ongoing needs of all parties.
AUTHORIZED CONSUMPTION											
Billed metered:	n/a (not applicable). Select n/a only if the entire customer population is not metered and is billed for water service on a flat or fixed rate basis. In such a case the volume entered must be zero.	Less than 50% of customers with volume-based billings from meter readings; flat or fixed rate billing exists for the majority of the customer population	At least 50% of customers with volume-based billing from meter reads; flat rate billing for others. Manual meter reading is conducted, with less than 50% meter read success rate, remainding accounts' consumption is estimated. Limited meter records, no regular meter testing or replacement. Billing data maintained on paper records, with no auditing.	Conditions between 2 and 4	At least 75% of customers with volume-based, billing from meter reads; flat or fixed rate billing for remaining accounts. Manual meter reading is conducted with at least 50% meter read success rate; consumption for accounts with failed reads is estimated. Purchase records verify age of customer meters; only very limited meter accuracy testing is conducted. Customer meters are replaced only upon complete failure. Computerized billing records exist, but only sporadic internal auditing conducted.	Conditions between 4 and 6	At least 90% of customers with volume based billing from meter reads; consumption for remaining accounts is estimated. Manual customer meter reading gives at least 80% customer meter reading success rate; consumption for accounts with failed reads is estimated. Good customer meter records eixst, but only limited meter accuracy testing is conducted. Regular replacement is conducted for the oldest meters. Computerized billing records exist with annual auditing of summary statistics conducting by utility personnel.	Conditions between 6 and 8	At least 97% of customers exist with volume-based billing from meter reads. At least 90% customer meter reading success rate; or at least 80% read success rate with planning and budgeting for trials of Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) in one or more pilot areas. Good customer meter records. Regular meter accuracy testing guides replacement of statistically significant number of meters each year. Routine auditing of computerized billing records for global and detailed statistics occurs annually by utility personnel, and is verified by third party at least once every five years.	Conditions between 8 and 10	At least 99% of customers exist with volume-based billing from meter reads. At least 95% customer meter reading success rate; or minimum 80% meter reading success rate, with Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) trials underway. Statistically significant customer meter testing and replacement program in place on a continuous basis. Computerized billing with routine, detailed auditing, including field investigation of representative sample of accounts undertaken annually by utility personnel. Audit is conducted by third party auditors at least once every three years.
Improvements to attain higher data grading for "Billed Metered Consumption" component:	If n/a is selected because the customer meter population is unmetered, consider establishing a new policy to meter the customer population and employ water rates based upon metered volumes.	to qualify for 2: Conduct investigations or trials of customer meters to select appropriate meter models. Budget funding for meter installations. Investigate volume based water rate structures.	to qualify for 4: Purchase and install meters on unmetered accounts. Implement policies to improve meter reading success. Catalog meter information during meter read visits to identify age/model of existing meters. Test a minimal number of meters for accuracy. Install computerized billing system.		to qualify for 6: Purchase and install meters on unmetered accounts. Eliminate flat fee billing and establish appropriate water rate structure based upon measured consumption. Continue to achieve verifiable success in removing manual meter reading barriers. Expand meter accuracy testing. Launch regular meter replacement program. Launch a program of annual auditing of global billing statistics by utility personnel.		to qualify for 8: Purchase and install meters on unmetered accounts. If customer meter reading success rate is less than 97%, assess cost-effectiveness of Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) system for portion or entire system; or otherwise achieve ongoing improvements in manual meter reading success rate to 97% or higher. Refine meter accuracy testing program. Set meter replacement goals based upon accuracy test results. Implement annual auditing of detailed billing records by utility personnel and implement third party auditing at least once every five years.		to qualify for 10: Purchase and install meters on unmetered accounts. Launch Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) system trials if manual meter reading success rate of at least 99% is not achieved within a five-year program. Continue meter accuracy testing program. Conduct planning and budgeting for large scale meter replacement based upon meter life cycle analysis using cumulative flow target. Continue annual detailed billing data auditing by utility personnel and conduct third party auditing at least once every three years.		to maintain 10: Continue annual internal billing data auditing, and third party auditing at least every three years. Continue customer meter accuracy testing to ensure that accurate customer meter readings are obtained and entered as the basis for volume based billing. Stay abreast of improvements in Automatic Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) and information management. Plan and budget for justified upgrades in metering, meter reading and billing data management to maintain very high accuracy in customer metering and billing.
Billed unmetered:	Select n/a if it is the policy of the water utility to meter all customer connections and it has been confirmed by detailed auditing that all customers do indeed have a water meter; i.e. no intentionally unmetered accounts exist	Water utility policy does not require customer metering; flat or fixed fee billing is employed. No data is collected on customer consumption. The only estimates of customer population consumption available are derived from data estimation methods using average fixture count multiplied by number of connections, or similar approach.	Water utility policy does not require customer metering; flat or fixed fee billing is employed. Some metered accounts exist in parts of the system (pilot areas or District Metered Areas) with consumption read periodically or recorded on portable dataloggers over one, three, or seven day periods. Data from these sample meters are used to infer consumption for the total customer population. Site specific estimation methods are used for unusual buildings/water uses.	Conditions between 2 and 4	Water utility policy does require metering and volume based billing in general. However, a liberal amount of exemptions and a lack of clearly written and communicated procedures result in up to 20% of billed accounts believed to be unmetered by exemption; or the water utility is in transition to becoming fully metered, and a large number of customers remain unmetered. A rough estimate of the annual consumption for all unmetered accounts is included in the annual water audit, with no inspection of individual unmetered accounts.	Conditions between 4 and 6	Water utility policy does require metering and volume based billing but established exemptions exist for a portion of accounts such as municipal buildings. As many as 15% of billed accounts are unmetered due to this exemption or meter installation difficulties. Only a group estimate of annual consumption for all unmetered accounts is included in the annual water audit, with no inspection of individual unmetered accounts.	Conditions between 6 and 8	Water utility policy does require metering and volume based billing for all customer accounts. However, less than 5% of billed accounts remain unmetered because meter installation is hindered by unusual circumstances. The goal is to minimize the number of unmetered accounts. Reliable estimates of consumption are obtained for these unmetered accounts via site specific estimation methods.	Conditions between 8 and 10	Water utility policy does require metering and volume based billing for all customer accounts. Less than 2% of billed accounts are unmetered and exist because meter installation is hindered by unusual circumstances. The goal exists to minimize the number of unmetered accounts to the extent that is economical. Reliable estimates of consumption are obtained at these accounts via site specific estimation methods.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Billed Unmetered Consumption" component:		to qualify for 2: Conduct research and evaluate cost/benefit of a new water utility policy to require metering of the customer population; thereby greatly reducing or eliminating unmetered accounts. Conduct pilot metering project by installing water meters in small sample of customer accounts and periodically reading the meters or datalogging the water consumption over one, three, or seven day periods.	to qualify for 4: Implement a new water utility policy requiring customer metering. Launch or expand pilot metering study to include several different meter types, which will provide data for economic assessment of full scale metering options. Assess sites with access difficulties to devise means to obtain water consumption volumes. Begin customer meter installation.		to qualify for 6: Refine policy and procedures to improve customer metering participation for all but solidly exempt accounts. Assign staff resources to review billing records to identify errant unmetered properties. Specify metering needs and funding requirements to install sufficient meters to significant reduce the number of unmetered accounts		to qualify for 8: Push to install customer meters on a full scale basis. Refine metering policy and procedures to ensure that all accounts, including municipal properties, are designated for meters. Plan special efforts to address "hard-to-access" accounts. Implement procedures to obtain a reliable consumption estimate for the remaining few unmetered accounts awaiting meter installation.		to qualify for 10: Continue customer meter installation throughout the service area, with a goal to minimize unmetered accounts. Sustain the effort to investigate accounts with access difficulties, and devise means to install water meters or otherwise measure water consumption.		to maintain 10: Continue to refine estimation methods for unmetered consumption and explore means to establish metering, for as many billed remaining unmetered accounts as is economically feasible.
Unbilled metered:	select n/a if all billing-exempt consumption is unmetered.	Billing practices exempt certain accounts, such as municipal buildings, but written policies do not exist; and a reliable count of unbilled metered accounts is unavailable. Meter upkeep and meter reading on these accounts is rare and not considered a priority. Due to poor recordkeeping and lack of auditing, water consumption for all such accounts is purely guesstimated.	Billing practices exempt certain accounts, such as municipal buildings, but only scattered, dated written directives exist to justify this practice. A reliable count of unbilled metered accounts is unavailable. Sporadic meter replacement and meter reading occurs on an as-needed basis. The total annual water consumption for all unbilled, metered accounts is estimated based upon approximating the number of accounts and assigning consumption from actively billed accounts of same meter size.	Conditions between 2 and 4	Dated written procedures permit billing exemption for specific accounts, such as municipal properties, but are unclear regarding certain other types of accounts. Meter reading is given low priority and is sporadic. Consumption is quantified from meter readings where available. The total number of unbilled, unmetered accounts must be estimated along with consumption volumes.	Conditions between 4 and 6	Written policies regarding billing exemptions exist but adherence in practice is questionable. Metering and meter reading for municipal buildings is reliable but sporadic for other unbilled metered accounts. Periodic auditing of such accounts is conducted. Water consumption is quantified directly from meter readings where available, but the majority of the consumption is estimated.	Conditions between 6 and 8	Written policy identifies the types of accounts granted a billing exemption. Customer meter management and meter reading are considered secondary priorities, but meter reading is conducted at least annually to obtain consumption volumes for the annual water audit. High level auditing of billing records ensures that a reliable census of such accounts exists.	Conditions between 8 and 10	Clearly written policy identifies the types of accounts given a billing exemption, with emphasis on keeping such accounts to a minimum. Customer meter management and meter reading for these accounts is given proper priority and is reliably conducted. Regular auditing confirms this. Total water consumption for these accounts is taken from reliable readings from accurate meters.
Improvements to attain higher data grading for "Unbilled Metered Consumption" component:		to qualify for 2: Reassess the water utility's policy allowing certain accounts to be granted a billing exemption. Draft an outline of a new written policy for billing exemptions, with clear justification as to why any accounts should be exempt from billing, and with the intention to keep the number of such accounts to a minimum.	to qualify for 4: Review historic written directives and policy documents allowing certain accounts to be billing-exempt. Draft an outline of a written policy for billing exemptions, identify criteria that grants an exemption, with a goal of keeping this number of accounts to a minimum. Consider increasing the priority of reading meters on unbilled accounts at least annually.		to qualify for 6: Draft a new written policy regarding billing exemptions based upon consensus criteria allowing this occurrence. Assign resources to audit meter records and billing records to obtain census of unbilled metered accounts. Gradually include a greater number of these metered accounts to the routes for regular meter reading.		to qualify for 8: Communicate billing exemption policy throughout the organization and implement procedures that ensure proper account management. Conduct inspections of accounts confirmed in unbilled metered status and verify that accurate meters exist and are scheduled for routine meter readings. Gradually increase the number of unbilled metered accounts that are included in regular meter reading routes.		to qualify for 10: Ensure that meter management (meter accuracy testing, meter replacement) and meter reading activities for unbilled accounts are accorded the same priority as billed accounts. Establish ongoing annual auditing process to ensure that water consumption is reliably collected and provided to the annual water audit process.		to maintain 10: Reassess the utility's philosophy in allowing any water uses to go "unbilled". It is possible to meter and bill all accounts, even if the fee charged for water consumption is discounted or waived. Metering and billing all accounts ensures that water consumption is tracked and water waste from plumbing leaks is detected and minimized.
Unbilled unmetered:		Extent of unbilled, unmetered consumption is unknown due to unclear policies and poor recordkeeping. Total consumption is quantified based upon a purely subjective estimate.	Clear extent of unbilled, unmetered consumption is unknown, but a number of events are randomly documented each year, confirming existence of such consumption, but without sufficient documentation to quantify an accurate estimate of the annual volume consumed.	Conditions between 2 and 4	Extent of unbilled, unmetered consumption is partially known, and procedures exist to document certain events such as miscellaneous fire hydrant uses. Formulae is used to quantify the consumption from such events (time running multiplied by typical flowrate, multiplied by number of events).	Default value of 1.25% of system input volume is employed	Coherent policies exist for some forms of unbilled, unmetered consumption but others await closer evaluation. Reasonable recordkeeping for the managed uses exists and allows for annual volumes to be quantified by inference, but unsupervised uses are guesstimated.	Conditions between 6 and 8	Clear policies and good recordkeeping exist for some uses (ex: water used in periodic testing of unmetered fire connections), but other uses (ex: miscellaneous uses of fire hydrants) have limited oversight. Total consumption is a mix of well quantified use such as from formulae (time running multiplied by typical flow, multiplied by number of events) or temporary meters, and relatively subjective estimates of less regulated use.	Conditions between 8 and 10	Clear policies exist to identify permitted use of water in unbilled, unmetered fashion, with the intention of minimizing this type of consumption. Good records document each occurrence and consumption is quantified via formulae (time running multiplied by typical flow, multiplied by number of events) or use of temporary meters.
Improvements to attain higher data grading for "Unbilled Unmetered Consumption" component:		to qualify for 5: Utilize the accepted default value of 1.25% of the volume of water supplied as an expedient means to gain a reasonable quantification of this use. to qualify for 2: Establish a policy regarding what water uses should be allowed to remain as unbilled and unmetered. Consider tracking a small sample of one such use (ex: fire hydrant flushings).	to qualify for 5: Utilize accepted default value of 1.25% of the volume of water supplied as an expedient means to gain a reasonable quantification of this use. to qualify for 4: Evaluate the documentation of events that have been observed. Meet with user groups (ex: for fire hydrants - fire departments, contractors to ascertain their need and/or volume requirements for water from fire hydrants).		to qualify for 5: Utilize accepted default value of 1.25% of the volume of water supplied as an expedient means to gain a reasonable quantification of all such use. This is particularly appropriate for water utilities who are in the early stages of the water auditing process, and should focus on other components since the volume of unbilled, umetered consumption is usually a relatively small quatity component, and other larger-quantity components should take priority.	to qualify for 6 or greater: Finalize policy and begin to conduct field checks to better establish and quantify such usage. Proceed if top-down audit exists and/or a great volume of such use is suspected.	to qualify for 8: Assess water utility policy and procedures for various unmetered usages. For example, ensure that a policy exists and permits are issued for use of fire hydrants by persons outside of the utility. Create written procedures for use and documentation of fire hydrants by water utility personnel. Use same approach for other types of unbilled, unmetered water usage.		to qualify for 10: Refine written procedures to ensure that all uses of unbilled, unmetered water are overseen by a structured permitting process managed by water utility personnel. Reassess policy to determine if some of these uses have value in being converted to billed and/or metered status.		to maintain 10: Continue to refine policy and procedures with intention of reducing the number of allowable uses of water in unbilled and unmetered fashion. Any uses that can feasibly become billed and metered should be converted eventually.
APPARENT LOSSES											

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Unauthorized consumption:		Extent of unauthorized consumption is unknown due to unclear policies and poor recordkeeping. Total unauthorized consumption is guesstimated.	Unauthorized consumption is a known occurrence, but its extent is a mystery. There are no requirements to document observed events, but periodic field reports capture some of these occurrences. Total unauthorized consumption is approximated from this limited data.	conditions between 2 and 4	Procedures exist to document some unauthorized consumption such as observed unauthorized fire hydrant openings. Use formulae to quantify this consumption (time running multiplied typical flowrate, multiplied by number of events).	Default value of 0.25% of volume of water supplied is employed	Coherent policies exist for some forms of unauthorized consumption (more than simply fire hydrant misuse) but others await closer evaluation. Reasonable surveillance and recordkeeping exist for occurrences that fall under the policy. Volumes quantified by inference from these records.	Conditions between 6 and 8	Clear policies and good auditable recordkeeping exist for certain events (ex: tampering with water meters, illegal bypasses of customer meters); but other occurrences have limited oversight. Total consumption is a combination of volumes from formulae (time x typical flow) and subjective estimates of unconfirmed consumption.	Conditions between 8 and 10	Clear policies exist to identify all known unauthorized uses of water. Staff and procedures exist to provide enforcement of policies and detect violations. Each occurrence is recorded and quantified via formulae (estimated time running multiplied by typical flow) or similar methods. All records and calculations should exist in a form that can be audited by a third party.
Improvements to attain higher data grading for "Unauthorized Consumption" component:		to qualify for 5: Use accepted default of 0.25% of volume of water supplied. to qualify for 2: Review utility policy regarding what water uses are considered unauthorized, and consider tracking a small sample of one such occurrence (ex: unauthorized fire hydrant openings)	to qualify for 5: Use accepted default of 0.25% of system input volume to qualify for 4: Review utility policy regarding what water uses are considered unauthorized, and consider tracking a small sample of one such occurrence (ex: unauthorized fire hydrant openings)		to qualify for 5: Utilize accepted default value of 0.25% of volume of water supplied as an expedient means to gain a reasonable quantification of all such use. This is particularly appropriate for water utilities who are in the early stages of the water auditing process.	to qualify for 6 or greater: Finalize policy updates to clearly identify the types of water consumption that are authorized from those usages that fall outside of this policy and are, therefore, unauthorized. Begin to conduct regular field checks. Proceed if the top-down audit already exists and/or a great volume of such use is suspected.	to quality for 8: Assess water utility policies to ensure that all known occurrences of unauthorized consumption are outlawed, and that appropriate penalties are prescribed. Create written procedures for detection and documentation of various occurrences of unauthorized consumption as they are uncovered.		to qualify for 10: Refine written procedures and assign staff to seek out likely occurrences of unauthorized consumption. Explore new locking devices, monitors and other technologies designed to detect and thwart unauthorized consumption.		to maintain 10: Continue to refine policy and procedures to eliminate any loopholes that allow or tacitly encourage unauthorized consumption. Continue to be vigilant in detection, documentation and enforcement efforts.
Customer metering inaccuracies:	select n/a only if the entire customer population is unmetered. In such a case the volume entered must be zero.	Customer meters exist, but with unorganized paper records on meters; no meter accuracy testing or meter replacement program for any size of retail meter. Metering workflow is driven chaotically with no proactive management. Loss volume due to aggregate meter inaccuracy is guesstimated.	Poor recordkeeping and meter oversight is recognized by water utility management who has allotted staff and funding resources to organize improved recordkeeping and start meter accuracy testing. Existing paper records gathered and organized to provide cursory disposition of meter population. Customer meters are tested for accuracy only upon customer request.	Conditions between 2 and 4	Reliable recordkeeping exists; meter information is improving as meters are replaced. Meter accuracy testing is conducted annually for a small number of meters (more than just customer requests, but less than 1% of inventory). A limited number of the oldest meters are replaced each year. Inaccuracy volume is largely an estimate, but refined based upon limited testing data.	Conditions between 4 and 6	A reliable electronic recordkeeping system for meters exists. The meter population includes a mix of new high performing meters and dated meters with suspect accuracy. Routine, but limited, meter accuracy testing and meter replacement occur. Inaccuracy volume is quantified using a mix of reliable and less certain data.	Conditions between 6 and 8	Ongoing meter replacement and accuracy testing result in highly accurate customer meter population. Testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for various types of meters.	Ongoing meter replacement and accuracy testing result in highly accurate customer meter population. Statistically significant number of meters are tested in audit year. This testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for these meters.	Good records of all active customer meters exist and include as a minimum: meter number, account number/location, type, size and manufacturer. Ongoing meter replacement occurs according to a targeted and justified basis. Regular meter accuracy testing gives a reliable measure of composite inaccuracy volume for the customer meter population. New metering technology is embraced to keep overall accuracy improving. Procedures are reviewed by a third party knowledgeable in the M36 methodology.
Improvements to attain higher data grading for "Customer meter inaccuracy volume" component:	If n/a is selected because the customer meter population is unmetered, consider establishing a new policy to meter the customer population and employ water rates based upon metered volumes.	to qualify for 2: Gather available meter purchase records. Conduct testing on a small number of meters believed to be the most inaccurate. Review staffing needs of the metering group and budget for necessary resources to better organize meter management.	to qualify for 4: Implement a reliable record keeping system for customer meter histories, preferably using electronic methods typically linked to, or part of, the Customer Billing System or Customer Information System. Expand meter accuracy testing to a larger group of meters.		to qualify for 6: Standardize the procedures for meter recordkeeping within an electronic information system. Accelerate meter accuracy testing and meter replacements guided by testing results.		to qualify for 8: Expand annual meter accuracy testing to evaluate a statistically significant number of meter makes/models. Expand meter replacement program to replace statistically significant number of poor performing meters each year.		to qualify for 9: Continue efforts to manage meter population with reliable recordkeeping. Test a statistically significant number of meters each year and analyze test results in an ongoing manner to serve as a basis for a target meter replacement strategy based upon accumulated volume throughput.	to qualify for 10: Continue efforts to manage meter population with reliable recordkeeping, meter testing and replacement. Evaluate new meter types and install one or more types in 5-10 customer accounts each year in order to pilot improving metering technology.	to maintain 10: Increase the number of meters tested and replaced as justified by meter accuracy test data. Continually monitor development of new metering technology and Advanced Metering Infrastructure (AMI) to grasp opportunities for greater accuracy in metering of water flow and management of customer consumption data.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Systematic Data Handling Errors:	Note: all water utilities incur some amount of this error. Even in water utilities with unmetered customer populations and fixed rate billing, errors occur in annual billing tabulations. Enter a positive value for the volume and select a grading.	Policies and procedures for activation of new customer water billing accounts are vague and lack accountability. Billing data is maintained on paper records which are not well organized. No auditing is conducted to confirm billing data handling efficiency. An unknown number of customers escape routine billing due to lack of billing process oversight.	Policy and procedures for activation of new customer accounts and oversight of billing records exist but need refinement. Billing data is maintained on paper records or insufficiently capable electronic database. Only periodic unstructured auditing work is conducted to confirm billing data handling efficiency. The volume of unbilled water due to billing lapses is a guess.	Conditions between 2 and 4	Policy and procedures for new account activation and oversight of billing operations exist but needs refinement. Computerized billing system exists, but is dated or lacks needed functionality. Periodic, limited internal audits conducted and confirm with approximate accuracy the consumption volumes lost to billing lapses.	Conditions between 4 and 6	Policy and procedures for new account activation and oversight of billing operations is adequate and reviewed periodically. Computerized billing system is in use with basic reporting available. Any effect of billing adjustments on measured consumption volumes is well understood. Internal checks of billing data error conducted annually. Reasonably accurate quantification of consumption volume lost to billing lapses is obtained.	Conditions between 6 and 8	New account activation and billing operations policy and procedures are reviewed at least biannually. Computerized billing system includes an array of reports to confirm billing data and system functionality. Checks are conducted routinely to flag and explain zero consumption accounts. Annual internal checks conducted with third party audit conducted at least once every five years. Accountability checks flag billing lapses. Consumption lost to billing lapses is well quantified and reducing year-by-year.	Conditions between 8 and 10	Sound written policy and procedures exist for new account activation and oversight of customer billing operations. Robust computerized billing system gives high functionality and reporting capabilities which are utilized, analyzed and the results reported each billing cycle. Assessment of policy and data handling errors are conducted internally and audited by third party at least once every three years, ensuring consumption lost to billing lapses is minimized and detected as it occurs.
Improvements to attain higher data grading for "Systematic Data Handling Error volume" component:		<u>to qualify for 2</u>: Draft written policy and procedures for activating new water billing accounts and oversight of billing operations. Investigate and budget for computerized customer billing system. Conduct initial audit of billing records by flow-charting the basic business processes of the customer account/billing function.	<u>to qualify for 4</u>: Finalize written policy and procedures for activation of new billing acocunts and overall billing operations management. Implement a computerized customer billing system. Conduct initial audit of billing records as part of this process.		<u>to qualify for 6</u>: Refine new account activation and billing operations procedures and ensure consistency with the utility policy regarding billing, and minimize opportunity for missed billings. Upgrade or replace customer billing system for needed functionality - ensure that billing adjustments don't corrupt the value of consumption volumes. Procedurize internal annual audit process.		<u>to qualify for 8</u>: Formalize regular review of new account activation process and general billing practices. Enhance reporting capability of computerized billing system. Formalize regular auditing process to reveal scope of data handling error. Plan for periodic third party audit to occur at least once every five years.		<u>to qualify for 10</u>: Close policy/procedure loopholes that allow some customer accounts to go unbilled, or data handling errors to exist. Ensure that billing system reports are utilized, analyzed and reported every billing cycle. Ensure that internal and third party audits are conducted at least once every three years.		<u>to maintain 10</u>: Stay abreast of customer information management developments and innovations. Monitor developments of Advanced Metering Infrastructure (AMI) and integrate technology to ensure that customer endpoint information is well-monitored and errors/lapses are at an economic minimum.
SYSTEM DATA											
Length of mains:		Poorly assembled and maintained paper as-built records of existing water main installations makes accurate determination of system pipe length impossible. Length of mains is guesstimated.	Paper records in poor or uncertain condition (no annual tracking of installations & abandonments). Poor procedures to ensure that new water mains installed by developers are accurately documented.	Conditions between 2 and 4	Sound written policy and procedures exist for documenting new water main installations, but gaps in management result in a uncertain degree of error in tabulation of mains length.	Conditions between 4 and 6	Sound written policy and procedures exist for permitting and commissioning new water mains. Highly accurate paper records with regular field validation; or electronic records and asset management system in good condition. Includes system backup.	Conditions between 6 and 8	Sound written policy and procedures exist for permitting and commissioning new water mains. Electronic recordkeeping such as a Geographical Information System (GIS) and asset management system are used to store and manage data.	Conditions between 8 and 10	Sound written policy exists for managing water mains extensions and replacements. Geographic Information System (GIS) data and asset management database agree and random field validation proves truth of databases. Records of annual field validation should be available for review.
Improvements to attain higher data grading for "Length of Water Mains" component:		<u>to qualify for 2</u>: Assign personnel to inventory current as-built records and compare with customer billing system records and highway plans in order to verify poorly documented pipelines. Assemble policy documents regarding permitting and documentation of water main installations by the utility and building developers; identify gaps in procedures that result in poor documentation of new water main installations.	<u>to qualify for 4</u>: Complete inventory of paper records of water main installations for several years prior to audit year. Review policy and procedures for commissioning and documenting new water main installation.		<u>to qualify for 6</u>: Finalize updates/improvements to written policy and procedures for permitting/commissioning new main installations. Confirm inventory of records for five years prior to audit year; correct any errors or omissions.		<u>to qualify for 8</u>: Launch random field checks of limited number of locations. Convert to electronic database such as a Geographic Information System (GIS) with backup as justified. Develop written policy and procedures.		<u>to qualify for 10</u>: Link Geographic Information System (GIS) and asset management databases, conduct field verification of data. Record field verification information at least annually.		<u>to maintain 10</u>: Continue with standardization and random field validation to improve the completeness and accuracy of the system.
Number of active AND inactive service connections:		Vague permitting (of new service connections) policy and poor paper recordkeeping of customer connections/billings result in suspect determination of the number of service connections, which may be 10-15% in error from actual count.	General permitting policy exists but paper records, procedural gaps, and weak oversight result in questionable total for number of connections, which may vary 5-10% of actual count.	Conditions between 2 and 4	Written account activation policy and procedures exist, but with some gaps in performance and oversight. Computerized information management system is being brought online to replace dated paper recordkeeping system. Reasonably accurate tracking of service connection installations & abandonments; but count can be up to 5% in error from actual total.	Conditions between 4 and 6	Written new account activation and overall billing policies and procedures are adequate and reviewed periodically. Computerized information management system is in use with annual installations & abandonments totaled. Very limited field verifications and audits. Error in count of number of service connections is believed to be no more than 3%.	Conditions between 6 and 8	Policies and procedures for new account activation and overall billing operations are written, well-structured and reviewed at least biannually. Well-managed computerized information management system exists and routine, periodic field checks and internal system audits are conducted. Counts of connections are no more than 2% in error.	Conditions between 8 and 10	Sound written policy and well managed and audited procedures ensure reliable management of service connection population. Computerized information management system, Customer Billing System, and Geographic Information System (GIS) information agree; field validation proves truth of databases. Count of connections recorded as being in error is less than 1% of the entire population.
Improvements to attain higher data grading for "Number of Active and Inactive Service Connections" component:	**Note: The number of Service Connections does <u>not</u> include fire hydrant leads/lines connecting the hydrant to the water main**	<u>to qualify for 2</u>: Draft new policy and procedures for new account activation and overall billing operations. Research and collect paper records of installations & abandonments for several years prior to audit year.	<u>to qualify for 4</u>: Refine policy and procedures for new account activation and overall billing operations. Research computerized recordkeeping system (Customer Information System or Customer Billing System) to improve documentation format for service connections.		<u>to qualify for 6</u>: Refine procedures to ensure consistency with new account activation and overall billing policy to establish new service connections or decommission existing connections. Improve process to include all totals for at least five years prior to audit year.		<u>to qualify for 8</u>: Formalize regular review of new account activation and overall billing operations policies and procedures. Launch random field checks of limited number of locations. Develop reports and auditing mechanisms for computerized information management system.		<u>to qualify for 10</u>: Close any procedural loopholes that allow installations to go undocumented. Link computerized information management system with Geographic Information System (GIS) and formalize field inspection and information system auditing processes. Documentation of new or decommissioned service connections encounters several levels of checks and balances.		<u>to maintain 10</u>: Continue with standardization and random field validation to improve knowledge of system.
	Note: if customer water	Gradings 1-9 apply if customer properties are unmetered, if customer meters exist and are located inside the customer building premises, or if the water utility owns and is responsible for the entire service connection piping from the water main to the customer building. In any of these cases the average distance between the curb stop or boundary separating utility/customer responsibility for service connection piping, and the typical first point of use (ex: faucet) or the customer meter must be quantified. Gradings of 1-9 are used to grade the validity of the means to quantify this value. (See the "Service Connection Diagram" worksheet)									<u>Either of two conditions can be met for a grading of 10</u>:

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Average length of customer service line:	meters are located outside of the customer building next to the curb stop or boundary separating utility/customer responsibility, then the auditor should answer "Yes" to the question on the Reporting Worksheet asking about this. If the answer is Yes, the grading description listed under the Grading of 10(a) will be followed, with a value of zero automatically entered at a Grading of 10. See the Service Connection Diagram worksheet for a visual presentation of this distance.	Vague policy exists to define the delineation of water utility ownership and customer ownership of the service connection piping. Curb stops are perceived as the breakpoint but these have not been well-maintained or documented. Most are buried or obscured. Their location varies widely from site-to-site, and estimating this distance is arbitrary due to the unknown location of many curb stops.	Policy requires that the curb stop serves as the delineation point between water utility ownership and customer ownership of the service connection piping. The piping from the water main to the curb stop is the property of the water utility; and the piping from the curb stop to the customer building is owned by the customer. Curb stop locations are not well documented and the average distance is based upon a limited number of locations measured in the field.	Conditions between 2 and 4	Good policy requires that the curb stop serves as the delineation point between water utility ownership and customer ownership of the service connection piping. Curb stops are generally installed as needed and are reasonably documented. Their location varies widely from site-to-site, and an estimate of this distance is hindered by the availability of paper records of limited accuracy.	Conditions between 4 and 6	Clear written policy exists to define utility/customer responsibility for service connection piping. Accurate, well-maintained paper or basic electronic recordkeeping system exists. Periodic field checks confirm piping lengths for a sample of customer properties.	Conditions between 6 and 8	Clearly worded policy standardizes the location of curb stops and meters, which are inspected upon installation. Accurate and well maintained electronic records exist with periodic field checks to confirm locations of service lines, curb stops and customer meter pits. An accurate number of customer properties from the customer billing system allows for reliable averaging of this length.	Conditions between 8 and 10	a) Customer water meters exist outside of customer buildings next to the curb stop or boundary separating utility/customer responsibility for service connection piping. If so, answer "Yes" to the question on the Reporting Working asking about this condition. A value of zero and a Grading of 10 are automatically entered in the Reporting Worksheet . b). Meters exist inside customer buildings, or properties are unmetered. In either case, answer "No" to the Reporting Worksheet question on meter location, and enter a distance determined by the auditor. For a Grading of 10 this value must be a very reliable number from a Geographic Information System (GIS) and confirmed by a statistically valid number of field checks.
Improvements to attain higher data grading for "Average Length of Customer Service Line" component:		<u>to qualify for 2</u>: Research and collect paper records of service line installations. Inspect several sites in the field using pipe locators to locate curb stops. Obtain the length of this small sample of connections in this manner.	<u>to qualify for 4</u>: Formalize and communicate policy delineating utility/customer responsibilities for service connection piping. Assess accuracy of paper records by field inspection of a small sample of service connections using pipe locators as needed. Research the potential migration to a computerized information management system to store service connection data.		<u>to qualify for 6</u>: Establish coherent procedures to ensure that policy for curb stop, meter installation and documentation is followed. Gain consensus within the water utility for the establishment of a computerized information management system.		<u>to qualify for 8</u>: Implement an electronic means of recordkeeping, typically via a customer information system, customer billing system, or Geographic Information System (GIS). Standardize the process to conduct field checks of a limited number of locations.		<u>to qualify for 10</u>: Link customer information management system and Geographic Information System (GIS), standardize process for field verification of data.		<u>to maintain 10</u>: Continue with standardization and random field validation to improve knowledge of service connection configurations and customer meter locations.
Average operating pressure:		Available records are poorly assembled and maintained paper records of supply pump characteristics and water distribution system operating conditions. Average pressure is guesstimated based upon this information and ground elevations from crude topographical maps. Widely varying distribution system pressures due to undulating terrain, high system head loss and weak/erratic pressure controls further compromise the validity of the average pressure calculation.	Limited telemetry monitoring of scattered pumping station and water storage tank sites provides some static pressure data, which is recorded in handwritten logbooks. Pressure data is gathered at individual sites only when low pressure complaints arise. Average pressure is determined by averaging relatively crude data, and is affected by significant variation in ground elevations, system head loss and gaps in pressure controls in the distribution system.	Conditions between 2 and 4	Effective pressure controls separate different pressure zones; moderate pressure variation across the system, occasional open boundary valves are discovered that breech pressure zones. Basic telemetry monitoring of the distribution system logs pressure data electronically. Pressure data gathered by gauges or dataloggers at fire hydrants or buildings when low pressure complaints arise, and during fire flow tests and system flushing. Reliable topographical data exists. Average pressure is calculated using this mix of data.	Conditions between 4 and 6	Reliable pressure controls separate distinct pressure zones; only very occasional open boundary valves are encountered that breech pressure zones. Well-covered telemetry monitoring of the distribution system (not just pumping at source treatment plants or wells) logs extensive pressure data electronically. Pressure gathered by gauges/dataloggers at fire hydrants and buildings when low pressure complaints arise, and during fire flow tests and system flushing. Average pressure is determined by using this mix of reliable data.	Conditions between 6 and 8	Well-managed, discrete pressure zones exist with generally predictable pressure fluctuations. A current full-scale SCADA System or similar realtime monitoring system exists to monitor the water distribution system and collect data, including real time pressure readings at representative sites across the system. The average system pressure is determined from reliable monitoring system data.	Conditions between 8 and 10	Well-managed pressure districts/zones, SCADA System and hydraulic model exist to give very precise pressure data across the water distribution system. Average system pressure is reliably calculated from extensive, reliable, and cross-checked data. Calculations are reported on an annual basis as a minimum.
Improvements to attain higher data grading for "Average Operating Pressure" component:		<u>to qualify for 2</u>: Employ pressure gauging and/or datalogging equipment to obtain pressure measurements from fire hydrants. Locate accurate topographical maps of service area in order to confirm ground elevations. Research pump data sheets to find pump pressure/flow characteristics	<u>to qualify for 4</u>: Formalize a procedure to use pressure gauging/datalogging equipment to gather pressure data during various system events such as low pressure complaints, or operational testing. Gather pump pressure and flow data at different flow regimes. Identify faulty pressure controls (pressure reducing valves, altitude valves, partially open boundary valves) and plan to properly configure pressure zones. Make all pressure data from these efforts available to generate system-wide average pressure.		<u>to qualify for 6</u>: Expand the use of pressure gauging/datalogging equipment to gather scattered pressure data at a representative set of sites, based upon pressure zones or areas. Utilize pump pressure and flow data to determine supply head entering each pressure zone or district. Correct any faulty pressure controls (pressure reducing valves, altitude valves, partially open boundary valves) to ensure properly configured pressure zones. Use expanded pressure dataset from these activities to generate system-wide average pressure.		<u>to qualify for 8</u>: Install a Supervisory Control and Data Acquisition (SCADA) System, or similar realtime monitoring system, to monitor system parameters and control operations. Set regular calibration schedule for instrumentation to insure data accuracy. Obtain accurate topographical data and utilize pressure data gathered from field surveys to provide extensive, reliable data for pressure averaging.		<u>to qualify for 10</u>: Annually, obtain a system-wide average pressure value from the hydraulic model of the distribution system that has been calibrated via field measurements in the water distribution system and confirmed in comparisons with SCADA System data.		<u>to maintain 10</u>: Continue to refine the hydraulic model of the distribution system and consider linking it with SCADA System for real-time pressure data calibration, and averaging.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
COST DATA											
Total annual cost of operating water system:		Incomplete paper records and lack of financial accounting documentation on many operating functions makes calculation of water system operating costs a pure guesstimate	Reasonably maintained, but incomplete, paper or electronic accounting provides data to estimate the major portion of water system operating costs.	Conditions between 2 and 4	Electronic, industry-standard cost accounting system in place. However, gaps in data are known to exist, periodic internal reviews are conducted but not a structured financial audit.	Conditions between 4 and 6	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Data audited periodically by utility personnel, but not a Certified Public Accountant (CPA).	Conditions between 6 and 8	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Data audited at least annually by utility personnel, and at least once every three years by third-party CPA.	Conditions between 8 and 10	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Data audited annually by utility personnel and annually also by third-party CPA.
Improvements to attain higher data grading for "Total Annual Cost of Operating the Water System" component:		<u>to qualify for 2</u>: Gather available records, institute new financial accounting procedures to regularly collect and audit basic cost data of most important operations functions.	<u>to qualify for 4</u>: Implement an electronic cost accounting system, structured according to accounting standards for water utilities		<u>to qualify for 6</u>: Establish process for periodic internal audit of water system operating costs; identify cost data gaps and institute procedures for tracking these outstanding costs.		<u>to qualify for 8</u>: Standardize the process to conduct routine financial audit on an annual basis. Arrange for CPA audit of financial records at least once every three years.		<u>to qualify for 10</u>: Standardize the process to conduct a third-party financial audit by a CPA on an annual basis.		<u>to maintain 10</u>: Maintain program, stay abreast of expenses subject to erratic cost changes and long-term cost trend, and budget/track costs proactively
Customer retail unit cost (applied to Apparent Losses):	Customer population unmetered, and/or only a fixed fee is charged for consumption.	Antiquated, cumbersome water rate structure is used, with periodic historic amendments that were poorly documented and implemented; resulting in classes of customers being billed inconsistent charges. The actual composite billing rate likely differs significantly from the published water rate structure, but a lack of auditing leaves the degree of error indeterminate.	Dated, cumbersome water rate structure, not always employed consistently in actual billing operations. The actual composite billing rate is known to differ from the published water rate structure, and a reasonably accurate estimate of the degree of error is determined, allowing a composite billing rate to be quantified.	Conditions between 2 and 4	Straight-forward water rate structure in use, but not updated in several years. Billing operations reliably employ the rate structure. The composite billing rate is derived from a single customer class such as residential customer accounts, neglecting the effect of different rates from varying customer classes.	Conditions between 4 and 6	Clearly written, up-to-date water rate structure is in force and is applied reliably in billing operations. Composite customer rate is determined using a weighted average residential rate using volumes of water in each rate block.	Conditions between 6 and 8	Effective water rate structure is in force and is applied reliably in billing operations. Composite customer rate is determined using a weighted average composite consumption rate, which includes residential, commercial, industrial, institutional (CII), and any other distinct customer classes within the water rate structure.	Conditions between 8 and 10	Current, effective water rate structure is in force and applied reliably in billing operations. The rate structure and calculations of composite rate - which includes residential, commercial, industrial, institutional (CII), and other distinct customer classes - are reviewed by a third party knowledgeable in the M36 methodology at least once every five years.
Improvements to attain higher data grading for "Customer Retail Unit Cost" component:		<u>to qualify for 2</u>: Formalize the process to implement water rates, including a secure documentation procedure. Create a current, formal water rate document and gain approval from all stakeholders.	<u>to qualify for 4</u>: Review the water rate structure and update/formalize as needed. Assess billing operations to ensure that actual billing operations incorporate the established water rate structure.		<u>to qualify for 6</u>: Evaluate volume of water used in each usage block by residential users. Multiply volumes by full rate structure.	<u>Launch effort to fully meter the customer population and charge rates based upon water volumes</u>	<u>to qualify for 8</u>: Evaluate volume of water used in each usage block by all classifications of users. Multiply volumes by full rate structure.		<u>to qualify for 10</u>: Conduct a periodic third-party audit of water used in each usage block by all classifications of users. Multiply volumes by full rate structure.		<u>to maintain 10</u>: Keep water rate structure current in addressing the water utility's revenue needs. Update the calculation of the customer unit rate as new rate components, customer classes, or other components are modified.
Variable production cost (applied to Real Losses):	Note: if the water utility purchases/imports its entire water supply, then enter the unit purchase cost of the bulk water supply in the Reporting Worksheet with a grading of 10	Incomplete paper records and lack of documentation on primary operating functions (electric power and treatment costs most importantly) makes calculation of variable production costs a pure guesstimate	Reasonably maintained, but incomplete, paper or electronic accounting provides data to roughly estimate the basic operations costs (pumping power costs and treatment costs) and calculate a unit variable production cost.	Conditions between 2 and 4	Electronic, industry-standard cost accounting system in place. Electric power and treatment costs are reliably tracked and allow accurate weighted calculation of unit variable production costs based on these two inputs and water imported purchase costs (if applicable). All costs are audited internally on a periodic basis.	Conditions between 4 and 6	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Pertinent additional costs beyond power, treatment and water imported purchase costs (if applicable) such as liability, residuals management, wear and tear on equipment, impending expansion of supply, are included in the unit variable production cost, as applicable. The data is audited at least annually by utility personnel.	Conditions between 6 and 8	Reliable electronic, industry-standard cost accounting system in place, with all pertinent primary and secondary variable production and water imported purchase (if applicable) costs tracked. The data is audited at least annually by utility personnel, and at least once every three years by a third-party knowledgeable in the M36 methodology.	Conditions between 8 and 10	Either of two conditions can be met to obtain a grading of 10: 1) Third party CPA audit of all pertinent primary and secondary variable production and water imported purchase (if applicable) costs on an annual basis. or: 2) Water supply is entirely purchased as bulk imported water, and unit purchase cost serves as the variable production cost.
Improvements to attain higher data grading for "Variable Production Cost" component:		<u>to qualify for 2</u>: Gather available records, institute new procedures to regularly collect and audit basic cost data and most important operations functions.	<u>to qualify for 4</u>: Implement an electronic cost accounting system, structured according to accounting standards for water utilities		<u>to qualify for 6</u>: Formalize process for regular internal audits of production costs. Assess whether additional costs (liability, residuals management, equipment wear, impending infrastructure expansion) should be included to calculate a more representative variable production cost.		<u>to qualify for 8</u>: Formalize the accounting process to include direct cost components (power, treatment) as well as indirect cost components (liability, residuals management, etc.) Arrange to conduct audits by a knowledgable third-party at least once every three years.		<u>to qualify for 10</u>: Standardize the process to conduct a third-party financial audit by a CPA on an annual basis.		<u>to maintain 10</u>: Maintain program, stay abreast of expenses subject to erratic cost changes and budget/track costs proactively

Average Length of Customer Service Line

The three figures shown on this worksheet display the assignment of the Average Length of Customer Service Line, Lp, for the three most common piping configurations.

Figure 1 shows the configuration of the water meter outside of the customer building next to the curb stop valve. In this configuration Lp = 0 since the distance between the curb stop and the customer metering point is essentially zero.

Figure 2 shows the configuration of the customer water meter located inside the customer building, where Lp is the distance from the curb stop to the water meter.

Figure 3 shows the configuration of an unmetered customer building , where Lp is the distance from the curb stop to the first point of customer water consumption, or, more simply, the building line.

In any water system the Lp will vary notably in a community of different structures, therefore the average Lp value is used and this should be approximated or calculated if a sample of service line measurements has been gathered.

Click for more information

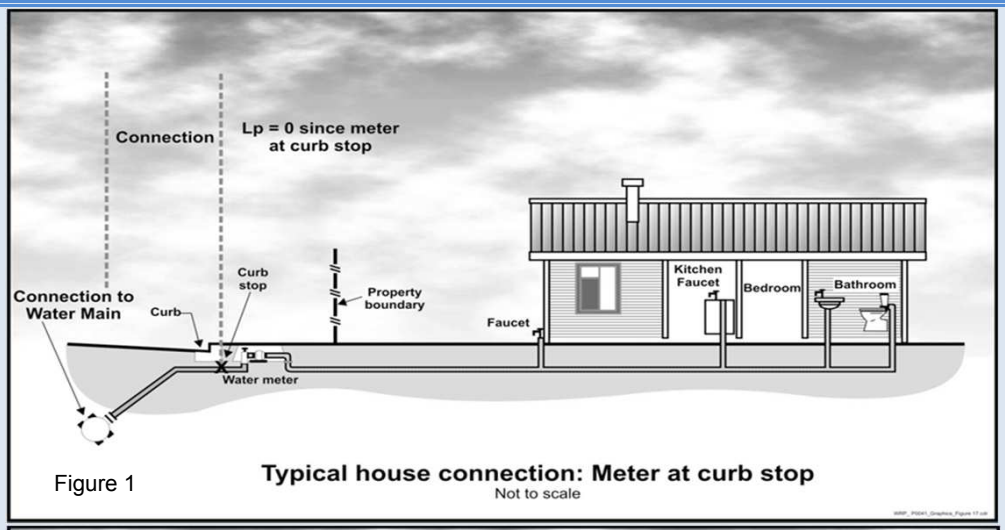


Figure 1 **Typical house connection: Meter at curb stop**
Not to scale

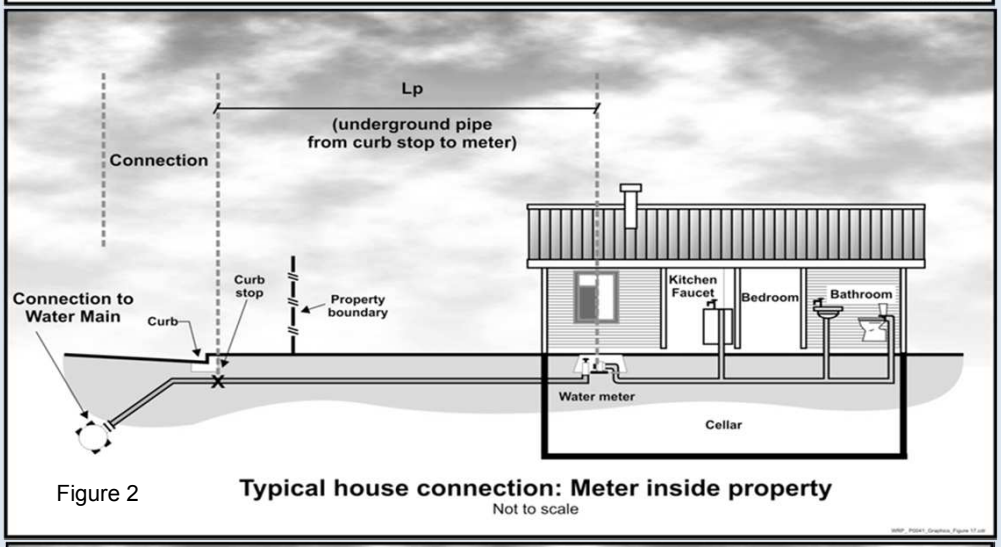


Figure 2 **Typical house connection: Meter inside property**
Not to scale

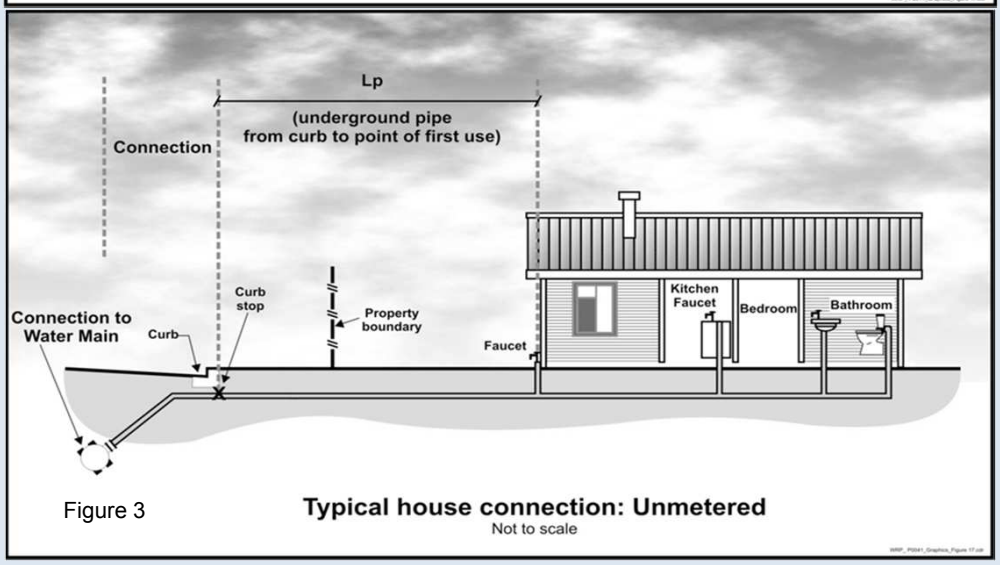
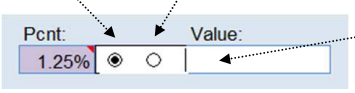


Figure 3 **Typical house connection: Unmetered**
Not to scale

Item Name	Description
Apparent Losses Find	= unauthorized consumption + customer metering inaccuracies + systematic data handling errors Apparent Losses include all types of inaccuracies associated with customer metering (worn meters as well as improperly sized meters or wrong type of meter for the water usage profile) as well as systematic data handling errors (meter reading, billing, archiving and reporting), plus unauthorized consumption (theft or illegal use). NOTE: Over-estimation of Apparent Losses results in under-estimation of Real Losses. Under-estimation of Apparent Losses results in over-estimation of Real Losses.
AUTHORIZED CONSUMPTION Find	= billed water exported + billed metered + billed unmetered + unbilled metered + unbilled unmetered consumption The volume of metered and/or unmetered water taken by registered customers, the water utility's own uses, and uses of others who are implicitly or explicitly authorized to do so by the water utility; for residential, commercial, industrial and public-minded purposes. Typical retail customers' consumption is tabulated usually from established customer accounts as billed metered consumption, or - for unmetered customers - billed unmetered consumption. These types of consumption, along with billed water exported, provide revenue potential for the water utility. **Be certain to tabulate the water exported volume as a separate component and do not "double-count" it by including in the billed metered consumption component as well as the water exported component.** Unbilled authorized consumption occurs typically in non-account uses, including water for fire fighting and training, flushing of water mains and sewers, street cleaning, watering of municipal gardens, public fountains, or similar public-minded uses. Occasionally these uses may be metered and billed (or charged a flat fee), but usually they are unmetered and unbilled. In the latter case, the water auditor may use a default value to estimate this quantity, or implement procedures for the reliable quantification of these uses. This starts with documenting usage events as they occur and estimating the amount of water used in each event. (See Unbilled unmetered consumption)
View Service Connection Diagram **Average length of customer service line** Find	This is the average length of customer service line, Lp, that is owned and maintained by the customer; from the point of ownership transfer to the customer water meter, or building line (if unmetered). The quantity is one of the data inputs for the calculation of Unavoidable Annual Real Losses (UARL), which serves as the denominator of the performance indicator: Infrastructure Leakage Index (ILI). The value of Lp is multiplied by the number of customer service connections to obtain a total length of customer owned piping in the system. The purpose of this parameter is to account for the unmetered service line infrastructure that is the responsibility of the customer for arranging repairs of leaks that occur on their lines. In many cases leak repairs arranged by customers take longer to be executed than leak repairs arranged by the water utility on utility-maintained piping. Leaks run longer - and lose more water - on customer-owned service piping, than utility owned piping. If the customer water meter exists near the ownership transfer point (usually the curb stop located between the water main and the customer premises) this distance is zero because the meter and transfer point are the same. This is the often encountered configuration of customer water meters located in an underground meter box or "pit" outside of the customer's building. The Free Water Audit Software asks a "Yes/No" question about the meter at this location. If the auditor selects "Yes" then this distance is set to zero and the data grading score for this component is set to 10. If water meters are typically located inside the customer premise/building, or properties are unmetered, it is up to the water auditor to estimate a system-wide average Lp length based upon the various customer land parcel sizes and building locations in the service area. Lp will be a shorter length in areas of high density housing, and a longer length in areas of low density housing and varied commercial and industrial buildings. General parcel demographics should be employed to obtain a composite average Lp length for the entire system. Refer to the "Service Connection Diagram" worksheet for a depiction of the service line/metering configurations that typically exist in water utilities. This worksheet gives guidance on the determination of the Average Length, Lp, for each configuration.
Average operating pressure Find	This is the average pressure in the distribution system that is the subject of the water audit. Many water utilities have a calibrated hydraulic model of their water distribution system. For these utilities, the hydraulic model can be utilized to obtain a very accurate quantity of average pressure. In the absence of a hydraulic model, the average pressure may be approximated by obtaining readings of static water pressure from a representative sample of fire hydrants or other system access points evenly located across the system. A weighted average of the pressure can be assembled; but be sure to take into account the elevation of the fire hydrants, which typically exist several feet higher than the level of buried water pipelines. If the water utility is compiling the water audit for the first time, the average pressure can be approximated, but with a low data grading. In subsequent years of auditing, effort should be made to improve the accuracy of the average pressure quantity. This will then qualify the value for a higher data grading.
Billed Authorized Consumption	All consumption that is billed and authorized by the utility. This may include both metered and unmetered consumption. See "Authorized Consumption" for more information.
Billed metered consumption Find	All metered consumption which is billed to retail customers, including all groups of customers such as domestic, commercial, industrial or institutional. **It does NOT include water supplied to neighboring utilities (water exported) which is metered and billed. Be sure to subtract any consumption for exported water sales that may be included in these billing roles. Water supplied as exports to neighboring water utilities should be included only in the Water Exported component.** The metered consumption data can be taken directly from billing records for the water audit period. The accuracy of yearly metered consumption data can be refined by including an adjustment to account for customer meter reading lag time since not all customer meters are read on the same day of the meter reading period. However additional analysis is necessary to determine the lag time adjustment value, which may or may not be significant.
Billed unmetered consumption Find	All billed consumption which is calculated based on estimates or norms from water usage sites that have been determined by utility policy to be left unmetered. This is typically a very small component in systems that maintain a policy to meter their customer population. However, this quantity can be the key consumption component in utilities that have not adopted a universal metering policy. **This component should NOT include any water that is supplied to neighboring utilities (water exported) which is unmetered but billed. Water supplied as exports to neighboring water utilities should be included only in the Water Exported component.**

Item Name	Description
Customer metering inaccuracies Find	Apparent water losses caused by the collective under-registration of customer water meters. Many customer water meters gradually wear as large cumulative volumes of water are passed through them over time. This causes the meters to under-register the flow of water. This occurrence is common with smaller residential meters of sizes 5/8-inch and 3/4 inch after they have registered very large cumulative volumes of water, which generally occurs only after periods of years. For meters sized 1-inch and larger - typical of multi-unit residential, commercial and industrial accounts - meter under-registration can occur from wear or from the improper application of the meter; i.e. installing the wrong type of meter or the wrong size of meter, for the flow pattern (profile) of the consumer. For instance, many larger meters have reduced accuracy at low flows. If an oversized meter is installed, most of the time the routine flow will occur in the low flow range of the meter, and a significant portion of it may not be registered. It is important to properly select and install all meters, but particularly large customer meters, size 1-inch and larger. The auditor has two options for entering data for this component of the audit. The auditor can enter a percentage under-registration (typically an estimated value), this will apply the selected percentage to the two categories of metered consumption to determine the volume of water not recorded due to customer meter inaccuracy. Note that this percentage is a composite average inaccuracy for all customer meters in the entire meter population. The percentage will be multiplied by the sum of the volumes in the Billed Metered and Unbilled Metered components. Alternatively, if the auditor has substantial data from meter testing activities, he or she can calculate their own loss volumes, and this volume may be entered directly. Note that a value of zero will be accepted but an alert will appear asking if the customer population is unmetered. Since all metered systems have some degree of inaccuracy, a positive value should be entered. A value of zero in this component is valid only if the water utility does not meter its customer population.
Customer retail unit cost Find	The Customer Retail Unit Cost represents the charge that customers pay for water service. This unit cost is applied routinely to the components of Apparent Loss, since these losses represent water reaching customers but not (fully) paid for. Since most water utilities have a rate structure that includes a variety of different costs based upon class of customer, a weighted average of individual costs and number of customer accounts in each class can be calculated to determine a single composite cost that should be entered into this cell. Finally, the weighted average cost should also include additional charges for sewer, storm water or biosolids processing, but only if these charges are based upon the volume of potable water consumed. For water utilities in regions with limited water resources and a questionable ability to meet the drinking water demands in the future, the Customer Retail Unit Cost might also be applied to value the Real Losses; instead of applying the Variable Production Cost to Real Losses. In this way, it is assumed that every unit volume of leakage reduced by leakage management activities will be sold to a customer. Note: the Free Water Audit Software allows the user to select the units that are charged to customers (either $/1,000 gallons, $/hundred cubic feet, or $/1,000 litres) and automatically converts these units to the units that appear in the "WATER SUPPLIED" box. The monetary units are United States dollars, $.
Infrastructure Leakage Index (ILI) Find	The ratio of the Current Annual Real Losses (Real Losses) to the Unavoidable Annual Real Losses (UARL). The ILI is a highly effective performance indicator for comparing (benchmarking) the performance of utilities in operational management of real losses.
Length of mains Find	Length of all pipelines (except service connections) in the system starting from the point of system input metering (for example at the outlet of the treatment plant). It is also recommended to include in this measure the total length of fire hydrant lead pipe. Hydrant lead pipe is the pipe branching from the water main to the fire hydrant. Fire hydrant leads are typically of a sufficiently large size that is more representative of a pipeline than a service connection. The average length of hydrant leads across the entire system can be assumed if not known, and multiplied by the number of fire hydrants in the system, which can also be assumed if not known. This value can then be added to the total pipeline length. Total length of mains can therefore be calculated as: Length of Mains, miles = (total pipeline length, miles) + [{(average fire hydrant lead length, ft) x (number of fire hydrants)} / 5,280 ft/mile] or Length of Mains, kilometres = (total pipeline length, kilometres) + [{(average fire hydrant lead length, metres) x (number of fire hydrants)} / 1,000 metres/kilometre]
NON-REVENUE WATER Find	= Apparent Losses + Real Losses + Unbilled Metered Consumption + Unbilled Unmetered Consumption. This is water which does not provide revenue potential to the utility.
Number of active AND inactive service connections Find	Number of customer service connections, extending from the water main to supply water to a customer. Please note that this includes the actual number of distinct piping connections, including fire connections, whether active or inactive. This may differ substantially from the number of customers (or number of accounts). **Note: this number does not include the pipeline leads to fire hydrants - the total length of piping supplying fire hyrants should be included in the "Length of mains" parameter.**
Real Losses Find	Physical water losses from the pressurized system (water mains and customer service connections) and the utility's storage tanks, up to the point of customer consumption. In metered systems this is the customer meter, in unmetered situations this is the first point of consumption (stop tap/tap) within the property. The annual volume lost through all types of leaks, breaks and overflows depends on frequencies, flow rates, and average duration of individual leaks, breaks and overflows.
Revenue Water	Those components of System Input Volume that are billed and have the potential to produce revenue.
Service Connection Density Find	=number of customer service connections / length of mains

Item Name	Description
Systematic data handling errors Find	Apparent losses caused by accounting omissions, errant computer programming, gaps in policy, procedure, and permitting/activation of new accounts; and any type of data lapse that results in under-stated customer water consumption in summary billing reports. **Systematic Data Handling Errors result in a direct loss of revenue potential. Water utilities can find "lost" revenue by keying on this component.** Utilities typically measure water consumption registered by water meters at customer premises. The meter should be read routinely (ex: monthly) and the data transferred to the Customer Billing System, which generates and sends a bill to the customer. Data Transfer Errors result in the consumption value being less than the actual consumption, creating an apparent loss. Such error might occur from illegible and mis-recorded hand-written readings compiled by meter readers, inputting an incorrect meter register unit conversion factor in the automatic meter reading equipment, or a variety of similar errors. Apparent losses also occur from Data Analysis Errors in the archival and data reporting processes of the Customer Billing System. Inaccurate estimates used for accounts that fail to produce a meter reading are a common source of error. Billing adjustments may award customers a rightful monetary credit, but do so by creating a negative value of consumption, thus under-stating the actual consumption. Account activation lapses may allow new buildings to use water for months without meter readings and billing. Poor permitting and construction inspection practices can result in a new building lacking a billing account, a water meter and meter reading; i.e., the customer is unknown to the utility's billing system. Close auditing of the permitting, metering, meter reading, billing and reporting processes of the water consumption data trail can uncover data management gaps that create volumes of systematic data handling error. Utilities should routinely analyze customer billing records to detect data anomalies and quantify these losses. For example, a billing account that registers zero consumption for two or more billing cycles should be checked to explain why usage has seemingly halted. Given the revenue loss impacts of these losses, water utilities are well-justified in providing continuous oversight and timely correction of data transfer errors & data handling errors. If the water auditor has not yet gathered detailed data or assessment of systematic data handling error, it is recommended that the auditor apply the default value of 0.25% of the the Billed Authorized Consumption volume. However, if the auditor has investigated the billing system and its controls, and has well validated data that indicates the volume from systematic data handling error is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations and select an appropriate grading. Note: negative values are not allowed for this audit component. If the auditor enters zero for this component then a grading of 1 will be automatically assigned.
Total annual cost of operating the water system Find	These costs include those for operations, maintenance and any annually incurred costs for long-term upkeep of the drinking water supply and distribution system. It should include the costs of day-to-day upkeep and long-term financing such as repayment of capital bonds for infrastructure expansion or improvement. Typical costs include employee salaries and benefits, materials, equipment, insurance, fees, administrative costs and all other costs that exist to sustain the drinking water supply. Depending upon water utility accounting procedures or regulatory agency requirements, it may be appropriate to include depreciation in the total of this cost. This cost should not include any costs to operate wastewater, biosolids or other systems outside of drinking water.
Unauthorized consumption Find	Includes water illegally withdrawn from fire hydrants, illegal connections, bypasses to customer consumption meters, or tampering with metering or meter reading equipment; as well as any other ways to receive water while thwarting the water utility's ability to collect revenue for the water. Unauthorized consumption results in uncaptured revenue and creates an error that understates customer consumption. In most water utilities this volume is low and, if the water auditor has not yet gathered detailed data for these loss occurrences, it is recommended that the auditor apply a default value of 0.25% of the volume of water supplied. However, if the auditor has investigated unauthorized occurrences, and has well validated data that indicates the volume from unauthorized consumption is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations. Note that a value of zero will not be accepted since all water utilities have some volume of unauthorized consumption occurring in their system. Note: if the auditor selects the default value for unauthorized consumption, a data grading of 5 is automatically assigned, but not displayed on the Reporting Worksheet.
Unavoidable Annual Real Losses (UARL) Find	UARL (gallons/day)=(5.41Lm + 0.15Nc + 7.5Lc) xP, or UARL (litres/day)=(18.0Lm + 0.8Nc + 25.0Lc) xP where: Lm = length of mains (miles or kilometres) Nc = number of customer service connections Lp = the average distance of customer service connection piping (feet or metres) (see the Worksheet "Service Connection Diagram" for guidance on deterring the value of Lp) Lc = total length of customer service connection piping (miles or km) Lc = Nc X Lp (miles or kilometres) P = Pressure (psi or metres) The UARL is a theoretical reference value representing the technical low limit of leakage that could be achieved if all of today's best technology could be successfully applied. It is a key variable in the calculation of the Infrastructure Leakage Index (ILI). Striving to reduce system leakage to a level close to the UARL is usually not needed unless the water supply is unusually expensive, scarce or both. NOTE: The UARL calculation has not yet been proven as fully valid for very small, or low pressure water distribution systems. If, in gallons per day: (Lm x 32) + Nc < 3000 or P <35psi in litres per day: (Lm x 20) + Nc < 3000 or P < 25m then the calculated UARL value may not be valid. The software does not display a value of UARL or ILI if either of these conditions is true.

Item Name	Description
Unbilled Authorized Consumption	All consumption that is unbilled, but still authorized by the utility. This includes Unbilled Metered Consumption + Unbilled Unmetered Consumption. See "Authorized Consumption" for more information. For Unbilled Unmetered Consumption, the Free Water Audit Software provides the auditor the option to select a default value if they have not audited unmetered activities in detail. The default calculates a volume that is 1.25% of the Water Supplied volume. If the auditor has carefully audited the various unbilled, unmetered, authorized uses of water, and has established reliable estimates of this collective volume, then he or she may enter the volume directly for this component, and not use the default value.
Unbilled metered consumption Find	Metered consumption which is authorized by the water utility, but, for any reason, is deemed by utility policy to be unbilled. This might for example include metered water consumed by the utility itself in treatment or distribution operations, or metered water provided to civic institutions free of charge. **It does not include water supplied to neighboring utilities (water exported) which may be metered but not billed.**
Unbilled unmetered consumption Find	Any kind of Authorized Consumption which is neither billed or metered. This component typically includes water used in activities such as fire fighting, flushing of water mains and sewers, street cleaning, fire flow tests conducted by the water utility, etc. In most water utilities it is a small component which is very often substantially overestimated. **It does NOT include water supplied to neighboring utilities (water exported) which is unmetered and unbilled – an unlikely case.** This component has many sub-components of water use which are often tedious to identify and quantify. Because of this, and the fact that it is usually a small portion of the water supplied, it is recommended that the auditor apply the default value, which is 1.25% of the Water Supplied volume. Select the default percentage to enter this value. If the water utility has carefully audited the unbilled, unmetered activities occurring in the system, and has well validated data that gives a value substantially higher or lower than the default volume, then the auditor should enter their own volume. However the default approach is recommended for most water utilities. Note that a value of zero is not permitted, since all water utilities have some volume of water in this component occurring in their system.
Units and Conversions	The user may develop an audit based on one of three unit selections: 1) Million Gallons (US) 2) Megalitres (Thousand Cubic Metres) 3) Acre-feet Once this selection has been made in the instructions sheet, all calculations are made on the basis of the chosen units. Should the user wish to make additional conversions, a unit converter is provided below (use drop down menus to select units from the yellow unit boxes): Enter Units: 1 | Convert From… Million Gallons (US) = **Converts to…..** 3.06888329 Acre-feet (conversion factor = 3.06888328973723)
Use of Option Buttons	To use the default percent value choose this button To enter a value choose this button and enter the value in the cell to the right  **NOTE:** For Unbilled Unmetered Consumption, Unauthorized Consumption and Systematic Data Handling Errors, a recommended default value can be applied by selecting the Percent option. The default values are based on fixed percentages of Water Supplied or Billed Authorized Consumption and are recommended for use in this audit unless the auditor has well validated data for their system. Default values are shown by purple cells, as shown in the example above. If a default value is selected, the user does not need to grade the item; a grading value of 5 is automatically applied (however, this grade will not be displayed).
Variable production cost (applied to Real Losses) Find	The cost to produce and supply the next unit of water (e.g., $/million gallons). This cost is determined by calculating the summed unit costs for ground and surface water treatment and all power used for pumping from the source to the customer. It may also include other miscellaneous unit costs that apply to the production of drinking water. It should also include the unit cost of bulk water purchased as an import if applicable. It is common to apply this unit cost to the volume of Real Losses. However, if water resources are strained and the ability to meet future drinking water demands is in question, then the water auditor can be justified in applying the Customer Retail Rate to the Real Loss volume, rather than applying the Variable Production Cost. The Free Water Audit Software applies the Variable Production costs to Real Losses by default. However, the auditor has the option on the Reporting Worksheet to select the Customer Retail Cost as the basis for the Real Loss cost evaluation if the auditor determines that this is warranted.
Volume from own sources Find	The volume of water withdrawn (abstracted) from water resources (rivers, lakes, streams, wells, etc) controlled by the water utility, and then treated for potable water distribution. Most water audits are compiled for utility retail water distribution systems, so this volume should reflect the amount of treated drinking water that entered the distribution system. Often the volume of water measured at the effluent of the treatment works is slightly less than the volume measured at the raw water source, since some of the water is used in the treatment process. Thus, it is useful if flows are metered at the effluent of the treatment works. If metering exists only at the raw water source, an adjustment for water used in the treatment process should be included to account for water consumed in treatment operations such as filter backwashing, basin flushing and cleaning, etc. If the audit is conducted for a wholesale water agency that sells untreated water, then this quantity reflects the measure of the raw water, typically metered at the source.

Item Name	Description
Volume from own sources: Master meter and supply error adjustment Find	An estimate or measure of the degree of inaccuracy that exists in the master (production) meters measuring the annual Volume from own Sources, and any error in the data trail that exists to collect, store and report the summary production data. This adjustment is a weighted average number that represents the collective error for all master meters for all days of the audit year and any errors identified in the data trail. Meter error can occur in different ways. A meter or meters may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Data error can occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of inaccuracy in master meters and data errors in archival systems are common; thus a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration.
Water exported Find	The Water Exported volume is the bulk water conveyed and sold by the water utility to neighboring water systems that exists outside of their service area. Typically this water is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water utility that is selling the water: i.e. the exporter. If the water utility who is compiling the annual water audit sells bulk water in this manner, they are an exporter of water. Note: The Water Exported volume is sold to wholesale customers who are typically charged a wholesale rate that is different than retail rates charged to the retail customers existing within the service area. Many state regulatory agencies require that the Water Exported volume be reported to them as a quantity separate and distinct from the retail customer billed consumption. For these reasons - and others - the Water Exported volume is always quantified separately from Billed Authorized Consumption in the standard water audit. **Be certain not to "double-count" this quantity by including it in both the Water Exported box and the Billed Metered Consumption box of the water audit Reporting Worksheet. This volume should be included only in the Water Exported box.**
Water exported: Master meter and supply error adjustment Find	An estimate or measure of the volume in which the Water Exported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived exported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of error in their metered data, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived data. Thus, a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment. Corrections to data gaps or other errors found in the archived data should also be included as a portion of this meter error adjustment.
Water imported Find	The Water Imported volume is the bulk water purchased to become part of the Water Supplied volume. Typically this is water purchased from a neighboring water utility or regional water authority, and is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water supplier selling the water to the utility conducting the water audit. The water supplier selling the bulk water usually charges the receiving utility based upon a wholesale water rate.
Water imported: Master meter and supply error adjustment Find	An estimate or measure of the volume in which the Water Imported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived imported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some level of meter inaccuracy, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived metered data. Thus, a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment.
WATER LOSSES Find	= apparent losses + real losses Water Losses are the difference between Water Supplied and Authorized Consumption. Water losses can be considered as a total volume for the whole system, or for partial systems such as transmission systems, pressure zones or district metered areas (DMA); if one of these configurations are the basis of the water audit.

Water Audit Report for: City of Brentwood (0710004)
Reporting Year: 2015 1/2015 - 12/2015
Data Validity Score: 92

Water Loss Control Planning Guide

Functional Focus Area	Water Audit Data Validity Level / Score				
	Level I (0-25)	**Level II** (26-50)	**Level III** (51-70)	**Level IV** (71-90)	**Level V** (91-100)
Audit Data Collection	Launch auditing and loss control team; address production metering deficiencies	Analyze business process for customer metering and billing functions and water supply operations. Identify data gaps.	Establish/revise policies and procedures for data collection	Refine data collection practices and establish as routine business process	Annual water audit is a reliable gauge of year-to-year water efficiency standing
Short-term loss control	Research information on leak detection programs. Begin flowcharting analysis of customer billing system	Conduct loss assessment investigations on a sample portion of the system: customer meter testing, leak survey, unauthorized consumption, etc.	Establish ongoing mechanisms for customer meter accuracy testing, active leakage control and infrastructure monitoring	Refine, enhance or expand ongoing programs based upon economic justification	Stay abreast of improvements in metering, meter reading, billing, leakage management and infrastructure rehabilitation
Long-term loss control		Begin to assess long-term needs requiring large expenditure: customer meter replacement, water main replacement program, new customer billing system or Automatic Meter Reading (AMR) system.	Begin to assemble economic business case for long-term needs based upon improved data becoming available through the water audit process.	Conduct detailed planning, budgeting and launch of comprehensive improvements for metering, billing or infrastructure management	Continue incremental improvements in short-term and long-term loss control interventions
Target-setting			Establish long-term apparent and real loss reduction goals (+10 year horizon)	Establish mid-range (5 year horizon) apparent and real loss reduction goals	Evaluate and refine loss control goals on a yearly basis
Benchmarking			Preliminary Comparisons - can begin to rely upon the Infrastructure Leakage Index (ILI) for performance comparisons for real losses (see below table)	Performance Benchmarking - ILI is meaningful in comparing real loss standing	Identify Best Practices/ Best in class - the ILI is very reliable as a real loss performance indicator for best in class service

For validity scores of 50 or below, the shaded blocks should not be focus areas until better data validity is achieved.

Once data have been entered into the Reporting Worksheet, the performance indicators are automatically calculated. How does a water utility operator know how well his or her system is performing? The AWWA Water Loss Control Committee provided the following table to assist water utilities is gauging an approximate Infrastructure Leakage Index (ILI) that is appropriate for their water system and local conditions. The lower the amount of leakage and real losses that exist in the system, then the lower the ILI value will be.

Note: this table offers an approximate guideline for leakage reduction target-setting. The best means of setting such targets include performing an economic assessment of various loss control methods. However, this table is useful if such an assessment is not possible.

General Guidelines for Setting a Target ILI (without doing a full economic analysis of leakage control options)

Target ILI Range	Financial Considerations	Operational Considerations	Water Resources Considerations
1.0 - 3.0	Water resources are costly to develop or purchase; ability to increase revenues via water rates is greatly limited because of regulation or low ratepayer affordability.	Operating with system leakage above this level would require expansion of existing infrastructure and/or additional water resources to meet the demand.	Available resources are greatly limited and are very difficult and/or environmentally unsound to develop.
>3.0 -5.0	Water resources can be developed or purchased at reasonable expense; periodic water rate increases can be feasibly imposed and are tolerated by the customer population.	Existing water supply infrastructure capability is sufficient to meet long-term demand as long as reasonable leakage management controls are in place.	Water resources are believed to be sufficient to meet long-term needs, but demand management interventions (leakage management, water conservation) are included in the long-term
>5.0 - 8.0	Cost to purchase or obtain/treat water is low, as are rates charged to customers.	Superior reliability, capacity and integrity of the water supply infrastructure make it relatively immune to supply shortages.	Water resources are plentiful, reliable, and easily extracted.
Greater than 8.0	Although operational and financial considerations may allow a long-term ILI greater than 8.0, such a level of leakage is not an effective utilization of water as a resource. Setting a target level greater than 8.0 - other than as an incremental goal to a smaller long-term target - is discouraged.		
Less than 1.0	If the calculated Infrastructure Leakage Index (ILI) value for your system is 1.0 or less, two possibilities exist. a) you are maintaining your leakage at low levels in a class with the top worldwide performers in leakage control. b) A portion of your data may be flawed, causing your losses to be greatly understated. This is likely if you calculate a low ILI value but do not employ extensive leakage control practices in your operations. In such cases it is beneficial to validate the data by performing field measurements to confirm the accuracy of production and customer meters, or to identify any other potential sources of error in the data.		

Example 1a: Million Gallons: | **Example 1b**: Million Gallons: Performance Indicators | **Example 2a**: Megalitres: Reporting Worksheet | **Example 2b**: Megalitres: Reporting Worksheet

Example Audit 1a:

AWWA Free Water Audit Software: Reporting Worksheet

WAS v5.0
American Water Works Association
Copyright © 2014, All Rights Reserved

Click to access definition
Click to add a comment

Water Audit Report for: City of Asheville (01-11-010)
Reporting Year: 2013 7/2012 - 6/2013

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

Master Meter Error Adjustments

WATER SUPPLIED

<---------- Enter grading in column 'E' and 'J' ---------->

					Pcnt:	Value:	
Volume from own sources:	7	7,352.880	MG/Yr	3		285.450	MG/Yr
Water imported:	n/a	0.000	MG/Yr				MG/Yr
Water exported:	n/a	0.000	MG/Yr				MG/Yr

Enter negative % or value for under-registration
Enter positive % or value for over-registration

WATER SUPPLIED: 7,067.430 MG/Yr

AUTHORIZED CONSUMPTION

Click here: for help using option buttons below

			Pcnt:	Value:	
Billed metered:	8	4,782.250	MG/Yr			
Billed unmetered:	n/a	0.000	MG/Yr			
Unbilled metered:	7	27.757	MG/Yr			
Unbilled unmetered:	8	157.790	MG/Yr		157.790	MG/Yr

Unbilled Unmetered volume entered is greater than the recommended default value

Use buttons to select percentage of water supplied OR value

AUTHORIZED CONSUMPTION: 4,967.797 MG/Yr

WATER LOSSES (Water Supplied - Authorized Consumption) 2,099.633 MG/Yr

Apparent Losses

			Pcnt:	Value:	
Unauthorized consumption:		17.669	MG/Yr	0.25%		MG/Yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies:	7	111.220	MG/Yr	2.26%	MG/Yr
Systematic data handling errors:	5	11.956	MG/Yr	0.25%	MG/Yr

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

Apparent Losses: 140.844 MG/Yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: 1,958.789 MG/Yr

WATER LOSSES: 2,099.633 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 2,285.180 MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	4	1,236.5	miles
Number of active AND inactive service connections:	7	55,256	
Service connection density:		45	conn./mile main

Are customer meters typically located at the curbstop or property line? Yes

Average length of customer service line: (length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line has been set to zero and a data grading score of 10 has been applied

Average operating pressure:	4	145.3	psi

COST DATA

Total annual cost of operating water system:	10	$33,630,676	$/Year	
Customer retail unit cost (applied to Apparent Losses):	10	$3.22	$/100 cubic feet (ccf)	
Variable production cost (applied to Real Losses):	6	$335.94	$/Million gallons	☐ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

*** YOUR SCORE IS: 72 out of 100 ***

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources
2: Variable production cost (applied to Real Losses)
3: Unauthorized consumption

Example Audit 1b:

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

Water Audit Report for: City of Asheville (01-11-010)
Reporting Year: 2013 7/2012 - 6/2013

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 72 out of 100 ***

System Attributes:

	Apparent Losses:	140.844	MG/Yr
+	Real Losses:	1,958.789	MG/Yr
=	**Water Losses:**	**2,099.633**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	794.34	MG/Yr
	Annual cost of Apparent Losses:	$606,265	
	Annual cost of Real Losses:	$658,036	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	32.3%	
	Non-revenue water as percent by cost of operating system:	3.9%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	6.98	gallons/connection/day
	Real Losses per service connection per day:	97.12	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.67	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	1,958.79	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:	2.47	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

Example Audit 2a:

AWWA Free Water Audit Software: Reporting Worksheet

WAS v5.0

Click to access definition
Click to add a comment

Water Audit Report for: The City of Calgary
Reporting Year: 2013 (1/2013 - 12/2013)

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MEGALITRES (THOUSAND CUBIC METRES) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

Master Meter Error Adjustments

WATER SUPPLIED

<---------- Enter grading in column 'E' and 'J' ----------> Pcnt: Value:

				Pcnt	Value	
Volume from own sources:	7	174,324.000	ML/Yr	1.00%		ML/Yr
Water imported:	n/a	0.000	ML/Yr			ML/Yr
Water exported:	7	8,190.131	ML/Yr	1.00%		ML/Yr

Enter negative % or value for under-registration
Enter positive % or value for over-registration

WATER SUPPLIED: 164,488.979 ML/Yr

AUTHORIZED CONSUMPTION

Click here: for help using option buttons below

				Pcnt	Value	
Billed metered:	6	125,111.268	ML/Yr			
Billed unmetered:	8	3,503.386	ML/Yr			
Unbilled metered:	7	166.157	ML/Yr			
Unbilled unmetered:	6	1,444.000	ML/Yr		1,444.000	ML/Yr

Use buttons to select percentage of water supplied OR value

AUTHORIZED CONSUMPTION: 130,224.811 ML/Yr

WATER LOSSES (Water Supplied - Authorized Consumption) 34,264.168 ML/Yr

Apparent Losses

				Pcnt	Value	
Unauthorized consumption:		411.222	ML/Yr	0.25%		ML/Yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies:	6	1,265.429	ML/Yr	1.00%		ML/Yr
Systematic data handling errors:		312.778	ML/Yr	0.25%		ML/Yr

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

Apparent Losses: 1,989.429 ML/Yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: 32,274.739 ML/Yr

WATER LOSSES: 34,264.168 ML/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 35,874.325 ML/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	8	4,945.0	kilometers
Number of active AND inactive service connections:	8	312,075	
Service connection density:		63	conn./km main
Are customer meters typically located at the curbstop or property line?		No	
Average length of customer service line:	8	12.0	metres
Average operating pressure:	8	50.8	metres (head)

(length of service line, beyond the property boundary, that is the responsibility of the utility)

COST DATA

Total annual cost of operating water system:	9	$169,973,759	$/Year	
Customer retail unit cost (applied to Apparent Losses):	9	$2.35	$/1000 litres	
Variable production cost (applied to Real Losses):	9	$73.54	$/Megalitre	☑ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

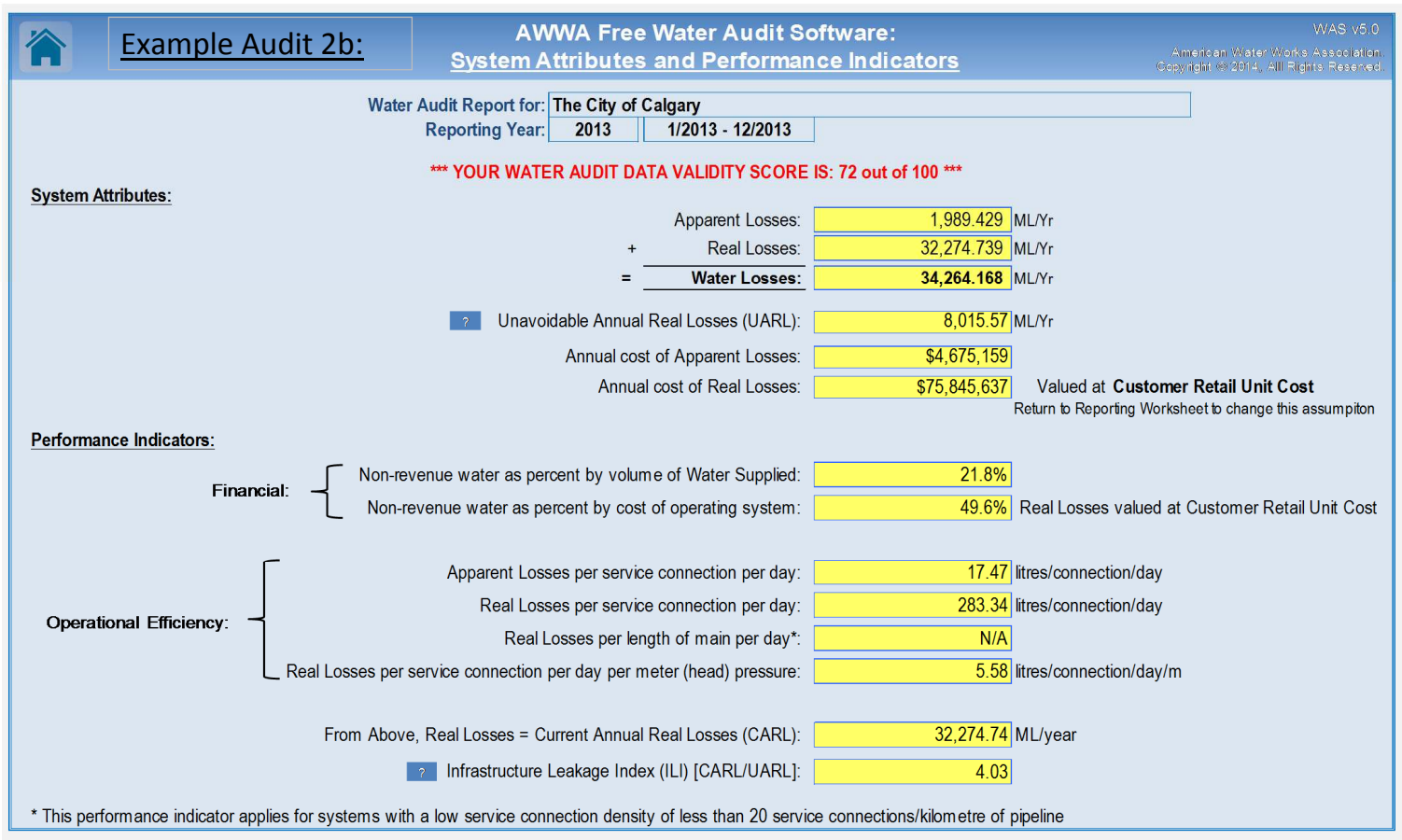
***** YOUR SCORE IS: 72 out of 100 *****

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources
2: Billed metered
3: Customer metering inaccuracies



Example Audit 2b:

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0

Water Audit Report for: The City of Calgary
Reporting Year: 2013 1/2013 - 12/2013

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 72 out of 100 ***

System Attributes:

	Apparent Losses:	1,989.429	ML/Yr
+	Real Losses:	32,274.739	ML/Yr
=	**Water Losses:**	**34,264.168**	ML/Yr
?	Unavoidable Annual Real Losses (UARL):	8,015.57	ML/Yr
	Annual cost of Apparent Losses:	$4,675,159	
	Annual cost of Real Losses:	$75,845,637	Valued at **Customer Retail Unit Cost**

Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

Financial:

Non-revenue water as percent by volume of Water Supplied:	21.8%	
Non-revenue water as percent by cost of operating system:	49.6%	Real Losses valued at Customer Retail Unit Cost

Operational Efficiency:

Apparent Losses per service connection per day:	17.47	litres/connection/day
Real Losses per service connection per day:	283.34	litres/connection/day
Real Losses per length of main per day*:	N/A	
Real Losses per service connection per day per meter (head) pressure:	5.58	litres/connection/day/m

From Above, Real Losses = Current Annual Real Losses (CARL):	32,274.74	ML/year
? Infrastructure Leakage Index (ILI) [CARL/UARL]:	4.03	

* This performance indicator applies for systems with a low service connection density of less than 20 service connections/kilometre of pipeline

AWWA Water Audit Software Version 5.0 Developed by the Water Loss Control Committee of the American Water Works Association August, 2014

This software is intended to serve as a basic tool to compile a preliminary, or "top-down", water audit. It is recommended that users also refer to the current edition of the AWWA M36 Publication, Water Audits and Loss Control Programs, for detailed guidance on compiling a comprehensive, or "bottom-up", water audit using the same water audit methodology.

DEVELOPED BY:

Andrew Chastain-Howley, PG, MCSM. Black & Veatch*
Will J. Jernigan, P.E. Cavanaugh & Associates, P.A.
George Kunkel, P.E. Philadelphia Water Department
Alain Lalonde, P.Eng. Master Meter Canada Inc.
Ralph Y. McCord, P.E. Louisville Water Company
David A. Sayers Delaware River Basin Commission
Brian M. Skeens, P.E. CH2M HILL
Reinhard Sturm Water Systems Optimization, Inc.
John H. Van Arsdel M.E. Simpson Company, Inc.

REFERENCES:

- Alegre, H., Hirner, W., Baptista, J. and Parena, R. Performance Indicators for Water Supply Services. IWA Publishing 'Manual of Best Practice' Series, 2000. ISBN 1 900222 272

- Kunkel, G. et al, 2003. Water Loss Control Committee Report: Applying Worldwide Best Management Practices in Water Loss Control. Journal AWWA, 95:8:65

- AWWA Water Audits and Loss Control Programs, M36 Publication, 3rd Edition, 2009

- Service Connection Diagrams courtesy of Ronnie McKenzie, WRP Pty Ltd.

VERSION HISTORY:

Version:	Release Date:	Number of Worksheets:	Key Features and Developments
v1	2005/ 2006	5	The AWWA Water Audit Software was piloted in 2005 (v1.0 beta). The early versions (1.x) of the software restricted data entry to units of Million Gallons per year. For each entry into the audit, users identified whether the input was measured or estimated.
v2	2006	5	The most significant enhancement in v2 of the software was to allow the user to choose the volumetric units to be used in the audit, Million Gallons or Thousand Cubic Metres (megalitres) per year. Two financial performance indicators were added to provide feedback to the user on the cost of Real and Apparent losses.
v3	2007	7	In v3, the option to report volumetric units in acre-feet was added. Another new feature in v3 was the inclusion of default values for two water audit components (unbilled unmetered and unauthorized consumption). v3 also included two examples of completed audits in units of million gallons and Megalitres. Several checks were added into v3 to provide instant feedback to the user on common data entry problems, in order to help the user complete an accurate water audit.
v4 - v4.2	2010	10	v4 (and versions 4.x) of the software included a new approach to data grading. The simple "estimated" or "measured" approach was replaced with a more granular scale (typically 1-10) that reflected descriptions of utility practices and served to describe the confidence and accuracy of the input data. Each input value had a corresponding scale fully described in the Grading Matrix tab. The Grading Matrix also showed the actions required to move to a higher grading score. Grading descriptions were available on the Reporting Worksheet via a pop-up box next to each water audit input. A water audit data validity score is generated (max = 100) and priority areas for attention (to improve audit accuracy) are identified, once a user completes the requied data grading. A service connection diagram was also added to help users understand the impact of customer service line configurations on water losses and how this information should be entered into the water audit software. An acknoweldgements section was also added. Minor bug fixes resulted in the release of versions 4.1 and 4.2. A French language version was also made available for v4.2.
v5	2014	12	In v5, changes were made to the way Water Supplied information is entered into software, with each major component having a corresponding Master Meter Error Adjustment entry (and data grading requirement). This required changes to the data validity score calculation; v5 of the software uses a weighting system that is, in part, proportional to the volume of input components. The Grading Matrix was updated to reflect the new audit inputs and also to include clarifications and additions to the scale descriptions. The appearance of the software was updated in v5 to make the software more user-friendly and several new features were added to provide more feedback to the user. Notably, a dashboard tab has been added to provide more visual feedback on the water audit results and associated costs of Non-Revenue Water. A comments sheet was added to allow the user to track notes, comments and to cite sources used.

This page intentionally left blank.

Appendix F: SBx7-7 GPCD Verification Forms

This page intentionally left blank.

WUEdata Entry Exceptions

The data from the tables below will not be entered into WUEdata tables (the tabs for these tables' worksheets are colored **purple**). These tables will be submitted as separate uploads, in Excel, to WUEdata.

Process Water Deduction

SB X7-7 tables 4-C, 4-C.1, 4-C.2, 4-C.3, 4-C.4 and 4-D

A supplier that will use the process water deduction will complete the appropriate tables in Excel, submit them as a separate upload to the WUE data tool, and include them in its UWMP.

Target Method 2

SB X7-7 tables 7-B, 7-C, and 7-D

A supplier that selects Target Method 2 will contact DWR (gwen.huff@water.ca.gov) for SB X7-7 tables 7-B, 7-C, and 7-D.

Target Method 4

These tables are only available online at http://www.dwr.water.ca.gov/wateruseefficiency/sb7/committees/urban/u4/ptm4.cfm A supplier that selects Target Method 4 will save the tables from the website listed above, complete the tables, submit as a separate upload to WUE data, and include them with its UWMP.

SB X7-7 Table 0: Units of Measure Used in UWMP* *(select one from the drop down list)*
Million Gallons
**The unit of measure must be consistent with Table 2-3*
NOTES:

SB X7-7 Table-1: Baseline Period Ranges			
Baseline	**Parameter**	**Value**	**Units**
10- to 15-year baseline period	2008 total water deliveries	4,537	Million Gallons
	2008 total volume of delivered recycled water	25	Million Gallons
	2008 recycled water as a percent of total deliveries	0.55%	Percent
	Number of years in baseline period[1]	10	Years
	Year beginning baseline period range	2001	
	Year ending baseline period range[2]	2010	
5-year baseline period	Number of years in baseline period	5	Years
	Year beginning baseline period range	2005	
	Year ending baseline period range[3]	2009	
[1]If the 2008 recycled water percent is less than 10 percent, then the first baseline period is a continuous 10-year period. If the amount of recycled water delivered in 2008 is 10 percent or greater, the first baseline period is a continuous 10- to 15-year period.			
[2]The ending year must be between December 31, 2004 and December 31, 2010.			
[3]The ending year must be between December 31, 2007 and December 31, 2010.			
NOTES:			

SB X7-7 Table 2: Method for Population Estimates	
Method Used to Determine Population (may check more than one)	
☑	**1. Department of Finance** (DOF) DOF Table E-8 (1990 - 2000) and (2000-2010) and DOF Table E-5 (2011 - 2015) when available
☐	**2. Persons-per-Connection Method**
☐	**3. DWR Population Tool**
☐	**4. Other** DWR recommends pre-review
NOTES:	

SB X7-7 Table 3: Service Area Population		
Year		**Population**
10 to 15 Year Baseline Population		
Year 1	2001	26,053
Year 2	2002	29,711
Year 3	2003	33,699
Year 4	2004	37,867
Year 5	2005	41,343
Year 6	2006	44,992
Year 7	2007	47,846
Year 8	2008	49,710
Year 9	2009	50,997
Year 10	2010	51,453
Year 11		
Year 12		
Year 13		
Year 14		
Year 15		
5 Year Baseline Population		
Year 1	2005	41,343
Year 2	2006	44,992
Year 3	2007	47,846
Year 4	2008	49,710
Year 5	2009	50,997
2015 Compliance Year Population		
2015		56,493
NOTES:		

SB X7-7 Table 4: Annual Gross Water Use *								
	Baseline Year *Fm SB X7-7 Table 3*	**Volume Into Distribution System** *Fm SB X7-7 Table(s) 4-A*	**Deductions**					**Annual Gross Water Use**
			Exported Water	Change in Dist. System Storage (+/-)	Indirect Recycled Water *Fm SB X7-7 Table 4-B*	Water Delivered for Agricultural Use	Process Water *Fm SB X7-7 Table(s) 4-D*	
10 to 15 Year Baseline - Gross Water Use								
Year 1	2001	2153.5			0		0	2,154
Year 2	2002	2920			0		0	2,920
Year 3	2003	3066			0		0	3,066
Year 4	2004	3403.8			0		0	3,404
Year 5	2005	3723			0		0	3,723
Year 6	2006	3942			0		0	3,942
Year 7	2007	4453			0		0	4,453
Year 8	2008	4501.8			0		0	4,502
Year 9	2009	4161			0		0	4,161
Year 10	2010	3905.5			0		0	3,906
Year 11	0	0			0		0	0
Year 12	0	0			0		0	0
Year 13	0	0			0		0	0
Year 14	0	0			0		0	0
Year 15	0	0			0		0	0
10 - 15 year baseline average gross water use								**2,415**
5 Year Baseline - Gross Water Use								
Year 1	2005	3,723			0		0	3,723
Year 2	2006	3,942			0		0	3,942
Year 3	2007	4,453			0		0	4,453
Year 4	2008	4,502			0		0	4,502
Year 5	2009	4,161			0		0	4,161
5 year baseline average gross water use								**4,156**
2015 Compliance Year - Gross Water Use								
2015		2,906			0		0	2,906
* NOTE that the units of measure must remain consistent throughout the UWMP, as reported in Table 2-3								
NOTES: 10-15 year Baseline is incorrect, the number should be 3,623.								

SB X7-7 Table 4-A: Volume Entering the Distribution System(s)

Complete one table for each source.

Name of Source	Source 1			
This water source is:				
☑	The supplier's own water source			
☑	A purchased or imported source			
Baseline Year *Fm SB X7-7 Table 3*		Volume Entering Distribution System	Meter Error Adjustment * *Optional (+/-)*	Corrected Volume Entering Distribution System
10 to 15 Year Baseline - Water into Distribution System				
Year 1	2001	2153.5		2,154
Year 2	2002	2920		2,920
Year 3	2003	3066		3,066
Year 4	2004	3403.8		3,404
Year 5	2005	3723		3,723
Year 6	2006	3942		3,942
Year 7	2007	4453		4,453
Year 8	2008	4501.8		4,502
Year 9	2009	4161		4,161
Year 10	2010	3905.5		3,906
Year 11	0			0
Year 12	0			0
Year 13	0			0
Year 14	0			0
Year 15	0			0
5 Year Baseline - Water into Distribution System				
Year 1	2005	3723		3,723
Year 2	2006	3942		3,942
Year 3	2007	4453		4,453
Year 4	2008	4501.8		4,502
Year 5	2009	4161		4,161
2015 Compliance Year - Water into Distribution System				
2015		2905.804		2,906

** Meter Error Adjustment - See guidance in Methodology 1, Step 3 of Methodologies Document*

NOTES: Gross water use calculated using Water Produced

SB X7-7 Table 5: Gallons Per Capita Per Day (GPCD)				
Baseline Year *Fm SB X7-7 Table 3*		Service Area Population *Fm SB X7-7 Table 3*	Annual Gross Water Use *Fm SB X7-7 Table 4*	Daily Per Capita Water Use (GPCD)
10 to 15 Year Baseline GPCD				
Year 1	2001	26,053	2,154	226
Year 2	2002	29,711	2,920	269
Year 3	2003	33,699	3,066	249
Year 4	2004	37,867	3,404	246
Year 5	2005	41,343	3,723	247
Year 6	2006	44,992	3,942	240
Year 7	2007	47,846	4,453	255
Year 8	2008	49,710	4,502	248
Year 9	2009	50,997	4,161	224
Year 10	2010	51,453	3,906	208
Year 11	0	0	0	
Year 12	0	0	0	
Year 13	0	0	0	
Year 14	0	0	0	
Year 15	0	0	0	
10-15 Year Average Baseline GPCD				**241**
5 Year Baseline GPCD				
Baseline Year *Fm SB X7-7 Table 3*		Service Area Population *Fm SB X7-7 Table 3*	Gross Water Use *Fm SB X7-7 Table 4*	Daily Per Capita Water Use
Year 1	2005	41,343	3,723	247
Year 2	2006	44,992	3,942	240
Year 3	2007	47,846	4,453	255
Year 4	2008	49,710	4,502	248
Year 5	2009	50,997	4,161	224
5 Year Average Baseline GPCD				**243**
2015 Compliance Year GPCD				
2015		56,493	2,906	141
NOTES:				

SB X7-7 Table 6: Gallons per Capita per Day *Summary From Table SB X7-7 Table 5*	
10-15 Year Baseline GPCD	241
5 Year Baseline GPCD	243
2015 Compliance Year GPCD	141
NOTES:	

SB X7-7 Table 7: 2020 Target Method *Select Only One*		
Target Method		Supporting Documentation
☑	Method 1	SB X7-7 Table 7A
☐	Method 2	SB X7-7 Tables 7B, 7C, and 7D *Contact DWR for these tables*
☐	Method 3	SB X7-7 Table 7-E
☐	Method 4	Method 4 Calculator
NOTES:		

SB X7-7 Table 7-A: Target Method 1 20% Reduction	
10-15 Year Baseline GPCD	2020 Target GPCD
241	193

SB X7-7 Table 7-F: Confirm Minimum Reduction for 2020 Target			
5 Year Baseline GPCD *From SB X7-7 Table 5*	Maximum 2020 Target*	Calculated 2020 Target *Fm Appropriate Target Table*	Confirmed 2020 Target
243	231	193	193
** Maximum 2020 Target is 95% of the 5 Year Baseline GPCD*			
NOTES: Calculated target was tabulated as 80% of the City's Baseline			

SB X7-7 Table 8: 2015 Interim Target GPCD		
Confirmed 2020 Target *Fm SB X7-7 Table 7-F*	10-15 year Baseline GPCD *Fm SB X7-7 Table 5*	2015 Interim Target GPCD
193	241	217
NOTES:		

SB X7-7 Table 9: 2015 Compliance								
Actual 2015 GPCD	2015 Interim Target GPCD	Optional Adjustments *(in GPCD)*					2015 GPCD *(Adjusted if applicable)*	Did Supplier Achieve Targeted Reduction for 2015?
		Extraordinary Events	Weather Normalization	Economic Adjustment	TOTAL Adjustments	Adjusted 2015 GPCD		
141	217	*From Methodology 8 (Optional)*	*From Methodology 8 (Optional)*	*From Methodology 8 (Optional)*	0	140.9220054	140.9220054	YES
NOTES:								

Appendix G: Draft Water Shortage Contingency Plan and Adopted Ordinance

This page intentionally left blank.

Appendix G

Draft Water Shortage Contingency Plan

Table of Contents

List of Tables

Attachments

This document is a Water Shortage Contingency Plan (WSCP) for the City of Brentwood (City) water system. The purpose of this contingency plan is to provide a plan of action to be followed at the various stages of a water shortage.

This WSCP was prepared in accordance with California Water Code Sections 350-359 and Government Code Sections 8550-8551 which gives authority to water suppliers to declare water shortage emergencies and to enforce prohibitions and regulations towards customers of the water supplier. Title 14 of the Brentwood Municipal Code (Municipal Code) gives the City the right to apportion its available water supply among customers in such a manner as appears most equitable under the circumstances then prevailing and with due regard to public health and safety. Municipal Code Section 14.01.500 gives authorization for the City Director of Public Works to enforce the water use regulations.

In 2015, the Governor of California began a series of Executive Orders and subsequently, the State Water Resource Control Board (SWRCB) mandated water conservation requirements as a result of the multi-year drought in California. The orders outlined water conservation measures and prohibitions as well as mandated a 32 percent potable water use reduction as compared to monthly water use in 2013. In 2016, this mandate was adjusted to 28 percent. The mandated measures and prohibitions have been incorporated into this WSCP to encourage conservation after the Executive Orders are lifted.

Section 1. Water Supply Shortage Stages and Conditions

This section describes the stages of action to be undertaken in response to water supply shortages. Included is an outline of specific water supply conditions that are applicable to each stage. Per California Water Code Section 10632(a), the City has developed four stages of action to be undertaken 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. The stages will be implemented during water supply shortages according to shortage level, ranging from five percent shortage in Stage I to 50 percent shortage in Stage IV. The stage determination and declaration during a water supply shortage is recommended by the Public Works Director or designee and is adopted by City Council. Table 1 describes the water supply shortage levels, stages, and triggering conditions.

During Stage I of a water supply shortage, the shortage is minimum, up to ten percent. Voluntary conservation is encouraged; this includes encouraging customers to limit the watering of lawn, landscape or other turf area with water supplied by the City. The City maintains an ongoing public information campaign consisting of distribution of literature, speaking engagements, bill inserts, and conversation messages printed in local newspapers and on the City's internet web page. The drought situation is explained to public and governmental bodies. The City explains other stages and forecast future actions. Also, the City requests voluntary water conservation. Educational programs in area schools are ongoing.

During Stage II of a water supply shortage, the shortage is moderate, 10 to 20 percent, and conservation may be voluntary, consist of conservation goals, and/or include mandatory conservation rules; this includes encouraging customers to limiting the watering of lawn, landscape or other turf area with water supplied by the City to any four days per week maximum. s. All steps taken in prior stages are intensified and production is monitored daily for compliance with necessary reductions. The severity of actions depends upon the percent shortage. The City aggressively continues it public information and education programs. The City asks for 10 to 20 percent voluntary or mandatory water use reductions. If necessary, the City also supports passage of drought ordinances.

Table 1. Water Supply Shortage Stages				
Shortage	Stage	Demand Reduction Goal	Type of Program	Triggering Condition
Minimum 5-10 percent	I	10 percent	Voluntary	There are no drought declarations or water shortage conditions observed by nearby water agencies.
Moderate 10-20 percent	II	20 percent	Mandatory Conservation Phase - Voluntary Conservation goals and/or Mandatory Conservation Rules	Water supply conditions may be impeded by lack of available water supplies, regional circumstances, or statewide climate influences.
Severe 20-35 percent	III	35 percent	Rationing Phase - Conservation goals and Mandatory Conservation Rules	Water supply conditions are impeded by lack of available water supplies, regional circumstances, or statewide climate influences.
Critical 35-50 percent	IV	50 percent	Intense Rationing Phase - Conservation goals and Mandatory Conservation and Rules	Water supply conditions are significantly impeded by interruption of available sources, a regional emergency, or state mandates.

During Stage III of a water supply shortage, the shortage is severe, 20 to 35 percent, and conservation consists of conservation goals and mandatory conservation rules. This may include limiting the watering of lawn, landscape or other turf area with water supplied by the City to any three days per week maximum. All steps taken in prior stages are intensified and production is monitored daily for compliance with necessary reductions. This phase becomes effective upon notification by the City that water usage is to be reduced by a mandatory percentage. The City would adopt drought ordinances, implement mandatory reductions, and enforce fines and penalties for water waste. Rate changes may be implemented to penalize excess usage. Drought surcharges or rates may be applied based on Council direction. The City would restrict outdoor water usage at City facilities by reducing water times or using non-potable/recycled water. The City would implement the use of recycled water fill stations at the City wastewater treatment plant to offset potable water use. Water use restrictions are put into effect; i.e., prohibited uses can include, but are not limited to, restrictions on daytime hours for watering, excessive watering resulting in gutter flooding, using hoses without a shutoff device, non-recycling fountains, washing down sidewalks or patios, and unrepaired leaks. The City monitors monthly customer billing data and production weekly for compliance with necessary reductions.

During Stage IV of a water supply shortage, the shortage is critical, 35 to 50 percent. Conservation consists of conservation goals and mandatory conservation rules. This may include limiting the watering of lawn, landscape or other turf area with water supplied by the City to any two days per week maximum. All steps taken in prior stages are intensified and production is monitored daily for compliance with necessary reductions.

Triggering from one stage to the next is done at the recommendation of the Director of Public Works. Factors to take into consideration include decreases in water allotments from the water supply wholesaler such as CCWD or ECCID, from reductions in infrastructure capacity related to the water treatment plants, pipelines or water treatment plants, or climate or from state political conditions that would impact the allotment of water supply.

Section 2. Prohibitions

California Water Code Section 10632(a)(4) requires mandatory prohibitions against specific water use practices that may be considered excessive during water shortages. Prohibitions apply to new developments and to end uses for existing development. In 2011, the City adopted the current Municipal Code Section 17.630, which addresses landscaping and irrigation for new construction of homes, commercial and industrial facilities. This code is included in Attachment 1. It requires a water audit and an annual maintenance schedule of the irrigation controllers and sprinklers. An irrigation plan is required for new development. Requirements of the irrigation plan include a requirement that 90 percent of the plants selected in non-turf areas to be well suited to the climate of Brentwood and require minimal water once established. Up to 10 percent of the plants may be of a non-drought-tolerant nature but must be grouped together and irrigated separately from the drought-tolerant plants. Turf is not allowed on City median strips, in areas less than 8 feet wide and on slopes greater than 4:1. Soil conditioning, decorative fountains, irrigation systems and sprinkler heads are all addressed in this ordinance. The landscaping shall be inspected and must be issued a certificate of substantial completion that is submitted to the City. This ordinance is a proactive means of reducing the water demand in the City of Brentwood. Municipal Code Section 8.36 is under review and is suspended by ordinance as it pertains to certain landscaping.

Should drought conditions warrant mandatory reductions, during Stage II of a water supply shortage, the City may adopt and implement an ordinance for mandatory conservation and water restriction plan. This ordinance may require a drought surcharge for the City to enforce the plan.

The ordinance may address prohibitions on various wasteful water uses, including, but not limited to:

- The hose washing of paved or hardscape surfaces using potable water, cleaning or filling decorative fountains.
- Allowing plumbing leaks to go uncorrected for more than 72 hours.
- No Outdoor watering between 8:00 am and 7:00 pm.
- No Outdoor watering within 48 hours of measurable rainfall.
- No outdoor watering more than X days per week.
- No excessive landscape runoff.
- No washing a vehicle, trailer, boat without a shutoff nozzle.
- May limit issuing potable hydrant meters for construction.

Table 2 identifies potential prohibitions and the stages during which the prohibition would be voluntary or mandatory.

Table 2. Prohibitions on End Uses

Stage	Prohibitions	Additional explanation or reference	Penalty, charge, or other enforcement?
II,III, IV	Other - Prohibit use of potable water for washing hard surfaces	Cleaning of streets/ sidewalks/ walkways/ parking areas/ patios or verandas.	Yes
II,III, IV	Other - Prohibit vehicle washing except at facilities using recycled or recirculating water		Yes
II,III, IV	Landscape - Prohibit all landscape irrigation	Watering lawns and landscapes with potable water is prohibited at City facilities. Prohibitions on time and day for residential outdoor irrigation.	Yes
II,III, IV	Other	Irrigation of non-permanent agriculture is prohibited.	Yes

Table 2. Prohibitions on End Uses			
Stage	Prohibitions	Additional explanation or reference	Penalty, charge, or other enforcement?
II,III, IV	Other - Customers must repair leaks, breaks, and malfunctions in a timely manner		Yes
II,III, IV	Other	Excessive water resulting in gutter flooding is prohibited.	Yes
II,III, IV	Water Features - Restrict water use for decorative water features, such as fountains	Cleaning/ filling/ operating/ maintaining levels in non-recirculated decorative fountains is prohibited.	Yes
III, IV	CII - Other CII restriction or prohibition	Car wash facilities must use recycled water.	Yes
III, IV	Other - Prohibit vehicle washing except at facilities using recycled or recirculating water		Yes
III, IV	CII - Other CII restriction or prohibition	Prohibit new car washes or laundries without recirculating water systems.	Yes
III, IV	Pools - Allow filling of swimming pools only when an appropriate cover is in place.		Yes

Section 3. Consumption Reduction Methods

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. California Water Code Section 10632(a)(5) requires the water supplier to provide consumption reduction methods in the most restrictive stages of a water shortage. The City will use the consumption reduction methods proposed in Table 3.

Table 3. Consumption Reduction Methods		
Stage	Consumption reduction methods by water supplier	Additional explanation or reference (optional)
I, II, III, IV	Expand public information campaign	Communication methods such as works shops, bill messages, Brentwood Press, or other communication methods.
III, IV	Offer Water Use Surveys	Expand notification of the availability of free water use evaluations.
III, IV	Implement or modify drought rate structure or surcharge	Penalties and fines for excessive water use implemented.
III, IV	Other	Prohibit irrigation of turf of newly built homes and buildings if irrigation systems are in any manner inconsistent with regulations or other requirements established by the California Building Standards Commission and the Department of Housing and Community Development.
III, IV	Provide rebates for water efficiency products	Such as toilet rebates, pool cover rebates, lawn conversion rebates.
IV	Increase Water Waste Patrols	
IV	Moratorium or net zero demand increase on new connections	

Section 4. Reduction Measuring Mechanism

California Water Code Section 10632(a)(9) requires the water supplier to develop a mechanism for determining actual reductions in water use in the course of carrying out the urban water supply shortage contingency analysis.

Water production data is recorded daily within and monitored by the Public Works Director or designee during normal water supply conditions. Totals are reported monthly and are incorporated into water supply reports. The City maintains extensive water use records on individual customer accounts. Exceptionally high usage is identified at meter reading time by the City's electronic meter reading management system. These accounts are investigated for potential water loss or abuse problems. Door hangers are initially given with an option to receive a water use survey.

On a daily basis, water production data is reported to and monitored by the Public Works Director or designee every day.

Section 5. Worst-Case Scenarios

California Water Code Section 10632 (a)(2) requires an estimate of the minimum water supply availability during each of the next three water years based on the driest 3-year historic sequence for the agency's water supply. Based on the City's diverse portfolio of water supply sources and conjunctive use of groundwater and surface water, the City is able to meet demands in all year types. Refer to Chapter 7 of the City's 2015 Urban Water Management Plan for this analysis.

Section 6. Preparation for Catastrophic Water Supply Interruption

The Water Code Section 10632 (a)(3) requires actions to be undertaken by the water supplier to prepare for and implement during a catastrophic interruption of water supplies. The City has a Water Quality Emergency Notification Plan in place that coordinates overall response to a disaster. This plan is included as Attachment 2.

A catastrophic event that constitutes a proclamation of a water shortage would be any event, either natural or manmade, that causes a severe shortage of water, synonymous with or with greater severity than the Stage III or Stage IV water supply shortage conditions. Facilities are inspected annually for earthquake safety. Auxiliary generators and improvements to the water storage facilities to prevent loss of these facilities during an earthquake or any disaster causing an electric power outage have been budgeted for and installed as part of the annual construction process. The City's catastrophic supply interruption actions are listed in Table 4. Table 5 is a summary of items discussed regarding the preparation actions for a catastrophe.

Table 4. Catastrophic Supply Interruption Actions	
Potential Catastrophic Event	**Summary of Actions**
Earthquake/Fault Rupture, Liquefaction	Emergency response plan procedures would be implemented. The City would ensure that any damaged sections of the distribution system would be isolated, customers would be notified of the need to reduce use, backup generators would be used for groundwater pumping, and the water supply would be supplemented by using stored surface water supplies from the City's five reservoirs.
Regional Power Outage	Customers would be notified of the need to reduce use, and backup generators would be used for groundwater pumping.
Flooding/Levee Breach/ Dam Failure	Emergency response plan procedures would be implemented. Depending on the level of flooding, flooded areas would be isolated to minimize the size of the area affected by the event; customers may be evacuated.
Fire	Affected customers would be notified and voluntary and mandatory rationing would be implemented in affected areas, if necessary.

Notes:
Source: City of Brentwood, 2011.

Table 5. Preparation Actions for a Catastrophe	
Examples of Penalties and Charges	**Check if Discussed**
Determine what constitutes a proclamation of a water shortage.	X
Determine where the funding will come from.	X
Contact and coordinate with other agencies.	X
Create an Emergency Response Team/Coordinator.	X
Create a catastrophe preparedness plan.	X
Put employees/contractors on-call.	X
Develop methods to communicate with the public.	X
Develop methods to prepare for water quality interruptions.	X

Section 7. Analysis of Revenue and Expenditure Impacts

Section 10632(a)(7) of the California Water Code requires an analysis of the impacts of each of the actions taken for conservation and water restriction on the revenues and expenditures of the water supplier. The City will establish memorandum accounts to track expenses and revenue shortfalls caused by both mandatory rationing and voluntary conservation efforts. The City will implement a surcharge to recover revenue shortfalls recorded in their drought memorandum accounts.

The City is currently in the third year of a five-year rate study that was approved in 2013 and set water rates through June 2018. While in the middle of the current rate structure, the Water Enterprise Fund has been significantly impacted by the governor's conservation requirements. In response, the City completed a new rate study to address long-term fiscal impacts of the current rate structure. On April 12, 2016 City Council adopted a two-year adjustment. The approved revenue adjustment is a six percent increase in 2016 and 2017 to standard rates, over the three percent adjustment already in place per the five-year rate structure. Standard rates assume "non-drought" conditions and an optional Drought Surcharge is proposed during times of conservation. A five-year rate study will be brought forth for the Fiscal Year 2018/19.

The City will also evaluate increased costs due to increasing staffing levels and providing water rebates to customers that exceed water use reductions. The City's Director of Public Works or designee will evaluate revenues and reserves monthly during a prolonged water shortage event.

Tables 6 and 7 display the Components of Revenue and Expenditure Impacts and confirm that all the various components were discussed.

Table 6. Components of Revenue Impact Description

Components	Check if Discussed
Review of rate adjustment	X
Development of reserves	X
Change in quantity of sales	X
Impact on Customer's bill	X
Distribution of customer impacts between customer types	X
Impacts to water supplier of higher rates and penalties	X
Cost recovery reviews	X

Table 7. Components of Expenditure Impact Description

Components	Check if Discussed
Change in quantity of sales	X
Cost recovery reviews	X
Increased staff salaries/overtime	X
Increased costs of new supplies, transfers or exchanges	X
Distribution of customer impacts between customer types	X
Impacts to water supplier of higher rates and penalties	X

ORDINANCE NO. 970

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF BRENTWOOD REQUIRING THAT POTABLE DOMESTIC WATER SERVICE CUSTOMERS REDUCE CONSUMPTION FROM THE AMOUNTS USED IN 2013 BY 28 PERCENT AND THAT POTABLE IRRIGATION WATER SERVICE CUSTOMERS REDUCE CONSUMPTION FROM THE AMOUNTS USED IN 2013 BY 35 PERCENT; ADOPTING REGULATIONS FOR CITY WATER SERVICE CUSTOMERS TO PROHIBIT CERTAIN ACTIVITIES SO AS TO PROMOTE WATER CONSERVATION; ELIMINATING USAGE PENALTIES; AND REPEALING ORDINANCE NO. 965.

WHEREAS in California the past few years have been the driest since the 1840s and the National Weather Service has declared that most of the State, including Contra Costa County, has been in a state of "severe" or "exceptional" drought; and

WHEREAS, water levels serving the City, the Delta, the Bay Area, and the State have been below average for the last few years; and

WHEREAS, a possibility exists that the current drought will stretch into a fifth straight year in 2016 and beyond; and

WHEREAS, on May 14, 2013, by Proclamation, City Council called upon each citizen of the City to help protect source waters from pollution, practice water conservation and get involved in local water issues; and

WHEREAS, on November 12, 2013, City Council adopted Ordinance No. 918 amending in its entirety Brentwood Municipal Code ("BMC") Chapter 14.01 (Municipal Water System), including Article 5 regarding Drought and Conservation; and

WHEREAS, on December 10, 2013, by Resolution No. 2013-176, City Council adopted the Final 2010 Urban Water Management Plan ("UWMP") containing the Water Shortage Contingency Plan for the City; and

WHEREAS, on April 22, 2014, by Resolution No. 2014-45, City Council adopted a resolution calling upon City water service customers to voluntarily reduce water use by 10 percent; and directed City staff to work with the Contra Costa Water District ("CCWD") on water conservation education and outreach; and

WHEREAS, in January 2014, the Governor declared a Drought State of Emergency and requested a voluntary 20 percent reduction in water use; and called upon local urban water suppliers and municipalities to implement their local water shortage contingency plans consistent with their UWMPs; and

WHEREAS, on July 15, 2014, the State Water Resource Control Board ("SWRCB") adopted emergency drought related regulations pertaining to urban water conservation for urban water suppliers to implement, and which target outdoor urban water use ("2014 SWRCB Regulations"); and

WHEREAS, the 2014 SWRCB Regulations established the minimum level of activity that residents, businesses and water suppliers were to meet as the drought deepens, and were to be in effect until April 25, 2015, unless otherwise extended or repealed; and

WHEREAS, pursuant to California Water Code Section 10632 (a) and the City's 2010 UWMP, there are four water conservation stages for a reduction in water use of up to 50 percent; and

WHEREAS, implementation of the water conservation stages is cumulative, meaning that implementation of a higher stage shall also include implementation of all lower stages; and

WHEREAS, with the adoption of the 2014 SWRCB Regulations, City staff recommended implementation of Stage II of the City's Water Shortage Contingency Plan as outlined in the UWMP, including a request that City water service customers achieve a 20 percent reduction in water use over the prior year; and

WHEREAS, in 2014, City water customers responded to the City's request for voluntary water use reductions of 20 percent and, to date, the City has seen a reduction in potable water consumption of 39 percent in comparison to 2013; and

WHEREAS, included in the 2014 SWRCB Regulations was the prohibition of certain activities by water users which, along with City regulations pertaining to water times, staff recommended adopting for City water service customers pursuant to Stage II of the City's Water Shortage Contingency Plan, State emergency regulations, and Municipal Code Section 14.01.500 that provides that in times of a water shortage emergency caused by drought, the City may adopt any necessary rules or regulations in accordance with applicable laws; and

WHEREAS, on August 12, 2014, City Council adopted Resolution No. 2014-117, that implemented Stage II of the City's water shortage contingency plan as outlined in the City's 2010 UWMP; requested that water service customers voluntarily reduce consumption from the amounts used in the prior year by twenty percent; adopted regulations for City water service customers to prohibit certain activities so as to promote water conservation; suspended enforcement of the provisions of Chapter 8.36, as those provisions related to dead or dying vegetation due to a lack of water; and authorized and empowered the City Manager to delegate his or her authority to designated individuals and to establish such rules, regulations and procedures as may be necessary to carry out the provisions of the resolution; and

WHEREAS, on March 17, 2015, the SWRCB adopted expanded emergency drought regulations ("2015 SWRCB Drought Regulations"); and

WHEREAS, the 2015 SWRCB Drought Regulations supplemented the 2014 SWRCB Drought Regulations by also prohibiting: the irrigation, with potable water, of turf or ornamental landscapes during, and 48 hours following, measurable precipitation; the serving of drinking water other than upon request in eating or drinking establishments; operators of hotels and motels from not providing guests with the option of choosing not to have towels and linens laundered daily, and not prominently displaying notice of this option; and

WHEREAS, the 2015 SWRCB Drought Regulations further require each urban water supplier to implement all requirements and actions of the stage of its water storage contingency plan that includes mandatory restrictions on the number of days that outdoor irrigation of ornamental landscaping or turf with potable water is allowed; and

WHEREAS, on March 27, 2015, the Office of Administrative Law approved the 2015 SWRCB Drought Regulations which will remain in effect until February 2016; and

WHEREAS, on April 1, 2015, the Governor issued Executive Order B-29-15 pertaining to additional drought regulations requiring the SWRCB to impose restrictions to achieve a statewide 25 percent reduction in potable urban water usage through February 28, 2016, and requires water suppliers to reduce usage as compared to the amount used in 2013; and

WHEREAS, the 2015 Executive Order further requires the SWRCB to impose restrictions to require commercial, industrial and institutional properties to immediately implement water efficiency measures to reduce potable water usage by 25 percent from 2013 levels; and

WHEREAS, the 2015 Executive Order further requires the SWRCB to prohibit: irrigation with potable water of ornamental turf on public street medians; and irrigation with potable water outside of newly constructed homes and buildings that is not delivered by drip or micro-spray; and

WHEREAS, the 2015 Executive Order further requires the SWRCB to direct urban water suppliers to develop rate structures and other pricing mechanisms to maximize water conservation consistent with statewide water restrictions; and

WHEREAS, on April 18, 2015, the SWRCB released Proposed Regulatory Framework which classifies the City as Tier 8 with a Conservation Standard of 32 percent and the Proposed Text of Emergency Regulations; and

WHEREAS, on April 28, 2015, City Council adopted Resolution No. 2015-68 to, among other things, require that potable water service customers reduce consumption from the amounts used in 2013 by 35 percent and adopt regulations for City water service customers to prohibit certain activities so as to promote water conservation; and

WHEREAS, on May 5, 2015 the SWRCB by Resolution 2015-0032, adopted final Emergency Regulations for Statewide Urban Water Conservation; and

WHEREAS, on May 26, 2015, City Council adopted a Resolution declaring a water shortage emergency pursuant to California Water Code § 350; and

WHEREAS, pursuant to California Water Code § 353, on May 26, 2015, City Council adopted an ordinance that implemented the SWRCB Drought Regulations and the requirement that potable domestic water service customers reduce consumption from the amounts used in 2013 by 35 percent and potable irrigation water service customers reduce consumption from the amounts used in 2013 by 40 percent; and that adopted regulations for City water service customers to restrict certain activities so as to promote water conservation; and

WHEREAS, on May 26, 2015, City Council also adopted an ordinance that implemented administrative penalties for water use that has not reached the 35 percent reduction and for irrigation water use that has not reached the 40 percent reduction from 2013 levels to further promote water conservation; and

WHEREAS, to promote long term water conservation, a Rebate Program was adopted on May 26, 2015 to provide incentives for water use that has been reduced below the mandated levels and conversion of landscape and irrigation facilities that permanently reduce water use; and

WHEREAS, on May 26, 2015, City Council adopted an Urgency Ordinance (No. 950) and introduced an Ordinance (No. 951) to effectuate the above desired goals; and

WHEREAS, on June 9, 2015, by Resolution No. 2015-89, City Council authorized the City Manager, Director of Public Works, or the Director of Administrative Services or their designees, in consultation with the City Attorney, to interpret the provisions of Ordinance Nos. 950 and 951 including, but not limited to, those related to regulatory procedures, conservation requirements, and appeal procedures; with the intent of ensuring that the City Council's primary goal of water conservation is met, while taking into account the severe nature of the drought, individual customer circumstances, and the fair and equitable application of the regulatory procedures, rebates, penalties, conservation requirements, and appeal procedures; and

WHEREAS, the City's administrative enforcement program, under Brentwood Municipal Code Chapter 1.12, has been utilized to enforce the conservation activity regulations, and emphasis has been placed on resolving a particular matter through personal contact, education, and notices prior to the imposition of any penalties; and

WHEREAS, on September 22, 2015, by Ordinance 957, City Council amended the water reduction levels, usage rebates and usage penalties to allow utility customer compliance during winter months and to reduce budgetary impacts resulting from conservation program expenses; and

WHEREAS, on November 13, 2015, Governor Brown issued Executive Order B-36-15 calling for an extension of urban water use restrictions until October 31, 2016, should drought conditions persist through January 2016; and

WHEREAS, on December 21, 2015, the SWRCB released a Proposed Regulatory Framework for Extended Emergency Regulation for Urban Water Conservation through October 2016, and

WHEREAS, On January 26, 2016,City Council adopted Ordinance No. 965 requiring that potable domestic water service customers reduce consumption from the amounts used in 2013 by 35 percent and potable irrigation water service customers reduce consumption from the amounts used in 2013 by 40 percent; adopting regulations for City water service customers to prohibit certain activities so as to promote water conservation; revising authorized water conservation incentives by eliminating usage rebates; and repealing Ordinance No. 957; and

WHEREAS, on February 2, 2016, the SWRCB adopted Regulatory Framework for Extended Emergency Regulation for Urban Water Conservation through October 2016 which classifies the City as Tier 7 with a Conservation Standard of 28 percent.

NOW, THEREFORE, BE IT ORDAINED by the City Council of the City of Brentwood that:

Section 1. Effective Date and repeal of Ordinance No. 965

The Council finds that the foregoing recitals are true and correct, that the current drought is a present and continuing threat to the preservation of the public health and safety. This ordinance will go into effect thirty days after adoption and shall repeal Ordinance No. 965.

Section 2. California Environmental Quality Act

The Council finds that this action is exempt from the California Environmental Quality Act (CEQA), under CEQA Guidelines Section 15061(b) (3), in that it can be seen with certainty that there is no possibility for the proposed ordinance to have a significant effect on the environment, and under Sections 15307 and 15308 in that the ordinance is enacted to assure the maintenance of a natural resource and of the environment.

Section 3. Potable Water Consumption Reduction and Conservation Regulations

3.1 Potable Water Consumption Reduction

A. Domestic water service customers are required to achieve a monthly 28 percent reduction in potable water use at the same service location from 2013.

B. Water service customers with a service connection dedicated solely for irrigation purposes are required to achieve a monthly 35 percent reduction at the same service location in potable water use from 2013.

3.2 Potable Water Conservation Regulations

A. Each of the following actions is prohibited, except where necessary to address an immediate health and safety need or to comply with a term or condition in a permit issued by a State or Federal agency:

1. The application of potable water to outdoor landscapes in a manner that causes runoff such that water flows onto adjacent property, non-irrigated areas, private and public walkways, roadways, parking lots, or structures.
2. The use of a hose that dispenses potable water to wash a motor vehicle, except where the hose is fitted with a shut-off nozzle or device attached to it that causes it to cease dispensing water immediately when not in use.
3. The application of potable water to driveways, sidewalks and other hardscaped surfaces.
4. The use of potable water in a fountain or other decorative water feature, except where the water is part of a recirculating system.
5. Irrigation with potable water between 8:00 a.m. and 7:00 p.m. daily.
6. The application of potable water to outdoor landscapes during and up to 48 hours after a measurable rainfall.
7. The serving of drinking water other than upon request in eating or drinking establishments, including but not limited to restaurants, hotels, cafes, cafeterias, bars, or other public places where food or drink are served and/or purchased.

B. Hotel and motels shall provide guests with the option of choosing not to have towels and linens laundered daily. The hotel or motel shall prominently display notice of this option in each bathroom using clear and easily understood language.

C. The outdoor irrigation of ornamental landscapes or turf with potable water is limited to no more than two days per week.

D. The irrigation with potable water of landscapes outside of newly constructed homes and buildings in a manner inconsistent with regulations or other requirements established by the California Building Standards Commission and the Department of Housing and Community Development.

E. The use of potable water to irrigate ornamental turf on public street medians is prohibited.

F. A failure to achieve the requirements set forth in Section 3.1 and a violation of the regulations in Section 3.2 A through E above is unlawful, and along with the penalties set forth in Section 1.08.010 of the Brentwood Municipal Code, may be enforced pursuant to and through the administrative and civil measures set forth in Brentwood Municipal Code Chapter 1.12.

Section 4. Rebate Programs

As funding allows, the City Council hereby authorizes staff to develop and implement a Water Conservation Rebate Program to incentivize customers to reduce potable water usage.

4.1 Rebate for permanent conversion of high water consumption landscaping and irrigation

Rebates may be made available to customers who permanently convert areas of landscaping or replace irrigation equipment that will permanently reduce a customer's volume of water use. Rebates shall be a maximum of $1,000 for each single family residential property account and $5,000 for each multi-family or non-residential property.

Section 5. Public Usage Data

The City Council determines that the public interest in providing 2013 water usage data to a property owner for their property address clearly outweighs the public interest in not providing the information; as the information will allow the property owner to more accurately evaluate their water usage during the drought emergency

Section 6. Ordinance Duration

This ordinance shall be suspended upon the lifting, by resolution of the City Council, of the water shortage emergency that has been declared pursuant to California Water Code Section 350; and reinstated upon the declaration, by resolution, of a water shortage emergency pursuant to California Water Code Section 350.

Section 7. Publication

This ordinance shall be published in accordance with Government Code Section 36933 by either posting or publishing the ordinance in accordance with that law.

Section 8. Severability

If any section, subsection, sentence, clause or phrase of this ordinance is for any reason held to be invalid or unconstitutional by the decision of a court of competent jurisdiction, the holding shall not affect the validity or enforceability of the remaining provisions, and the City Council declares that it would have adopted each provision of this ordinance irrespective of the validity of any other provision.

Section 9. Interpretation

The City Manager, Director of Public Works, or the Director of Administrative Services or their designees, in consultation with the City Attorney, are authorized to interpret the provisions of this Ordinance including, but not limited to, those related to regulatory procedures and conservation requirements; with the intent of ensuring that the City Council's primary goal of water conservation is met, while taking into account the severe nature of the drought, individual customer circumstances, and the fair and equitable application of the regulatory procedures and conservation requirements.

THE FOREGOING ORDINANCE was introduced with the first reading waived at a regular meeting of the Brentwood City Council on the 12th day of April 2016 by the following vote:

This page intentionally left blank.

CITY OF BRENTWOOD

Water Cost of Service Study

Final Report / April 12, 2016

RAFTELIS
FINANCIAL CONSULTANTS, INC.

RAFTELIS
FINANCIAL CONSULTANTS, INC.

445 S. Figueroa St,
Suite 2270
Los Angeles, CA 90071

Phone 213.262.9300
Fax 213.262.9303

www.raftelis.com

March 31, 2016

Ms. Debra Galey
Senior Analyst
City of Brentwood Public Works Department – Engineering Division
150 City Park Way
Brentwood, CA 94513

Subject: Water Cost of Service Study Report

Dear Ms. Galey:

Raftelis Financial Consultants, Inc. (RFC) is pleased to present this report on the water cost of service study (Study) to the City of Brentwood (City). The Study involved a comprehensive review of the City's financial plan and rate structure. We are confident that the results, based on a cost of service principles, result in fair and equitable water rates for the City's customers and meet the requirements of Proposition 218.

The report includes an Executive Summary followed by the financial plan and a detailed rate derivation for the water utility.

It was a pleasure working with you and we wish to express our thanks for your and other staff member support during the study. If you have any questions, please call me at (626) 583-1894.

Sincerely,
RAFTELIS FINANCIAL CONSULTANTS, INC.

Sudhir D. Pardiwala, PE
Executive Vice President

Hannah Phan
Senior Consultant

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

This page intentionally left blank to facilitate two-sided printing.

1. EXECUTIVE SUMMARY

The City of Brentwood (City) engaged Raftelis Financial Consultants, Inc. (RFC) to conduct a comprehensive financial plan and develop cost of service water rates for implementation in fiscal years (FY) 2016 through FY 2018. The rate study process was conducted in conjunction with input from City staff. This report documents the resultant findings, analyses, and proposed changes that were developed with input from and approved by City staff.

The major objectives of the study include the following:

1. Ensure *Revenue Sufficiency* to meet the operation and maintenance (O&M) and capital needs of the City's water utility.
2. Address the water supply and water restriction use in the City.
3. Ensure that rates are *Fair and Equitable* and are based on *Cost of Service* guidelines used in the industry.
4. Plan for *Rate and Revenue Stability* to prevent rate spikes and provide for adequate operating and capital reserves and the overall financial health of the water utility under varying conditions.

This executive summary provides an overview of the study and includes findings and recommendations for water rates.

The remainder of the report defines a unit of water as a thousand gallon (kgal). Also, a fiscal year for the City is from July 1 to June 30 the following year. Therefore, July 1, 2014 through June 30, 2015 is identified as FY 2015; July 1, 2015 through June 30, 2016 is identified as FY 2016 and so on.

System Background

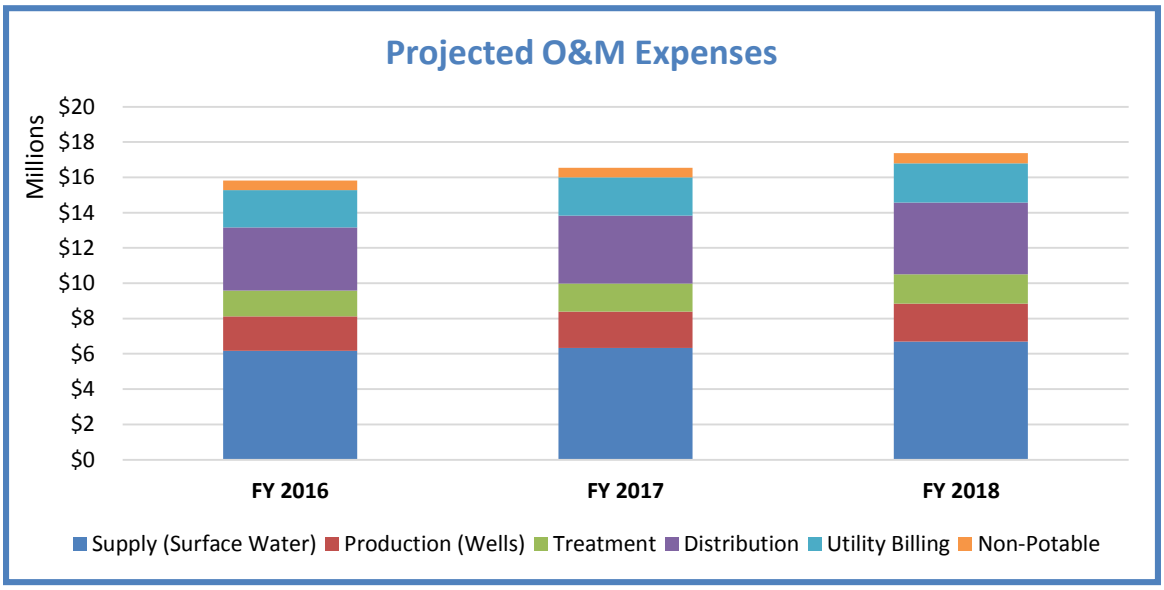
The water utility supplies potable water to over 17,500 customer accounts through 172 miles of transmission and distribution pipelines. Water is supplied through two main sources: local groundwater, from the City's groundwater wells, and surface water that originates from rivers within the Sierra mountain range and flow into the Delta. Surface water is treated at the City of Brentwood Water Treatment Plant (Brentwood TP) and the Randall Bold Water Treatment Plant (RBWTP). The cost of water supply has increased in the last several years due to continued years of drought, tightening water supplies and environmental and regulatory requirements.

Financial Plan

In order to determine the revenue adjustments needed to meet the ongoing expenses of the City and provide fiscal stability, RFC projected the revenue requirements, including operations and maintenance (O&M) expenses, capital improvement expenses, debt service costs, reserve requirements, etc., for the study period from FY 2016 to 2018. O&M expenses include the cost of operating and maintaining water supply, treatment, storage, and distribution facilities, as well as the costs of providing technical services such as engineering services and other administrative costs of the water system including meter reading and billing. O&M projections are based on the City's FY 2016 adopted budget and the City's projected budgetary increases in FY 2017 and FY 2018. The City uses different inflation factors for different expenditures within the budget. On average, the O&M costs are increasing at approximately 4.8 percent per year. **Figure 1-1** shows the projected water O&M expenses over the planning period.

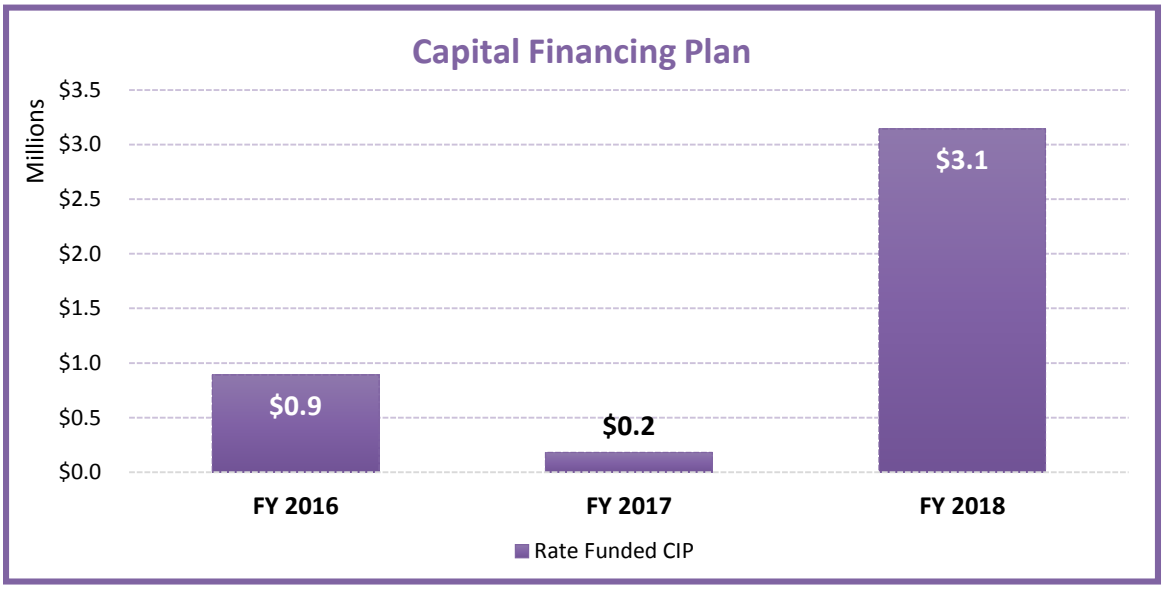
Due to the current drought and ongoing conservation efforts, the "new normal" potable water usage is projected to be the average usage of the previous three years, from FY 2013 through FY 2015. Water shortage projections due to the drought are conducted separately. The proposed financial plan and water rates are based on the new normal water usage.

Figure 1-1: Projected O&M Expenses



In addition to the operating expenses, the City is planning significant capital expenditures over the next three years (FY 2016 to 2018), totaling about $4.2 million, to be funded by water rates. Existing and anticipated annual debt service payments range from $2.8 million to $4.4 million over the planning period. **Figure 1-2** shows the water CIP that will be funded by rates over the planning period.

Figure 1-2: Capital Financing Plan



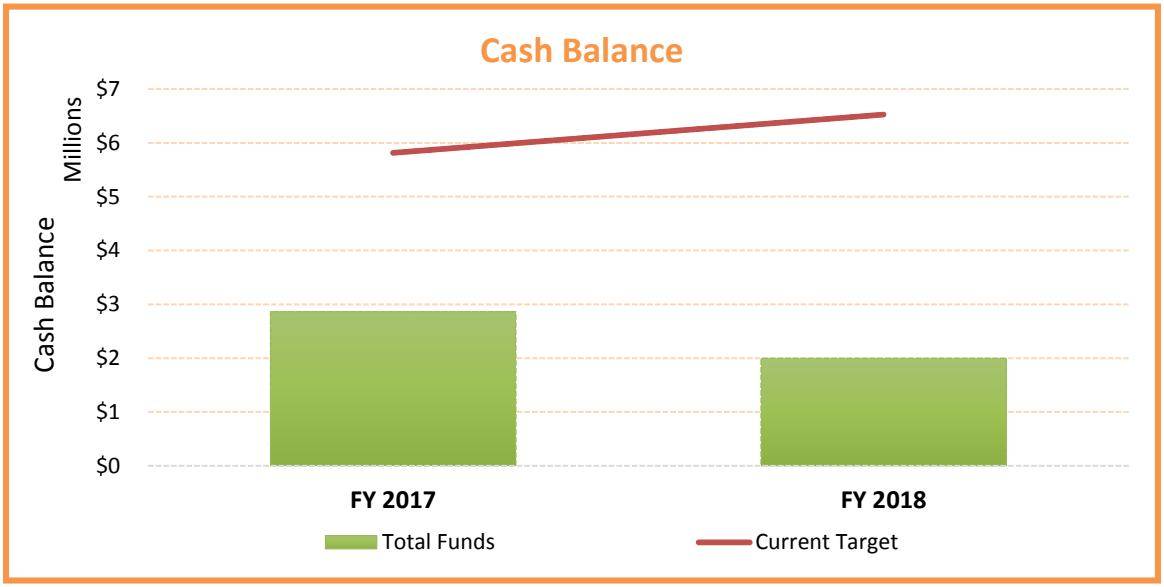
To ensure that the City will have adequate revenues to fund water operating and capital expenses and to maintain sufficient reserves, RFC recommends the revenue adjustments in **Table 1-1**. These increases are also needed to finance the capital and inflationary expenses.

Table 1-1: Annual Revenue Increases

Effective Date	Increases
June 2016	9%
July 2017	9%

Figure 1-3 shows the resulting cash balance for the water utility. The red line represents the total current target, which equals to 30 percent of annual operating expenses and debt service payments.

Figure 1-3: Cash Balance



Cost of Service Analysis and Rate Design

To calculate fair and equitable rates so that users pay in proportion to the cost of providing service, RFC performed a cost allocation of the total revenue requirements consistent with industry standards. The cost of service allocation is based on the Base-Extra Capacity Method described in the American Water Works Association (AWWA) *Manual M1*. Under this method, costs are apportioned amongst various cost parameters to determine the costs to provide service under average conditions, meet peaking requirements, provide meter capacity and provide customer service. Costs to serve different customer classes are determined; rates are then designed to recover the costs equitably consistent with Proposition 218 requirements.

Proposed Water Rates

RFC recommends that the City retains its current inclining rate structure, with revisions to the residential and non-residential tiers. The proposed residential tiers are: Tier 1 is set at 0 to 5 thousand gallons (kgal) per month, which represents the total available lowest cost water supply; Tier 2 is set at 6 to 14 kgal per month, which represents the FY 2013 and 2014 average monthly water usage; Tier 3 is set at 15 to 20 kgal per month, which represents the FY 2013 and 2014 average summer water usage; Tier 4 is any usage above Tier 3. Non-residential customers will have two tiers, with Tier 1 set at 0 to 5 kgal per month since all customers benefit equally from the available lowest cost water supply. The rates are also revised to be more consistent with cost of service. **Table 1-2** shows the proposed rates for the next two years, effective in June 1, 2016 and in July 1, 2017.

The City reserves the right to pass through costs that are not within the City's control, such as water purchased costs, electrical costs, chemical costs etc. to the proposed rates when such an action is deemed necessary. The financial plan has built in projected increases in these costs. However, in

the event that those costs exceed the projected amount, the Council may decide to pass through the increase to the customers.

Table 1-2: Proposed Monthly Water Rates

		June 1, 2016	July 1, 2017
Monthly Base Rate			
Meter Size			
5/8" or 3/4"		$21.61	$23.56
1"		$29.83	$32.52
1 1/2"		$50.39	$54.93
2"		$75.07	$81.83
3"		$153.21	$167.00
4"		$268.36	$292.65
6"		$543.89	$592.85
Commodity Rate ($/kgal)			
Residential	Monthly (kgal)		
Tier 1	5	$2.49	$2.72
Tier 2	14	$4.96	$5.41
Tier 3	20	$5.93	$6.47
Tier 4	21+	$6.52	$7.11
Non-Residential			
Tier 1	5	$2.31	$2.52
Tier 2	6+	$4.60	$5.02
Hydrant		$6.04	$6.59
Non-Potable		$1.31	$1.43

Customer Impacts

Table 1-3 below shows the impacts of an average residential customer with a 1-inch meter using an average 12 kgal of water monthly. For comparison purposes, the impacts on very low-end to very high-end users are also shown. Due to rounding in the calculations, some values may not add to the penny.

Table 1-3: Residential Water Monthly Rate Impacts

Residential	Usage (kgal)	Current Bill	Proposed Bill	Difference
Low volume	5	$47.62	$42.28	-11.2%
Median	10	$63.97	$67.08	4.9%
Average	12	$71.75	$77.00	7.3%
Summer Avg.	17	$91.20	$104.71	14.8%
High	25	$126.17	$155.10	22.9%
Very high	40	$203.77	$252.90	24.1%

2. OVERVIEW

INTRODUCTION

In August 2015, City of Brentwood (City) engaged Raftelis Financial Consultants, Inc. (RFC) to conduct a cost of service rate study (Study) for the water utility to meet regulatory requirements and ensure that there is a recovery of costs proportionate to the service provided to its customers. This Report documents the resultant findings, analyses, and proposed changes.

The major objectives of the study include the following:

1. Ensure *Revenue Sufficiency* to meet the operation and maintenance (O&M) and capital needs of the City's water utility.
2. Address the water supply and water restriction use in the City.
3. Ensure that rates are *Fair and Equitable* and are based on *Cost of Service* guidelines used in the industry.
4. Plan for *Rate and Revenue Stability* to prevent rate spikes and provide for adequate operating and capital reserves and the overall financial health of the water utility under varying conditions.

This Report provides an overview of the Study and includes findings and recommendations for water rates.

ORGANIZATION OF THE REPORT

This Report includes four sections in addition to the Executive Summary and this Overview. A brief description of the remaining sections follows.

1. ***Section 3 – Water Rates*** describes the long-range financial plan for the water utility, findings and results of the water rate study, and a detailed discussion of the proposed water rates and the customer impacts resulting from the proposed rates. It also includes a description of the water system, the water cost of service methodology, the determination of annual revenues required from rates, and a detailed discussion on the Cost of Service, which includes allocation of costs to water parameters and the determination of unit costs, and water rates derivation.
2. ***Section 4 – Appendix A: Drought Surcharges*** includes the derivation of the drought surcharges at various levels of water conservation to recover the revenue shortfall that results from demand reduction during a drought or water shortage condition.
3. ***Section 5 – Appendix B*** provides larger, easier to read tables found in the body of the report and show the data and the various calculations conducted to derive the unit costs and rates. The original table number from the main body of the report is retained for easy reference.

3. WATER RATES

This section describes the long-range financial plan for the water utility, findings and results of the water rate study, and a detailed discussion of the proposed water rates and the customer impacts resulting from the proposed rates. It also includes a description of the water system, the water cost of service methodology, the determination of annual revenues required from rates, and a detailed discussion on the Cost of Service, which includes allocation of costs to water cost causation parameters and the determination of unit costs.

SYSTEM BACKGROUND

The water utility supplies potable water to over 17,500 customer accounts through 172 miles of transmission and distribution pipelines. Water is supplied through two main sources: local groundwater, from the City's groundwater wells, and surface water that originates from rivers within the Sierra mountain range and flows into the Delta. Surface water is treated at the City of Brentwood Water Treatment Plant (Brentwood TP) and the Randall Bold Water Treatment Plant (RBWTP). The cost of water supply has increased in the last several years due to continued years of drought, tightening water supplies and environmental and regulatory requirements.

On January 17, 2014, Governor Jerry Brown issued a drought state of emergency declaration in response to record-low water levels in California's rivers and reservoirs as well as an abnormally low snowpack. On April 1, 2015, Governor Brown issued an Executive Order calling for statewide mandatory water reductions of up to 25%. Additionally, on May 5, 2015, the State Water Resources Control Board approved regulations, based on Governor Brown's Executive Order, mandating the City to reduce its water consumption by 32% percent for June 2015 through February 2016 as compared to the same months in 2013.

ACCOUNT AND USAGE ASSUMPTIONS

Table 3-1 shows the estimated number of water accounts by meter size for fiscal year (FY) 2015 through FY 2018. RFC estimated the number of accounts by tabulating FY 2015 (actual) account data provided by the City and escalating the number of accounts by approximately 1.4 to 1.5 percent per year, to account for growth, based on City estimates. The number of accounts (meters) are used to forecast the amount of fixed revenue the City will receive from the meter service charge.

Table 3-1: Projected Water Accounts by Meter Size

Accounts Data	FY 2015	FY 2016	FY 2017	FY 2018
TOTAL REGULAR METERS				
5/8" or 3/4"	7,954	8,062	8,182	8,302
1"	9,729	9,861	10,008	10,154
1 1/2"	206	209	212	215
2"	385	390	396	402
3"	35	35	36	37
4"	32	32	33	33
6"	14	14	14	15
TOTAL REGULAR METERS	**18,355**	**18,605**	**18,882**	**19,158**

The revenue calculated for each of the fiscal years in the Financial Plan is a function of the number of meters, meter size, account growth, water use, and existing rates. Due to the current water shortage, the City has, like most water purveyors, realized reduced water use due to conservation. The rate study is designed to determine water rates for the next two years; thus the water usage projections are based on a "new normal" assumption for FY 2016 through FY 2018. The demand reductions related to the drought are projected separately in Appendix A. For purposes of this rate cycle, City staff has estimated that the "new normal" usage is the average of the water usage from FY 2013 through FY 2015, and remains constant for the planning period.

Water Use

Table 3-2 shows the projected water use for FY 2016 through FY 2018 by customer class. The projections are based on a "new normal" assumption for FY 2016 through FY 2018.

Table 3-2: Projected Water Use by Customer Class

Usage Data by Tier (KGAL)		FY 2015	FY 2016	FY 2017	FY 2018
Residential					
Tier 1	10	1,615,702	1,795,810	1,822,567	1,849,177
Tier 2	20	500,674	558,036	566,350	574,619
Tier 3	30	141,756	158,015	160,369	162,711
Tier 4	31+	68,693	76,575	77,716	78,851
Subtotal Residential		**2,326,825**	**2,588,436**	**2,627,003**	**2,665,358**
Non-Residential					
Tier 1	10	77,411	87,160	88,459	89,750
Tier 2	11+	524,264	612,407	621,532	630,606
Subtotal Non-Residential		**601,675**	**699,567**	**709,991**	**720,356**
Hydrant					
Tier 1	10	582	512	512	512
Tier 2	11+	21,479	18,882	18,882	18,882
Subtotal Hydrant		**22,061**	**19,393**	**19,393**	**19,393**
Non-Potable		355,093	431,105	437,525	443,909
TOTAL USAGE		**3,305,654**	**3,738,501**	**3,793,912**	**3,849,016**

INFLATIONARY AND OTHER ASSUMPTIONS

This section describes the assumptions used in projecting operating and capital expenses as well as reserve coverage requirements that determine the overall revenue adjustments required to ensure the financial stability of the City. Revenue adjustments represent the average increase in rates for the City as a whole, rate changes for individual classes will depend on the cost of service.

To ensure that future costs are reasonably projected, it is necessary to make informed assumptions about inflationary factors and water costs and use. O&M projections are based on the City's FY 2016 adopted budget and the City's projected budgetary increases in FY 2017 and FY 2018. The City uses different inflation factors for different expenditures within the budget. On average, the O&M costs are increasing at approximately 4.8 percent per year.

FINANCIAL PLAN

The assumptions shown above were incorporated into the Financial Plan. To develop the Financial Plan, RFC projected annual expenses and revenues, modeled reserve balances, capital expenditures and calculated debt service coverage ratios to estimate the amount of additional rate revenue needed per year. This section of the report provides a discussion of O&M expenses, the Capital

Improvement Plan (CIP), reserve funding, projected revenue under existing rates and the revenue adjustments needed to ensure the fiscal sustainability and solvency of the City.

Revenue Requirement

A utility's yearly revenue requirement is the amount of yearly revenue needed to operate, maintain and ensure fiscal solvency of the City. The revenue requirement includes O&M expenses, rate funded capital expenditures, debt service payments and reserve requirements (funding for reserves).

O&M Expenses

The City's FY 2016 O&M budget and projected O&M expenses are shown in **Table 3-3**. The Financial Plan study period is from FY 2016 to 2018. O&M expenses include the cost of purchased surface water, operating and maintaining groundwater wells, treatment, distribution facilities, meter reading and billing, and providing non-potable water service. **Table 3-3** summarizes the projected O&M expenses in two different ways: by function and by type of expenditures.

Table 3-3: Projected Water O&M Expenses

	Budgeted FY 2016	Projected FY 2017	Projected FY 2018
Supply (Surface Water)	$6,170,500	$6,340,076	$6,690,425
Production (Wells)	$1,959,429	$2,060,807	$2,155,852
Treatment	$1,453,588	$1,577,896	$1,663,424
Distribution	$3,580,299	$3,848,673	$4,067,082
Utility Billing	$2,110,207	$2,163,858	$2,217,801
Non-Potable	$548,406	$555,678	$574,046
TOTAL O&M EXPENSES	**$15,822,428**	**$16,546,988**	**$17,368,631**

	Budgeted FY 2016	Projected FY 2017	Projected FY 2018
Personnel Services	$4,091,326	$4,491,596	$4,795,344
Supplies and Services	$7,987,077	$8,150,422	$8,564,148
Other Supplies and Services	$2,208,614	$2,265,386	$2,323,411
Internal Service	$735,296	$759,681	$784,913
Capital Outlay	$251,709	$324,226	$326,768
Non-Potable	$548,406	$555,678	$574,046
TOTAL O&M EXPENSES	**$15,822,428**	**$16,546,988**	**$17,368,631**

Capital Improvement Plan

Table 3-4 shows the City's CIP, which totaled approximately $4.2 million. The projects will be funded through rates.

Table 3-4: Detailed Capital Improvement Plan – Inflated

		FY 2016	FY 2017	FY 2018
Fund #560 - Water				
56394	BWTP Maintenance and Capital Upgrades	$685,000	$0	$697,000
0	Corporation Yard Wash Pad	$6,062	$0	$0
56381	RBWTP Maintenance and Capital Upgrades	$169,000	$0	$298,000
0	Los Vaqueros capacity buy-in	$0	$0	$2,000,000
56395	Well Sites and Pump Stations Painting and Recoating	$30,000	$30,000	$0
56395	Reservoir Painting and Recoating	$0	$150,000	$150,000
Total Water Funds		**$890,062**	**$180,000**	**$3,145,000**

Debt Service

The City is not planning to issue any debt during this planning period. **Table 3-5** shows the existing debt service payments for the next three years. Debt service payments for the planning period range from $2.8 million to $4.4 million.

Table 3-5: Debt Service Payments

Fund 560 Only	FY 2016	FY 2017	FY 2018
Water Revenue Bonds Series 2008			
Principal	$987,500	$1,035,000	$1,090,750
Interest	$192,875	$125,125	$47,025
Total Debt Service	**$1,180,375**	**$1,160,125**	**$1,137,775**
Water Revenue Refunding Bonds Series 2014			
Principal	$0	$0	$1,306,346
Interest	$1,657,656	$1,676,906	$1,941,735
Total Debt Service	**$1,657,656**	**$1,676,906**	**$3,248,081**
TOTAL EXISTING DEBT SERVICE	**$2,838,031**	**$2,837,031**	**$4,385,856**

Proposed Financial Plan and Revenue Adjustments

The proposed revenue adjustments help ensure adequate revenue to fund operating expenses, capital expenditures and compliance with bond covenants. The Financial Plan model assumes the revenue adjustment occurs on June 1, 2016 and on July 1, 2017. The proposed revenue adjustments would enable the City to execute the CIP shown in **Table 3-4** and exceed its debt service coverage requirement of 125% over the study period.

Table 3-6 shows the proposed revenue adjustments for 2016 and 2017. These increases are needed to finance the operating and capital expenses and reserves funding.

Table 3-6: Proposed Rate Adjustments

Effective Date	Increases
June 2016	9%
July 2017	9%

Table 3-7 shows the cash flow detail over the next two years.

Table 3-7: Proposed Water Cash Flow

Potable Water		FY 2017	FY 2018
Revenue at Current Rates		$18,857,026	$19,131,241
Additional Revenue:			
Fiscal Year	**Revenue Adjustments**		
2016	9.0%	$1,697,132	$1,721,812
2017	0.0%	$0	$0
2018	9.0%		$1,876,775
Additional Rate Revenue		$1,697,132	$3,598,587
Total Rate Revenue		$20,554,158	$22,729,828
Current Services		$243,042	$253,357
Other Revenue		$257,243	$293,593
Standby Charges		$102,476	$101,451
Operating Transfers		$0	$0
Interest Income		$16,856	$22,941
TOTAL REVENUE		**$21,173,775**	**$23,401,170**
O&M Expenses			
Supply (Surface Water)		$6,340,076	$6,690,425
Production (Wells)		$2,060,807	$2,155,852
Treatment		$1,577,896	$1,663,424
Distribution		$3,848,673	$4,067,082
Utility Billing		$2,163,858	$2,217,801
Existing Debt Service		$2,837,031	$4,385,856
Proposed Debt Service		$0	$0
Rate Funded Capital Projects*		$166,000	$3,085,000
Reserve Funding		$159,913	$251,919
TOTAL EXPENSES		**$19,154,255**	**$24,517,359**
Net Cash Flow		**$2,019,520**	**($1,116,189)**

*Non-potable water is responsible for a portion of the capital costs, shown in Table 3-23. Potable capital costs, in addition to non-potable capital costs (as shown in Table 3-23), represent total Capital Improvement Plan, Table 3-4.

Table 3-8 shows the calculated debt coverage calculation. The City's debt service payments are split between the water rates fund and the facility fees fund. In order to calculate accurate debt coverage ratios, the total revenue, including the facilities fees revenue, is included as well as the total debt service payments. The City meets and exceeds debt coverage requirement of 125 percent during this planning period.

Table 3-8: Debt Coverage Calculation

Debt Coverage Calculation	FY 2017	FY 2018
Projected Facility Fees Revenue	$1,241,891	$1,373,770
Projected Non-Potable Revenue	$569,678	$634,046
Projected Water Revenue	$21,173,775	$23,401,170
Non-Potable O&M Expenses	$555,678	$574,046
Water O&M Expenses, less depreciation	$15,160,079	$15,948,353
Total Debt Service	$3,511,225	$5,060,050
Calculated Debt Coverage	207%	176%
Required Debt Coverage	125%	125%

Figures 3-1 through **3-4** display the FY 2016 through FY 2018 Financial Plan in graphical format. **Figure 3-1** shows the modeled revenue adjustments (blue bars) for the next three years on the left hand axis. Given the current drought situation, the City is implementing rates for FY 2016 and FY 2018. FY 2019 and beyond will be evaluated in the future when more water usage has been collected to project future water use more accurately. **Figure 3-1** also graphs the calculated and required debt coverage requirements as shown by the green and red lines respectively on the right hand axis.

Figure 3-1: Proposed Revenue Adjustments and Debt Coverage Ratio

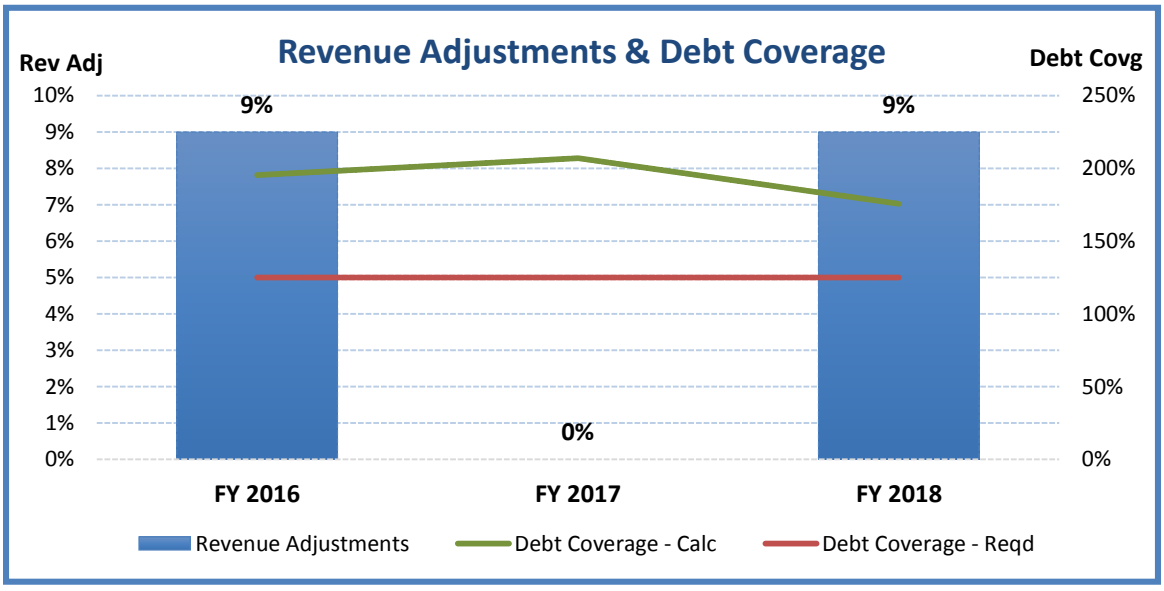


Figure 3-2 graphically illustrates the Financial Plan – it compares existing and proposed revenues with projected expenses. The expenses include water supply, O&M, debt service, capital costs, and reserves transfer are shown by the stacked bars; and total revenues at existing and proposed rates

are shown by the horizontal orange and blue lines, respectively. Current revenue from existing rates, in orange, does not meet future total expenses and clearly shows the need for revenue adjustments.

Figure 3-2: Proposed Potable Water Financial Plan

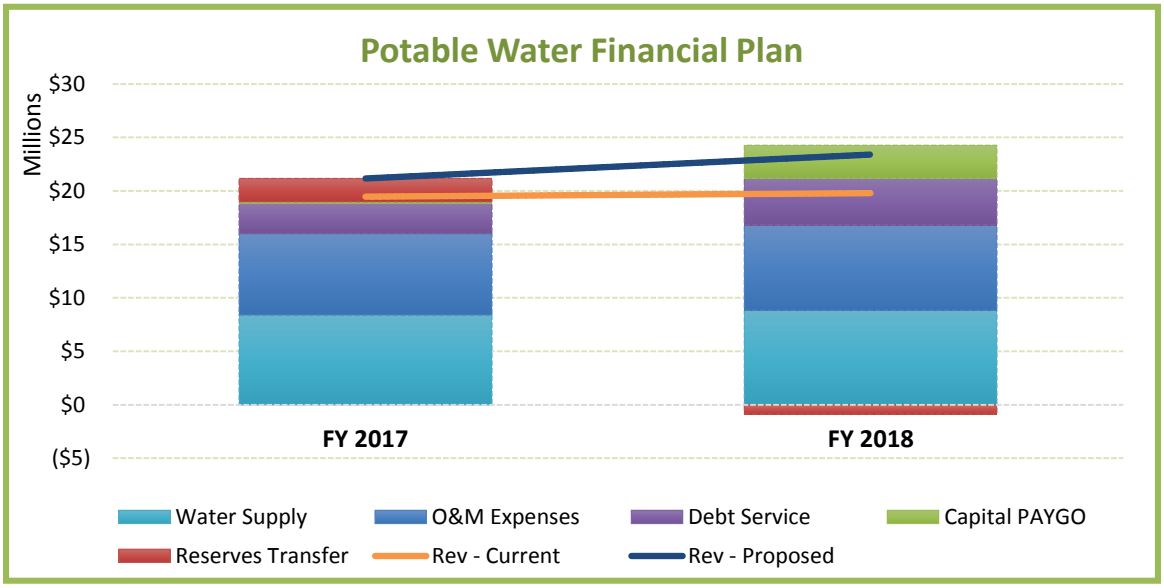


Figure 3-3 summarizes the projected CIP to be funded by water rates.

Figure 3-3: Projected CIP and Funding Sources

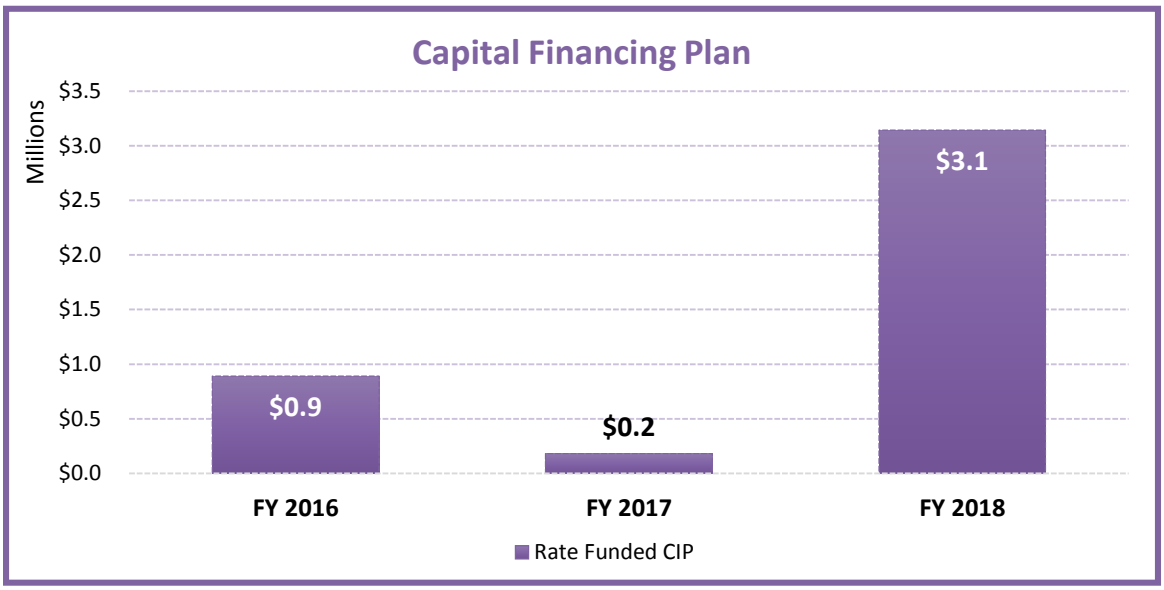


Figure 3-4 displays the resulting fund balance for the water utility. The red line represents the total current target, which equals to 30 percent of annual operating expenses and debt service payments. To reduce the impact to customers during the drought, the reserves targets will be met in the next rate cycle.

Figure 3-4: Total Cash Balance

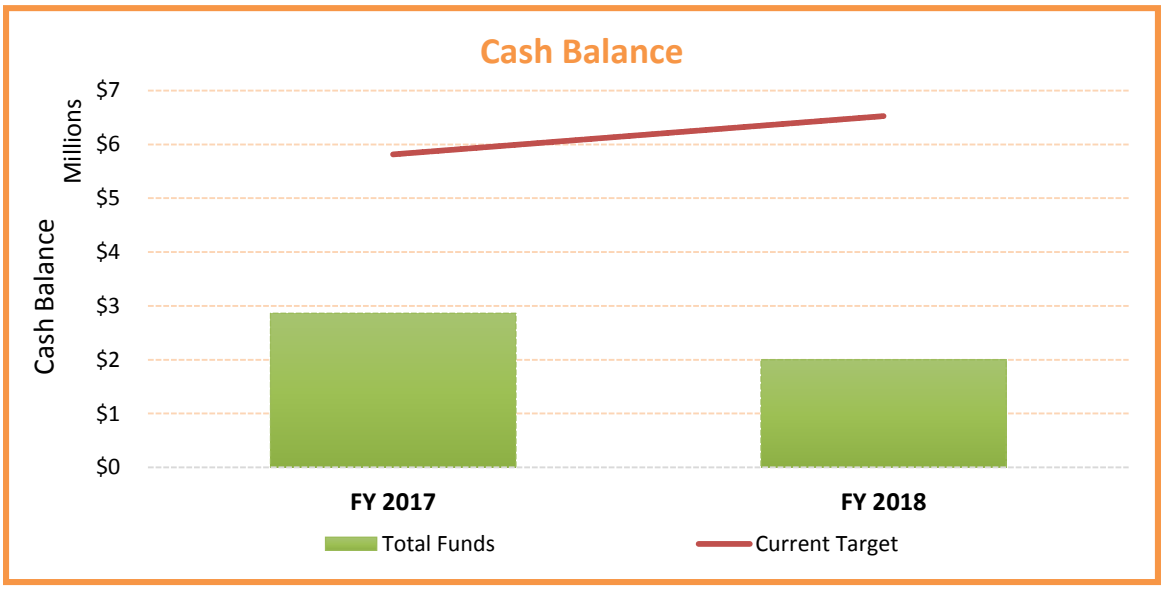


Table 3-9 shows the projected cash balance and the reserves target for each of the proposed reserves in the water utility. This table corresponds with **Figure 3-4**.

Table 3-9: Projected Cash Balance

Water Fund	FY 2017	FY 2018
Beginning Balance	$684,228	$2,863,661
Net Cash Flow	$2,019,520	($1,116,189)
Reserve Funding	$159,913	$251,919
Ending Balance	**$2,863,661**	**$1,999,391**
Interest Income	*$16,856*	*$22,941*
Current Reserve Target	$5,815,206	$6,526,346

COST-BASED RATE-SETTING METHODOLOGY

As stated in the American Water Works Association (AWWA) M1 Manual, "the costs of water rates and charges should be recovered from classes of customers in proportion to the cost of serving those customers." To develop utility rates that comply with Proposition 218 and industry standards while meeting other emerging goals and objectives of the utility, there are four major steps discussed below.

1) Calculate Revenue Requirement

The rate-making process starts by determining the test year revenue requirement - which for this study is FY 2017. The revenue requirement should sufficiently fund the utility's O&M, debt service, and capital expenses, and reserve funding.

2) Cost Of Service Analysis (COS)

The annual cost of providing water service is distributed among customer classes commensurate with their service requirements. A COS analysis involves the following:

1. Functionalizing costs. Examples of functions are supply, treatment, transmission, distribution, storage, meter servicing and customer billing and collection.
2. Allocating functionalized costs to cost causation components. Cost causation components include base delivery, maximum day, maximum hour[1], meter service, customer servicing and conservation costs.
3. Calculating cost to serve each customer class. Allocate cost causation components to customer demands to determine unit costs for each cost causation component and spread the unit costs to customer classes in proportion to their demands on the water system. This is described in the M1 Manual published by AWWA.

A COS analysis considers both the average quantity of water consumed (base delivery costs) and the peak rate at which it is consumed (peaking or capacity costs as identified by maximum day and maximum hour demands).[2] Peaking costs are costs that are incurred during peak times of consumption. The water system is designed to handle peak demands and additional costs are associated with designing, constructing, and operating and maintaining facilities to meet peak demands. The peak demand costs need to be allocated to those imposing such costs on the utility. In other words, not all customer classes share the same responsibility for peaking related costs.

3) Rate Design and Calculations

Rates do more than simply recover costs. Within the legal framework and industry standards, properly designed rates should support and optimize a blend of various utility objectives, such as conservation, affordability for essential needs and revenue stability among other objectives. Rates may also act as a public information tool in communicating these objectives to customers.

4) Rate Adoption

Rate adoption is the last step of the rate-making process to comply with Proposition 218. RFC documented the rate study results in this Study Report to help educate the public about the proposed changes, the rationale and justifications behind the changes and their anticipated financial impacts in lay terms.

---

[1] *Collectively maximum day and maximum hour costs are known as peaking costs or capacity costs.*

[2] *System capacity is the system's ability to supply water to all delivery points at the time when demanded. It is measured by each customer's water demand at the time of greatest system demand. The time of greatest demand is known as peak demand. Both the operating costs and the capital asset related costs incurred to accommodate the peak flows are generally allocated to each customer class based upon the class's contribution to the peak event.*

COST OF SERVICE ANALYSIS

The principles and methodology of a cost of service analysis were described in the preceding section. A cost of service analysis distributes a utility's revenue requirements (costs) to each customer class. After determining a utility's revenue requirements, the next step in a cost of service analysis is to functionalize its O&M costs, based on the City's current O&M classification:

1. Supply (Surface Water) – represents the cost of purchasing surface water
2. Production (Wells) – represents the cost of producing water from groundwater wells
3. Treatment – represents the cost of treating the water
4. Distribution – represents the operating and maintenance cost of the water distribution system
5. Utility Billing – represents the costs associated with billing and customer service
6. Non-Potable – represents the cost of operating and maintaining the non-potable water system

The functionalization of costs allows us to better allocate the functionalized costs to the **cost causation components**. The cost causation components include:

1. Supply – costs that are associated with providing water supply to all customers
2. Base Delivery costs – costs that are associated with providing service under average conditions
3. Peaking costs (maximum day and maximum hour) – costs that are associated with meeting the peak demand in excess of the average rate of use
4. Fire protection – costs that are associated with providing fire protection capacity
5. Meter service – costs that are associated with maintenance and capital costs of meters and services
6. Billing and customer service – costs that are incurred to provide billing and customer service
7. General and administrative costs – costs that do not have any direct cost causation

Peaking costs are further divided into maximum day and maximum hour demand. The maximum day demand is the maximum amount of water used in a single day in a year. The maximum hour demand is the maximum usage in an hour on the maximum usage day. Different facilities, such as distribution and storage facilities (and the O&M costs associated with those facilities), are designed to meet the peaking demands of customers. Therefore, extra capacity[3] costs include the O&M and capital costs associated with meeting peak customer demand. This method is consistent with the AWWA M1 Manual, and is widely used in the water industry to perform cost of service analyses.

Allocation of Functionalized Expenses to Cost Components

[3] *The terms extra capacity, peaking and capacity costs are used interchangeably.*

After functionalizing expenses, the next step is to allocate the functionalized expenses to cost causation components. To do so we must identify system wide peaking factors which were provided by the City and are shown in **Table 3-10**. The system-wide peaking factors, provided by the City, are used to derive the cost component allocation bases (i.e., percentages) shown in **Table 3-10**. Functionalized expenses are then allocated to the cost components using these allocation bases. To understand the interpretation of the percentages, we must first establish the base use as the average daily demand during the year.

To determine the relative proportion of costs to assign to Base Delivery, Max Day and Max Hour, allocations are calculated based on these factors. Cost components that are solely Base Delivery related to provide average day demand (ADD), such as source of supply, are allocated 100 percent to Base Delivery. Cost components that are designed to meet Max Day peaks, such as reservoirs and transmission facilities, are allocated to Base Delivery and Max Day factors. Since facilities such as reservoirs and distribution systems are also designed to handle fire flow, an allocation is also provided for fire flow. The Max Day allocation is as follows:

Base Delivery:	43%	= (1.00/2.10)x100 – 5% (half the fire allocation)
Max Day:	47%	= (2.10-1.00)/2.10x100 – 5% (half the fire allocation)
Fire:	10%	

Cost components such as those related to the distribution system that are designed for Max Hour peaks are allocated similarly. The allocation of Max Hour facilities is shown below:

Base Delivery:	22%	= (1.00/4.00)x100 – 3.33% (1/3 fire allocation)
Max Day:	24%	= (2.10-1.00)/4.00x100 – 3.33% (1/3 fire allocation)
Max Hour:	44%	= (4.00-2.10)/4.00x100 – 3.33% (1/3 fire allocation)
Fire:	10%	

Collectively the maximum day and hour cost components are known as peaking costs. These allocation bases are used to assign the functionalized costs to the cost causation components.

Table 3-10: System-Wide Peaking Factors and Allocation to Cost Causation Components

	Factor	Base Delivery	Max Day	Max Hour	Fire
Base	1.00	100%	0%	0%	0%
Max Day	2.10	43%	47%	0%	10%
Max Hour	4.00	22%	24%	44%	10%
Average		32%	36%	22%	10%

Table 3-11 shows the derivation of the peaking factors by customer class and tier by dividing the total maximum monthly usage by the average monthly usage for each customer class and tier. These peaking factors are used to allocate the peaking costs to each customer class and tier in the rate derivation section.

Table 3-11: Peaking Factors by Customer Class

Customer Specific	Proposed Tiers	Max Monthly	Average Monthly	Peaking Factor
Residential		314,373	193,902	1.62
Tier 1	5	88,248	84,002	1.05
Tier 2	14	121,660	73,667	1.65
Tier 3	20	47,090	18,695	2.52
Tier 4	21+	57,375	17,537	3.27
Non-Residential		105,080	51,978	2.02
Tier 1	5	4,187	3,626	1.15
Tier 2	6+	100,893	48,352	2.09
Hydrant		7,501	1,838	4.08

To allocate meter-related costs appropriately, the concept of equivalent meters needs to be understood. By using equivalent meters instead of a straight meter count, the analysis accounts for the fact that larger meters impose larger demands and are more expensive to install, maintain, and replace than smaller meters and commit a greater capacity in the system. Equivalent meters are used in calculating meter service costs.

Equivalent meters are based on meter hydraulic capacity. Equivalent meters represent the potential demand on the water system in terms of the base or smallest meter size. A ratio of hydraulic capacity is calculated by dividing large meter capacities by the base meter capacity. The base meter is the smallest meter, in our case, a 3/4-inch meter. The actual number of meters by size is multiplied by the corresponding capacity ratio to calculate equivalent meters. The capacity ratio is calculated using the meter capacity in gallons per minute (gpm) provided in the AWWA M22 Manual. **Table 3-12** shows the equivalent meters for FY 2017.

Table 3-12: Equivalent Meters

Meter Size	Capacity (gpm)	Number of Meters	Equivalent Meters
5/8" or 3/4"	30	8,182	8,182
1"	50	10,008	16,680
1 1/2"	100	212	706
2"	160	396	2,112
3"	350	36	420
4"	630	33	691
6"	1,300	14	624
TOTAL		**18,882**	**29,417**

Table 3-13 allocates the O&M and capital expenses to each cost component. The functional costs are allocated according to industry standards based on the nature of the water function. For

example: water supply and production costs are allocated 100 percent to the Supply component. Treatment costs are allocated on the basis of Max Day. Distribution costs are allocated on the basis of Max Hour. Utility billing costs are allocated 100 percent to the Customer component. Some costs which cannot be readily classified into one of the functions are allocated to General and then spread amongst all the other cost causation components proportionate to the overall cost allocation.

Table 3-13 shows the total resulting cost causation component allocation for O&M expenses. This resulting allocation is used to allocate the City's operating revenue requirement to the cost causation components.

Table 3-13 also shows the total resulting allocation for the City's assets. The resulting total asset allocation is derived in a similar manner as the O&M allocation - first, RFC functionalized the City's assets and then allocated them to the cost causation components resulting in the asset total allocation shown at the bottom of **Table 3-13**.

Table 3-13: Allocation of Functionalized O&M and Capital Expenses to Cost Causation Components

O&M Allocation	Supply	Base Delivery	Max Day	Max Hour	Fire	Meter	Customer	General	TOTAL
Supply (Surface Water)	100%								100%
Production (Wells)	100%								100%
Treatment		48%	52%						100%
Distribution		22%	24%	44%	10%				100%
Utility Billing							100%		100%

O&M Allocation	Supply	Base Delivery	Max Day	Max Hour	Fire	Meter	Customer	General	TOTAL
Supply (Surface Water)	$6,340,076	$0	$0	$0	$0	$0	$0	$0	$6,340,076
Production (Wells)	$2,060,807	$0	$0	$0	$0	$0	$0	$0	$2,060,807
Treatment	$0	$751,379	$826,517	$0	$0	$0	$0	$0	$1,577,896
Distribution	$0	$833,879	$930,096	$1,699,830	$384,867	$0	$0	$0	$3,848,673
Utility Billing	$0	$0	$0	$0	$0	$0	$2,163,858	$0	$2,163,858
TOTAL O&M EXPENSES	**$8,400,883**	**$1,585,258**	**$1,756,613**	**$1,699,830**	**$384,867**	**$0**	**$2,163,858**	**$0**	**$15,991,311**
% Allocation	53%	10%	11%	11%	2%	0%	14%	0%	100%

Capital Allocation	Supply	Base Delivery	Max Day	Max Hour	Fire	Meter	Customer	General	TOTAL
Land								100%	100%
Well		100%							100%
Reservoir		43%	47%	0%	10%				100%
Distribution		22%	24%	44%	10%				100%
Transmission		43%	47%	0%	10%				100%
Buildings								100%	100%
Machinery & Equipment						100%			100%
Vehicles								100%	100%
Pumps		48%	52%						100%
Treatment Plant		48%	52%						100%

Capital Allocation	Supply	Base Delivery	Max Day	Max Hour	Fire	Meter	Customer	General	TOTAL
Land	$0	$0	$0	$0	$0	$0	$0	$62,556	$62,556
Well	$0	$5,748,989	$0	$0	$0	$0	$0	$0	$5,748,989
Reservoir	$0	$5,259,657	$5,847,328	$0	$1,234,109	$0	$0	$0	$12,341,095
Distribution	$0	$11,802,296	$13,164,100	$24,058,527	$5,447,214	$0	$0	$0	$54,472,137
Transmission	$0	$0	$0	$0	$0	$0	$0	$0	$0
Buildings	$0	$0	$0	$0	$0	$0	$0	$819,421	$819,421
Machinery & Equipment	$0	$0	$0	$0	$0	$1,444,305	$0	$0	$1,444,305
Vehicles	$0	$0	$0	$0	$0	$0	$0	$0	$0
Pumps	$0	$1,370,190	$1,507,209	$0	$0	$0	$0	$0	$2,877,398
Treatment Plant	$0	$31,453,545	$34,598,899	$0	$0	$0	$0	$0	$66,052,444
TOTAL ASSETS	**$0**	**$55,634,676**	**$55,117,536**	**$24,058,527**	**$6,681,323**	**$1,444,305**	**$0**	**$881,977**	**$143,818,346**
% Allocation	0%	39%	38%	17%	5%	1%	0%	1%	100%

Revenue Requirement Determination

Table 3-14 shows the revenue requirement derivation with the total revenue required from rates. The totals shown in the "Operating" and "Capital" columns are the total O&M and capital revenue requirements, respectively, that are allocated to the cost causation components using the allocation percentages shown in **Table 3-13**.

RFC calculated the revenue requirement using FY 2017 expenses, which include O&M expenses, rate funded capital expenses and existing and proposed debt service. To arrive at the rate revenue requirement, we subtract revenue offsets from other expenses and make adjustments for annual cash balances. The adjustments, shown as negative values are subtracted (therefore added as a result of subtracting a negative number) to arrive at the total revenue requirement from rates. This is the amount that fixed charge and commodity rates are designed to collect.

Table 3-14: Revenue Requirement Determination

	FY 2017		
	Operating	**Capital**	**Total**
Revenue Requirements			
O&M Expenses	$15,991,311		$15,991,311
Existing Debt Service		$2,837,031	$2,837,031
Proposed Debt Service		$0	$0
Rate Funded Capital Projects		$166,000	$166,000
Reserve Funding		$159,913	$159,913
Total Revenue Requirements	**$15,991,311**	**$3,162,944**	**$19,154,255**
Less: Revenue Offsets			
Current Services	$243,042		$243,042
Other Revenue	$257,243		$257,243
Standby Charges		$102,476	$102,476
Operating Transfers	$0		$0
Interest Income	$16,856		$16,856
Total Revenue Offsets	**$517,141**	**$102,476**	**$619,617**
Less: Adjustments			
Adjustment for Cash Balance		($2,019,520)	($2,019,520)
Adjustment for Midyear Increase	$0		$0
Total Adjustments	**$0**	**($2,019,520)**	**($2,019,520)**
Revenue Requirement from Rates	**$15,474,170**	**$5,079,988**	**$20,554,158**

Unit Cost Component Derivation

Our end goal is to proportionately distribute the cost causation components to each user class. To do so we must calculate the cost causation component unit costs, which starts by assessing the total

units demanded by each class for each cost causation component. This is shown in **Table 3-15**. The capacity or peaking factor for each customer class is taken from **Table 3-11**. The total equivalent meters are from **Table 3-12**.

Table 3-15: Derivation of Cost Causation Component Units

				Maximum Day Requirements			Maximum Hour Requirements				
	Monthly Tiers (kgal)	Annual Use (kgal)	Average Daily Use (kgal/day)	Capacity Factor	Total Capacity (kgal/day)	Extra Capacity (kgal/day)	Capacity Factor	Total Capacity (kgal/day)	Extra Capacity (kgal/day)	No. of Meters (Equiv.)	No. of Bills (No.)
Residential											
Tier 1	5	1,135,528	3,111	1.05	3,267	156	2.00	6,222	2,955		
Tier 2	14	999,560	2,739	1.65	4,519	1,780	3.14	8,607	4,088		
Tier 3	20	253,830	695	2.52	1,752	1,057	4.80	3,338	1,586		
Tier 4	21+	238,086	652	3.27	2,133	1,481	6.23	4,063	1,930		
Non-Residential											
Tier 1	5	49,202	135	1.15	155	20	2.19	295	140		
Tier 2	6+	660,789	1,810	2.09	3,784	1,973	3.98	7,207	3,423		
Hydrant		19,393	53	4.08	217	164	7.77	413	196		
TOTAL		**3,356,387**				**6,631**			**14,319**	**29,417**	**226,582**

Table 3-16 shows the cost causation component unit cost derivation. The operating revenue requirement shown in **Table 3-14** is allocated to the cost causation components using the resulting O&M allocation from **Table 3-13**. Similarly the capital revenue requirement in **Table 3-14** is allocated to the cost causation components using the asset resulting allocation from **Table 3-13**. General and Administrative costs, which cannot be tied to a specific function, are redistributed in proportion to the resulting allocation of the other cost causation components, except Supply. The Fire cost component represents public fire protection costs and are reallocated to the meter component. To provide revenue stability a portion of the extra capacity costs are allocated to the meter component in order to collect approximately 30 percent of the rate revenue from fixed charges. The total adjusted cost of service is divided by the units of service to calculate the unit cost. For example, the unit cost for the base component is determined by dividing the total base cost by total water use in kgal, annual billing and customer service costs are divided by the estimated number of annual monthly bills. The unit costs are used to distribute the cost causation components to the customer classes. **Tables 3-15** through **3-17** are reproduced in Appendix B in a larger format.

Table 3-16: Unit Cost Calculation

	Supply	Base Delivery	Max Day	Max Hour	Fire	Meter	Customer	General	TOTAL
Operating Expenses	$8,129,208	$1,533,993	$1,699,806	$1,644,860	$372,421	$0	$2,093,882	$0	$15,474,170
Capital Expenses	$0	$1,965,142	$1,946,876	$849,801	$235,999	$51,016	$0	$31,153	$5,079,988
Total Cost of Service	**$8,129,208**	**$3,499,135**	**$3,646,682**	**$2,494,661**	**$608,420**	**$51,016**	**$2,093,882**	**$31,153**	**$20,554,158**
Allocation of General Cost		$8,796	$9,166	$6,271	$1,529	$128	$5,263	($31,153)	$0
Allocation of Public Fire Protection Cost					($609,950)	$609,950			$0
Allocation of Peaking Cost to Meter			($2,193,509)	($1,500,559)		$3,694,068			$0
Total Adjusted Cost of Service	**$8,129,208**	**$3,507,930**	**$1,462,339**	**$1,000,373**	**$0**	**$4,355,162**	**$2,099,145**	**$0**	**$20,554,158**
Unit of Service	3,356,387	3,356,387	6,631	14,319		29,417	226,582		
Unit	kgal	kgal	kgal/day	kgal/day		equiv meters	bills		
Unit Cost	$2.42	$1.05	$220.55	$69.86		$12.34	$9.26		

Distribution of Cost Causation Components to Customer Classes

The final step in a cost of service analysis is to distribute the cost causation components to the user classes using the unit costs derived in **Table 3-16** to arrive at the cost to serve each customer class. **Table 3-17** shows the derivation of the cost to serve (i.e., cost of service for) each class. The Supply, Base Delivery, Max Day, and Max Hour cost components are collected through the commodity (volumetric) rates ($/kgal) for potable water. The Meter and Customer cost components are collected through the City's monthly meter service charges providing fixed revenue. The proposed fixed revenue from rates is approximately 30%, compared to the existing fixed revenue of approximately 35% and conversely the variable revenue increases from the current 65% to 70% providing for greater incentive for conservation. The California Urban Water Conservation Council recommends that no more than 30% of the rate revenue should be collected from fixed charges to ensure a strong conservation incentive through the commodity rates.

To derive the cost to serve each class, the unit costs from **Table 3-16** are multiplied by the units shown in **Table 3-15** for each customer class. For example, the supply costs for the SFR class is calculated by multiplying the supply unit cost ($2.42 per kgal) by the annual SFR use in each tier (**Table 3-15**). Similarly the *customer* costs are derived by multiplying the *customer* unit cost ($9.26 per bill) (**Table 3-17**) by the number of bills (226,582 bills) (**Table 3-15**). Similar calculations for each of the remaining user classes and tiers and cost components yield the total cost to serve each user class shown in **Table 3-17**. Note that the total cost of service is equal to the revenue requirement in **Table 3-14** as intended. We have now calculated the cost to serve each user class and can proceed to derive rates to collect the cost to serve each class.

Table 3-17: Allocation of Cost to Customer Class

	Supply	Base Delivery	Max Day	Max Hour	Fire	Meter	Customer	General	TOTAL
Residential									
Tier 1	$2,750,261	$1,186,798	$34,306	$206,482					$4,177,847
Tier 2	$2,420,945	$1,044,690	$392,582	$285,619					$4,143,836
Tier 3	$614,780	$265,291	$233,128	$110,774					$1,223,974
Tier 4	$576,646	$248,835	$326,563	$134,827					$1,286,871
Non-Residential									
Tier 1	$119,167	$51,423	$4,459	$9,799					$184,848
Tier 2	$1,600,438	$690,624	$435,208	$239,169					$2,965,439
Hydrant	$46,971	$20,269	$36,092	$13,703					$117,035
Base Meters						$4,355,162	$2,099,145		$6,454,307
TOTAL	**$8,129,208**	**$3,507,930**	**$1,462,339**	**$1,000,373**	**$0**	**$4,355,162**	**$2,099,145**	**$0**	**$20,554,158**

RATE DERIVATION

Existing Rate Structure and Rates

The City's existing rate structure consists of a monthly base charge, which is a fixed charge determined on the basis of the size of the meter serving a property. In addition, the City has a four-tiered commodity rate structure for residential customers, and a two-tiered rate structure for non-residential customers. Non-potable water customers have a different uniform rate. **Table 3-18** shows the existing rate structure and rates.

Table 3-18: Existing Monthly Rate Structure and Rates

Monthly Base Rate		
Meter Size		
5/8" or 3/4"		$20.85
1"		$31.27
1 1/2"		$62.55
2"		$104.25
3"		$187.65
4"		$271.05
6"		$562.96
Commodity Rate ($/kgal)		
Residential	Monthly (kgal)	
Tier 1	10	$3.27
Tier 2	20	$3.89
Tier 3	30	$4.66
Tier 4	31+	$5.43
Non-Residential		
Tier 1	10	$3.27
Tier 2	11+	$3.89
Non-Potable		$1.20

Proposed Monthly Fixed Charge

Table 3-19 shows the derivation of the monthly base charge. The cost of service analysis derived in **Table 3-17** feeds into the meter charge derivation as the meter charge is designed to collect the amount of revenue shown in the "Meter" and "Customer" columns of **Table 3-19**.

Fixed Meter Charge Components

There are two components that comprise the fixed meter charges: meter capacity and customer service (or billing), both are described below. This charge recognizes the fact that even when a customer does not use any water, the City incurs fixed costs in connection with maintaining the ability or readiness to serve each connection.

Meter Capacity Component

The meter capacity component collects capacity (also known as peaking) related costs. Capacity related costs can be allocated to and collected through the meter service charge by meter size. This reflects the fact that larger meters have the potential to demand more capacity compared to smaller meters. The potential capacity demanded is proportional to the potential flow through each meter size as established by the AWWA hydraulic capacity ratios which are shown in the "Meter Ratio" column of **Table 3-19**. The ratios show the potential flow through each meter size compared to the

flow through a 3/4-inch meter. For example, the "Meter Ratio" column in **Table 3-19** shows that the flow through a 2-inch meter is 5.3 times that of a 3/4-inch and therefore the meter capacity component of the base charge is 5.3 times that of the 3/4-inch meter. The meter capacity component for a 3/4-inch meter is derived in the "Meter" column of **Table 3-19** and the capacity component for larger meters is scaled up using the AWWA capacity ratios shown in the "Meter Ratio" column of **Table 3-19**.

Allocating capacity costs by meter size is a common way to provide greater revenue stability, especially in light of decreasing revenues during a drought or other water shortage. Two drawbacks are that it creates higher bills for low volume water users and reduces incentives for conservation by reducing the commodity (or variable) rates. In the City's case, the fixed or meter portion of the revenue is decreasing so that there is greater incentive for conservation.

Customer/Billing Component

The customer/billing component recovers costs associated with meter reading, customer billing and collection as well as customer service costs. These costs are the same for all meter sizes as it costs the same to provide billing and customer services to a small meter as it does a larger meter. The customer/billing component is derived in the "Customer/Billing" column of **Table 3-19.**

Table 3-19: Derivation of the Monthly Base Charge

Meter Size	Meter Ratio	Meter	Customer/ Billing	Total Charges	Current Charges	Difference
5/8" or 3/4"	1.00	$12.34	$9.26	$21.61	$20.85	4%
1"	1.67	$20.56	$9.26	$29.83	$31.27	-5%
1 1/2"	3.33	$41.13	$9.26	$50.39	$62.55	-19%
2"	5.33	$65.80	$9.26	$75.07	$104.25	-28%
3"	11.67	$143.94	$9.26	$153.21	$187.65	-18%
4"	21.00	$259.09	$9.26	$268.36	$271.05	-1%
6"	43.33	$534.63	$9.26	$543.89	$562.96	-3%

Proposed Commodity Rates

Residential Tier Definitions

The City's current rate structure includes four tiers for residential customers. Tier 1 is from 0 to 10 kgal per month, Tier 2 is 11 to 20 kgal per month, Tier 3 is 21 to 30 kgal per month, and Tier 4 is 31 kgal per month or more. RFC is proposing new tiers for residential customers based upon the class' usage consumption patterns. The new proposed tiers are as follows:

- Tier 1: 0 to 5 kgal per month – this represents the amount of water available from the lowest cost water supply source equally to all customers.
- Tier 2: 6 to 14 kgal per month – this represents the FY 2013 and 2014 average monthly water usage for residential customers. This allocation provides sufficient water for an average residential customer.

- Tier 3: 15 to 20 kgal per month – this represents the FY 2013 and 2014 average summer water usage between June and September for residential customers. This allocation provides sufficient outdoor water for an average residential customer.
- Tier 4: Over 21 kgal per month

Non-Residential Tier Definitions

The City's current rate structure includes two tiers for non-residential customers. Tier 1 is from 0 to 10 kgal per month, Tier 2 is 11 kgal per month or more. RFC is proposing that the City retains the two tier structure. However, Tier 1 would be changed to 0 to 5 kgal per month, which is the same as residential Tier 1 since Tier 1 represents the amount of water available from the lowest cost water supply source.

Unit Cost Definitions

The commodity rates for each class and tier are derived by summing of the unit rates ($/kgal) for:

1. Supply
2. Base Delivery
3. Peaking

Supply costs are costs related to the cost of purchasing and producing water. The City has three sources of water, each incurring different costs, as shown in **Table 3-20**. Each source of supply is allocated to each customer class based on the proportional amount of water usage in each class. Within each customer class, each available supply is allocated to each tier based on the usage in each tier, with priority given to the lower tiers. For example, the residential class is allocated 1,004,650 kgal of groundwater, which is in turn allocated entirely to Tier 1 because it represents the most essential use. This principle applies to the Non-Residential customer class as well.

Table 3-20: Allocation of Water Supply

Sources	Groundwater	Brentwood TP	RBWTP	Total
Available Supply (kgal)	1,283,590	1,305,637	767,160	**3,356,387**
Cost	$1,249,317	$4,172,256	$2,707,635	**$8,129,208**
Unit Cost ($/kgal)	$0.97	$3.20	$3.53	**$2.42**

	Usage (kgal)	Groundwater	Brentwood TP	RBWTP	Total	Unit Cost
Residential	2,627,003	1,004,650	1,021,906	600,447	2,627,003	$2.42
Non-Residential	709,991	271,523	276,187	162,280	709,991	$2.42
Hydrant	19,393	7,417	7,544	4,433	19,393	$2.42
TOTAL	**3,356,387**	**1,283,590**	**1,305,637**	**767,160**	**3,356,387**	**$2.42**

	Usage (kgal)	Groundwater	Brentwood TP	RBWTP	Total	Unit Cost
Residential						
Tier 1	1,135,528	1,004,650	130,877	0	1,135,528	$1.23
Tier 2	999,560	0	891,029	108,531	999,560	$3.23
Tier 3	253,830	0	0	253,830	253,830	$3.53
Tier 4	238,086	0	0	238,086	238,086	$3.53
Subtotal Residential	**2,627,003**	**1,004,650**	**1,021,906**	**600,447**	**2,627,003**	**$2.42**
Non-Residential						
Tier 1	49,202	49,202	0	0	49,202	$0.97
Tier 2	660,789	222,322	276,187	162,280	660,789	$2.53
Subtotal Non-Residential	**709,991**	**271,523**	**276,187**	**162,280**	**709,991**	**$2.42**
Hydrant	19,393	7,417	7,544	4,433	19,393	$2.42
TOTAL	**3,356,387**	**1,283,590**	**1,305,637**	**767,160**	**3,356,387**	**$2.42**

Base Delivery costs are the operating and capital costs associated with delivering water to all customers at a constant average rate of use – also known as serving customers under average daily demand conditions. Therefore base delivery costs are spread over all units of water irrespective of customer class or tiers. Based on **Table 3-16**, the delivery or base unit cost is $1.05 per kgal.

Peaking costs, or extra-capacity costs, represent costs incurred to meet customer peak demands in excess of a base use (or average daily demand). Total extra capacity costs are comprised of maximum day and maximum hour demands. The peaking costs are distributed to each tier and class using peaking factors derived from customer use data. **Table 3-21** shows the peaking unit cost for each customer class and tier, which is calculated by dividing the total peaking costs for each class and tier, from **Table 3-17**, by the total usage in each class and tier, from **Table 3-15**.

Table 3-21: Peaking Cost Calculation

Customer Class	Monthly Tier (kgal)	Peaking Costs	Usage (kgal)	Unit Cost
Residential				
Tier 1	5	$240,788	1,135,528	$0.21
Tier 2	14	$678,201	999,560	$0.68
Tier 3	20	$343,903	253,830	$1.35
Tier 4	21+	$461,390	238,086	$1.94
Non-Residential				
Tier 1	5	$14,258	49,202	$0.29
Tier 2	6+	$674,377	660,789	$1.02
Hydrant		$49,795	19,393	$2.57

Table 3-22 shows the proposed commodity rate, which makes up of the three previously discussed rate component, for each customer class. The Supply component is from **Table 3-20**; the Delivery component is from **Table 3-16**; and the Peaking component is from **Table 3-21**. The non-potable water rate is based on the calculation shown in **Table 3-23**.

Table 3-22: Proposed Commodity Rates

Customer Class	Monthly Tier (kgal)	Supply	Delivery	Peaking	Total Rate
Residential					
Tier 1	5	$1.23	$1.05	$0.21	**$2.49**
Tier 2	14	$3.23	$1.05	$0.68	**$4.96**
Tier 3	20	$3.53	$1.05	$1.35	**$5.93**
Tier 4	21+	$3.53	$1.05	$1.94	**$6.52**
Subtotal Residential					
Non-Residential					
Tier 1	5	$0.97	$1.05	$0.29	**$2.31**
Tier 2	6+	$2.53	$1.05	$1.02	**$4.60**
Subtotal Non-Residential					
Hydrant		$2.42	$1.05	$2.57	**$6.04**
Non-Potable					**$1.31**

Non-Potable Water

Non-potable water rates are calculated to recover costs associated providing non-potable water service. **Table 3-23** shows the calculation for the City's retail non-potable water customers.

Table 3-23: Non-Potable Water Rate Calculation

Non-Potable Water	FY 2016	FY 2017	FY 2018
O&M Expenses	$548,406	$555,678	$574,046
Capital Expenses	$12,500	$14,000	$60,000
Total Expenses	**$560,906**	**$569,678**	**$634,046**
Non-Potable Usage	431,105	437,525	443,909
Non-Potable Rate ($/kgal)	$1.31	$1.31	$1.43

Table 3-24 shows the proposed rates for the next two years. These rates are effective in June 1, 2016 and in July 1, 2017. The City reserves the right to pass through costs that are not within the City's control, such as water purchased costs, electrical costs, chemical costs etc. to the proposed rates when such an action is deemed necessary. The financial plan has built in projected increases in these costs. However, in the event that those increases exceed the projected amount, the Council may decide to pass through the increase to the customers.

Table 3-24: Proposed Monthly Water Rates

		June 1, 2016	July 1, 2017
Monthly Base Rate			
Meter Size			
5/8" or 3/4"		$21.61	$23.56
1"		$29.83	$32.52
1 1/2"		$50.39	$54.93
2"		$75.07	$81.83
3"		$153.21	$167.00
4"		$268.36	$292.65
6"		$543.89	$592.85
Commodity Rate ($/kgal)			
Residential	Monthly (kgal)		
Tier 1	5	$2.49	$2.72
Tier 2	14	$4.96	$5.41
Tier 3	20	$5.93	$6.47
Tier 4	21+	$6.52	$7.11
Non-Residential			
Tier 1	5	$2.31	$2.52
Tier 2	6+	$4.60	$5.02
Hydrant		$6.04	$6.59
Non-Potable		$1.31	$1.43

BILL IMPACTS

Table 3-25 shows the impacts of an average residential customer with a 1-inch meter using an average 12 kgal of water monthly. For comparison purposes, the impacts on very low-end to very high-end users are also shown. Due to rounding in the calculations, some values may not add to the penny.

Table 3-25: Residential Water Monthly Rate Impacts

Residential	Usage (kgal)	Current Bill	Proposed Bill	Difference
Low volume	5	$47.62	$42.28	-11.2%
Median	10	$63.97	$67.08	4.9%
Average	12	$71.75	$77.00	7.3%
Summer Avg.	17	$91.20	$104.71	14.8%
High	25	$126.17	$155.10	22.9%
Very high	40	$203.77	$252.90	24.1%

4. APPENDIX A: DROUGHT SURCHARGES

As part of the Study, RFC calculated the demand reduction surcharges to recover the revenue shortfall that occurs as a result of demand reduction during water shortage situations. According to the City's Water Shortage Contingency Plan, the City has four levels of water supply shortage. Stage 1 Water Supply Shortage calls for a demand reduction of up to 10 percent; Stage 2 calls for a reduction of up to 20 percent; Stage 3 Water Supply Shortage calls for demand reduction of up to 35 percent and Stage 4 up to 50 percent. Since Stage 1 is considered a minor drought and can be met with irrigation usage restrictions, RFC recommends that drought surcharges be implemented for Stages 2 to 4 only.

A Drought Surcharge may be imposed by the Brentwood City Council during times of a declared drought when the City Council has implemented a Stage 2, 3, or 4 water shortage. The Drought Surcharges correspond to increasingly severe stages of mandated conservation and reduced water usage. Drought Surcharges are charged on each unit of water used and are calculated to recover costs resulting from loss of revenue due to less water being used, funding of conservation programs such as landscape conversion incentives and the free Recycled Water Fill Station, among other drought-related customer service activities. The amount of the temporary Drought Surcharge for each Stage is based upon the City's projected revenue shortfall and cost increases associated with that Stage. A Drought Surcharge could only be implemented while there is a declared Drought Stage, and the City Council would always retain the discretion not to implement a Drought Surcharge as well as the discretion to end a Drought Surcharge, even while a declared Drought Stage continued, based upon projected water usage reductions, revenue losses, and expenses.

To determine the demand reduction surcharges, the first step is to project the water demand reduction for each customer class under each level of shortage. **Table 4-1** shows the projected water demand for each customer class and tier at each level of reduction. RFC analyzed individual customer usage data, assuming that customers using more water are expected to reduce more since they have more discretionary water use. Overall, in our analysis, the City is projected to reduce its total water usage by 19 percent in Stage 2, 32 percent in Stage 3, and 46 percent in Stage 4. The projected demand reduction under each Stage is based on the "new normal" water usage in FY 2017 which represents a reduction of approximately 4.4 percent.

Table 4-1: Projected Water Demand by Stage

Usage Data (kgal)	Monthly Tier	Proposed Rates	FY 2017	% Reduction	Stage 2 - up to 20%	% Reduction	Stage 3 - up to 35%	% Reduction	Stage 4 - up to 50%
Residential									
Tier 1	5	$2.49	1,135,528	0%	1,135,528	-3%	1,098,030	-6%	1,064,563
Tier 2	14	$4.96	999,560	-17%	831,514	-35%	652,011	-61%	390,587
Tier 3	20	$5.93	253,830	-54%	115,841	-81%	47,638	-97%	6,843
Tier 4	21+	$6.52	238,086	-73%	63,518	-91%	22,478	-99%	3,421
Subtotal Residential			**2,627,003**	**-18%**	**2,146,401**	**-31%**	**1,820,157**	**-44%**	**1,465,414**
Non-Residential									
Tier 1	5	$2.31	49,202	0%	49,202	0%	49,202	-1%	48,762
Tier 2	6+	$4.60	660,789	-25%	493,222	-39%	402,309	-56%	287,641
Subtotal Non-Residential			**709,991**	**-24%**	**542,424**	**-36%**	**451,510**	**-53%**	**336,403**
Hydrant		$6.04	19,393	0%	19,393	0%	19,393	0%	19,393
Total Potable Water			**3,356,387**		**2,708,218**		**2,291,061**		**1,821,210**
% Total Reduction					-19%		-32%		-46%

The next step is to estimate the water supply cost savings that result when there is a reduction in demand. The City purchases a significant amount of surface water. Thus, as demand reduces, the City will be able to purchase less water, which in turn would reduce the water supply costs. Almost all other costs are fixed and will not vary based on water demand. **Table 4-2** shows the estimated cost savings in the water supply costs for each Stage due to the reduction in usage. The total supply assumes a five percent water loss from the water usage shown in **Table 4-1**. Since the Randall-Bold Treatment Plant has a minimum water purchase of 1,864 AF, it is kept the same for all Stages. The Surface Water supply purchases are estimated based on the variable portion of water purchase costs per existing agreement with Contra Costa Water District. The groundwater source makes up the remainder of the required water supply for each Stage.

For each water supply source, there are some fixed costs, which do not vary by the amount of water purchased, within the water purchase costs, as shown in the middle section of **Table 4-2**. This fixed cost remains the same for all Stages. The variable unit cost for each source is assumed to remain the same in each Stage. Since the amount of water purchased or produced decreases in each Stage, the total variable cost decreases. This resulted in a cost saving, shown in the last line of **Table 4-2**, for each Stage as compared to the normal year cost.

Table 4-2: Estimated Cost Savings by Stage

	FY 2017	Stage 2 - up to 20%	Stage 3 - up to 35%	Stage 4 - up to 50%
SUPPLY (AF)				
Groundwater Wells	4,136	3,363	2,719	2,005
CCWD Randall-Bold Treatment Plant	2,472	1,864	1,864	1,864
Surface Water	4,207	3,500	2,800	2,000
Total Potable Supply	**10,815**	**8,727**	**7,383**	**5,869**
FIXED COST ($/AF)				
Groundwater Wells	$0			
CCWD Randall-Bold Treatment Plant	$1,095			
Surface Water	$555			
TOTAL FIXED COSTS	**$5,044,099**	**$5,044,099**	**$5,044,099**	**$5,044,099**
VARIABLE COST ($/AF)				
Groundwater Wells	$302	$302	$302	$302
CCWD Randall-Bold Treatment Plant	$0	$0	$0	$0
Surface Water	$436	$436	$436	$436
TOTAL VARIABLE COSTS	**$3,085,110**	**$2,542,930**	**$2,042,903**	**$1,478,160**
TOTAL WATER SUPPLY COSTS	**$8,129,208**	**$7,587,029**	**$7,087,002**	**$6,522,259**
Cost Savings		$542,179	$1,042,207	$1,606,950

The final step is to calculate the drought surcharges, shown in **Table 4-3**. First, the projected potable water revenue is calculated by multiplying the demand projections from **Table 4-1** for each Stage and the proposed water rates in FY 2017. The revenue shortfall is determined by comparing this revenue for each Stage with the FY 2017 revenues. Next, we add the estimated cost savings from **Table 4-2**. The City also incurs some drought related expenses relating to water conservation programs such as conversion incentives and the Recycled Water Fill Station in addition to customer service costs. The drought related expenses are estimated at $700,000. The sum these three components: revenue shortfall, cost savings, and drought related expenses, result in the net revenue shortfall to be recovered in each Stage. The total shortfall is divided by the projected demand in each Stage to arrive at a uniform dollar increase per unit of water for each Stage. This means that in Stage 2, all customers will pay an additional $1.38 per kgal of water consumption. **Table 4-3** shows the proposed surcharges that will be effective June 1, 2016 and July 1, 2017. The July 2017 surcharges represent a nine percent increase over the June 2016 surcharges, consistent with the revenue demand and rates schedule shown in **Table 3-24**.

Table 4-3: Drought Surcharge by Stage

	FY 2017	Stage 2 - up to 20%	Stage 3 - up to 35%	Stage 4 - up to 50%
Projected Potable Revenue	**$14,113,233**	**$10,552,463**	**$8,478,531**	**$6,203,882**
Revenue Shortfall		($3,560,770)	($5,634,701)	($7,909,351)
Cost Savings		$542,179	$1,042,207	$1,606,950
Net Drought Related Expenses		($700,000)	($700,000)	($700,000)
Net Revenue Shortfall to be Recovered		**($3,718,591)**	**($5,292,495)**	**($7,002,401)**
$ Increase per unit - June 1, 2016		$1.38	$2.32	$3.85
$ Increase per unit - July 1, 2017		$1.50	$2.53	$4.20

5. APPENDIX B

Table 3-13: Allocation of Functionalized O&M and Capital Expenses to Cost Causation Components

O&M Allocation	Supply	Base Delivery	Max Day	Max Hour	Fire	Meter	Customer	General	TOTAL
Supply (Surface Water)	100%								100%
Production (Wells)	100%								100%
Treatment		48%	52%						100%
Distribution		22%	24%	44%	10%				100%
Utility Billing							100%		100%

O&M Allocation	Supply	Base Delivery	Max Day	Max Hour	Fire	Meter	Customer	General	TOTAL
Supply (Surface Water)	$6,340,076	$0	$0	$0	$0	$0	$0	$0	$6,340,076
Production (Wells)	$2,060,807	$0	$0	$0	$0	$0	$0	$0	$2,060,807
Treatment	$0	$751,379	$826,517	$0	$0	$0	$0	$0	$1,577,896
Distribution	$0	$833,879	$930,096	$1,699,830	$384,867	$0	$0	$0	$3,848,673
Utility Billing	$0	$0	$0	$0	$0	$0	$2,163,858	$0	$2,163,858
TOTAL O&M EXPENSES	**$8,400,883**	**$1,585,258**	**$1,756,613**	**$1,699,830**	**$384,867**	**$0**	**$2,163,858**	**$0**	**$15,991,311**
% Allocation	53%	10%	11%	11%	2%	0%	14%	0%	100%

Table 3-13: Allocation of Functionalized O&M and Capital Expenses to Cost Causation Components (cont'd)

Capital Allocation	Supply	Base Delivery	Max Day	Max Hour	Fire	Meter	Customer	General	TOTAL
Land								100%	100%
Well		100%							100%
Reservoir		43%	47%	0%	10%				100%
Distribution		22%	24%	44%	10%				100%
Transmission		43%	47%	0%	10%				100%
Buildings								100%	100%
Machinery & Equipment						100%			100%
Vehicles								100%	100%
Pumps		48%	52%						100%
Treatment Plant		48%	52%						100%

Capital Allocation	Supply	Base Delivery	Max Day	Max Hour	Fire	Meter	Customer	General	TOTAL
Land	$0	$0	$0	$0	$0	$0	$0	$62,556	$62,556
Well	$0	$5,748,989	$0	$0	$0	$0	$0	$0	$5,748,989
Reservoir	$0	$5,259,657	$5,847,328	$0	$1,234,109	$0	$0	$0	$12,341,095
Distribution	$0	$11,802,296	$13,164,100	$24,058,527	$5,447,214	$0	$0	$0	$54,472,137
Transmission	$0	$0	$0	$0	$0	$0	$0	$0	$0
Buildings	$0	$0	$0	$0	$0	$0	$0	$819,421	$819,421
Machinery & Equipment	$0	$0	$0	$0	$0	$1,444,305	$0	$0	$1,444,305
Vehicles	$0	$0	$0	$0	$0	$0	$0	$0	$0
Pumps	$0	$1,370,190	$1,507,209	$0	$0	$0	$0	$0	$2,877,398
Treatment Plant	$0	$31,453,545	$34,598,899	$0	$0	$0	$0	$0	$66,052,444
TOTAL ASSETS	**$0**	**$55,634,676**	**$55,117,536**	**$24,058,527**	**$6,681,323**	**$1,444,305**	**$0**	**$881,977**	**$143,818,346**
% Allocation	0%	39%	38%	17%	5%	1%	0%	1%	100%

Table 3-15: Derivation of Cost Component Units

	Monthly Tiers (kgal)	Annual Use (kgal)	Average Daily Use (kgal/day)	Maximum Day Requirements Capacity Factor	Maximum Day Requirements Total Capacity (kgal/day)	Maximum Day Requirements Extra Capacity (kgal/day)	Maximum Hour Requirements Capacity Factor	Maximum Hour Requirements Total Capacity (kgal/day)	Maximum Hour Requirements Extra Capacity (kgal/day)	No. of Meters (Equiv.)	No. of Bills (No.)
Residential											
Tier 1	5	1,135,528	3,111	1.05	3,267	156	2.00	6,222	2,955		
Tier 2	14	999,560	2,739	1.65	4,519	1,780	3.14	8,607	4,088		
Tier 3	20	253,830	695	2.52	1,752	1,057	4.80	3,338	1,586		
Tier 4	21+	238,086	652	3.27	2,133	1,481	6.23	4,063	1,930		
Non-Residential											
Tier 1	5	49,202	135	1.15	155	20	2.19	295	140		
Tier 2	6+	660,789	1,810	2.09	3,784	1,973	3.98	7,207	3,423		
Hydrant		19,393	53	4.08	217	164	7.77	413	196		
TOTAL		**3,356,387**				**6,631**			**14,319**	**29,417**	**226,582**

Table 3-16: Unit Cost Calculation

	Supply	Base Delivery	Max Day	Max Hour	Fire	Meter	Customer	General	TOTAL
Operating Expenses	$8,129,208	$1,533,993	$1,699,806	$1,644,860	$372,421	$0	$2,093,882	$0	$15,474,170
Capital Expenses	$0	$1,965,142	$1,946,876	$849,801	$235,999	$51,016	$0	$31,153	$5,079,988
Total Cost of Service	**$8,129,208**	**$3,499,135**	**$3,646,682**	**$2,494,661**	**$608,420**	**$51,016**	**$2,093,882**	**$31,153**	**$20,554,158**
Allocation of General Cost		$8,796	$9,166	$6,271	$1,529	$128	$5,263	($31,153)	$0
Allocation of Public Fire Protection Cost					($609,950)	$609,950			$0
Allocation of Peaking Cost to Meter			($2,193,509)	($1,500,559)		$3,694,068			$0
Total Adjusted Cost of Service	**$8,129,208**	**$3,507,930**	**$1,462,339**	**$1,000,373**	**$0**	**$4,355,162**	**$2,099,145**	**$0**	**$20,554,158**
Unit of Service	3,356,387	3,356,387	6,631	14,319		29,417	226,582		
Unit	kgal	kgal	kgal/day	kgal/day		equiv meters	bills		
Unit Cost	$2.42	$1.05	$220.55	$69.86		$12.34	$9.26		

Table 3-17: Allocation of Cost to Customer Class

	Supply	Base Delivery	Max Day	Max Hour	Fire	Meter	Customer	General	TOTAL
Residential									
Tier 1	$2,750,261	$1,186,798	$34,306	$206,482					$4,177,847
Tier 2	$2,420,945	$1,044,690	$392,582	$285,619					$4,143,836
Tier 3	$614,780	$265,291	$233,128	$110,774					$1,223,974
Tier 4	$576,646	$248,835	$326,563	$134,827					$1,286,871
Non-Residential									
Tier 1	$119,167	$51,423	$4,459	$9,799					$184,848
Tier 2	$1,600,438	$690,624	$435,208	$239,169					$2,965,439
Hydrant	$46,971	$20,269	$36,092	$13,703					$117,035
Base Meters						$4,355,162	$2,099,145		$6,454,307
TOTAL	**$8,129,208**	**$3,507,930**	**$1,462,339**	**$1,000,373**	**$0**	**$4,355,162**	**$2,099,145**	**$0**	**$20,554,158**

Table 4-1: Projected Water Demand by Stage

Usage Data (kgal)	Monthly Tier	Proposed Rates	FY 2017	% Reduction	Stage 2 - up to 20%	% Reduction	Stage 3 - up to 35%	% Reduction	Stage 4 - up to 50%
Residential									
Tier 1	5	$2.49	1,135,528	0%	1,135,528	-3%	1,098,030	-6%	1,064,563
Tier 2	14	$4.96	999,560	-17%	831,514	-35%	652,011	-61%	390,587
Tier 3	20	$5.93	253,830	-54%	115,841	-81%	47,638	-97%	6,843
Tier 4	21+	$6.52	238,086	-73%	63,518	-91%	22,478	-99%	3,421
Subtotal Residential			**2,627,003**	**-18%**	**2,146,401**	**-31%**	**1,820,157**	**-44%**	**1,465,414**
Non-Residential									
Tier 1	5	$2.31	49,202	0%	49,202	0%	49,202	-1%	48,762
Tier 2	6+	$4.60	660,789	-25%	493,222	-39%	402,309	-56%	287,641
Subtotal Non-Residential			**709,991**	**-24%**	**542,424**	**-36%**	**451,510**	**-53%**	**336,403**
Hydrant		$6.04	19,393	0%	19,393	0%	19,393	0%	19,393
Total Potable Water			**3,356,387**		**2,708,218**		**2,291,061**		**1,821,210**
% Total Reduction					-19%		-32%		-46%

Appendix H: Water Conservation 2013/2014 BMP Reports

This page intentionally left blank.

CUWCC BMP Retail Coverage Report 2013

Foundational Best Managemant Practices for Urban Water Efficiency

BMP 1.1 Operation Practices

ON TRACK

47 City of Brentwood

1. Conservation Coordinator provided with necessary resources to implement BMPs?

Name: Diana Williford

Title: Water Conservation Specialist

Email: dwilliford@brentwoodca.gov

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.	Copy_of_14.01.510_Conservation-Water_waste_prohibited.pdf		
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.	17.630 Landscape Requirements.pdf		

At Least As effective As No

Exemption No

Comments:

CUWCC BMP Retail Coverage Report 2013

Foundational Best Managemant Practices for Urban Water Efficiency

BMP 1.1 Operation Practices **ON TRACK**

CUWCC BMP Coverage Report 2013

Foundational Best Management Practices For Urban Water Efficiency

BMP 1.2 Water Loss Control

NOT ON TRACK

47 City of Brentwood

Completed Standard Water Audit Using AWWA Software?	Yes
AWWA File provided to CUWCC?	Yes
2013 AWWA Audit for BMP Reporting 10-7-15.xls	
AWWA Water Audit Validity Score?	92
Complete Training in AWWA Audit Method	Yes
Complete Training in Component Analysis Process?	Yes
Component Analysis?	No
Repaired all leaks and breaks to the extent cost effective?	Yes
Locate and Repar unreported leaks to the extent cost effective?	Yes
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)

At Least As effective As No

Exemption No

Comments:

CUWCC BMP Coverage Report 2013

Foundational Best Management Practices For Urban Water Efficiency

BMP 1.3 Metering With Commodity

ON TRACK

47 City of Brentwood

Numbered Unmetered Accounts	No
Metered Accounts billed by volume of use	Yes
Number of CII Accounts with Mixed Use Meters	
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: 1/1/0001

Uploaded file name:

Completed a written plan, policy or program to test, repair and replace meters	Yes

At Least As effective As Yes

We began a program which provides an incentive to switch mixed-use accounts to dedicated landscape meters in 2015. Program documents uploaded under 2014.

Exemption No

Comments:

CUWCC BMP Coverage Report 2013

Foundational Best Management Practices For Urban Water Efficiency

BMP 1.4 Retail Conservation Pricing

Not On Track

47 City of Brentwood

Implementation (Water Rate Structure)

Customer Class	Water Rate Type	Conserving Rate?	(V) Total Revenue Comodity Charges	(M) Total Revenue Fixed Carges
Single-Family	Increasing Block	Yes	8742720	4564674
Multi-Family	Increasing Block	Yes	332351	99962
Commercial	Increasing Block	Yes	690988	367643
Dedicated Irrigation	Increasing Block	Yes	2130997	369412
			11897056	**5401691**

Calculate: V / (V + M) **69 %**

Implementation Option: Use Annual Revenue As Reported

☐ Use 3 years average instead of most recent year

Canadian Water and Wastewater Association

Upload file:

Agency Provide Sewer Service: Yes

Customer Class	Rate Type	Conserving Rate?
Single-Family	Uniform	Yes
Multi-Family	Uniform	Yes
Commercial	Uniform	Yes

At Least As effective As No

Exemption No

Comments:

CUWCC BMP Coverage Report 2013

Foundational Best Management Practices For Urban Water Efficiency

BMP 2.1 Public Outreach

ON TRACK

47 **City of Brentwood** **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

Contra Costa WD - Wholesale

The name of agency, contact name and email address if not CUWCC Group 1 members

Did at least one contact take place during each quater of the reporting year? Yes

Public Outreach Program List	Number
Newsletter articles on conservation	19000
Flyers and/or brochures (total copies), bill stuffers, messages printed on bill, information packets	500
Website	
Newsletter articles on conservation	19000
Newsletter articles on conservation	19000
Newsletter articles on conservation	19000
General water conservation information	5
Total	**76505**

Did at least one contact take place during each quater of the reporting year? No

Number Media Contacts	Number
Articles or stories resulting from outreach	1
Newspaper contacts	1
Total	**2**

Did at least one website update take place during each quater of the reporting year? Yes

Public Information Program Annual Budget

Annual Budget Category	Annual Budget Amount
Outreach	1200
Total Amount:	**1200**

Public Outreah Additional Programs
Rock Steady program at the Farmers Market

Description of all other Public Outreach programs

Friends of Marsh Creek

CUWCC BMP Coverage Report 2013

Foundational Best Management Practices For Urban Water Efficiency

BMP 2.1 Public Outreach

ON TRACK

Comments:

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

47 City of Brentwood **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

Contra Costa WD - Wholesale

Materials meet state education framework requirements? Yes

Project WET based curriculum

Materials distributed to K-6? Yes

Project WET based curriculum and AWWA.

Materials distributed to 7-12 students? Yes (Info Only)

Project WET based curriculum

Annual budget for school education program: 1200.00

Description of all other water supplier education programs

Offer plant tours and a ground water model.

Comments:

At Least As effective As No

Exemption No 0

CUWCC BMP Retail Coverage Report 2014

Foundational Best Managemant Practices for Urban Water Efficiency

BMP 1.1 Operation Practices

ON TRACK

47 City of Brentwood

1. Conservation Coordinator provided with necessary resources to implement BMPs?

Name: Diana Williford

Title: Water Conservation Specialist

Email: dwilliford@brentwoodca.gov

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.	Copy1_of_14.01.510_Conservation-Water_waste_prohibited.pdf	www.brentwoodca.gov	A copy of the ordinance has been uploaded.
Option B Describe any water waste prevention ordinances or requirements adopted by your local jurisdiction or regulatory agencies within your service area.		http://qcode.us/codes/brentwood/view.php?topic=17-ix-17_630&showAll=1&frames=off	
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

Exemption No

Comments:

CUWCC BMP Retail Coverage Report 2014

Foundational Best Managemant Practices for Urban Water Efficiency

BMP 1.1 Operation Practices **ON TRACK**

CUWCC BMP Coverage Report 2014

Foundational Best Management Practices For Urban Water Efficiency

BMP 1.2 Water Loss Control

NOT ON TRACK

47 City of Brentwood

Completed Standard Water Audit Using AWWA Software?	Yes
AWWA File provided to CUWCC?	Yes
2014 AWWA Audit for BMP Reporting 10-7-15.xls	
AWWA Water Audit Validity Score?	92
Complete Training in AWWA Audit Method	Yes
Complete Training in Component Analysis Process?	Yes
Component Analysis?	No
Repaired all leaks and breaks to the extent cost effective?	Yes
Locate and Repar unreported leaks to the extent cost effective?	Yes
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)

At Least As effective As No

Exemption No

Comments:

CUWCC BMP Coverage Report 2014

Foundational Best Management Practices For Urban Water Efficiency

BMP 1.3 Metering With Commodity

ON TRACK

47 City of Brentwood

Numbered Unmetered Accounts	No
Metered Accounts billed by volume of use	Yes
Number of CII Accounts with Mixed Use Meters	
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: 1/1/0001

Uploaded file name:

Completed a written plan, policy or program to test, repair and replace meters	Yes

At Least As effective As Yes

We began a program which provides an incentive to switch mixed-use accounts to dedicated landscape meters in 2015.

Exemption No

Comments:

CUWCC BMP Coverage Report 2014

Foundational Best Management Practices For Urban Water Efficiency

BMP 1.4 Retail Conservation Pricing

On Track

47 City of Brentwood

Implementation (Water Rate Structure)

Customer Class	Water Rate Type	Conserving Rate?	(V) Total Revenue Comodity Charges	(M) Total Revenue Fixed Carges
Single-Family	Increasing Block	Yes	8809469	4745735
Multi-Family	Increasing Block	Yes	359362	105952
Commercial	Increasing Block	Yes	686959	376506
Dedicated Irrigation	Increasing Block	Yes	2158616	387877
			12014406	**5616070**

Calculate: V / (V + M) **68 %**

Implementation Option: Use Annual Revenue As Reported

☐ Use 3 years average instead of most recent year

Canadian Water and Wastewater Association

Upload file:

Agency Provide Sewer Service: No

Customer Class	Rate Type	Conserving Rate?
Single-Family	Uniform	Yes
Multi-Family	Uniform	Yes
Commercial	Uniform	Yes

At Least As effective As No

Exemption No

Comments:

CUWCC BMP Coverage Report 2014

Foundational Best Management Practices For Urban Water Efficiency

BMP 2.1 Public Outreach

ON TRACK

47 **City of Brentwood** **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

Contra Costa WD - Wholesale

The name of agency, contact name and email address if not CUWCC Group 1 members

Did at least one contact take place during each quater of the reporting year? Yes

Public Outreach Program List	Number
Newsletter articles on conservation	19000
Flyers and/or brochures (total copies), bill stuffers, messages printed on bill, information packets	500
Website	
Newsletter articles on conservation	19000
Newsletter articles on conservation	19000
Newsletter articles on conservation	19000
General water conservation information	5
Total	**76505**

Did at least one contact take place during each quater of the reporting year? No

Number Media Contacts	Number
Articles or stories resulting from outreach	1
Newspaper contacts	1
Total	**2**

Did at least one website update take place during each quater of the reporting year? Yes

Public Information Program Annual Budget

Annual Budget Category	Annual Budget Amount
Outreach	1200
Total Amount:	**1200**

Public Outreah Additional Programs
Rock Steady program at the Farmers Market

Description of all other Public Outreach programs

Friends of Marsh Creek

CUWCC BMP Coverage Report 2014

Foundational Best Management Practices For Urban Water Efficiency

BMP 2.1 Public Outreach

ON TRACK

Comments:

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

47 City of Brentwood **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

Contra Costa WD - Wholesale

Agencies Name	ID number
Contra Costa WD - Wholesale	2003

Materials meet state education framework requirements? Yes

Project WET Curriculum

Materials distributed to K-6? Yes

AWWA Water Booklet

Materials distributed to 7-12 students? Yes (Info Only)

Project WET Curriculum

Annual budget for school education program: 1200.00

Description of all other water supplier education programs

Annual assembly at 6 elementary schools, Annual Public Works Open House.

Comments:

At Least As effective As No

Exemption No 0

Appendix I: Model Water Efficient Landscape Ordinance and Municipal Landscape and Screening Ordinance

This page intentionally left blank.

California Code of Regulations
Title 23. Waters
Division 2. Department of Water Resources
Chapter 2.7. Model Water Efficient Landscape Ordinance

§ 490. Purpose.

(a) The State Legislature has found:

(1) that the waters of the state are of limited supply and are subject to ever increasing demands;

(2) that the continuation of California's economic prosperity is dependent on the availability of adequate supplies of water for future uses;

(3) that it is the policy of the State to promote the conservation and efficient use of water and to prevent the waste of this valuable resource;

(4) that landscapes are essential to the quality of life in California by providing areas for active and passive recreation and as an enhancement to the environment by cleaning air and water, preventing erosion, offering fire protection, and replacing ecosystems lost to development; and

(5) that landscape design, installation, maintenance and management can and should be water efficient; and

(6) that Section 2 of Article X of the California Constitution specifies that the right to use water is limited to the amount reasonably required for the beneficial use to be served and the right does not and shall not extend to waste or unreasonable method of use.

(b) Consistent with these legislative findings, the purpose of this model ordinance is to:

(1) promote the values and benefits of landscapes while recognizing the need to invest water and other resources as efficiently as possible;

(2) establish a structure for planning, designing, installing, maintaining and managing water efficient landscapes in new construction and rehabilitated projects;

(3) establish provisions for water management practices and water waste prevention for existing landscapes;

(4) use water efficiently without waste by setting a Maximum Applied Water Allowance as an upper limit for water use and reduce water use to the lowest practical amount;

(5) promote the benefits of consistent landscape ordinances with neighboring local and regional agencies;

(6) encourage local agencies and water purveyors to use economic incentives that promote the efficient use of water, such as implementing a tiered-rate structure; and

(7) encourage local agencies to designate the necessary authority that implements and enforces the provisions of the Model Water Efficient Landscape Ordinance or its local landscape ordinance.

Note: Authority cited: Section 65593, Government Code. Reference: Sections 65591, 65593, 65596, Government Code.

§ 490.1 Applicability

(a) After January 1, 2010, this ordinance shall apply to all of the following landscape projects:

(1) new construction and rehabilitated landscapes for public agency projects and private development projects with a landscape area equal to or greater than 2,500 square feet requiring a building or landscape permit, plan check or design review;

(2) new construction and rehabilitated landscapes which are developer-installed in single-family and multi-family projects with a landscape area equal to or greater than 2,500 square feet requiring a building or landscape permit, plan check, or design review;

(3) new construction landscapes which are homeowner-provided and/or homeowner-hired in single-family and multi-family residential projects with a total project landscape area equal to or greater than 5,000 square feet requiring a building or landscape permit, plan check or design review;

(4) existing landscapes limited to Sections 493, 493.1 and 493.2; and
(5) cemeteries. Recognizing the special landscape management needs of cemeteries, new and rehabilitated cemeteries are limited to Sections 492.4, 492.11 and 492.12; and existing cemeteries are limited to Sections 493, 493.1 and 493.2.
(b) This ordinance does not apply to:
(1) registered local, state or federal historical sites;
(2) ecological restoration projects that do not require a permanent irrigation system;
(3) mined-land reclamation projects that do not require a permanent irrigation system; or
(4) plant collections, as part of botanical gardens and arboretums open to the public.

Note: Authority Cited: Section 65595, Government Code. Reference: Section 65596, Government Code.

§ 491. Definitions.

The terms used in this ordinance have the meaning set forth below:
(a) "applied water" means the portion of water supplied by the irrigation system to the landscape.
(b) "automatic irrigation controller" means an automatic timing device used to remotely control valves that operate an irrigation system. Automatic irrigation controllers schedule irrigation events using either evapotranspiration (weather-based) or soil moisture data.
(c) "backflow prevention device" means a safety device used to prevent pollution or contamination of the water supply due to the reverse flow of water from the irrigation system.
(d) "Certificate of Completion" means the document required under Section 492.9.
(e) "certified irrigation designer" means a person certified to design irrigation systems by an accredited academic institution a professional trade organization or other program such as the US Environmental Protection Agency's WaterSense irrigation designer certification program and Irrigation Association's Certified Irrigation Designer program.
(f) "certified landscape irrigation auditor" means a person certified to perform landscape irrigation audits by an accredited academic institution, a professional trade organization or other program such as the US Environmental Protection Agency's WaterSense irrigation auditor certification program and Irrigation Association's Certified Landscape Irrigation Auditor program.
(g) "check valve" or "anti-drain valve" means a valve located under a sprinkler head, or other location in the irrigation system, to hold water in the system to prevent drainage from sprinkler heads when the sprinkler is off.
(h) "common interest developments" means community apartment projects, condominium projects, planned developments, and stock cooperatives per Civil Code Section 1351.
(i) "conversion factor (0.62)" means the number that converts acre-inches per acre per year to gallons per square foot per year
(j) "drip irrigation" means any non-spray low volume irrigation system utilizing emission devices with a flow rate measured in gallons per hour. Low volume irrigation systems are specifically designed to apply small volumes of water slowly at or near the root zone of plants.
(k) "ecological restoration project" means a project where the site is intentionally altered to establish a defined, indigenous, historic ecosystem.
(l)"effective precipitation" or "usable rainfall" (Eppt) means the portion of total precipitation which becomes available for plant growth.
(m) "emitter" means a drip irrigation emission device that delivers water slowly from the system to the soil.
(n) "established landscape" means the point at which plants in the landscape have developed significant root growth into the soil. Typically, most plants are established after one or two years of growth.
(o) "establishment period of the plants" means the first year after installing the plant in the landscape or the first two years if irrigation will be terminated after establishment. Typically, most plants are established after one or two years of growth.

(p) “Estimated Total Water Use” (ETWU) means the total water used for the landscape as described in Section 492.4.
(q) “ET adjustment factor” (ETAF) means a factor of 0.7, that, when applied to reference evapotranspiration, adjusts for plant factors and irrigation efficiency, two major influences upon the amount of water that needs to be applied to the landscape.
A combined plant mix with a site-wide average of 0.5 is the basis of the plant factor portion of this calculation. For purposes of the ETAF, the average irrigation efficiency is 0.71. Therefore, the ET Adjustment Factor is (0.7)=(0.5/0.71). ETAF for a Special Landscape Area shall not exceed 1.0. ETAF for existing non-rehabilitated landscapes is 0.8.
(r) “evapotranspiration rate” means the quantity of water evaporated from adjacent soil and other surfaces and transpired by plants during a specified time.
(s) “flow rate” means the rate at which water flows through pipes, valves and emission devices, measured in gallons per minute, gallons per hour, or cubic feet per second.
(t) “hardscapes” means any durable material (pervious and non-pervious).
(u) “homeowner-provided landscaping” means any landscaping either installed by a private individual for a single family residence or installed by a licensed contractor hired by a homeowner. A homeowner, for purposes of this ordinance, is a person who occupies the dwelling he or she owns. This excludes speculative homes, which are not owner-occupied dwellings.
(v) “hydrozone” means a portion of the landscaped area having plants with similar water needs. A hydrozone may be irrigated or non-irrigated.
(w) “infiltration rate” means the rate of water entry into the soil expressed as a depth of water per unit of time (e.g., inches per hour).
(x)“invasive plant species” means species of plants not historically found in California that spread outside cultivated areas and can damage environmental or economic resources. Invasive species may be regulated by county agricultural agencies as noxious species. “Noxious weeds” means any weed designated by the Weed Control Regulations in the Weed Control Act and identified on a Regional District noxious weed control list. Lists of invasive plants are maintained at the California Invasive Plant Inventory and USDA invasive and noxious weeds database.
(y) “irrigation audit” means an in-depth evaluation of the performance of an irrigation system conducted by a Certified Landscape Irrigation Auditor. An irrigation audit includes, but is not limited to: inspection, system tune-up, system test with distribution uniformity or emission uniformity, reporting overspray or runoff that causes overland flow, and preparation of an irrigation schedule.
(z) “irrigation efficiency” (IE) means the measurement of the amount of water beneficially used divided by the amount of water applied. Irrigation efficiency is derived from measurements and estimates of irrigation system characteristics and management practices. The minimum average irrigation efficiency for purposes of this ordinance is 0.71. Greater irrigation efficiency can be expected from well designed and maintained systems.
(aa) “irrigation survey” means an evaluation of an irrigation system that is less detailed than an irrigation audit. An irrigation survey includes, but is not limited to: inspection, system test, and written recommendations to improve performance of the irrigation system.
(bb) “irrigation water use analysis” means an analysis of water use data based on meter readings and billing data.
(cc) “landscape architect” means a person who holds a license to practice landscape architecture in the state of California Business and Professions Code, Section 5615.
(dd) “landscape area” means all the planting areas, turf areas, and water features in a landscape design plan subject to the Maximum Applied Water Allowance calculation. The landscape area does not include footprints of buildings or structures, sidewalks, driveways, parking lots, decks, patios, gravel or stone walks, other pervious or non-pervious hardscapes, and other non-irrigated areas designated for non-development (e.g., open spaces and existing native vegetation).

(ee) “landscape contractor” means a person licensed by the state of California to construct, maintain, repair, install, or subcontract the development of landscape systems.
(ff) “Landscape Documentation Package” means the documents required under Section 492.3.
(gg) “landscape project” means total area of landscape in a project as defined in “landscape area” for the purposes of this ordinance, meeting requirements under Section 490.1.
(hh) “lateral line” means the water delivery pipeline that supplies water to the emitters or sprinklers from the valve.
(ii) “local agency” means a city or county, including a charter city or charter county, that is responsible for adopting and implementing the ordinance. The local agency is also responsible for the enforcement of this ordinance, including but not limited to, approval of a permit and plan check or design review of a project.
(jj) “local water purveyor” means any entity, including a public agency, city, county, or private water company that provides retail water service.
(kk) “low volume irrigation” means the application of irrigation water at low pressure through a system of tubing or lateral lines and low-volume emitters such as drip, drip lines, and bubblers. Low volume irrigation systems are specifically designed to apply small volumes of water slowly at or near the root zone of plants.
(ll) “main line” means the pressurized pipeline that delivers water from the water source to the valve or outlet.
(mm) “Maximum Applied Water Allowance” (MAWA) means the upper limit of annual applied water for the established landscaped area as specified in Section 492.4. It is based upon the area’s reference evapotranspiration, the ET Adjustment Factor, and the size of the landscape area. The Estimated Total Water Use shall not exceed the Maximum Applied Water Allowance. Special Landscape Areas, including recreation areas, areas permanently and solely dedicated to edible plants such as orchards and vegetable gardens, and areas irrigated with recycled water are subject to the MAWA with an ETAF not to exceed 1.0.
(nn) “microclimate” means the climate of a small, specific area that may contrast with the climate of the overall landscape area due to factors such as wind, sun exposure, plant density, or proximity to reflective surfaces.
(oo) “mined-land reclamation projects” means any surface mining operation with a reclamation plan approved in accordance with the Surface Mining and Reclamation Act of 1975.
(pp) “mulch” means any organic material such as leaves, bark, straw, compost, or inorganic mineral materials such as rocks, gravel, and decomposed granite left loose and applied to the soil surface for the beneficial purposes of reducing evaporation, suppressing weeds, moderating soil temperature, and preventing soil erosion.
(qq) “new construction” means, for the purposes of this ordinance, a new building with a landscape or other new landscape, such as a park, playground, or greenbelt without an associated building.
(rr) “operating pressure” means the pressure at which the parts of an irrigation system are designed by the manufacturer to operate.
(ss) “overhead sprinkler irrigation systems” means systems that deliver water through the air (e.g., spray heads and rotors).
(tt) “overspray” means the irrigation water which is delivered beyond the target area.
(uu) “permit” means an authorizing document issued by local agencies for new construction or rehabilitated landscapes.
(vv) “pervious” means any surface or material that allows the passage of water through the material and into the underlying soil.
(ww) “plant factor” or “plant water use factor” is a factor , when multiplied by ETo, estimates the amount of water needed by plants. For purposes of this ordinance, the plant factor range for low water use plants is 0 to 0.3, the plant factor range for moderate water use plants is 0.4 to 0.6, and the plant

factor range for high water use plants is 0.7 to 1.0. Plant factors cited in this ordinance are derived from the Department of Water Resources 2000 publication "Water Use Classification of Landscape Species".
(xx) "precipitation rate" means the rate of application of water measured in inches per hour.
(yy) "project applicant" means the individual or entity submitting a Landscape Documentation Package required under Section 492.3, to request a permit, plan check, or design review from the local agency. A project applicant may be the property owner or his or her designee.
(zz) "rain sensor" or "rain sensing shutoff device" means a component which automatically suspends an irrigation event when it rains.
(aaa) "record drawing" or "as-builts" means a set of reproducible drawings which show significant changes in the work made during construction and which are usually based on drawings marked up in the field and other data furnished by the contractor.
(bbb) "recreational area" means areas dedicated to active play such as parks, sports fields, and golf courses where turf provides a playing surface.
(ccc) "recycled water", "reclaimed water", or "treated sewage effluent water" means treated or recycled waste water of a quality suitable for non-potable uses such as landscape irrigation and water features. This water is not intended for human consumption.
(ddd) "reference evapotranspiration" or "ETo" means a standard measurement of environmental parameters which affect the water use of plants. ETo is expressed in inches per day, month, or year as represented in Section 495.1, and is an estimate of the evapotranspiration of a large field of four- to seven-inch tall, cool-season grass that is well watered. Reference evapotranspiration is used as the basis of determining the Maximum Applied Water Allowance so that regional differences in climate can be accommodated.
(eee) "rehabilitated landscape" means any re-landscaping project that requires a permit , plan check, or design review, meets the requirements of Section 490.1, and the modified landscape area is equal to or greater than 2,500 square feet, is 50% of the total landscape area, and the modifications are completed within one year.
(fff) "runoff" means water which is not absorbed by the soil or landscape to which it is applied and flows from the landscape area. For example, runoff may result from water that is applied at too great a rate (application rate exceeds infiltration rate) or when there is a slope.
(ggg) "soil moisture sensing device" or "soil moisture sensor" means a device that measures the amount of water in the soil. The device may also suspend or initiate an irrigation event.
(hhh) "soil texture" means the classification of soil based on its percentage of sand, silt, and clay.
(iii)"Special Landscape Area" (SLA) means an area of the landscape dedicated solely to edible plants, areas irrigated with recycled water, water features using recycled water and areas dedicated to active play such as parks, sports fields, golf courses, and where turf provides a playing surface.
(jjj) "sprinkler head" means a device which delivers water through a nozzle.
(kkk) "static water pressure" means the pipeline or municipal water supply pressure when water is not flowing.
(lll) "station" means an area served by one valve or by a set of valves that operate simultaneously.
(mmm) "swing joint" means an irrigation component that provides a flexible, leak-free connection between the emission device and lateral pipeline to allow movement in any direction and to prevent equipment damage.
(nnn) "turf" means a ground cover surface of mowed grass. Annual bluegrass, Kentucky bluegrass, Perennial ryegrass, Red fescue, and Tall fescue are cool-season grasses. Bermudagrass, Kikuyugrass, Seashore Paspalum, St. Augustinegrass, Zoysiagrass, and Buffalo grass are warm-season grasses.
(ooo) "valve" means a device used to control the flow of water in the irrigation system.
(ppp) "water conserving plant species" means a plant species identified as having a low plant factor.
(qqq) "water feature" means a design element where open water performs an aesthetic or recreational function. Water features include ponds, lakes, waterfalls, fountains, artificial streams, spas, and swimming pools (where water is artificially supplied). The surface area of water features is included in

the high water use hydrozone of the landscape area. Constructed wetlands used for on-site wastewater treatment or stormwater best management practices that are not irrigated and used solely for water treatment or stormwater retention are not water features and, therefore, are not subject to the water budget calculation.
(rrr) "watering window" means the time of day irrigation is allowed.
(sss) "WUCOLS" means the Water Use Classification of Landscape Species published by the University of California Cooperative Extension, the Department of Water Resources and the Bureau of Reclamation, 2000.

Note: Authority Cited: Section 65595, Government Code. Reference: Sections 65592, 65596, Government Code.

§ 492. Provisions for New Construction or Rehabilitated Landscapes.
(a) A local agency may designate another agency, such as a water purveyor, to implement some or all of the requirements contained in this ordinance. Local agencies may collaborate with water purveyors to define each entity's specific responsibilities relating to this ordinance.

Note: Authority Cited: Section 65595, Government Code. Reference: Section 65596, Government Code.

§ 492.1 Compliance with Landscape Documentation Package.
(a) Prior to construction, the local agency shall:
(1) provide the project applicant with the ordinance and procedures for permits, plan checks, or design reviews;
(2) review the Landscape Documentation Package submitted by the project applicant;
(3) approve or deny the Landscape Documentation Package;
(4) issue a permit or approve the plan check or design review for the project applicant; and
(5) upon approval of the Landscape Documentation Package, submit a copy of the Water Efficient Landscape Worksheet to the local water purveyor.
(b) Prior to construction, the project applicant shall:
(1) submit a Landscape Documentation Package to the local agency.
(c) Upon approval of the Landscape Documentation Package by the local agency, the project applicant shall:
(1) receive a permit or approval of the plan check or design review and record the date of the permit in the Certificate of Completion;
(2) submit a copy of the approved Landscape Documentation Package along with the record drawings, and any other information to the property owner or his/her designee; and
(3) submit a copy of the Water Efficient Landscape Worksheet to the local water purveyor.

Note: Authority Cited: Section 65595, Government Code. Reference: Section 65596, Government Code.

§ 492.2 Penalties.
(a) A local agency may establish and administer penalties to the project applicant for non-compliance with the ordinance to the extent permitted by law.

Note: Authority Cited: Section 65595, Government Code. Reference: Section 65596, Government Code.

§ 492.3 Elements of the Landscape Documentation Package.

(a) The Landscape Documentation Package shall include the following six (6) elements:

(1) project information;

(A) date

(B) project applicant

(C) project address (if available, parcel and/or lot number(s))

(D) total landscape area (square feet)

(E) project type (e.g., new, rehabilitated, public, private, cemetery, homeowner-installed)

(F) water supply type (e.g., potable, recycled, well) and identify the local retail water purveyor if the applicant is not served by a private well

(G) checklist of all documents in Landscape Documentation Package

(H) project contacts to include contact information for the project applicant and property owner

(I) applicant signature and date with statement, "I agree to comply with the requirements of the water efficient landscape ordinance and submit a complete Landscape Documentation Package".

(2) Water Efficient Landscape Worksheet;

(A) hydrozone information table

(B) water budget calculations

1. Maximum Applied Water Allowance (MAWA)

2. Estimated Total Water Use (ETWU)

(3) soil management report;

(4) landscape design plan;

(5) irrigation design plan; and

(6) grading design plan.

Note: Authority Cited: Section 65595, Government Code. Reference: Section 65596, Government Code.

§ 492.4 Water Efficient Landscape Worksheet.

(a) A project applicant shall complete the Water Efficient Landscape Worksheet which contains two sections (see sample worksheet in Appendix B):

(1) a hydrozone information table (see Appendix B, Section A) for the landscape project; and

(2) a water budget calculation (see Appendix B, Section B) for the landscape project. For the calculation of the Maximum Applied Water Allowance and Estimated Total Water Use, a project applicant shall use the ETo values from the Reference Evapotranspiration Table in Appendix A. For geographic areas not covered in Appendix A, use data from other cities located nearby in the same reference evapotranspiration zone, as found in the CIMIS Reference Evapotranspiration Zones Map, Department of Water Resources, 1999.

(b) Water budget calculations shall adhere to the following requirements:

(1) The plant factor used shall be from WUCOLS. The plant factor ranges from 0 to 0.3 for low water use plants, from 0.4 to 0.6 for moderate water use plants, and from 0.7 to 1.0 for high water use plants.

(2) All water features shall be included in the high water use hydrozone and temporarily irrigated areas shall be included in the low water use hydrozone.

(3) All Special Landscape Areas shall be identified and their water use calculated as described below.

(4) ETAF for Special Landscape Areas shall not exceed 1.0.

(c) Maximum Applied Water Allowance

The Maximum Applied Water Allowance shall be calculated using the equation:

$$MAWA = (ETo)\ (0.62)\ [(0.7 \times LA) + (0.3 \times SLA)]$$

The example calculations below are hypothetical to demonstrate proper use of the equations and do not represent an existing and/or planned landscape project. The ETo values used in these calculations are from the Reference Evapotranspiration Table in Appendix A, for planning purposes only. For actual irrigation scheduling, automatic irrigation controllers are required and shall use current reference evapotranspiration data, such as from the California Irrigation Management Information System (CIMIS), other equivalent data, or soil moisture sensor data.

(1) Example MAWA calculation: a hypothetical landscape project in Fresno, CA with an irrigated landscape area of 50,000 square feet without any Special Landscape Area (SLA= 0, no edible plants, recreational areas, or use of recycled water). To calculate MAWA, the annual reference evapotranspiration value for Fresno is 51.1 inches as listed in the Reference Evapotranspiration Table in Appendix A.

MAWA = (ETo) (0.62) [(0.7 x LA) + (0.3 x SLA)]
MAWA = Maximum Applied Water Allowance (gallons per year)
ETo = Reference Evapotranspiration (inches per year)
0.62 = Conversion Factor (to gallons)
0.7 = ET Adjustment Factor (ETAF)
LA = Landscape Area including SLA (square feet)
0.3 = Additional Water Allowance for SLA
SLA = Special Landscape Area (square feet)
MAWA = (51.1 inches) (0.62) [(0.7 x 50,000 square feet) + (0.3 x 0)]
= 1,108,870 gallons per year
To convert from gallons per year to hundred-cubic-feet per year:
= 1,108,870/748 = 1,482 hundred-cubic-feet per year
(100 cubic feet = 748 gallons)

(2) In this next hypothetical example, the landscape project in Fresno, CA has the same ETo value of 51.1 inches and a total landscape area of 50,000 square feet. Within the 50,000 square foot project, there is now a 2,000 square foot area planted with edible plants. This 2,000 square foot area is considered to be a Special Landscape Area.

MAWA = (ETo) (0.62) [(0.7 x LA) + (0.3 x SLA)]
MAWA = (51.1 inches) (0.62) [(0.7 x 50,000 square feet) + (0.3 x 2,000 square feet)]
= 31.68 x [35,000 + 600] gallons per year
= 31.68 x 35,600 gallons per year
=1,127,808 gallons per year or 1,508 hundred-cubic-feet per year

(d) Estimated Total Water Use.

The Estimated Total Water Use shall be calculated using the equation below. The sum of the Estimated Total Water Use calculated for all hydrozones shall not exceed MAWA.

$$ETWU = (ETo)(0.62)\left(\frac{PF\ x\ HA}{IE} + SLA\right)$$

Where:

ETWU = Estimated Total Water Use per year (gallons)
ETo = Reference Evapotranspiration (inches)
PF = Plant Factor from WUCOLS (see Section 491)
HA = Hydrozone Area [high, medium, and low water use areas] (square feet)
SLA = Special Landscape Area (square feet)
0.62 = Conversion Factor
IE = Irrigation Efficiency (minimum 0.71)

(1) Example ETWU calculation: landscape area is 50,000 square feet; plant water use type, plant factor, and hydrozone area are shown in the table below. The ETo value is 51.1 inches per year. There are no Special Landscape Areas (recreational area, area permanently and solely dedicated to edible plants, and area irrigated with recycled water) in this example.

Hydrozone	Plant Water Use Type(s)	Plant Factor (PF)*	Hydrozone Area (HA) (square feet)	PF x HA (square feet)
1	High	0.8	7,000	5,600
2	High	0.7	10,000	7,000
3	Medium	0.5	16,000	8,000
4	Low	0.3	7,000	2,100
5	Low	0.2	10,000	2,000
			Sum	24,700

*Plant Factor from WUCOLS

$$ETWU = (51.1)(0.62)\left(\frac{24,700}{0.71} + 0\right)$$

= 1,102,116 gallons per year

Compare ETWU with MAWA: For this example MAWA = (51.1) (0.62) [(0.7 x 50,000) + (0.3 x 0)] = 1,108,870 gallons per year. The ETWU (1,102,116 gallons per year) is less than MAWA (1,108,870 gallons per year). In this example, the water budget complies with the MAWA.

(2) Example ETWU calculation: total landscape area is 50,000 square feet, 2,000 square feet of which is planted with edible plants. The edible plant area is considered a Special Landscape Area (SLA). The reference evapotranspiration value is 51.1 inches per year. The plant type, plant factor, and hydrozone area are shown in the table below.

Hydrozone	Plant Water Use Type(s)	Plant Factor (PF)*	Hydrozone Area (HA) (square feet)	PF x HA (square feet)
1	High	0.8	7,000	5,600
2	High	0.7	9,000	6,300
3	Medium	0.5	15,000	7,500
4	Low	0.3	7,000	2,100
5	Low	0.2	10,000	2,000
			Sum	23,500
6	SLA	1.0	2,000	2,000

*Plant Factor from WUCOLS

$$ETWU = (51.1)(0.62)\left(\frac{23,500}{0.71} + 2,000\right)$$

= (31.68) (33,099 + 2,000)

= 1,111,936 gallons per year

Compare ETWU with MAWA. For this example:
MAWA = (51.1) (0.62) [(0.7 x 50,000) + (0.3 x 2,000)]
= 31.68 x [35,000 + 600]
= 31.68 x 35,600
=1,127,808 gallons per year

The ETWU (1,111,936 gallons per year) is less than MAWA (1,127,808 gallons per year). For this example, the water budget complies with the MAWA.

Note: Authority Cited: Section 65595, Government Code. Reference: Section 65596, Government Code.

§ 492.5 Soil Management Report.

(a) In order to reduce runoff and encourage healthy plant growth, a soil management report shall be completed by the project applicant, or his/her designee, as follows:
(1) Submit soil samples to a laboratory for analysis and recommendations.
(A) Soil sampling shall be conducted in accordance with laboratory protocol, including protocols regarding adequate sampling depth for the intended plants.
(B) The soil analysis may include:
1. soil texture;
2. infiltration rate determined by laboratory test or soil texture infiltration rate table;
3. pH;
4. total soluble salts;
5. sodium;
6. percent organic matter; and
7. recommendations.
(2) The project applicant, or his/her designee, shall comply with one of the following:
(A) If significant mass grading is not planned, the soil analysis report shall be submitted to the local agency as part of the Landscape Documentation Package; or
(B) If significant mass grading is planned, the soil analysis report shall be submitted to the local agency as part of the Certificate of Completion.
(3) The soil analysis report shall be made available, in a timely manner, to the professionals preparing the landscape design plans and irrigation design plans to make any necessary adjustments to the design plans.
(4) The project applicant, or his/her designee, shall submit documentation verifying implementation of soil analysis report recommendations to the local agency with Certificate of Completion.

Note: Authority Cited: Section 65595, Government Code. Reference: Section 65596, Government Code.

§ 492.6 Landscape Design Plan.

(a) For the efficient use of water, a landscape shall be carefully designed and planned for the intended function of the project. A landscape design plan meeting the following design criteria shall be submitted as part of the Landscape Documentation Package.
(1) Plant Material
(A) Any plant may be selected for the landscape, providing the Estimated Total Water Use in the landscape area does not exceed the Maximum Applied Water Allowance. To encourage the efficient use of water, the following is highly recommended:
1. protection and preservation of native species and natural vegetation;
2. selection of water-conserving plant and turf species;

3. selection of plants based on disease and pest resistance;
4. selection of trees based on applicable local tree ordinances or tree shading guidelines; and
5. selection of plants from local and regional landscape program plant lists.
(B) Each hydrozone shall have plant materials with similar water use, with the exception of hydrozones with plants of mixed water use, as specified in Section 492.7(a)(2)(D).
(C) Plants shall be selected and planted appropriately based upon their adaptability to the climatic, geologic, and topographical conditions of the project site. To encourage the efficient use of water, the following is highly recommended:
1. use the Sunset Western Climate Zone System which takes into account temperature, humidity, elevation, terrain, latitude, and varying degrees of continental and marine influence on local climate;
2. recognize the horticultural attributes of plants (i.e., mature plant size, invasive surface roots) to minimize damage to property or infrastructure [e.g., buildings, sidewalks, power lines]; and
3. consider the solar orientation for plant placement to maximize summer shade and winter solar gain.
(D) Turf is not allowed on slopes greater than 25% where the toe of the slope is adjacent to an impermeable hardscape and where 25% means 1 foot of vertical elevation change for every 4 feet of horizontal length (rise divided by run x 100 = slope percent).
(E) A landscape design plan for projects in fire-prone areas shall address fire safety and prevention. A defensible space or zone around a building or structure is required per Public Resources Code Section 4291(a) and (b). Avoid fire-prone plant materials and highly flammable mulches.
(F) The use of invasive and/or noxious plant species is strongly discouraged.
(G) The architectural guidelines of a common interest development, which include community apartment projects, condominiums, planned developments, and stock cooperatives, shall not prohibit or include conditions that have the effect of prohibiting the use of low-water use plants as a group.
(2) Water Features
(A) Recirculating water systems shall be used for water features.
(B) Where available, recycled water shall be used as a source for decorative water features.
(C) Surface area of a water feature shall be included in the high water use hydrozone area of the water budget calculation.
(D) Pool and spa covers are highly recommended.
(3) Mulch and Amendments
(A) A minimum two inch (2″) layer of mulch shall be applied on all exposed soil surfaces of planting areas except in turf areas, creeping or rooting groundcovers, or direct seeding applications where mulch is contraindicated.
(B) Stabilizing mulching products shall be used on slopes.
(C) The mulching portion of the seed/mulch slurry in hydro-seeded applications shall meet the mulching requirement.
(D) Soil amendments shall be incorporated according to recommendations of the soil report and what is appropriate for the plants selected (see Section 492.5).
(b) The landscape design plan, at a minimum, shall:
(1) delineate and label each hydrozone by number, letter, or other method;
(2) identify each hydrozone as low, moderate, high water, or mixed water use. Temporarily irrigated areas of the landscape shall be included in the low water use hydrozone for the water budget calculation;
(3) identify recreational areas;
(4) identify areas permanently and solely dedicated to edible plants;
(5) identify areas irrigated with recycled water;
(6) identify type of mulch and application depth;
(7) identify soil amendments, type, and quantity;
(8) identify type and surface area of water features;
(9) identify hardscapes (pervious and non-pervious);

(10) identify location and installation details of any applicable stormwater best management practices that encourage on-site retention and infiltration of stormwater. Stormwater best management practices are encouraged in the landscape design plan and examples include, but are not limited to:
(A) infiltration beds, swales, and basins that allow water to collect and soak into the ground;
(B) constructed wetlands and retention ponds that retain water, handle excess flow, and filter pollutants; and
(C) pervious or porous surfaces (e.g., permeable pavers or blocks, pervious or porous concrete, etc.) that minimize runoff.
(11) identify any applicable rain harvesting or catchment technologies (e.g., rain gardens, cisterns, etc.);
(12) contain the following statement: "I have complied with the criteria of the ordinance and applied them for the efficient use of water in the landscape design plan"; and
(13) bear the signature of a licensed landscape architect, licensed landscape contractor, or any other person authorized to design a landscape. (See Sections 5500.1, 5615, 5641, 5641.1, 5641.2, 5641.3, 5641.4, 5641.5, 5641.6, 6701, 7027.5 of the Business and Professions Code, Section 832.27 of Title16 of the California Code of Regulations, and Section 6721 of the Food and Agriculture Code.)

Note: Authority Cited: Section 65595, Government Code. Reference: Section 65596, Government Code and Section 1351, Civil Code.

§ 492.7 Irrigation Design Plan.
(a) For the efficient use of water, an irrigation system shall meet all the requirements listed in this section and the manufacturers' recommendations. The irrigation system and its related components shall be planned and designed to allow for proper installation, management, and maintenance. An irrigation design plan meeting the following design criteria shall be submitted as part of the Landscape Documentation Package.
(1) System
(A) Dedicated landscape water meters are highly recommended on landscape areas smaller than 5,000 square feet to facilitate water management.
(B) Automatic irrigation controllers utilizing either evapotranspiration or soil moisture sensor data shall be required for irrigation scheduling in all irrigation systems.
(C) The irrigation system shall be designed to ensure that the dynamic pressure at each emission device is within the manufacturer's recommended pressure range for optimal performance.
1. If the static pressure is above or below the required dynamic pressure of the irrigation system, pressure-regulating devices such as inline pressure regulators, booster pumps, or other devices shall be installed to meet the required dynamic pressure of the irrigation system.
2. Static water pressure, dynamic or operating pressure. and flow reading of the water supply shall be measured at the point of connection. These pressure and flow measurements shall be conducted at the design stage. If the measurements are not available at the design stage, the measurements shall be conducted at installation.
(D) Sensors (rain, freeze, wind, etc.), either integral or auxiliary, that suspend or alter irrigation operation during unfavorable weather conditions shall be required on all irrigation systems, as appropriate for local climatic conditions. Irrigation should be avoided during windy or freezing weather or during rain.
(E) Manual shut-off valves (such as a gate valve, ball valve, or butterfly valve) shall be required, as close as possible to the point of connection of the water supply, to minimize water loss in case of an emergency (such as a main line break) or routine repair.

(F) Backflow prevention devices shall be required to protect the water supply from contamination by the irrigation system. A project applicant shall refer to the applicable local agency code (i.e., public health) for additional backflow prevention requirements.
(G) High flow sensors that detect and report high flow conditions created by system damage or malfunction are recommended.
(H) The irrigation system shall be designed to prevent runoff, low head drainage, overspray, or other similar conditions where irrigation water flows onto non-targeted areas, such as adjacent property, non-irrigated areas, hardscapes, roadways, or structures.
(I) Relevant information from the soil management plan, such as soil type and infiltration rate, shall be utilized when designing irrigation systems.
(J) The design of the irrigation system shall conform to the hydrozones of the landscape design plan.
(K) The irrigation system must be designed and installed to meet, at a minimum, the irrigation efficiency criteria as described in Section 492.4 regarding the Maximum Applied Water Allowance.
(L) It is highly recommended that the project applicant or local agency inquire with the local water purveyor about peak water operating demands (on the water supply system) or water restrictions that may impact the effectiveness of the irrigation system.
(M) In mulched planting areas, the use of low volume irrigation is required to maximize water infiltration into the root zone.
(N) Sprinkler heads and other emission devices shall have matched precipitation rates, unless otherwise directed by the manufacturer's recommendations.
(O) Head to head coverage is recommended. However, sprinkler spacing shall be designed to achieve the highest possible distribution uniformity using the manufacturer's recommendations.
(P) Swing joints or other riser-protection components are required on all risers subject to damage that are adjacent to high traffic areas.
(Q) Check valves or anti-drain valves are required for all irrigation systems.
(R) Narrow or irregularly shaped areas, including turf, less than eight (8) feet in width in any direction shall be irrigated with subsurface irrigation or low volume irrigation system.
(S) Overhead irrigation shall not be permitted within 24 inches of any non-permeable surface. Allowable irrigation within the setback from non-permeable surfaces may include drip, drip line, or other low flow non-spray technology. The setback area may be planted or unplanted. The surfacing of the setback may be mulch, gravel, or other porous material. These restrictions may be modified if:
1. the landscape area is adjacent to permeable surfacing and no runoff occurs; or
2. the adjacent non-permeable surfaces are designed and constructed to drain entirely to landscaping; or
3. the irrigation designer specifies an alternative design or technology, as part of the Landscape Documentation Package and clearly demonstrates strict adherence to irrigation system design criteria in Section 492.7 (a)(1)(H). Prevention of overspray and runoff must be confirmed during the irrigation audit.
(T) Slopes greater than 25% shall not be irrigated with an irrigation system with a precipitation rate exceeding 0.75 inches per hour. This restriction may be modified if the landscape designer specifies an alternative design or technology, as part of the Landscape Documentation Package, and clearly demonstrates no runoff or erosion will occur. Prevention of runoff and erosion must be confirmed during the irrigation audit.
(2) Hydrozone
(A) Each valve shall irrigate a hydrozone with similar site, slope, sun exposure, soil conditions, and plant materials with similar water use.
(B) Sprinkler heads and other emission devices shall be selected based on what is appropriate for the plant type within that hydrozone.
(C) Where feasible, trees shall be placed on separate valves from shrubs, groundcovers, and turf.
(D) Individual hydrozones that mix plants of moderate and low water use, or moderate and high water use, may be allowed if:

1. plant factor calculation is based on the proportions of the respective plant water uses and their plant factor; or
2. the plant factor of the higher water using plant is used for calculations.
(E) Individual hydrozones that mix high and low water use plants shall not be permitted.
(F) On the landscape design plan and irrigation design plan, hydrozone areas shall be designated by number, letter, or other designation. On the irrigation design plan, designate the areas irrigated by each valve, and assign a number to each valve. Use this valve number in the Hydrozone Information Table (see Appendix B Section A). This table can also assist with the irrigation audit and programming the controller.
(b) The irrigation design plan, at a minimum, shall contain:
(1) location and size of separate water meters for landscape;
(2) location, type and size of all components of the irrigation system, including controllers, main and lateral lines, valves, sprinkler heads, moisture sensing devices, rain switches, quick couplers, pressure regulators, and backflow prevention devices;
(3) static water pressure at the point of connection to the public water supply;
(4) flow rate (gallons per minute), application rate (inches per hour), and design operating pressure (pressure per square inch) for each station;
(5) recycled water irrigation systems as specified in Section 492.14;
(6) the following statement: "I have complied with the criteria of the ordinance and applied them accordingly for the efficient use of water in the irrigation design plan"; and
(7) the signature of a licensed landscape architect, certified irrigation designer, licensed landscape contractor, or any other person authorized to design an irrigation system. (See Sections 5500.1, 5615, 5641, 5641.1, 5641.2, 5641.3, 5641.4, 5641.5, 5641.6, 6701, 7027.5 of the Business and Professions Code, Section 832.27 of Title 16 of the California Code of Regulations, and Section 6721 of the Food and Agricultural Code.)

Note: Authority Cited: Section 65595, Government Code. Reference: Section 65596, Government Code.

§ 492.8 Grading Design Plan.
(a) For the efficient use of water, grading of a project site shall be designed to minimize soil erosion, runoff, and water waste. A grading plan shall be submitted as part of the Landscape Documentation Package. A comprehensive grading plan prepared by a civil engineer for other local agency permits satisfies this requirement.
(1) The project applicant shall submit a landscape grading plan that indicates finished configurations and elevations of the landscape area including:
(A) height of graded slopes;
(B) drainage patterns;
(C) pad elevations;
(D) finish grade; and
(E) stormwater retention improvements, if applicable.
(2) To prevent excessive erosion and runoff, it is highly recommended that project applicants:
(A) grade so that all irrigation and normal rainfall remains within property lines and does not drain on to non-permeable hardscapes;
(B) avoid disruption of natural drainage patterns and undisturbed soil; and
(C) avoid soil compaction in landscape areas.
(3) The grading design plan shall contain the following statement: "I have complied with the criteria of the ordinance and applied them accordingly for the efficient use of water in the grading design plan" and shall bear the signature of a licensed professional as authorized by law.

Note: Authority Cited: Section 65595, Government Code. Reference: Section 65596, Government Code.

§ 492.9 Certificate of Completion.

(a) The Certificate of Completion (see Appendix C for a sample certificate) shall include the following six (6) elements:

(1) project information sheet that contains:

(A) date;

(B) project name;

(C) project applicant name, telephone, and mailing address;

(D) project address and location; and

(E) property owner name, telephone, and mailing address;

(2) certification by either the signer of the landscape design plan, the signer of the irrigation design plan, or the licensed landscape contractor that the landscape project has been installed per the approved Landscape Documentation Package;

(A) where there have been significant changes made in the field during construction, these "as-built" or record drawings shall be included with the certification;

(3) irrigation scheduling parameters used to set the controller (see Section 492.10);

(4) landscape and irrigation maintenance schedule (see Section 492.11);

(5) irrigation audit report (see Section 492.12); and

(6) soil analysis report, if not submitted with Landscape Documentation Package, and documentation verifying implementation of soil report recommendations (see Section 492.5).

(b) The project applicant shall:

(1) submit the signed Certificate of Completion to the local agency for review;

(2) ensure that copies of the approved Certificate of Completion are submitted to the local water purveyor and property owner or his or her designee.

(c) The local agency shall:

(1) receive the signed Certificate of Completion from the project applicant;

(2) approve or deny the Certificate of Completion. If the Certificate of Completion is denied, the local agency shall provide information to the project applicant regarding reapplication, appeal, or other assistance.

Note: Authority Cited: Section 65595, Government Code. Reference: Section 65596, Government Code.

§ 492.10 Irrigation Scheduling.

(a) For the efficient use of water, all irrigation schedules shall be developed, managed, and evaluated to utilize the minimum amount of water required to maintain plant health. Irrigation schedules shall meet the following criteria:

(1) Irrigation scheduling shall be regulated by automatic irrigation controllers.

(2) Overhead irrigation shall be scheduled between 8:00 p.m. and 10:00 a.m. unless weather conditions prevent it. If allowable hours of irrigation differ from the local water purveyor, the stricter of the two shall apply. Operation of the irrigation system outside the normal watering window is allowed for auditing and system maintenance.

(3) For implementation of the irrigation schedule, particular attention must be paid to irrigation run times, emission device, flow rate, and current reference evapotranspiration, so that applied water meets the Estimated Total Water Use. Total annual applied water shall be less than or equal to Maximum Applied Water Allowance (MAWA). Actual irrigation schedules shall be regulated by automatic irrigation controllers using current reference evapotranspiration data (e.g., CIMIS) or soil moisture sensor data.

(4) Parameters used to set the automatic controller shall be developed and submitted for each of the following:

(A) the plant establishment period;

(B) the established landscape; and
(C) temporarily irrigated areas.
(5) Each irrigation schedule shall consider for each station all of the following that apply:
(A) irrigation interval (days between irrigation);
(B) irrigation run times (hours or minutes per irrigation event to avoid runoff);
(C) number of cycle starts required for each irrigation event to avoid runoff;
(D) amount of applied water scheduled to be applied on a monthly basis;
(E) application rate setting;
(F) root depth setting;
(G) plant type setting;
(H) soil type;
(I) slope factor setting;
(J) shade factor setting; and
(K) irrigation uniformity or efficiency setting.

Note: Authority Cited: Section 65595, Government Code. Reference: Section 65596, Government Code.

§ 492.11 Landscape and Irrigation Maintenance Schedule.
(a) Landscapes shall be maintained to ensure water use efficiency. A regular maintenance schedule shall be submitted with the Certificate of Completion.
(b) A regular maintenance schedule shall include, but not be limited to, routine inspection; adjustment and repair of the irrigation system and its components; aerating and dethatching turf areas; replenishing mulch; fertilizing; pruning; weeding in all landscape areas, and removing and obstruction to emission devices. Operation of the irrigation system outside the normal watering window is allowed for auditing and system maintenance.
(c) Repair of all irrigation equipment shall be done with the originally installed components or their equivalents.
(d) A project applicant is encouraged to implement sustainable or environmentally-friendly practices for overall landscape maintenance.

Note: Authority Cited: Section 65595, Government Code. Reference: Section 65596, Government Code.

§ 492.12 Irrigation Audit, Irrigation Survey, and Irrigation Water Use Analysis.
(a) All landscape irrigation audits shall be conducted by a certified landscape irrigation auditor.
(b) For new construction and rehabilitated landscape projects installed after January 1, 2010, as described in Section 490.1:
(1) the project applicant shall submit an irrigation audit report with the Certificate of Completion to the local agency that may include, but is not limited to: inspection, system tune-up, system test with distribution uniformity, reporting overspray or run off that causes overland flow, and preparation of an irrigation schedule;
(2) the local agency shall administer programs that may include, but not be limited to, irrigation water use analysis, irrigation audits, and irrigation surveys for compliance with the Maximum Applied Water Allowance.

Note: Authority Cited: Section 65595, Government Code. Reference: Section 65596, Government Code.

§ 492.13 Irrigation Efficiency.
(a) For the purpose of determining Maximum Applied Water Allowance, average irrigation efficiency is assumed to be 0.71. Irrigation systems shall be designed, maintained, and managed to meet or exceed an average landscape irrigation efficiency of 0.71.

Note: Authority Cited: Section 65595, Government Code. Reference: Section 65596, Government Code.

§ 492.14 Recycled Water.
(a) The installation of recycled water irrigation systems shall allow for the current and future use of recycled water, unless a written exemption has been granted as described in Section 492.14(b).
(b) Irrigation systems and decorative water features shall use recycled water unless a written exemption has been granted by the local water purveyor stating that recycled water meeting all public health codes and standards is not available and will not be available for the foreseeable future.
(c) All recycled water irrigation systems shall be designed and operated in accordance with all applicable local and State laws.
(d) Landscapes using recycled water are considered Special Landscape Areas. The ET Adjustment Factor for Special Landscape Areas shall not exceed 1.0.

Note: Authority Cited: Section 65595, Government Code. Reference: Section 65596, Government Code.

§ 492.15 Stormwater Management.
(a) Stormwater management practices minimize runoff and increase infiltration which recharges groundwater and improves water quality. Implementing stormwater best management practices into the landscape and grading design plans to minimize runoff and to increase on-site retention and infiltration are encouraged.
(b) Project applicants shall refer to the local agency or Regional Water Quality Control Board for information on any applicable stormwater ordinances and stormwater management plans.
(c) Rain gardens, cisterns, and other landscapes features and practices that increase rainwater capture and create opportunities for infiltration and/or onsite storage are recommended.

Note: Authority Cited: Section 65595, Government Code. Reference: Section 65596, Government Code.

§ 492.16 Public Education.
(a) Publications. Education is a critical component to promote the efficient use of water in landscapes. The use of appropriate principles of design, installation, management and maintenance that save water is encouraged in the community.
(1) A local agency shall provide information to owners of new, single-family residential homes regarding the design, installation, management, and maintenance of water efficient landscapes.
(b) Model Homes. All model homes that are landscaped shall use signs and written information to demonstrate the principles of water efficient landscapes described in this ordinance.
(1) Signs shall be used to identify the model as an example of a water efficient landscape featuring elements such as hydrozones, irrigation equipment, and others that contribute to the overall water efficient theme.
(2) Information shall be provided about designing, installing, managing, and maintaining water efficient landscapes.

Note: Authority Cited: Section 65595, Government Code. Reference: Section 65596, Government Code.

§ 492.17 Environmental Review.
(a) The local agency must comply with the California Environmental Quality Act (CEQA), as appropriate.

Note: Authority cited: Section 21082, Public Resources Code. Reference: Sections 21080, 21082, Public Resources Code.

§ 493. Provisions for Existing Landscapes.
(a) A local agency may designate another agency, such as a water purveyor, to implement some or all of the requirements contained in this ordinance. Local agencies may collaborate with water purveyors to define each entity's specific responsibilities relating to this ordinance.

Note: Authority Cited: Section 65595, Government Code. Reference: Section 65596, Government Code.

§ 493.1 Irrigation Audit, Irrigation Survey, and Irrigation Water Use Analysis.
(a) This section, 493.1, shall apply to all existing landscapes that were installed before January 1, 2010 and are over one acre in size.
(1) For all landscapes in 493.1(a) that have a water meter, the local agency shall administer programs that may include, but not be limited to, irrigation water use analyses, irrigation surveys, and irrigation audits to evaluate water use and provide recommendations as necessary to reduce landscape water use to a level that does not exceed the Maximum Applied Water Allowance for existing landscapes. The Maximum Applied Water Allowance for existing landscapes shall be calculated as: MAWA = (0.8) (ETo)(LA)(0.62).
(2) For all landscapes in 493.1(a), that do not have a meter, the local agency shall administer programs that may include, but not be limited to, irrigation surveys and irrigation audits to evaluate water use and provide recommendations as necessary in order to prevent water waste.
(b) All landscape irrigation audits shall be conducted by a certified landscape irrigation auditor.

Note: Authority Cited: Section 65595, Government Code. Reference: Section 65596, Government Code.

§ 493.2 Water Waste Prevention.
(a) Local agencies shall prevent water waste resulting from inefficient landscape irrigation by prohibiting runoff from leaving the target landscape due to low head drainage, overspray, or other similar conditions where water flows onto adjacent property, non-irrigated areas, walks, roadways, parking lots, or structures. Penalties for violation of these prohibitions shall be established locally.
(b) Restrictions regarding overspray and runoff may be modified if:
(1) the landscape area is adjacent to permeable surfacing and no runoff occurs; or
(2) the adjacent non-permeable surfaces are designed and constructed to drain entirely to landscaping.

Note: Authority cited: Section 65594, Government Code. Reference: Section 65596, Government Code.

§ 494. Effective Precipitation.
(a) A local agency may consider Effective Precipitation (25% of annual precipitation) in tracking water use and may use the following equation to calculate Maximum Applied Water Allowance:
MAWA= (ETo - Eppt) (0.62) [(0.7 x LA) + (0.3 x SLA)].

Note: Authority Cited: Section 65595, Government Code. Reference: Section 65596, Government Code.

Appendices.

Appendix A. Reference Evapotranspiration (ETo) Table.

This page intentionally left blank.

Appendix A - Reference Evapotranspiration (ETo) Table*													
County and City	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual ETo**
ALAMEDA													
Fremont	1.5	1.9	3.4	4.7	5.4	6.3	6.7	6.0	4.5	3.4	1.8	1.5	47.0
Livermore	1.2	1.5	2.9	4.4	5.9	6.6	7.4	6.4	5.3	3.2	1.5	0.9	47.2
Oakland	1.5	1.5	2.8	3.9	5.1	5.3	6.0	5.5	4.8	3.1	1.4	0.9	41.8
Oakland Foothills	1.1	1.4	2.7	3.7	5.1	6.4	5.8	4.9	3.6	2.6	1.4	1.0	39.6
Pleasanton	0.8	1.5	2.9	4.4	5.6	6.7	7.4	6.4	4.7	3.3	1.5	1.0	46.2
Union City	1.4	1.8	3.1	4.2	5.4	5.9	6.4	5.7	4.4	3.1	1.5	1.2	44.2
ALPINE													
Markleeville	0.7	0.9	2.0	3.5	5.0	6.1	7.3	6.4	4.4	2.6	1.2	0.5	40.6
AMADOR													
Jackson	1.2	1.5	2.8	4.4	6.0	7.2	7.9	7.2	5.3	3.2	1.4	0.9	48.9
Shanandoah Valley	1.0	1.7	2.9	4.4	5.6	6.8	7.9	7.1	5.2	3.6	1.7	1.0	48.8
BUTTE													
Chico	1.2	1.8	2.9	4.7	6.1	7.4	8.5	7.3	5.4	3.7	1.7	1.0	51.7
Durham	1.1	1.8	3.2	5.0	6.5	7.4	7.8	6.9	5.3	3.6	1.7	1.0	51.1
Gridley	1.2	1.8	3.0	4.7	6.1	7.7	8.5	7.1	5.4	3.7	1.7	1.0	51.9
Oroville	1.2	1.7	2.8	4.7	6.1	7.6	8.5	7.3	5.3	3.7	1.7	1.0	51.5
CALAVERAS													
San Andreas	1.2	1.5	2.8	4.4	6.0	7.3	7.9	7.0	5.3	3.2	1.4	0.7	48.8
COLUSA													
Colusa	1.0	1.7	3.4	5.0	6.4	7.6	8.3	7.2	5.4	3.8	1.8	1.1	52.8
Williams	1.2	1.7	2.9	4.5	6.1	7.2	8.5	7.3	5.3	3.4	1.6	1.0	50.8
CONTRA COSTA													
Benicia	1.3	1.4	2.7	3.8	4.9	5.0	6.4	5.5	4.4	2.9	1.2	0.7	40.3
Brentwood	1.0	1.5	2.9	4.5	6.1	7.1	7.9	6.7	5.2	3.2	1.4	0.7	48.3
Concord	1.1	1.4	2.4	4.0	5.5	5.9	7.0	6.0	4.8	3.2	1.3	0.7	43.4
Courtland	0.9	1.5	2.9	4.4	6.1	6.9	7.9	6.7	5.3	3.2	1.4	0.7	48.0
Martinez	1.2	1.4	2.4	3.9	5.3	5.6	6.7	5.6	4.7	3.1	1.2	0.7	41.8
Moraga	1.2	1.5	3.4	4.2	5.5	6.1	6.7	5.9	4.6	3.2	1.6	1.0	44.9
Pittsburg	1.0	1.5	2.8	4.1	5.6	6.4	7.4	6.4	5.0	3.2	1.3	0.7	45.4
Walnut Creek	0.8	1.5	2.9	4.4	5.6	6.7	7.4	6.4	4.7	3.3	1.5	1.0	46.2
DEL NORTE													
Crescent City	0.5	0.9	2.0	3.0	3.7	3.5	4.3	3.7	3.0	2.0	0.9	0.5	27.7
EL DORADO													
Camino	0.9	1.7	2.5	3.9	5.9	7.2	7.8	6.8	5.1	3.1	1.5	0.9	47.3
FRESNO													
Clovis	1.0	1.5	3.2	4.8	6.4	7.7	8.5	7.3	5.3	3.4	1.4	0.7	51.4
Coalinga	1.2	1.7	3.1	4.6	6.2	7.2	8.5	7.3	5.3	3.4	1.6	0.7	50.9
Firebaugh	1.0	1.8	3.7	5.7	7.3	8.1	8.2	7.2	5.5	3.9	2.0	1.1	55.4
FivePoints	1.3	2.0	4.0	6.1	7.7	8.5	8.7	8.0	6.2	4.5	2.4	1.2	60.4
FRESNO													
Fresno	0.9	1.7	3.3	4.8	6.7	7.8	8.4	7.1	5.2	3.2	1.4	0.6	51.1
Fresno State	0.9	1.6	3.2	5.2	7.0	8.0	8.7	7.6	5.4	3.6	1.7	0.9	53.7
Friant	1.2	1.5	3.1	4.7	6.4	7.7	8.5	7.3	5.3	3.4	1.4	0.7	51.3
Kerman	0.9	1.5	3.2	4.8	6.6	7.7	8.4	7.2	5.3	3.4	1.4	0.7	51.2
Kingsburg	1.0	1.5	3.4	4.8	6.6	7.7	8.4	7.2	5.3	3.4	1.4	0.7	51.6
Mendota	1.5	2.5	4.6	6.2	7.9	8.6	8.8	7.5	5.9	4.5	2.4	1.5	61.7
Orange Cove	1.2	1.9	3.5	4.7	7.4	8.5	8.9	7.9	5.9	3.7	1.8	1.2	56.7
Panoche	1.1	2.0	4.0	5.6	7.8	8.5	8.3	7.3	5.6	3.9	1.8	1.2	57.2
Parlier	1.0	1.9	3.6	5.2	6.8	7.6	8.1	7.0	5.1	3.4	1.7	0.9	52.0
Reedley	1.1	1.5	3.2	4.7	6.4	7.7	8.5	7.3	5.3	3.4	1.4	0.7	51.3
Westlands	0.9	1.7	3.8	6.3	8.0	8.6	8.6	7.8	5.9	4.3	2.1	1.1	58.8

Appendix A - Reference Evapotranspiration (ETo) Table*													
County and City	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual ETo**
GLENN													
Orland	1.1	1.8	3.4	5.0	6.4	7.5	7.9	6.7	5.3	3.9	1.8	1.4	52.1
Willows	1.2	1.7	2.9	4.7	6.1	7.2	8.5	7.3	5.3	3.6	1.7	1.0	51.3
HUMBOLDT													
Eureka	0.5	1.1	2.0	3.0	3.7	3.7	3.7	3.7	3.0	2.0	0.9	0.5	27.5
Ferndale	0.5	1.1	2.0	3.0	3.7	3.7	3.7	3.7	3.0	2.0	0.9	0.5	27.5
Garberville	0.6	1.2	2.2	3.1	4.5	5.0	5.5	4.9	3.8	2.4	1.0	0.7	34.9
Hoopa	0.5	1.1	2.1	3.0	4.4	5.4	6.1	5.1	3.8	2.4	0.9	0.7	35.6
IMPERIAL													
Brawley	2.8	3.8	5.9	8.0	10.4	11.5	11.7	10.0	8.4	6.2	3.5	2.1	84.2
Calipatria/Mulberry	2.4	3.2	5.1	6.8	8.6	9.2	9.2	8.6	7.0	5.2	3.1	2.3	70.7
El Centro	2.7	3.5	5.6	7.9	10.1	11.1	11.6	9.5	8.3	6.1	3.3	2.0	81.7
Holtville	2.8	3.8	5.9	7.9	10.4	11.6	12.0	10.0	8.6	6.2	3.5	2.1	84.7
Meloland	2.5	3.2	5.5	7.5	8.9	9.2	9.0	8.5	6.8	5.3	3.1	2.2	71.6
Palo Verde II	2.5	3.3	5.7	6.9	8.5	8.9	8.6	7.9	6.2	4.5	2.9	2.3	68.2
Seeley	2.7	3.5	5.9	7.7	9.7	10.1	9.3	8.3	6.9	5.5	3.4	2.2	75.4
Westmoreland	2.4	3.3	5.3	6.9	8.7	9.6	9.6	8.7	6.9	5.0	3.0	2.2	71.4
Yuma	2.5	3.4	5.3	6.9	8.7	9.6	9.6	8.7	6.9	5.0	3.0	2.2	71.6
INYO													
Bishop	1.7	2.7	4.8	6.7	8.2	10.9	7.4	9.6	7.4	4.8	2.5	1.6	68.3
Death Valley Jct	2.2	3.3	5.4	7.7	9.8	11.1	11.4	10.1	8.3	5.4	2.9	1.7	79.1
Independence	1.7	2.7	3.4	6.6	8.5	9.5	9.8	8.5	7.1	3.9	2.0	1.5	65.2
Lower Haiwee Res.	1.8	2.7	4.4	7.1	8.5	9.5	9.8	8.5	7.1	4.2	2.6	1.5	67.6
Oasis	2.7	2.8	5.9	8.0	10.4	11.7	11.6	10.0	8.4	6.2	3.4	2.1	83.1
KERN													
Arvin	1.2	1.8	3.5	4.7	6.6	7.4	8.1	7.3	5.3	3.4	1.7	1.0	51.9
Bakersfield	1.0	1.8	3.5	4.7	6.6	7.7	8.5	7.3	5.3	3.5	1.6	0.9	52.4
Bakersfield/Bonanza	1.2	2.2	3.7	5.7	7.4	8.2	8.7	7.8	5.7	4.0	2.1	1.2	57.9
Bakersfield/Greenlee	1.2	2.2	3.7	5.7	7.4	8.2	8.7	7.8	5.7	4.0	2.1	1.2	57.9
KERN													
Belridge	1.4	2.2	4.1	5.5	7.7	8.5	8.6	7.8	6.0	3.8	2.0	1.5	59.2
Blackwells Corner	1.4	2.1	3.8	5.4	7.0	7.8	8.5	7.7	5.8	3.9	1.9	1.2	56.6
Buttonwillow	1.0	1.8	3.2	4.7	6.6	7.7	8.5	7.3	5.4	3.4	1.5	0.9	52.0
China Lake	2.1	3.2	5.3	7.7	9.2	10.0	11.0	9.8	7.3	4.9	2.7	1.7	74.8
Delano	0.9	1.8	3.4	4.7	6.6	7.7	8.5	7.3	5.4	3.4	1.4	0.7	52.0
Famoso	1.3	1.9	3.5	4.8	6.7	7.6	8.0	7.3	5.5	3.5	1.7	1.3	53.1
Grapevine	1.3	1.8	3.1	4.4	5.6	6.8	7.6	6.8	5.9	3.4	1.9	1.0	49.5
Inyokern	2.0	3.1	4.9	7.3	8.5	9.7	11.0	9.4	7.1	5.1	2.6	1.7	72.4
Isabella Dam	1.2	1.4	2.8	4.4	5.8	7.3	7.9	7.0	5.0	3.2	1.7	0.9	48.4
Lamont	1.3	2.4	4.4	4.6	6.5	7.0	8.8	7.6	5.7	3.7	1.6	0.8	54.4
Lost Hills	1.6	2.2	3.7	5.1	6.8	7.8	8.7	7.8	5.7	4.0	2.1	1.6	57.1
McFarland/Kern	1.2	2.1	3.7	5.6	7.3	8.0	8.3	7.4	5.6	4.1	2.0	1.2	56.5
Shafter	1.0	1.7	3.4	5.0	6.6	7.7	8.3	7.3	5.4	3.4	1.5	0.9	52.1
Taft	1.3	1.8	3.1	4.3	6.2	7.3	8.5	7.3	5.4	3.4	1.7	1.0	51.2
Tehachapi	1.4	1.8	3.2	5.0	6.1	7.7	7.9	7.3	5.9	3.4	2.1	1.2	52.9
KINGS													
Caruthers	1.6	2.5	4.0	5.7	7.8	8.7	9.3	8.4	6.3	4.4	2.4	1.6	62.7
Corcoran	1.6	2.2	3.7	5.1	6.8	7.8	8.7	7.8	5.7	4.0	2.1	1.6	57.1
Hanford	0.9	1.5	3.4	5.0	6.6	7.7	8.3	7.2	5.4	3.4	1.4	0.7	51.5
Kettleman	1.1	2.0	4.0	6.0	7.5	8.5	9.1	8.2	6.1	4.5	2.2	1.1	60.2
Lemoore	0.9	1.5	3.4	5.0	6.6	7.7	8.3	7.3	5.4	3.4	1.4	0.7	51.7
Stratford	0.9	1.9	3.9	6.1	7.8	8.6	8.8	7.7	5.9	4.1	2.1	1.0	58.7

Appendix A - Reference Evapotranspiration (ETo) Table*													
County and City	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual ETo**
LAKE													
Lakeport	1.1	1.3	2.6	3.5	5.1	6.0	7.3	6.1	4.7	2.9	1.2	0.9	42.8
Lower Lake	1.2	1.4	2.7	4.5	5.3	6.3	7.4	6.4	5.0	3.1	1.3	0.9	45.4
LASSEN													
Buntingville	1.0	1.7	3.5	4.9	6.2	7.3	8.4	7.5	5.4	3.4	1.5	0.9	51.8
Ravendale	0.6	1.1	2.3	4.1	5.6	6.7	7.9	7.3	4.7	2.8	1.2	0.5	44.9
Susanville	0.7	1.0	2.2	4.1	5.6	6.5	7.8	7.0	4.6	2.8	1.2	0.5	44.0
LOS ANGELES													
Burbank	2.1	2.8	3.7	4.7	5.1	6.0	6.6	6.7	5.4	4.0	2.6	2.0	51.7
Claremont	2.0	2.3	3.4	4.6	5.0	6.0	7.0	7.0	5.3	4.0	2.7	2.1	51.3
El Dorado	1.7	2.2	3.6	4.8	5.1	5.7	5.9	5.9	4.4	3.2	2.2	1.7	46.3
Glendale	2.0	2.2	3.3	3.8	4.7	4.8	5.7	5.6	4.3	3.3	2.2	1.8	43.7
Glendora	2.0	2.5	3.6	4.9	5.4	6.1	7.3	6.8	5.7	4.2	2.6	2.0	53.1
Gorman	1.6	2.2	3.4	4.6	5.5	7.4	7.7	7.1	5.9	3.6	2.4	1.1	52.4
Hollywood Hills	2.1	2.2	3.8	5.4	6.0	6.5	6.7	6.4	5.2	3.7	2.8	2.1	52.8
Lancaster	2.1	3.0	4.6	5.9	8.5	9.7	11.0	9.8	7.3	4.6	2.8	1.7	71.1
Long Beach	1.8	2.1	3.3	3.9	4.5	4.3	5.3	4.7	3.7	2.8	1.8	1.5	39.7
Los Angeles	2.2	2.7	3.7	4.7	5.5	5.8	6.2	5.9	5.0	3.9	2.6	1.9	50.1
LOS ANGELES													
Monrovia	2.2	2.3	3.8	4.3	5.5	5.9	6.9	6.4	5.1	3.2	2.5	2.0	50.2
Palmdale	2.0	2.6	4.6	6.2	7.3	8.9	9.8	9.0	6.5	4.7	2.7	2.1	66.2
Pasadena	2.1	2.7	3.7	4.7	5.1	6.0	7.1	6.7	5.6	4.2	2.6	2.0	52.3
Pearblossom	1.7	2.4	3.7	4.7	7.3	7.7	9.9	7.9	6.4	4.0	2.6	1.6	59.9
Pomona	1.7	2.0	3.4	4.5	5.0	5.8	6.5	6.4	4.7	3.5	2.3	1.7	47.5
Redondo Beach	2.2	2.4	3.3	3.8	4.5	4.7	5.4	4.8	4.4	2.8	2.4	2.0	42.6
San Fernando	2.0	2.7	3.5	4.6	5.5	5.9	7.3	6.7	5.3	3.9	2.6	2.0	52.0
Santa Clarita	2.8	2.8	4.1	5.6	6.0	6.8	7.6	7.8	5.8	5.2	3.7	3.2	61.5
Santa Monica	1.8	2.1	3.3	4.5	4.7	5.0	5.4	5.4	3.9	3.4	2.4	2.2	44.2
MADERA													
Chowchilla	1.0	1.4	3.2	4.7	6.6	7.8	8.5	7.3	5.3	3.4	1.4	0.7	51.4
Madera	0.9	1.4	3.2	4.8	6.6	7.8	8.5	7.3	5.3	3.4	1.4	0.7	51.5
Raymond	1.2	1.5	3.0	4.6	6.1	7.6	8.4	7.3	5.2	3.4	1.4	0.7	50.5
MARIN													
Black Point	1.1	1.7	3.0	4.2	5.2	6.2	6.6	5.8	4.3	2.8	1.3	0.9	43.0
Novato	1.3	1.5	2.4	3.5	4.4	6.0	5.9	5.4	4.4	2.8	1.4	0.7	39.8
Point San Pedro	1.1	1.7	3.0	4.2	5.2	6.2	6.6	5.8	4.3	2.8	1.3	0.9	43.0
San Rafael	1.2	1.3	2.4	3.3	4.0	4.8	4.8	4.9	4.3	2.7	1.3	0.7	35.8
MARIPOSA													
Coulterville	1.1	1.5	2.8	4.4	5.9	7.3	8.1	7.0	5.3	3.4	1.4	0.7	48.8
Mariposa	1.1	1.5	2.8	4.4	5.9	7.4	8.2	7.1	5.0	3.4	1.4	0.7	49.0
Yosemite Village	0.7	1.0	2.3	3.7	5.1	6.5	7.1	6.1	4.4	2.9	1.1	0.6	41.4
MENDOCINO													
Fort Bragg	0.9	1.3	2.2	3.0	3.7	3.5	3.7	3.7	3.0	2.3	1.2	0.7	29.0
Hopland	1.1	1.3	2.6	3.4	5.0	5.9	6.5	5.7	4.5	2.8	1.3	0.7	40.9
Point Arena	1.0	1.3	2.3	3.0	3.7	3.9	3.7	3.7	3.0	2.3	1.2	0.7	29.6
Sanel Valley	1.0	1.6	3.0	4.6	6.0	7.0	8.0	7.0	5.2	3.4	1.4	0.9	49.1
Ukiah	1.0	1.3	2.6	3.3	5.0	5.8	6.7	5.9	4.5	2.8	1.3	0.7	40.9
MERCED													
Kesterson	0.9	1.7	3.4	5.5	7.3	8.2	8.6	7.4	5.5	3.8	1.8	0.9	55.1
Los Banos	1.0	1.5	3.2	4.7	6.1	7.4	8.2	7.0	5.3	3.4	1.4	0.7	50.0
Merced	1.0	1.5	3.2	4.7	6.6	7.9	8.5	7.2	5.3	3.4	1.4	0.7	51.5

Appendix A - Reference Evapotranspiration (ETo) Table*													
County and City	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual ETo**
MODOC													
Modoc/Alturas	0.9	1.4	2.8	3.7	5.1	6.2	7.5	6.6	4.6	2.8	1.2	0.7	43.2
MONO													
Bridgeport	0.7	0.9	2.2	3.8	5.5	6.6	7.4	6.7	4.7	2.7	1.2	0.5	43.0
MONTEREY													
Arroyo Seco	1.5	2.0	3.7	5.4	6.3	7.3	7.2	6.7	5.0	3.9	2.0	1.6	52.6
Castroville	1.4	1.7	3.0	4.2	4.6	4.8	4.0	3.8	3.0	2.6	1.6	1.4	36.2
Gonzales	1.3	1.7	3.4	4.7	5.4	6.3	6.3	5.9	4.4	3.4	1.9	1.3	45.7
MONTEREY													
Greenfield	1.8	2.2	3.4	4.8	5.6	6.3	6.5	6.2	4.8	3.7	2.4	1.8	49.5
King City	1.7	2.0	3.4	4.4	4.4	5.6	6.1	6.7	6.5	5.2	2.2	1.3	49.6
King City-Oasis Rd.	1.4	1.9	3.6	5.3	6.5	7.3	7.4	6.8	5.1	4.0	2.0	1.5	52.7
Long Valley	1.5	1.9	3.2	4.1	5.8	6.5	7.3	6.7	5.3	3.6	2.0	1.2	49.1
Monterey	1.7	1.8	2.7	3.5	4.0	4.1	4.3	4.2	3.5	2.8	1.9	1.5	36.0
Pajaro	1.8	2.2	3.7	4.8	5.3	5.7	5.6	5.3	4.3	3.4	2.4	1.8	46.1
Salinas	1.6	1.9	2.7	3.8	4.8	4.7	5.0	4.5	4.0	2.9	1.9	1.3	39.1
Salinas North	1.2	1.5	2.9	4.1	4.6	5.2	4.5	4.3	3.2	2.8	1.5	1.2	36.9
San Ardo	1.0	1.7	3.1	4.5	5.9	7.2	8.1	7.1	5.1	3.1	1.5	1.0	49.0
San Juan	1.8	2.1	3.4	4.6	5.3	5.7	5.5	4.9	3.8	3.2	2.2	1.9	44.2
Soledad	1.7	2.0	3.4	4.4	5.5	5.4	6.5	6.2	5.2	3.7	2.2	1.5	47.7
NAPA													
Angwin	1.8	1.9	3.2	4.7	5.8	7.3	8.1	7.1	5.5	4.5	2.9	2.1	54.9
Carneros	0.8	1.5	3.1	4.6	5.5	6.6	6.9	6.2	4.7	3.5	1.4	1.0	45.8
Oakville	1.0	1.5	2.9	4.7	5.8	6.9	7.2	6.4	4.9	3.5	1.6	1.2	47.7
St Helena	1.2	1.5	2.8	3.9	5.1	6.1	7.0	6.2	4.8	3.1	1.4	0.9	44.1
Yountville	1.3	1.7	2.8	3.9	5.1	6.0	7.1	6.1	4.8	3.1	1.5	0.9	44.3
NEVADA													
Grass Valley	1.1	1.5	2.6	4.0	5.7	7.1	7.9	7.1	5.3	3.2	1.5	0.9	48.0
Nevada City	1.1	1.5	2.6	3.9	5.8	6.9	7.9	7.0	5.3	3.2	1.4	0.9	47.4
ORANGE													
Irvine	2.2	2.5	3.7	4.7	5.2	5.9	6.3	6.2	4.6	3.7	2.6	2.3	49.6
Laguna Beach	2.2	2.7	3.4	3.8	4.6	4.6	4.9	4.9	4.4	3.4	2.4	2.0	43.2
Santa Ana	2.2	2.7	3.7	4.5	4.6	5.4	6.2	6.1	4.7	3.7	2.5	2.0	48.2
PLACER													
Auburn	1.2	1.7	2.8	4.4	6.1	7.4	8.3	7.3	5.4	3.4	1.6	1.0	50.6
Blue Canyon	0.7	1.1	2.1	3.4	4.8	6.0	7.2	6.1	4.6	2.9	0.9	0.6	40.5
Colfax	1.1	1.5	2.6	4.0	5.8	7.1	7.9	7.0	5.3	3.2	1.4	0.9	47.9
Roseville	1.1	1.7	3.1	4.7	6.2	7.7	8.5	7.3	5.6	3.7	1.7	1.0	52.2
Soda Springs	0.7	0.7	1.8	3.0	4.3	5.3	6.2	5.5	4.1	2.5	0.7	0.7	35.4
Tahoe City	0.7	0.7	1.7	3.0	4.3	5.4	6.1	5.6	4.1	2.4	0.8	0.6	35.5
Truckee	0.7	0.7	1.7	3.2	4.4	5.4	6.4	5.7	4.1	2.4	0.8	0.6	36.2
PLUMAS													
Portola	0.7	0.9	1.9	3.5	4.9	5.9	7.3	5.9	4.3	2.7	0.9	0.5	39.4
Quincy	0.7	0.9	2.2	3.5	4.9	5.9	7.3	5.9	4.4	2.8	1.2	0.5	40.2
RIVERSIDE													
Beaumont	2.0	2.3	3.4	4.4	6.1	7.1	7.6	7.9	6.0	3.9	2.6	1.7	55.0
Blythe	2.4	3.3	5.3	6.9	8.7	9.6	9.6	8.7	6.9	5.0	3.0	2.2	71.4
Cathedral City	1.6	2.2	3.7	5.1	6.8	7.8	8.7	7.8	5.7	4.0	2.1	1.6	57.1
Coachella	2.9	4.4	6.2	8.4	10.5	11.9	12.3	10.1	8.9	6.2	3.8	2.4	88.1

Appendix A - Reference Evapotranspiration (ETo) Table*													
County and City	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual ETo**
RIVERSIDE													
Desert Center	2.9	4.1	6.4	8.5	11.0	12.1	12.2	11.1	9.0	6.4	3.9	2.6	90.0
Elsinore	2.1	2.8	3.9	4.4	5.9	7.1	7.6	7.0	5.8	3.9	2.6	1.9	55.0
Indio	**3.1**	3.6	6.5	8.3	10.5	11.0	10.8	9.7	8.3	5.9	3.7	2.7	83.9
La Quinta	2.4	2.8	5.2	6.5	8.3	8.7	8.5	7.9	6.5	4.5	2.7	2.2	66.2
Mecca	2.6	3.3	5.7	7.2	8.6	9.0	8.8	8.2	6.8	5.0	3.2	2.4	70.8
Oasis	2.9	3.3	5.3	6.1	8.5	8.9	8.7	7.9	6.9	4.8	2.9	2.3	68.4
Palm Deser	2.5	3.4	5.3	6.9	8.7	9.6	9.6	8.7	6.9	5.0	3.0	2.2	71.6
Palm Springs	2.0	2.9	4.9	7.2	8.3	8.5	11.6	8.3	7.2	5.9	2.7	1.7	71.1
Rancho California	1.8	2.2	3.4	4.8	5.6	6.3	6.5	6.2	4.8	3.7	2.4	1.8	49.5
Rancho Mirage	2.4	3.3	5.3	6.9	8.7	9.6	9.6	8.7	6.9	5.0	3.0	2.2	71.4
Ripley	2.7	3.3	5.6	7.2	8.7	8.7	8.4	7.6	6.2	4.6	2.8	2.2	67.8
Salton Sea North	2.5	3.3	5.5	7.2	8.8	9.3	9.2	8.5	6.8	5.2	3.1	2.3	71.7
Temecula East II	2.3	2.4	4.1	4.9	6.4	7.0	7.8	7.4	5.7	4.1	2.6	2.2	56.7
Thermal	2.4	3.3	5.5	7.6	9.1	9.6	9.3	8.6	7.1	5.2	3.1	2.1	72.8
Riverside UC	2.5	2.9	4.2	5.3	5.9	6.6	7.2	6.9	5.4	4.1	2.9	2.6	56.4
Winchester	2.3	2.4	4.1	4.9	6.4	6.9	7.7	7.5	6.0	3.9	2.6	2.1	56.8
SACRAMENTO													
Fair Oaks	1.0	1.6	3.4	4.1	6.5	7.5	8.1	7.1	5.2	3.4	1.5	1.0	50.5
Sacramento	1.0	1.8	3.2	4.7	6.4	7.7	8.4	7.2	5.4	3.7	1.7	0.9	51.9
Twitchell Island	1.2	1.8	3.9	5.3	7.4	8.8	9.1	7.8	5.9	3.8	1.7	1.2	57.9
SAN BENITO													
Hollister	1.5	1.8	3.1	4.3	5.5	5.7	6.4	5.9	5.0	3.5	1.7	1.1	45.1
San Benito	1.2	1.6	3.1	4.6	5.6	6.4	6.9	6.5	4.8	3.7	1.7	1.2	47.2
San Juan Valley	1.4	1.8	3.4	4.5	6.0	6.7	7.1	6.4	5.0	3.5	1.8	1.4	49.1
SAN BERNARDINO													
Baker	2.7	3.9	6.1	8.3	10.4	11.8	12.2	11.0	8.9	6.1	3.3	2.1	86.6
Barstow NE	2.2	2.9	5.3	6.9	9.0	10.1	9.9	8.9	6.8	4.8	2.7	2.1	71.7
Big Bear Lake	1.8	2.6	4.6	6.0	7.0	7.6	8.1	7.4	5.4	4.1	2.4	1.8	58.6
Chino	2.1	2.9	3.9	4.5	5.7	6.5	7.3	7.1	5.9	4.2	2.6	2.0	54.6
Crestline	1.5	1.9	3.3	4.4	5.5	6.6	7.8	7.1	5.4	3.5	2.2	1.6	50.8
Lake Arrowhead	1.8	2.6	4.6	6.0	7.0	7.6	8.1	7.4	5.4	4.1	2.4	1.8	58.6
Lucerne Valley	2.2	2.9	5.1	6.5	9.1	11.0	11.4	9.9	7.4	5.0	3.0	1.8	75.3
Needles	3.2	4.2	6.6	8.9	11.0	12.4	12.8	11.0	8.9	6.6	4.0	2.7	92.1
Newberry Springs	2.1	2.9	5.3	8.4	9.8	10.9	11.1	9.9	7.6	5.2	3.1	2.0	78.2
San Bernardino	2.0	2.7	3.8	4.6	5.7	6.9	7.9	7.4	5.9	4.2	2.6	2.0	55.6
Twentynine Palms	2.6	3.6	5.9	7.9	10.1	11.2	11.2	10.3	8.6	5.9	3.4	2.2	82.9
Victorville	2.0	2.6	4.6	6.2	7.3	8.9	9.8	9.0	6.5	4.7	2.7	2.1	66.2
SAN DIEGO													
Chula Vista	2.2	2.7	3.4	3.8	4.9	4.7	5.5	4.9	4.5	3.4	2.4	2.0	44.2
Escondido SPV	2.4	2.6	3.9	4.7	5.9	6.5	7.1	6.7	5.3	3.9	2.8	2.3	54.2
SAN DIEGO													
Miramar	2.3	2.5	3.7	4.1	5.1	5.4	6.1	5.8	4.5	3.3	2.4	2.1	47.1
Oceanside	2.2	2.7	3.4	3.7	4.9	4.6	4.6	5.1	4.1	3.3	2.4	2.0	42.9
Otay Lake	2.3	2.7	3.9	4.6	5.6	5.9	6.2	6.1	4.8	3.7	2.6	2.2	50.4
Pine Valley	1.5	2.4	3.8	5.1	6.0	7.0	7.8	7.3	6.0	4.0	2.2	1.7	54.8
Ramona	2.1	2.1	3.4	4.6	5.2	6.3	6.7	6.8	5.3	4.1	2.8	2.1	51.6
San Diego	2.1	2.4	3.4	4.6	5.1	5.3	5.7	5.6	4.3	3.6	2.4	2.0	46.5
Santee	2.1	2.7	3.7	4.5	5.5	6.1	6.6	6.2	5.4	3.8	2.6	2.0	51.1
Torrey Pines	2.2	2.3	3.4	3.9	4.0	4.1	4.6	4.7	3.8	2.8	2.0	2.0	39.8
Warner Springs	1.6	2.7	3.7	4.7	5.7	7.6	8.3	7.7	6.3	4.0	2.5	1.3	56.0

Appendix A - Reference Evapotranspiration (ETo) Table*													
County and City	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual ETo**
SAN FRANCISCO													
San Francisco	1.5	1.3	2.4	3.0	3.7	4.6	4.9	4.8	4.1	2.8	1.3	0.7	35.1
SAN JOAQUIN													
Farmington	1.5	1.5	2.9	4.7	6.2	7.6	8.1	6.8	5.3	3.3	1.4	0.7	50.0
Lodi West	1.0	1.6	3.3	4.3	6.3	6.9	7.3	6.4	4.5	3.0	1.4	0.8	46.7
Manteca	0.9	1.7	3.4	5.0	6.5	7.5	8.0	7.1	5.2	3.3	1.6	0.9	51.2
Stockton	0.8	1.5	2.9	4.7	6.2	7.4	8.1	6.8	5.3	3.2	1.4	0.6	49.1
Tracy	1.0	1.5	2.9	4.5	6.1	7.3	7.9	6.7	5.3	3.2	1.3	0.7	48.5
SAN LUIS OBISPO													
Arroyo Grande	2.0	2.2	3.2	3.8	4.3	4.7	4.3	4.6	3.8	3.2	2.4	1.7	40.0
Atascadero	1.2	1.5	2.8	3.9	4.5	6.0	6.7	6.2	5.0	3.2	1.7	1.0	43.7
Morro Bay	2.0	2.2	3.1	3.5	4.3	4.5	4.6	4.6	3.8	3.5	2.1	1.7	39.9
Nipomo	2.2	2.5	3.8	5.1	5.7	6.2	6.4	6.1	4.9	4.1	2.9	2.3	52.1
Paso Robles	1.6	2.0	3.2	4.3	5.5	6.3	7.3	6.7	5.1	3.7	2.1	1.4	49.0
San Luis Obispo	2.0	2.2	3.2	4.1	4.9	5.3	4.6	5.5	4.4	3.5	2.4	1.7	43.8
San Miguel	1.6	2.0	3.2	4.3	5.0	6.4	7.4	6.8	5.1	3.7	2.1	1.4	49.0
San Simeon	2.0	2.0	2.9	3.5	4.2	4.4	4.6	4.3	3.5	3.1	2.0	1.7	38.1
SAN MATEO													
Hal Moon Bay	1.5	1.7	2.4	3.0	3.9	4.3	4.3	4.2	3.5	2.8	1.3	1.0	33.7
Redwood City	1.5	1.8	2.9	3.8	5.2	5.3	6.2	5.6	4.8	3.1	1.7	1.0	42.8
Woodside	1.8	2.2	3.4	4.8	5.6	6.3	6.5	6.2	4.8	3.7	2.4	1.8	49.5
SANTA BARBARA													
Betteravia	2.1	2.6	4.0	5.2	6.0	5.9	5.8	5.4	4.1	3.3	2.7	2.1	49.1
Carpenteria	2.0	2.4	3.2	3.9	4.8	5.2	5.5	5.7	4.5	3.4	2.4	2.0	44.9
Cuyama	2.1	2.4	3.8	5.4	6.9	7.9	8.5	7.7	5.9	4.5	2.6	2.0	59.7
Goleta	2.1	2.5	3.9	5.1	5.7	5.7	5.4	5.4	4.2	3.2	2.8	2.2	48.1
Goleta Foothills	2.3	2.6	3.7	5.4	5.3	5.6	5.5	5.7	4.5	3.9	2.8	2.3	49.6
Guadalupe	2.0	2.2	3.2	3.7	4.9	4.6	4.5	4.6	4.1	3.3	2.4	1.7	41.1
Lompoc	2.0	2.2	3.2	3.7	4.8	4.6	4.9	4.8	3.9	3.2	2.4	1.7	41.1
Los Alamos	1.8	2.0	3.2	4.1	4.9	5.3	5.7	5.5	4.4	3.7	2.4	1.6	44.6
Santa Barbara	2.0	2.5	3.2	3.8	4.6	5.1	5.5	4.5	3.4	2.4	1.8	1.8	40.6
SANTA BARBARA													
Santa Maria	1.8	2.3	3.7	5.1	5.7	5.8	5.6	5.3	4.2	3.5	2.4	1.9	47.4
Santa Ynez	1.7	2.2	3.5	5.0	5.8	6.2	6.4	6.0	4.5	3.6	2.2	1.7	48.7
Sisquoc	2.1	2.5	3.8	4.1	6.1	6.3	6.4	5.8	4.7	3.4	2.3	1.8	49.2
Solvang	2.0	2.0	3.3	4.3	5.0	5.6	6.1	5.6	4.4	3.7	2.2	1.6	45.6
SANTA CLARA													
Gilroy	1.3	1.8	3.1	4.1	5.3	5.6	6.1	5.5	4.7	3.4	1.7	1.1	43.6
Los Gatos	1.5	1.8	2.8	3.9	5.0	5.6	6.2	5.5	4.7	3.2	1.7	1.1	42.9
Morgan Hill	1.5	1.8	3.4	4.2	6.3	7.0	7.1	6.0	5.1	3.7	1.9	1.4	49.5
Palo Alto	1.5	1.8	2.8	3.8	5.2	5.3	6.2	5.6	5.0	3.2	1.7	1.0	43.0
San Jose	1.5	1.8	3.1	4.1	5.5	5.8	6.5	5.9	5.2	3.3	1.8	1.0	45.3
SANTA CRUZ													
De Laveaga	1.4	1.9	3.3	4.7	4.9	5.3	5.0	4.8	3.6	3.0	1.6	1.3	40.8
Green Valley Rd	1.2	1.8	3.2	4.5	4.6	5.4	5.2	5.0	3.7	3.1	1.6	1.3	40.6
Santa Cruz	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
Watsonville	1.5	1.8	2.7	3.7	4.6	4.5	4.9	4.2	4.0	2.9	1.8	1.2	37.7
Webb	1.8	2.2	3.7	4.8	5.3	5.7	5.6	5.3	4.3	3.4	2.4	1.8	46.2

Appendix A - Reference Evapotranspiration (ETo) Table*													
County and City	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual ETo**
SHASTA													
Burney	0.7	1.0	2.1	3.5	4.9	5.9	7.4	6.4	4.4	2.9	0.9	0.6	40.9
Fall River Mills	0.6	1.0	2.1	3.7	5.0	6.1	7.8	6.7	4.6	2.8	0.9	0.5	41.8
Glenburn	0.6	1.0	2.1	3.7	5.0	6.3	7.8	6.7	4.7	2.8	0.9	0.6	42.1
McArthur	0.7	1.4	2.9	4.2	5.6	6.9	8.2	7.2	5.0	3.0	1.1	0.6	46.8
Redding	1.2	1.4	2.6	4.1	5.6	7.1	8.5	7.3	5.3	3.2	1.4	0.9	48.8
SIERRA													
Downieville	0.7	1.0	2.3	3.5	5.0	6.0	7.4	6.2	4.7	2.8	0.9	0.6	41.3
Sierraville	0.7	1.1	2.2	3.2	4.5	5.9	7.3	6.4	4.3	2.6	0.9	0.5	39.6
SISKIYOU													
Happy Camp	0.5	0.9	2.0	3.0	4.3	5.2	6.1	5.3	4.1	2.4	0.9	0.5	35.1
MacDoel	1.0	1.7	3.1	4.5	5.9	7.2	8.1	7.1	5.1	3.1	1.5	1.0	49.0
Mt Shasta	0.5	0.9	2.0	3.0	4.5	5.3	6.7	5.7	4.0	2.2	0.7	0.5	36.0
Tule lake FS	0.7	1.3	2.7	4.0	5.4	6.3	7.1	6.4	4.7	2.8	1.0	0.6	42.9
Weed	0.5	0.9	2.0	2.5	4.5	5.3	6.7	5.5	3.7	2.0	0.9	0.5	34.9
Yreka	0.6	0.9	2.1	3.0	4.9	5.8	7.3	6.5	4.3	2.5	0.9	0.5	39.2
SOLANO													
Dixon	0.7	1.4	3.2	5.2	6.3	7.6	8.2	7.2	5.5	4.3	1.6	1.1	52.1
Fairfield	1.1	1.7	2.8	4.0	5.5	6.1	7.8	6.0	4.8	3.1	1.4	0.9	45.2
Hastings Tract	1.6	2.2	3.7	5.1	6.8	7.8	8.7	7.8	5.7	4.0	2.1	1.6	57.1
Putah Creek	1.0	1.6	3.2	4.9	6.1	7.3	7.9	7.0	5.3	3.8	1.8	1.2	51.0
Rio Vista	0.9	1.7	2.8	4.4	5.9	6.7	7.9	6.5	5.1	3.2	1.3	0.7	47.0
Suisun Valley	0.6	1.3	3.0	4.7	5.8	7.0	7.7	6.8	5.3	3.8	1.4	0.9	48.3
Winters	0.9	1.7	3.3	5.0	6.4	7.5	7.9	7.0	5.2	3.5	1.6	1.0	51.0
SONOMA													
Bennett Valley	1.1	1.7	3.2	4.1	5.5	6.5	6.6	5.7	4.5	3.1	1.5	0.9	44.4
Cloverdale	1.1	1.4	2.6	3.4	5.0	5.9	6.2	5.6	4.5	2.8	1.4	0.7	40.7
Fort Ross	1.2	1.4	2.2	3.0	3.7	4.5	4.2	4.3	3.4	2.4	1.2	0.5	31.9
Healdsburg	1.2	1.5	2.4	3.5	5.0	5.9	6.1	5.6	4.5	2.8	1.4	0.7	40.8
Lincoln	1.2	1.7	2.8	4.7	6.1	7.4	8.4	7.3	5.4	3.7	1.9	1.2	51.9
Petaluma	1.2	1.5	2.8	3.7	4.6	5.6	4.6	5.7	4.5	2.9	1.4	0.9	39.6
Santa Rosa	1.2	1.7	2.8	3.7	5.0	6.0	6.1	5.9	4.5	2.9	1.5	0.7	42.0
Valley of the Moon	1.0	1.6	3.0	4.5	5.6	6.6	7.1	6.3	4.7	3.3	1.5	1.0	46.1
Windsor	0.9	1.6	3.0	4.5	5.5	6.5	6.5	5.9	4.4	3.2	1.4	1.0	44.2
Denair	1.0	1.9	3.6	4.7	7.0	7.9	8.0	6.1	5.3	3.4	1.5	1.0	51.4
La Grange	1.2	1.5	3.1	4.7	6.2	7.7	8.5	7.3	5.3	3.4	1.4	0.7	51.2
Modesto	0.9	1.4	3.2	4.7	6.4	7.7	8.1	6.8	5.0	3.4	1.4	0.7	49.7
Newman	1.0	1.5	3.2	4.6	6.2	7.4	8.1	6.7	5.0	3.4	1.4	0.7	49.3
STANISLAUS													
Oakdale	1.2	1.5	3.2	4.7	6.2	7.7	8.1	7.1	5.1	3.4	1.4	0.7	50.3
Patterson	1.3	2.1	4.2	5.4	7.9	8.6	8.2	6.6	5.8	4.0	1.9	1.3	57.3
Turlock	0.9	1.5	3.2	4.7	6.5	7.7	8.2	7.0	5.1	3.4	1.4	0.7	50.2
SUTTER													
Nicolaus	0.9	1.6	3.2	4.9	6.3	7.5	8.0	6.9	5.2	3.4	1.5	0.9	50.2
Yuba City	1.3	2.1	2.8	4.4	5.7	7.2	7.1	6.1	4.7	3.2	1.2	0.9	46.7
TEHAMA													
Corning	1.2	1.8	2.9	4.5	6.1	7.3	8.1	7.2	5.3	3.7	1.7	1.1	50.7
Gerber	1.0	1.8	3.5	5.0	6.6	7.9	8.7	7.4	5.8	4.1	1.8	1.1	54.7
Gerber Dryland	0.9	1.6	3.2	4.7	6.7	8.4	9.0	7.9	6.0	4.2	2.0	1.0	55.5
Red Bluff	1.2	1.8	2.9	4.4	5.9	7.4	8.5	7.3	5.4	3.5	1.7	1.0	51.1

Appendix A - Reference Evapotranspiration (ETo) Table*													
County and City	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual ETo**
TRINITY													
Hay Fork	0.5	1.1	2.3	3.5	4.9	5.9	7.0	6.0	4.5	2.8	0.9	0.7	40.1
Weaverville	0.6	1.1	2.2	3.3	4.9	5.9	7.3	6.0	4.4	2.7	0.9	0.7	40.0
TULARE													
Alpaugh	0.9	1.7	3.4	4.8	6.6	7.7	8.2	7.3	5.4	3.4	1.4	0.7	51.6
Badger	1.0	1.3	2.7	4.1	6.0	7.3	7.7	7.0	4.8	3.3	1.4	0.7	47.3
Delano	1.1	1.9	4.0	4.9	7.2	7.9	8.1	7.3	5.4	3.2	1.5	1.2	53.6
Dinuba	1.1	1.5	3.2	4.7	6.2	7.7	8.5	7.3	5.3	3.4	1.4	0.7	51.2
Lindcove	0.9	1.6	3.0	4.8	6.5	7.6	8.1	7.2	5.2	3.4	1.6	0.9	50.6
Porterville	1.2	1.8	3.4	4.7	6.6	7.7	8.5	7.3	5.3	3.4	1.4	0.7	52.1
Visalia	0.9	1.7	3.3	5.1	6.8	7.7	7.9	6.9	4.9	3.2	1.5	0.8	50.7
TUOLUMNE													
Groveland	1.1	1.5	2.8	4.1	5.7	7.2	7.9	6.6	5.1	3.3	1.4	0.7	47.5
Sonora	1.1	1.5	2.8	4.1	5.8	7.2	7.9	6.7	5.1	3.2	1.4	0.7	47.6
VENTURA													
Camarillo	2.2	2.5	3.7	4.3	5.0	5.2	5.9	5.4	4.2	3.0	2.5	2.1	46.1
Oxnard	2.2	2.5	3.2	3.7	4.4	4.6	5.4	4.8	4.0	3.3	2.4	2.0	42.3
Piru	2.8	2.8	4.1	5.6	6.0	6.8	7.6	7.8	5.8	5.2	3.7	3.2	61.5
Port Hueneme	2.0	2.3	3.3	4.6	4.9	4.9	4.9	5.0	3.7	3.2	2.5	2.2	43.5
Thousand Oaks	2.2	2.6	3.4	4.5	5.4	5.9	6.7	6.4	5.4	3.9	2.6	2.0	51.0
Ventura	2.2	2.6	3.2	3.8	4.6	4.7	5.5	4.9	4.1	3.4	2.5	2.0	43.5
YOLO													
Bryte	0.9	1.7	3.3	5.0	6.4	7.5	7.9	7.0	5.2	3.5	1.6	1.0	51.0
Davis	1.0	1.9	3.3	5.0	6.4	7.6	8.2	7.1	5.4	4.0	1.8	1.0	52.5
Esparto	1.0	1.7	3.4	5.5	6.9	8.1	8.5	7.5	5.8	4.2	2.0	1.2	55.8
Winters	1.7	1.7	2.9	4.4	5.8	7.1	7.9	6.7	5.3	3.3	1.6	1.0	49.4
Woodland	1.0	1.8	3.2	4.7	6.1	7.7	8.2	7.2	5.4	3.7	1.7	1.0	51.6
Zamora	1.1	1.9	3.5	5.2	6.4	7.4	7.8	7.0	5.5	4.0	1.9	1.2	52.8
YUBA													
Browns Valley	1.0	1.7	3.1	4.7	6.1	7.5	8.5	7.6	5.7	4.1	2.0	1.1	52.9
Brownsville	1.1	1.4	2.6	4.0	5.7	6.8	7.9	6.8	5.3	3.4	1.5	0.9	47.4
* The values in this table were derived from:													
1) California Irrigation Management Information System (CIMIS);													
2) Reference EvapoTranspiration Zones Map, UC Dept. of Land, Air & Water Resources and													
California Dept of Water Resources 1999; and													
3) Reference Evapotranspiration for California, University of California, Department of Agriculture													
and Natural Resources (1987) Bulletin 1922 4) Determining Daily Reference Evapotranspiration,													
Cooperative Extension UC Division of Agriculture and Natural Resources (1987),													
Publication Leaflet 21426													

Appendix B – Sample Water Efficient Landscape Worksheet.

WATER EFFICIENT LANDSCAPE WORKSHEET

This worksheet is filled out by the project applicant and it is a required element of the Landscape Documentation Package.
Please complete all sections (A and B) of the worksheet.

SECTION A. HYDROZONE INFORMATION TABLE

Please complete the hydrozone table(s) for each hydrozone. Use as many tables as necessary to provide the square footage of landscape area per hydrozone.

Hydrozone*	Zone or Valve	Irrigation Method**	Area (Sq. Ft.)	% of Landscape Area
	Total			**100%**

**** Hydrozone***
HW = High Water Use Plants
MW = Moderate Water Use Plants
LW = Low Water Use Plants

*****Irrigation Method***
MS = Micro-spray
S = Spray
R = Rotor
B= Bubbler
D= Drip
O = Other

SECTION B. WATER BUDGET CALCULATIONS

Section B1. Maximum Applied Water Allowance (MAWA)

The project's Maximum Applied Water Allowance shall be calculated using this equation:

MAWA = (ETo) (0.62) [(0.7 x LA) + (0.3 x SLA)]

where:

MAWA = Maximum Applied Water Allowance (gallons per year)
ETo = Reference Evapotranspiration from Appendix A (inches per year)
0.7 = ET Adjustment Factor (ETAF)
LA = Landscaped Area includes Special Landscape Area (square feet)
0.62 = Conversion factor (to gallons per square foot)
SLA = Portion of the landscape area identified as Special Landscape Area (square feet)
0.3 = the additional ET Adjustment Factor for Special Landscape Area (1.0 - 0.7 = 0.3)

Maximum Applied Water Allowance = _____**gallons per year**

Show calculations.

Effective Precipitation (Eppt)

If considering Effective Precipitation, use 25% of annual precipitation. Use the following equation to calculate Maximum Applied Water Allowance:

MAWA= (ETo – Eppt) (0.62) [(0.7 x LA) + (0.3 x SLA)]

Maximum Applied Water Allowance = _____**gallons per year**

Show calculations.

Section B2. Estimated Total Water Use (ETWU)

The project's Estimated Total Water Use is calculated using the following formula:

$$ETWU = (ETo)(0.62)\left(\frac{PF\,x\,HA}{IE} + SLA\right)$$

where:

ETWU = Estimated total water use per year (gallons per year)
ETo = Reference Evapotranspiration (inches per year)
PF = Plant Factor from WUCOLS (see Definitions)
HA = Hydrozone Area [high, medium, and low water use areas] (square feet)
SLA = Special Landscape Area (square feet)
0.62 = Conversion Factor (to gallons per square foot)
IE = Irrigation Efficiency (minimum 0.71)

Hydrozone Table for Calculating ETWU

Please complete the hydrozone table(s). Use as many tables as necessary.

Hydrozone	Plant Water Use Type(s)	Plant Factor (PF)	Area (HA) (square feet)	PF x HA (square feet)
			Sum	
	SLA			

Estimated Total Water Use = _____**gallons**

Show calculations.

Appendix C – Sample Certificate of Completion.

CERTIFICATE OF COMPLETION

This certificate is filled out by the project applicant upon completion of the landscape project.

PART 1. PROJECT INFORMATION SHEET

Date		
Project Name		
Name of Project Applicant	Telephone No.	
	Fax No.	
Title	Email Address	
Company	Street Address	
City	State	Zip Code

Project Address and Location:

Street Address		Parcel, tract or lot number, if available.
City		Latitude/Longitude (optional)
State	Zip Code	

Property Owner or his/her designee:

Name	Telephone No.	
	Fax No.	
Title	Email Address	
Company	Street Address	
City	State	Zip Code

Property Owner

"I/we certify that I/we have received copies of all the documents within the Landscape Documentation Package and the Certificate of Completion and that it is our responsibility to see that the project is maintained in accordance with the Landscape and Irrigation Maintenance Schedule."

_____

Property Owner Signature Date

Please answer the questions below:

1. Date the Landscape Documentation Package was submitted to the local agency_____
2. Date the Landscape Documentation Package was approved by the local agency_____
3. Date that a copy of the Water Efficient Landscape Worksheet (including the Water Budget Calculation) was submitted to the local water purveyor_____

PART 2. CERTIFICATION OF INSTALLATION ACCORDING TO THE LANDSCAPE DOCUMENTATION PACKAGE

"I/we certify that based upon periodic site observations, the work has been substantially completed in accordance with the ordinance and that the landscape planting and irrigation installation conform with the criteria and specifications of the approved Landscape Documentation Package."

Signature*	Date	
Name (print)	Telephone No.	
	Fax No.	
Title	Email Address	
License No. or Certification No.		
Company	Street Address	
City	State	Zip Code

*Signer of the landscape design plan, signer of the irrigation plan, or a licensed landscape contractor.

PART 3. IRRIGATION SCHEDULING

Attach parameters for setting the irrigation schedule on controller per ordinance Section 492.10.

PART 4. SCHEDULE OF LANDSCAPE AND IRRIGATION MAINTENANCE

Attach schedule of Landscape and Irrigation Maintenance per ordinance Section 492.11.

PART 5. LANDSCAPE IRRIGATION AUDIT REPORT

Attach Landscape Irrigation Audit Report per ordinance Section 492.12.

PART 6. SOIL MANAGEMENT REPORT

Attach soil analysis report, if not previously submitted with the Landscape Documentation Package per ordinance Section 492.5.

Attach documentation verifying implementation of recommendations from soil analysis report per ordinance Section 492.5.

Chapter 17.630 LANDSCAPING AND SCREENING

17.630.001 Title and purpose of provisions.

A. Title. The provisions of this chapter shall be known as the “landscaping and screening regulations” of this title.

B. Purpose. The purpose of the landscape and screening regulations is to provide for the general welfare and convenience of the public by:

1. Increasing the compatibility between different intensities of land uses, by providing visual barriers, visually interrupting the barren expanse of paved parking lots, screening undesirable views which have a blighting impact on surrounding properties, and providing a visual separation and physical buffer between varying intensities of abutting land uses;

2. Implementing the comprehensive plan;

3. Encouraging the retention of significant existing vegetation to the extent feasible;

4. Reducing erosion and water runoff;

5. Conserving energy;

6. Preserving and promoting urban wildlife habitats;

7. Minimizing impacts of noise, light and glare. (Ord. 408 (part), 1987)

17.630.002 Applicability of provisions— General.

A. Landscaping shall be required within all yards, off-street parking lots and open land uses that are visible to and/or accessible to the public.

B. Shade trees shall be required within required landscaping, off-street parking lots and open land uses.

C. Screening shall be required as a buffer between activities having a different intensity of use and between certain zoning districts so as to mitigate the impacts of noise, light and glare and human activity.

D. All ornamental uses of water in the common areas of a development project, such as ponds, lakes and fountains shall be supplied, operated and maintained with alternative sources of water if they are available.

E. Exceptions to the specific requirements may be granted on a case-by-case basis due to either unusual site conditions or other extenuating circumstances.

F. The requirements are applicable to:

1. All landscaping for new construction, including:

a. All residential development greater than one unit,

b. Model homes or temporary development,

c. Commercial,

d. Industrial,

e. Public authorities.

G. The requirements shall be used as a guideline for landscaping and irrigation for a single-family

residence.

H. The requirements does not apply to that portion of a site irrigating edible crops or using nonpotable water. (Ord. 523 § 2, 1992; Ord. 408 (part), 1987)

17.630.003 Definitions.

For the purposes of this chapter, unless otherwise apparent from the context, certain works and phrases used in this chapter are defined as follows:

A. “Landscaping” means vegetative plantings such as grass, trees, shrubs and vines and related improvements such as pools, walkways, rock work and sculpture which is of a design that will beautify and enhance a property and control erosion and reduce glare.

B. “Screening” means a masonry wall, board fence, screened chain link fence, hedge, berm or vegetative planting or combination thereof which is of a design that will provide a visual and audible barrier between land uses having different intensities of use.

C. “Shade tree” means trees of a variety approved by the city that will, under ordinary circumstances and growing conditions, provide shade upon reaching maturity.

D. “Automatic controller” means a mechanical or solid state timer, capable of operating valve stations to set the days and length of time of a water application.

E. “Check valve” means a valve located under a sprinkler head to hold water in the system so it minimizes drainage from the lower elevation sprinkler heads.

F. “Conversion factor (0.62)” means a number that converts the estimated total water use from acres-inches per acre per year to gallons per square foot per year. The conversion factor is calculated as follows:

(325,851 gallons/43,560 square feet)/12 inches = (0.62)

325,851 gallons = one acre foot

43,560 square feet = one acre

12 inches = one foot

To convert gallons per year to one hundred-cubic-feet per year, another common billing unit for water, divide gallons per year by seven hundred forty-eight. (Seven hundred forty-eight gallons equal one hundred cubic feet.)

G. “Estimated total water use” means the annual total amount of water estimated to be needed to keep the plants in the landscaped area healthy. It is based upon such factors as the local evapotrans-piration rate, the size of the landscaped area, the type of plants, and the efficiency of the irrigation system.

H. “Evapotranspiration” means the quantity of water evaporated from adjacent soil surfaces and transpired by plants during a specific time.

I. “Flowrate” means a portion of the landscaped area having plants with similar water needs that are served by a valve or set of valves with the same schedule. A hydro-zone may be irrigated or nonirrigated. For example, a naturalized area planted with native vegetation that will not need supplemental irrigation once established is a nonirrigated hydrozone.

J. “Hydrozone” means a portion of the landscaped area having plants with similar water needs that are served by a valve or set of valves with the same schedule. A hydrozone may be irrigated or nonirrigated. For example, a naturalized area planted with native vegetation that will not need supplemental irrigation once established is a nonirrigated hydrozone.

K. “Irrigation efficiency” means the measurement of the amount of water beneficially used divided by the amount of water applied. Irrigation efficiency is derived from measurements and estimates of irrigation system characteristics and management practices. For the purpose of this chapter the following factors shall be used:

Spray heads (pop-up or riser)	0.60
Rotor or impact heads	0.70
Bubbler	0.70
Drip	0.76

L. “Landscape irrigation audit” means a process to perform site inspections, evaluate irrigation systems and develop efficient irrigation schedules.

M. “Landscaped area” means the entire parcel less the building(s) footprint, driveways, nonirrigated portions of the parking lots, hardscapes such as decks and patios and other nonporous areas. Water features are included in the calculation of the landscaped area. Areas dedicated to edible plants, such as orchards or vegetable gardens, are not included.

N. “Mulch” means any material such as leaves, bark, straw or other materials left loose and applied to the soil surface to reduce evaporation.

O. “Nonpotable water” means water unfit for human consumption, such as treated or recycled waste water, untreated irrigation water or untreated groundwater.

P. “Overspray” means the water which is delivered beyond the landscaped area, wetting pavements, walks, structures or other nonlandscaped areas.

Q. “Plant factor” means a factor that when multiplied by reference evapotranspiration, estimates the amount of water used by plants. For purposes of this ordinance, use the following plant factors:

Low water using:	0.1 - 0.3
Medium water using:	0.4 - 0.6
High water using:	0.7 - 0.9

These plant factors are based on the Water Use Classification Of Landscape Species project (WUCOLS). The project list is intended solely as a guide to help landscape professional identify irrigation water needs of landscape species. It is not intended to be used as a required, mandatory, approved or master list. The WUCOLS Project is available from the California Department of Water Resources or from the Contra Costa water district.

R. “Reference evapotranspiration” or “ETo” means a standard measurement of environmental parameters which affect the water use of plants. ETo is given in inches per day, month or year and is an estimate of the evapotranspiration of a large field of four-to-seven-inch tall, cool season grasses that is well watered. Reference evapotranspiration is used as the basis of determining the estimated total water use so that regional differences in climate can be accommodated. (For historical ETo rates see Exhibit B attached to the ordinance codified in this chapter.)

S. “Runoff” means water which is not absorbed by the soil or landscape to which it is applied and flows from the area. For example, runoff may result from water that is applied at too great a rate (application rate exceeds infiltration rate) or when there is a severe slope.

T. “Soil composition” means the classification of soil based on the percentage of sand, silt and clay in the soil.

U. “Sprinkler” means a device which sprays water through a nozzle.

V. “Station” means an area served by one valve or by a set of valves that operate simultaneously.

W. “Turf” means a surface layer of earth containing mowed grass and its roots. This can be either a cool season or warm season grass. For example, Red Fescue and Tall Fescue are cool season grasses; Bermuda grass, Kikuyu grass, St. Augustine, Zoysia grass, and Buffalo grass are warm season grasses.

X. “Valve” means a device used to control the flow of water in the irrigation systems. (Ord. 523 § 3, 1992; Ord. 408 (part), 1987)

17.630.004 Landscaping required.

Landscaping in conformance with Section 17.630.008 shall be required as follows:

A. Residential uses: Within any front yard or side yard adjacent to a street;

B. Public and quasi-public uses: Within any parking lot, front yard, side yards adjacent to a street or interior open space that is visible from a public right-of-way or accessible to the public;

C. Commercial and industrial uses: Within any parking lot, front yard, side yard adjacent to a street or open land use that is visible from a public right-of-way or accessible to the public;

D. Where a parking lot abuts a public right-of-way there shall be required a landscaped strip of not less than five feet in width contiguous to and parallel to such right-of-way;

E. Except for single-family residential uses landscaping shall be subject to design and site development review. (Ord. 408 (part), 1987)

17.630.005 Screening required.

Screening in conformance with Section 17.630.009 shall be required as follows:

A. Along the interior boundaries between any R, A, or OS zone and any C, IC, PEC, PF or SPF zone.

B. Parking lots for more than six vehicles shall be enclosed, except for necessary driveway openings, by screening where contiguous to or within two hundred feet of any property in any R zone, any A zone or the OS zone.

C. Where a parking lot abuts a public right-of-way across from property in any R zone, any A zone or the OS zone, such lot shall be screened along that right-of-way to a height of forty-eight inches.

D. The following specific uses shall be screened:

1. Multiple residential projects having four or more dwellings;

2. Public and quasi-public uses such as churches, schools and similar uses;

3. The boundaries of new subdivisions upon development;

4. Mobile home parks. (Ord. 408 (part), 1987)

17.630.006 Shade trees required.

Shade trees in conformance with Section 17.630.008 shall be required as follows:

A. Within any public parking lot;

B. Within any area of required landscaping;

C. Within any area of open land use. (Ord. 408 (part), 1987)

17.630.007 Exceptions—Landscaping and screening.

The exception to the landscape and screening requirements are as follows:

A. The standards set forth in this chapter for location and height of landscaping or screening may be modified by the city when such landscaping or screening would constitute a danger to traffic by reason of impairment of vision at a street or driveway intersection.

B. Screening shall not be required along a lot line where a building wall, solid fence or freestanding wall of the required height exists immediately abutting and on the other side of the lot line. (Ord. 408 (part), 1987)

17.630.008 Landscape standards.

Required landscaping, to include shade trees, shall be installed in accordance with the following minimum standards. These standards may be exceeded voluntarily by the developer and greater standards may be imposed as a condition of an approved permit:

A. Parking lots and other open land uses which are visible to, or accessible to the public shall be landscaped at the following rate:

Parking Lot Size (Spaces)	Open Space Area (Acres)	Percent of Lot In Landscaping
6 or less	.1 AC	4%
7 to 15	.2 AC	7%
16 to 30	.3 AC	10%
31 to 70	.4 AC	13%
71 or more	.5 AC	16%

B. Landscaped areas, parking lots and other open land uses shall be required to have shade trees at the rate of sixteen trees per acre or fraction thereof.

C. Shade trees generally shall be of a fifteen-gallon can size having a minimum height of six feet and a one-inch caliper. Modification of these standards for equivalent quality of tree may be permitted by the city depending on tree species and quality of stock.

D. Shade trees shall be scattered within a parking lot approximately thirty feet apart and may be clustered within landscaped areas.

E. Landscaped areas and tree wells shall be contained by pavement, fences or walls, or shall be contained in planters and tree wells bordered by a minimum six-inch-high concrete curb or equivalent approved by the city.

F. Planters and tree wells shall have a width of not less than five feet and shall be protected from automobile overhang where necessary through the provision of tire stops or other barriers approved by the city.

G. Landscaped areas and planters shall be watered by an automatic irrigation system approved by the city and designed to maximize water conservation.

H. All landscaping shall be maintained in good growing condition. Maintenance shall include, where appropriate, pruning, mowing, weeding, cleaning, fertilizing and regular watering. Whenever necessary, planting shall be replaced with other plant materials to insure continued compliance with applicable landscaping requirements.

I. Paved and graveled walkways and the use of gravel or similar materials as a landscape feature shall not exceed twenty percent of the landscape area.

J. Vegetive materials shall be selected from among those known to be suitable to the climate of the city of Brentwood area.

K. In order to foster water conservation programs the use of native plants or other plant material proven to require minimal watering shall be permitted and encouraged.

L. Except for shade trees, landscaping or screening shall not exceed three feet in height within thirty-five feet of the street corner on any corner lots.

M. Within overhead utility line easements trees shall be of a type that customarily grow to a height not exceeding fifteen feet.

N. Within underground utility line easements the planting of trees shall be prohibited. (Ord. 408 (part), 1987)

17.630.009 Screening standards.

Required screening shall be installed in accordance with the following minimum standards;

A. Except where a greater height is required by the city for noise abatement, fences and walls shall not exceed a height of six feet.

B. Walls shall be constructed in conformance with the requirements of the city director of public works.

C. Fence supports should be on a maximum of six-foot centers and cemented in place and may be four-by-four wood posts, pipe or masonry piers.

D. Fence covering shall be masonry, wood boards of not less than one-inch thickness or a chain link type fence with slats, vegetative or other durable screening.

E. Fences or walls shall be maintained in good repair, including painting if required, without any signs or advertising thereon except in conformance with the city sign ordinance.

F. Vegetive screening may include an evergreen hedge or a mix of evergreen shrubs and trees of a type, density and spacing so that sight and illumination will be obscured through the screening within three years of planting.

G. Except for trees, vegetative screening shall be maintained at a height of not less than six feet nor more than ten feet.

H. An earth berm may be used in combination with any of the above types of screening, but not more than two-thirds of the required height of such screening may be provided by the berm.

I. All screening shall follow the lot line of the lot to be screened, or the inside edge of the sidewalks or shall be so arranged within the boundaries of the lot as to substantially screen, from adjoining properties the building, facility or activity required to be screened. (Ord. 408 (part), 1987)

17.630.010 Landscaping for new development.

A. Plant Selection. At least ninety percent of the plants selected in nonturf areas shall be well-suited to the climate of Brentwood and require minimal water once established. Up to ten percent of the plants may be of a non-drought tolerant variety as long as they are grouped together and can be irrigated separately.

B. Turf Selection and Limitations.

1. The combined turf and/or water area (i.e., pools, ponds and fountains) shall be limited to twenty-five percent of landscape areas. Turf limitation is excluded for public parks, golf courses, cemeteries, school and recreation areas;

2. No turf shall be allowed:

a. In median strips,

b. In areas less than eight feet wide,

c. On slopes greater than 4:1.

C. Soil Conditioning and Mulching.

1. A soil analysis shall be submitted with the landscape plans, showing general suitability, soluble salts, available micronutrients, plus gypsum requirement and applicable recommendations;

2. A minimum of two inches of mulch shall be added in nonturf areas to the soil surface after planting. Nonporous material shall not be placed under the mulch.

D. Irrigation.

1. Sprinklers and sprays shall not be used in areas less than eight feet wide. Micro-irrigation devices and/or bubblers shall be used that do not exceed 1.5 gallons per minute per device;

2. Sprinkler heads with a precipitation rate of .85 inches per hour or less shall be used on slopes exceeding fifteen percent to minimize runoff, or exceeding ten percent within ten feet of hardscape;

3. Valves and circuits shall be separated based on water use (hydrozoning);

4. Bubbler irrigation systems are required for newly installed trees;

5. Sprinkler heads must have matched precipitation rates within each control valve circuit;

6. Serviceable check valves are required where elevation differential may cause low head drainage;

7. Sprinkler head spacing shall be designed for head-to-head coverage. The system should be designed for minimum runoff and overspray onto nonirrigated areas;

8. All irrigation systems shall be equipped with an automatic controller capable of multiple programming. Controllers must have multiple cycle start capacity and a flexible calendar program;

9. Pop-up sprinklers in lawn areas shall have at least a four inch pop-up height;

10. All irrigation systems shall be equipped with automatic rain shutoff devices and high-flow shutoff valves at heads adjacent to walks, curbs or other high-traffic areas, or other flow sensor devices;

11. Irrigation plans shall include:

a. Irrigated turf area (in square feet),

b. Irrigated nonturf area (in square feet),

c. Flow rate in gallons per minute per valve,

d. Estimated annual water use per hydrozone in gallons (see Exhibit A attached to the ordinance codified in this chapter for formula),

e. Estimated total annual water use in gallons (sum of all hydrozones;)

12. Upon completing the installation of the landscaping and irrigation system, during the maintenance period, an irrigation audit shall be performed by a certified landscape irrigation auditor.

E. Certification. A licensed contractor and a licensed landscape architect and/or certified irrigation designer and/or other licensed or certified professional in a related field shall conduct a final field observation and shall provide a certificate of substantial completion to the city. (See Exhibit C attached to the ordinance codified in this chapter for the certificate of substantial completion.) (Ord. 523 § 4, 1992: Ord. 408 (part), 1987)

17.630.011 Installation.

All landscaping, shade trees and screening required pursuant to this chapter shall be installed prior to granting of any occupancy permit(s) approval. Except upon submittal of a bond or other surety acceptable to the city, installation may be deferred for a period not to exceed six months from the date of occupancy. (Ord. 523 § 5, 1992)

This page intentionally left blank.