2015

URBAN WATER MANAGEMENT PLAN

FINAL

MAY 2016

2015 URBAN WATER MANAGEMENT PLAN

Municipal Water District of Orange County

FINAL

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ACRONYMS AND ABBREVIATIONS

20x2020	20% water use reduction in GPCD by year 2020
Act	Urban Water Management Planning Act
ACWRF	Aliso Creek Water Reclamation Facility
AF	Acre-Feet
AFY	Acre-Feet per Year
AOP	Advanced Oxidation Processes
AWTP	Advanced Water Treatment Plant
AWWA	American Water Works Association
Base	Marine Corps Base, Camp Pendleton
BDCP	Bay-Delta Conservation Plan
BEA	Basin Equity Assessment
Biops	Biological Opinions
BMO	Best Management Objective
BMP	Best Management Practice
BPP	Basin Production Percentage
BPOU	Baldwin Park Operable Unit
CalWARN	California Water and Wastewater Agency Response Network
CCC	California Coastal Commission
CDR	Center for Demographic Research
CDWC	California Domestic Water Company
Cfs	cubic feet per second
CII	Commercial/Industrial/Institutional
CRA	Colorado River Aqueduct
CSANS	California Sprinkler Adjustment Notification System
CTP	Coastal Treatment Plant
CUP	Conjunctive Use Program
CUWCC	California Urban Water Conservation Council
CVP	Central Valley Project
CVWD	Cucamonga Valley Water District
CVWD	Coachella Valley Water District
CWRP	Chiquita Water Reclamation Plant
DATS	Deep Aquifer Treatment System
DDW	Division of Drinking Water
Delta	Sacramento-San Joaquin River Delta
DMM	Demand Management Measure
DRP	Direct Potable Reuse
DVL	Diamond Valley Lake
DWR	Department of Water Resources
EBSD	Emerald Bay Services District

EOCWD	East Orange County Water District
EIR	Environmental Impact Report
EOC	Emergency Operation Center
ET	Evapotranspiration
ETWD	El Toro Water District
Festival	Children's Water Education Festival
FTE	Full Time Equivalent
FY	Fiscal Year
GAC	Granular Activated Carbon Filter
GAP	Green Acres Project
GCM	General Circulation Model
GPCD	Gallons per Capita per Day
GPD	Gallons per Day
GRF	Groundwater Recovery Facility
GSWC	Golden State Water Company
GWRP	Groundwater Recovery Plant
GWRS	Groundwater Replenishment System
HECW	High Efficiency Clothes Washers
HEN	High Efficiency Sprinkler Nozzle
HET	High Efficiency Toilet
IID	Imperial Irrigation District
IPR	Indirect Potable Reuse
IRP	Integrated Water Resource Plan
IRWD	Irvine Ranch Water District
IWA	International Water Association
LAWRP	Los Alisos Water Recycling Plant
LBCWD	Laguna Beach County Water District
LRP	Local Resources Program
LTFP	Long-Term Facilities Plan
MARS	Member Agency Response System
MAWA	Maximum Allowed Water Allowance
M&I	Municipal and industrial
MAF	Million Acre-Feet
MCL	Maximum Contaminant Level
Mesa Water	Mesa Water District
Metropolitan	Metropolitan Water District of Southern California
MF	Microfiltration
MGD	Million Gallons per Day
MNWD	Moulton Niguel Water District
MOU	Memorandum of Understanding Regarding Urban Water Conservation in California

MTBE	Methyl Tert-Butyl Ether
MWDOC	Municipal Water District of Orange County
MWRF	Mesa Water Reliability Facility
MWRP	Michelson Water Recycling Plant
NDMA	N-nitrosodimethylamine
NRCS	Natural Resource Conservation Service
OC	Orange County
OCSD	Orange County Sanitation District
OCWD	Orange County Water District
OCWRP	Oso Creek Water Reclamation Plant
Plan	Urban Water Management Plan
Poseidon	Poseidon Resources LLC
PPCP	Pharmaceuticals and Personal Care Product
PPB	Parts per Billion
PPR	Percent Perfected Right
PVID	Palo Verde Irrigation District
QSA	Quantification Settlement Agreement
RA	Replenishment Assessment
RO	Reverse Osmosis
RRWTP	Robinson Ranch Wastewater Treatment Plant
RTP	Regional Treatment Plant
RWQCB	Regional Water Quality Control Board
SAR	Santa Ana River
SARCCUP	Santa Ana River Conservation and Conjunctive Use Program
SBx7-7	Senate Bill 7 as part of the Seventh Extraordinary Session
SCAB	South Coast Air Basin
SCWD	South Coast Water District
SDCWA	San Diego County Water Authority
SDP	Seawater Desalination Program
SEMS	Standardized Emergency Management System
Serrano	Serrano Water District
SJBA	San Juan Basin Authority
SMWD	Santa Margarita Water District
SNWA	Southern Nevada Water Authority
SOC	South Orange County
SOCWA	South Orange County Wastewater Authority
Study	Colorado River Basin Water Supply and Demand Study
SWP	State Water Project
SWRCB	California State Water Resources Control Board
SWSD	Semitropic Water Storage District

TCWD	Trabuco Canyon Water District
TDS	Total Dissolved Solids
TVMWD	Three Valleys Municipal Water District
USBR	United States Bureau of Reclamation
USGVMWD	Upper San Gabriel Valley Municipal Water District
UV	Ultraviolet
UWMP	Urban Water Management Plan
WACO	Water Advisory Committee of Orange County
WBIC	Weather Based Irrigation Controller
WEROC	Water Emergency Response Organization of Orange County
WRP	Water Recycling Plant
WSAP	Water Supply Allocation Plan
WSDM	Water Surplus and Drought Management Plan
WUE	Water Use Efficiency
YLWD	Yorba Linda Water District

MESSAGE FROM THE BOARD OF DIRECTORS

Since the Municipal Water District of Orange County's (MWDOC) formation in 1951, MWDOC has remained steadfast in its commitment to provide a reliable supply of high-quality water for Orange County at a reasonable rate. Through leadership, representation at the Metropolitan Water District of Southern California (Metropolitan) and collaboration with our retail agencies, MWDOC seeks opportunities to improve Orange County's water resources and reliability. By integrating local planning challenges and regional stakeholder partnerships, MWDOC maximizes water system reliability and overall system efficiencies. MWDOC works to expand Orange County's water supply portfolio by providing planning and local resource development in the areas of recycled water, groundwater, ocean water desalination, and water-use efficiency.

DIRECTORS

Division 1   Brett R. Barbre

Brea, Buena Park, La Habra, La Palma, Yorba Linda Water District, and portions of Golden State Water Company

Division 2   Larry D. Dick

Orange, Tustin, East Orange County Water District, portions of Golden State Water Company, Serrano Water District, Garden Grove, and portions of Irvine Ranch Water District

Division 3   Wayne Osborne

Fountain Valley, Westminster, portions of Golden State Water Company, and portions of Garden Grove

Division 4   Joan C. Finnegan

Huntington Beach, Seal Beach, and Mesa Water District

Division 5   Sat Tamaribuchi

Newport Beach and portions of Irvine Ranch Water District and El Toro Water District

Division 6   Jeffery M. Thomas

Santa Margarita Water District, Tustin, Trabuco Canyon Water District, and portions of Irvine Ranch Water District

Division 7   Susan Hinman

San Clemente, San Juan Capistrano, Moulton Niguel Water District, Laguna Beach County Water District, Emerald Bay Service District, and South Coast Water District

MISSION STATEMENT

"To provide reliable, high-quality supplies from Metropolitan Water District of Southern California and other sources to meet present and future needs, at an equitable and economical cost, and to promote water use efficiency for all of Orange County."

1 INTRODUCTION

1.1 Urban Water Management Plan Requirements

Water Code Sections 10610 through 10656 of the Urban Water Management Planning Act (Act) require every urban water supplier providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre-feet (AF) of water annually to prepare, adopt, and file an Urban Water Management Plan (UWMP) with the California Department of Water Resources (DWR) every five years in the years ending in zero and five. The 2015 UWMP updates are due to DWR by July 1, 2016.

This UWMP provides DWR with a detailed summary of present and future water resources and demands within the Municipal Water District of Orange County (MWDOC) service area and assesses its water resource needs. Specifically, the UWMP provides water supply planning for a 25-year planning period in five-year increments and identifies water supplies needed to meet existing and future demands. The demand analysis must identify supply reliability under three hydrologic conditions: a normal year, a single-dry year, and multiple-dry years. MWDOC's 2015 UWMP updates the 2010 UWMP in compliance with the requirements of the Act as amended in 2009, and includes a discussion of:

- Water Service Area and Facilities
- Water Sources and Supplies
- Water Use by Customer Type
- Demand Management Measures
- Water Supply Reliability
- Planned Water Supply Projects and Programs
- Water Shortage Contingency Plan
- Recycled Water Use

Since the original Act's passage in 1983, several amendments have been added. The most recent changes affecting the 2015 UWMP include Senate Bill 7 as part of the Seventh Extraordinary Session (SBx7-7) and SB 1087. SBx7-7, or the Water Conservation Act of 2009, is part of the Delta Action Plan that stemmed from the Governor's goal to achieve a 20 percent statewide reduction in urban per capita water use by 2020 (20x2020). Reduction in water use is an important part of this plan that aims to sustainably manage the Bay Delta and reduce conflicts between environmental conservation and water supply conveyance; it is detailed in Section 3.2.3. SBx7-7 requires each urban retail water supplier to develop urban water use targets to achieve the 20x2020 goal and the interim ten percent goal by 2015. Each urban retail water supplier must include in its 2015 UWMPs the following information from its target-setting process:

- Baseline daily per capita water use
- 2020 urban water use target

- 2015 interim water use target compliance
- Compliance method being used along with calculation method and support data
- An implementation plan to meet the targets

Wholesale water suppliers such as MWDOC are required to include an assessment of present and proposed future measures, programs, and policies that would help achieve the 20 percent water use reduction goal by 2020.

In an effort to assist retail agencies in Orange County to meet the requirement of SB7x7, the MWDOC 2015 UWMP describes the Orange County Regional Alliance and methodology used to calculate the regional targets for 2015 and 2020.

The other recent amendment made to the UWMP on September 19, 2014, is set forth by SB 1420, Distribution System Water Losses. SB 1420 requires water purveyors to quantify distribution system losses for the most recent 12-month period available. The water loss quantification is based on the water system balance methodology developed by the American Water Works Association (AWWA).

This 2015 Plan update also incorporates MWDOC's current and planned water use efficiency efforts pursuant to the *Memorandum of Understanding Regarding Urban Water Conservation in California* (MOU). MWDOC became a signatory and adopted the MOU in 1991.

An UWMP may serve as a foundational document and source of information for a Water Supply Assessment (Water Code Section 10613), and a Written Verification of Water Supply (Water Code Section 66473.7). Both statutes require detailed information regarding water supply availability be provided to city and county decision makers prior to approval of specified large development projects. Additionally, a UWMP also serves as a:

- Long-range planning document for water supply;
- Long-range planning document for water use efficiency measures;
- Source data for development of a regional water plan;
- Source document for cities and counties, as they prepare and update their General Plans;
- Key component of an Integrated Regional Water Management Plan; and
- Condition to qualify for receipt of certain State grant funds.

The activities associated with the update of MWDOC's Plan and the benefits the Plan ultimately affords its local retailers extend far beyond the implied or stated supply-reliability goals. This Plan allows MWDOC to do the following:

- Provide a comprehensive assessment of water resource needs in its service area;
- Provide guidance to coordinate implementation of water use efficiency programs in a cost-effective manner;
- Provide assistance to maximize the beneficial use of recycled water and local groundwater supplies, supplying the region with new sources of local water to reduce the need to purchase imported water supplies from Metropolitan; and

- Offer opportunities for community participation through public meetings, and provide information that allows the public to gain further understanding of the region's comprehensive water planning.

The sections in this UWMP correspond to the outline of the Act, specifically Article 2, Contents of Plans, Sections 10631, 10632, and 10633. The sequence used for the required information, however, differs slightly in order to present information in a manner reflecting the unique characteristics of MWDOC. The UWMP Checklist which identifies the location of Act requirements in this Plan is included in Appendix A. This is an individual UWMP for a wholesale agency, as shown in Tables 1-1 and 1-2. Table 1-2 also indicates the units that will be used throughout this document.

Table 1-1: Plan Identification

Plan Identification			
Select Only One	**Type of Plan**		**Name of RUWMP or Regional Alliance**
☑	**Individual UWMP**		
	☐	Water Supplier is also a member of a RUWMP	-
	☑	Water Supplier is also a member of a Regional Alliance	Orange County 20x2020 Regional Alliance
☐	**Regional Urban Water Management Plan (RUWMP)**		-
NOTES:			

Table 1-2: Agency Identification

Agency Identification	
Type of Agency	
☑	Agency is a wholesaler
☐	Agency is a retailer
Fiscal or Calendar Year	
☐	UWMP Tables Are in Calendar Years
☑	UWMP Tables Are in Fiscal Years
If Using Fiscal Years Provide Month and Date that the Fiscal Year Begins (mm/dd)	
7/1	
Units of Measure Used in UWMP	
Unit	AF
NOTES:	

1.2 Municipal Water District of Orange County

1.2.1 Formation and Purpose

Orange County was settled around areas of surface water. San Juan Creek supplied the mission at San Juan Capistrano. The Santa Ana River supplied the early Cities of Anaheim and Santa Ana. The Santa Ana River also provided water to a large aquifer underlying the northern half of the county, enabling settlers to move away from the river's edge and still obtain water by drilling wells.

By the early 1900s, Orange County residents understood that their water supply was limited, the rivers and creeks did not flow all year long, and the aquifer would eventually be degraded or even dry up if the water was not replenished on a regular basis.

In 1928, the Cities of Anaheim, Santa Ana, and Fullerton joined with 10 other southern California cities to form Metropolitan. Their objective was to build an aqueduct from the Colorado River to provide the additional water necessary to sustain the growing southern California economy and its enviable lifestyle.

The Orange County Water District (OCWD) was formed in 1933 to protect the County's water rights on the Santa Ana River. Later that mission was expanded to manage the underground aquifer, optimizing use of local supplies and augmenting those with imported supplies provided through the Metropolitan member agencies in Orange County.

It was not long before other parts of Orange County also saw the need for supplemental supplies. A severe drought in the late 1940s further emphasized this need for coastal communities from Newport

Beach to San Clemente. In 1948, coastal communities from Newport Beach south to the San Diego county line formed the Coastal Municipal Water District as a way to join in the benefits provided by Metropolitan. Three years later, MWDOC was formed by Orange County voters in 1951 under the Municipal Water District Act of 1911 to provide imported water to inland areas of Orange County. To improve services and reduce cost, the Coastal Municipal Water District became a part of MWDOC in January 2001.

Today, MWDOC is Metropolitan's third largest member agency, providing and managing the imported water supplies used within its service area.

1.2.2 Relationship to Metropolitan

MWDOC became a member agency of Metropolitan in 1951 to bring supplemental imported water supplies to parts of Orange County. Metropolitan is a consortium of 26 cities and water agencies that provides supplemental water supplies to parts of Los Angeles, Orange, San Diego, Riverside, San Bernardino, and Ventura Counties. Metropolitan's two main sources of supply are the Colorado River and Sacramento-San Joaquin Bay-Delta. Supplies from these sources are delivered to southern California via the Colorado River Aqueduct (CRA) and the State Water Project (SWP). MWDOC purchases imported water from these sources from Metropolitan and distributes the water to its 28 retail agencies, which provide retail water services to the public.

1.2.3 MWDOC Board of Directors

MWDOC is governed by an elected seven-member Board of Directors, with each board member representing a specific area of the County and elected to a four-year term by voters who reside within that part of the MWDOC service area. The Board of Directors map is shown on Figure 1-1.

Each director is a member of at least one of the following three standing committees: Planning and Operations; Administration and Finance; and Public Affairs and Legislation. Each committee meets monthly. The full board convenes for its regular monthly meeting on the third Wednesday of the month, and holds a Board workshop on Metropolitan issues the first Wednesday of the month.

The President of the Board, Vice President, and immediate past President also comprise the Executive Committee, which meets monthly with the General Manager, Assistant General manager, and Board Secretary.

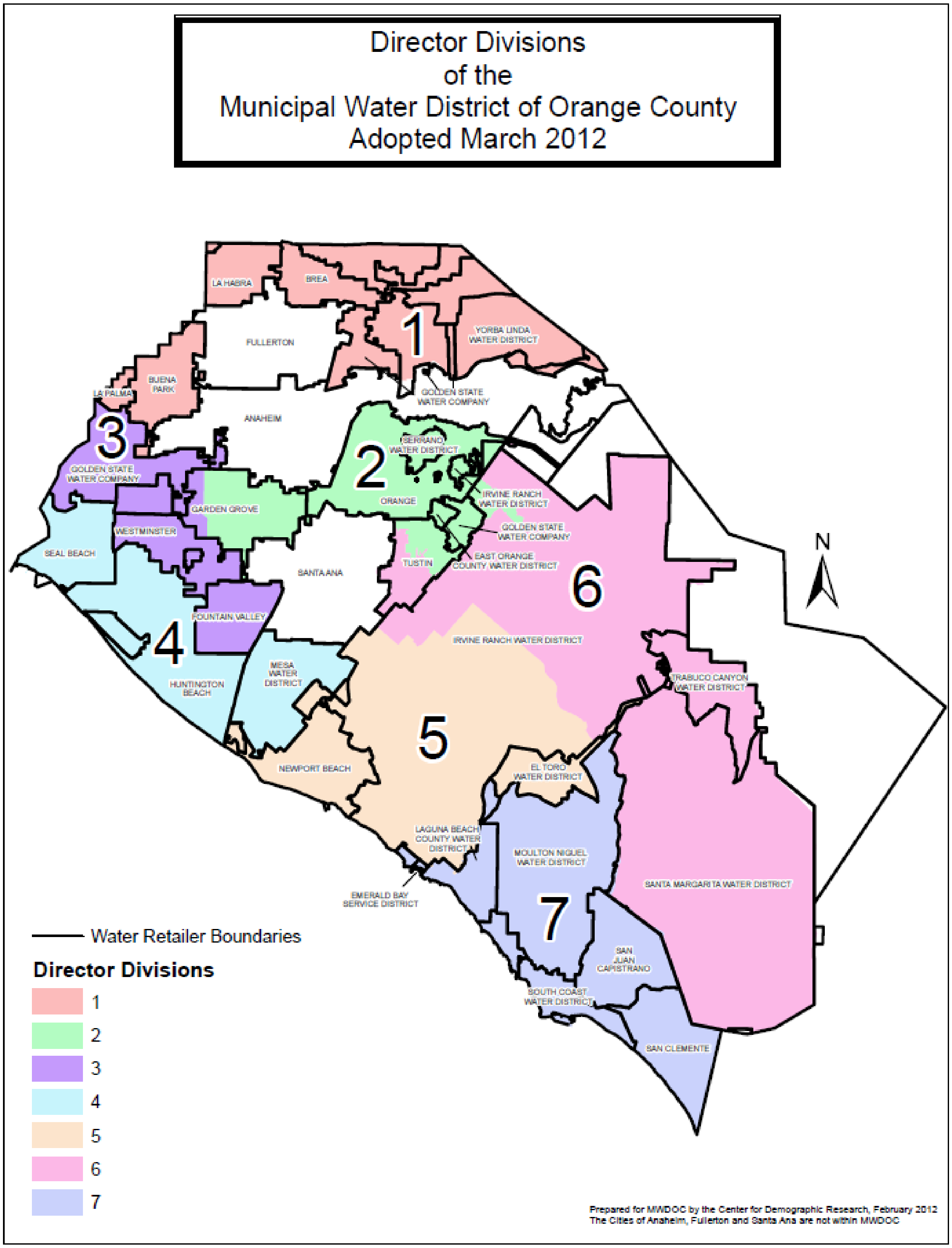


Figure 1-1: MWDOC Board of Directors Map, by Director Division

1.2.4 Goals and Objectives

MWDOC's Mission Statement is "*To provide reliable, high-quality supplies from Metropolitan Water District of Southern California and other sources to meet present and future needs, at an equitable and economical cost, and to promote water use efficiency for all of Orange County."*

MWDOC’s related water management goals and objectives are to

- Represent the interests of the public within its jurisdiction;
- Appoint its representative directors to the Board of Metropolitan;
- Inform its directors and its retail agencies about Metropolitan issues;
- Guide Metropolitan in its planning efforts and act as a resource of information and advocate for our retail agencies;
- Purchase water from Metropolitan and represent the interest of our service area at Metropolitan;
- Work together with Orange County water agencies and others to focus on solutions and priorities for improving Orange County's future water supply reliability;
- Cooperate with and assist OCWD and other agencies in coordinating the balanced use of the area's imported and native surface and groundwater;
- Plan and manage the allocation of imported water to its retail agencies during periods of shortage;
- Coordinate and facilitate the resolution of water issues and development of joint water projects among its retail agencies;
- Represent the public and assist its retail agencies in dealing with other governmental entities at the local, regional, state, and federal levels on water-related issues; and
- Inform its retail agencies and inform and educate the general public on matters affecting present and future water use and supply.

As a regional wholesaler, MWDOC has roles that are broadly applicable to all of its retail agencies. A key goal of MWDOC is to provide broad reaching services and programs that the retail agencies cannot reasonably provide as single entities.

MWDOC works with other agencies to promote efficient use of Orange County's water supply. As previously stated, MWDOC is a signatory to the MOU monitored by the California Urban Water Conservation Council (CUWCC), which outlines 14 Best Management Practices (BMP) for urban water use efficiency. The urban water use efficiency practices are intended to reduce long-term urban demands from what they would have been without implementation of these practices, and are in addition to programs that may be instituted during occasional water supply shortages.

For more than 30 years, MWDOC's Public Information and Water Education programs have reached thousands of consumers and nearly 90,000 Orange County students annually. The programs are performed on behalf of, and in coordination with, MWDOC’s retail agencies and are designed to facilitate a student’s understanding of current water issues as well as the challenges, opportunities, and costs involved in securing a reliable supply of high quality water.

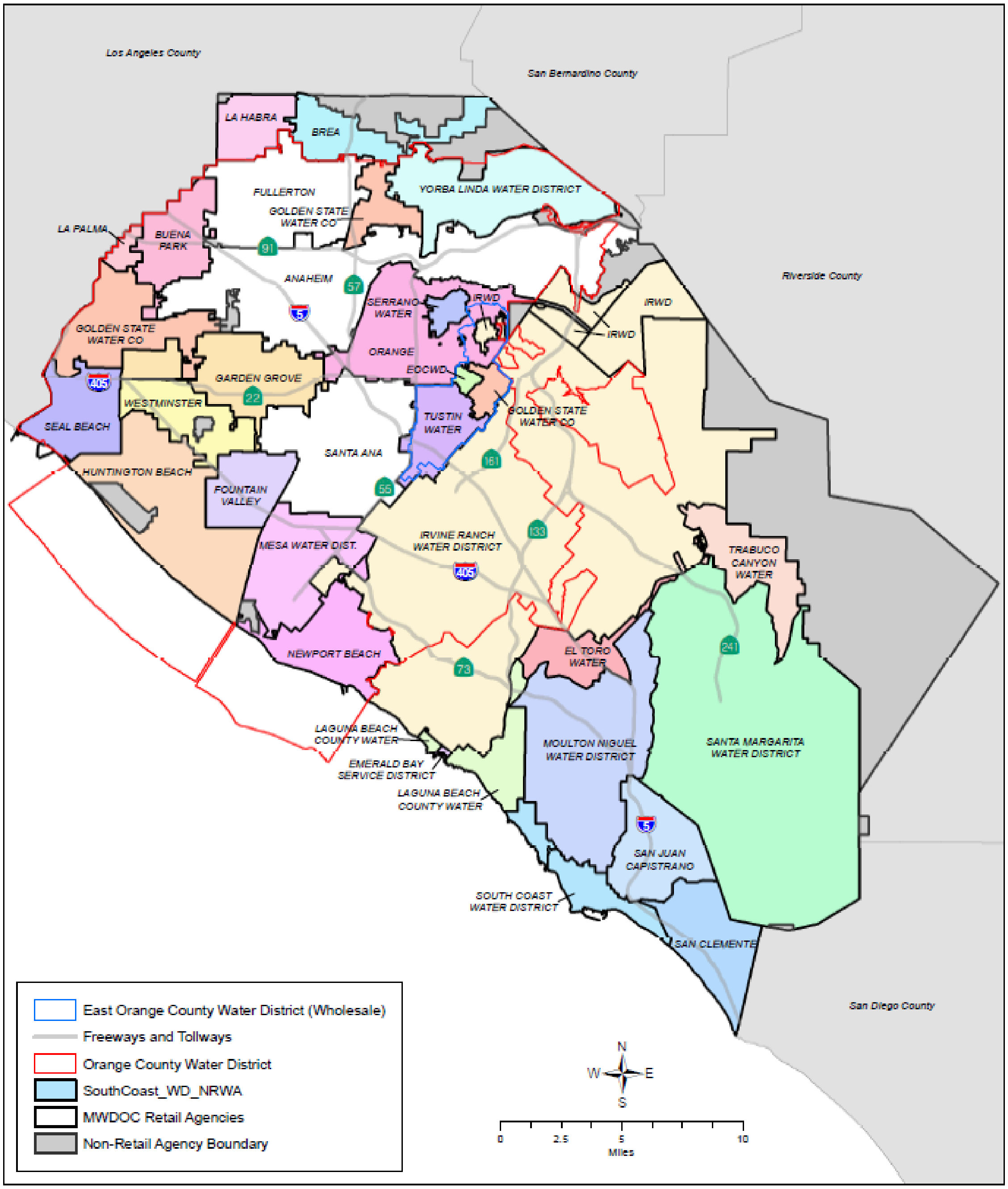
In 2004, MWDOC formed a partnership with the Discovery Science Center to bring the School Education Program to more elementary students and provide them with even greater educational experiences in the areas of water and science. In addition, earlier this year MWDOC formed partnership with the Orange County Department of Education – Inside the Outdoor to reach High School Students in conjunction with the Ecology Center out of San Juan Capistrano.

1.3 Service Area

MWDOC is a regional water wholesaler and resource planning agency, managing all of Orange County's imported water supply with the exception of water imported to the cities of Anaheim, Fullerton, and Santa Ana. MWDOC serves more than 2.3 million residents in a 600-square-mile service area (see Figure 1-2 below). It is committed to ensuring water reliability for the communities it serves. To that end, MWDOC focuses on sound planning and appropriate investments in water supply, water use efficiency, regional delivery infrastructure, and emergency preparedness.

MWDOC serves imported water in Orange County to 28 retail water agencies. MWDOC has informed these water suppliers of its available supplies in accordance with CWC 10631. These entities, comprised of cities and water districts, are referred to as MWDOC retail agencies and provide water to approximately 2.3 million customers. MWDOC retail agencies include:

- City of Brea
- City of Buena Park
- City of Fountain Valley
- City of Garden Grove
- City of Huntington Beach
- City of La Habra
- City of La Palma
- City of Newport Beach
- City of Orange
- City of San Clemente
- City of San Juan Capistrano
- City of Seal Beach
- City of Tustin
- City of Westminster
- East Orange County Water District (EOCWD)
- El Toro Water District (ETWD)
- Emerald Bay Services District (EBSD)
- Irvine Ranch Water District (IRWD)
- Golden State Water Company (GSWC)
- Laguna Beach County Water District (LBCWD)
- Mesa Water District (Mesa Water)
- Moulton Niguel Water District (MNWD)
- Orange County Water District (OCWD)
- Santa Margarita Water District (SMWD)
- Serrano Water District (Serrano)
- South Coast Water District (SCWD)
- Trabuco Canyon Water District (TCWD)
- Yorba Linda Water District (YLWD)



MWDOC Service Area
and Member Agencies

Prepared by the Center for Demographic Research, 2015
Portions of this map are copyrighted, and reproduced with permission from TomTom USA.

Figure 1-2: Regional Location of Urban Water Supplier

Orange County relies on numerous sources of water and water purveyors to meet the needs of its growing population, with sources including imported water, groundwater, surface water, and recycled water.

Imported water provided by Metropolitan from Northern California and the Colorado River meet approximately half of the County's water needs. However, this dependence of 50 percent imported water does not apply evenly over the entire service area. South Orange County relies on imported water to meet approximately 95 percent of its water demand. The remaining five percent is provided by surface water, limited groundwater, and water recycling. North Orange County relies roughly 30 percent on imported water, as a result of their ability to rely on the Orange County Groundwater Basin to meet a majority of their demands.

OCWD manages the Orange County Groundwater basin. The groundwater basin, which underlies north and central Orange County, provides approximately 62 percent of the water needed in that area; with imported water meeting the remaining balance of the water demand. Groundwater is pumped by producers before being delivered to customers.

Figure 1-3 illustrates the water service organization in the MWDOC service area.

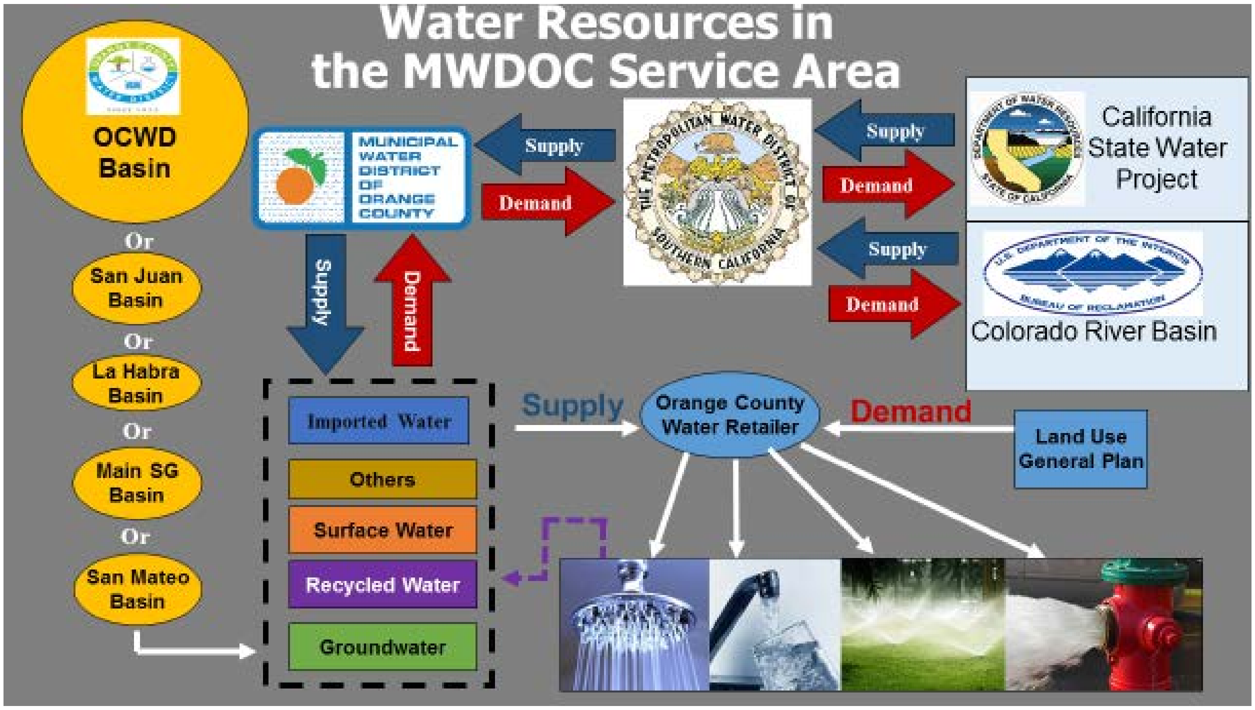


Figure 1-3: Water Service Organization in MWDOC's Service Area

2 WATER DEMAND

2.1 Overview

One of the main objectives of this UWMP is to provide an insight into MWDOC's future water demands. This section describes MWDOC's service area's current and future water demands, factors that influence demands, and the methodology used to forecast of future water demands over the next 25 years. In addition, to satisfy SBx7-7 requirements for the Regional Alliance, this section provides details of the SBx7-7 compliance method selection, baseline water use calculation, and 2015 and 2020 water use targets carried out by MWDOC.

Similar to all of California, MWDOC's urban water demands has been largely shaped by Governor's Emergency Conservation Regulations. This is the result of one of the most severe droughts in California's history, requiring a collective reduction in statewide urban water use of 25 percent by February 2016, with each agency in the state given a specific reduction target by the California State Water Resources Control Board (SWRCB). In response to the Governor's mandate, MWDOC's retail agencies carried out aggressive outreach efforts and implemented higher (more restrictive) stages of their water conservation ordinance. Based on these emergency regulations, water demand is projected to decrease as much as 75,000 AF for FY 2015-16 for the MWDOC's service area.

As shown below, MWDOC's service area's municipal and industrial (M&I) water use for the FY 2014-15 totaled 432,276 AF. This is roughly the same amount of water used 25 years ago (1990-91); all the while the service area's population has grown 32 percent since 1990 as shown on Figure 2-1.

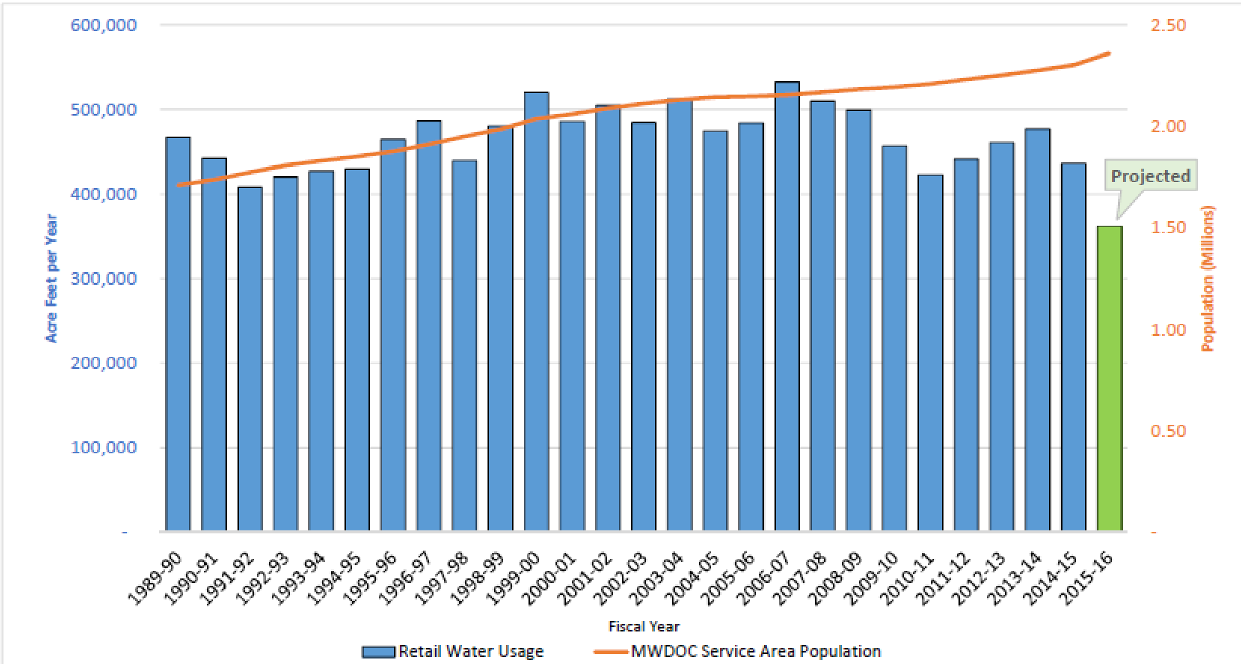


Figure 2-1: MWDOC's Service Area Historical Water Demand and Population

2.2 Factors Affecting Demand

Water demands within MWDOC's service area are dependent on many factors such as local climate conditions, demographics, land use characteristics, and economic conditions. Below is a description of factors that influence water demand.

2.2.1 Climate Characteristics

MWDOC's service area is located within the South Coast Air Basin (SCAB) that encompasses all of Orange County, as well as the urban areas of Los Angeles, San Bernardino, and Riverside Counties. The SCAB climate is characterized by southern California's "Mediterranean" climate: a semi-arid environment with mild winters, warm summers and moderate rainfall.

Local rainfall and temperature greatly influence water usage in the service area. The biggest variation in annual water demand are due to changes in rainfall and temperature. In Orange County, the average daily temperatures range from 58 ˚F in December and January to 74 ˚F in August in a typical year. The average annual precipitation is 14 inches, although the region is subject to significant variations in annual precipitation. The average evapotranspiration (ET) is almost 50 inches per year which is four times the annual average rainfall. This translates to a high demand for landscape irrigation for homes, commercial properties, parks, and golf courses.

It should also be noted that Metropolitan's core water supplies from the SWP and the CRA are significantly influenced by climate conditions in northern California and the Colorado River Basin, respectively. Both regions have been suffering from multi-year drought conditions due to record low precipitation which directly impact water supplies to southern California.

2.2.2 Demographics

MWDOC serves a 2015 population of 2,302,578 according to the California State University at Fullerton's Center of Demographics Research (CDR). MWDOC's population is representative of its 28 retail agencies. The population is projected to increase 10 percent by 2040, representing an average growth rate of just 0.4 percent per year.

Projected growth decreased slightly since the 2010 UWMP due to less than expected economic rebound. However, housing, in particular within the cities, is becoming denser with new multi-storied residential units. This is apparent in many of the cities located in the northern and central areas of MWDOC's service area. Whereas in South Orange County, the southern portion of MWDOC's service area, there still remains open land suitable for further development and growth. Table 2-1 shows the population projections in five-year increments out to 2040 within MWDOC's service area.

Table 2-1: Current and Projected MWDOC Service Area Population

Wholesale: Population - Current and Projected						
Population Served	2015	2020	2025	2030	2035	2040
	2,302,578	2,409,256	2,470,451	2,505,284	2,527,230	2,533,088
NOTES: Center for Demographic Research at California State University, Fullerton, 2015						

As shown below in Table 2-2, the number of Housing Units in the MWDOC service area is expected to increase by 11.7 percent in the next 25 years from 791,404 in 2015 to 883,864 in 2040. While the number of persons per household is projected to remain relatively flat, urban employment in the service area is expected to rise by 13.5 percent over the next 25 years.

Table 2-2: MWDOC Service Area Demographics

MWDOC Service Area Demographics						
Demographics	2015	2020	2025	2030	2035	2040
Occupied Housing Units	**791,404**	**814,115**	**836,907**	**849,545**	**862,183**	**883,864**
Single Family	525,735	538,990	547,622	551,054	560,304	569,960
Multi-Family	265,668	275,125	289,285	298,491	301,879	313,903
Persons per Household	**2.89**	**2.91**	**2.89**	**2.89**	**2.85**	**2.89**
Urban Employment	**1,150,840**	**1,174,471**	**1,207,065**	**1,230,646**	**1,259,511**	**1,305,817**
Source: Metropolitan 2015 UWMP						

2.3 Direct and Indirect Water Use

There are two types of water use in Orange County. “Direct use” is the consumption of water directly piped from treatment facilities or wells to homes, commercial, institutional, and industrial buildings, landscape, and agriculture. “Indirect use” is the use of water to replenish groundwater basins and to serve as a hydrologic barrier against seawater intrusion. Although this water is used to fill the groundwater basins or act as a seawater barrier it will eventually become a future source of supply for Orange County residents, thus an indirect use.

Integrating the two usages of water in the planning process can be confusing and misleading and does not necessarily reflect the actual level of consumptive water demand in the region. In practice, the two types of water usage are often shown separately. The following subsections will discuss these two types of uses separately.

2.3.1 Direct Use – Municipal/Industrial and Agricultural Demands

Direct water use in Orange County includes municipal, industrial, and agricultural use. It represents on average approximately 90 percent of MWDOC’s total demands. Demands for direct use are met through imported water (treated and untreated), groundwater, local surface water, and recycled water. M&I demands represent the full spectrum of water use within a region, including residential and commercial, industrial, institutional (CII), as well as un-metered uses (e.g. hydrant flushing, fire-fighting). Agricultural demands represent less than 1 percent of the total direct use. It has significantly decreased over the years due to development and urban growth within the service area.

Direct Use water demands total 432,276 AF in FY 2014-15, roughly 36,000 AF or 12 percent less than the 10-year average. This decrease was partly due to the recent statewide water conservation mandates imposed on retail agencies throughout the state (whereby mandatory restrictions started on June 2015). While MWDOC’s service area M&I demands are expected to rebound after the drought, conservation and public awareness will likely keep future demands increases relative low.

2.3.2 Indirect Use – Replenishment and Barrier Demands

Indirect water use in Orange County includes water to replenish groundwater basins and to serve as a barrier against seawater intrusion. It represents on average 10 percent of MWDOC’s total demands. Most, if not all of the indirect water use delivered is for managing and replenishing the Orange County Groundwater Basin. This water is purchased by the OCWD, a special district created by the state and governed by a ten-member Board of Directors to protect, manage, and replenish the Orange County Groundwater Basin with purchased imported water, storm water, and recycled water. OCWD further protects the groundwater basin from seawater intrusion through the injection of imported and recycled water along the coast, known as the Talbert Injection Barrier.

Since demands for replenishment of the groundwater basin storage and seawater barriers are driven by the availability of local supplies to OCWD, the demand forecast for this type of use is based on the projection of the following supplies under normal conditions:

- Santa Ana River Flows (Base flows & Storm flows);
- Incidental Recharge;

- Imported supplies from Metropolitan; and
- Recycled supplies for replenishment & seawater barrier use.

In addition to Replenishment and Barrier demands, MWDOC also provides imported water to meet the needs of surface water demands, such as those that occurs with respect to Irvine Lake. The water delivered to Irvine Lake is used for both consumptive and storage water purposes. Imported water delivered into Irvine Lake can be held for a short or long periods of time to be later delivered for consumptive use. On average, surface water supplies total 7,300 acre-feet per year (AFY) in Irvine Lake.

Figure 2-2 shows the historical demand of imported water for indirect consumption in MWDOC's service area.

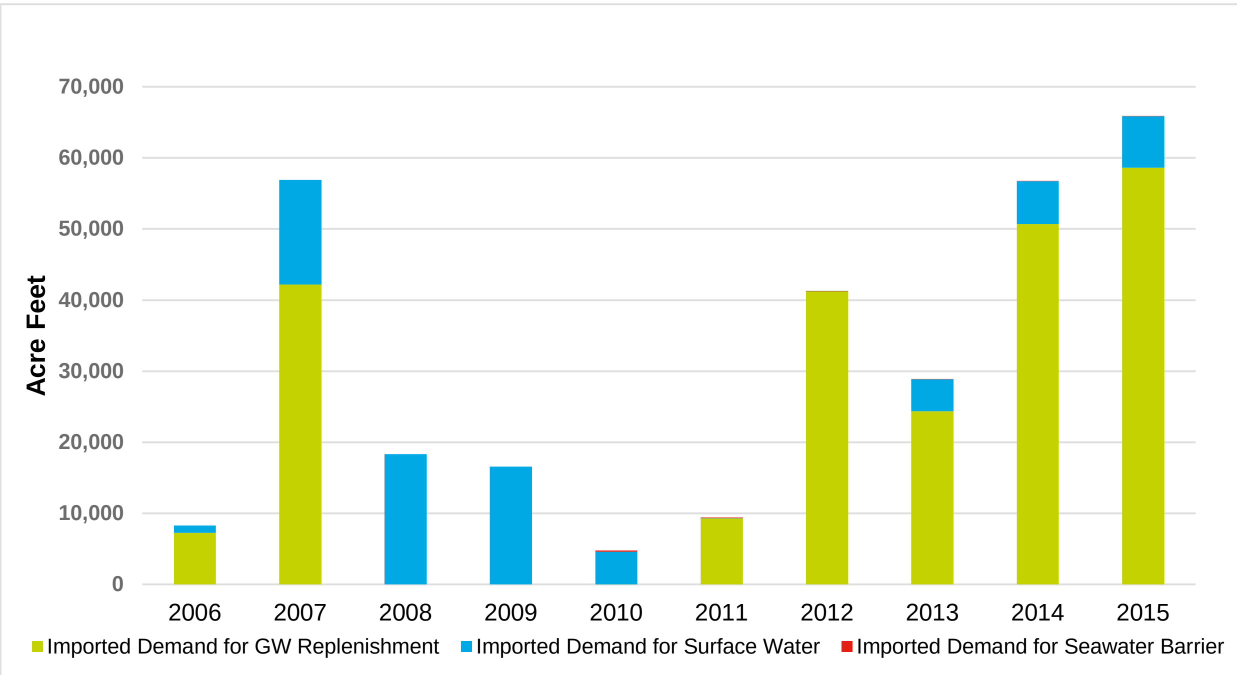


Figure 2-2: MWDOC's Historical Imported Water Demands for Indirect Consumption

2.4 MWDOC Demand Projections

MWDOC's service area total direct and indirect demands in FY 2014-2015 was 499,120 AF, which was met through a combination of 45 percent groundwater, 45 percent imported water, 2 percent surface water, and 8 percent recycled water. Under normal conditions, total direct and indirect water demands are projected to increase to 515,425 AF by the year 2040 or 3.27 percent over the next 25 years. This demand projection comes from MWDOC's Orange County (OC) Reliability Study that considered such factors as current and future demographics, future conservation measures, and ground & surface water needs. Below is a detail description of the methodology used to calculated MWDOC's demand projections.

2.4.1 Demand Projection Methodology

The water demand projections were an outcome of the OC Reliability Study led by MWDOC where demand projections were divided into three regions within Orange County: Brea/La Habra, Orange County Groundwater Basin, and South County. The demand projections were obtained based on multiplying a unit water use factor and a demographic factor for three water use sectors, including single-family and multi-family residential (in gallons per day per household), and non-residential (in gallons per day per employee). The unit water use factors were based on a survey of Orange County water agencies (FY 2013-14) and represent a normal weather, normal economy, and non-drought condition. Additionally, MWDOC worked with OCWD to determine groundwater replenishment and seawater barrier demands. MWDOC also worked with CDR at California State University of Fullerton to obtain projections on employment and economic growth in the MWDOC service area, which was taken into account when developing the demand projections.

Also included was the effects of water conservation on demand projections. Three demand trajectories were developed representing three levels of conservation: 1) continued with existing levels of conservation as of 2013-14 (lowest conservation), 2) addition of future passive measures and active measures (baseline conservation), and 3) aggressive turf removal program - 20 percent removal by 2040 (aggressive conservation). The second level of conservation, i.e. baseline demand projection, was selected for the 2015 UWMP. The baseline scenario assumes the implementation of future passive measures affecting new developments, including the Model Water Efficient Landscape, plumbing code efficiencies for toilets, and expected plumbing code for high-efficiency clothes washers. It also assumes the implementation of future active measures, assuming the implementation of Metropolitan incentive programs at historical annual levels seen in Orange County.

The OC Reliability Study also considered the drought impacts on demands by applying the assumption that water demands will bounce back to 85 percent of 2014 levels i.e. pre-drought levels by 2020 and 90 percent by 2025, and continue at 90 percent of unit water use through 2040. The unit water use factor multiplied by a demographic factor yields demand projections without new conservation beyond 2013-14. To account for new conservation, projected savings from new passive and active conservation were subtracted from these demands. Figure 2-3 shows MWDOC's historical and future demand forecast of direct demands. The figure below does not take in account indirect demands for groundwater and surface water supplies needs.

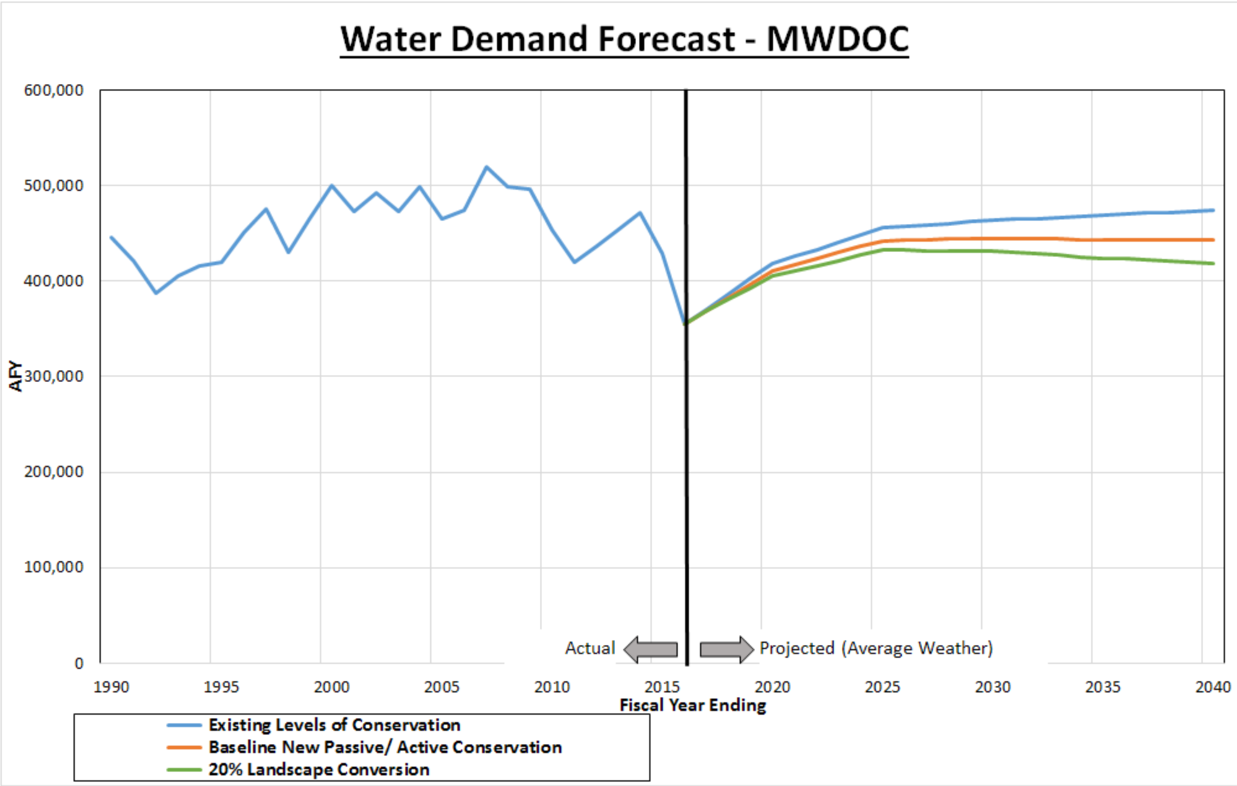


Figure 2-3: MWDOC Water Demand Forecast

Note: This does not include projected indirect water demands, such as groundwater and surface reservoir replenishment needs

2.4.2 25 Year Total Demand Projections

Based on the OC Reliability Study demand methodology, MWDOC's total water demands for the next 25 years are shown in Table 2-3.

Table 2-3: MWDOC Service Area Total Demands – Current and Projected (AF)

MWDOC Service Area Total Demands – Projected						
Water Source	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
OCWD Basin GW	202,403	196,035	207,383	208,510	208,438	208,665
Non-OCWD GW	20,036	27,297	27,477	27,477	27,477	27,477
Recycled	41,280	49,415	58,157	63,546	66,344	66,842
Surface Water	9,893	5,000	5,000	5,000	5,000	5,000
Imported Water (Retail M&I)	158,664	132,826	144,254	140,203	135,913	135,135
Total MWDOC Direct-Use Water Demand	**432,276**	**410,573**	**442,271**	**444,735**	**443,171**	**443,119**
Imported Demand for Surface Water	8,227	7,306	7,306	7,306	7,306	7,306
Imported Demand for GW Replenishment	58,617	65,000	65,000	65,000	65,000	65,000
Total MWDOC Indirect-Use Water Demand	**66,844**	**72,306**	**72,306**	**72,306**	**72,306**	**72,306**
Total MWDOC Water Demand	**499,120**	**482,879**	**514,577**	**517,041**	**515,477**	**515,425**

The demand data presented in this section accounts for additional future passive measures and active measures. Passive savings are water savings as a result of codes, standards, ordinances and public outreach on water conservation and higher efficiency fixtures. Active savings are water savings as a result of water conservation rebates, programs, and incentives.

As described in previous sections, MWDOC provides only imported water from Metropolitan to its service area. Table 2-4 below shows MWDOC's total projected demand of imported water.

Table 2-4: MWDOC's Total Imported Water Demands (AF)

MWDOC's Total Imported Water Demands						
	2015	2020	2025	2030	2035	2040
M&I Water Demands	158,664	132,826	144,254	140,203	135,913	135,135
Groundwater Replenishment and Surface Water Demands	66,844	72,306	72,306	72,306	72,306	72,306
Recycled Water	0	0	0	0	0	0
TOTAL MWDOC IMPORTED WATER DEMAND	**225,508**	**205,132**	**216,560**	**212,509**	**208,219**	**207,441**
NOTES: Includes M&I demands to be met via imported supplies as well as GW replenishment and surface water demands						

2.5 SBx7-7 Requirements

The Water Conservation Act of 2009, also known as SBx7-7, signed into law on February 3, 2010, requires the State of California to reduce urban water use by 20 percent by the year 2020. To achieve this each retail urban water supplier must determine baseline water use during their baseline period and target water use for the years 2015 and 2020 to meet the state's water reduction goal. Retail water suppliers are required to comply with SBx7-7 individually or as a region in collaboration with other retail water suppliers, or demonstrate they have a plan or have secured funding to be in compliance, in order to be eligible for water related state grants and loans on or after July 16, 2016.

As a wholesale water supplier, MWDOC is not required to establish a baseline or set targets for daily per capita water use. However, it is required to provide an assessment of its present and proposed future measures, programs and policies that will help its retail water suppliers achieve their SBx7-7 water use reduction targets. One of the ways MWDOC is assisting its retail agencies is by leading the coordination of Orange County Regional Alliance for all of the retail agencies in Orange County. MWDOC's role is to assist each retail water supplier in Orange County in analyzing the requirements and establishing their baseline and target water use, as guided by DWR (DWR, Technical Methodologies, February 2011[1]).

The following sections describe the efforts by MWDOC to assist retail agencies in complying with the requirements of SBx7-7, including the formation of a Regional Alliance to provide additional flexibility to all water suppliers in Orange County. This section also includes the documentation of calculations that allow retail water suppliers to use recycled water for groundwater recharge (indirect reuse) to offset a portion of their potable demand when meeting the regional as well as individual water use targets for compliance purposes. A discussion of programs implemented to support retail agencies in achieving their per capita water reduction goals is covered in Section 4 – Demand Management Measures of this UWMP.

2.5.1 Orange County 20x2020 Regional Alliance

MWDOC in collaboration with all of its retail agencies as well as the Cities of Anaheim, Fullerton, and Santa Ana, has created the Orange County 20x2020 Regional Alliance in an effort to create flexibility in meeting the daily per capita water use targets. This Regional Alliance allows all of Orange County to benefit from regional investments, such as the Groundwater Replenishment System (GWRS), recycled water, and water conservation programs. The members of the Orange County 20x2020 Regional Alliance are shown in Table 2-5.

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[1] An *Updated Methodologies for Calculating Baseline and Compliance Urban Per Capita Water Use* document is pending DWR management approval and is expected in April 2016.

Table 2-5: Members of Orange County 20x2020 Regional Alliance

Orange County 20x2020 Regional Alliance	
Anaheim	Moulton Niguel Water District
Brea	Newport Beach
Buena Park	Orange
East Orange County Water District	San Clemente
El Toro WD	San Juan Capistrano
Fountain Valley	Santa Ana
Fullerton	Santa Margarita Water District
Garden Grove	Seal Beach
Golden State Water Company	Serrano Water District
Huntington Beach	South Coast Water District
Irvine Ranch Water District	Trabuco Canyon Water District
La Habra	Tustin
La Palma	Westminster
Laguna Beach County Water District	Yorba Linda Water District
Mesa Water District	

Within a Regional Alliance, each retail water supplier will have an additional opportunity to achieve compliance under either an individual target or a regional water use target.

- If the Regional Alliance meets its water use target on a regional basis, all agencies in the alliance are deemed compliant.
- If the Regional Alliance fails to meet its water use target, each individual supplier will have an opportunity to meet their water use targets individually.

Individual water suppliers in the Orange County 20x2020 Regional Alliance will state their participation in the alliance, and include the regional 2015 and 2020 water use targets in their individual UWMPs.

As the reporting agency for the Orange County 20x2020 Regional Alliance, MWDOC has documented the calculations for the regional urban water use reduction targets. MWDOC will also provide annual monitoring and reporting for the region on progress toward the regional per capita water use reduction targets.

2.5.2 Water Use Target Calculations

To preserve maximum flexibility in the Orange County 20x2020 Regional Alliance, each water supplier in the Regional Alliance first calculates its individual target in its retail UWMP as if it were complying individually. Then, the individual targets are weighted by each supplier's population and averaged over all members in the alliance to determine the regional water use target.

2.5.2.1 Retail Agency Compliance Targets

As described above, the first step in calculating a regional water use target is to determine each water supplier's individual target. DWR has established four target options for urban retail water suppliers to choose from in calculating their water use reduction targets under SBx7-7. The four options are as follows:

- *Option 1* requires a simple 20 percent reduction from the baseline by 2020 and 10 percent by 2015.
- *Option 2* employs a budget-based approach by requiring an agency to achieve a performance standard based on three metrics
  - Residential indoor water use of 55 gallons per capita per day (GPCD)
  - Landscape water use commensurate with the Model Landscape Ordinance
  - 10 percent reduction in baseline CII water use
- *Option 3* is to achieve 95 percent of the applicable state hydrologic region target as set forth in the State's 20x2020 Water Conservation Plan.
- *Option 4* requires the subtraction of Total Savings from the baseline GPCD:
  - Total savings includes indoor residential savings, meter savings, CII savings, and landscape and water loss savings.

MWDOC has analyzed each of these options, and has worked with all retail agencies in Orange County to assist them in selecting the most suitable option in 2010 and 2015. In 2015, retail water agencies may update their 2020 water use target using a different target method than was used in 2010. However, the target method is not permitted to change after the 2015 UWMP is submitted.

2.5.2.2 Regional Targets Calculation and 2015 Compliance

The regional water use targets for the Orange County 20x2020 Regional Alliance are calculated by weighting the individual retail agency water use targets by population and averaging them over all members of the alliance. The calculation of the baseline water use and water use targets in the 2010 UWMP was based on the 2000 U.S. Census population numbers obtained from CDR. In 2015, the baseline water use and water use targets for all retail agencies have been revised using population numbers based on the 2010 U.S. Census obtained from CDR in 2012.

The regional alliance target calculation is provided below in Table 2-5. Column (1) shows the 2015 population for each individual supplier. The individual targets, including appropriate deductions for recycled water, for each supplier is provided in column (2) for the interim 2015 targets, and column (4) for the final 2020 targets.

To calculate the weighted averages for each retail water supplier, the population is multiplied by the individual targets to get a weighted total for each individual supplier. This is found in column (3) for the interim 2015 targets and in column (5) for the final 2020 targets. The regional targets for the Orange County 20x2020 Regional Alliance are then derived as the sum of the individual weighted averages divided by the total population for a regional alliance.

For example, the 2020 water use target for the City of Brea is 221 GPCD, and the 2015 population is 43,093. By multiplying this 2020 target by the population, the result is a weighted average of 9,513,018. The sum of the weighted averages for all members of the Orange County 20x2020 Regional Alliance is 479,137,952. By dividing this weighted total by the regional population of 3,138,846, the resulting regional 2020 water use target is 158 GPCD.

The source of the information in Table 2-6, including the population figures, is from within the individual 2015 UWMPs for each water supplier in the Orange County 20x2020 Regional Alliance.

Table 2-6: Calculation of Regional Urban Water Use Targets for Orange County 20x2020 Regional Alliance

Calculation of Regional Compliance Daily Per Capita Water Use					
Orange County 20x2020 Regional Alliance	**(1) 2015 Population**	**(2) Individual Targets 2015[A,B]**	**(3) Weighted Total 2015**	**(4) Individual Targets 2020[A,C]**	**(5) Weighted Total 2020**
Brea	43,093	248	10,702,145	221	9,513,018
Buena Park	82,791	178	14,740,224	158	13,102,421
East Orange CWD RZ	3,257	261	851,540	232	756,925
El Toro WD	48,797	183	8,945,341	163	7,951,415
Fountain Valley	57,908	157	9,071,479	142	8,196,877
Garden Grove	176,649	152	26,919,945	142	25,004,666
Golden State WC	169,573	157	26,623,806	142	24,003,058
Huntington Beach	198,429	151	30,034,368	142	28,087,625
Irvine Ranch WD	379,510	192	72,746,132	170	64,663,229
La Habra	61,843	151	9,342,976	150	9,292,066
La Palma	16,030	149	2,387,516	140	2,243,890
Laguna Beach CWD	20,311	183	3,722,297	163	3,308,708
Mesa Water	107,588	163	17,496,928	145	15,552,825
Moulton Niguel WD	170,326	194	33,086,891	173	29,410,570
Newport Beach	65,777	228	14,987,798	203	13,322,487
Orange	138,987	203	28,226,005	181	25,089,782
San Clemente	51,385	172	8,835,311	153	7,853,609
San Juan Capistrano	38,829	206	8,006,483	183	7,116,874
Santa Margarita WD	156,949	190	29,779,903	169	26,471,025
Seal Beach	23,706	149	3,526,804	142	3,355,584
Serrano WD	6,464	434	2,804,135	386	2,492,565
South Coast WD	35,004	169	5,918,683	150	5,261,051
Trabuco Canyon WD	12,712	233	2,965,219	200	2,539,757
Tustin	68,088	170	11,581,691	151	10,294,836
Westminster	93,785	137	12,817,421	130	12,195,988
Yorba Linda WD	74,787	266	19,911,283	237	17,698,918
Anaheim	360,142	183	65,767,509	162	58,460,008
Fullerton	140,827	201	28,284,657	179	25,141,917
Santa Ana	335,299	123	41,165,687	116	38,756,257
Regional Alliance Total	3,138,846	**176**	551,250,176	**158**	497,137,952

[A] Targets were calculated using the first option for calculating regional compliance from page 53 of the Methodologies for Calculating Baseline and Compliance Urban Per Capita Water Use, dated October 1, 2010.
[B] The targets listed in column (2) are the actual GPCDs achieved in 2015, including any recycled water credit.
[C] The targets listed in column (3) are the GPCD goals for 2020, including any recycled water credit.

Table 2-7 provides the regional urban water use targets for the Orange County 20x2020 Regional Alliance – the 2015 target is 176 GPCD and the 2020 target is 158 GPCD. The actual 2015 GPCD achieved by the regional alliance is 125 GPCD indicating that not only has the region met its 2015 target but it has already well below its 2020 water use target. This is indicative of the collective efforts of MWDOC and retail agencies in reducing water use in the region. Note, the target and actual GPCD values listed include appropriate deductions for recycled water used for indirect potable reuse as detailed below.

Table 2-7: Urban Water Use Targets for Orange County 20x2020 Regional Alliance

	2015 GPCD[1]	2020 Target[2]
Orange County 20X2020 Regional Alliance	125	158

[1] Actual GPCD achieved in 2015
[2] GPCD Target to achieve by the year 2020

2.5.2.3 Deducting Recycled Water Used for Indirect Potable Reuse

SBx7-7 allows urban retail water suppliers to calculate a deduction for recycled water entering their distribution system indirectly through a groundwater source. Individual water suppliers within the Orange County Groundwater Basin have the option of choosing this deduction to account for the recharge of recycled water into the Orange County Groundwater Basin by OCWD, historically through Water Factory 21, and more recently by GWRS. These deductions also benefit all members of the Orange County 20x2020 Regional Alliance.

MWDOC has provided the documentation for the calculations of this deduction to assist retail water suppliers if they choose to include recycled water for indirect potable reuse in their individual targets. This calculation is applied as a deduction from the water supplier’s calculation of Gross Water Use.

Table 2-8 provides the calculation to deduct recycled water for indirect potable reuse for Orange County Groundwater Basin Agencies. Because year-to-year variations can occur in the amount of recycled water applied in a groundwater recharge operation, a previous five-year average of recharge is used, as found in column (1). To account for losses during recharge and recovery, a factor of 96.5 percent is applied in column (2).

After accounting for these losses, the estimated volume of recycled water entering the distribution system is calculated in column (3).

In column (4), the annual deduction for recycled water for indirect potable reuse is expressed as a percentage of the total volume of water extracted from the Orange County Groundwater Basin in that year. This is the annual percentage of total OCWD basin production that is eligible for a deduction. For individual water suppliers in the OCWD Basin, the annual deduction is calculated as their basin pumping in a given year multiplied by the value in column (4).

For example, if Agency A pumped 10,000 AF of water from the OCWD Basin in Fiscal Year 2004-05, then 1.47 percent of that total production would be deducted from the agency’s calculation of Gross Water Use for that year as found in column (4). This equates to a deduction of 147 AF.

Table 2-8: Calculation of Annual Deductible Volume of Indirect Recycled Water Entering Distribution System

Deduct Recycled Water Used for Indirect Potable Reuse [1]						
Fiscal Year Ending	Total Groundwater Recharge	(1) 5-Year Average Recharge (Acre-Feet)	(2) Loss Factor for Recharge & Recovery	(1) x (2) = (3) Volume Entering Distribution System (Acre-Feet)	Total Basin Production	(4) Percent of Total Basin Production
1990	6,498	6,498	96.5%	6,271	229,878	2.73%
1991	6,634	6,498	96.5%	6,271	235,532	2.66%
1992	6,843	6,566	96.5%	6,336	244,333	2.59%
1993	8,161	6,658	96.5%	6,425	243,629	2.64%
1994	5,042	7,034	96.5%	6,788	237,837	2.85%
1995	2,738	6,636	96.5%	6,403	276,096	2.32%
1996	4,282	5,884	96.5%	5,678	302,273	1.88%
1997	4,389	5,413	96.5%	5,224	310,217	1.68%
1998	2,496	4,922	96.5%	4,750	297,726	1.60%
1999	3,489	3,789	96.5%	3,657	322,476	1.13%
2000	5,774	3,479	96.5%	3,357	320,250	1.05%
2001	2,067	4,086	96.5%	3,943	323,129	1.22%
2002	4,143	3,643	96.5%	3,515	322,590	1.09%
2003	3,867	3,594	96.5%	3,468	274,927	1.26%
2004	1,784	3,868	96.5%	3,733	272,954	1.37%
2005	4,156	3,527	96.5%	3,404	232,199	1.47%
2006	4,086	3,203	96.5%	3,091	215,172	1.44%
2007	218	3,607	96.5%	3,481	284,706	1.22%
2008	17,792	2,822	96.5%	2,723	351,622	0.77%
2009	54,261	5,607	96.5%	5,411	310,586	1.74%
2010	65,950	16,103	96.5%	15,539	273,889	5.67%
2011	66,083	28,461	96.5%	27,465	248,659	11.05%
2012	71,678	40,861	96.5%	39,431	266,066	14.82%
2013	72,877	55,153	96.5%	53,223	298,175	17.85%
2014	66,167	66,170	96.5%	63,854	318,967	20.02%
2015	76,546	68,551	96.5%	66,152	296,292	22.33%
2016						
2017						
2018						
2019						
2020						

[1] Indirect is recycled water for groundwater recharge through spreading and injection of GWRS and Water Factory 21. The yearly totals are apportioned among the OCWD Basin agencies on the basis of groundwater production over a five year rolling average.

[2] Loss factor provided by OCWD, includes loss over county lines to LA Basin.

The deductible amount of indirect recycled water increased fourfold from 2010 to approximately 66,000 AF in 2015 as a result of the full production from GWRS. OCWD has additional expansion plans for GWRS, which are expected to further increase the deductible amount of indirect recycled water up to approximately 98,400 AF.

3 WATER SOURCES AND SUPPLY RELIABILITY

3.1 Overview

Water supplies within the MWDOC's service area are from local and imported sources. MWDOC delivers water, purchased from Metropolitan, to its retail agencies in order to supplement their local supplies. In FY 2014-15, MWDOC supplied approximately 158,664 AFY of imported water to its retail agencies for M&I purposes and 66,844 AFY for groundwater replenishment and surface water purposes. Imported water represents approximately 35 percent of total water supply in the MWDOC service area. Sources of Metropolitan's imported water include the CRA and SWP.

Local supplies developed by individual retail agencies, primarily groundwater, presently account for approximately 65 percent of the service area's water supplies. Local supplies include groundwater, recycled water, and surface water. The primary groundwater basin, Orange County Groundwater Basin is located in the northern portion of MWDOC's service area.

Figure 3-1 shows a breakdown of all sources within MWDOC's service area. Although MWDOC only delivers imported water to its retail agencies, other sources of water are obtained locally and are specific to each retail agency. Note that GWRS supplies are included as part of groundwater pumping numbers.

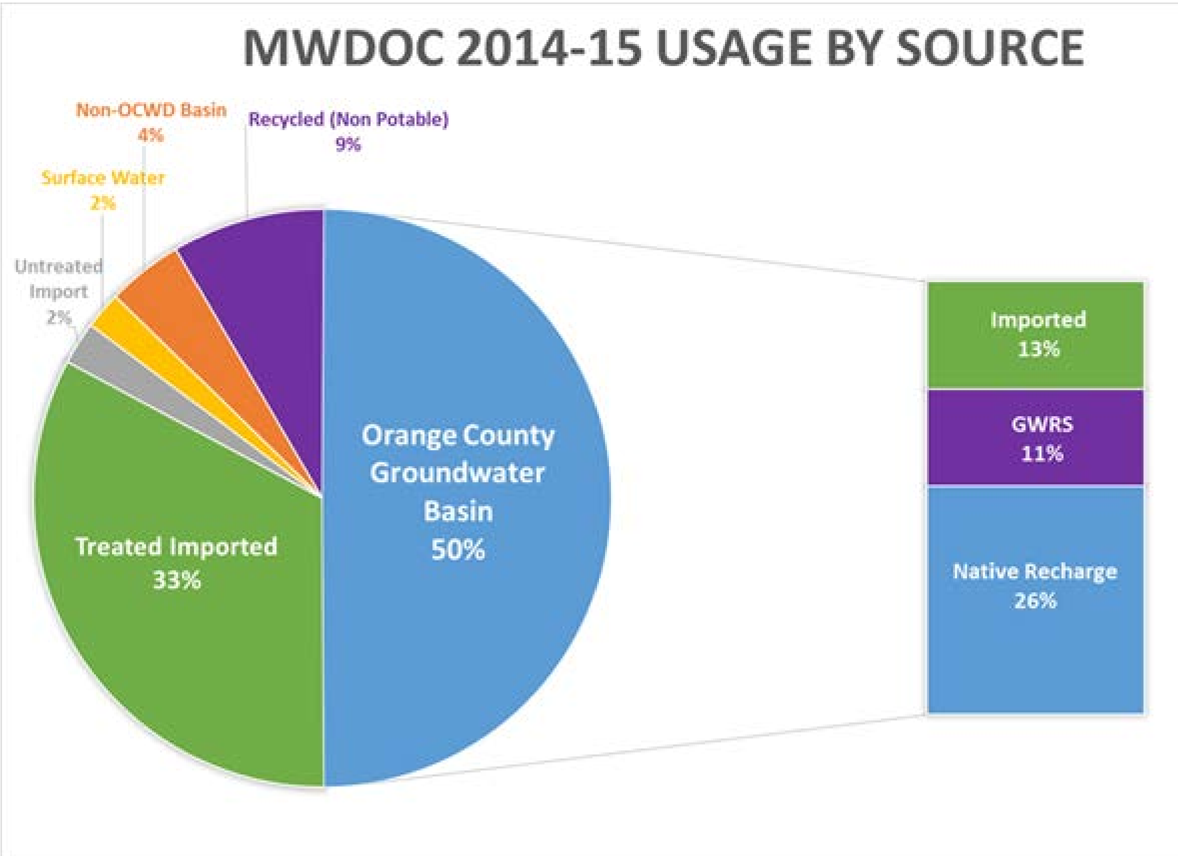

Figure 3-1: Water Supply Sources within MWDOC's Service Area

MWDOC and its retail agencies collectively work together to improve the water reliability within the service area by developing additional local supplies and by implementing water use efficiency efforts and by developing local projects. MWDOC works in collaboration with two primary agencies – Metropolitan and OCWD to insure a safe and high quality water supply.

Figure 3-2 provides a summary illustrating the different water sources in MWDOC's service area and for all of Orange County:

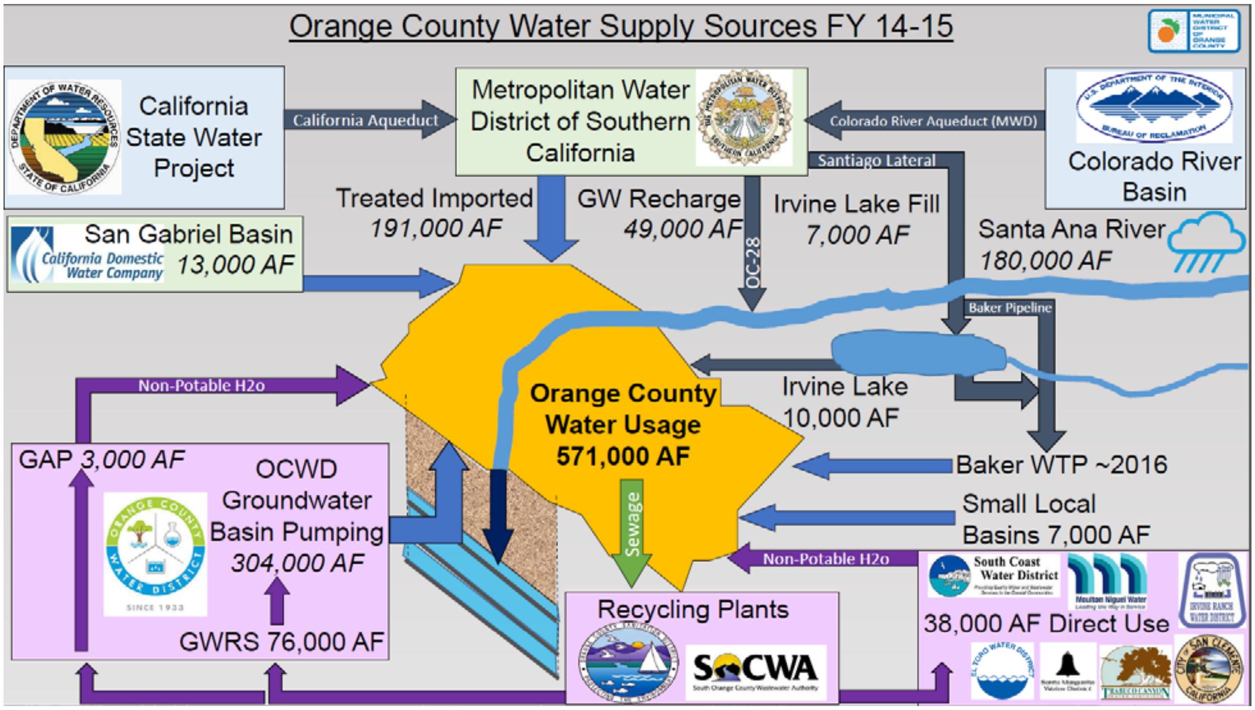

Figure 3-2: Orange County Water Supply Sources

The following sections provide a detailed discussion of MWDOC's water source portfolio as well as projections for the next 25 years. In addition, this section will evaluate MWDOC's projected supply and demand under various hydrological conditions to determine its supply reliability during a 25 year planning horizon.

3.2 Metropolitan Water District of Southern California

Metropolitan is the largest water wholesaler for domestic and municipal uses in California, serving approximately 21.9 million customers. Metropolitan wholesales imported water supplies to 26 member cities and water districts in six southern California counties. Its service area covers the southern California coastal plain, extending approximately 200 miles along the Pacific Ocean from the City of Oxnard in the north to the international boundary with Mexico in the south. This encompasses 5,200 square miles and includes portions of Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura counties. Approximately 85 percent of the population from the aforementioned counties reside within Metropolitan's boundaries.

Metropolitan is governed by a Board of Directors comprised of 38 appointed individuals with a minimum of one representative from each of Metropolitan's 26 member agencies. The allocation of directors and voting rights are determined by each agency's assessed valuation. Each member of the Board shall be entitled to cast one vote for each ten million dollars ($10,000,000) of assessed valuation of property taxable for district purposes, in accordance with Section 55 of the Metropolitan Water District Act (Metropolitan Act). Directors can be appointed through the chief executive officer of the member agency or by a majority vote of the governing board of the agency. Directors are not compensated by Metropolitan for their service.

Metropolitan is responsible for importing water into the region through its operation of the CRA and its contract with the State of California for SWP supplies. Major imported water aqueducts bringing water to southern California are shown in Figure 3-3. Member agencies receive water from Metropolitan through various delivery points and pay for service through a rate structure made up of volumetric rates, capacity charges and readiness to serve charges. Member agencies provide estimates of imported water demand to Metropolitan annually in April regarding the amount of water they anticipate they will need to meet their demands for the next five years.

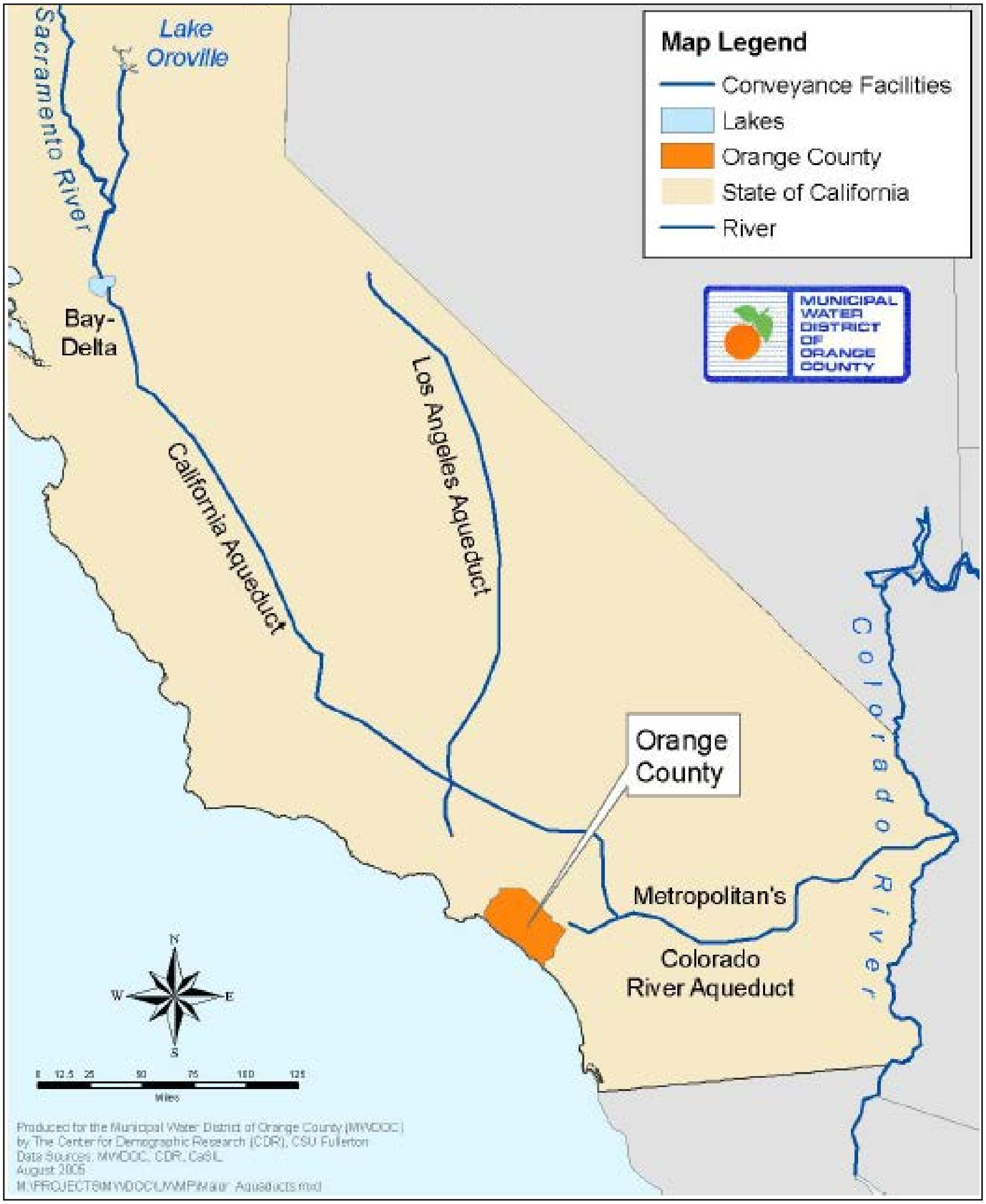

Figure 3-3: Major Aqueducts Bringing Water to Southern California

In Orange County, MWDOC and the cities of Anaheim, Fullerton, and Santa Ana are Metropolitan member agencies that purchase imported water directly from Metropolitan. Furthermore, MWDOC purchases both treated potable and untreated water from Metropolitan to supplement its retail agencies' local supplies. Figure 3-4 illustrates the Metropolitan feeders and major transmission pipelines that deliver water within Orange County.

Figure 3-4: Metropolitan Feeders and Transmission Mains Serving Orange County

3.2.1 Metropolitan's 2015 Urban Water Management Plan

Metropolitan's 2015 UWMP reports on its water reliability and identifies projected supplies to meet the long-term demand within its service area. The Metropolitan 2015 UWMP discusses the current water supply conditions and long-term plans for supply implementation and continued development of a diversified resource mix. It describes the programs being implemented such as: the CRA, SWP, and Central Valley storage/transfer programs, water use efficiency programs, local resource projects, and in-region storage that will enable the region to meet its water supply needs. Metropolitan's 2015 UWMP also presents Metropolitan's supply capacities from 2020 through 2040 for average year, single dry-year, and multiple dry-years as specified in the UWMP Act.

Information concerning Metropolitan's UWMP, including the background, associated challenges, and long-term development of programs for each of Metropolitan's supply sources and capacities have been summarized and included herein. Additional information on Metropolitan can be found directly in Metropolitan's 2015 UWMP,
http://mwdh2o.com/PDF_About_Your_Water/2.4.2_Regional_Urban_Water_Management_Plan.pdf

3.2.2 Colorado River Aqueduct

The Colorado River was Metropolitan's original source of water after Metropolitan's establishment in 1928. The CRA, which is owned and operated by Metropolitan, transports water from the Colorado River to its terminus at Lake Mathews in Riverside County. The actual amount of water per year that may be conveyed through the CRA to Metropolitan's member agencies is subject to the availability of Colorado River water for delivery, but is limited to no more than the hydraulic capacity of the aqueduct at about 1.20 million acre-feet (MAF).

The CRA includes supplies from the implementation of the Quantification Settlement Agreement and related agreements to transfer water from agricultural agencies to urban uses. The 2003 Quantification Settlement Agreement enabled California to implement major Colorado River water conservation and transfer programs, stabilizing water supplies for 75 years and reducing the state's demand on the river to its 4.4 MAF entitlement. Colorado River transactions are potentially available to supply additional water up to the CRA capacity of 1.20 MAF on an as-needed basis. Water from the Colorado River or its tributaries is available to users in California, Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming, as well as to Mexico. California is apportioned the use of 4.4 MAF of water from the Colorado River each year plus one-half of any surplus that may be available for use collectively in Arizona, California, and Nevada. In addition, California has historically been allowed to use Colorado River water apportioned to but not used by Arizona or Nevada. Metropolitan has a basic entitlement of 550,000 AFY of Colorado River water, plus surplus water up to an additional 662,000 AFY when the following conditions exists (Metropolitan, 2015 Draft UWMP, March 2016):

- Water unused by the California holders of priorities 1 through 3
- Water saved by the Palo Verde land management, crop rotation, and water supply program
- When the U.S. Secretary of the Interior makes available either one or both:
  - Surplus water is available
  - Colorado River water is apportioned to but unused by Arizona and/or Nevada

Unfortunately, Metropolitan has not received surplus water for a number of years. The Colorado River supply faces current and future imbalances between water supply and demand in the Colorado River Basin due to long term drought conditions. Over the past 16 years (2000-2015), there have only been three years when the Colorado River flow has been above average (Metropolitan, 2015 UWMP, June 2016). The long-term imbalance in future supply and demand on the Colorado River is projected to be approximately 3.2 MAF by the year 2060.

Approximately 40 million people rely on the Colorado River and its tributaries for water with 5.5 million acres of land using Colorado River water for irrigation. Climate change will also affect future supply and demand as increasing temperatures may increase evapotranspiration from vegetation along with an increase in water loss due to evaporation in reservoirs, therefore reducing the available amount of supply from the Colorado River and exacerbating imbalances between increasing demands from rapid growth and decreasing supplies.

Four water supply scenarios were developed around these uncertainties, each representing possible water supply conditions. These four scenarios are as follow:

- **Observed Resampled:** future hydrologic trends and variability are similar to the past approximately 100 years.
- **Paleo Resampled:** future hydrologic trends and variability are represented by reconstructions of streamflow for a much longer period in the past (approximately 1,250 years) that show expanded variability.
- **Paleo Conditioned:** future hydrologic trends and variability are represented by a blend of the wet-dry states of the longer paleo-reconstructed period.
- **Downscaled General Circulation Model (GCM) Projected:** future climate will continue to warm, with regional precipitation and temperature trends represented through an ensemble of future downscaled GCM projections.

The Colorado River Basin Water Supply and Demand Study (Study) assessed the historical water supply in the Basin through two historical streamflow data sets, from the year 1906 through 2007 and the paleo-reconstructed record from 762 through 2005. The following are findings from the study:

- Increased temperatures in both the Upper and Lower Colorado River Basins since the 1970s has been observed.
- Loss of springtime snowpack was observed with consistent results across the lower elevation northern latitudes of the western United States. The large loss of snow at lower elevations strongly suggest the cause is due to shifts in temperature.
- The deficit between the two year running average flow and the long-term mean annual flow that started in the year 2000 is more severe than any other deficit in the observed period, at nine years and 28 MAF deficit.
- There are deficits of greater severity from the longer paleo record compared to the period from 1906 through 2005. One deficit amounted to 35 MAF through a span of 16 years.

- A summary of the trends from the observed period suggest declining stream flows, increases in variability, and seasonal shifts in streamflow that may be related to shifts in temperature.

Findings concerning the future projected supply were obtained from the Downscaled GCM Projected scenario as the other methods did not consider the impacts of a changing climate beyond what has occurred historically. These findings include:

- Increased temperatures are projected across the Basin with larger changes in the Upper Basin than in the Lower Basin. Annual Basin-wide average temperature is projected to increase by 1.3 degrees Celsius over the period through 2040.
- Projected seasonal trends toward drying are significant in certain regions. A general trend towards drying is present in the Basin, although increases in precipitation are projected for some higher elevation and hydrologically productive regions. Consistent and expansive drying conditions are projected for the spring and summer months throughout the Basin, although some areas in the Lower Basin are projected to experience slight increases in precipitation, which is thought to be attributed to monsoonal influence in the region. Upper Basin precipitation is projected to increase in the fall and winter, and Lower Basin precipitation is projected to decrease.
- Snowpack is projected to decrease due to precipitation falling as rain rather than snow and warmer temperatures melting the snowpack earlier. Areas where precipitation does not change or increase is projected to have decreased snowpack in the fall and early winter. Substantial decreases in spring snowpack are projected to be widespread due to earlier melt or sublimation of snowpack.
- Runoff (both direct and base flow) is spatially diverse, but is generally projected to decrease, except in the northern Rockies. Runoff is projected to increase significantly in the higher elevation Upper Basin during winter but is projected to decrease during spring and summer.

The following future actions must be taken to implement solutions and help resolve the imbalance between water supply and demand in areas that use Colorado River water (U.S. Department of the Interior USBR, Colorado River Basin Water Supply and Demand Study, December 2012):

- Resolution of significant uncertainties related to water conservation, reuse, water banking, and weather modification concepts.
- Costs, permitting issues, and energy availability issues relating to large-capacity augmentation projects need to be identified and investigated.
- Opportunities to advance and improve the resolution of future climate projections should be pursued.
- Consideration should be given to projects, policies, and programs that provide a wide-range of benefits to water users and healthy rivers for all users.

3.2.2.1 Background on Colorado River Water Rights

Historically, Metropolitan's fifth priority rights under the Seven Party Agreement were satisfied with water allocated to Arizona and Nevada that these states did not use. Beginning in 1985, with the commencement of Colorado River water deliveries to the Central Arizona Project, year-to-year availability of Colorado River water to Metropolitan became uncertain. The Secretary of the Interior asserted that California's users of Colorado River water had to limit their use to a total of 4.4 MAF per year, plus any available surplus water. Under the auspices of the State's Colorado River Board, these users developed a draft plan to resolve the problems, which was known as "California's Colorado River Water Use Plan" (California Plan).

The California Plan characterized how California would develop a combination of programs to allow the state to limit its annual use of Colorado River water to 4.4 MAF per year plus any available surplus water. The 2003 Quantification Settlement Agreement (QSA) among Imperial Irrigation District (IID), Coachella Valley Water District (CVWD), and Metropolitan is a critical component of this plan. It established a baseline water use for each of these agencies and facilitates the transfer of water from agricultural agencies to urban uses, and specifies that IID, CVWD, and Metropolitan would forbear use of water to permit the Secretary of the Interior to satisfy the uses of the non-encompassed present perfected rights (PPR). The PPR holders include certain Indian reservation, federal wildlife refuges, and other users, some but not all of which are encompassed by the Seven Party Agreement.

3.2.2.2 Current Conditions of the Colorado River Aqueduct

On November 5, 2003, IID filed a validation action in Imperial County Superior Court, seeking a judicial determination that thirteen agreements associated with the IID/San Diego County Water Authority (SDCWA) water transfer and the QSA are valid, legal and binding. Other lawsuits also were filed challenging the execution, approval and subsequent implementation of the QSA on various grounds. One of the key issues was the constitutionality of the QSA Joint Powers Authority Agreement, pursuant to which IID, CVWD, and SDCWA agreed to commit $133 million toward certain mitigation costs associated with implementation of the transfer of 300 TAF of water conserved by IID pursuant to the QSA, and the State agreed to be responsible for any mitigation costs exceeding this amount. A final judgment was issued on February 11, 2015, holding that the State's commitment was unconditional in nature and, as such, violated the State's debt limitation under the California Constitution, and that eleven other agreements, including the QSA, also are invalid because they are inextricably interrelated with the QSA Joint Powers Authority Agreement and the funding mechanism it established to cover such mitigation costs.

Metropolitan, CVWD and SDCWA have filed appeals of the court's decision, which will stay the ruling pending outcome of the appeal. If the ruling stands, it could delay the implementation of programs authorized under the QSA or result in increased costs or other adverse impacts. The impact, if any, which the ruling might have on Metropolitan's water supplies cannot be adequately determined at this time.

3.2.2.3 Colorado River Programs and Long-Term Planning

Metropolitan has identified a number of programs that could be used to achieve the regional long-term development targets for the CRA and has entered into or is exploring agreements with a number of agencies as discussed below. These programs are described in greater detail in Metropolitan's 2015 UWMP.

Existing and proposed Colorado River Water Management Programs include:

- ***IID / Metropolitan Conservation Program*** - Under this program, Metropolitan has funded water efficiency improvements within IID's service area in return for the right to divert the water conserved by those investments.

- ***Palo Verde Land Management, Crop Rotation, and Water Supply Program*** - Under this program, participating farmers in Palo Verde Irrigation District (PVID) are paid to reduce their water use by not irrigating a portion of their land.
- ***Southern Nevada Water Authority (SNWA) and Metropolitan Storage and Interstate Release Agreement*** - Under this agreement, additional Colorado River supplies are made available to Metropolitan when there is space available in the CRA to receive the water. SNWA may call on Metropolitan to reduce is Colorado River water order to return this water no earlier than 2019, unless Metropolitan agrees otherwise.
- ***Lower Colorado Water Supply Project*** - Under this contract, Metropolitan receives, on an annual basis, Lower Colorado Water Supply Project water unused by the City of Needles and other entities with no rights or insufficient rights to use of Colorado River water in California.
- ***Lake Mead Storage Program*** - This program allows Metropolitan to storage “Intentionally Created Surplus” conserved through extraordinary conservation in Lake Mead.

3.2.2.4 Available Supplies on Colorado River Aqueduct

Metropolitan’s current CRA program capabilities under average year, single dry year, and multiple dry year hydrologies are shown below in Table 3-1 (Metropolitan, 2015 UWMP, June 2016, Table 3-1). The projections essentially indicate that Metropolitan can achieve a full CRA whenever needed, by augmenting supplies from ICS, fallowing or other exchange opportunities. This analysis has not considered the potential for shortage declarations on the Colorado River under the condition that the Lake Mead elevation declines to 1000 feet; at this point, new provisions would need to be put into place to handle such a situation.

Table 3-1: Metropolitan Colorado River Aqueduct Program Capabilities

Colorado River Aqueduct
Program Capabilities
Year 2035
(acre-feet per year)

Hydrology	Multiple Dry Years (1990-92)	Single Dry Year (1977)	Average Year (1922-2004)
Current Programs			
Basic Apportionment – Priority 4	550,000	550,000	550,000
IID/MWD Conservation Program	85,000	85,000	85,000
Priority 5 Apportionment (Surplus)	250,000	0	21,000
PVID Land Management, Crop Rotation, and Water Supply Program	130,000	130,000	130,000
Lower Colorado Water Supply Project	5,000	5,000	5,000
Lake Mead ICS Storage Program	400,000	400,000	400,000
Binational ICS	8,000	24,000	24,000
Forbearance for Present Perfected Rights	(2,000)	(2,000)	(2,000)
CVWD SWP/QSA Transfer Obligation	(35,000)	(35,000)	(35,000)
DWCV SWP Table A Obligation	(45,000)	(42,000)	(118,000)
DWCV SWP Table A Transfer Callback	23,000	22,000	61,000
DWCV Advance Delivery Account	22,000	20,000	57,000
SNWA Agreement Payback	0	0	(5,000)
Subtotal of Current Programs	***1,391,000***	***1,157,000***	***1,173,000***
Programs Under Development			
SNWA Interstate Banking Agreement	0	0	0
Additional Fallowing Programs	25,000	25,000	25,000
Subtotal of Proposed Programs	***25,000***	***25,000***	***25,000***
Additional Non-Metropolitan CRA Supplies			
SDCWA/IID Transfer	200,000	200,000	200,000
Coachella & All-American Canal Lining			
To SDCWA	82,000	82,000	82,000
To San Luis Rey Settlement Parties[1]	16,000	16,000	16,000
Subtotal of Non-Metropolitan Supplies	***298,000***	***298,000***	***298,000***
Maximum CRA Supply Capability[2]	**1,714,000**	**1,480,000**	**1,496,000**
Less CRA Capacity Constraint (amount above 1.20 MAF)	*(464,000)*	*(230,000)*	*(246,000)*
Maximum Expected CRA Deliveries[3]	**1,200,000**	**1,200,000**	**1,200,000**
Less Non-Metropolitan Supplies[4]	*(298,000)*	*(298,000)*	*(298,000)*
Maximum Metropolitan Supply Capability[5]	**902,000**	**902,000**	**902,000**

[1] Subject to satisfaction of conditions specified in agreement among Metropolitan, the United States, and the San Luis Rey Settlement Parties
[2] Total amount of supplies available without taking into consideration CRA capacity constraint.
[3] The Colorado River Aqueduct delivery capacity is 1.20 MAF annually.
[4] Exchange obligation for the SDCWA-IID transfer and exchange and the Coachella and All American Canal Lining projects.
[5] The amount of CRA water available to Metropolitan after meeting its exchange obligations.

3.2.3 State Water Project

3.2.3.1 Background

The SWP consists of a series of pump stations, reservoirs, aqueducts, tunnels, and power plants operated by DWR and is an integral part of the effort to ensure that business and industry, urban and suburban residents, and farmers throughout much of California have sufficient water. The SWP is the largest state-built, multipurpose, user-financed water project in the United States. Nearly two-thirds of residents in California receive at least part of their water from the SWP with approximately 70 percent of SWP's contracted water supply going to urban users and 30 percent to agricultural users. The primary purpose of the SWP is to divert and store water during wet periods in Northern and Central California and distribute it to areas of need in Northern California, the San Francisco Bay area, the San Joaquin Valley, the Central Coast, and southern California.

The availability of water supplies from the SWP can be highly variable. A wet water year may be followed by a dry or critically dry year and fisheries issues can restrict the operations of the export pumps even when water supplies are available.

The Sacramento-San Joaquin River Delta (Delta) is key to the SWP's ability to deliver water to its agricultural and urban contractors. All but five of the 29 SWP contractors receive water deliveries below the Delta (pumped via the Harvey O. Banks or Barker Slough pumping plants). However, the Delta faces many challenges concerning its long-term sustainability such as climate change posing a threat of increased variability in floods and droughts. Sea level rise complicates efforts in managing salinity levels and preserving water quality in the Delta to ensure a suitable water supply for urban and agricultural use. Furthermore, other challenges include continued subsidence of Delta islands, many of which are below sea level, and the related threat of a catastrophic levee failure as the water pressure increases, or as a result of a major seismic event.

Ongoing regulatory restrictions, such as those imposed by federal biological opinions (Biops) on the effects of SWP and the federal Central Valley Project (CVP) operations on certain marine life, also contributes to the challenge of determining the SWP's water delivery reliability. In dry, below-normal conditions, Metropolitan has increased the supplies delivered through the California Aqueduct by developing flexible CVP/SWP storage and transfer programs. The goal of the storage/transfer programs is to develop additional dry-year supplies that can be conveyed through the available Harvey O. Banks pumping plant capacity to maximize deliveries through the California Aqueduct during dry hydrologic conditions and regulatory restrictions. In addition, SWRCB has set water quality objectives that must be met by the SWP including minimum Delta outflows, limits on SWP and CVP Delta exports, and maximum allowable salinity level.

Metropolitan's Board approved a Delta Action Plan in June 2007 that provides a framework for staff to pursue actions with other agencies and stakeholders to build a sustainable Delta and reduce conflicts between water supply conveyance and the environment. The Delta action plan aims to prioritize immediate short-term actions to stabilize the Delta while an ultimate solution is selected, and mid-term steps to maintain the Delta while a long-term solution is implemented. Currently, Metropolitan is working towards addressing three basin elements: Delta ecosystem restoration, water supply conveyance, and flood control protection and storage development.

3.2.3.2 Current Conditions on State Water Project

"Table A" water is the maximum entitlement of SWP water for each water contracting agency. Currently, the combined maximum Table A amount is 4.17 MAFY. Of this amount, 4.13 MAFY is the maximum Table A water available for delivery from the Delta pumps as stated in the State Water Contract, however, deliveries commonly are less than 50% of the Table A in recent years.

SWP contractors may receive Article 21 water on a short-term basis in addition to Table A water if requested. Article 21 of SWP contracts allows contractors to receive additional water deliveries only under specific conditions, generally during wet months of the year (December through March). Because an SWP contractor must have an immediate use for Article 21 supply or a place to store it outside of the SWP, there are few contractors like Metropolitan that can access such supplies. .

Carryover water is SWP water allocated to an SWP contractor and approved for delivery to the contractor in a given year but not used by the end of the year. The unused water is stored in the SWP's share of San Luis Reservoir, when space is available, for the contractor to use in the following year.

Turnback pool water is Table A water that has been allocated to SWP contractors that has exceeded their demands. This water can then be purchased by another contractor depending on its availability.

SWP Delta exports are the water supplies that are transferred directly to SWP contractors or to San Luis Reservoir storage south of the Delta via the Harvey O. Banks pumping plant. Estimated average annual Delta exports and SWP Table A water deliveries have generally decreased since 2005, when Delta export regulations affecting SWP pumping operations became more restrictive due to the Biops. A summary SWP water deliveries from the years 2005 and 2013 is summarized in Table 3-2.

Table 3-2: State Water Project Capabilities

Year	Average Annual Delta Exports	Average Annual Table A Deliveries
2005	2.96 MAF	2.82 MAF
2013	2.61 MAF	2.55 MAF
Percent Change	-11.7%	-9.4%

The following factors affect the ability to estimate existing and future water delivery reliability:

- Water availability at the source: Availability depends on the amount and timing of rain and snow that fall in any given year. Generally, during a single dry year or two, surface and groundwater storage can supply most water deliveries, but multiple dry years can result in critically low water reserves.
- Water rights with priority over the SWP: Water users with prior water rights are assigned higher priority in DWR's modeling of the SWP's water delivery reliability, even ahead of SWP Table A water.
- Climate change: mean temperatures are predicted to vary more significantly than previously expected. This change in climate is anticipated to bring warmer winter storms that result in less snowfall at lower elevations, reducing total snowpack. From historical data, DWR projects that by 2050, the Sierra snowpack will be reduced from its historical average by 25 to 40 percent. Increased precipitation as rain could result in a larger number of "rain-on-snow" events, causing snow to melt

earlier in the year and over fewer days than historically, affecting the availability of water for pumping by the SWP during summer.

- Regulatory restrictions on SWP Delta exports due to the Biops to protect special-status species such as delta smelt and spring- and winter-run Chinook salmon. Restrictions on SWP operations imposed by state and federal agencies contribute substantially to the challenge of accurately determining the SWP's water delivery reliability in any given year.
- Ongoing environmental and policy planning efforts: the California WaterFix involves water delivery improvements that could reduce salinity levels by diverting a greater amount of lower salinity Sacramento water to the South Delta export pumps. The EcoRestore Program aims to restore at least 30,000 acres of Delta habitat, and plans to be well on the way to meeting that goal by the year 2020.
- Delta levee failure: The levees are vulnerable to failure because most original levees were simply built with soils dredged from nearby channels and were not engineered. A breach of one or more levees and island flooding could affect Delta water quality and SWP operations for several months. When islands are flooded, DWR may need to drastically decrease or even cease SWP Delta exports to evaluate damage caused by salinity in the Delta.

The Delta Risk Management Strategy addresses the problem of Delta levee failure and evaluates alternatives to reduce the risk to the Delta. Four scenarios were developed to represent a range of possible risk reduction strategies (Department of Water Resources, The State Water Project Final Delivery Capability Report 2015, July 2015). They are:

- ***Trial Scenario 1 Improved Levees:*** This scenario looks at improving the reliability of Delta levees against flood-induced failures by providing up to 100-year flood protection. The report found that improved levees would not reduce the risk of potential water export interruptions, nor would it change the seismic risk of most levees.
- ***Trial Scenario 2 Armored Pathway:*** This scenario looks at improving the reliability of water conveyance by creating a route through the Delta that has high reliability and the ability to minimize saltwater intrusion into the south Delta. The report found that this scenario would have the joint benefit of reducing the likelihood of levee failures from flood events and earthquakes, and of significantly reducing the likelihood of export disruptions.
- ***Trial Scenario 3 Isolated Conveyance:*** This scenario looks to provide high reliability for conveyance of export water by building an isolated conveyance facility on the east side of the Delta. The effects of this scenario are similar to those for Trial Scenario 2 but with the added consequence of seismic risk of levee failure on islands that are not part of the isolated conveyance facility.
- ***Trial Scenario 4 Dual Conveyance:*** This scenario is a combination of Scenarios 2 and 3 as it looks to improve reliability and flexibility for conveyance of export water by constructing an isolated conveyance facility and through-Delta conveyance. It would mitigate the vulnerability of water exports associated with Delta levee failure and offer flexibility in water exports from the Delta and the isolated conveyance facility. However, seismic risk would not be reduced on islands not part of the export conveyance system or infrastructure pathway.

In response to this report there have been a number of steps that have been taken, such as ongoing Delta levee improvements by the Delta Reclamation Agencies and property acquisition for rock stockpiling for an improved emergency pathway. All of these scenarios are consistent with the Metropolitan Board adopted Action Plan.

DWR has altered the SWP operations to accommodate species of fish listed under the Biops, and these changes have adversely impacted SWP deliveries. DWR's Water Allocation Analysis indicated that export restrictions are currently reducing deliveries to Metropolitan as much as 150 TAF to 200 TAF under median hydrologic conditions.

Operational constraints likely will continue until a long-term solution to the problems in the Bay-Delta is identified and implemented. New biological opinions for listed species under the Federal ESA or by the California Department of Fish and Game's issuance of incidental take authorizations under the Federal ESA and California ESA might further adversely affect SWP and CVP operations. Additionally, new litigation, listings of additional species or new regulatory requirements could further adversely affect SWP operations in the future by requiring additional export reductions, releases of additional water from storage or other operational changes impacting water supply operations.

3.2.3.3 State Water Project Programs and Long-Term Planning

Metropolitan's implementation approach for the SWP depends on restoration of pre-Biops exports based on implementation of a number of agreements, including the Sacramento Valley Water Management (Phase 8 Settlement Agreement and the Bay-Delta Conservation Plan (BDCP – now called the California WaterFix). The California WaterFix is being pursued through a collaboration of state, federal, and local water agencies, state and federal fish agencies, environmental organizations, and other interested parties with the ultimate goal of developing a set of actions that will provide for both species/habitat protection and improved reliability of water supplies. The Phase 8 Settlement Agreement was developed among Bay-Delta watershed users to determine how all Bay-Delta water users would bear some of the responsibility of meeting flow requirements.

Other programs and agreements that Metropolitan has implemented to improve management of SWP supplies include:

- ***Monterey Amendment*** – This settlement between SWP contractors and DWR altered the water allocation procedures such that both shortages and surpluses would be shared in the same manner for all contractors, eliminating the prior "agriculture first" shortage provision.
- ***SWP Terminal Storage*** – Metropolitan has contractual rights to 65 TAF of flexible storage at Lake Perris and 154 TAF of flexible storage at Castaic Lake, which provides Metropolitan with additional options for maximizing yield from the SWP. It can provide Metropolitan with 73 TAF of additional supply over multiply dry-years, and in a single-dry year as much as 219 TAF.
- ***Yuba Dry Year Water Purchase Program*** – Metropolitan entered into this agreement with DWR in 2007 to provide for Metropolitan's participation in the Yuba Dry Year Water Purchase Program, which provides transfers of water from the Yuba County Water Agency during dry years through 2025.
- ***Desert Water Agency/CVWD SWP Table A Transfer*** – Under this agreement, Metropolitan transferred 100 TAF of its SWP Table A contractual amount to Desert Water Agency/CVWD.

Metropolitan is able to recall the SWP transfer water in years in which Metropolitan determines it needs the water to meet its water management goals. The main benefit of the agreement is to reduce Metropolitan's SWP fixed costs in wetter years when there are more than sufficient supplies to meet Metropolitan's water management goals, while at the same time preserving its dry-year SWP supply.

- ***Desert Water Agency/CVWD Advance Delivery Program*** – Under this program, Metropolitan delivers Colorado River water to the Desert Water Agency and CVWD in advance of the exchange for their SWP Contract Table A allocations. By delivering enough water in advance to cover Metropolitan's exchange obligations, Metropolitan is able to receive Desert Water Agency and CVWD's available SWP supplies in years in which Metropolitan's supplies are insufficient without having to deliver an equivalent amount of Colorado River water.
- ***Desert Water Agency/CVWD Other SWP Deliveries*** – Since 2008, Metropolitan has provided Desert Water Agency and CVWD written consent to take delivery from the SWP facilities non-SWP supplies separately acquired by each agency.
- ***Diamond Valley Lake (DVL)*** – The completion and filling of DVL between 1999 and 2003 marked an important achievement with respect to protecting southern California against a SWP system outage. The lake can hold up to 810 TAF that provides a portion of southern California's six-month emergency water supply as well as carryover and regulatory storage. The remainder of the six-month emergency supply is held in other SWP reservoirs in southern California and in other Metropolitan reservoirs. It should be noted that the utility of DVL has been compromised by the existence of the quagga mussel in Colorado River supplies. The original design of DVL anticipated storage of both CRA and SWP water; to keep quaggas out of the DVL system, Metropolitan has made the decision to eliminate storage of any CRA supplies in DVL.
- ***Inland Feeder Project*** – The Inland Feeder project is a high-capacity water delivery system designed to increase southern California's water supply reliability. The project will take advantage of large volumes of water when available from northern California, depositing it in surface storage reservoirs, such as Diamond Valley Lake, and local groundwater basins for use during dry periods and emergencies.

3.2.3.4 Available Supplies on State Water Project

Metropolitan's current SWP (also known as the California Aqueduct) program capabilities under average year, single dry year, and multiple dry year hydrologies are shown below in Table 3-3 (Metropolitan, 2015 UWMP, June 2016, Table 3-2).

Table 3-3: Metropolitan California Aqueduct Program Capabilities

California Aqueduct
Program Capabilities
Year 2035
(acre-feet per year)

Hydrology	Multiple Dry Years (1990-92)	Single Dry Year (1977)	Average Year (1922-2004)
Current Programs			
MWD Table A	410,000	210,000	1,181,000
DWCV Table A	45,000	42,000	118,000
San Luis Carryover [1]	80,000	240,000	240,000
Article 21 Supplies	0	0	51,000
Yuba River Accord Purchase	0	0	0
Subtotal of Current Programs	***535,000***	***492,000***	***1,590,000***
Programs Under Development			
Delta Improvements	87,000	178,000	205,000
Subtotal of Proposed Programs	***87,000***	***178,000***	***205,000***
Maximum Supply Capability	**622,000**	**670,000**	**1,795,000**

[1] Includes DWCV carryover.

3.2.4 Central Valley/State Water Project Storage and Transfer Programs

Storage is a major component of Metropolitan's dry year resource management strategy. Metropolitan's likelihood of having adequate supply capability to meet projected demands, without implementing its Water Supply Allocation Plan (WSAP), is dependent on its storage resources. Metropolitan aims to increase the reliability of its supplies through the development of flexible SWP storage and transfer programs. Over the years, Metropolitan has developed numerous voluntary Central Valley storage and transfer programs, aiming to develop additional dry-year water supplies.

3.2.4.1 Background on State Water Project Transfers

Metropolitan has formed partnerships in the past with Central Valley agricultural districts as well as with other southern California SWP Contractors in order to manage the wide fluctuations of SWP supplies. Metropolitan's storage and transfer programs were established to augment SWP reliability in dry years. Metropolitan's Board determined that the criteria for operating the SWP did not provide sufficient reliability to meet Metropolitan's overall supply reliability objectives. Most recently, DWR's estimates of SWP reliability capability show that SWP reliability under conditions similar to 1977, the driest year on record, could be significantly worse than earlier modeling indicated.

Metropolitan believes that it now has in place Central Valley/SWP storage and transfer programs capable of reaching its planning target, and it has several other programs under development.

3.2.4.2 Current Programs and Long-Term Planning on State Water Project

Metropolitan currently has several Central Valley/SWP storage programs in operation. Metropolitan is also pursuing a new storage program with Antelope Valley-East Kern Water Agency, and it is currently under development. In addition, Metropolitan pursues Central Valley water transfers on an as needed basis. Existing and planned storage and transfer programs include:

- ***Semitropic Storage Program***- Under this program, Metropolitan can store portions of its SWP entitlement water in excess of the amounts needed to meet its demands. The water is delivered to farmers in the Semitropic Water Storage District (SWSD) who use the water in lieu of pumping groundwater. During dry years, Metropolitan's previously stored water is returned by direct groundwater pumping by the SWSD and the exchange of SWP entitlement water. The maximum storage capacity of the program is 350 TAF.
- ***Arvin-Edison Storage Program***- This program was amended in 2008 to include the South Canal Improvement Project, which increases reliability and improves the quality of water returned to the California Aqueduct. Metropolitan can use the program to store excess SWP Table A supplies during wet years. The water can either be directly recharged into the groundwater basin or delivered to farmers in the Arvin-Edison Water Storage District who use the water in-lieu of pumping groundwater. During dry years, the water is returned to Metropolitan by direct groundwater pumping or by exchange of surface water supplies. The program storage capacity is 350 TAF.
- ***San Bernardino Valley MWD Storage Program***- This program allows Metropolitan to purchase a portion of San Bernardino Valley Municipal Water District's SWP supply. The program has a minimum purchase provision of 20 TAF and can deliver up to 70 TAF, depending on hydrologic conditions. The agreement also allows Metropolitan to store up to 50 TAF of transfer water for use in dry years. This agreement can be renewed until December 31, 2035. ***San Gabriel Valley MWD Exchange Program*** – This program allows for the exchange of up to 5 TAF each year. For each AF Metropolitan delivers to the City of Sierra Madre, a San Gabriel Valley MWD member agency, San Gabriel Valley MWD provides two AF to Metropolitan in the Main San Gabriel Basin, up to 5 TAF.
- ***Antelope Valley-Kern Water Agency Exchange and Storage Program*** – This program allows for every two AF Metropolitan receives, Metropolitan returns one AF to AVEK to improve its reliability. The exchange program is expected to deliver 30 TAF over ten years, with 10 TAF available in dry years. Under the program, Metropolitan will also be able to store up to 30 TAF in the AVEK's groundwater basin, with a dry year return capability of 10 TAF.
- ***Kern-Delta Water District Storage Program***- This program, currently under development, will allow Metropolitan to store up to 250 TAF of water and will be capable of providing 50 TAF of dry year supply. The water will be either directly recharged into the groundwater basin or delivered to Kern-Valley Water District farmers who use the water in-lieu of pumping groundwater. During dry years, MWDOC will return Metropolitan's previously stored water by direct groundwater pump-in return or by exchange of surface water supplies.
- ***Mojave Storage Program***- Metropolitan entered into a groundwater banking and exchange transfer agreement with Mojave Water Agency on October 29, 2003.This program will allow Metropolitan to store SWP supply delivered in wet years for subsequent withdrawal during dry years. Metropolitan can annually withdraw the Mojave Water Agency's SWP contractual amounts in excess of a 10

percent reserve through 2021 and the SWP allocation is 60 percent or less. The mount Metropolitan can withdraw increases to 20 percent when the SWP allocation is over 60 percent. Under a 100 percent allocation, the State Water Contract provides Mojave Water Agency 82.8 TAF of water.

- ***Central Valley Transfer Programs***- Metropolitan expects to secure Central Valley water transfer supplies via spot markets and option contracts to meet its service area demands when necessary. Metropolitan secured water transfer supplies in 2003-2015 to fill anticipated supply shortfalls needed to meet service area demands. Metropolitan's recent water transfer activities in have demonstrated Metropolitan's ability to develop and negotiate water transfer agreements either working directly with the agricultural districts who are selling the water or through a statewide Drought Water Bank.

3.2.4.3 Available Supplies on Central Valley/State Water Project

Metropolitan's current Central Valley/SWP storage and transfer program supply capabilities under average year, single dry, and multiple dry year hydrologies are shown below in Table 3-4. In developing the supply capabilities for the Metropolitan 2015 UWMP, Metropolitan assumed a simulated median storage level going into each of the five-year increments based on the balances of supplies and demands.

Table 3-4: Metropolitan Central Valley/State Water Project and Transfer Programs

Central Valley/State Water Project Storage and Transfer Programs
Supply Projection
Year 2035
(acre-feet per year)

Hydrology	Multiple Dry Years (1990-92)	Single Dry Year (1977)	Average Year (1922-2004)
Current Programs			
San Bernardino Valley MWD Minimum Purchase	3,000	0	20,000
San Bernardino Valley MWD Option Purchase	0	0	16,000
San Gabriel Valley MWD Exchange and Purchase	2,000	2,000	2,000
Central Valley Storage and Transfers			
Semitropic Program	50,000	49,000	70,000
Arvin Edison Program	63,000	75,000	75,000
Mojave Storage Program	2,000	0	26,000
Kern Delta Program	47,000	50,000	50,000
Transfers and Exchanges	50,000	50,000	50,000
Subtotal of Current Programs	***217,000***	***226,000***	***309,000***
Programs Under Development			
Antelope Valley/East Kern Acquisition and Storage	7,000	20,000	20,000
Subtotal of Proposed Programs	***7,000***	***20,000***	***20,000***
Maximum Supply Capability	**224,000**	**246,000**	**329,000**

3.2.5 Supply Reliability within Metropolitan

In the Metropolitan 2015 UWMP, Metropolitan evaluated supply reliability by projecting supply and demand conditions for the single- and multi-year drought cases based on conditions affecting the SWP (Metropolitan's largest and most variable supply). For this supply source, the single driest-year was 1977 and the three-year dry period was 1990-1992. The analyses also includes Colorado River supplies under the same hydrologies. Metropolitan's analyses are shown in Tables 3-5, 3-6, and 3-7. Metropolitan has concluded that the region can provide reliable water supplies not only under normal conditions but also under both the single driest year and the multiple dry year hydrologies. Because Metropolitan's projections take into account the imported demands from OC, Metropolitan's analysis will be used to determine, by virtue of MWDOC being part of Metropolitan, that demands within MWDOC can be met not only under normal conditions but also under both the single driest year and the multiple dry year hydrologies

Table 3-5: Metropolitan Average Year Projected Supply Capability and Demands through 2040

Average Year
Supply Capability[1] and Projected Demands
Average of 1922-2012 Hydrologies
(Acre-feet per year)

Forecast Year	2020	2025	2030	2035	2040
Current Programs					
In-Region Supplies and Programs	693,000	774,000	852,000	956,000	992,000
California Aqueduct[2]	1,760,000	1,781,000	1,873,000	1,899,000	1,899,000
Colorado River Aqueduct					
Total Supply Available[3]	1,468,000	1,488,000	1,484,000	1,471,000	1,460,000
Aqueduct Capacity Limit[4]	*1,200,000*	*1,200,000*	*1,200,000*	*1,200,000*	*1,200,000*
Colorado River Aqueduct Capability	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000
Capability of Current Programs	**3,653,000**	**3,755,000**	**3,925,000**	**4,055,000**	**4,091,000**
Demands					
Total Demands on Metropolitan	1,586,000	1,636,000	1,677,000	1,726,000	1,765,000
IID-SDCWA Transfers and Canal Linings	274,000	282,000	282,000	282,000	282,000
Total Metropolitan Deliveries[5]	**1,860,000**	**1,918,000**	**1,959,000**	**2,008,000**	**2,047,000**
Surplus	**1,793,000**	**1,837,000**	**1,966,000**	**2,047,000**	**2,044,000**
Programs Under Development					
In-Region Supplies and Programs	43,000	80,000	118,000	160,000	200,000
California Aqueduct	20,000	20,000	225,000	225,000	225,000
Colorado River Aqueduct					
Total Supply Available[3]	5,000	25,000	25,000	25,000	25,000
Aqueduct Capacity Limit[4]	*0*	*0*	*0*	*0*	*0*
Colorado River Aqueduct Capability	0	0	0	0	0
Capability of Proposed Programs	**63,000**	**100,000**	**343,000**	**385,000**	**425,000**
Potential Surplus	**1,856,000**	**1,937,000**	**2,309,000**	**2,432,000**	**2,469,000**

1 Represents Supply Capability for resource programs under listed year type.
2 California Aqueduct includes Central Valley transfers and storage program supplies conveyed by the aqueduct.
3 Colorado River Aqueduct includes programs, IID-SDCWA transfer and exchange and canal linings conveyed by the aqueduct.
4 Maximum CRA deliveries limited to 1.20 MAF including IID-SDCWA transfer and exchange and canal linings.
5 Total deliveries are adjusted to include IID-SDCWA transfer and exchange and canal linings. These supplies are calculated as local supply, but need to be shown for the purposes of CRA capacity limit calculations without double counting.

Table 3-6: Metropolitan Single-Dry Year Projected Supply Capability and Demands through 2040

Single Dry-Year
Supply Capability[1] and Projected Demands
Repeat of 1977 Hydrology
(Acre-feet per year)

Forecast Year	2020	2025	2030	2035	2040
Current Programs					
In-Region Supplies and Programs	693,000	774,000	852,000	956,000	992,000
California Aqueduct[2]	644,000	665,000	692,000	718,000	718,000
Colorado River Aqueduct					
Total Supply Available[3]	1,451,000	1,457,000	1,456,000	1,455,000	1,454,000
Aqueduct Capacity Limit[4]	*1,200,000*	*1,200,000*	*1,200,000*	*1,200,000*	*1,200,000*
Colorado River Aqueduct Capability	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000
Capability of Current Programs	**2,537,000**	**2,639,000**	**2,744,000**	**2,874,000**	**2,910,000**
Demands					
Total Demands on Metropolitan	1,731,000	1,784,000	1,826,000	1,878,000	1,919,000
IID-SDCWA Transfers and Canal Linings	274,000	282,000	282,000	282,000	282,000
Total Metropolitan Deliveries[5]	**2,005,000**	**2,066,000**	**2,108,000**	**2,160,000**	**2,201,000**
Surplus	**532,000**	**573,000**	**636,000**	**714,000**	**709,000**
Programs Under Development					
In-Region Supplies and Programs	43,000	80,000	118,000	160,000	200,000
California Aqueduct	20,000	20,000	198,000	198,000	198,000
Colorado River Aqueduct					
Total Supply Available[3]	155,000	125,000	75,000	25,000	25,000
Aqueduct Capacity Limit[4]	*0*	*0*	*0*	*0*	*0*
Colorado River Aqueduct Capability	0	0	0	0	0
Capability of Proposed Programs	**63,000**	**100,000**	**316,000**	**358,000**	**398,000**
Potential Surplus	**595,000**	**673,000**	**952,000**	**1,072,000**	**1,107,000**

[1] Represents Supply Capability for resource programs under listed year type.
[2] California Aqueduct includes Central Valley transfers and storage program supplies conveyed by the aqueduct.
[3] Colorado River Aqueduct includes programs, IID-SDCWA transfer and exchange and canal linings conveyed by the aqueduct.
[4] Maximum CRA deliveries limited to 1.20 MAF including IID-SDCWA transfer and exchange and canal linings.
[5] Total deliveries are adjusted to include IID-SDCWA transfer and exchange and canal linings. These supplies are calculated as local supply, but need to be shown for the purposes of CRA capacity limit calculations without double counting.

Table 3-7: Metropolitan Multiple-Dry Year Projected Supply Capability and Demands through 2040

Multiple Dry-Year
Supply Capability[1] and Projected Demands
Repeat of 1990-1992 Hydrology
(Acre-feet per year)

Forecast Year	2020	2025	2030	2035	2040
Current Programs					
In-Region Supplies and Programs	239,000	272,000	303,000	346,000	364,000
California Aqueduct[2]	712,000	730,000	743,000	752,000	752,000
Colorado River Aqueduct					
Total Supply Available[3]	1,403,000	1,691,000	1,690,000	1,689,000	1,605,000
Aqueduct Capacity Limit[4]	*1,200,000*	*1,200,000*	*1,200,000*	*1,200,000*	*1,200,000*
Colorado River Aqueduct Capability	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000
Capability of Current Programs	**2,151,000**	**2,202,000**	**2,246,000**	**2,298,000**	**2,316,000**
Demands					
Total Demands on Metropolitan	1,727,000	1,836,000	1,889,000	1,934,000	1,976,000
IID-SDCWA Transfers and Canal Linings	274,000	282,000	282,000	282,000	282,000
Total Metropolitan Deliveries[5]	**2,001,000**	**2,118,000**	**2,171,000**	**2,216,000**	**2,258,000**
Surplus	**150,000**	**84,000**	**75,000**	**82,000**	**58,000**
Programs Under Development					
In-Region Supplies and Programs	36,000	73,000	110,000	151,000	192,000
California Aqueduct	7,000	7,000	94,000	94,000	94,000
Colorado River Aqueduct					
Total Supply Available[3]	80,000	75,000	50,000	25,000	25,000
Aqueduct Capacity Limit[4]	*0*	*0*	*0*	*0*	*0*
Colorado River Aqueduct Capability	0	0	0	0	0
Capability of Proposed Programs	**43,000**	**80,000**	**204,000**	**245,000**	**286,000**
Potential Surplus	**193,000**	**164,000**	**279,000**	**327,000**	**344,000**

[1] Represents Supply Capability for resource programs under listed year type.
[2] California Aqueduct includes Central Valley transfers and storage program supplies conveyed by the aqueduct.
[3] Colorado River Aqueduct includes programs, IID-SDCWA transfer and exchange and canal linings conveyed by the aqueduct.
[4] Maximum CRA deliveries limited to 1.20 MAF including IID-SDCWA transfer and exchange and canal linings.
[5] Total deliveries are adjusted to include IID-SDCWA transfer and exchange and canal linings. These supplies are calculated as local supply, but need to be shown for the purposes of CRA capacity limit calculations without double counting.

3.2.6 MWDOC's Imported Water Supply

California Water Code requires Metropolitan to provide information to MWDOC for inclusion in its UWMP that identifies and quantifies the existing and planned sources of water available from the wholesale agency. By virtue of MWDOC being a part of Metropolitan and by virtue that imported demands from MWDOC were included in Metropolitan projections, MWDOC's supply projections have been covered by Metropolitan.

Thus, based on Metropolitan's supply projections, MWDOC will be able to meet demands under average year, single dry year, and multiple dry year scenarios. The water supply projections represent the amount of supplies projected to meet MWDOC demands, as MWDOC will only purchase the amount of water needed to meet its service area demands from Metropolitan. The current and future water supply projections that MWDOC will obtain from Metropolitan are shown in Tables 3-8 and 3-9.

Table 3-8: Wholesale Water Supplies – Actual (AF)

Wholesale: Water Supplies — Actual			
Water Supply	Additional Detail on Water Supply	2015	
		Actual Volume	Water Quality
Purchased or Imported Water	M&I	158,664	Drinking Water
Purchased or Imported Water	GW Recharge	58,617	Untreated Water
Purchased or Imported Water	Surface Storage	8,227	Untreated Water
	Total	225,508	
NOTES:			

Table 3-9: Wholesale Water Supplies – Projected (AF)

Wholesale: Water Supplies — Projected						
Water Supply	Additional Detail on Water Supply	Projected Water Supply *Report To the Extent Practicable*				
		2020	2025	2030	2035	2040
Imported Water for M&I	Purchased from Metropolitan	132,826	144,254	140,203	135,913	135,135
Purchased or Imported Water	GW Recharge	65,000	65,000	65,000	65,000	65,000
Purchased or Imported Water	Surface Storage	7,306	7,306	7,306	7,306	7,306
	Total	205,132	216,560	212,509	208,219	207,441
NOTES:						

3.3 Groundwater

Among all local supplies available to MWDOC's retail agencies, groundwater supplies make up the majority. The water supply resources within MWDOC's service area are enhanced by the existence of four groundwater basins, which provide a reliable local source and, additionally, are used as reservoirs to store water during wet years and draw from storage during dry years. This section describes the six groundwater basins used by MWDOC's retail agencies and provides information on historical groundwater production as well as a 25-year projection of the service area's groundwater supply.

3.3.1 Orange County Groundwater Basin

The OCWD overlies the majority of what is called by the California DWR, the Coastal Plain of Orange County Groundwater Basin (Orange County Groundwater Basin). In DWR's Bulletin 118, which describes the extent of all groundwater basins in California, this basin is designated at Basin 8-1 and includes the cities of La Habra and Brea. The Orange County Groundwater Basin underlies the north half of Orange County beneath broad lowlands, bordered by the Coyote and Chino Hills to the north, the Santa Ana Mountains to the northeast, the Pacific Ocean to the southwest, and terminates at the Orange County line to the northwest, where its aquifer systems continue into the Central Basin of Los Angeles County. Figure 3-5 depicts the extent of the Orange County Groundwater Basin. The aquifers comprising this Basin are over 2,000 feet deep and form a complex series of interconnected sand and gravel deposits. It is estimated to hold approximately 66 MAF of water when full, although the amount of "useable storage" has been established by OCWD at a maximum 500,000 AF below full conditions. Keeping the basin within the usable storage range minimizes the potential for seawater intrusion and other potential deleterious effects.

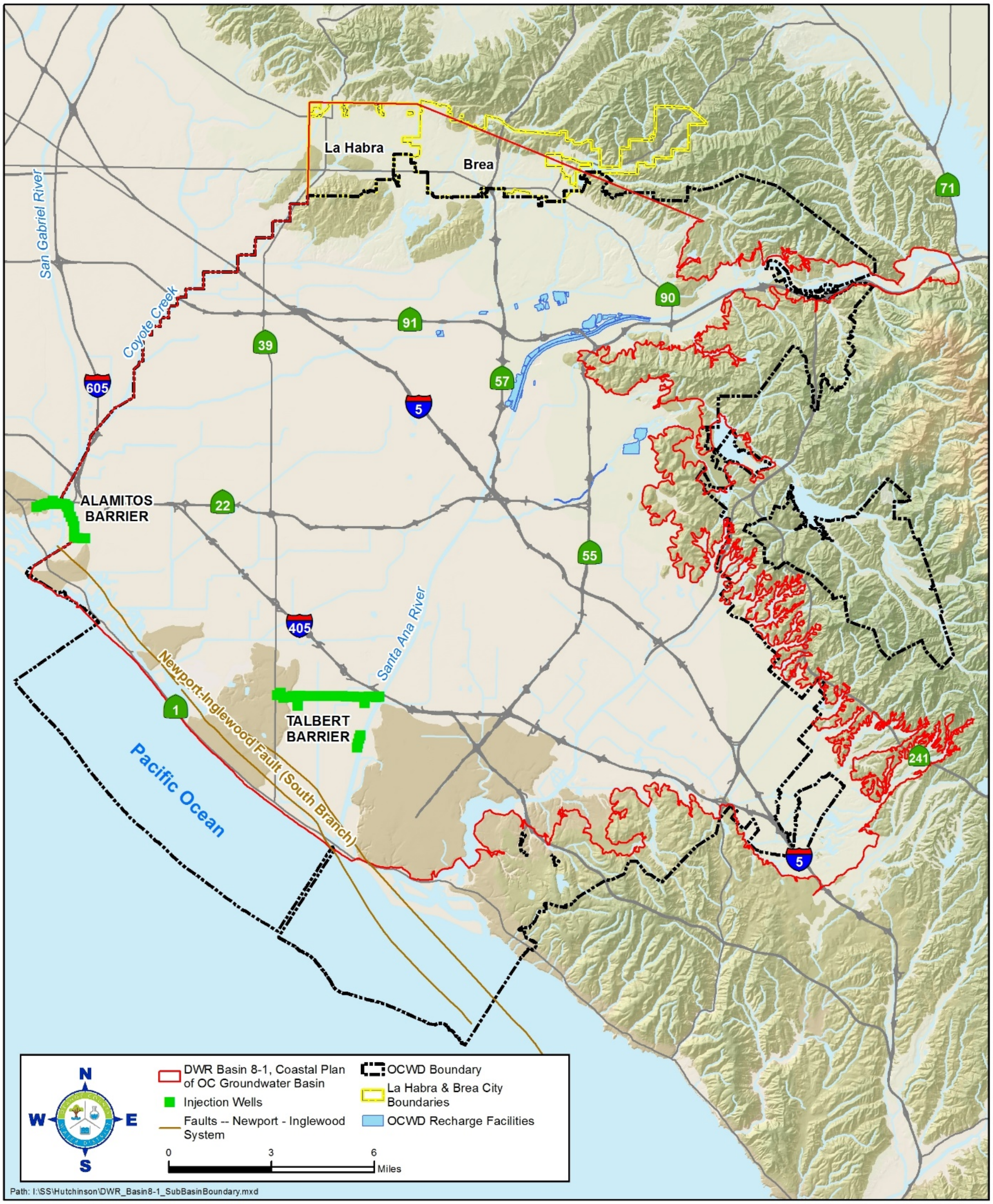

Figure 3-5: Orange County Groundwater Basin

The OCWD was formed in 1933 by a special legislative act of the California State Legislature to protect and manage the County's vast, natural, groundwater supply using the best available technology and defend its water rights to the Santa Ana River. This legislation is found in the State of California Statutes, Water – Uncodified Acts, Act 5683, as amended. The Orange County Groundwater Basin is managed by OCWD under the Act, which functions as a statutorily-imposed physical solution.

The Orange County Groundwater Basin is managed by OCWD for the benefit of municipal, agricultural and private groundwater producers. It meets approximately 60 to 70 percent of the water needs within the boundaries of OCWD. There are 19 major producers including cities, water districts, and private water companies, extracting water from the Orange County Groundwater Basin, serving a population of approximately 2.4 million.

Groundwater storage is managed within a safe basin operating range to protect the long-term sustainability of the Orange County Groundwater Basin and to protect against seawater intrusion and other potential deleterious effects. OCWD uses financial incentives to modulate the amount of pumping from the basin.

OCWD developed a computer-based groundwater flow model to study and better understand the Orange County Groundwater Basin's reaction to pumping and recharge. OCWD manages the Orange County Groundwater Basin by establishing on an annual basis the appropriate level of groundwater production known as the Basin Production Percentage (BPP) as described below (OCWD, Groundwater Management Plan 2015 Update, June 2015).

3.3.1.1 Basin Production Percentage

Pumping from the Orange County Groundwater Basin is managed through a process that uses financial incentives to encourage groundwater producers to pump within a target range established by OCWD. The framework for the financial incentives is based on establishing the BPP, which is the percentage of each Producer's total water supply that comes from groundwater pumped from the Orange County Groundwater Basin. Groundwater production at or below the BPP is assessed a Replenishment Assessment (RA). While there is no legal limit as to how much an agency pumps from the Orange County Groundwater Basin, there is a financial disincentive to pump above the BPP. Pumping above the BPP is also assessed a Basin Equity Assessment (BEA), in addition to the RA, which is calculated so that the cost of groundwater production is equal to MWDOC's full service rate. The BPP is set uniformly for all Producers by OCWD on an annual basis.

The BPP is established each year based on estimated hydrologic conditions for the coming year, basin storage levels, availability of imported water supplies, and other basin management objectives.

In some cases, OCWD encourages treating and pumping groundwater that does not meet drinking water standards in order to protect water quality. This is achieved by using a financial incentive called the BEA Exemption. A BEA Exemption is used to clean up and contain the spread of poor quality water. OCWD uses a partial or total exemption of the BEA to compensate a qualified participating agency or Producer for the costs of treating poor quality groundwater. When OCWD authorizes a BEA exemption for a project, it is obligated to provide the replenishment water for the production above the BPP and forgoes the BEA revenue that OCWD would otherwise receive from the producer.

3.3.1.2 Recharge Management

The Orange County Groundwater Basin is recharged by multiple sources. These include artificial, i.e., man-made systems, and incidental or natural recharge. One of OCWD's core activities is refilling or replenishing the Orange County Groundwater Basin to balance the removal of groundwater by pumping. OCWD is able to increase allowable pumping from the Orange County Groundwater Basin, above the natural safe yield, via the recharge of various sources of water.

OCWD currently owns and operates more than 1,500 acres of surface water recharge facilities in and adjacent to the Santa Ana River and Santiago Creek. Historical groundwater flow was generally toward the ocean in the southwest, but modern pumping has caused groundwater levels to drop below sea level inland of the Newport-Inglewood fault zone. This trough-shaped depression encourages sea water to migrate inland, which if unchecked, could affect water quality. Strategic lines of wells in the Alamitos and Talbert Gaps inject imported and reclaimed water to create a mound of water seaward of the pumping trough to protect the Orange County Groundwater Basin from seawater intrusion. In addition to operating the surface water recharge system, OCWD also operates the Talbert Barrier in Fountain Valley and Huntington Beach, and participates in the financing of the Alamitos Barrier in Seal Beach and Long Beach. The barriers help prevent seawater intrusion and also recharge the Orange County Groundwater Basin.

In addition to natural recharge, sources of recharge water include Santa Ana River (SAR) baseflow and storm flow, Santiago Creek flows, imported supplies purchased from Metropolitan, supplemental supplies from the upper SAR Watershed, and purified water from the GWRS.

Imported water from Metropolitan via MWDOC is one source of water used for groundwater replenishment. However, imported water is not always available. When imported water for groundwater replenishment is not available for extended periods, OCWD can draw upon groundwater in storage under this operation, the Orange County Groundwater Basin draws on stored water to sustain higher levels of pumping. Depending on the severity of the drought and local supply conditions, this operation can be sustained for two to three years before the Orange County Groundwater Basin reaches the base of its allowable storage range (500,000 AF below full conditions). OCWD has defined a series of steps it will take as basin storage declines, including reducing the BPP. The reduced pumping level can remain in place until basin storage levels increase due to heavy rainfall or when water for groundwater replenishment becomes available from Metropolitan. This close coordination of the Orange County Groundwater Basin's operation with the availability of Metropolitan supplies benefits the local service area with enhanced pumping levels in most years.

Water for groundwater replenishment is received at OCWD's recharge facilities in the Cities of Anaheim and Orange and is physically recharged into the Orange County Groundwater Basin through percolation.

3.3.1.3 Recharge Facilities for Orange County Groundwater Basin

Recharging water into the Orange County Groundwater Basin through natural and artificial means is essential to support pumping from the Orange County Groundwater Basin. Active recharge of groundwater began in 1936, in response to increasing drawdown of the Orange County Groundwater Basin and consequently the threat of seawater intrusion. The Orange County Groundwater Basin's primary source of recharge is flow from the Santa Ana River, which is diverted into recharge basins and its main Orange County tributary, Santiago Creek. Other sources of recharge water include natural infiltration, imported water, and recycled water. Today OCWD owns and operates a network of recharge facilities that cover over 1,500 acres.

One of OCWD's primary efforts has been the control of seawater intrusion into the Orange County Groundwater Basin, especially via the Talbert and Alamitos seawater intrusion barriers. OCWD began addressing the Alamitos Gap intrusion by entering a partnership in 1965 with the Los Angeles County Flood Control District to operate injection wells in the Alamitos Gap. The Talbert Barrier was constructed by OCWD in 1975. Operation of the injection wells in both gaps forms a hydraulic barrier to seawater intrusion.

The GWRS is a cooperative project between OCWD and Orange County Sanitation District (OCSD) that began operating in 2008 at a capacity of about 70,000 AFY. The Phase 2 expansion of the GWRS was recently implemented, bolstering capacity to about 100,000 AFY and is discussed in more detail in Sections 6.3 and 6.4.

3.3.2 San Juan Groundwater Basin

The San Juan Groundwater Basin is located in the San Juan Creek Watershed and is comprised of four principal groundwater basins: 1) Lower Basin, 2) Middle Basin, 3) Upper Basin, and 4) Arroyo Trabuco. A map of the four principal groundwater basins is shown on Figure 3-6. The Middle Basin, Lower Basin, and Lower Trabuco consists of approximately 5.9 square miles of water bearing alluvium. Groundwater occurs in the relatively thin alluvial deposits along the valley floors and within the major stream channels. The younger alluvial deposits within the San Juan Groundwater Basin consists of a heterogeneous mixture of sand, silts, and gravel.

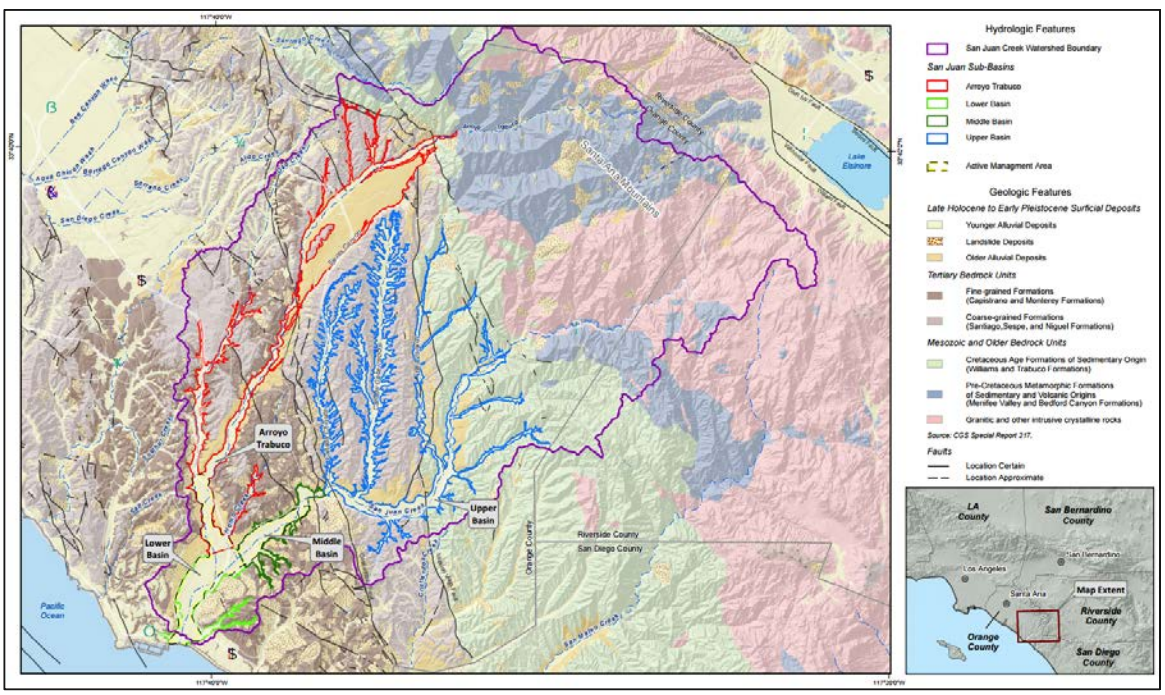

Figure 3-6: Principal Groundwater Formation within the San Juan Groundwater Basin

The physical boundaries of the San Juan Groundwater Basin include the Santa Ana Mountain to the north, sedimentary rock formations to the sides of the Upper Basin and Arroyo Trabuco, and the Pacific Ocean to the south.

San Juan Groundwater Basin is recharged through a variety of sources such as:

- Streambed infiltration in San Juan Creek, Horno Creek, Oso Creek, and Arroyo Trabuco.
- Subsurface inflows along boundaries at the head of the tributaries upstream and other minor subsurface inflows from other boundaries.
- Precipitation and applied water.
- Flow from fractures and springs.

Discharge of groundwater from the San Juan Groundwater Basin occurs from a variety of sources such as:

- Groundwater production
- Rising groundwater
- Evapotranspiration
- Outflow to Pacific Ocean

Currently, five agencies have groundwater rights to the San Juan Groundwater Basin and uses this water for either municipal purposes or for irrigation. The agencies with groundwater rights to the San Groundwater Juan Basin and their current rights are listed below:

- SCWD: 1,300 AFY
- SJBA: 8,026 AFY
- SMWD: 643 AFY
- San Juan Hills Golf Course: 450 AFY
- City of San Juan Capistrano: 3,325 AFY

The San Juan Groundwater Basin differs from many other adjudicated groundwater basins as it does not strictly follow the term “safe yield” in preventing undesirable results occurring as a result of over-production of groundwater. The basin is governed by the San Juan Basin Authority (SJBA) and is a Joint Power Agency comprised of representatives from four local jurisdictions, SMWD, MNWD, the City of San Juan Capistrano, and SCWD. The SJBA has recently adopted the concept of “adaptive management” of the San Juan Groundwater Basin to vary pumping from year to year based on actual basin conditions derived from monitoring efforts. This is due in part to the SWRCB characterization of the San Juan Groundwater Basin as a “flowing underground stream” and because the storage in the groundwater basin is small relative to recharge and production. The range of natural yield of the San Juan Groundwater Basin is 7,700 AFY to 8,600 AFY. Work is underway to construct rubber dams and increase recharge with recycled water to increase the recharge of the basin by 4,000 AFY to 7,000 AFY (SJBA, Draft Foundational Action Program Report, March 2016).

3.3.3 La Habra Groundwater Basin

The La Habra Groundwater Basin covers the northernmost part of the Orange County Groundwater Basin (Figure 3-5) and extends into parts of Los Angeles County. The La Habra Groundwater Basin lies entirely within the Coyote Creek Watershed and is shown on Figure 3-7.

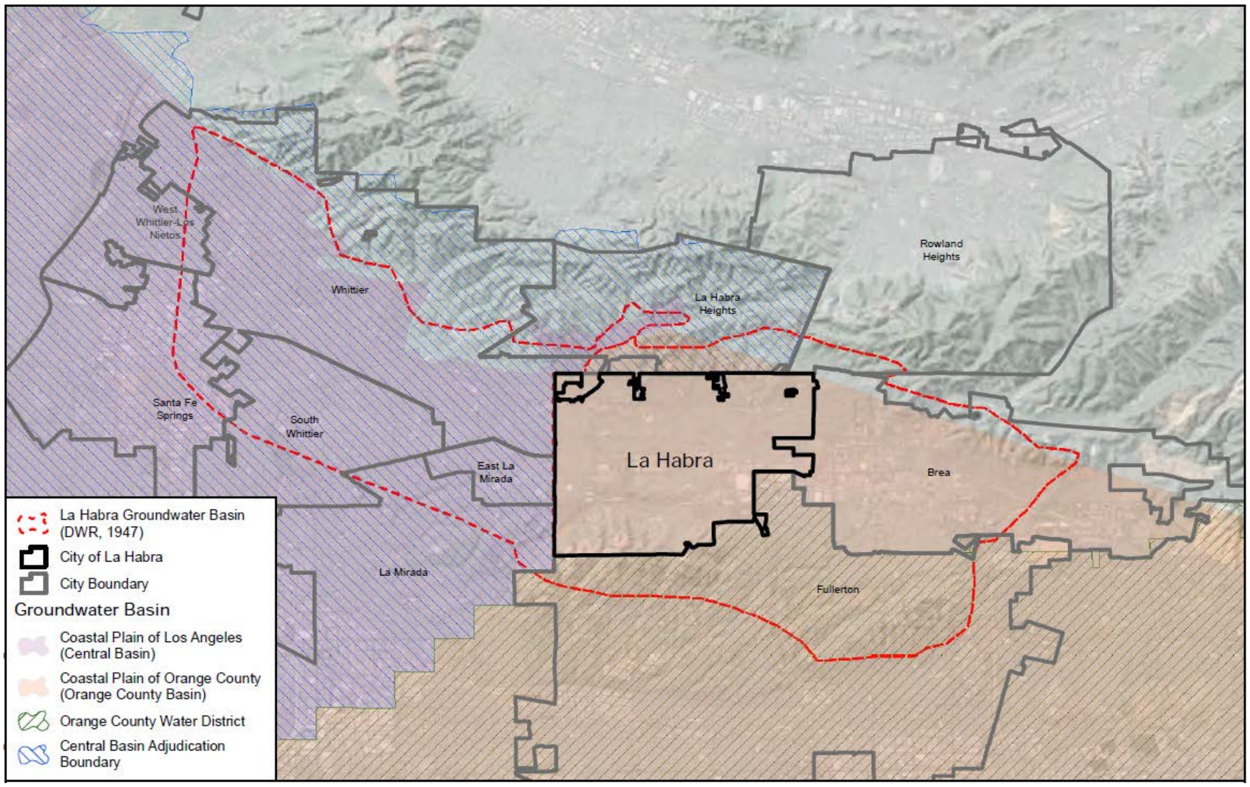

Figure 3-7: La Habra Groundwater Basin

3.3.3.1 La Habra Groundwater Basin Management Objectives

Basin Management Objectives (BMO) are locally developed flexible guidelines for groundwater development of a particular basin. The City of La Habra has four proposed BMOs:

- BMO No. 1 is to reduce the City of La Habra's dependence on imported water. Currently, approximately 62 percent of its demand is met with imported water. This BMO intends for the City of La Habra to use more local groundwater to meet its demands in order to increase reliability. The City of La Habra's compliance with the 20x2020 program will help meet this BMO as its total water demand will decrease.
- BMO No. 2 is to maintain groundwater sustainability within the La Habra Groundwater Basin. The City of La Habra can meet this objective through the coordination of groundwater production within the estimated safe yield of the La Habra Groundwater Basin.

- BMO No. 3 is to protect and enhance the water quality of the La Habra Groundwater Basin. The City of La Habra may meet this objective through continuing and supplementing its existing water quality monitoring program.
- BMO No. 4 is to improve the understanding of the La Habra Groundwater Basin's hydrogeology, groundwater elevations, and basin yields. The City of La Habra can use and supplement its existing groundwater elevation monitoring program to review general trends in groundwater elevations in the La Habra Groundwater Basin. The City of La Habra will also evaluate the need for additional monitoring (La Habra, Draft Groundwater Study, August 2014).

3.3.4 Main San Gabriel Groundwater Basin (California Domestic Water Company)

California Domestic Water Company (CDWC) has water rights, production, treatment and conveyance facilities in the Main San Gabriel Groundwater Basin that serve customers overlying the basin within Suburban Water Systems as well as serving the cities of Brea and La Habra in Orange County. The annual deliveries of groundwater to Brea and La Habra are estimated at about 12,000 AFY. The Main San Gabriel Basin and its operations are described below.

The Main San Gabriel Basin lies in eastern Los Angeles County and occupies most of San Gabriel Valley. The hydrologic basin or watershed coincides with a portion of the upper San Gabriel River watershed, and the aquifer or groundwater basin underlies most of the San Gabriel Valley. It is bounded on the north by the San Gabriel Mountains, on the northwest by Raymond Basin, on the southeast by Puente Basin, and on the south by Central Basin. The Main San Gabriel Basin encompasses approximately 107,000 acres and has a storage of 8.9 MAF when the groundwater elevation at the Baldwin Park Key Well is 316 feet. Generally speaking, one foot of groundwater elevation is equivalent to approximately 8,000 AF of storage.

The hydrogeological San Gabriel Basin is divided between three sub-basins, Main Basin, Puente Basin, and portions of Six Basins area. A portion of Six Basins area is tributary to the Main Basin. Each of the sub-basins are adjudicated and managed separately.

Major sources of recharge to the Main San Gabriel Basin are infiltration of rainfall on the valley floor and runoff from the nearby mountains. The Main San Gabriel Basin is the first of a series of basins to receive the water from mountain runoff. The Main San Gabriel Basin interacts hydrogeologically and institutionally with adjoining basins, including Puente Basin, Central Basin, and West Coast Basin (Main San Gabriel Basin Watermaster, Annual Report, 2015).

Figure 3-8 depicts the boundaries of the Main San Gabriel Basin.

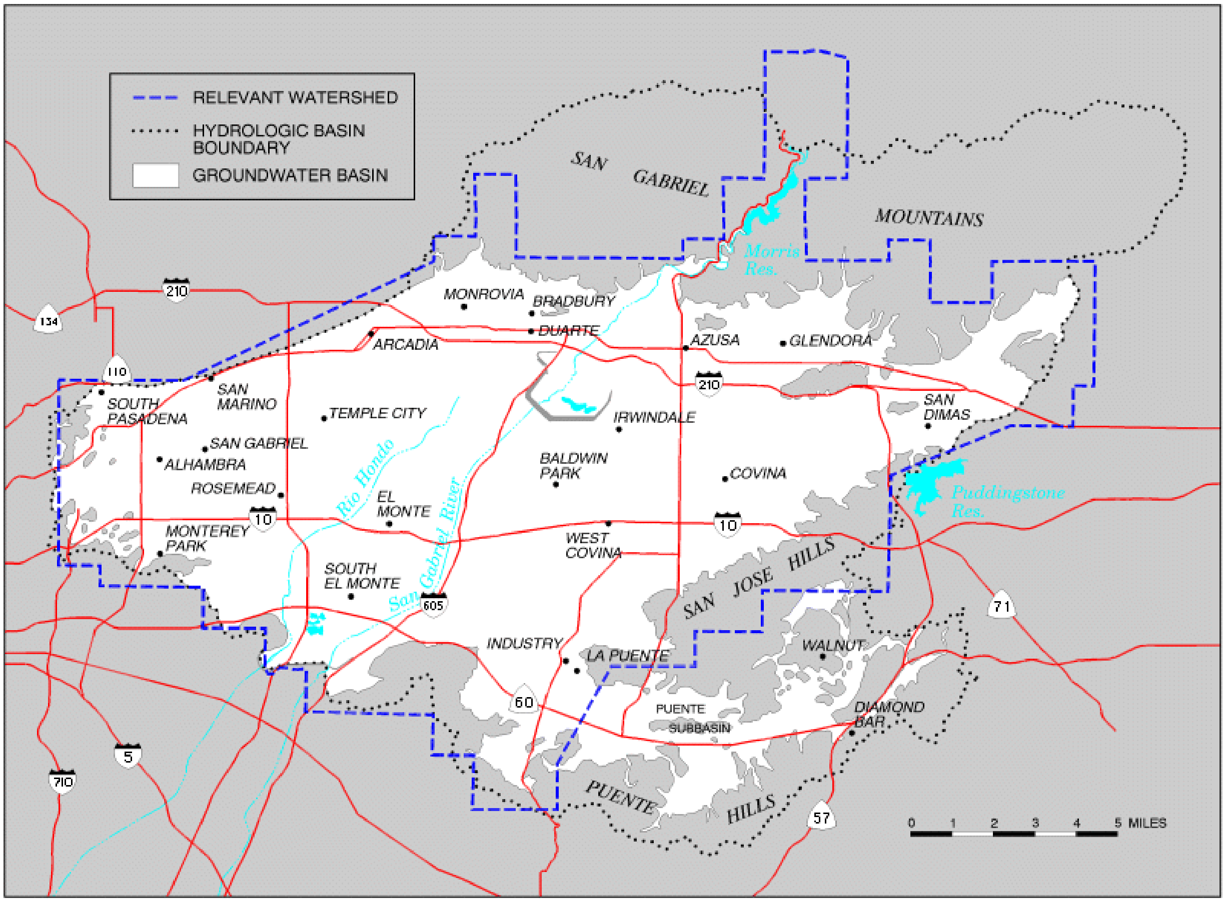

Figure 3-8: Main San Gabriel Groundwater Basin

3.3.4.1 Basin Judgment

Rapid urbanization in the San Gabriel Valley in the 1940s resulted in an increased demand for groundwater drawn from the Upper Area users in Main San Gabriel Basin. Consequently, the Main San Gabriel Basin was in a state of overdraft and the available water supply for the Lower Area and downstream users decreased. In 1968, at the request of producers, the Upper San Gabriel Municipal Water District filed a complaint that would adjudicate water rights in the Basin and would bring all Basin producers under control of one governing body. The final result was the entry of the Main San Gabriel Basin Judgment in 1973.

The Judgment defined the water rights of 190 original parties to the legal action. It created a new governing body, the Main San Gabriel Basin Watermaster, and described a program for management of water in the Basin. Under the terms of the Main San Gabriel Basin Judgment all rights to the diversion of surface water and production of groundwater within the Main Basin and its Relevant Watershed were adjudicated. The Main Basin Judgment does not restrict the quantity of water agencies may extract from the Main Basin. Rather, it provides a means for replacing with Supplemental Water all annual extractions in excess of an agency's annual right to extract water. The Main Basin Watermaster annually establishes an Operating Safe Yield for the Main Basin that is then used to allocate to each agency its portion of the

Operating Safe Yield that can be produced free of a Replacement Water Assessment. If a producer extracts water in excess of his right under the annual Operating Safe Yield, it must pay an assessment for Replacement Water that is sufficient to purchase one AF of Supplemental Water to be spread in the basin for each AF of excess production. All water production is metered and is reported quarterly to the Main Basin Watermaster. The Operating Safe yield for FY 2014 to 2015 was set at 150,000 AF.

In addition to Replacement Water Assessments, the Main Basin Watermaster levies an Administration Assessment to fund the administration of the Main Basin management program under the Main Basin Judgment and a Make-up Obligation Assessment in order to fulfill the requirements for any Make-Up Obligation under the Long Beach Judgment and to supply fifty percent of the administration costs of the River Watermaster service. The Main Basin Watermaster levies an In-lieu Assessment and may levy special Administration Assessments.

Water rights under the Main Basin Judgment are transferable by lease or purchase so long as such transfers meet the requirements of the Main Basin Judgment. There is also provision for Cyclic Storage Agreements that allow parties and non-parties to store imported supplemental water in the Main San Gabriel Basin under such agreements with the Main Basin Watermaster pursuant to uniform rules and conditions and Court approval (Main San Gabriel Basin Watermaster, Annual Report, 2015).

The Main Basin Watermaster has entered into a Cyclic Storage Agreement with three municipal water districts, Metropolitan, Three Valleys Municipal Water District (TVMWD), and Upper San Gabriel Valley Municipal Water District (USGVMWD). The first agreement with Metropolitan and USGVMWD permits Metropolitan to deliver and store imported water in the Main Basin in an amount not to exceed 100,000 AF for future Replacement Water use. The second Cyclic Storage Agreement is with TVMWD and permits Metropolitan to deliver and store 40,000 AF for future Replacement Water use. The third is with San Gabriel Valley Municipal Water District.

3.3.5 San Mateo Groundwater Basin

The San Mateo Groundwater Basin is located to the south of the Orange County boundary, within the boundary of the Marine Corps Base, Camp Pendleton (Base) in San Diego County. Historically, the Base utilized groundwater from the San Mateo Basin for Base use and for irrigation of agricultural lease lands on Base property. Recent data have not been obtained on use of water from the basin by the Base but the agricultural leases in the area have been terminated for some time now. The City of San Clemente has a well two wells that produce between 500 and 1000 AF from the groundwater basin.

San Mateo Creek is accessible to the public, as the creek mouth and lagoon lie within the leasehold of San Onofre State Park. San Mateo Creek is the most pristine, intact coastal stream in Southern California. The streambed and floodplain are in a natural state and the riparian habitat is uniquely native. Several distinct tributaries collect winter rains which flow unimpeded to the ocean.

The watershed encompasses a total of 85,402 acres. These include 40,533 acres of Cleveland National Forest lands, 18,686 acres of Camp Pendleton lands, and 26,183 acres of private lands. The topography is rugged mountains with elevations ranging from 400 feet to 3500 feet. Vegetation types present include chaparral, coastal sage scrub, grassland, oak woodland, and riparian woodland. There are 63 miles of perennial streams within the watershed, of which 11 miles are known or suitable habitat breeding habitat for southern steelhead. Currently, the suitable breeding habitat is the main stem of San Mateo Creek and a portion of Devil Creek. All of the stream miles that are suitable breeding habitat for southern steelhead are within the San Mateo Wilderness of Cleveland National Forest. There are 12 miles of stream on Camp Pendleton that the steelhead use as a corridor.

Five endangered species occur within the watershed: southern steelhead, arroyo toad, tidewater goby, least Bell's vireo, and southwestern willow flycatcher. Of these, the primary concern of this plan is the southern steelhead. Historically San Mateo Creek supported rainbow trout and anadromous steelhead.

In its "Proposed Range Extension for Endangered Steelhead in Southern California," the National Marine Fisheries Service identified increased groundwater extraction, loss of riparian vegetation, stream channel changes, surficial flow reductions, human-caused fires, and the introduction of non-native predator species as the main threats to steelhead in the San Mateo Creek watershed.

Water Gaging records from 1953 to 2009 indicate an average annual streamflow of 8,720 AF per year. The minimum thickness of the alluvial and San Mateo aquifer units ranges from 33 to 1,400 feet. Aquifer tests have been conducted at five locations within the coastal basin. Groundwater quality from the basin indicates total dissolved solids of less than 900 milligrams per liter and nitrate concentrations less than 7 milligrams per liter.

In the 1990's a Conjunctive Use Concept was considered that envisioned a joint venture between the Marine Corps Base Camp Pendleton and Tri-Cities MWD (was subsequently consolidated into South Coast Water District) that would utilize the potential groundwater basin yield of about 2,000 AF ± and also would also consider storage of imported water for use for emergency purposes in an arrangement with the Marine Base. No current discussions or contacts have been made with the Marine Base.

3.3.6 Laguna Canyon Groundwater Basin

The Laguna Creek watershed lies in the San Joaquin Hills of southern Orange County. The drainage area of approximately 5,412 acres includes the Laguna Creek and Niguel Creek basins and is the largest stream basin to drain exclusively from the San Joaquin Hills into the ocean. The drainage basin is roughly 6.5 miles long and averages 1.5 miles wide between its boundaries. The upper or northern half of the Laguna Canyon Basin is relatively wide with low subdued hills, whereas the lower half is narrow, with steep slopes forming Laguna Canyon. Elevations reach 1,000 feet above sea level in parts of the drainage basin.

The average annual rainfall is about 12 inches at Laguna Beach at the mouth of Laguna Creek and, at times, rainfall in the San Joaquin Hills is sufficient to cause sharp, damaging floods along Laguna Creek. In general, however, the drainage basin is dry with only sufficient water discharge to reflect losses from groundwater sources and urban runoff.

Historically, limited groundwater was produced from this basin when the Laguna area was first settled. However, over time, the supplies could not meet demands and LBCWD (and its predecessor water company) looked first to groundwater supplies in Huntington Beach from the Orange County Groundwater Basin, and later to imported water to meet the needs of its service area. While LBCWD has conducted a review of the potential production from this area, it is not viewed as a reliable source of water into the future. In 2016, LBCWD was able to resurrect its old water rights within the Orange County Groundwater Basin by agreement with OCWD to obtain 2,025 AFY. They are in the process of developing plans to produce and import this water.

3.3.7 Impaired Groundwater

The combined yield from the seven projects described below, was 17,864 AF in 2015. This supply is expected to increase substantially to over 30,000 AF at ultimate development of these projects. Since these projects use groundwater, a similar amount must either be replenished on an average annual basis to maintain water balance or be salvaged from water that otherwise would flow into the ocean as subsurface outflow. The benefit of these projects is to provide a firm base supply, restore use of groundwater storage impaired by natural causes and/or agricultural drainage, improve conjunctive use storage operations, and provide a drought supply by the additional capacity to tap groundwater in storage.

Tustin Main Street Desalter - The City of Tustin currently operates two desalter plants. The Main Street Treatment plant began operating in 1989 with a capacity of 2 MGD (million gallons per day). The Main Street Desalter reduces nitrate levels from the groundwater produced by Tustin's Main Street wells. The untreated groundwater undergoes either Reverse Osmosis or Ion Exchange treatment.

Tustin 17th Street Desalter - The Tustin 17th Street Desalter began operating in 1996 with a capacity of 3 MGD. The Tustin 17th Street Desalter reduces high nitrate and total dissolved solids (TDS) concentrations from the groundwater pumped by Tustin's 17th Street wells. The 17th Street Desalter plant uses two Reverse Osmosis membrane trains to treat the groundwater.

Mesa Water Reliability Facility – Mesa currently owns and operates a Mesa Water Reliability Facility (MWRF) with a capacity of 5.8 MGD that removes color from the water using microfiltration.

IRWD Deep Aquifer Treatment System – IRWD's Deep Aquifer Treatment System (DATS) purifies drinking water from the lower aquifer of the Orange County Groundwater Basin. The water in this aquifer is very high quality, but has a brownish tint imparted from the remains of ancient vegetation. The DATS facility went on-line in 2002 and can treat up to 7.4 MGD from two wells that pump water from 2000 feet below ground level.

IRWD Irvine Desalter Project - The Irvine Desalter Project was completed in 2006 and purifies water found in the Irvine sub-basin of the larger Orange County groundwater basin. It is a two-part endeavor, with recycled water and drinking water components. The Irvine Desalter Potable Treatment Facility uses two reverse osmosis trains to produce 2.7 MGD by removing salts that are caused by natural geology and past agricultural use.

San Juan Basin Desalter **-** The Groundwater Recovery Plant (GWRP) came on-line in 2004, also known as the San Juan Basin Desalter, is a 5 MGD plant that is owned and operated by the City of San Juan Capistrano. The GWRP takes groundwater high in iron, manganese, and total dissolved solids using reverse osmosis and makes it suitable for potable water uses. The plant has never operated continuously at the 5 MGD rate, but prior to the drought restrictions in the basin, had been producing water at the rate of about 3 MGD.

SCWD Groundwater Desalter - SCWD currently owns and operates a 1 MGD GRF that came on-line in 2007, also known as the Capistrano Beach Desalter. The plant extracts brackish groundwater from an aquifer in the San Juan Basin and goes through iron and manganese removal due to high mineral content.

3.3.8 Metropolitan Imported Water for Groundwater Replenishment

In the past OCWD, MWDOC, and Metropolitan have coordinated water management to increase storage in the Orange County Groundwater Basin when imported supplies are available for this purpose. The "discounted" replenishment water availability was discontinued on January 1, 2013, and currently MWDOC sells replenishment water to OCWD at the firm untreated Metropolitan rate. Figure 3-9 shows MWDOC imported water sales to OCWD since FY 1989-90, which average approximately 27,000 AF per year. However, due to low Santa Ana River flows as a result of low precipitation and increased use along the river, OCWD anticipates to purchase 65,000 AF of imported water per year. This does not include water amounts from Metropolitan's Conjunctive Use Program (CUP).

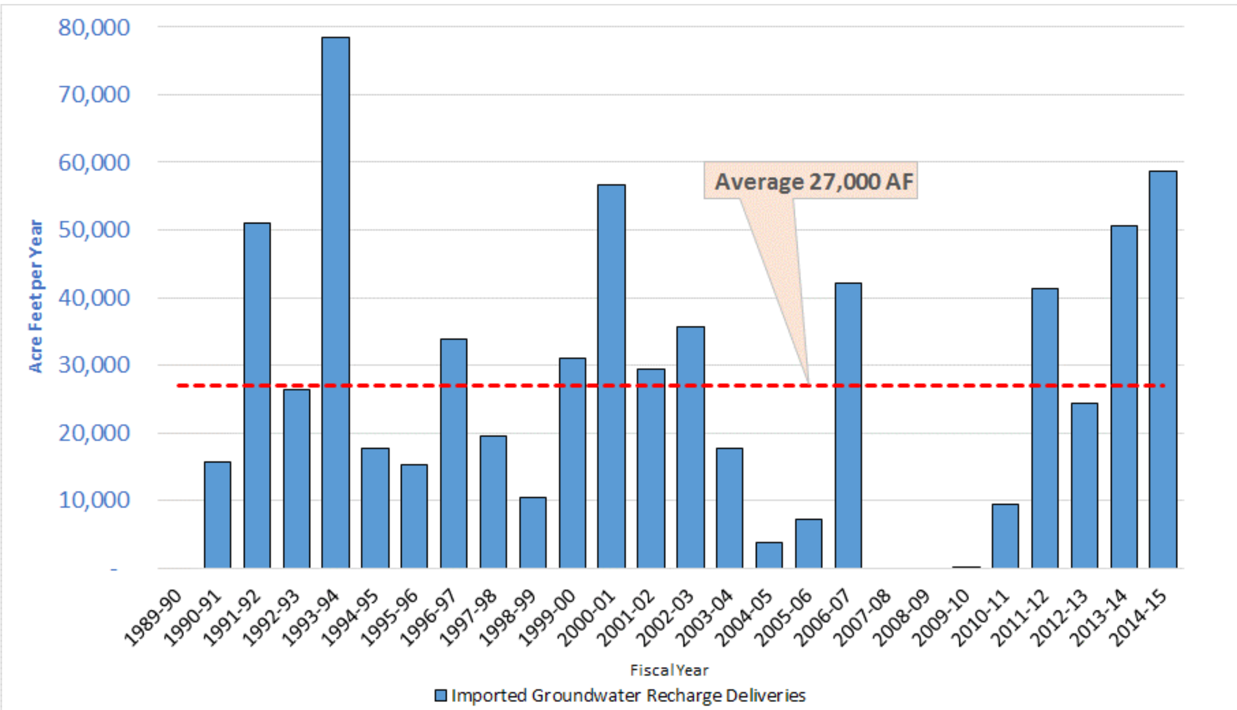

Figure 3-9: MWDOC Imported Water Sales for Groundwater Replenishment

3.3.9 Metropolitan Conjunctive Use Program with OCWD

Since 2004, OCWD, MWDOC, and certain groundwater producers have participated in Metropolitan's CUP. This program allows for the storage of Metropolitan water in the Orange County Groundwater Basin. The existing Metropolitan program provides storage up to 66,000 AF of water in the Orange County Groundwater Basin in exchange for Metropolitan's contribution to improvements in basin management facilities. These improvements include eight new groundwater production wells, improvements to the seawater intrusion barrier, and construction of the Diemer Bypass Pipeline. The water is accounted for via the CUP program administered by the wholesale agencies and is controlled by Metropolitan such that it can be withdrawn over a three-year time period.

As shown in Figure 3-10, the MWDOC CUP storage account has been utilized over the past ten-years. The CUP account has filled in the wet year of 2007 and withdrawn to zero during the dry-years of 2009 and 2010. Currently, due to the drought conditions, the CUP account is projected to reach 100 AF by the end of 2016.

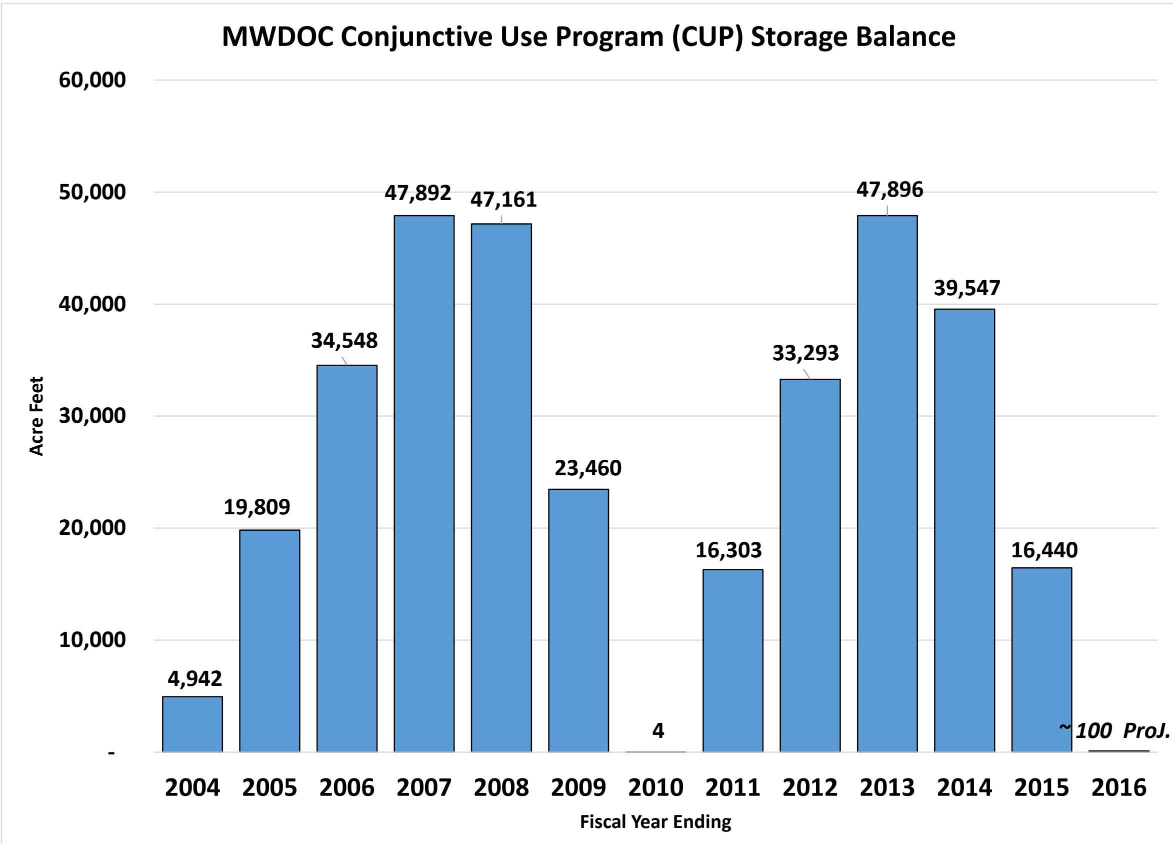

Figure 3-10: MWDOC Conjunctive Use Program Historical Storage Balance

3.3.10 Historical Groundwater Production

MWDOC does not provide any groundwater to its retail agencies. However, its retail agencies do extract groundwater locally in order to better diversify their portfolio. Table 3-10 shows a breakdown of historical groundwater production by the retail agencies from all groundwater basins within MWDOC's service area.

Table 3-10: Groundwater Pumped in the Past 5 Years within MWDOC's Service Area (AF)

Groundwater Basin	Fiscal Year Ending				
	2010	2011	2012	2013	2014
Orange County Basin[1]	204,215	209,216	227,819	236,706	211,061
San Juan Basin	4,408	6,870	4,450	3,146	4,550
La Habra Basin	1,285	1,241	1,322	1,530	1,657
Main San Gabriel Basin	12,727	12,440	11,504	10,127	9,698
Total Groundwater	**222,633**	**229,767**	**245,095**	**251,510**	**226,967**

[1] Includes only the MWDOC member agencies' groundwater production. Does not include the groundwater production of Anaheim, Fullerton, and Santa Ana

3.4 Surface Water

MWDOC does not use surface water for its water supply. However, surface water provides an additional local source to some MWDOC retail agencies, including IRWD, Serrano, TCWD, and the City of Orange. Surface water supplies in Orange County are captured mostly from Santiago Creek into Santiago Reservoir.

To help augment surface water reservoir, imported water is purchased annually. Table 3-11 shows the projected surface water yearly demand of imported water purchased from MWDOC.

Table 3-11: Current and Projected Surface Water Production within MWDOC's Service Area (AF)

	Fiscal Year Ending					
	2015	2020	2025	2030	2035	2040
Surface Water	8,227	7,306	7,306	7,306	7,306	7,306

3.5 Recycled Water

Orange County is the leader in water recycling in the State of California, in both quantity and innovation. Water supply and wastewater treatment agencies in Orange County have received well-deserved recognition in the field of water reclamation and reuse.

Recycled water is widely accepted as a water supply source throughout MWDOC's service area. In the past, recycled water was mainly used for landscape irrigation. IRWD, a MWDOC retail agency, is also at the forefront of using recycled water not only for irrigation but also for other uses such as toilet flushing and commercial needs. Recycled water in MWDOC's service area is treated to various levels dependent upon the ultimate end use and in accordance with Title 22 regulation.

Recycled water programs in the region are described in greater detail in Section 6.

3.6 Existing Transfers and Exchanges

A few MWDOC retail agencies have expressed interests in pursuing transfers of water from outside of the region. MWDOC will continue to help its retail agencies in developing these opportunities and ensuring their success. In fulfilling this role, MWDOC will help its retail agencies navigate the operational and administrative issues of wheeling water through the Metropolitan water distribution system or by examining other delivery options.

Santa Margarita Water District - SMWD has actively pursued additional water supply reliability through water transfers and successfully completed water transfers in the late 1990's through the Metropolitan system. At present the future of such transfers as a reliable and cost-effective means of providing the basic supply are uncertain. However, transfer with specific purposes, such as supplementing dry year supplies can be effective. SMWD will continue to pursue water transfers as an alternative water supply and is currently working with MWDOC and other agencies to investigate possible transfers. The Supplemental Dry Year Agreements are transfer agreements that are triggered under specific conditions when supplies from Metropolitan are limited. Cucamonga Valley Water District (CVWD) and GSWC will use groundwater in lieu of taking delivery of imported water from Metropolitan. SMWD has a transfer agreement with Cucamonga Valley Water District of 4,250 AFY, both short term and long term. SMWD also has a short term transfer agreement with GSWC of 2,000 AFY.

IRWD Strand Ranch Water Banking Program - IRWD implemented their Strand Ranch Water Banking Program and initiated the first delivery of water under the program to their service territory in OC in June 2015 as a demonstration effort. The delivered water was determined by Metropolitan to meet the definition of an "extraordinary supply" meaning that IRWD received full credit for the water under Metropolitan's water supply allocation plan. The banking program has been implemented via agreements with Metropolitan to wheel the water through their system, when requested.

3.7 Supply Reliability

3.7.1 Overview

Every urban water supplier is required to assess the reliability of their water service to its customers under normal, dry, and multiple dry water years. MWDOC's service area depends on a combination of imported and local supplies to meet its service area water demands and has taken numerous steps to ensure its member agencies have adequate supplies. Development of numerous local sources augment the reliability of the imported water system. There are various factors that may impact reliability of supplies such as legal, environmental, water quality and climatic which are discussed below. The water supplies available to the MWDOC service area are projected to meet full-service demands based on the findings by Metropolitan in its 2015 UWMP starting 2020 through 2040 during normal years, single dry year, and multiple dry years.

Metropolitan's 2015 UWMP describes the core water resources that will be used to meet full-service demands at the retail level under all foreseeable hydrologic conditions from 2020 through 2040. The foundation of Metropolitan's resource strategy for achieving regional water supply reliability has been to develop and implement water resources programs and activities through its preferred resource mix. This preferred resource mix includes conservation, local resources such as water recycling and groundwater storage, in-region groundwater storage, out-of-region banking, treatment, conveyance and infrastructure improvements. Table 3-12 shows the basis of water year data used to predict drought supply availability.

Table 3-12: Basis of Water Year Data

<table>
<tr><th colspan="4">Wholesale: Basis of Water Year Data</th></tr>
<tr><th rowspan="4">Year Type</th><th rowspan="4">Base Year</th><th colspan="2">Available Supplies if Year Type Repeats</th></tr>
<tr><td>☐</td><td>Quantification of available supplies is not compatible with this table and is provided elsewhere in the UWMP. Location ________</td></tr>
<tr><td>☑</td><td>Quantification of available supplies is provided in this table as either volume only, percent only, or both.</td></tr>
<tr><th>Volume Available</th><th>% of Average Supply</th></tr>
<tr><td>Average Year</td><td>1990-2014</td><td>-</td><td>100%</td></tr>
<tr><td>Single-Dry Year</td><td>2014</td><td>-</td><td>106%</td></tr>
<tr><td>Multiple-Dry Years 1st Year</td><td>2012</td><td>-</td><td>106%</td></tr>
<tr><td>Multiple-Dry Years 2nd Year</td><td>2013</td><td>-</td><td>106%</td></tr>
<tr><td>Multiple-Dry Years 3rd Year</td><td>2014</td><td>-</td><td>106%</td></tr>
<tr><td colspan="4">(1) NOTES: Assumes M&I demand levels in 2015 of 159,000, Irvine Lake replenishment of 7,000 AF and groundwater replenishment demands of 65,000 AFY.
(2) Assumes increase of demands in dry and multiple dry years of +6% based on OC Reliability Study (See Appendix G)</td></tr>
</table>

3.7.2 Factors Contributing to Reliability

The Act requires a description of water supply reliability and vulnerability to seasonal or climatic shortage. The following are some of the factors identified that may have an impact on the reliability of imported water supplies.

3.7.2.1 Environment

Endangered species protection needs in the Delta have resulted in operational constraints to the SWP system, as mentioned previously in the State Water Project Supplies section.

3.7.2.2 Legal

The addition of more species under the Endangered Species Act and new regulatory requirements could impact SWP operations by requiring additional export reductions, releases of additional water from storage or other operational changes impacting water supply operations. In addition, water rights challenges can occur on a multi-level – State, regional and local basis. Water rights on both the Colorado River, along the California Aqueduct, and in and around the SWP are always under review and challenged.

3.7.2.3 Water Quality

3.7.2.3.1 Imported Water

Metropolitan is responsible for providing high quality potable water throughout its service area. Over 300,000 water quality tests are performed per year on Metropolitan's water to test for regulated contaminants and additional contaminants of concern to ensure the safety of its waters. Metropolitan's supplies originate primarily from the CRA and from the SWP. A blend of these two sources, proportional to each year's availability of the source, is then delivered throughout Metropolitan's service area.

Metropolitan's primary water sources face individual water quality issues of concern. The CRA water source contains higher TDS and the SWP contains higher levels of organic matter, lending to the formation of disinfection byproducts. To remediate the CRA's high level of salinity and the SWP's high level of organic matter, Metropolitan blends CRA and SWP supplies and has upgraded all of its treatment facilities to include ozone treatment processes. In addition, Metropolitan has been engaged in efforts to protect its Colorado River supplies from threats of uranium, perchlorate, and chromium VI while also investigating the potential water quality impact of emerging contaminants, N-nitrosodimethylamine (NDMA), and pharmaceuticals and personal care products (PPCP). While unforeseeable water quality issues could alter reliability, Metropolitan's current strategies ensure the deliverability of high quality water.

The presence of Quagga Mussels in water sources is a water quality concern. Quagga Mussels are an invasive species that was first discovered in 2007 at Lake Mead, on the Colorado River. This species of mussels form massive colonies in short periods of time, disrupting ecosystems and blocking water intakes. They are capable of causing significant disruption and damage to water distribution systems. Controlling the spread and impacts of this invasive species within the CRA requires extensive maintenance and results in reduced operational flexibility. It has also resulted in Metropolitan eliminating deliveries of CRA water into DVL to keep the reservoir free from Quagga Mussels.

3.7.2.3.2 Groundwater

Orange County Groundwater Basin

OCWD is responsible for managing the Orange County Groundwater Basin. To maintain groundwater quality, OCWD conducts an extensive monitoring program that serves to manage the Orange County Groundwater Basin's groundwater production, control groundwater contamination, and comply with all required laws and regulations. A network of nearly 700 wells provides OCWD a source for samples, which are tested for a variety of purposes. OCWD collects 600 to 1,700 samples each month to monitor Orange County Groundwater Basin water quality. These samples are collected and tested according to approved federal and state procedures as well as industry-recognized quality assurance and control protocols.

San Juan Groundwater Basin

Groundwater quality from the San Juan Basin was determined through the analyses of available data from production and monitoring wells. Constituents of concern within the San Juan Basin include TDS, nitrate nitrogen, manganese, and iron.

TDS consists of inorganic salts dissolved in water, with the major ions being sodium, potassium, calcium, magnesium, bicarbonates, chlorides, and sulfates under Title 22. The California secondary MCL for TDS is 500 mg/L. Four wells were tested for TDS and all of the wells exceeded the secondary MCL for TDS. The lower portion of the San Juan Basin exhibits relatively higher TDS levels due to irrigation return flows, fertilizer use, consumptive use, and dissolution of ions from weathered rock surfaces and salts.

Nitrate within groundwater can be both naturally-occurring and can also be associated with agriculture and other synthetic production. The primary MCL for nitrate in drinking water is 10 mg/L. Most groundwater wells monitored for nitrate exhibited levels below MCL except for two wells.

Manganese is a naturally-occurring inorganic constituent dissolved in water. Manganese is an essential micronutrient at low concentrations, but at higher concentrations in drinking water, manganese may lead to objectionable aesthetic qualities such as bitter taste and staining of clothes. The California secondary MCL for manganese is 0.5 mg/L. Most wells monitored for manganese exceeded the secondary MCL for manganese by as much as 40 times with the exception of two wells in the Oso and Lower Trabuco area.

Iron is a naturally-occurring inorganic constituent dissolved in water. Similar to manganese, iron in low concentrations is an essential micronutrient, but iron in higher concentrations in drinking water leads to the same objectionable aesthetic qualities as those of manganese. The California secondary drinking water MCL for iron is 0.3 mg/L. With the exception of one groundwater well in the Oso area, all wells exceeded the secondary MCL for iron by as much as 60 times (San Juan Basin Authority, San Juan Basin Groundwater and Facilities Management Plan, November 2013).

La Habra Groundwater Basin

La Habra Groundwater Basin has water quality concerns that require treatment or blending with higher quality water to meet the State’s health standards. TDS, hydrogen sulfide, iron, and manganese impair La Habra Groundwater’s water supply. The quality of Idaho Street Well raw water requires treatment before entering the City of La Habra’s distribution system. The treatment system includes chlorination, air-stripping to remove hydrogen sulfide and ammonia that may be present, and the addition of sodium hexametaphosphate to sequester iron and manganese. Water from the La Bonita Well and the Portola Well is chlorinated and then blended with CDWC purchased water in a 250,000-gallon forebay to reduce mineral concentration (La Habra, Draft Groundwater Study, August 2014).

Main San Gabriel Groundwater Basin

VOCs and nitrates are the most prevalent contaminants found in the Main San Gabriel Basin. As a result, the location and treatment methods are generally well understood. During FY 2014 to 2015, 30 treatment plants treated approximately 78,300 AF of water from the Main San Gabriel Basin. VOC and nitrate levels throughout the Main San Gabriel Basin are shown on Figures 3-10 and 3-11, respectively.

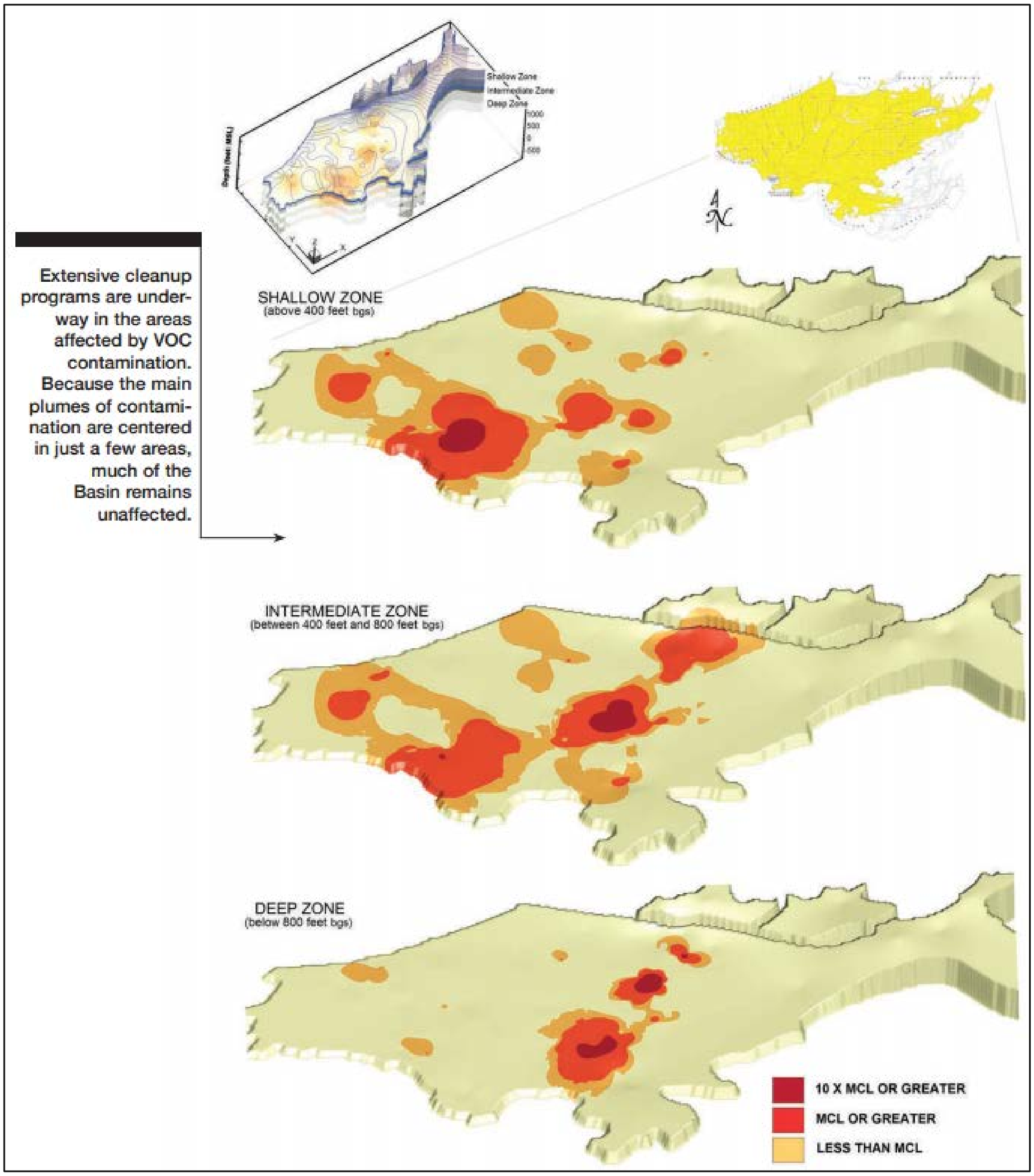

Figure 3-11: VOC levels through the Main San Gabriel Basin

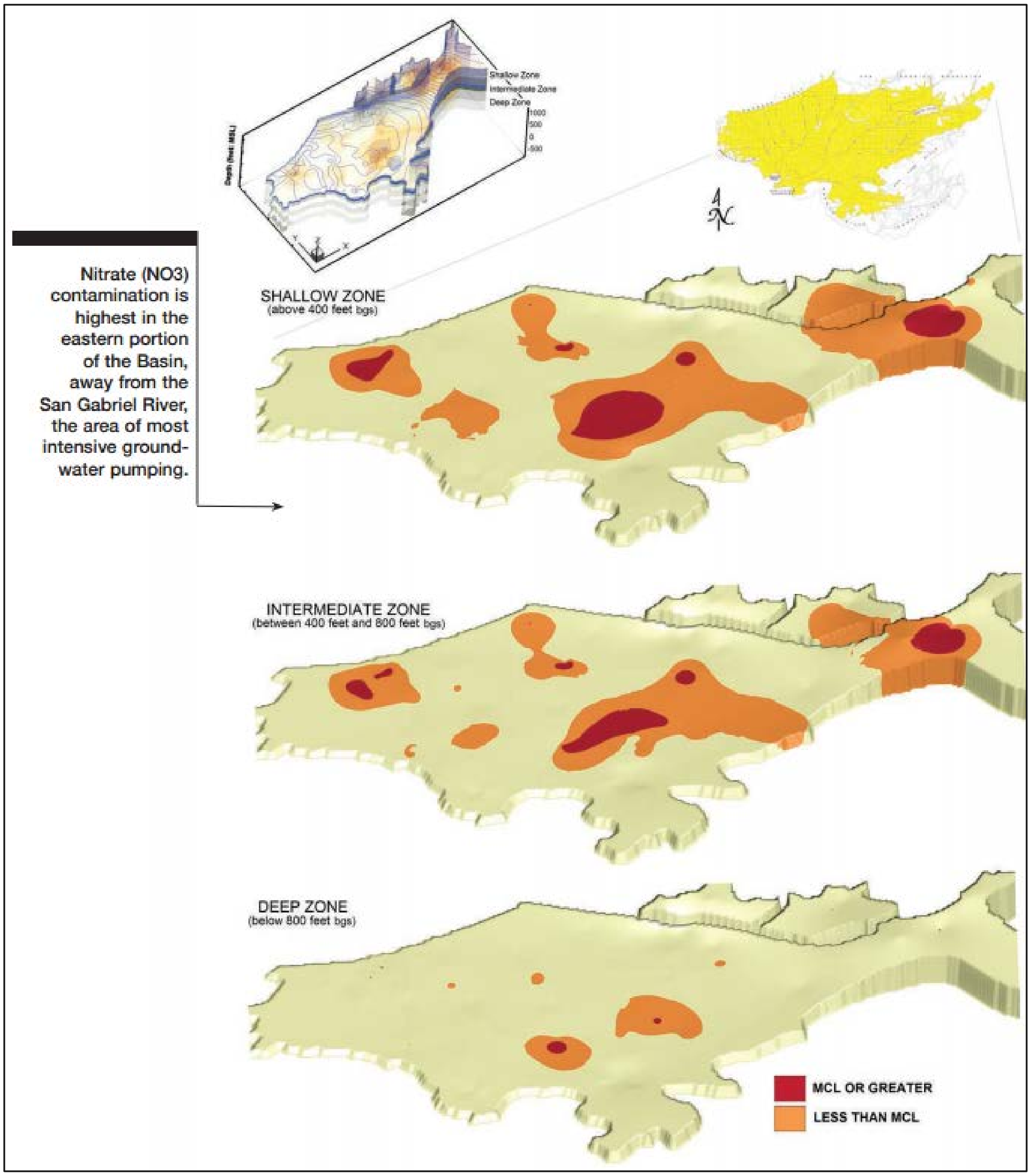

Figure 3-12: Nitrate levels throughout the Main San Gabriel Basin

The Division of Drinking water (DDW) lowered the notification level of perchlorate from 18 to 4 parts per billion (ppb) in January 2002. Subsequently, a total of 22 wells from the Main San Gabriel Basin were removed from service due to unacceptable levels of perchlorate. In October 2007, the DDW established an MCL of 6 ppb. Efforts to treat perchlorate by the Watermaster resulted in ion-exchange technology treatment facilities at five sites in the Baldwin Park Operable Unit (BPOU) and at two facilities in other parts of the Main San Gabriel Basin during FY 2014 to 2015.

During 1998, local eight local wells within the Main San Gabriel Basin were had levels of NDMA above the notification level. Three of the wells were taken off-line as a direct result of NDMA levels above notification level. The Watermaster played a key role in the construction of NDMA treatment facilities within the Main San Gabriel Basin. Five facilities were operational during FY 2014 to 2015.

1,2,3-TCP is a degreasing agent that has been detected in the BPOU during the winter of 2006. Its presence delayed the use of one treatment facility for potable purposes. The DDW determined 1,2,3-TCP is best treated through liquid phase granular activated carbon. Facilities to treat 1,2,3-TCP were operational during FY 2014-2015.

Cr VI is a naturally occurring substance that has been detected in drinking water wells through the Main San Gabriel Basin. Cr VI is also associated with industrial sources of contamination, such as metal plating. In July 1, 2014, the DDW established a new MCL for Cr VI of 10 ppb. Currently, Cr VI concentrations in all active wells are below the maximum contaminant level (MCL) (Main San Gabriel Basin Watermaster, Five-Year Water Quality and Supply Plan, 2015).

3.7.2.4 Climate Change

Changing climate patterns are expected to shift precipitation and temperature patterns and affect both water supply and demands. Unpredictable weather patterns will make water supply planning more challenging. The areas of concern for California include a reduction in Sierra Nevada Mountain snowpack, increased intensity and frequency of extreme weather events, and rising sea levels causing increased risk of Delta levee failure, seawater intrusion of coastal groundwater basins, and potential cutbacks on the SWP and CVP. The major impact in California is that without additional surface storage, the earlier and heavier runoff (rather than snowpack retaining water in storage in the mountains), will result in more water being lost into the oceans. A heavy emphasis on storage is needed in the State of California.

In addition, the Colorado River Basin supplies have been inconsistent since 2000, resulting in 13 of the last 16 years of the upper basin runoff being below normal. Climate models are predicting a continuation of this pattern whereby hotter and drier weather conditions will result in continuing lower runoff.

Legal, environmental, and water quality issues may have impacts on Metropolitan supplies.

3.7.3 Normal-Year Reliability Comparison

The water demand forecasting model developed for the Orange County Reliability Study (described in Section 2.4.1), to project the 25-year demand for Orange County water agencies, also isolated the impacts that weather and future climate can have on water demand through the use of a statistical model. The explanatory variables of population, temperature, precipitation, unemployment rate, drought restrictions, and conservation measures were used to create the statistical model. The impacts of hot/dry weather condition are reflected as a percentage increase in water demands from the average condition. The average (normal) demand is represented by the average water demand of 1990 to 2014 (CDM Smith, Final Technical Memorandum #1 of Orange County Reliability Study, April 2016).

MWDOC is 100 percent reliable for normal year demands from 2020 through 2040. MWDOC receives imported water from Metropolitan via connection to Metropolitan's regional distribution system. Although pipeline and connection capacity rights do not guarantee the availability of water, per se, they do guarantee the ability to convey water into the local system when it is available from the Metropolitan distribution system.

A comparison between the supply and demand for projected years between 2020 and 2040 is shown in Table 3-13. As stated above, the available supply will meet projected imported demands due to a diversified supply and conservation measures limiting and reducing imported demands in the later years.

Table 3-13: Normal Year Supply and Demand Comparison (AF)

Wholesale: Normal Year Supply and Demand Comparison					
	2020	2025	2030	2035	2040
Supply totals	205,132	216,560	212,509	208,219	207,441
Demand totals	205,132	216,560	212,509	208,219	207,441
Difference	0	0	0	0	0
NOTES: Includes MWDOC Service Area Projected imported M&I and Surface & GW replenishment demands					

3.7.4 Single Dry-Year Reliability Comparison

A single dry year is defined as a single year of minimal rainfall within a period that average precipitation is expected to occur. The water demand forecasting model developed for the Orange County Reliability Study (described in Section 2.4.1) isolated the impacts that weather and future climate can have on water demand through the use of a statistical model. The impacts of hot/dry weather condition are reflected as a percentage increase in water demands from the average condition (1990-2014). For a single dry year condition (FY2013-14), the model projects a six percent increase in demand for the MWDOC's service area (CDM Smith, Final Technical Memorandum #1 of Orange County Reliability Study, April 2016). Detailed information of the model is included in Appendix G.

MWDOC has documented that it is 100 percent reliable for single dry year demands from 2020 through 2040 with a demand increase of six percent from normal demand with significant reserves held by Metropolitan and conservation. A comparison between the supply and the demand in a single dry year is shown in Table 3-14.

Table 3-14: Single Dry Year Supply and Demand Comparison (AF)

Wholesale: Single Dry Year Supply and Demand Comparison					
	2020	2025	2030	2035	2040
Supply totals	213,101	225,215	220,921	216,374	215,549
Demand totals	213,101	225,215	220,921	216,374	215,549
Difference	0	0	0	0	0
Note: The Single Dry-Year projections estimate a 6% increase on imported M&I and surface water. Groundwater Replenishment remain at 65,000 AF per year.					

3.7.5 Multiple Dry-Year Reliability Comparison

Multiple dry years are defined as three or more years with minimal rainfall within a period of average precipitation. The water demand forecasting model developed for the Orange County Reliability Study (described in Section 2.4.1) isolated the impacts that weather and future climate can have on water demand through the use of a statistical model. The impacts of hot/dry weather condition are reflected as a percentage increase in water demands from the average condition (1990-2014). For a single dry year condition (FY2013-14), the model projects a six percent increase in demand for the MWDOC's service area (CDM Smith, Final Technical Memorandum #1 of Orange County Reliability Study, April 2016). It is conservatively assumed that a three-year multi dry year scenario is a repeat of the single dry year over three consecutive years (FY 2011-12 through FY 2013-14).

MWDOC is capable of meeting all customers' demands with significant reserves held by Metropolitan and conservation in multiple dry years from 2020 through 2040 with a demand increase of 6.0 percent from normal condition with significant reserves held by Metropolitan and conservation. The basis of the water year is displayed in Table 3-15.

Table 3-15: Multiple Dry Years Supply and Demand Comparison (AF)

Wholesale: Multiple Dry Years Supply and Demand Comparison						
		2020	2025	2030	2035	2040
First year	Supply totals	213,101	225,215	220,921	216,374	215,549
	Demand totals	213,101	225,215	220,921	216,374	215,549
	Difference	0	0	0	0	0
Second year	Supply totals	213,101	225,215	220,921	216,374	215,549
	Demand totals	213,101	225,215	220,921	216,374	215,549
	Difference	0	0	0	0	0
Third year	Supply totals	213,101	225,215	220,921	216,374	215,549
	Demand totals	213,101	225,215	220,921	216,374	215,549
	Difference	0	0	0	0	0
Note: The Multi Dry-Year projections estimate a 6% increase on imported M&I and surface water. Groundwater Replenishment remain at 65,000 AF per year.						

4 DEMAND MANAGEMENT MEASURES

The goal of the Demand Management Measures (DMM) section is to provide a comprehensive description of the water conservation programs that a supplier has implemented, is currently implementing, and plans to implement in order to meet its urban water used reduction targets. The reporting of DMMs were significantly modified in 2014 by Assembly Bill 2067 to streamline the DMM reporting requirements. For retail suppliers the requirements changed from 14 specific measures to six more general requirements plus an “other” category:

- Water waste prevention ordinances
- Metering
- Conservation pricing
- Public education and outreach
- Programs to assess and manage distribution system real loss
- Water conservation program coordination and staffing support
- 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

Wholesale agencies must now provide narrative descriptions of metering, public education and outreach, water conservation program coordination and staffing support, and other DMMs, as well as a narrative of asset management and the wholesale supplier assistance programs.

4.1 Overview

MWDOC demonstrated its commitment to water use efficiency in 1991 by voluntarily signing the MOU Regarding Urban Water Conservation in the CUWCC. The California Urban Water Conservation Council was formed through adoption of this MOU and is considered the “keeper” of the BMPs, with the authority to add, change, or remove BMPs. The CUWCC also monitors implementation of the MOU. As a signatory to the MOU, MWDOC has committed to a good-faith-effort to implement all cost-effective BMPs.

An ethic of efficient use of water has been developing over the last 25 years of implementing water use efficiency programs. Retail water agencies throughout Orange County also recognize the need to use existing water supplies efficiently – implementation of BMP-based efficiency programs makes good economic sense and reflects responsible stewardship of the region’s water resources. All retail water agencies in Orange County are actively implementing BMP-based programs; however, not all retail water agencies are signatory to the MOU.

As a signatory to the CUWCC MOU regarding urban water use efficiency, MWDOC’s commitment to implement BMP-based water use efficiency program continues today. To help facilitate implementation of BMPs throughout Orange County, as a wholesaler MWDOC’s efforts focus on the following three areas that both comply with and go beyond the Foundational BMPs of Utility Operations Programs, formerly BMP 10 - Wholesale Agency Assistance Program, requirements.

Regional Program Implementation - MWDOC develops, obtains funding for, and implements regional BMP programs on behalf of all retail water agencies in Orange County. This approach minimizes confusion to consumers by providing the same programs with the same participation guidelines, and also maintains a consistent message to the public to use water efficiently. Further, MWDOC helps build partnerships to accomplish conservation.

Local Program Assistance - When requested, MWDOC assists retail agencies to develop and implement local programs within their individual service areas. This assistance includes collaboration with each retail agency to design a program to fit that agency's local needs, which may include providing staffing, targeting customer classes, acquiring grant funding from a variety of sources, and implementing, marketing, reporting, and evaluating the program. MWDOC provides assistance with a variety of local programs including, but not limited to, Home Water Surveys, Large Landscape Water Use Reports, Drip Irrigation Pilot Program, Public Agency Water Smart Landscape Incentives, HOA and Public Information, School Education, Conservation Pricing, and Water Waste Prohibitions. Many of these local programs have also been structured through Integrated Regional Water Management Planning processes in north, central and south Orange County.

Research and Evaluation - An integral component of any water use efficiency program is the research and evaluation of potential and existing programs. Research allows an agency to measure the water savings benefits of a specific program and then compare those benefits to the costs of implementing the program in order to evaluate the economic feasibility of the program when compared to other efficiency projects or existing or potential sources of supply. Furthermore, in 2013 MWDOC published its first Orange County Water Use Efficiency Master Plan to define how Orange County will comply with, or exceed, the state mandate of a 20 percent reduction in water use by 2020, and how MWDOC will achieve its share of Metropolitan's Integrated Resources Plan water savings goal. The Master Plan is being used to achieve the water savings goal at the lowest possible costs while maintaining a mix of programs desired by water agencies and consumers throughout Orange County.

Table 4-1 summarizes BMP implementation responsibilities of MWDOC as Orange County's wholesale supplier and responsibilities of MWDOC's retail agencies. The last BMP Report submitted to the CUWCC is included in Appendix C.

Table 4-1: BMP Implementation Responsibility and Regional Programs in Orange County

Efficiency Measure	Former BMP No.	Applies to:		MWDOC Regional Program
		Retailer	MWDOC as a Wholesaler	
Operations Practices				
Wholesale Agency Assistance Programs	10	-	√	√
Conservation Pricing	11	√	√	√
Conservation Coordinator	12	√	√	√
Water Waste Prevention	13	√	-	√
WaterSense Specification toilets (Residential Plumbing Fixture Retrofits(1))	14	√	-	√
WaterSense Specification for Residential Development	-	√	-	-
Water Loss Control (System Water Audits, Leak Detection and Repair)	3	√	(2)	√
Metering With Commodity Rates	4	√	(2)	
Commercial, Industrial, and Institutional (CII) Programs	9	√	-	√
Large Landscape Conservation Programs	5	√		√
Residential Implementation				
Residential Assistance Program (Home Water Surveys Water Efficiency Suggestions)	1 & 2	√	-	√
Landscape Water Survey	1	√	-	√
High-Efficiency Washing Machine Rebate Programs	6	√	-	√

Efficiency Measure	Former BMP No.	Applies to:		MWDOC Regional Program
		Retailer	MWDOC as a Wholesaler	
WaterSense Specification toilets (Residential Plumbing Fixture Retrofits[1])	14	√	-	√
WaterSense Specification for Residential Development	-	√	-	-
Education Programs				
Public Information Programs	7	√	√	√
School Education Programs	8	√	√	√

(1) 75% Saturation goal achieved in 2009.
(2) MWDOC does not own or operate a distribution system; water wholesaled by MWDOC is delivered through the Metropolitan distribution system and meters.

4.2 BMP Implementation in MWDOC Service Area

Successful strategies are built by leveraging opportunities and creating customer motivation to take action to begin a market transformation. For Water Use Efficiency programs specifically, this starts by selecting the highest water consuming sectors and then creating an attractive implementation package. The next step is to identify ways to break through traditional market barriers by testing out innovative technologies and/or delivery mechanisms. Last of all, any program marketing campaign needs to be launched, employing a full spectrum of varying outreach methods. The Implementation Design Steps are illustrated on Figure 4-1.

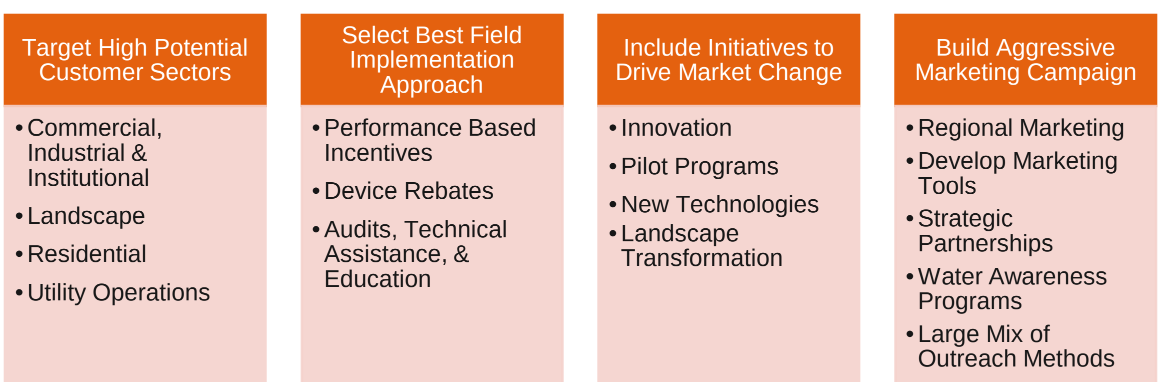

Figure 4-1: Implementation Design Steps

Table 4-2 summarizes the remaining water use efficiency potential by market sector within Orange County. Within each sector the table lists sources of conservation, the stage of programmatic development, description of how the potential is derived, and the qualitative range from low to high. This broad overview organizes the more detailed discussion of conservation potential in what follows.

Table 4-2: Remaining Water Use Efficiency Potential

Sector, Measures, End Uses	Stage	Description of Potential	Potential
Residential Indoor			
Toilets	Late	Small number 3.5gpf, ULF to HET, >HET?	Low
Faucets, Aerators, Flow Restrictors	Late	Small remaining potential	Low
Showerheads	Late	Very low flow rates, behaviour	Low
Clothes Washers	Mid	Low saturation	High
Pressure Regulating Valves	Pilot, Research	Covers all end uses	High
Surveys, Education, Outreach	Ongoing	Gateway program, behaviour	Low-Mid
Conservation Rates	Developing	Covers all end uses	High
Landscape			
Controllers	Early	SF Residential large remaining potential	High
Nozzles	Early	Large remaining potential	High
Turf Replacement, Low Water Plants	Early	Large technical potential; small economic potential	High
Artificial Turf	Early	Large technical potential; small economic potential	High
Pressure Regulating Valves	Pilot, Research	Covers all end uses	High
Landscape Management	Ongoing	Gateway program, behaviour, communication	High
Surveys, Education, Outreach	Ongoing	Gateway program, behaviour	Low-Mid
Conservation Rates	Developing	Covers all end uses	High
CII (Non-Landscape)			
Toilets	Mid	Small number 3.5gpf, ULF to HET, >HET?	Mid
Urinals	Mid	High traffic sites	Mid
Faucets, Aerators, Flow Restrictors	Late	Small remaining potential	Low
Showerheads	Mid	Sports facilities, accomodation	Mid
Food Service Equipment	Mid	Needs short pay back	Mid
Laundry	Mid	High water use is economic incentive	High
Industrial Processes and Manufacturi	Mid	Acceptance, regulatory issues, competiveness	High
Cooling	Mid	Needs short pay back	High
Pressure Regulating Valves	Pilot, Research	Covers all end uses	High
Surveys, Education, Outreach	Ongoing	Gateway program, behaviour	Low-Mid
Conservation Rates	Developing	Covers all end uses	High

MWDOC’s water use efficiency programs cut across a number of market segments and differ in their delivery formats. There are intentional reasons for this varied approach. Through evaluation of past programs, it has been shown that there are three implementation approaches that are particularly effective at securing water savings in a cost-effective and persistent manner. These implementation approaches have been built into each of MWDOC’s program offerings and matched up with the appropriate program sector as follows:

Performance based incentives - This payment format works especially well for the large landscape and CII sectors due to the array of site specific needs and custom processes and equipment at these sites.

Standardized device rebates - Rebates are most applicable for the more “cookie cutter” type measures where there is a limited number of products and styles and well defined water savings rates. These incentives are the predominant payment method for residential, small commercial, and small to medium sized landscape markets.

Audits, assistance, and education - All customer segments benefit from additional technical support services. This includes services such as audits for CII customers, sprinkler adjustment notices for the landscape segment and home water audits or certification programs for residential customers.

Figure 4-2 shows MWDOC's programs under each of the three implementation approaches.

	Field Implementation Approaches		
***Program Segments*:**	**Performance Based Incentives**	**Device Based Incentives**	**Audits, Assistance & Education**
Commercial, Industrial, & Institutional	Industrial Process Pay for Performance Program	**SoCal Water$mart Device Rebates** •ULV Urinals •High Efficiency Toilets •Food Steamers •Ice Machines •pH & Conductivity Controllers •Laminar Flow Restrictors	Hotel Audits Residential Care and Dormitory Audits Future: Restaurant and Hospital Audits
Landscape	Landscape Pay for Performance Program	**SoCal Water$mart Device Rebates (Commercial and Residential)** •Smart Controllers •Large Rotary Nozzles •In-stem Flow Regulators **Public Spaces Program** **Turf Removal Incentive Program**	HOA WaterSmart Landscape Program California Sprinkler Adjustment Notification System Metropolitan program of $200 per AF.
Residential	Single Family -- None Available Multi Family—Landscape planning and future pay for performance.	**SoCal Water$mart Device Rebates** •High Efficiency Washers •High Efficiency Toilets	WaterSmart Software Home Certification Program
Utility Operations	Distribution System Audits and Technical Support Leak Detection and Repair	Budget-Based Rate Technical Assistance Sub-Metering Evaluation	School Education Public Information

Figure 4-2: Demand Management Measure Implementation Approaches

4.3 Wholesale Supplier Assistance Programs

As described in the sections above, MWDOC provides financial incentives, conservation-related technical support, and regional implementation of a variety of BMP-based programs. In addition, MWDOC conducts research projects to evaluate implementation of both existing programs and new pilot programs. On behalf of its member agencies, MWDOC also organizes and provides the following:

- Monthly coordinator meetings
- Marketing materials
- Public speaking
- Community events
- American Water Works Association/International Water Association (IWA) Audit Study

4.4 Landscape Ordinance

The Water Conservation in Landscaping Act (Assembly Bill 1881, Laird) was passed in 2006 to increase outdoor water use efficiency. Governor Brown's Drought Executive Order of April 1, 2015 (EO B-29-15) directed DWR to update the State's Model Water Efficient Landscape Ordinance (Ordinance) through expedited regulation. The California Water Commission approved the revised Ordinance on July 15, 2015.

This legislation required cities and counties to adopt a Water Efficient Landscape Ordinance by December 1, or adopt their own ordinance, which must be at least as effective in conserving water as the State's Ordinance. Local agencies working together to develop a regional ordinance have until February 1, 2016. MWDOC worked in partnership with the Orange County Division of the League of Cities, Orange County cities, retail water providers, building industry, landscape architects, and irrigation consultants to develop an Orange County Model Water Efficient Landscape Ordinance specific to the needs of Orange County. The foundation of the Orange County Model Ordinance was based on the State Model Ordinance.

This collaborative, regional approach has ensured that local ordinances are consistent from city to city, and has limited the cost and complexity of implementing the mandate. Based on the Orange County model ordinance, cities and unincorporated areas have adopted local ordinances that set guidelines for designing and approving landscape projects. The new ordinance imposes a lower Maximum Applied Water Allowance (MAWA) that new and rehabilitated landscapes must be designed to meet.

Through this effort, cities throughout Orange County have adopted and are implementing landscape ordinances that are consistent with the requirements of the updated Water Conservation in the Landscape Act

4.5 Metering

Metering with commodity rates by wholesale and retail agencies has been an industry standard throughout Orange County for many years. All customers are metered and billed based on commodity rates either monthly or bi-monthly.

With the sale of the Allen-McColloch Pipeline to Metropolitan in 1995, MWDOC no longer owns or operates a distribution system. Water purchased and sold by MWDOC is distributed through Metropolitan's system to the MWDOC retail agencies.

4.6 Conservation Pricing

MWDOC publishes annually the *Orange County Water Agencies Water Rates, Water System Operations, and Financial Information* survey. This survey documents the rates charged by each retail water agency, as well as the type of rate structure, i.e., a flat rate, inclined block, or seasonal rate structure. Table 4-3 provides a brief summary of the types of rates used by retail water agencies in Orange County and shows a slow progression away from uniform rates.

Table 4-3: Summary of Rate Structure Types Used in Orange County

Types of Rate Structure	Number of Agencies Utilizing Different Rate Structure Types					
	1990	1995	2000	2005	2010	2015
Declining Block	0	0	0	0	0	0
Uniform or Flat	22	23	19	16	8	9
Inclined Block	13	9	10	12	14	-
Seasonal Inclined Block	1	2	3	3	6	-
Budget Based Tiered Rate	0	1	1	1	2	-

4.7 Public Education and Outreach

MWDOC currently offers a wide range of public information programs in Orange County. Each program targets different water customer segments. For example, the O.C. Water Hero Program aims to encourage school children to use water wisely; MWDOC's electronic newsletter "eCurrents" is designed to keep residents and businesses, stakeholder groups, opinion leaders, and others apprised of MWDOC news and programs. MWDOC's current public information programs are described below.

OC Water Summit

Currently in its ninth year, the O.C. Water Summit is an innovative, interactive forum that brings together hundreds of business professionals, elected officials, water industry stakeholders, and community leaders from throughout southern California and beyond. Co-hosted by the MWDOC and OCWD, this one of-a-kind event engages participants in discussion on new and ongoing water supply challenges, water policy issues, and other important topics that impact our economy and public health. O.C. Water Summit About the Prominent authors, world-renowned experts, and distinguished speakers will deliver presentations and engage in dialogue with participants on these critical issues. By sponsoring the O.C. Water Summit, you are investing in water reliability for southern California. A variety of sponsorship opportunities are available to meet your organization’s strategic goals.

Water Facility Inspection Trip Program

The inspection trip program is sponsored by MWDOC and Metropolitan. Each year, Orange County elected officials, residents, business owners, and community leaders are invited to attend educational inspection trips to tour key water facilities throughout the state of California, such as Diamond Valley Lake, a Metropolitan storage reservoir (Figure 4-3). The goal is to educate members of our community about planning, procurement and management of southern California’s water supply and the issues surrounding delivery and management of this vital resource. The inspection trips are specifically designed to address various water issues affecting the state, including water supply, delivery, treatment, sustainability, environment, and water policy. All trips are hosted by a MWDOC/Metropolitan Director.

Figure 4-3: Diamond Valley Lake, Hemet, California

eCurrents

eCurrents is the monthly electronic newsletter of the MWDOC. It is designed to keep MWDOC's 28 retail agencies, residents and businesses, stakeholder groups, opinion leaders, and others apprised of MWDOC news, programs, events, and activities. The publication also serves to keep readers informed about regional, state, and federal issues affecting water supply, water management, water quality, and water policy and regulation.

Water Advisory Committee of Orange County (WACO)

WACO was formed in 1983 to facilitate the introduction, discussion, and debate of current and emerging water issues among Orange County policymakers and water professionals. It has also advocated the Orange County water community's position on issues affecting the provision and management of our water supplies with lawmakers, regulatory agencies, regional and state water organizations, and others.

The committee's membership has evolved during the past quarter century to include elected officials and management staff from Orange County cities and water districts, engineers, attorneys, consultants, and other industry professionals. The meetings are also attended from time-to-time by Orange County residents, community group members, and legislators or their staff, who share a common interest in water issues.

Monthly meetings are open to the public and are typically held on the first Friday of each month at 7:30 a.m. The meetings take place at the Fountain Valley headquarters of MWDOC and OCWD. The meetings are designed to provide attendees with an opportunity for professional networking and to receive informative presentations from water industry professionals, academics, economists, engineers, political officials, and industry experts about key water issues affecting Orange County.

School Education Programs

One of the most successful and well-recognized water education curriculums in southern California is MWDOC's Water Education School Program. For more than 30 years, School Program mascot "Ricki the Rambunctious Raindrop" (Figure 4-4) has been educating students in grades 1-6 about the water cycle, the importance and value of water, and the personal responsibility we all have as environmental stewards.

The School Program features keypad assembly-style presentations that are grade-specific and performed on-site at the schools. The program curriculum is aligned with the science content standards established by the State of California. Since its inception in 1973, nearly three million Orange County students have been educated through the School Program.

Figure 4-4: Water Education School Program Mascot, Ricki the Rambunctious Raindrop

The School Program features assembly-style presentations that are grade-specific and performed on-site at the schools. The program curriculum is aligned with the science content standards established by the State of California. Since its inception in 1973, nearly three million Orange County students have been educated through the School Program.

In 2004, MWDOC formed an exciting partnership with Discovery Science Center that has allowed both organizations to reach more Orange County students each year and provide them with even greater educational experiences in the areas of water and science. Discovery Science Center currently serves as the School Program administrator, handling all of the program marketing, bookings, and program implementation. During the 2015-16 school year, more than 60,000 students will be educated through the program.

For the 2015-2016 school year, the Municipal Water District of Orange County also implemented a Water Education School Program in Orange County High Schools for grades 9-12. MWDOC entered into contract with Inside the Outdoors, the Orange County Superintendent of Schools' environmental science program, to administer the program. The target goal for the initial year was to reach 25,000 students.

The program consists of three components: teacher trainings, an online digital platform, and the students' program. The teacher trainings host more than 100 teachers with the goal of teaching them water education and awareness. The topics include water sources, water education, water recycling, watersheds, technological solutions, and water conservation. Due to the current drought conditions in Southern California, water conservation is heavily stressed. They learn about conservation techniques such as irrigation technology, rainwater harvesting, and water recycling.

The online digital platform allow the students to take action by providing them with digital assets that are relevant and meaningful. They are directed to visit The Water Effect website to make a water conservation pledge. Also, they are encourage to post photographs and conservation related messages on social media using the #thewatereffect.

Each year, MWDOC also holds a Water Education Poster and Slogan Contest and Photography and Digital Arts Contest to increase water awareness. To participate, children in grades K-12 develop posters and slogans that reflect a water awareness message. For the Photography and Digital Arts Contest, which is open to grades 9-12, students submit photographs and digital artwork that also reflects a water awareness message. The goal is to get children thinking about how they can use water wisely and to facilitate discussion about water between children and their friend, parents, and teachers. Each year, more than 700 poster and slogan entries are received through the contest. During a special judging event, approximately 40 entries are selected as the winners. All of our winners – and their parents, teachers, and principals – are invited to attend a special awards ceremony with Ricki the Raindrop at Discovery Science Center. At the awards ceremony, the winners are presented with their framed artwork as well as a custom t-shirt featuring their entry, a trophy, a certificate, and other fun water-saving prizes. The 2015 winning poster is shown on Figure 4-5.

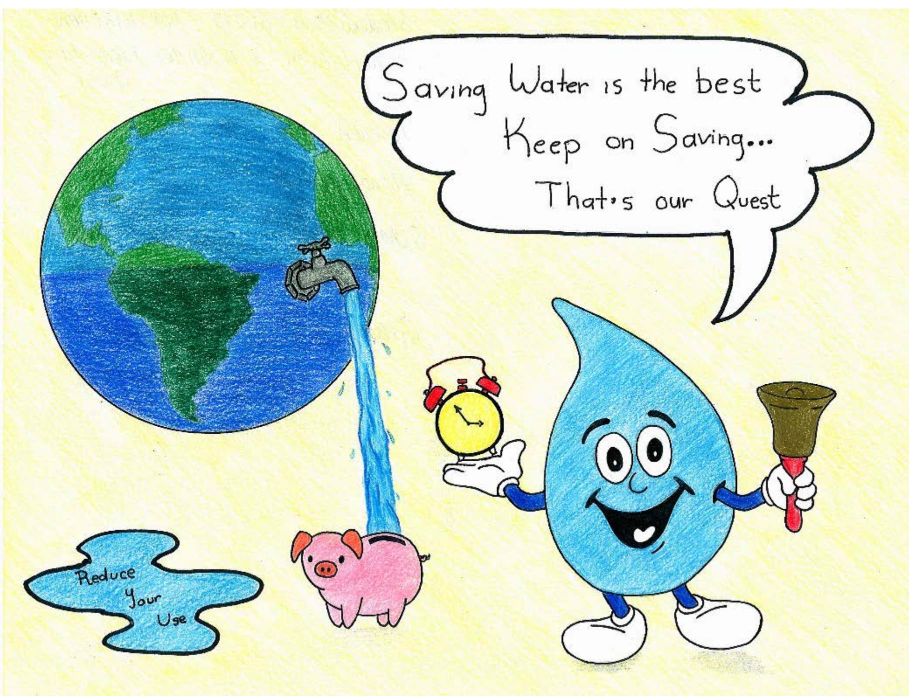

Figure 4-5: 2015 Water Education Poster & Slogan Contest, 4th Grade Winning Poster

Children's Water Education Festival

The largest water education festival of its kind is the annual Children's Water Education Festival (Festival). The Festival is presented by OCWD, the National Water Research Institute, Disneyland Resort, and sponsored by MWDOC. Each year, more than 5,000 students participate in the Festival over the course of this two-day event. The Festival is currently held at the University of California, Irvine.

The Festival presents a unique opportunity to educate students in grades four through six about local water issues and help them understand how they can protect our water resources and the environment. Students attend the Festival with their teacher and classmates, visiting a variety of booths focused on different water-related topics throughout the day. Participating organizations (presenters) engage the students through interactive educational presentations that are aligned with the science content standards established by the State of California. Since its inception, more than 80,000 children from schools throughout Orange County have experienced the Festival and all it has to offer.

O.C. Water Hero Program

The Orange County Water Hero Program is a joint offering between MWDOC and OCWD that began in 2007. The basic premise of the program is to provide education to the youngest Orange County water users and to encourage them to be more water efficient, educate them on ways to save water both inside their home and outdoors, and to encourage their families to take the same pledge. Through a variety of outreach efforts and additional grant funding, we have been able to register over 15,000 children as OC Water Heroes, and an additional nearly 4,000 Super Heroes. The current effort underway, the development of a mobile OC Water Hero App is designed to transition the children currently enrolled and re-engage them in water saving activities and education as well as engage new users and their families.

Figure 4-6: O.C. Water Hero Program Mascots, Left to right: Aqua Joe, Filter Bob, Hydrate, and Captain Sponge

Orange County Garden Friendly

The Orange County Garden Friendly Program in spring 2014, MWDOC began teaming up with the Orange County Stormwater Program and University of California Cooperative Extension to host events on Saturdays during fall and spring, with educational booth appearances at local garden centers across Orange County to engage customers before they made landscaping decisions and purchases. Retail customers learned about WaterSense® labeled weather-based irrigation controllers and the importance of "sprucing up" irrigation systems. Attendees can learn about and purchase OC Garden Friendly-approved plants and water-efficient irrigation devices, apply for rebates, and consult with gardening experts. As a result, WaterSense labeled controller sales during the inaugural season increased by more than 225 percent compared to average daily sales activity.

A critical component of the OC Garden Friendly initiative is city and water agency cooperative involvement and public outreach at each event. Educating the retail staff's awareness of water agency incentive and rebate programs, climate-appropriate plant material, and irrigation equipment improved over the course of events has also been a program benefit. Some retail spots display the promotional materials for months after the events.

Figure 4-7: MWDOC's 2014 Orange County Garden Friendly Booth

California Sprinkler Adjustment Notification System

The California Sprinkler Adjustment Notification System (CSANS) provides e-mail or "push" an irrigation index to assist property owners with making global irrigation scheduling adjustments, and is found at <null>. Participants voluntarily register to receive this e-mail and can unsubscribe at any time. Additionally, the Base Irrigation Schedule Calculator and instructional videos were developed to enhance the system.

4.8 Programs to Assess and Manage Distribution System Real Loss

With the sale of the Allen-McColloch Pipeline to Metropolitan in 1995, MWDOC no longer owns or operates a distribution system. Water purchased and sold by MWDOC is distributed through Metropolitan's system to the MWDOC retail agencies.

However, in an effort to assist its retail agencies, MWDOC publishes annually the *Orange County Water Agencies Water Rates, Water System Operations, and Financial Information* survey. This survey facilitates a pre-screening survey that estimates the volume and percent of unaccounted-for-water for each retail water agency in the county. In 2009, the percent of unaccounted-for-water for retail water agencies ranged from a low of 1.5 percent to a high of 7.5 percent, with an average of 3.8 percent.

In addition to the survey, MWDOC was awarded a grant to implement a study titled "Water Loss Management Program Assessment: Potable Water System Audits." This study used the American Water Works Association and International Water Association Water Audit Methodology. The following retail water agencies participated in the study: City of Brea, City of Huntington Beach, LBCWD, MNWD and City of Tustin.

The purpose of the study was to:

- Educate the agencies on the most current water loss control methods and technologies
- Perform system water audit for each agency to determine current water losses and areas for improvement
- Review each agency's leakage management program and recommend improvements
- Assist the agencies in achieving the California Urban Water Conservation Council Best Management Practice 1.2 compliance

Non-Revenue water ranged from 3 to 10 percent of volume of water supplied, which is very good and will within the range of efficient water utilities concerned about conservation and water loss management practices.

4.9 Water Conservation Program Coordination and Staffing Support

MWDOC's Water Use Efficiency Department is comprised of five (5) full time equivalent (FTE) positions and two (2) intern positions. Heading the department is the Water Use Efficiency (WUE) Director. Beneath him on the department organizational chart are Water Use Efficiency Supervisor, Water Use Efficiency Specialist, Water Use Efficiency Coordinator, and the Water Use Efficiency Analyst. The department also employs two part time student interns who function in a support role to the full time staff. The department works together in a collaborative nature, assisting one another in the implementation of the many Water Use Efficiency Programs.

MWDOC's WUE Department has a rich history of writing successful grant proposal from both State and Federal sources. State granting agencies include the SWRCB and DWR. Although there has been times when MWDOC has received federal funding from the Natural Resource Conservation Service (NRCS), the United States Bureau of Reclamation (USBR) is typically the primary federal source. Local Funding programs is considered at the center of the funding MWDOC receives for its WUE programs. This funding comes from two sources, the Metropolitan and MWDOC's retail water agencies. MWDOC, as a regional wholesaler of imported water, is one of Metropolitans member agencies and through its water rates paid to Metropolitan recoups these funds through a Metropolitan funding program under its Conservation Credits program. Metropolitan establishes a bi-yearly funding budget for both WUE programs and devices. MWDOC in turn establishes its own WUE programs using these Conservation Credits funds. MWDOC assists Orange County retail agencies by implementing an array of water use efficiency programs. These agencies elect to participate in the MWDOC programs and provide funding of their own for select devices or services.

MWDOC's WUE department has a long standing practice of conducting regular audits via program process and impact evaluations. The process evaluations are utilized to ensure administrative quality control. An adaptive management approach is taken to implement efficiency practices or to correct for identified process deficiencies. The impact evaluations measure the actual water saving achieved in comparison to the expected industry water savings estimates. Results from impact evaluations have provided insight relating to those devices and programs that yield the best water savings in relationship to program administrative effort, cost effectiveness, and appropriate rebate levels.

4.9.1 Residential Implementation

MWDOC assists its retail water agencies to implement this BMP by making available the following programs aimed at increasing landscape water use efficiency for residential customers. MWDOC has implemented successful water use efficiency programs for residential customers for over 30 years. This began with our highly successful Ultra-Low-Flush Toilet Rebate Program, continued on through the High Efficiency Washer Program, and now continues with the High Efficiency Toilet Program.

Water Smart Home Survey Program

The Water Smart Home Survey Program provides free home water surveys (indoor and outdoor). The Water Smart Home Survey Program uses a Site Water Use Audit program format to perform 1,000 comprehensive, single-family home audits. Residents choose to have outdoor (and indoor, if desired) audits to identify opportunities for water savings throughout their properties. A customized home water audit report is provided after each site audit is completed and provides the resident with their survey results, rebate information, and an overall water score.

High Efficiency Clothes Washer Rebate Program

The High Efficiency Clothes Washer (HECW) Rebate Program provides residential customers with rebates for purchasing and installing WaterSense labeled HECWs. HECWs use 35-50 percent less water than standard washer models, with savings of approximately 9,000 gallons per year, per device. Devices must have a water factor of 4.0 or less, and a listing of qualified products can be found at ocwatersmart.com. There is a maximum of one rebate per home.

	High Efficiency Clothes Washers	Standard Incentive: $85 per washer Enhanced Incentive: Varies by participating agency. Market Description: Although HECWs have been incentivized heavily in recent years, the MWDOC market is far from saturated. Approximately 26% saturation rate with a potential of 650,000 units in the market that have yet to be changed out for high efficiency models. Per Unit Savings: 31 gallons per day (GPD) 15 year useful life .52 AF lifetime savings Cost per AF: **$360 with base rebate; $1,129 with enhanced rebate**

High Efficiency Toilet Rebate Program

The largest amount of water used inside a home, 30 percent, goes toward flushing the toilet. The High Efficiency Toilet (HET) Rebate Program offers incentives to residential customers for replacing their standard, water-guzzling toilets with HETs. HETs use just 1.28 gallons of water or less per flush, which is 20 percent less water than standard toilets. In addition, HETS save an average of 38 gallons of water per day while maintaining high performance standards.

	High Efficiency Toilets	Standard Incentive: $50 per toilet Enhanced Incentive: Varies by participating agency. Market Description: Ultra low flush toilets, and in more recent years, high efficiency toilets have been heavily targeted over the last 20 years. 85% saturation rate with a potential of 250,000 – 350,000 residential units in the market that have yet to be changed out for high efficiency models. Per Unit Savings: 38 GPD 20 year useful life .85 AF lifetime savings Cost per AF: **$119** per AF

4.9.2 Conservation Programs for Commercial, Industrial and Institutional Accounts

MWDOC provides technical resources and financial incentives to help Orange County businesses, institutions, hotels, hospitals, industrial facilities, and public sector sites achieve their efficiency goals. Technical assistance is provided through on-site surveys, water use audits, and engineering assistance. Such projects include high efficiency commercial equipment installation and manufacturing process improvements.

Financial incentives are available for customized WUE projects at a rate of $1,500 to $1,950 per AF saved over one year. Funding is provided in part by the USBR, CA Department of Water Resources, and Metropolitan.

Water Smart Hotel Program

Water used in hotels and other lodging businesses accounts for approximately 15 percent of the total water use in commercial and institutional facilities in the United States. The Water Smart Hotel Program provides water use surveys, customized facility reports, technical assistance, and enhanced incentives to hotels that invest in water use efficiency improvements. Rebates available include high efficiency toilets, ultralow volume urinals, air-cooled ice machines, weather-based irrigation controllers, and rotating nozzles.

In 2008 and 2009, MWDOC received grants from DWR and the USBR to conduct the Water Smart Hotel Program, a program designed to provide Orange County hotels and motels with commercial and landscape water saving surveys, incentives for retrofits and customer follow-up and support. The goal of the program is to implement water use efficiency changes in hotels to achieve an anticipated water savings of 7,078 AF over 10 years.

Water Smart Industrial Program

The Water Smart Industrial Program provides engineering surveys to identify water saving process improvements in the Orange County industrial customer base. Additionally it provides Engineering Assistance and Financial incentives to help implement the recommendations from those surveys. This is done with funding from DWR, USBR, Metropolitan and MWDOC. To date the program has identified a water savings potential of 450 million gallons per year. Types of projects have included treating and reusing water in manufacturing process or for cooling towers and new wash equipment with upgraded washers, nozzles and automated control systems.

Device Retrofits

MWDOC also offers financial incentives under the Socal Water$mart Rebate Program which offers rebates for various water efficient devices to CII customers.

	Ultra Low Water / Zero Water Urinals	<u>Standard Incentive:</u> $200 <u>Per Unit Savings:</u> 110 GPD 20 year useful life 2.45 AF lifetime savings <u>Market Description:</u> Urinal installations are highest in public, high-traffic areas. Building managers often do not have the capital improvement budgets to change fixtures. Thus, incentives may help participation rates. <u>Cost per AF:</u> Standard Incentive: **$149** per AF
	High Efficiency Toilet *(HETs)*	<u>Standard Incentive:</u> $50 for Tank Type (this may be increased to $100) $100 for Flushometer Type <u>Enhanced Incentive</u>: The regular CII indoor program does not, per se, have enhanced incentives. The Hotel Program enhances some devices, and certain agencies enhance some devices. We also have new grants that will allow us to enhance some devices, but those enhanced incentives have not yet been officially set. $100 for Non-Verified Units $200 for Verified Existing 3.5 gpf <u>Per Unit Savings:</u> 38 GPD 20 year useful life 0.85 AF lifetime savings <u>Market Description:</u> High efficiency toilets are the highest use indoor fixture in many facilities; they are also the most universal device located in just about any facility regardless of facility purpose. <u>Cost per AF:</u> Standard Tank Type: **$106** per AF Enhanced Tank Type: **$214** per AF Verified Tank Type: $454 per AF (if toilet is verified >=3.5 gpf)

 Connectionless Food Steamers (aka Boiler-less)	Standard Incentive: $485 per compartment Enhanced Incentive: Additional $100 per compartment Per Unit Savings: 223 GPD 10 year useful life 2.5 AF lifetime savings Market Description: The best opportunities for use of connectionless food steamers are in food service facilities with large batch cooking such as cafeterias, institutions, and large family style restaurants. Cost per AF: Standard Incentive: **$242** per AF Enhanced Incentive: **$287** per AF
 Air-Cooled Ice Machines	Standard Incentive: $1,000 per machine Enhanced Incentive: Additional $250 per machine Per Unit Savings: 137 GPD 10 year useful life 1.54 AF lifetime savings Market Description: Ice machines are located in all food service operations, bars, supermarkets, convenience stores, hotels and many other operations throughout Orange County territory. Cost per AF: Standard Incentive: **$809** per AF Enhanced Incentive: **$993** per AF
 Standard Cooling Tower Conductivity Controller	Standard Incentive: $625 per controller Per Unit Savings: 575 GPD 5 year useful life 3.22 AF lifetime savings Cost per AF: **$226** per AF.

	pH-Cooling Tower Controller	<u>Standard Incentive:</u> $1,750 per controller <u>Enhanced Incentive</u>: Additional $1,800 <u>Per Unit Savings:</u> 1,735 GPD 5 year useful life 9.72 AF lifetime savings <u>Market Description:</u> Cooling towers are located at large buildings (typically anything over three stories), industrial process operations and locations with large cooling requirement such as supermarkets. There are thousands of cooling towers in the MWDOC territory. <u>Cost per AF:</u> Standard Incentive: **$209** per AF. Enhanced Incentive: **$405** per AF.
	Laminar Flow Restrictors	<u>Incentive:</u> $10 per restrictor <u>Per Unit Savings:</u> 10.3 GPD 5 year useful life 0.06 AF lifetime savings <u>Market Description:</u> Laminar flow restrictors force water through a small opening reducing the flow while inhibiting bacterial growth. They are recommended in hospitals and other health care facilities, making them a target for program outreach. <u>Cost per AF:</u> **$185** per AF.
	Dry Vacuum Pumps	<u>Incentive:</u> $125 per 0.5 Horse Power <u>Per Unit Savings:</u> 81.8 GPD 7 year useful life 0.64 AF lifetime savings <u>Market Description:</u> Dry vacuum pumps are used at dental and medical facilities to create suction and remove excess air and by-products. The largest opportunity is in dental offices. <u>Cost per AF:</u> **$235** per AF.

4.9.3 Landscape Conservation Programs and Incentives

One of the most active and exciting water use efficiency sectors MWDOC provides services for are those programs that target the reduction of outdoor water use. With close to 60 percent of water consumed outdoors, this sector has been and will continue to be a focus for MWDOC. MWDOC offers several landscape water use efficiency program aimed at both residential and commercial customers. MWDOC also offers programs within Orange County to specifically assist retail agencies and their large landscape customers and public agencies.

Turf Removal Program

The Orange County Turf Removal Program offers incentives to remove non-recreational turf grass from commercial properties throughout the County. This program is a partnership between MWDOC, Metropolitan, and local retail water agency. The goals of this program are to increase water use efficiency within Orange County, reduce runoff leaving the properties, and evaluate the effectiveness of turf removal as a water-saving practice. Participants are encouraged to replace their turf grass with drought-tolerant landscaping, diverse plant palettes, and artificial turf, and they are encouraged to retrofit their irrigation systems with Smart Timers and drip irrigation (or to remove it entirely). Through December 2015, Orange County residents and commercial properties removed 11.9 million square feet of turf, representing approximately 1,550 AFY of water savings.

Water Smart Landscape Program

MWDOC's Water Smart Landscape Program is a free water management tool for homeowner associations, landscapers, and property managers. Participants in the Program use the Internet to track their irrigation meter's monthly water use and compare it to a custom water budget established by the Program. This enables property managers and landscapers to easily identify areas that are over/under watered and enhances their accountability to homeowner association boards. There are 12,386 dedicated irrigation meter customers enrolled in the Program with water savings of more than 10,000 AF.

Water Smart Public Spaces

In 2012, MWDOC received funding from the Department of Water Resources through a three-year Integrated Regional Water Management Program grant to implement a comprehensive landscape improvement program targeting publicly owned landscapes in south Orange County. The program encourages removing non-functional turf grass, upgrading conventional irrigation controllers to smart irrigation timers, and converting high-volume overhead spray irrigation to low-volume irrigation. Once fully implemented, the program will reduce water use in 84 acres of existing landscape areas.

Smart Timer Rebate Program

Smart Timers are irrigation clocks that are either weather-based irrigation controllers (WBIC) or soil moisture sensor systems. WBICs adjust automatically to reflect changes in local weather and site-specific landscape needs, such as soil type, slopes, and plant material. When WBICs are programmed properly, turf and plants receive the proper amount of water throughout the year. During the fall months, when property owners and landscape professionals often overwater, Smart Timers can save significant amounts of water.

Soil moisture sensors are relatively new to MWDOC’s suite of landscape water management tools. Much like a Smart Timer, soil moisture sensors determine the amount of water in the soil by way of sensors placed in the actual root zone of a given landscape area. This measurement of water is then relayed back to the controller and through the controller’s programming, and the correct amount of water is then applied.

	Smart Controllers (Weather-Based Irrigation Controllers and Soil Moisture Sensor Systems)	Standard **Residential** Incentive: $80 per controller Enhanced **Residential** Incentive: Up to $300 per controller Standard **Commercial** Incentive: $35 per station Per Unit **Residential** Savings: 37 GPD (WBIC) to 41 GPD (Soil Moisture Sensor) 10 year useful life 0.41 to 0.46 AF lifetime savings Per Unit **Commercial** Savings: 11.52 GPD per station 10 year useful life 0.13 AF lifetime savings per station Market Description: The market for smart or weather based irrigation controllers has been advancing in recent years yet the market is estimated to have only a 10-20% saturation rate. Cost per AF: Residential **$1,106 to $1,408** enhanced incentive, **$586** standard incentive Commercial **$555** per AF

Rotating Nozzles Rebate Program

The Rotating Nozzle Rebate Program provides incentives to residential and commercial properties for the replacement of high-precipitation rate spray nozzles with low-precipitation rate multi-stream, multi-trajectory rotating nozzles. The rebate offered through this Program aims to offset the cost of the device and installation.

	High Efficiency Sprinkler Nozzles (*HEN)*	Incentive: $4 per nozzle for residential, commercial and irrigation customers Market Description: The market for high efficiency spray nozzles has only emerged in recent years and has a tremendous potential. Hundreds of thousands of inefficient pop up heads are installed in the MWDOC territory. Virtually any site with irrigation will have pop up spray heads. Per Unit Savings: 3.6 GPD per nozzle 5 year useful life 0.02 AF lifetime savings Cost per AF: **$288** per AF

Spray to Drip Rebate Program

The Spray to Drip Pilot Rebate Program offers residential and commercial customers rebates for converting planting areas irrigated by spray heads to drip irrigation. Drip irrigation systems are very water-efficient. Rather than spraying wide areas, drip systems use point emitters to deliver water to specific locations at or near plant root zones. Water drips slowly from the emitters either onto the soil surface or below ground. As a result, less water is lost to wind and evaporation.

Device Retrofits

MWDOC also offers financial incentives under the SoCal Water$mart Rebate Program for a variety of other water efficient landscape devices.

	Central Computer Irrigation Controllers	Standard Incentive: $25 per station Per Unit Savings: Same as standalone smart controllers 11.52 GPD per station 10 year useful life 0.13 AF lifetime savings per station Market Description: The market for central irrigation controllers are customers with multiple sites and multiple controllers. Central controller allows for customers to remotely manage their irrigation. Part of the technology includes weather based scheduling. Typical customers are cities, school districts, universities, multi-family owners and other large landscape sites. Cost per AF: **$232** per AF

 Large Rotary Nozzles	Standard Incentive: $13 per set of two nozzles Per Unit Savings: 16 GPD per set of two nozzles 10 year useful life 0.18 AF lifetime savings per set of two nozzles Market Description: Large rotary nozzles are brass nozzle inserts for large rotary sprinkler heads. Large rotary nozzles are used at golf courses and large athletic fields, irrigating extremely large turf areas. Cost per AF: **$85** per AF.
 In-Stem Flow Regulators	Standard Incentive: $1 per flow regulator Per Unit Savings: 1.4 – 2.7 GPD per station 5 year useful life 0.015 - 0.0076 AF lifetime savings per station Market Description: *Valvette Systems* is currently the only approved manufacturer of in-stem flow regulators. There are hundreds of thousands of the pop up sprinklers in MWDOC's territory, however much of the time customers will prefer to retrofit just the nozzle. Cost per AF: **$92** per AF.

California Friendly Landscape Training (Residential)

The California Friendly Landscape Training provides education to residential homeowners, property managers, and professional landscape contractors on a variety of landscape water efficiency practices they can employ. These classes are hosted by Metropolitan, MWDOC and/or the retail agencies to encourage participation across the county. The residential training program consists of either an in person training or individual, topic-specific, online classes. The four topics presented include: 1) Basic Landscape Design, 2) California Friendly Plants, 3) Efficiency Irrigation Systems, and 4) Soils, Watering, Fertilizing.

5 WATER SHORTAGE CONTINGENCY PLAN

5.1 Overview

Recent water supply challenges throughout the American Southwest and the State of California have resulted in the development of a number of policy actions that water agencies would implement in the event of a water shortage. In southern California, the development of such policies has occurred at both the wholesale and retail level. This section describes how new and existing policies that Metropolitan and MWDOC have in place, such as shortage actions, water use restrictions, revenue changes, and reduction measuring mechanisms, to respond to water supply shortages, including a catastrophic interruption and up to a 50 percent reduction in water supply.

5.2 Shortage Actions

MWDOC is a wholesale water agency, and while it has broad powers to allocate or prohibit uses of water upon the declaration of a Water Shortage Emergency by its Board of Directors, MWDOC has not acted to directly mandate how water is used by its retail agencies in the past. However, MWDOC is responsible for how imported water will be allocated to each retail agency, which play a factor in the specific stages of retail agency's shortage actions in accordance with their local ordinances. Thus, during past shortages and for the current situation, MWDOC has adopted Board Resolutions urging its retail agencies to develop and implement water shortage plans, calling upon each agency to adopt and enforce regulations prohibiting the waste of water, and implementing an allocation plan for available imported water consistent with reductions, incentives, and allocation surcharges imposed on MWDOC by Metropolitan. Below are stages MWDOC and Metropolitan called upon for their Water Shortage Contingency Plan, with the last stage calling for the implementation of Water Supply Allocations.

Table 5-1: Stages of Water Shortage Contingency Plan

MWDOC Stages of Water Shortage Contingency Plan		
Stage	Percent Supply Reduction	Water Supply Condition
Baseline Water Use Efficiency	Long-term Conservation	Ongoing water use efficiency, outreach and public awareness efforts to continue water use saving and build storage reserves
Condition 1: Water Supply Watch	Variable	Call for voluntary dry-year conservation measures and use of Metropolitan's regional storage reserves
Condition 2: Water Supply Alert	Variable	Regional call for cities and water agencies in the service area to implement extraordinary conservation measures through their drought ordinance and other water use efficiency efforts
Condition 3: Water Supply Allocation	5% to 50%	Implement MWDOC's Water Supply Allocation Plan
NOTES: See discussion on Metropolitan's and MWDOC water shortage actions, such as Metropolitan's WSDM Plan and implementation of both Metropolitan and MWDOC's Water Supply Allocation Plan.		

5.2.1 Metropolitan Water Surplus and Drought Management Plan

Metropolitan evaluates the level of supplies available and existing levels of water in storage to determine the appropriate management stage annually. Each stage is associated with specific resource management actions to avoid extreme shortages to the extent possible and minimize adverse impacts to retail customers should an extreme shortage occur. The sequencing outlined in the Water Surplus and Drought Management (WSDM) Plan reflects anticipated responses towards Metropolitan's existing and expected resource mix.

Surplus stages occur when net annual deliveries can be made to water storage programs. Under the WSDM Plan, there are four surplus management stages that provides a framework for actions to take for surplus supplies. Deliveries in DVL and in SWP terminal reservoirs continue through each surplus stage provided there is available storage capacity. Withdrawals from DVL for regulatory purposes or to meet seasonal demands may occur in any stage.

The WSDM Plan distinguishes between shortages, severe shortages, and extreme shortages. The differences between each term is listed below.

- ***Shortage:*** Metropolitan can meet full-service demands using stored water or water transfers as necessary.
- ***Severe Shortage:*** Metropolitan can meet full-service demands only by using stored water, transfers, and possibly calling for extraordinary conservation.
- ***Extreme Shortage:*** Metropolitan must allocate available supply to full-service customers.

There are six shortage management stages to guide resource management activities. These stages are defined by shortfalls in imported supply and water balances in Metropolitan's storage programs. When Metropolitan must make net withdrawals from storage to meet demands, it is considered to be in a shortage condition. Figure 5-1 gives a summary of actions under each surplus and shortage stages when an allocation plan is necessary to enforce mandatory cutbacks. The goal of the WSDM Plan is to avoid Stage 6, an extreme shortage.

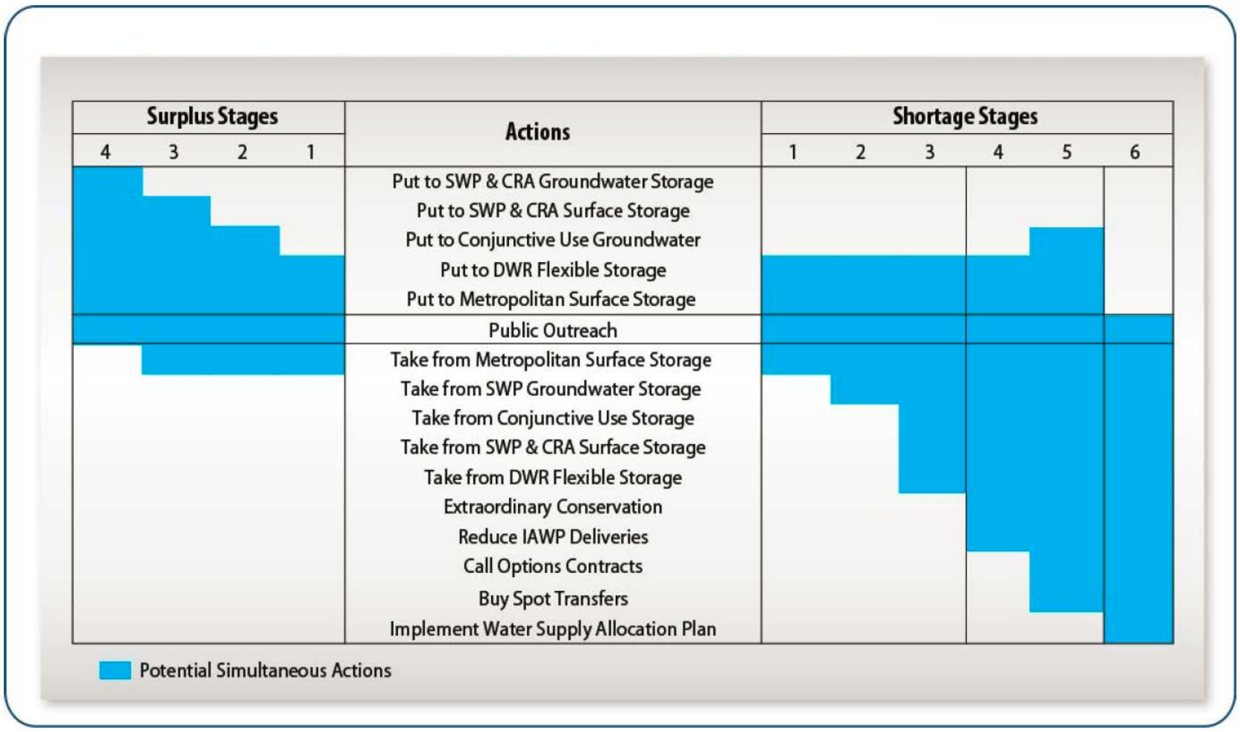

Figure 5-1: Resource Stages, Anticipated Actions, and Supply Declarations

Metropolitan's Board of Directors adopted a Water Supply Condition Framework in June 2008 in order to communicate the urgency of the region's water supply situation and the need for further water conservation practices. The framework has four conditions, each calling increasing levels of conservation. Descriptions for each of the four conditions are listed below:

- ***Baseline Water Use Efficiency:*** Ongoing conservation, outreach, and recycling programs to achieve permanent reductions in water use and build storage reserves.
- ***Condition 1 Water Supply Watch:*** Local agency voluntary dry-year conservation measures and use of regional storage reserves.
- ***Condition 2 Water Supply Alert:*** Regional call for cities, counties, member agencies, and retail water agencies to implement extraordinary conservation through drought ordinances and other measures to mitigate use of storage reserves.
- ***Condition 3 Water Supply Allocation:*** Implement Metropolitan's WSAP

As noted in Condition 3, should supplies become limited to the point where imported water demands cannot be met, Metropolitan will allocate water through the WSAP (Metropolitan, 2015 Draft UWMP, March 2016).

5.2.2 Metropolitan's Water Supply Allocation Plan

Metropolitan's imported supplies have been impacted by a number of water supply challenges as noted earlier. In case of an extreme water shortage, within the Metropolitan service area, the implementation of its Water Supply Allocation Plan is recommended.

Metropolitan's Board of Directors adopted the WSAP in February 2008 to fairly distribute a limited amount of water supply it through a detailed methodology to reflect a range of local conditions and needs of the region's retail water consumers.

The WSAP includes the specific formula for calculating member agency supply allocations and the key implementation elements needed for administering an allocation. Metropolitan's WSAP is the foundation for the urban water shortage contingency analysis required under Water Code Section 10632 and is part of Metropolitan's 2015 UWMP.

Metropolitan's WSAP was developed in consideration of the principles and guidelines in Metropolitan's 1999 WSDM Plan with the core objective of creating an equitable "needs-based allocation". The WSAP's formula seeks to balance the impacts of a shortage at the retail level while maintaining equity on the wholesale level for shortages of Metropolitan supplies of up to 50 percent. The formula takes into account a number of factors, such as the impact on retail customers, growth in population, changes in supply conditions, investments in local resources, demand hardening aspects of water conservation savings, recycled water, extraordinary storage and transfer actions, and groundwater imported water needs.

The formula is calculated in three steps: 1) based period calculations, 2) allocation year calculations, and 3) supply allocation calculations. The first two steps involve standard computations, while the third step contains specific methodology developed for the WSAP.

Step 1: Base Period Calculations – The first step in calculating a member agency's water supply allocation is to estimate their water supply and demand using a historical based period with established water supply and delivery data. The current base period for each of the different categories of supply and demand is calculated using data from the two most recent non-shortage fiscal years ending 2013 and 2014.

Step 2: Allocation Year Calculations – The next step in calculating the member agency's water supply allocation is estimating water needs in the allocation year. This is done by adjusting the base period estimates of retail demand for population growth and changes in local supplies.

Step 3: Supply Allocation Calculations – The final step is calculating the water supply allocation for each member agency based on the allocation year local water supplies.

In order to implement the WSAP, Metropolitan's Board of Directors makes a determination on the level of the regional shortage, based on specific criteria, typically in April. The criteria used by Metropolitan includes, current levels of storage, estimated water supplies conditions, and projected imported water demands. The allocations, if deemed necessary, go into effect in July of the same year and remain in effect for a 12-month period. The schedule is made at the discretion of the Board of Directors.

Although Metropolitan's 2015 UWMP forecasts that Metropolitan will be able to meet projected imported demands throughout the projected period from 2020 to 2040, uncertainty in supply conditions can result in Metropolitan needing to implement its WSAP to preserve dry-year storage and curtail demands.

5.2.3 MWDOC's Water Supply Allocation Plan

To prepare for the potential allocation of imported water supplies from Metropolitan, MWDOC worked collaboratively with its 28 retail agencies to develop its own WSAP that was adopted in January 2009 and amended in 2015. The MWDOC WSAP outlines how MWDOC will determine and implement each of its retail agency's allocation during a time of shortage.

The MWDOC WSAP uses a similar method and approach, when reasonable, as that of the Metropolitan's WSAP. However, MWDOC's plan remains flexible to use an alternative approach when Metropolitan's method produces a significant unintended result for the member agencies. The MWDOC WSAP model follows five basic steps to determine a retail agency's imported supply allocation.

Step 1: Determine Baseline Information – The first step in calculating a water supply allocation is to estimate water supply and demand using a historical based period with established water supply and delivery data. The base period for each of the different categories of demand and supply is calculated using data from the last two non-shortage fiscal years ending 2013 and 2014.

Step 2: Establish Allocation Year Information – In this step, the model adjusts for each retail agency's water need in the allocation year. This is done by adjusting the base period estimates for increased retail water demand based on population growth and changes in local supplies.

Step 3: Calculate Initial Minimum Allocation Based on Metropolitan's Declared Shortage Level – This step sets the initial water supply allocation for each retail agency. After a regional shortage level is established, MWDOC will calculate the initial allocation as a percentage of adjusted base period imported water needs within the model for each retail agency.

Step 4: Apply Allocation Adjustments and Credits in the Areas of Retail Impacts and Conservation– In this step, the model assigns additional water to address disparate impacts at the retail level caused by an across-the-board cut of imported supplies. It also applies a conservation credit given to those agencies that have achieved additional water savings at the retail level as a result of successful implementation of water conservation devices, programs and rate structures.

Step 5: Sum Total Allocations and Determine Retail Reliability – This is the final step in calculating a retail agency's total allocation for imported supplies. The model sums an agency's total imported allocation with all of the adjustments and credits and then calculates each agency's retail reliability compared to its Allocation Year Retail Demand.

The MWDOC WSAP includes additional measures for plan implementation, including the following:

- Appeal Process – An appeals process to provide retail agencies the opportunity to request a change to their allocation based on new or corrected information. MWDOC anticipates that under most circumstances, a retail agency's appeal will be the basis for an appeal to Metropolitan by MWDOC.
- Melded Allocation Surcharge Structure – At the end of the allocation year, MWDOC would only charge an allocation surcharge to each retail agency that exceeded their allocation if MWDOC

exceeds its total allocation and is required to pay a surcharge to Metropolitan. Metropolitan enforces allocations to retail agencies through an allocation surcharge to a retail agency that exceeds its total annual allocation at the end of the 12-month allocation period. MWDOC's surcharge would be assessed according to the retail agency's prorated share (AF over usage) of MWDOC amount with Metropolitan. Surcharge funds collected by Metropolitan will be invested in its Water Management Fund, which is used to in part to fund expenditures in dry-year conservation and local resource development.

- Tracking and Reporting Water Usage – MWDOC will provide each retail agency with water use monthly reports that will compare each retail agency's current cumulative retail usage to their allocation baseline. MWDOC will also provide quarterly reports on it cumulative retail usage versus its allocation baseline.
- Timeline and Option to Revisit the Plan – The allocation period will cover 12 consecutive months and the Regional Shortage Level will be set for the entire allocation period. MWDOC only anticipates calling for allocation when Metropolitan declares a shortage; and no later than 30 days from Metropolitan's declaration will MWDOC announce allocation to its retail agencies.

5.3 Three-Year Minimum Water Supply

As a matter of practice, Metropolitan does not provide annual estimates of the minimum supplies available to its member agencies. As such, Metropolitan member agencies must develop their own estimates for the purposes of meeting the requirements of the Act.

Section 135 of the Metropolitan Act declares that a member agency has the right to invoke its "preferential right" to water, which grants each member agency a preferential right to purchase a percentage of Metropolitan's available supplies based on specified, cumulative financial contributions to Metropolitan. Each year, Metropolitan calculates and distributes each member agency's percentage of preferential rights. However, since Metropolitan's creation in 1927, no member agency has ever invoked these rights as a means of acquiring limited supplies from Metropolitan.

As an alternative to invoking preferential rights, Metropolitan and member agencies accepted the terms and conditions of Metropolitan's shortage allocation plan, which allocated imported water under limited supplies conditions. In fact in FY 2015-16, Metropolitan implemented its WSAP at a stage level 3 (seeking no greater than a 15 percent regional reduction of water use), which is the largest reduction Metropolitan has ever imposed on its member agencies. Moreover, this WSAP reduction level 3 was determined when Metropolitan water supplies from the SWP were at their lowest levels ever delivered and water storage declined more than 1 MAF in one year.

Based on analysis shown in Section 3 of this Plan, Metropolitan believes that the water supply and demand management actions it is undertaking will increase its reliability throughout the 25-year period. Thus for purposes of this estimate, it is assumed that Metropolitan and MWDOC will be able to maintain the identified supply amounts throughout the three-year period. However, assuming Metropolitan is again faced with another critically dry year as what we had faced in 2014 and 2015, MWDOC estimates it can meet projected imported demands as follows. To estimate the three year minimum water supply, MWDOC will used the latest allocation (MWDOC's 2015-16 imported allocation) for 2015-2018. Thus, the estimate of the minimum imported supplies available to MWDOC in 2015-16 is 224,579 AF. It is assumed this would continue for an additional two years. If the severity of the drought increases, higher levels of curtailment i.e. greater levels of allocations could be needed.

Table 5-2: Minimum Supply Next Three Years (AF)

MWDOC's Minimum Supply Next Three Years			
	2016	2017	2018
Available Imported Water Supply	224,579	224,579	224,579
NOTES: MWDOC Water Shortage Allocation Model, March 2015			

5.4 Catastrophic Supply Interruption

From a regional perspective, Orange County and all of southern California is heavily dependent upon imported water supplies from Metropolitan. Imported water is conveyed through the SWP and CRA, which travel hundreds of miles to reach urban southern California, and specifically to Orange County. Additionally, this water is distributed to customers through an intricate network of pipes and water mains that are susceptible to damage from earthquakes and other disasters. Regional storage for southern California and Orange County is provided by Metropolitan to mitigate an outage of either the SWP or CRA. DVL, Metropolitan's newest reservoir located in Hemet, Riverside County is an 800,000 AF reservoir, of which about 400,000 AF of water is reserved for catastrophic emergencies. In fact, protection from catastrophic events such as earthquakes was a major reason for the construction of Diamond Valley Lake. Additionally, the Orange County Water purveyors have taken significant efforts to respond to emergencies through the formation of the Water Emergency Response Organization of Orange County (WEROC).

5.4.1 Metropolitan

Metropolitan has comprehensive plans for stages of actions it would undertake to address a catastrophic interruption in water supplies through its WSAP and WSDM Plans. Metropolitan also developed an Emergency Storage Requirement to mitigate against potential interruption in water supplies resulting from catastrophic occurrences within the southern California region, including seismic events along the San Andreas Fault. In addition, Metropolitan is working with the State to implement a comprehensive improvement plan to address catastrophic occurrences that could occur outside of the southern California region, such as a maximum probable seismic event in the Delta that would cause levee failure and disruption of SWP deliveries. For greater detail on Metropolitan's planned responses to catastrophic interruption, please refer to Metropolitan's 2015 UWMP.

5.4.2 Water Emergency Response Organization of Orange County (WEROC)

In 1983, the Orange County water community developed a Water Supply Emergency Preparedness Plan that identified a need to develop a plan on how agencies would to respond effectively to disasters impacting the regional water distribution system. The collective efforts of these agencies resulted in the formation of WEROC to coordinate emergency response on behalf of all Orange County water and wastewater agencies, develop an emergency plan to respond to disasters, and conduct disaster training exercises for the Orange County water community. WEROC was established with the creation of an indemnification agreement between its member agencies to protect each other against civil liabilities and to facilitate the exchange of resources. WEROC is unique in its ability to provide a single point of contact for representation of all water and wastewater utilities in Orange County during a disaster. This representation is to the local, county, state, and federal disaster coordination agencies. Within the Orange County Operational Area, WEROC is the recognized contact for emergency disaster response for the water community.

Each local water and wastewater utility is responsible for developing its own disaster preparedness and response plan to meet emergencies within their service area. WEROC performs the coordination of information and mutual-aid requests among water and wastewater agencies. WEROC provides assistance to utilities developing their plans and facilitates working groups when new best practices need to be examined or regulations come into effect. Additionally, WEROC supports the utilities efforts with training, exercise coordination, and representation to other emergency response agencies.

In the event of a major emergency or regional disaster WEROC would perform the following functions:

- Collect damage assessment reports from Orange County water and wastewater utilities;
- Assess the overall condition of the Orange County water supply system; including treatment, storage and distribution; and assess the overall condition of the Orange County wastewater system;
- Identify the information and resource needs of the impacted water and wastewater utilities;
- Identify available resources, determine optimal use of those resources and coordinate the exchange of those resources as mutual aid;
- Determine water supply needs;
- Recommend water emergency allocations and coordinate water distribution as needed;
- Liaison with water utilities, local government, Metropolitan, the Orange County Operational Area and the California Office of Emergency Services; and
- Document remedial actions taken during the disaster operation and assist impacted agencies with the Federal Stafford Act Public Assistance process.

Two dedicated WEROC Emergency Operations Centers (EOC) are located within Orange County. Both sites are maintained in a state of readiness in the event that they will be activated following a major disaster. WEROC EOCs are staffed by trained volunteer personnel from the water community. WEROC's Emergency Radio Communication System consists of two mountain-top radio repeaters and several control stations. WEROC is a flexible and dynamic program that continues to make improvements to its emergency preparedness plan, emergency response facilities, and its training program to address new issues as they surface.

During a disaster, WEROC will work cooperatively with Metropolitan through their Member Agency Response System (MARS) Radio to facilitate the flow of information and requests for mutual-aid within Metropolitan's 5,100 square mile service area. WEROC also provides updated information to Metropolitan's EOC at Eagle Rock.

Day-to-day management of WEROC is provided by MWDOC. Although MWDOC is a majority contributor to the WEROC budget, the program is also supported by OCWD, OCSD, SOCWA and the three Cities of Anaheim, Fullerton and Santa Ana. Additionally, ETWD and Metropolitan provide facility and maintenance support to the WEROC EOCs on a regular basis.

Additional emergency response mutual aid plans in the State of California include the California Master Mutual Aid Agreement, and the California Water and Wastewater Agency Response Network (CalWARN), and the California Public Works Mutual Aid Plan. The California Master Mutual Aid Agreement includes all public agencies that have incorporated the Standardized Emergency Management System (SEMS) into their response plans, and is coordinated by the California Office of Emergency Services. It requires a declared disaster to be used for response. Cal WARN includes 353 (as of Dec 2015) public and private water and wastewater utilities that have signed the Cal WARN agreement, and provides the opportunity for mutual assistance regardless of a declared disaster. Cal WARN is coordinated by a State Steering Committee and can be activated by any signatory to the agreement. The California Public Works Mutual Aid Plan provides for mutual aid between public works departments at the local and county level. All Orange County Cities and the County of Orange have signed this agreement.

A summary of actions in response to a catastrophe is listed below:

- **Regional Power Outage:** Coordinate communication with So. California Edison and San Diego Gas and Electric for restoration of services. Provide contacts for vendors of rental generators and initiate mutual assistance between unaffected agencies for emergency backup power. Work with impacted utilities to determine fuel replenishment needs and coordinate fuel procurement. Consult with the impacted utilities and the California DDW for water quality concerns and public notices.
- **Earthquake:** Coordinate the resources necessary for repair of the Orange County water and wastewater agencies' infrastructure. Facilitate mutual aid from outside agencies through the Orange County Operational Area using the above mentioned mutual aid agreements. Use WEROC Mutual Aid Directory and private vendor lists to identify available water haulers, temporary water lines, piping, heavy equipment, etc.
- **Tsunami:** If time allows, notify coastal agencies to take the appropriate actions for life safety. Work with impacted agencies to identify potential damages and request DDW support in evaluating suspected water contamination. Support agency efforts to restore water flow in unique conditions of flooding (safety) and potentially lack of electricity. Continue support similar to an earthquake response.

- **Malicious Act:** Such an incident typically involves a long-term response with law enforcement, sometimes causing interference with water supply verses ongoing law enforcement activities. WEROC could support the agency with staff, liaison efforts with outside agencies, and resources required for recovery of operational systems. In addition, coordination of water quality advisors, DDW, and public information officers will be critical.
- **Flooding:** Coordination with the Orange County Public Works Department, Orange County Fire Authority and DWR for flood control support. Coordination of mutual assistance for repair of infrastructure.
- **Dam Failure:** Identify impacts to water infrastructure and resource management for the county during the current weather season and conditions. Evaluate the need and ability for accelerated reconstruction and/or restoration of services. Coordinate alternate water supply as needed.
- **SONGS – Nuclear Release:** Work with the DDW and the Orange County retail water agencies that have open water sources to determine impacts to water quality and appropriate protective actions. Work with agencies within the fallout zone to determine current operational capabilities and future use of infrastructure in the affected area.
- **Wild Land Fire:** Facilitate Water Utility Representation to the Fire Unified Command Post to ensure that information and resource needs are being met. Ensure that fire protection is being provided to critical infrastructure and that responding agencies understand the impacts of losing infrastructure.
- **Water Contamination:** Contamination can be from multiple sources: malicious, sewer leak, underground contaminated plume, etc. WEROC would provide information and resource coordination support to the impacted agency if requested. The WEROC Public Information Officer will work with the agency and the media to ensure proper information is provided to the public for their health and safety.
- **Hazardous Materials Spill/Release:** Communicate with impacted agencies to determine the impact to water supply and quality. Provide coordination with responding agencies if necessary. The WEROC Public Information Officer will work with the agency and the media to ensure proper information is provided to the public for their health and safety.
- **Pandemic:** Communicate recommended health precautions from the County Public Health Officer. Advocate on behalf of the utilities for any medication that may be made available to first responders only. Assistant agencies in identifying critical functions, mandatory staffing and reduced staffing operations. Coordinate resource allocations if resources become sparse.
- **Severe Drought:** Facilitate a coordinated public information campaign. Coordinate with other government agencies on severe conservation measures and ensure understanding of the impacts.

5.5 Prohibitions, Penalties and Consumption Reduction Methods

Working in coordination and collaboration with its retail agencies, MWDOC is able to reduce demands during water shortages. Although MWDOC may actually require more imported water during water shortages to offset losses of local supplies, MWDOC is able to maintain demands at a lower level than would be possible if water reduction mechanisms were not implemented. A variety of mechanisms, such as mandatory prohibitions, consumption reductions, and penalties and charges has been and can be implemented during water shortages.

5.5.1 Mandatory Water Use Prohibitions

Because MWDOC's does not have power to "enforce" restrictions on the use of water as a practical matter, mandatory use prohibitions would be difficult for MWDOC to enforce given the different sources of water accessed by end users. The establishment of mandatory prohibitions on water usage during water shortages is therefore not part of MWDOC's Plan under Water Code Section 10620 (c). However, historically MWDOC has focused its activity in developing service area shortage allocation plans that include water purchase allocations and surcharges. MWDOC has also worked with its agencies and others in communicating the conservation need to the general public and to develop unified messages. In addition, MWDOC has urged its retail agencies to develop specific shortage management plans to meet targeted reduction in total water demand during a shortage. Retail agencies of MWDOC will address mandatory prohibitions during water shortages in their individual UWMPs.

5.5.2 Consumption Reduction Methods

As mentioned in Section 5.5.1, MWDOC does not have power to "enforce" restriction on the use of water. Therefore, it is more appropriate for water reduction methods to be applied to the public through the retail agencies. Reductions in water consumption by MWDOC's retail agencies during water shortages will ultimately reduce MWDOC's overall demands on Metropolitan. MWDOC's Board has the authority to provide for a method of allocation for available imported water supplies, as the Board may determine necessary, through implementation of its Water Shortage Management Plan for all classes of service. Each retail agency decides how it will allocate supplies it receives from MWDOC during water shortages. Retail agencies of MWDOC will address water reduction methods during water shortages in their individual UWMPs.

5.6 Impacts to Revenue

During a catastrophic interruption of water supplies, prolonged drought, or water shortage of any kind, water agencies can experience a reduction in revenue as water sales decrease. In addition, during this period of time, expenditures may also increase or decrease with varying circumstances. However, it likely that expenditures will increase due to the need to increase water conservation measures and outreach efforts. However, this is dependent on how an agency's water rates are structured. MWDOC water rates are 100 percent fixed and are not subject to variation in water sales.

5.6.1 MWDOC Fixed Water Rate

MWDOC's operating budget is funded from a fixed annual Retail Meter Charge collected from MWDOC's retail agencies for each retail water meter in their service area. This charge provides a stable source of revenue that does not vary with weather or water sales. Therefore, to the extent a water shortage occurs, MWDOC does not see a shortfall in revenue.

5.7 Reduction Measuring Mechanism

The establishment of a method to measure water consumption reductions during water shortages is necessary to determine the effectiveness of water reduction measures. Although MWDOC, as a wholesale supplier, cannot enforce water reduction measures upon end users, MWDOC does work closely with its retail agencies to collect and evaluate data and report on water usage during such events, such as the Governor's recent mandatory water use reduction requests. To monitor the effectiveness, MWDOC generally relies on monthly reading of Metropolitan's meter connections and monthly reports of local water production by the retail agencies. Reports prepared from this data allow MWDOC to evaluate the trends of consumption at the retail agency and county level.

MWDOC's retail agencies will address methods to determine water consumption reductions in their individual UWMPs.

6 RECYCLED WATER

6.1 Agency Coordination

MWDOC does not produce or manage recycled water, but supports, encourages and partners in recycled water efforts within its service area. Recycled water planning within MWDOC's service area requires close coordination with multiple agencies that many times have overlapping jurisdictional boundaries. As imported water supplies have become more challenged, the local agencies, including OCWD have continued working to identify opportunities for the use of recycled water for irrigation purposes, groundwater recharge and some non-irrigation applications.

6.2 Wastewater Description and Discharge

6.2.1 Overview

Wastewater collection and treatment within MWDOC's service area is managed by multiple agencies. Some local agencies provide wastewater collection and treatment as well as potable water services, while other agencies send their wastewater to large regional facilities. Wastewater is not collected by MWDOC and MWDOC does not treat or discharge of wastewater.

6.2.2 Orange County Sanitation District

OCSD collects wastewater from residential, commercial, and industrial customers in 21 cities, three special districts, and portions of unincorporated Orange County, totaling 479 square miles serving more than 2.5 million residents. These flows include dry weather urban runoff collected from 15 diversion points and discharged into the sewer system for treatment and Santa Ana River Interceptor flows from the upper Santa Ana watershed.

OCSD operates and maintains two treatment plants: Reclamation Plant No. 1, located in Fountain Valley with a capacity of 320 MGD, and Treatment Plant No. 2 located in Huntington Beach with a capacity of 312 MGD. OCSD also operates 572 miles of collection system pipelines along with 15 offsite pump stations. Treated wastewater is discharged to the Pacific Ocean via an ocean outfall in compliance with state and federal requirements as set forth in OCSD's National Pollutant Discharge Elimination System permit. Approximately 100 MGD of secondary effluent undergoes advanced treatment at the GWRS facility operated by the OCWD and 7 MGD undergoes tertiary treatment at OCWD's Green Acres Project (GAP) facility. OCSD's ocean outfall is 120-inch diameter and extends four miles off the coast of Huntington Beach. A 78-inch diameter emergency outfall also exists that extends 1.3 miles off the coast.

OCSD Reclamation Plant No. 1 - Reclamation Plant No. 1 treats raw wastewater and has a maximum treatment capacity of 320 MGD. The plant provides primary and secondary treatment and supplies secondary effluent to OCWD for further tertiary treatment at their GAP facility and advanced treatment at their GWRS. Reclamation Plant No. 1 is the only plant that provides water to OCWD for additional treatment and recycling. An interplant pipeline allows flows to be conveyed to Treatment Plant No. 2.

OCSD Treatment Plant No. 2 - Treatment Plant No. 2 provides primary and secondary treatment to raw wastewater and has a maximum treatment capacity of 312 MGD. All secondary effluent from their plant is discharged to the ocean through the ocean outfall.

6.2.3 South Orange County Wastewater Authority

South Orange County Wastewater Authority (SOCWA) is a Joint Powers Authority created on July 1, 2001 to facilitate and manage the collection, transmission, treatment and discharge of wastewater for more than 500,000 homes and businesses across South Orange County. It was formed as the legal successor to the Aliso Water Management Agency, South East Regional Reclamation Authority, and South Orange County Reclamation Authority. SOCWA has ten member agencies that include: City of Laguna Beach, City of San Clemente, City of San Juan Capistrano, ETWD, EBSD, IRWD, MNWD, SMWD, SCWD, and TCWD. All of these service areas receive wholesale water through MWDOC. The service area encompasses approximately 220 square miles including the Aliso Creek, Salt Creek, Laguna Canyon Creek, and San Juan Creek Watersheds.

Within its service area, SOCWA operates four wastewater treatment plants, with an additional eight wastewater treatment plants operated by SOCWA member agencies. Wastewater in the service area is collected at the local and regional level through a series of interceptors that convey influent to the wastewater treatment plants. Treated effluent throughout the service area is conveyed to two gravity flow ocean outfalls operated by SOCWA the Aliso Creek Outfall and the San Juan Creek Outfall. The Aliso Creek outfall has a capacity of 33.2 MGD and extends 1.5 miles offshore near Aliso Beach in the City of Laguna Beach. The San Juan Creek outfall has a nominal capacity of 36.8 MGD which can be increased by pumping and extends 2.2 miles offshore near Doheny Beach in the City of Dana Point. Full secondary treatment is provided at SOCWA wastewater treatment plants, with most plants exceeding this level of treatment when the water is beneficially reused.

SOCWA Coastal Treatment Plant - SOCWA's Coastal Treatment Plant (CTP) in Aliso Canyon, Laguna Niguel has a 6.7 MGD capacity and treats wastewater received from the City of Laguna Beach, EBSD, MNWD, and SCWD to secondary effluent standards. Effluent from the CTP is treated to secondary or tertiary levels depending on the discharge method, ocean outfall or beneficial reuse. Recycled water is treated to Title 22 standards at the Advanced Water Treatment Plant (AWTP) owned by SCWD, but operated by SOCWA, located adjacent to the CTP. During the summer months, over 2 MGD of recycled water can be produced by the AWTP. Treated effluent that is not recycled is discharged through the Aliso Creek Ocean Outfall. Waste sludge is sent to the Regional Treatment Plant (RTP) in Laguna Niguel.

SOCWA Regional Treatment Plant – SOCWA's RTP in Laguna Niguel has a 12 MGD liquid capacity and 24.6 MGD solids handling capacity. The RTP treats wastewater from MNWD's service area to secondary or tertiary levels depending on discharge method, ocean outfall or reuse such as landscape irrigation. Recycled water is treated to applicable Title 22 standards. Secondary effluent is conveyed to the Aliso Creek Ocean Outfall via the SOCWA Effluent Transmission Main.

SOCWA Plant 3A – SOCWA's Plant 3A located in the City of Mission Viejo has a maximum capacity of 6 MGD and treats wastewater received from MNWD and SMWD. Effluent is treated to secondary or tertiary levels depending on the discharge method, ocean outfall or beneficial reuse. Recycled water is treated to applicable Title 22 standards and used to irrigate parks and greenbelts. Secondary effluent is conveyed to the San Juan Creek Outfall via the 3A Effluent Transmission Main.

SOCWA J. B. Latham Treatment Plant - SOCWA's J. B. Latham Treatment Plant located in the City of Dana Point has a 13 MGD capacity and treats wastewater from MNWD, City of San Juan Capistrano, SMWD, and SCWD to secondary effluent standards. The secondary effluent is conveyed directly to the San Juan Creek Outfall as the plant does not have tertiary treatment.

6.3 Current Recycled Water Uses

Recycled water is widely accepted as a water supply source throughout MWDOC's service area. In the past, recycled water was mainly used for landscape irrigation, but large recycled water projects including OCWD's GAP and GWRS, and IRWD's recycled water projects have significantly expanded and increased uses. GWRS uses include injection for sea water barriers and percolation for groundwater recharge. IRWD is at the forefront of using recycled water not only for irrigation, but for other uses such as toilet flushing and commercial applications. Other agencies in south Orange County, such as MNWD and SMWD use a significant amount of recycled water. Recycled water in Orange County is treated to various levels depending on the end use and in accordance with Title 22 regulations as described below.

OCWD Green Acres Project – OCWD owns and operates the GAP, a water recycling system that provides up to 7,000 AFY of recycled water for irrigation and industrial uses. GAP provides an alternate source of water that is mainly delivered to parks, golf courses, greenbelts, cemeteries, and nurseries in the cities of Costa Mesa, Fountain Valley, Newport Beach, and Santa Ana. Approximately 100 sites use GAP water, current recycled water users include Mile Square Park and Golf Courses in Fountain Valley, Costa Mesa Country Club, Chroma Systems carpet dyeing, Kaiser Permanente, and Caltrans.

OCWD Groundwater Replenishment System - OCWD's GWRS receives secondary treated wastewater from OCSD and purifies it to levels that meet all state and federal drinking water standards. The GWRS Phase 1 plant has been operational since January 2008, and uses a three-step advanced treatment process consisting of microfiltration (MF), reverse osmosis (RO), and ultraviolet (UV) light with hydrogen peroxide. A portion of the treated water is injected into the seawater barrier to prevent seawater intrusion into the groundwater basin. The other portion of the water is pumped to ponds where the water percolates into deep aquifers and becomes part of Orange County's water supply.

The design and construction of the first phase (70,000 AFY) of the GWRS project was jointly funded by OCWD and OCSD; Phase 2 expansion (33,000 AFY) was funded solely by OCWD. Expansion beyond this is currently in discussion and could provide an additional 30,000 AFY of water, increasing total GWRS production to 133,000 AFY. The GWRS is the world's largest water purification system for indirect potable reuse (IPR).

OCWD's GWRS has a current production capacity of 103,000 AFY with the expansion that was completed in 2015. Approximately 36,000 AFY of the highly purified water is pumped into the injection wells and 67,000 AFY is pumped to the percolation ponds in the City of Anaheim where the water is naturally filtered through sand and gravel to deep aquifers of the groundwater basin. The Orange County Groundwater Basin provides approximately 72 percent of the potable water supply for north and central Orange County.

ETWD Water Recycling Plant – ETWD's Water Recycling Plant (WRP) located in the City of Lake Forest has a maximum influent capacity of 6 MGD. Wastewater is treated to secondary or tertiary levels depending on the discharge method, ocean outfall or beneficial reuse. Recycled water is treated to Title

22 standards with the expansion completed in 2014. Treated effluent that is not recycled is discharged of through the Aliso Creek Ocean Outfall.

SMWD Chiquita Water Reclamation Plant – SMWD's Chiquita Water Reclamation Plant (CWRP) located in Chiquita Canyon treats wastewater to a tertiary level for recycled water use meeting Title 22 standards. CWRP has a maximum design capacity of 8 MGD with plans to increase its size to 10 MGD by 2025. Effluent that is not beneficially reused is discharged via the Chiquita Land Outfall that connects to the San Juan Creek Ocean Outfall.

SMWD Oso Creek Water Reclamation Plant – SMWD's Oso Creek Water Reclamation Plant (OCWRP) located along Oso Creek. Wastewater is treated to a secondary or tertiary depending on the method of discharge, ocean outfall or beneficial reuse. Recycled water is treated to Title 22 standards. A bypass facility allows excess wastewater to be sent to SOCWA's J.B. Latham Treatment Plant as OCWRP does not have an outfall. Without the ability to discharge treated effluent, excess flows beyond recycled water demands are sent to J.B. Latham Treatment Plant. OCWRP has a maximum design capacity of 3 MGD and is considered a scalping plant as it intercepts flows from a large trunkline.

SMWD Nichols Institute Water Reclamation Plant – the Nichols Institute Water Reclamation Plant is operated by SMWD, but owned by a private company that owns property within SMWD's service area. This small facility treats approximately 34 AFY and does not have an outfall. All wastewater is treated to Title 22 standards for recycling purposes. Since this facility is remote from existing water and wastewater facilities, SMWD is not obligated to provide an alternate source of water in the event the facility becomes inoperable.

San Clemente Water Reclamation Plant - The City of San Clemente owns and operates the San Clemente Water Reclamation Plant located within San Clemente. The plant has a design capacity of 7 MGD and treats wastewater to secondary or tertiary levels depending on the discharge method, ocean outfall or beneficial reuse. Any secondary effluent in excess of the plant's recycling limit is conveyed to the San Juan Creek Ocean Outfall via the San Clemente Land Outfall. Recycling capacity is currently 4.4 MGD after the expansion was completed in 2014 and included 9 miles of pipelines, conversion of a domestic water reservoir to recycled water storage, and a pressure reducing station as well as an interconnection with SMWD.

IRWD Los Alisos Water Recycling Plant - Los Alisos Water Recycling Plant (LAWRP) is operated by IRWD and is located in the City of Lake Forest. LAWRP has a capacity of 7.5 MGD and wastewater is treated to a secondary or tertiary level depending on the use, ocean outfall or beneficial reuse such as landscape irrigation and other non-potable uses. When excess secondary effluent beyond the plant's tertiary treatment capacity is received, it is conveyed to the SOCWA Effluent Transmission Main for discharge via the Aliso Creek Ocean Outfall.

IRWD Michelson Water Recycling Plant - Michelson Water Recycling Plant (MWRP) is located in the City of Irvine and is operated by IRWD. MWRP has a maximum influent capacity of 28 MGD. Wastewater is treated to a tertiary level with advanced treatment in the form of UV disinfection meeting Title 22 standards. All effluent is conveyed to the recycled water distribution system for landscape irrigation, toilet flushing, and industrial uses.

TCWD Robinson Ranch Water Reclamation Plant - TCWD owns and operates the Robinson Ranch Wastewater Treatment Plant (RRWWTP) located in the Robinson Ranch development in Trabuco

Canyon, an unincorporated area of Orange County. RRWTP has a treatment capacity of 0.85 MGD, and the wastewater is treated to a tertiary level meeting Title 22 standards. All of the wastewater is recycled as the plant is not permitted to have stream discharges, and is infeasible to connect to the existing outfalls in the SOCWA service area.

MNWD RTP Advanced Wastewater Treatment Plant – MNWD's RTP AWTP is operated by SOCWA and is located in the City of Laguna Niguel. The AWTP has a total capacity of 11.4 MGD and the secondary effluent from RTP is treated to a disinfected tertiary level that meets Title 22 requirements for landscape irrigation use.

MNWD Plant 3A Advanced Wastewater Treatment Plant - MNWD's Plant 3A AWTP is operated by SOCWA and is located within the City of Laguna Niguel. The Plant 3A AWTP has a capacity of 2.4 MGD and the secondary effluent from 3A is treated to a disinfected tertiary level that meets Title 22 requirements for landscape irrigation use.

SCWD CTP Advanced Wastewater Treatment Plant - SCWD's CTP AWTP is operated by SOCWA and is located in the City of Laguna Niguel. The CTP AWTP has a capacity of 2.6 MGD and the secondary effluent from CTP is treated to a disinfected tertiary level that meets Title 22 requirements for landscape irrigation use.

SCWD Aliso Creek Water Reclamation Facility - SCWD completed construction on the Aliso Creek Water Reclamation Facility (ACWRF) in 2014 that intercepts and treats a portion of the urban runoff in lower Aliso Creek to supplement the advanced water treatment facility at CTP. The ACWRF has a capacity of 800 GPD and the creek water is treated using ultrafiltration and reverse osmosis to improve the quality of the recycled water supply to make it more attractive for irrigation users. The ACWRF has not been able to be used as the Aliso Creek water level is below what regulation allows.

MWDOC does not directly treat or distribute recycled water within their service area.

6.4 Potential Recycled Water Uses

Potential recycled water use within MWDOC's service area hinges upon many variables including, but not limited to, economics of treatment and distribution system extension (as well as site retrofits and conversions), water quality, public acceptance, infrastructure requirements, and reliability.

Even though demands exist, it is not necessarily economically feasible to provide recycled water to all potential users. Expansion of recycled water systems eventually reach a point where returns diminish and higher investments for expansion are not cost effective. Water recycling projects involve collecting and treating wastewater to applicable standards depending on the end use, providing seasonal storage, pipeline construction, pump station installation, and conversions for existing potable water users or dual plumbing systems for new users. Creative solutions to secure funding, and overcome regulatory requirements, institutional arrangements, and public acceptance are required to offset existing potable demands with potential recycled water demands.

OCWD Groundwater Replenishment System Expansion - Investments beyond the Phase 2 expansion have not been approved by OCWD and require further review before proceeding. If the further envisioned phase of the project is approved and developed, it is projected that up to 130 MGD of water will be produced.

SMWD Chiquita Water Reclamation Plant Expansion - CWRP currently has a capacity of 5 MGD. SMWD plans to expand the plant to 10 MGD by 2015. The expansion will increase total production and reduce dependency on imported water. SMWD is planning to expand the CWRP tertiary capacity from 5 MGD to 10 MGD by 2015, increasing its recycled water supply to 11,200 AFY. The expansion would reduce SMWD's dependency on imported water and provide additional recycled water for irrigation purposes. Because RMV holds riparian water rights for its ranching, agriculture and tenants' uses; RMV and SMWD are looking into an agreement for RMV to potentially provide water in areas of the Ranch Plan to supplement recycled water in the event recycled water is unavailable.

MNWD Plant 3A Expansion - The 3A Treatment Plant Tertiary Expansion Project will provide an additional 3,000 AFY of capacity for recycled water use. The expansion includes the following components: increase the reliability of the aeration system, expand and/or replacing the existing filters with more effective tertiary filters, expand the disinfection system, expand the tertiary effluent pumps, possible upsizing of the discharge pipeline where it connects to SMWD's recycled water distribution system, modification to various in-plant piping and electrical systems, and addition of a standby generator to maintain operation during a power outage. The expansion will increase the local water supply reliability by producing an additional 3,000 AFY of recycled water, reducing dependence on imported water. The expansion will conserve approximately 5,653,000 kWh of energy per year and 3,448,330 pounds of carbon dioxide by producing and distributing recycled water in lieu of imported water. The expansion also benefits MNWD, the project partner.

6.4.1 Direct Non-Potable Reuse

MWDOC does not directly produce recycled water, but a number of its retail agencies produce recycled water and use it for direct non-potable reuse. Total direct non-potable reuse within the MWDOC service area from its retail agencies was 45,280 AFY for FY 2014-15.

6.4.2 Indirect Potable Reuse

The indirect potable water reuse produced from OCWD's GWRS system used for groundwater recharge and seawater barriers is approximately 100,000 AFY within MWDOC's service area.

6.5 Optimization Plan

Metropolitan and MWDOC support research efforts to encourage development and use of recycled water. These include conducting studies and research to address public concerns, developing new technologies, and assessing health effects. Addressing public concerns is required to gain the support of stakeholders early in the planning process. Education is required to inform the public of treatment processes. Developing new technologies is a prerequisite to help reduce the cost of producing recycled water. Health effects assessments have a two-fold purpose of alleviating public concerns and ensuring the protection of public health and the environment. Further research supported by Metropolitan and others (such as the National Water Research Institute) will have the benefit of reducing risks for MWDOC's retail agencies.

To assist in meeting projections, MWDOC plans to take numerous actions to facilitate the use and production of recycled water within its service area. However, MWDOC is a wholesaler and does not impose development requirements or enact ordinances that mandate the use of recycled water. In many cases, additional recycled water production and use is economically infeasible given the current cost of potable water supplies in comparison to recycled water costs. MWDOC has taken the following actions to facilitate further production and use of recycled water:

- Sponsoring retail agencies in obtaining Local Resources Program (LRP) incentives from Metropolitan;
- Assisting and supporting retail agencies in applications made for bond funds such as Proposition 84;
- Encouraging Metropolitan to participate in studies that will benefit recycled water production;
- Supporting Metropolitan in deriving solutions to regulatory issues;
- Participating in regional plan such as the South Orange County IRWMP;
- Working cooperatively with retail agencies, Metropolitan and its member agencies, and other Orange County water and wastewater agencies to encourage recycled water use and develop creative solutions to increase recycled water use;
- Participating in Metropolitan's Foundational Action Funding Program to provide funding for research needed to set the state standards for Direct Potable Reuse (DPR) on AWWA's research Foundation Project.

Dealing with needed additional funding and other implementation barriers for recycled water at the state and regional level would assist in increasing recycled water production within MWDOC's service area. State funding assistance could reduce the overall cost per AF of recycled water so that it is comparable to the cost of potable water and would allow the development of more expensive recycled water projects in an earlier timeframe. There are numerous barriers to increasing water recycling that could be addressed at the State level. These barriers include establishment of uniform Regional Water Quality Control Board (RWQCB) requirements for recycled water, especially in areas where water and wastewater agency jurisdictions cross RWQCB jurisdictions resulting in varying requirements; partnering in health studies to illustrate the safety of recycled water; increasing public education; and establishing uniform requirements for retrofitting facilities to accept recycled water.

7 FUTURE WATER SUPPLY PROJECTS AND PROGRAMS

7.1 Water Management Tools

MWDOC has worked closely with its retail agencies to decrease dependence on imported water and increase supply reliability by expanding local supplies and implementing water use efficiency measures. Development of additional local supplies improves both local and regional reliability as well as system (emergency reliability).

Although MWDOC is not responsible for carrying out supply development projects in the region, they are aware of their retail agencies supply opportunities.

7.2 Transfer or Exchange Opportunities

Interconnections with other agencies result in the ability to share water supplies during short term emergency situations or planned shutdowns of major imported water systems. Transfers of water can help with short-term outages, but can also be involved with longer term water exchanges to deal with droughts or water allocation situations. MWDOC helps its retail agencies develop both local and regional transfer and exchange opportunities that promote reliability within their systems. Examples of these types of projects that might occur in the future are discussed below.

Mesa Water - Mesa Water plans to expand their Mesa Water Reliability Facility. With this expansion, Mesa Water is exploring opportunities that may develop into potential transfer or exchange opportunities with neighboring agencies to convey and sell excess pumped and treated water from the expansion project.

IRWD Strand Ranch Water Banking Program – As previously noted, IRWD has begun implementation of the Strand Ranch Banking Program (including adding property to the program including the Stockdale East and West parcels) and it has about 23,000 AF stored for IRWD's benefit. By agreement, the water is defined to be an "Extraordinary Supply" by Metropolitan and counts essentially 1:1 during a drought/water shortage condition under Metropolitan's Water Supply Allocation Plan. It is possible that IRWD could decide to open up the Strand Ranch Banking Program to other Orange County agencies in the future. Decisions regarding whether to do this and terms and conditions would have to be considered; discussions regarding this concept have not yet been initiated.

Santa Margarita Water District – As previously discussed, SMWD has actively pursued additional water supply reliability through water transfers. They are currently involved in the analysis and evaluation of the Cadiz water storage project. The Cadiz Project includes an average yield of 50,000 AF per year for 50 years that could be produced from the Fenner Valley Groundwater Basin. Cadiz is authorized to pump as much as 75,000 AF per year as long as the average yield over 50 years is 50,000 AF and assuming they are meeting all of the monitoring requirements imposed on the project. If not produced, the water would evaporate from the nearby dry lakes and be lost to productive use. The water would require treatment for Chromium VI and would be conveyed via a pump station and pipeline about 40 miles to Metropolitan's Colorado River Aqueduct. SMWD has an option for 5,000 AF per year, expandable to 15,000 AF per year; OCWD is considering the water supply. Work is underway to develop the terms and conditions for conveying the water via the Colorado River Aqueduct into southern California. The cost of water at the Aqueduct is $960 per AF. The water would have to be wheeled through the Metropolitan system.

7.3 Planned Water Supply Projects and Programs

A list of potential future projects that could improve water supply and system reliability in Orange County were identified in 2015 during the discussions regarding the OC Water Reliability Study. The projects listed below include potential projects that could be completed by agencies in Orange County to meet future projected demands as well as projects to improve the County's reliability from Metropolitan's supplies. Further detail of these projects should be available in the UWMPs developed by each retail agency and/or Metropolitan. Although some of these projects do not introduce new sources of supply, they increase system reliability (emergency services).

Huntington Beach Seawater Desalination Project - 56,000 AF per year produced by Poseidon in Huntington Beach with distribution in Orange County by OCWD and MWDOC.

Doheny Ocean Desalination Project - 16,000 AF max potential; first phase being pursued at 4,000 to 5,000 AF/year by SCWD as a demonstration project.

Prado Basin Operations with the Corps of Engineers (storage and sediment issues) - Increase conservation pool for additional capture of Santa Ana River water – 6,000 AF ±; this is part of OCWD's long term goal of capturing additional stormwater and percolating it in the groundwater basin.

Expansion of Water Recycling in Orange County - Placeholder for projects that go above and beyond the current vision for water recycling in the County; it can include expansions of purple pipe projects as well as additional elements of IPR and DPR type of projects. A separate placeholder is included for GWRS type of expansions being considered by OCWD and OCSD.

A separate listing of increased production on an agency by agency basis is provided in Table 7-1 below.

Table 7-1: Recycling Projections for Orange County (AF)

Recycling Water Projections for Orange County		
	Current	Future
IRWD	26,000	34,000
OCWD Green Acres	3,800	3,800
Anaheim	-	55
SMWD	5,600	13,400
Trabuco	800	1,000
San Clemente	500	1,500
San Juan Capistrano	700	2,500
South Coast	1,000	2,000
MNWD	7,000	9,500
ETWD	500	1,665
	-	-
Total Purple Pipe Recycling	45,900	69,420
	-	-
OCWD GWRS Indirect Potable Reuse	100,000	130,000
	-	-
Total Orange County	145,900	199,420

Lower San Juan Creek Groundwater Management - The project would involve construction of rubber dams on San Juan Creek to capture additional stormflow for percolation into the groundwater basin. A second phase would involve streamflow recharge with polished tertiary treated recycled water into the San Juan Creek for capture and percolation into the groundwater basin for replenishment purposes. The water would blend and commingle with native groundwater and then be fully treated by RO and Advanced Oxidation Processes (AOP) when it is pumped out for beneficial uses; the project will likely be implemented in phases with a potential of up to 7,000 AF of increased supply, in addition to the natural yield of the basin, which ranges between 7,700 and 8,600 AF per year based on hydrology. The feasibility study for these efforts is just now being completed in March 2016; if desired by the local agencies, preliminary design and CEQA work would be initiated.

Production in San Mateo Groundwater Basin – Currently, the City of San Clemente pumps between 500 and 1000 AF from this source. Issues with wells and high chloride levels have hampered additional production. A project was considered in the 1990's that would have required a joint venture with the Marine Corps Base Camp Pendleton; the 1990's project anticipated a potential groundwater basin yield of about 2,000 AF ± and also considered storage of imported water for use for emergency purposes in an arrangement with the Marine Base. No current discussions or contacts have been made with the Marine Base involving this expanded opportunity. Environmentalists consider this the last pristine basin in or nearby to OC and want to protect it from outside influences.

Other Water Banking Projects (e.g., Semi-Tropic) - Semi-Tropic Water Storage District has several rate schedules for storing and retrieving water from storage when needed. Their schedules do not include the actual water or the cost of water, which needs to be secured. They have a program with a capital payment and another program without a capital payment. Without any cost of water going into storage, the program cost for storing and retrieving water runs on the order of $600 to $800 per AF; the water must then be wheeled to get it into the Metropolitan service area. Considering the cost of central valley water at $350 per AF, the all in costs of this source for dry year supply from this source would be about $1700 to $1800 per AF for years in which drought protection would be needed.

San Diego County/Camp Pendleton Ocean Desalination - An ocean desalination plant by SDCWA at a southern Camp Pendleton location is still under consideration. Work on various types of intake facilities is still being studied. Work completed in 2009 indicated the cost of water at $1,400 to $1,500 per AF at that time. MWDOC staff estimated an additional cost of about $500 per AF to get the water integrated into South Orange County.

West Orange County Enhanced Pumping Project - A conceptual project by OCWD to enhance groundwater production in the county and reduce the loss of water stored in the OCWD basin into LA County. Conceptually, additional pumping reduces basin losses by up to 40 percent to 50 percent of the additional pumping. The project concept involves four new production wells with total pumping of 10,000 AFY with the water to be conveyed to the West OC Water Board pipelines for the benefit of the groundwater producers. This project is estimated to reduce losses of groundwater flow from OC to LA County by approximately 5,000 AFY.

Capture of Stormflows - A placeholder for all parts of the county to examine the potential opportunity for water to be captured, primarily to increase the capture and replenishment into groundwater basins where possible. In certain situations, the supplies may be able to be introduced into recycled systems to increase irrigation supplies. Stormflows in San Juan Creek, the Santa Ana River and Santiago Creek in Orange County are already mostly captured for groundwater replenishment purposes except for the high storm flows.

Extraordinary Water Supply Project in OC - A conceptual project whereby water from a non-Metropolitan source could be stored in the OCWD groundwater basin and reserved for use during Metropolitan Allocations. If the water is managed in this manner and is accessed during a WSDM Plan allocation event, the water counts directly toward improving the reliability on a 1:1 basis, during the allocation event.

Purchase and Storage of Imported water in the OCWD Basin for Drought Protection and Enhanced Yield - Under this concept the availability of imported water, both treated and untreated, would be evaluated to enhance operations of the groundwater basin to maintain higher levels of storage.

Santa Ana River Conservation and Conjunctive Use Program (SARCCUP) – The SARCCUP program is an overall effort by a number of agencies in the SAR Watershed to coordinate on (1) Habitat Creation & Arundo Removal, (2) Water Use Efficiency efforts involving outreach & technical support for Budget-Based Rates, and (3) development of regional Water Banking opportunities. The groundwater basins involved include the Chino Basin, the Elsinore Basin, the San Bernardino Basin and the San Jacinto Basin as well as the OCWD Basin. The vision is to create 180,000 AF of total storage with 60,000 AFY

Dry-Year Yield Supply (3 years out of 10), of which, each SAR Agency receives water bank capacity of 12,000 AFY Dry-Year Yield. The benefits to Orange County include:

- Dry year water supplies at a cost of approximately $991 per AF
- Use of existing recharge basins and infrastructure in upper watershed without OCWD having to pay for their capital cost
- Storage in water bank upstream of Orange County without having to pay a storage fee
- Purchasing supplies for the water bank through the combined efforts of the five agencies, including Valley District, which is a State Water Project contractor
- Approximately 50 percent of Arundo removal cost funded through the grant, for up to 640 acres of Arundo removal

System Reliability Only Projects (improve emergency response)

System reliability projects do not necessarily produce any new water but help to meet demands during emergency outages due to earthquakes or other risks. Projects that are being discussed at this time include:

Addition of Generators & Back-up Power - This program would involve working with various retail agencies around the county to improve emergency power to local production facilities for emergency events.

Expansion of the Irvine Interconnection Project to SOC - An agreement completed in 2006 resulted in an investment by SOC agencies in the IRWD system to allow exchanges of water to be delivered by IRWD into SOC under emergency situations. Capacity was provided to move up to 30 cubic feet per second (cfs); the agreement allows moving up to 50 cfs, not to exceed 3,000 AF per emergency event. The ability of IRWD was projected to decline over time and go to zero by 2030. IRWD is examining their ability to increase the exchange and conveyance of water under this arrangement or extend to extend the end date of the agreement and the capacity thereunder. Other options could also be implemented if arrangements can be worked out with OCWD and the groundwater producers.

Additional Reservoir Projects in SOC - SMWD led an effort to construct Upper Chiquita Reservoir at a capacity of 750 AF at a cost of $50 million in 2008 to provide emergency storage water in SOC. Other reservoir sites in SOC offer the ability to expand storage by an additional 1,000 to 4,000 AF. Another project that could be considered is to increase the storage capacity at Irvine Lake to allow more storage for emergency purposes.

EOCWD Treatment Plant in Peters Canyon **-** EOCWD has been studying the feasibility of constructing a 9 cfs water treatment plant in Peters Canyon that would treat untreated Metropolitan water via the Santiago Lateral and the Baker Pipeline. Findings to date indicate there is a long term economic benefit to the project compared to purchasing treated water from Metropolitan, but there is also a potential system reliability benefit from the project. This benefit is based on the Treatment Plant being able to continue providing potable water in the event of an outage of the Diemer Plant or other facilities in OC. A 9 cfs supply for 30 to 60 days would be equivalent to having storage in the amount of 500 to 1000 AF; based on the cost of regional storage, it provides a similar benefit equivalent to $40 to $80 million dollars if that same amount of water was held in a lined and covered emergency storage reservoir, similar to Upper Chiquita Reservoir in SOC.

Metropolitan Projects

The following list of Metropolitan Projects is not all inclusive, but provides a flavor of the types of projects within Metropolitan's IRP that will help to improve the reliability of imported supplies to southern California and to Orange County. These include:

Metropolitan Indirect Potable Reuse Project to provide water to OCWD - Metropolitan has begun investigations of a project to treat wastewater from the Carson Plant to better than drinking water standards (similarly to GWRS) and to distribute these flows through a regional distribution system for groundwater replenishment. The initial phase being investigated would provide between 20,000 and 65,000 AF per year, with OC being part of the Phase 1 project for up to 65,000 AF per year.

Metropolitan PVID Land Purchase - Metropolitan recently completed the purchase of Land in PVID that will ultimately result in an augmentation of CRA supplies in years when needed.

USBR Colorado River Basin Plan - The BOR has underway a multi-year Basin Study to examine supplies and demands for Colorado River water. Results of the supply and demand analysis included that long-term historical flow was about 16.4 MAFY, and total consumptive use and losses in the Basin averaged approximately 15.3 MAFY. Consumptive use is projected to increase to a range of 18.1 to 20.4 MAFY by 2060 (depending on the scenario), which would result in a long-term projected imbalance in future supply and demand of about 3.2 MAFY to 2060. The study also included many potential ideas and projects to resolve the supply and demand imbalance, which were organized into four groups: 1) increasing Basin supply; 2) reducing Basin demand; 3) modifying operations; and 4) institutional and governance issues. All parties will need to work together to overcome the supply and demand imbalance to maintain reliability of the Colorado River supply.

Metropolitan Emergency Water Storage South of the Tehachapi's - Metropolitan to review their ability to provide emergency water supplies out of storage in the event of a simultaneous rupture of the CRA and SWP supply systems by the San Andreas Fault. This is an issue MWDOC has asked Metropolitan to examine further.

California WaterFix – This DWR led effort is intended to provide a NEW point of diversion for the export of water from the Sacramento-San Joaquin Bay-Delta area for conveyance to improve the reliability of supplies through the SWP and CVP Projects and for habitat restoration under EcoRestore. The purpose of this project is not to necessarily provide any NEW supplies, but to more reliably convey supplies across the Delta area in a manner beneficial to the fish in the Delta area and to protect water quality from salinity and bromide impacts from intrusion of the Bay water into the Delta waterways. Without this project, the ability to export water will likely rapidly decline. With the project, the ability to export water is intended to be restored to levels circa 2005, at pre-Biops levels.

7.4 Desalination Opportunities

In 2001, Metropolitan developed a Seawater Desalination Program (SDP) to provide incentives for developing new seawater desalination projects in Metropolitan's service area. In 2014, Metropolitan modified the provisions of their LRP to include incentives for locally produced seawater desalination projects that reduce the need for imported supplies. To qualify for the incentive, proposed projects must replace an existing demand or prevent new demand on Metropolitan's imported water supplies. In return, Metropolitan offers three incentive formulas under the program:

- Up to $340 per AF for 25 years, depending on the unit cost of seawater produced compared to the cost of Metropolitan supplies
- Up to $475 per AF for 15 years, depending on the unit cost of seawater produced compared to the cost of Metropolitan supplies
- A fixed contribution per year calculated over 25 years, not based on the sliding scale

Developing local supplies within Metropolitan's service area, including supplies based on ocean desalination, is part of their Integrated Water Resource Plan (IRP) goal of improving water supply reliability in the region. Creating new local supplies reduce pressure on imported supplies from the SWP and Colorado River.

On May 6th, 2015, the SWRCB approved an amendment to the state's Water Quality Control Plan for the Ocean Waters of California (California Ocean Plan) to address effects associated with the construction and operation of seawater desalination facilities (Desalination Amendment). The amendment supports the use of ocean water as a reliable supplement to traditional water supplies while protecting marine life and water quality. The California Ocean Plan now formally acknowledges seawater desalination as a beneficial use of the Pacific Ocean and the Desalination Amendment provides a uniform, consistent process for permitting seawater desalination facilities statewide.

If the following projects are developed, Metropolitan's imported water deliveries to Orange County could be reduced. These projects include the Huntington Beach Seawater Desalination Project, the Doheny Desalination Project, and the Camp Pendleton Seawater Desalination Project.

Brackish groundwater is groundwater with a salinity higher than freshwater, but lower than seawater. Brackish groundwater typically requires treatment using desalters.

7.4.1 Groundwater Desalination

Metropolitan instituted its Groundwater Recovery Program in 1991 to provide financial incentives (up to $250 per AF) to local agencies to develop brackish groundwater impaired from either natural causes or from agricultural drainage. The purpose of the program was to increase usage of groundwater storage within the region for firm local production, conjunctive use storage, and drought supply. In MWDOC's service area, five groundwater recovery brackish water projects have contracts with Metropolitan.

Mesa Water Reliability Facility Expansion - The MWRF, owned and operated by Mesa Water, pumps colored water from a deep colored water aquifer and removes the color microfiltration. Due to increased color and bromide in the source water, Mesa Water upgraded the facility to include Nano filtration membrane treatment. The MWRF's capacity was also increased from 5.8 MGD to 8.6 MGD.

SCWD Capistrano Beach Groundwater Recovery Facility Expansion - SCWD constructed a 1 MGD Groundwater Recovery Facility (GRF) that came online in FY 2007-08 in Dana Point. SCWD plans to expand the GRF with the addition of new wells. Treating in excess of 1,300 AFY will require expansion of the GRF and agreement with SJBA or confirmation of water rights from the SWRCB.

Garden Grove Nitrate Blending Project - The Garden Grove Nitrate Blending Project was active during the years of 1990 to 2005. The project is located at the Lampson Reservoir site, where groundwater pumped from two wells is blended in order to meet the maximum contaminant level for nitrate. The blending project was shut down in 2005, but the City retrofitted Well 28 with a variable frequency drive and reinstated the blending operation.

San Juan Desalter Groundwater Recovery Plant Expansion – The City of San Juan Capistrano has operated the GWRP since about 2005. A number of issues have impacted the reliability of production from the facility including iron bacteria in the wells, the discovery of a plume of Methyl Tert-Butyl Ether (MTBE) that required a reduction in production in half to about 2 MGD or less since the spring of 2008 until the responsible party contributed to provide Granular Activated Carbon Filter (GAC) for removal of the MTBE to allow increased production. The drought then struck, reducing the amount of water that could be pumped from the San Juan groundwater basin, requiring a large reduction in production from the groundwater basin in 2014, 2015 and initially in 2016.

Tustin Nitrate Removal Project - The Tustin Nitrate Removal Project consists of two groundwater treatment facilities that are allowed above the BPP and the charges are BEA-exempt. The first facility is the Main Street Treatment Plant, operating since 1989 to reduce nitrate levels from the groundwater produced by Wells No. 3 and 4 by blending untreated groundwater with treatment plant product water which undergoes reverse osmosis and ion exchange treatment processes. The second facility is the Tustin Seventeenth Street Desalter, operating since 1996 to reduce high nitrate and total dissolved solids concentration from groundwater produced by Wells No. 2 and 4 and the Newport well using reverse osmosis (OCWD, 2015 Groundwater Management Plan, June 2015).

7.4.2 Ocean Water Desalination

Huntington Beach Seawater Desalination Project – Poseidon Resources LLC (Poseidon), a private company, is developing the Huntington Beach Seawater Desalination Project to be co-located at the AES Power Plant in the City of Huntington Beach along Pacific Coast Highway and Newland Street. The proposed project would produce up to 50 MGD (56,000 AFY) of drinking water to provide approximately 10 percent of Orange County's water supply needs.

Over the past several years, Poseidon has been working with OCWD on the general terms and conditions for selling the water to OCWD. OCWD and MWDOC have proposed a few distribution options to agencies in Orange County. The northern option proposes the water be distributed to the northern agencies closer to the plant within OCWD's service area with the possibility of recharging/injecting a portion of the product water into the OC Groundwater Basin. The southern option builds on the northern option by delivering a portion of the product water through the existing OC-44 pipeline for conveyance to the south Orange County water agencies. A third option is also being explored that includes all of the product water to be recharged into the OC Groundwater Basin. Currently, a combination of these options could be pursued.

OCWD's current Long-Term Facilities Plan (LTFP) identifies the Huntington Beach Seawater Desalination project as a priority project and determined the plant capacity of 56,000 AFY as the single largest source of new, local drinking water available to the region. In addition to offsetting imported demand, water from this project could provide OCWD with management flexibility in the OC Groundwater Basin by augmenting supplies into the Talbert Seawater Barrier to prevent seawater intrusion.

In May 2015, OCWD and Poseidon entered into a Term Sheet that provided the overall partner structure in order to advance the project. Based on the initial Term Sheet, Poseidon would be responsible for permitting, financing, design, construction, and operations of the treatment plant while OCWD would purchase the production volume, assuming the product water quality and quantity meet specific contract parameters and criteria. Furthermore, OCWD would then distribute the water in Orange County using one of the proposed distribution options described above.

Currently, the project is in the late-stages of the regulatory permit approval process and Poseidon hopes to obtain the last discretionary permit necessary to construct the plant from the California Coastal Commission (CCC) in 2016. If the CCC permit is obtained, the plant could be operational as early as 2019.

Doheny Desalination Project – In 2013, after five years and $6.2 million to investigate use of a slant well intake for the Doheny Desalination Project, it was concluded the project was feasible and could produce 15 MGD (16,800 AFY) of new potable water supplies to five participating agencies. These agencies consist of: SCWD, City of San Clemente, City of San Juan Capistrano, LBCWD and MNWD.

Only SCWD and LBCWD expressed interest in moving forward after work was completed, with the other agencies electing to monitor the work and consider options to subsequently come back into the project while considering other water supply investments.

More recently, LBCWD has had success in accessing previously held water rights in the OC groundwater basin and has elected to move forward with that project instead of ocean desalination. A final decision was reached to secure the necessary approvals on the groundwater agreement.

SCWD has taken the lead on the desalination project and has hired a consulting team to proceed with project development for the Doheny Desalination Project. Major items scheduled over the next year include:

- Preliminary Design Report and Cost Estimate
- Brine Outfall Analysis
- Environmental Impact Report (EIR) Process
- Environmental Permitting Approvals
- Public Outreach
- Project Funding
- Project Delivery Method
- Economic Analysis

The schedule for this project includes start-up and operation of up to a 5 MGD (5,600 AFY) facility by the end of 2019. SCWD anticipates leaving the option open for other agencies to participate in a larger, 15 MGD facility, with subsequent permitting and construction of additional slant wells and treatment capacity.

Camp Pendleton Seawater Desalination Project – SDCWA is studying a desalination project to be located at the southwest corner of Camp Pendleton Marine Corps Base adjacent to the Santa Margarita River. The initial project would be a 50 (56,000 AFY) or 100 (112,100) MGD plant with expansions in 50 MGD increments to a maximum capacity of 150 MGD (168,100 AFY), making this the largest proposed desalination plant in the U.S.

The project is currently in the feasibility study stage and SDCWA is conducting geological surveys, analyzing intake options, and studying the effect on ocean life and routes to bring desalinated water to SDCWA's delivery system. MWDOC and south Orange County agencies are maintaining an interest in the project.

8 UWMP ADOPTION PROCESS

8.1 Overview

Recognizing that close coordination among other relevant public agencies is key to the success of its UWMP, MWDOC worked closely with many other entities, including representation from diverse social, cultural, and economic elements of the population within MWDOC's service area, to develop and update this planning document. MWDOC also encouraged public involvement by holding a public hearing for residents to learn and ask questions about their water supply.

This section provides the information required in Article 3 of the Water Code related to adoption and implementation of the UWMP. Table 8-1 summarizes external coordination and outreach activities carried out by MWDOC and their corresponding dates. The UWMP checklist to confirm compliance with the Water Code is provided in Appendix A.

Table 8-1: External Coordination and Outreach

External Coordination and Outreach	Date	Reference
Encouraged public involvement (Public Hearing Notice)	5/2/16 & 5/9/16	Appendix E
Notified city or county within supplier's service area that water supplier is preparing an updated UWMP (at least 60 days prior to public hearing)	3/1/16	Appendix E
Held public hearing	5/18/16	Appendix E
Adopted UWMP	5/18/16	Appendix F
Submitted UWMP to DWR	7/1/16	-
Submitted UWMP to the California State Library and cities and county within the supplier's service area	7/1/16	-
Made UWMP available for public review (no later than 30 days after filing with DWR)	8/1/16	-

This UWMP was adopted by the Board of Directors on May 18, 2016. A copy of the adopted resolution is provided in Appendix F.

The 2009 legislative session requires agencies preparing UWMPs to notify any city or county within its service area at least 60 days prior to the public hearing. As shown in Table 8-2, MWDOC sent a Letter of Notification to the County of Orange and all cities within its service area on March 1, 2016 to state that it was in the process of preparing an updated UWMP (Appendix E).

Table 8-2: Notifications to Cities and Counties

Wholesale: Notification to Cities and Counties	
☑	Supplier has notified more than 10 cities or counties in accordance with CWC 10621 (b) and 10642. **Completion of the table below is not required. Provide a separate list of the cities and counties that were notified.**
Appendix E	Provide the page or location of this list in the UWMP.
☐	Supplier has notified 10 or fewer cities or counties. **Complete the table below.**

8.2 Public Participation

MWDOC encouraged community and public interest involvement in the plan update through a public hearing and inspection of the draft document on May 18, 2016. In addition, MWDOC placed a draft copy of the public on its website on April 4, 2016. The hearing was conducted during a regularly scheduled meeting of the MWDOC Board of Directors at MWDOC's offices in Fountain Valley. Public hearing notifications were sent to retail agencies and other interested parties. Individual letters were also sent to potential stakeholders about the development of this UWMP and public review hearing. A copy of the Notice of Public Hearing is included in Appendix E. The hearing provided an opportunity for all residents and employees in the service area to learn and ask questions about their water supply. Copies of the draft plan were made available for public inspection at MWDOC's office and on the District website.

A staff report and presentation reviewed the process, key components of the Plan and the conclusions that served as the basis of the Plan. The President of the Board of Directors then opened the Public Hearing where all comments were recorded.

8.3 Agency Coordination

The MWDOC's water supply planning relates to the policies, rules, and regulations of its regional and local water providers. The MWDOC is dependent on imported water from Metropolitan. As such, MWDOC involved Metropolitan and other relevant agencies in this 2015 UWMP at various levels of contribution as summarized in Table 8-3.

Table 8-3: Coordination with Appropriate Agencies

	Participated in Plan Development	Commented on Draft	Attended Public Meetings	Contacted for Assistance	Sent Copy of Draft Plan	Sent Notice of Public Hearing	Not Involved / No Information
MWDOC 28 Retail Agencies	√	√	√	√	√	√	√
Cities within MWDOC service area	-	-	-	-	√	√	√
County of Orange	-	-	-	-	√	√	√
Orange County Water District	√	-	-	√	√	√	√
San Juan Basin Authority	√	-	-	√	√	-	-
Metropolitan Water District of Southern California	√	-	-	√	√	√	√
Orange County Sanitation District	√	-	-	√	√	-	-
South Orange County Wastewater Authority	√	-	-	√	√	-	-
Public Library	-	-	-	-	-	√	-
General Public	-	-	-	-	-	√	-

MWDOC Retail Agencies - MWDOC worked cooperatively with its 28 retail agencies on descriptions of any planned development of local supplies. Methodologies and assumptions underlying these projections vary from agency to agency, but all projections reflect an in-depth knowledge of the individual agencies' service areas.

Cities and County - As described earlier, General Plans are source documents for water suppliers as they assess their own water resource needs. When completed, an UWMP also serves as a source document for cities and counties as they prepare their General Plans. General Plans and UWMPs may be linked, as their accuracy and usefulness are interdependent.

Groundwater Management Agencies - MWDOC also worked with the following five agencies to obtain information for the five groundwater basin resources in its service area: OCWD for Lower Santa Ana River Basin, SJBA for San Juan Basin, City of La Habra for La Habra Basin, City of San Clemente for San Mateo Basin, and LBCWD for Laguna Canyon Basin. Details of the basin information are described in Section 3.3.

Metropolitan - As a member agency of Metropolitan, MWDOC participated in workshops hosted by Metropolitan to facilitate the information exchange for the development of this Plan.

Wastewater Management Agencies - To meet the requirements of the Act in the preparation of this Plan, MWDOC contacted individual wastewater collection and treatment providers and other water agencies within its service area for data on recycled water and associated projects in the region. The information MWDOC obtained was then combined with a review of several completed Orange County studies. The information MWDOC obtained from wastewater collection and treatment providers allows the Plan to describe wastewater discharge methods, treatment levels, discharge volumes, and recycled use in the region.

8.4 UWMP Submittal

8.4.1 Review of 2010 UWMP Implementation

As required by California Water Code, the MWDOC summarized Water Conservation Programs implemented to date, and compares the implementation to those as planned in its 2010 UWMP.

Comparison of 2010 Planned Water Conservation Programs with 2015 Actual Programs

As a wholesaler, MWDOC did not include a specific implementation plan in its 2010 UWMP. As a signatory to the MOU regarding urban water use efficiency, MWDOC is committed to implementing BMP-based water use efficiency programs. For MWDOC's specific achievements in the area of conservation, please see Section 4 of this Plan.

8.4.2 Adoption and Filing of 2015 UWMP

Members of the Board of Directors reviewed the Final Draft Plan in May 2016 at the Planning and Operations Committee meeting. The Committee recommended that the Board of Directors approve the 2015 UWMP at its May 18, 2016 meeting. The seven-member MWDOC Board of Directors approved the 2015 UWMP at its May 18, 2016 meeting. See Appendix F for the resolution approving the Plan.

By July 1, 2016, the Adopted 2015 MWDOC UWMP was filed with DWR, California State Library, County of Orange, and cities within MWDOC's service area. MWDOC will make the plan available for public review no later than 30 days after filing with DWR

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APPENDIX A

UWMP Checklist

UWMP Checklist

This checklist is developed directly from the Urban Water Management Planning Act and SB X7-7. It is provided to support water suppliers during preparation of their UWMPs. Two versions of the UWMP Checklist are provided – the first one is organized according to the California Water Code and the second checklist according to subject matter. The two checklists contain duplicate information and the water supplier should use whichever checklist is more convenient. In the event that information or recommendations in these tables are inconsistent with, conflict with, or omit the requirements of the Act or applicable laws, the Act or other laws shall prevail.

Each water supplier submitting an UWMP can also provide DWR with the UWMP location of the required element by completing the last column of eitherchecklist. This will support DWR in its review of these UWMPs. The completed form can be included with the UWMP.

If an item does not pertain to a water supplier, then state the UWMP requirement and note that it does not apply to the agency. For example, if a water supplier does not use groundwater as a water supply source, then there should be a statement in the UWMP that groundwater is not a water supply source.

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 1.1**
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 8.3**
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 8.2 and Appendix E**
10631(a)	Describe the water supplier service area.	System Description	Section 3.1	**Section 1.3**
10631(a)	Describe the climate of the service area of the supplier.	System Description	Section 3.3	**Section 2.2.1**
10631(a)	Provide population projections for 2020, 2025, 2030, and 2035.	System Description	Section 3.4	**Section 2.2.2**
10631(a)	Describe other demographic factors affecting the supplier's water management planning.	System Description	Section 3.4	**Section 2.2.2**
10631(a)	Indicate the current population of the service area.	System Description and Baselines and Targets	Sections 3.4 and 5.4	**Section 2.2.2**
10631(e)(1)	Quantify past, current, and projected water use, identifying the uses among water use sectors.	System Water Use	Section 4.2	**Section 2.3 and 2.4.2**
10631(e)(3)(A)	Report the distribution system water loss for the most recent 12-month period available.	System Water Use	Section 4.3	**N/A**
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	**N/A**
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	**N/A**
10608.20(e)	Retail suppliers shall provide baseline daily per capita water use, urban water use target, interim urban water use target, and compliance daily per capita water use, along	Baselines and Targets	Chapter 5 and App E	**N/A**

	with the bases for determining those estimates, including references to supporting data.			
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	**N/A**
10608.24(a)	Retail suppliers shall meet their interim target by December 31, 2015.	Baselines and Targets	Section 5.8 and App E	**N/A**
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**
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	**Section 2.5**
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	**N/A**
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 2.4.2 and 3.1**
10631(b)	Indicate whether groundwater is an existing or planned source of water available to the supplier.	System Supplies	Section 6.2	**Section 3.3**
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 3.3**
10631(b)(2)	Describe the groundwater basin.	System Supplies	Section 6.2.1	**Section 3.3**
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 3.3**
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 3.3**
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 3.3.10**

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	**Section 3.3**
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 7.2**
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 7**
10631(h)	Describe desalinated water project opportunities for long-term supply.	System Supplies	Section 6.6	**Section 7.4**
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	**N/A**
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	**Section 8**
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 6.1**
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 6.2**
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 6.2**
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 6.3**
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 6.4**
10633(e)	Describe the projected use of recycled water within the supplier's service area at the end of 5, 10, 15, and 20 years, and a description of the actual use of recycled water in comparison to uses previously projected.	System Supplies (Recycled Water)	Section 6.5.4	**Section 6.3 and 6.4**
10633(f)	Describe the actions which may be taken to	System Supplies	Section 6.5.5	**Section 6.4**

	encourage the use of recycled water and the projected results of these actions in terms of acre-feet of recycled water used per year.	(Recycled Water)		
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**
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 7.1**
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 3.7**
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 3.7.5**
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	**Section 3.3, 3.7, 4**
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 3.7.2.3**
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 3.7.5**
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 5.2**
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 5.3**
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 5.4**
10632(a)(4)	Identify mandatory prohibitions against specific water use practices during water shortages.	Water Shortage Contingency Planning	Section 8.2	**Section 5.5**
10632(a)(5)	Specify consumption reduction methods in the most restrictive stages.	Water Shortage Contingency Planning	Section 8.4	**Section 5.5**
10632(a)(6)	Indicated penalties or charges for excessive use, where applicable.	Water Shortage Contingency Planning	Section 8.3	**Section 5.5**

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 5.6**
10632(a)(8)	Provide a draft water shortage contingency resolution or ordinance.	Water Shortage Contingency Planning	Section 8.7	**Appendix D**
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 5.7**
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	**N/A**
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	**Section 4**
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 C**
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 8.2**
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	**Appendix E**
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 8.4.2**
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 8.4.2**
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	Plan Adoption, Submittal, and Implementation	Sections 10.2.2, 10.3, and 10.5	**Section 8.2**

	about the plan.			
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	**Appendix E**
10642	Provide supporting documentation that the plan has been adopted as prepared or modified.	Plan Adoption, Submittal, and Implementation	Section 10.3.1	**Appendix F**
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 8.4.2**
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 8.3**
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 8.4.2**
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 8**

APPENDIX B

Standardized Tables

Table 2-2: Plan Identification			
Select Only One	**Type of Plan**		**Name of RUWMP or Regional Alliance** *if applicable* *drop down list*
☑	**Individual UWMP**		
	☐	Water Supplier is also a member of a RUWMP	
	☑		Orange County 20x2020 Regional Alliance
☐	**Regional Urban Water Management Plan (RUWMP)**		
NOTES:			

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
If Using Fiscal Years Provide Month and Date that the Fiscal Year Begins (mm/dd)	
7/1	
Units of Measure Used in UWMP (select from Drop down)	
Unit	AF
NOTES:	

Table 2-4 Wholesale: Water Supplier Information Exchange (select one)	
☑	Supplier has informed more than 10 other water suppliers of water supplies available in accordance with CWC 10631. Completion of the table below is optional. If not completed include a list of the water suppliers that were informed.
Appendix E	**Provide page number for location of the list.**
☐	Supplier has informed 10 or fewer other water suppliers of water supplies available in accordance with CWC 10631. **Complete the table below.**

Table 3-1 Wholesale: Population - Current and Projected						
Population Served	2015	2020	2025	2030	2035	2040
	2,302,578	2,409,256	2,470,451	2,505,284	2,527,230	2,533,088
NOTES: Center for Demographic Research at California State University, Fullerton						

Table 4-1 Wholesale: Demands for Potable and Raw Water - Actual

Use Type *(Add additional rows as needed)*	2015 Actual	
Use Drop down list *May select each use multiple times* *These are the only use types that will be recognized by the WUE data online submittal tool*	Level of Treatment When Delivered *Drop down list*	Volume
Sales to other agencies	Drinking Water	158,664
Groundwater recharge	Drinking Water	66,844
	TOTAL	225,508
NOTES:		

Table 4-2 Wholesale: Demands for Potable and Raw Water - Projected					
Use Type *(Add additional rows as needed)*	Projected Water Use *Report To the Extent that Records are Available*				
Drop down list *May select each use multiple times* *These are the only Use Types that will be recognized by the WUEdata online submittal tool.*	2020	2025	2030	2035	2040
Sales to other agencies	132,826	144,254	140,203	135,913	135,135
Groundwater recharge	72,306	72,306	72,306	72,306	72,306
TOTAL	205,132	216,560	212,509	208,219	207,441
NOTES:					

Table 4-3 Wholesale: Total Water Demands						
	2015	2020	2025	2030	2035	2040
Potable and Raw Water *From Tables 4-1 and 4-2*	225,508	205,132	216,560	212,509	208,219	207,441
Recycled Water Demand *From Table 6-4*	0	0	0	0	0	0
TOTAL WATER DEMAND	225,508	205,132	216,560	212,509	208,219	207,441
NOTES:						

Table 5-1 Baselines and Targets Summary *Retail Agency or Regional Alliance Only*					
Baseline Period	Start Year	End Year	Average Baseline GPCD*	2015 Interim Target *	Confirmed 2020 Target*
10-15 year	*1996*	*2005*	*190*	*176*	*158*
5 Year	*2004*	*2008*	*185*		
*All values are in Gallons per Capita per Day (GPCD)					
NOTES:					

Table 5-2: 2015 Compliance *Retail Agency or Regional Alliance Only**		
Actual 2015 GPCD	2015 Interim Target GPCD	Did Supplier Achieve Targeted Reduction for 2015? Y/N
125	176	Yes
**All values are in Gallons per Capita per*		
NOTES:		

Table 6-1 Wholesale: Groundwater Volume Pumped	
☑	Supplier does not pump groundwater. The supplier will not complete the table below.

Table 6-3 Wholesale: Wastewater Treatment and Discharge Within Service Area in 2015	
☑	Wholesale supplier does not provide supplemental treatment to recycled water it distributes. The supplier will not complete the table below.

Table 6-4 Wholesale: Current and Projected Retailers Provided Recycled Water Within Service Area	
☑	Recycled water is not directly treated or distributed by the supplier. The supplier will not complete the table below.

Table 6-5 Wholesale: 2010 UWMP Recycled Water Use Projection Compared to 2015 Actual	
☑	Recycled water was not used or distributed by the supplier in 2010, nor projected for use or distribution in 2015. The wholesale supplier will not complete the table below.

Table 6-7 Wholesale: Expected Future Water Supply Projects or Programs	
☑	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.

Table 6-8 Wholesale: Water Supplies — Actual			
Water Supply	Additional Detail on Water Supply	2015	
Drop down list *May use each category multiple times.These are the only water supply categories that will be recognized by the WUEdata online submittal tool*		Actual Volume	Water Quality *Drop Down List*
Purchased or Imported Water	Purchased from Metropolitan	158,664	Drinking Water
Purchased or Imported Water	GW Recharge	58,617	Raw Water
Purchased or Imported Water	Surface Storage	8,227	Raw Water
	Total	225,508	
NOTES:			

Table 6-9 Wholesale: Water Supplies — Projected						
Water Supply	Additional Detail on Water Supply	**Projected Water Supply** *Report To the Extent Practicable*				
		2020	**2025**	**2030**	**2035**	**2040**
		Reasonably Available Volume	Reasonably Available Volume	Reasonably Available Volume	Reasonably Available Volume	Reasonably Available Volume
Purchased or Imported Water	Purchased from Metropolitan	132,826	144,254	140,203	135,913	135,135
Purchased or Imported Water	GW Recharge	65,000	65,000	65,000	65,000	65,000
Purchased or Imported Water	Surface Storage	7,306	7,306	7,306	7,306	7,306
	Total	205,132	216,560	212,509	208,219	207,441
NOTES:						

Table 7-1 Wholesale: Basis of Water Year Data			
Year Type	**Base Year** *If not using a calendar year, type in the last year of the fiscal, water year, or range of years, for example, water year 1999-2000, use 2000*	**Available Supplies if Year Type Repeats**	
		☐ Quantification of available supplies is not compatible with this table and is provided elsewhere in the UWMP. Location ___________________________	
		☑ Quantification of available supplies is provided in this table as either volume only, percent only, or both.	
		Volume Available	**% of Average Supply**
Average Year	1990-2014		100%
Single-Dry Year	2014		106%
Multiple-Dry Years 1st Year	2012		106%
Multiple-Dry Years 2nd Year	2013		106%
Multiple-Dry Years 3rd Year	2014		106%

NOTES: 1) Assumes M&I demand levels in 2015 of 159,000, Irvine Lake replenishment of 7,000 AF, and groundwater replenishment demands of 65,000 AFY. 2) Assumes increase of demands in dry and multiple dry years of +6% based on OC Reliability Study.

Table 7-2 Wholesale: Normal Year Supply and Demand Comparison					
	2020	2025	2030	2035	2040
Supply totals *(autofill from Table 6-9)*	205,132	216,560	212,509	208,219	207,441
Demand totals *(autofill fm Table 4-3)*	205,132	216,560	212,509	208,219	207,441
Difference	0	0	0	0	0
NOTES: Includes MWDOC Service Area Projected M&I and Surface & GW replenishment demands. Source: OC Reliability Study					

Table 7-3 Wholesale: Single Dry Year Supply and Demand Comparison					
	2020	2025	2030	2035	2040
Supply totals	213,101	225,215	220,921	216,374	215,549
Demand totals	213,101	225,215	220,921	216,374	215,549
Difference	0	0	0	0	0
NOTES: OC Reliability Study					

Table 7-4 Wholesale: Multiple Dry Years Supply and Demand Comparison						
		2020	2025	2030	2035	2040
First year	Supply totals	213,101	225,215	220,921	216,374	215,549
	Demand totals	213,101	225,215	220,921	216,374	215,549
	Difference	0	0	0	0	0
Second year	Supply totals		225,215	220,921	216,374	215,549
	Demand totals	0	225,215	220,921	216,374	215,549
	Difference	0	0	0	0	0
Third year	Supply totals	0	225,215	220,921	216,374	215,549
	Demand totals	0	225,215	220,921	216,374	215,549
	Difference	0	0	0	0	0
NOTES: OC Reliability Study						

Table 8-1 Wholesale Stages of Water Shortage Contingency Plan		
Stage	Complete Both	
	Supply Reduction[1]	Water Supply Condition (*Narrative description)*
Baseline Water Use Efficiency	Long-term Conservation	Ongoing water use efficiency, outreach and public awareness efforts to continue water use saving and build storage reserves
Condition 1: Water Supply Watch	1990-2014	
Condition 2: Water Supply Alert	Variable	Regional call for cities and water agencies in the service area to implement extraordinary conservation measures through their drought ordinance and other water use efficiency efforts
Condition 3: Water Supply Allocation	5% to 50%	Implement MWDOC's Water Supply Allocation Plan
[1] *One stage in the Water Shortage Contingency Plan must address a water shortage of 50%.*		
NOTES: See discussion on Metropolitan's and MWDOC water shortage actions, such as		

Table 8-4 Wholesale: Minimum Supply Next Three Years			
	2016	2017	2018
Available Water Supply	224,579	224,579	224,579
NOTES: MWDOC Water Shortage Allocation Model March 2015			

Table 10-1 Wholesale: Notification to Cities and Counties (select one)	
☑	Supplier has notified more than 10 cities or counties in accordance with CWC 10621 (b) and 10642. **Completion of the table below is not required. Provide a separate list of the cities and counties that were notified.**
Section 8	Provide the page or location of this list in the UWMP.

APPENDIX C

2012 BMP Report

CUWCC BMP Wholesale Coverage Report **2012**

Foundational Best Manegemant Practices for Urban Water Efficiency

Foundational BMPs

BMP 1.1.3 Wholesale Agency Assistance Programs

168 Municipal Water District of Orange County

Name: Joe Berg

Email: jberg@mwdoc.com

a) Financial Investments and Building Partnerships

BMP Section	Monetary Amount for Financial Incentives	Monetary Amount for Equivalent Resources	
BMP 1.1 Operation Practices	7948.84	0	
BMP 1.2 Wate Loss Control	7948.84	0	
BMP 1.3 Metering with Commodity	3974.42	10000	
BMP 1.4 Retail Conservation Pricing	11923.26	131705	
BMP 2.1 Public Outreach	71539.56	0	
BMP 2.2 School Education Program	23846.52	0	
BMP 3 Residential	60554.71	0	
BMP 4 CII	102477.97	235862	
BMP 5 Landscape	222300.89	799939	

On Track

b) Technical Support

Not On Track

c) Retail Agency

Retail Agency Name	Program Description
	See uploaded document titled BMP 1-Operations Practices FY11-12-Wholesale for Program Management efforts.

Not On Track

d) Water Shortage Allocation

Adoption Date:

File Name: See uploaded document titled BMP 1-Operations Practices FY11-12-Wholesale for Water Shortage Allocation efforts.

On Track

e) Non signatory Reporting of BMP implementation by non-signatory Agencies

See uploaded document for this BMP

f) Encourage CUWCC Membership List Efforts to Recuit Retailers

CUWCC BMP Wholesale Coverage Report **2012**

Foundational Best Manegemant Practices for Urban Water Efficiency

Foundational BMPs

BMP 1.1.3 Wholesale Agency Assistance Programs

Not On Track

CUWCC BMP Coverage Report 2012

Foundational Best Management Practices for Urban Water Efficiency

Foundational BMPs

BMP 1.2 Water Loss Control

168 Municipal Water District of Orange County No No Not On Track 88

Complete Standard Water Audit using AWWA software? Com

AWWA file provided to CUWCC? AW

Municipal Water District of Orange County BMP1.2 FY12 City

AWWA Water Audit Validity Score? AW

Complete Training in AWWA Audit Method? Com

Complete Training in Component Analysis Process? Com

CompComponent Analisys? Not On Track Com

Repaired all leaks and breaks to the extent cost effective? No Not On Track Rep cost

Locate and repar unreported leaks to the extent cost effective? Loca cost

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. Not On Track Main leak pipe repa

Provided 7 types of Water Loss Control Info Prov

Leaks Repars	Value Real Losses	Value Apparent Losses	Miles Surveyed	Press Reduction	Cost of Interventions	Water Saved (AF)	Lea Rep
136482	211390544.615	167427428.556	50835.092		177774288.642	228827.386	

Not On Track

At Least As Effective As At L

In lieu of an active leak detection program, the City has opted to replace 1% of distribution system lines each year. Lines are replaced based on age and other asset management factors. Attached documentation shows the reduction in main breaks due to Municipal Water District of Orange County 168 BMP 1.2 Results from Main Replacement Program In lie Line redu

We encourage them every year to join. Not On Track We

CUWCC BMP Coverage Report 2011

Foundational Best Manegemant Practices for Urban Water Efficiency

Foundational BMPs

BMP 1.2 Water Loss Control

88 City of Santa Barbara, PWD 88

Complete Standard Water Audit using AWWA software? Com

BMP 1.3 Metering With Commodity

2012

Agency name: Municipal Water District of Orange County

Reporting unit name (District name): Municipal Water District of Orange County

Reporting unit number: 168

Implementation

Does your agency have any unmetered service connections? No

If YES, has your agency completed a meter retrofit plan? No

Enter the number of previously unmetered accounts fitted with meters during reporting year:

Are all new service connections being metered? Yes

Are all new service connections being billed volumetrically? Yes

Has your agency completed and submitted electronically to the Council a written plan, policy or program to test, repair and replace meters? No

Meters Matrix

Error: Subreport could not be shown.

Number of CII Accounts with Mixed-use Meters: 0

Number of CII Accounts with Mixed-use Meters Retrofitted with Dedicated Irrigation Meters during Reporting Period: 0

Feasibility Study

Has your agency conducted a feasibility study to assess the merits of a program to provide incentives to switch mixed-use accounts to dedicated landscape meters? No

If YES, please fill in the following information:

A. When was the Feasibility Study conducted: 1/1/0001 12:00:00 AM

B. Describe, upload or provide an electronic link to the Feasibility Study Upload File:

Comments:

As a wholesale MWD member agency, MWDOC does not own/operate a distribution system including water meters. Water is served directly from MWD's distribution system to the MWDOC member agency distribution systems. MWD owns, calibrates & repairs meters.

CUWCC BMP Coverage Report 2012

Foundational Best Manegemant Practices for Urban Water Efficiency

Foundational BMPs

BMP 2.1 Public Outreach

168 Municipal Water District of Orange County Wholesale Only

Does Agency help any retail Agency implement Public Outreach Programs? Yes

List of retail Agencies

Public Outreach Program List	Number
General water conservation information	25000
Flyers and/or brochures (total copies), bill stuffers, messages printed on bill, information packets	631700
Website	38000
Newsletter articles on conservation	72800
Email Messages	555
Total	**768055**

On Track

Number Media Contacts	Number
Articles or stories resulting from outreach	12
Editorial board visits	1
News releases	10
Newspaper contacts	24
Radio contacts	2
Television contacts	5
Total	**54**

On Track

An actively maintained website that is updated regularly (minimum = 4 times per year, i.e., at least quarterly) Yes

Annual Budget Category	Annual Budget Amount
Total Public Information Budget	254909
Water Use Efficiency Marketing Budget	40000
Total Amount:	**294909**

On Track

Description of all other Public Outreach programs

Rebate and incentive information; California Friendly landscape training class info; water use efficiency reports and studies; surface soil textures map; water use efficiency tips; home water use calculator; native plant resources; irrigation info.

On Track

CUWCC BMP Coverage Report 2012

Foundational Best Manegemant Practices for Urban Water Efficiency

Foundational BMPs

BMP 2.1 Public Outreach

At Least As Effective As **No**

BMP 2.1 Public Outreach

2012

Agency name: Municipal Water District of Orange County

Reporting unit # 168

Reporting unit name (District name) Municipal Water District of Orange County / Wholesale Only

Does Agency help any retail Agency implement Public Outreach Programs? Yes

List of retail Agencies

Please provide the name of Agency if not CUWCC Group1 members

Is your agency performing public outreach?

Report a minimum of 4 water conservation related contacts your agency had with the public during the year.

Did at least one contact take place duringeach quarter of the reporting year? No

Public Information Programs List

Number of Public Contacts	Public Information Programs Name	
25000	General water conservation information	
631700	Flyers and/or brochures (total copies), bill stuffers, messages printed on bill, information packets	
38000	Website	
72800	Newsletter articles on conservation	
555	Email Messages	

Contact with the Media

Does Agency help any retail Agency implement Public Outreach Programs? Yes

List of retail Agencies

Please provide the name of Agency if not CUWCC Group1 members

OR Retail Agency (Contacts with the Media)

Did at least one contact take place during each quarter of the reporting year? Yes

Media Contacts List

Number of Media Contacts	Public Outreach Media Contact Name List	
12	Articles or stories resulting from outreach	
1	Editorial board visits	
10	News releases	
24	Newspaper contacts	

BMP 2.1 Public Outreach

2012

2	Radio contacts	
5	Television contacts	

Does Agency help any retail Agency implement Public Outreach Programs? No

List of retail Agencies

Please provide the name of Agency if not CUWCC Group1 members

Is Your Agency Performing Website Updates?

Enter your agency's URL (website address): www.mwdoc.com

Describe a minimum of four water conservationrelated updates to your agency's website thattook place during the year: Rebate and incentive information; California Friendly landscape training class info; water use efficiency reports and studies; surface soil textures map; water use efficiency tips; home water use calculator; native plant resources; irrigation info.

Did at least one Website Update take place duringeach quarter of the reporting year? Yes

Public Outreach Annual Budget

Enter budget for public outreach programs. You may enter total budget in a single line or brake the budget into discretecategories by entering many rows. Please indicate if personnel costs are included in the entry.

Annual Budget Category	Annual Budget Amount	Personal Cost Included?	Comments	
Total Public Information Budget	254909	V		
Water Use Efficiency Marketing Budget	40000			

Public Outreach Expenses

Enter expenses for public outreach programs. Please include the same kind of expenses you included in the question relatedto your budget (Section 2.1.7, above). For example, if you included personnel costs in the budget entered above, be sure to include them here as well.

Public Outreach Expense Category	Expense Amount	Personal Cost Included?	
Professional service fees	45000		
Postage fees	1000		
Reproduction expenses	19000		

BMP 2.1 Public Outreach

2012

Miscellaneous expenses	33500		
Salaries wages and benefits	156409	V	
Water use efficiency marketing activities	40000		

Additional Public Information Program

Please report additional public information contacts. List these additional contacts in order of howyour agency views their importance / effectiveness with respect to conserving water, with the mostimportant/ effective listed first
(where 1 = most important).

Were there additional Public Outreach efforts? Yes

Public Outreach Additional Information

Social Marketing Programs

Branding

Does your agency have a water conservation"brand," "theme" or mascot? Yes

Describe the brand, theme or mascot. Our mascot is an animated, life-size water drop character named Ricki the Rambunctious Raindrop. He educates children of all ages about water and how to use it wisely.

Market Research

Have you sponsored or participated inmarket research to refine your message? No

Market Research Topic

Brand Message

Brand Mission Statement

Community Committees

Do you have a community conservationcommittee? No

Enter the names of the community committees:

Training

Social Marketing Expenditures

Public Outreach Social Marketing Expenses

Partnering Programs - Partners

Name	Type of Program
☐ CLCA?	
☐ Green Building Programs?	

BMP 2.1 Public Outreach

2012

[ ]	Master Gardeners?	
[ ]	Cooperative Extension?	
[ ]	Local Colleges?	
V	Other	Orange County Garden Friendly Program

[ ] Retail and wholesale outlet; name(s) and type(s) of programs:

Partnering Programs - Newsletters

Number of newsletters per year: 5

Number of customers per year: 25000

Partnering with Other Utilities

Describe other utilities your agency partners with, including electrical utilities: County of Orange- OC Stormwater Program; UC Cooperative Extension

Conservation Gardens

Describe water conservation gardens at your agency or other high traffic areas or new homes:

Landscape contests or awards

Describe water wise landscape contest or awards program conducted by your agency:

Additional Programs supported by Agency but not mentioned above:

Comments

CUWCC BMP Coverage Report 2012

Foundational Best Manegemant Practices for Urban Water Efficiency

Foundational BMPs

BMP 2.2 School Education Programs

168 Municipal Water District of Orange County | Wholesale Only

Does Agency help any retail Agency implement School Education Programs? Yes

List of retail Agencies

City of Anaheim, PUD

Materials meet state education framework requirements and are grade-level appropriate? Yes

Curriculum materials developed and/or provided by Agency:

All lessons are aligned with the California Science Content Standards to achieve the state education framework requirements.

Materials Distributed to K-6? Yes

Describe K-6 Materials

Grade-specific education booklets featuring mascot Ricki the Rambunctious Raindrop. Booklets contain lessons and hands-on activities that are designed to reinforce and augment the concepts taught in the large group assemblies (described below).

Materials distributed to 7-12 students? No (Info Only)

Annual budget for school education program: 201631.00

Description of all other water supplier education programs

All lessons are aligned with the California Science Content Standards to achieve the state education framework requirements. Grade-specific education booklets featuring mascot Ricki the Rambunctious Raindrop. Booklets contain lessons and hands-on activities that are designed to reinforce and augment the concepts taught in the large group assemblies (described below). OC Water Hero Program (described below) The O.C. Water Hero Program enables students to become official water heroes by pledging to save 20 gallons of water per day. Participants receive an OC Water Hero kit with fun water-saving items, like a 5-minute shower timer, "fix-it" tickets, etc. Annual Poster & Slogan Contest wherein K-6 grade students submit original, hand-drawn posters and short slogans that reflect water conservation messages. 30 winning students are selected and invited to a special awards ceremony with Ricki Raindrop.

On Track

At Least As Effective As **No**

WMP 2.2 School Education Programs
2012

School Education Programs

168 Municipal Water District of Orange County

Wholesale Only

Does Agency help any retail Agency implement School Education Programs? Yes

List of retail Agencies

Please provide the name of Agency if not FORTECH Group1 members

City of Anaheim, PUD

V	Materials meet state education framework requirements?	Description	All lessons are aligned with the California Science Content Standards to achieve the state education framework requirements.
V	Materials distributed to K-6 Students?	Description	Grade-specific education booklets featuring mascot Ricki the Rambunctious Raindrop. Booklets contain lessons and hands-on activities that are designed to reinforce and augment the concepts taught in the large group assemblies (described below).

Number of students reached: 78525

	Materials distributed to 7-12 Students? (optional)	Description	

Annual budget for school education program: 201631.00

Description of all other water supplier educationprograms: OC Water Hero Program (described below)

School Programs Activities

Classroom Presentation:

Number of presentation: 0 | Number of attendees: 0

Describe the topics covered in your classroom presentations: n/a

Large group assemblies:

Number of presentation: 1033 | Number of attendees: 78525

Children's water festivals or other events:

Number of presentation: 14 | Number of attendees: 500

Cooperative efforts with existing science/water education programs (various workshops, science fair awardsor judging) and follow-up:

Number of presentation: | Number of attendees:

Other methods of disseminating information (i.e. themed age-appropriate classroom loaner kits):

Description: | Number distributed:

Staffing children's booths at events & festivals:

Number of booths: 28 | Number of attendees: 5500

Water conservation contests such as poster and photo:

Description: | Number of participants:

Offer monetary awards/funding or scholarships to students:

WMP 2.2 School Education Programs

2012

Number offered	0	Total funding	0.00

Teacher training workshops:

Number of presentation	1	Number of attendees	32

Fund and/or staff student field trips to treatment facilities, recycling facilities, water conservation gardens,etc.:

Number of tours or fieldtrips	0	Number of participants	0

College internships in water conservation offered:

Number of internship	2	Total funding	24000.0

Career Fairs / Workshops:

Number of presentation	0	Number of attendees	0

Additional program(s) supported by agency but not mentioned above:

Description	Number of events	Number of participants

Comments

APPENDIX D

MWDOC Water Supply Allocation Plan

Municipal Water District of Orange County

Water Supply Allocation Plan

DRAFT
Revised 2016

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Section 1: Introduction

The Municipal Water District of Orange County (MWDOC) is dedicated to ensuring water reliability for the communities we serve. Hundreds of thousands of Orange County residents have taken advantage of our water conservation rebates to install water saving toilets, clothes washers, and other water saving devices. We continue to partner with our client agencies to develop new local supplies such as recycled water, brackish water desalting, ocean water desalination, and the Groundwater Replenishment System.

However, a combination of water supply challenges have brought about the possibility that MWDOC may not have access to the imported supplies necessary to meet the demands of its client agencies in the coming years. The following factors have dramatically impacted water supply conditions not only in Orange County, but all of Southern California:

- In CY 2013 many areas of California experienced the driest year on record. California received record low snowpack in FY 2014-15. On January 17, 2014, Governor Brown proclaimed a statewide drought emergency. On May 5, 2015, the State Water Resources Control Board adopted an emergency conservation regulations in accordance with the Governor's directive. The provisions of the emergency regulations went into effect on May 18, 2015. On February 2, 2016, the SWRCB will consider a resolution to extend the existing May 2015 Emergency Regulation as directed in the November 2015 executive order.

- The Colorado River is recovering from a long-term drought. Reservoirs along the river are less than half full. In the summer of 2015, Lake Mead water levels reached record lows. Supplies from this source have been reduced since 2003 and will continue to be limited.

To meet the imported water demands of its member agencies, the Metropolitan Water District of Southern California (MET) is quickly withdrawing supplies from surface and groundwater storage. Over the past three years, MET has drawn down 67% of its available reserves.

The recent dry conditions and the uncertainty about future supplies from the State Water Project have raised the possibility that MET will not have access to the supplies necessary to meet the imported water demands of its member agencies. As a result, MET has developed a Water Supply Allocation Plan that allocates wholesale imported water supplies among its 26 member agencies throughout Southern California.

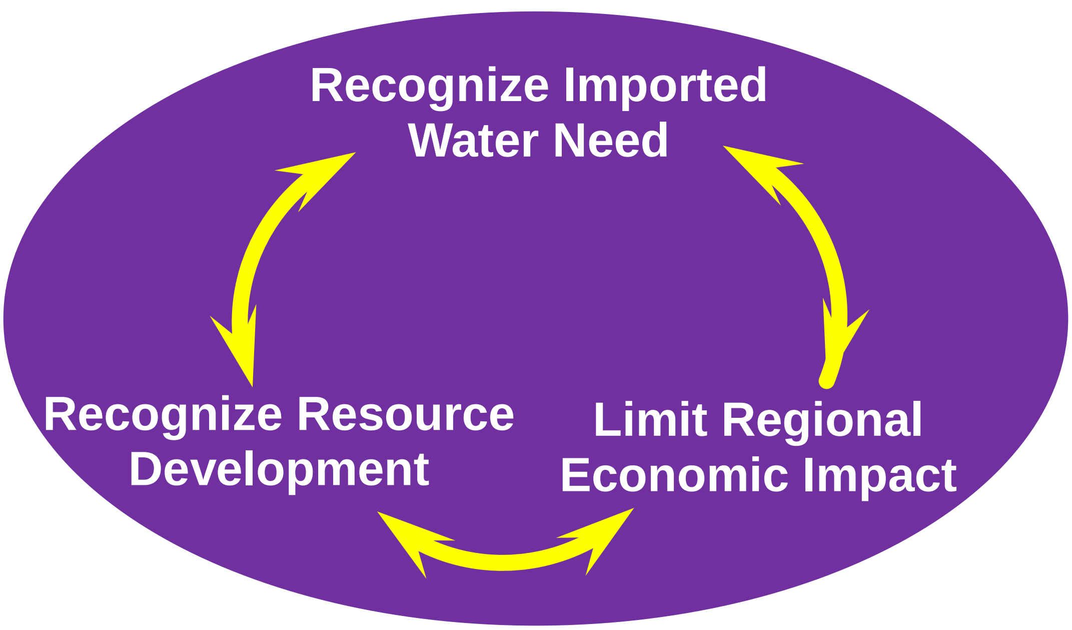
To prepare for the possibility of an allocation of imported water supplies from MET, MWDOC has worked in collaboration with its 28 client agencies to develop this Water Supply Allocation Plan to allocate imported water supplies at the retail level. This document lays out the essential components of how MWDOC plans to determine and implement each agency's allocation during a time of shortage.

Section 2: Metropolitan Water District's Water Supply Allocation Plan

In February 2008, MET approved a Water Supply Allocation Plan (WSAP) designed to allocate imported water to all of its member agencies during a shortage. In June 2014 MET convened a member agency working group to revisit the WSAP. The purpose of the working group was to collaborate with member agencies to identify potential revisions to the WSAP in preparation for mandatory supply allocations in 2015. There were eight working group meetings and three discussions at the monthly Member Agency Managers' Meetings. The WSAP follows the principles and considerations identified in MET's Water Surplus and Drought Management Plan, which calls upon the allocation of water in a fair and equitable manner to all of MET's member agencies. To the extent possible, this means developing a plan that minimizes regional hardship during times of shortage.

The MET WSAP seeks to balance the impacts of a shortage at the retail level while maintaining equity on the wholesale level. To achieve this, it takes into account:

- The impact to retail customers and the economy
- Allowance for population and growth
- Change and/or loss of local supply
- Reclamation/Recycling
- Conservation
- Investments in local resources
- Investments in MET's facilities



The WSAP states that MET staff will go before the Board with a recommendation in April, from which the Board of Directors will make a determination on the level of the Regional Shortage. If the Board determines allocations are necessary, they will go into effect in July and remain for a twelve-month period. *Note: This schedule is at the discretion of the MET Board, and is subject to change.*

The recommendation to declare a regional shortage will be based upon water supply availability from the State Water Project, the Colorado River Aqueduct, and the amount of surface and groundwater storage remaining in MET's reserves. It will also take into account the implementation of MET's water management actions i.e. Five Year Water Supply Plan, extraordinary conservation efforts, the acceleration of local resource projects, and the purchases of water transfers.

A full copy of MET's Water Supply Allocation Plan as revised in December 2014 is available in Appendix B.

Section 3: Development Process

In preparation for possible allocation of imported water supplies from MET, MWDOC's Board first adopted the following policy principles to help guide staff and the client agency technical workgroup to develop a plan that is fair and equitable for everyone within its service area:

- **Seek best allocation available from MET**
- **Develop MWDOC Plan in collaboration with client agencies**
- **When reasonable, use similar method/approach as MET**
- **When MET's method would produce significant unintended result, use an alternative approach**
- **Develop accurate data on local supply, conservation, recycling, rate structures, growth and other relevant adjustment factors**
- **Seek opportunities within MWDOC service area to provide mutually beneficial shortage mitigation**

Client Agency Input

Between the months of September and January of 2014-15, MWDOC staff worked cooperatively with the client agencies through a series of technical workgroups to develop a formula and implementation plan to allocate imported supplies in the event that MET declares a regional shortage. These workgroups provided an arena for in-depth discussion of the objectives, mechanics, and policy aspects of the different parts of the Plan. MWDOC staff also met individually with a number of client agencies for detailed discussions on elements of the Plan. The discussions, suggestions, and comments expressed by the client agencies during this process played a key part in the development of this Plan.

The following MWDOC client agencies participated in the Technical Workgroup:

- **City of Buena Park**
- **City of Fountain Valley**
- **City of Garden Grove**
- **City of Huntington Beach**
- **City of Newport Beach**
- **City of Orange**
- **City of San Clemente**
- **City of San Juan Capistrano**
- **City of Tustin**
- **City of Westminster**
- **East Orange County Water District**
- **El Toro Water District**
- **Golden State Water Co.**
- **Irvine Ranch Water District**
- **Laguna Beach County Water District**

- **Mesa Water District**
- **Moulton Niguel Water District**
- **Orange County Water District**
- **Serrano Water District**
- **Santa Margarita Water District**
- **South Coast Water District**
- **Trabuco Canyon Water District**
- **Yorba Linda Water District**

In addition to the workshops, individual meetings were held between MWDOC staff and the following MWDOC client agencies to address more specific and agency-related questions.

These individual meetings provided MWDOC staff with a great deal of insight on exactly how a retail agency would implement allocations at the customer level. Such information was extremely valuable in our regional discussion at MET and in the development of this Plan.

Board of Directors Input

Throughout the Plan's development process, the MWDOC Board of Directors was provided with regular progress reports on the status of the Plan and the technical workgroup discussions. During the months the Plan was being developed, the Board Planning and Operations Committee was kept apprised of key issues regarding MET's and MWDOC's allocation plan. Moreover, the Committee played an integral part in the development of key implementation issues such as the appeal process and the surcharge rate structure.

Section 4: Water Supply Allocation Formula

The MWDOC Water Supply Allocation Model follows five (5) basic steps to determine an agency's imported supply allocation:

- Step 1: Determine Baseline Information
- Step 2: Establish Allocation Year Information
- Step 3: Assess the Shortage Reduction Stage (Based on MET's Declared Shortage Level)
- Step 4: Apply Allocation Adjustments and Credits in the areas of retail impacts, conservation, groundwater recharge.
- Step 5: Sum total allocations and determine retail reliability

A description of how the calculation is used in each step is described below:

Step 1 – Determine Baseline Information

In order to determine a client agency's retail demands and imported supply needs in the allocation year, the model needs to establish a historical base period for water supply and delivery data. The base period for each of the different categories of demands and supplies is calculated using data from fiscal years (July through June) ending 2013 and 2014.

The following is a description of the base period calculations:

Base Period Local Supplies: Local supplies for the base period are calculated using a two-year average (from fiscal years ending 2013 and 2014) of groundwater production, groundwater recovery, surface water production, and other non-imported supplies.

Base Period Wholesale ("Imported") Firm Demands: Firm demands on MWDOC for the base period are calculated using a two-year average (from fiscal years ending 2013 and 2014) of full-service, and surface storage operating agreement demands.

Base Period In-lieu Deliveries: Base period in-lieu deliveries to client agencies are calculated using a two year average (from fiscal years ending 2013 and 2014) of In-lieu deliveries to long-term groundwater replenishment, conjunctive use, cyclic, and supplemental storage programs. In-lieu deliveries are not calculated as imported supplies from MET. They are calculated as local supplies to account for the corresponding reduction in base year local production that was required to take In-lieu deliveries.

Base Period Retail Demands: Total retail municipal and industrial demands for the base period are calculated by adding the Base Period Local Supplies, Base Period Wholesale Imported Firm Demands, and Base Period In-Lieu Deliveries.

Step 2 – Establish Allocation Year Information

In this step, the model adjusts for each member agency's water need in the allocation year. To do so, it adjusts the base period estimates for population growth and changes in local supplies.

The following is a description of how the allocation year information is established:

Allocation Year Retail Demands: Total retail M&I demands for the allocation year are calculated by adjusting the Base Period Retail Demands for growth. The method in which MWDOC determines each client agency's growth is through population increases for the fiscal years ending 2013 to 2014[1]. Based on the data received from California State University of Fullerton, Center for Demographic Research, MWDOC prorates each agency's population increase share to MWDOC's growth adjustment received from MET[2], as shown in Appendix C.

Growth Adjustment: The growth adjustment is calculated by taking the average percent of growth from fiscal years ending 2013 and 2014, as generated by the Center for Demographic Research at California State University, Fullerton.

Allocation Year Local Supplies: Allocation year local supplies include groundwater production, groundwater recovery, surface water production, and other imported supplies not from MET. In-lieu deliveries are considered as local supplies to account for the corresponding reduction in base year local production that was required to take in-lieu deliveries. Allocation year local supplies reflect a more accurate estimate of actual supplies in the allocation year, and in turn more accurately estimates an agency's demand for imported supplies.

Extraordinary Increased Production Adjustment: This adjustment accounts for extraordinary increases in local supplies above the base period. Extraordinary increases in production include such efforts as purchasing water transfers. In order not to discourage such extraordinary efforts, a percentage of the yield from these supplies is added back to Allocation Year Local Supplies in shortage levels as shown below. This has the effect of "setting aside" the majority of the yield for the agency who procured the supply. The percentage of the extraordinary increases in local supply corresponds according to the regional shortage level, as shown in Table 4.1.

[1] Although many options were discussed in the technical workgroup sessions, this option was chosen to best reflect the increase in water demand due to population growth as intended by MET's allocation formula for each client agency in the MWDOC service area.

[2] MET's growth adjustment is calculated by using the average of the last two year County-wide population growth rates, which include not only MWDOC's service area but also the cities of Fullerton, Anaheim, and Santa Ana.

Table 4.1
Extraordinary Increased
Production Adjustment

Regional Shortage Level	Regional Shortage Percentage	Extraordinary Increase Percentage
1	5%	5%
2	10%	10%
3	15%	15%
4	20%	20%
5	25%	25%
6	30%	30%
7	35%	35%
8	40%	40%
9	45%	45%
10	50%	50%

Step 3 – Calculate Initial Minimum Allocation Based on Declared Shortage Level

This step sets the initial allocation. After a regional shortage level is established, MWDOC will calculate the initial allocation as a percentage of adjusted Demand for Firm MET Supplies within the model for each client agency.

Regional Shortage Levels: The model allocates shortages of supplies over ten levels: from 5 to 50 percent, in 5 percent increments.

Initial (Wholesale Minimum) Allocation: The Wholesale Minimum Allocation is established to ensure a minimum level of imported supplies. The Wholesale Minimum Allocation ensures that client agencies will not experience shortages on the wholesale level that are greater than one-and-a-half times the percentage shortage of MET's regional water supplies. As illustrated in Table 4.2, the Wholesale Minimum Allocation percentage is equal to 100 minus one-and-a-half times the shortage level. The allocation is based on each agency's demand of firm MET water.

Table 4.2
Wholesale ("Imported")
Supply Minimum Allocation

Regional Shortage Level		Wholesale Minimum Allocation
1		92.5%
2		85.0%
3		77.5%
4		70.0%
5		62.5%
6		55.0%
7		47.5%
8		40.0%
9		32.5%
10		25.0%

Step 4 – Assign Allocation Adjustments and Conservation Credit

In this step, the model assigns additional water to address disparate impacts at the retail level caused by an across-the-board cut of imported supplies. It also applies a conservation credit given to those agencies that have achieved additional water savings at the retail level as a result of successful implementation of water conservation devices, programs and rate structures.

Retail Impact Adjustment: The Retail Impact Adjustment is the factor used to address major differences in retail level shortages associated with across-the-board cuts. The purpose of this adjustment is to ensure that agencies with a high level of dependence on MET do not experience highly disparate shortages compared to other agencies when faced with a reduction in imported supplies. The Retail Impact Adjustment is calculated as the difference between the Regional Shortage Percentage and the Wholesale Imported Minimum Allocation. The amount of the adjustment each client agency receives is prorated on a linear scale, based on its dependence on imported water at the retail level. The prorated amount of allocation is referred to as the Retail Impact Adjustment Allocation. Table 4.3 below illustrates the maximum adjustment an agency may receive according to the regional shortage level.

Table 4.3
Retail Impact Adjustment

Regional Shortage Level	Regional Shortage Percentage	Retail Impact Adjustment Maximum
1	5%	2.5%
2	10%	5.0%
3	15%	7.5%
4	20%	10.0%
5	25%	12.5%
6	30%	15.0%
7	35%	17.5%
8	40%	20.0%
9	45%	22.5%
10	50%	25.0%

Unfortunately, the Retail Impact Adjustment MWDOC receives from MET may be less than the aggregate retail impact adjustment for its client agencies. To mitigate this difference, MWDOC decreases each client agency's retail impact adjustment according to their prorated share.

Conservation Demand Hardening Credit: The Conservation Demand Hardening Credit addresses the increased difficulty in achieving additional water savings at the retail level that comes as a result of successful implementation of water conserving devices and conservation savings programs. To estimate conservation savings, each member agency has a historical baseline Gallons Per Person Per Day (GPCD) calculated by the maximum usage from fiscal year ending 2004 to fiscal year ending 2014. Reductions from the baseline GPCD to the Allocation Year are used to calculate the equivalent conservation savings in acre-feet. The Conservation Demand Hardening Credit is based on an initial 10 percent of the GPCD-based Conservation savings plus an additional 5 percent for each level of Regional Shortage set by the Board during implementation of the WSAP. The credit will also be adjusted for:

- The overall percentage reduction in retail water demand
- The member agency's dependence on Metropolitan

The credit is calculated using the following formula:

Conservation Demand Harding Credit = Conservation Savings x (10% + Regional Shortage Level Percentage) x (1 +((Baseline GPCD – Allocation Year GPCD)/Baseline GCPD))x Dependence on MWD Percentage.

Minimum Per-Capita Water Use Credit: This adjustment creates a minimum daily gallons per capita (GPCD) water use threshold. Member agencies' retail-level water use is compared to a total water use of 100 GPCD. Agencies that fall below this threshold receive additional allocation to bring them up to the minimum GPCD water use level[3].

Step 5 – Sum Total Allocations and Calculate Retail Reliability

This is the final step in calculating an agency's total allocation for imported supplies. The model sums an agency's total imported allocation with all of the adjustments and credits and then calculates each agency's retail reliability compared to its Allocation Year Retail Demand.

Final Metropolitan Allocation: The final allocation of imported supplies to an agency for its retail demand is the sum of the Wholesale Imported Minimum Allocation, their Retail Impact Adjustment, their Conservation Demand Hardening Credit, and Per-Capita Adjustment Allocation (if applicable).

Total Metropolitan Supply Allocations: In addition to the WSAP Allocation described above, agencies may also receive separate allocations of supplies for seawater barrier and groundwater replenishment demands. Allocations of supplies to meet seawater barrier demands are to be determined by the MET Board of Directors independently, but in conjunction with the WSAP. Separating the seawater barrier allocation from the WSAP allocation allows the MET Board to consider actual barrier requirements in the Allocation Year and address the demand hardening issues associated with cutting seawater barrier deliveries. According to the principles outlined for allocating seawater barrier demands, allocations should be no deeper than the WSAP Wholesale Minimum Percentage implemented at that time. The WSAP also provides a limited allocation for drought-impacted groundwater basins based on the following framework:

1. Metropolitan staff will hold a consultation with the requesting member agency and the appropriate groundwater basin manager to document whether the basin is in one of the following conditions:

    a. Groundwater basin overdraft conditions that will result in water levels being outside normal operating ranges during the WSAP allocation period; or
    b. Violations of groundwater basin water quality and/or regulatory parameters that would occur without imported deliveries.

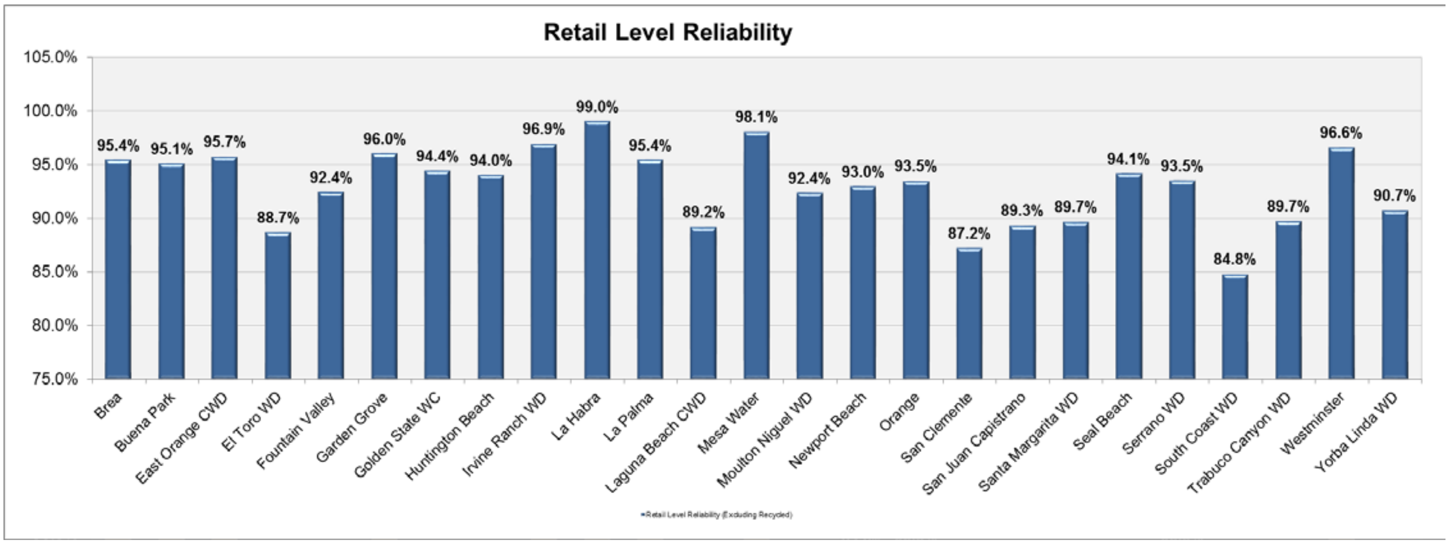
2. An allocation is provided based on the verified need for groundwater replenishment. The allocation would start with a member agency's ten-year average purchases of imported groundwater replenishment supplies (excluding years in which deliveries were curtailed). The amount would then be reduced by the declared WSAP Regional Shortage Level.

Agency's Retail Reliability: This calculates an agency's total MET allocation versus their allocation year retail demands to determine their overall reliability percentage (supplies

3 Per capita water used based on Total Retail-Level Use and population data received from California State University of Fullerton, Center for Demographic Research

as a percentage of retail demand) under a regional shortage level. This percentage excludes recycled water supplies from an agency's total water supply. Figure 4.1 illustrates the MWDOC client agencies' reliability percentages under a stage 3 regional shortage level (15%).

Figure 4.1
MWDOC's Water Supply Allocation Plan
Stage 3 with a Regional Shortage of 15%*



Source: MWDOC Allocation Model Version 3.1 and assumes a BPP of 75%.
[*] These are estimated reliability percentages for MWDOC client agencies under a regional shortage stage 3 (15%) based on initial local supply data received from the client agencies and OCWD's projected BPP for 2015/16.

Section 5: Plan Implementation

This section covers implementation issues which include: the appeal process, penalties rate structure and billing, tracking and reporting water usage, timeline and option to revisit the plan.

Allocation Appeals Process

The purpose of the appeals process is to provide client agencies the opportunity to request a change to their allocation based on new or corrected information. The grounds for appeal can include but are not limited to:

- Adjusting errors in historical data used in the Base period calculations
- Adjusting for unforeseen losses or gains in local supplies
- Adjusting for extraordinary increases in local supplies
- Adjusting for population growth rates
- Adjusting for credits with the Conservation base data, including Conservation Rate Structure

MWDOC anticipates that under most circumstances, a client agency's appeal will be the basis for an appeal to MET by MWDOC. MWDOC staff will work with client agencies to ensure that such an appeal is a complete and accurate reflection of the client agency's allocation and is properly reviewed by MET. To accomplish this, MWDOC will require the following information from the client agency submitting an appeal:

- ➢ Written letter (in the form of a letter or e-mail) from the client agency requesting an appeal
- ➢ Brief description of the type of appeal e.g. incorrect base data, loss/gain in local supply, extraordinary increase in local supply, adjustment in agency's conservation base data, or other
- ➢ Rationale for the appeal
- ➢ Quantity in acre-feet in question
- ➢ Verifiable documentation that supports the rationale i.e. billing statements, invoices for conservation device installations, Groundwater reports

To provide clarity of the process and ensure your appeal is properly handled, the following steps will occur:

Step 1 – Submit Appeal – Client agency will submit the necessary information, described above, to MWDOC.

Step 2 – Notification of Response and Appeal Meeting – Once MWDOC staff receives the appeal information, MWDOC will send a response and schedule a meeting with MWDOC staff and the client agency, within two weeks of receiving the information, to discuss the appeal in further detail.

Step 3 – Submittal to MET & MWDOC Board Notification – Using the information received from the client agency, MWDOC will prepare and submit the appeal to MET no later than one month of receiving the information. In addition, MWDOC staff will notify its Board of the submittal to MET.

Step 4 – MET Appeal Process - MWDOC will follow the terms of MET's appeal process, as described in Appendix B. Client agencies will also be invited, as deemed appropriate, by MWDOC to attend any meetings with MET on their appeal.

Step 5 –Client Agency Notification of MET's Decision – Once MET has made a determination of the appeal, MWDOC staff will notify the client agency of the decision and determine if additional actions are needed i.e. Appeal to MET Board.

In the event that MET denies the appeal, MWDOC staff will continue to work with the appealing agency to resolve their issue(s). Any action that will result in adjustments to client agency's allocation will be submitted to the Board for review and approval.

Allocation Surcharge Rates & Billing

MET's Surcharge Rates

MET will enforce its allocations through a tiered surcharge rate structure. MET will assess surcharge rates to a member agency that exceeds its total annual allocation at the end of the twelve-month allocation period, according to the rate structure below:

Table 5.1: Metropolitan Water District Allocation Surcharge Rate Structure (FY2015/16 Rates)*

Water Use up to:	(1) **Base Rate**	(2) **Surcharge Rate****	(1)+(2) = **Total Rate**
100% Allocation	Tier 1 ($942/AF)	-	**$942/AF**
100% < = 115%	Tier 1 ($942/AF)	Tier 1 + (1,480/AF)***	**$2,422/AF**
Use > 115%	Tier 1 ($942/AF)	Tier 1 + (2,960/AF)***	**$3,902/AF**

[*] The base rate shall be the applicable water rate for the water being purchased (Model shows CY 2016 rate).
[**] If MWDOC exceeds its allocation limit but is within its equivalent preferential right amount, MET will decrease the surcharge rate by one level.
[***] Surcharge rate is applied to water use in excess of an agency's WSAP allocation.

These surcharge rates will be assessed according to MET water rates in effect at the time of billing. Any surcharge funds collected by MET will be invested back to the MET member agency through conservation and local resource development.

MWDOC Surcharge Rates

As a water wholesaler, MWDOC has the opportunity to assess penalties in many different ways. A number of options were discussed and analyzed with the client agencies and Board Committee members. The key components that helped guide development of a surcharge structure included:

- A financial incentive to discourage water usage above a client agency's allocation
- A surcharge rate structure that is administratively easy to understand and implement
- Surcharge rates that are fair and appropriate during a shortage

From these components and input received from both the MWDOC Board and the client agencies, a melded surcharge rate structure was recommended. This was mainly due to its "region-wide" style approach and similar structure to other MWDOC rates and charges.

MWDOC Surcharge Rate Structure – At the end of the allocation year, MWDOC would charge a surcharge to each client agency that exceeded their allocation. This surcharge would be assessed according to the client agency's prorated share (acre-feet over usage) of MWDOC surcharge amount with MET. Below is an example of how this surcharge rate structure would apply:

Under the melded surcharge rate structure, client agencies will only be assessed penalties if MWDOC exceeds its total allocation and is required to pay a surcharge to MET.

MWDOC Billing

During the allocation period, MWDOC billing will remain the same. Only at the end of the twelve-month allocation period will MWDOC calculate each member agency's total potable water use based on the local supply certification and MWDOC allocation model and determine which agencies exceeded their annual allocation. From those agencies that exceeded their allocation, MWDOC will assess surcharge rates according to the melded surcharge rate structure on their next water invoice.

Understanding that the penalties can be significant to a retail agency, MET and MWDOC will allow payment of these penalties to be spread over three monthly billing periods. Therefore, a third of the penalties will be applied each month to the agency's water invoice over a three-month period

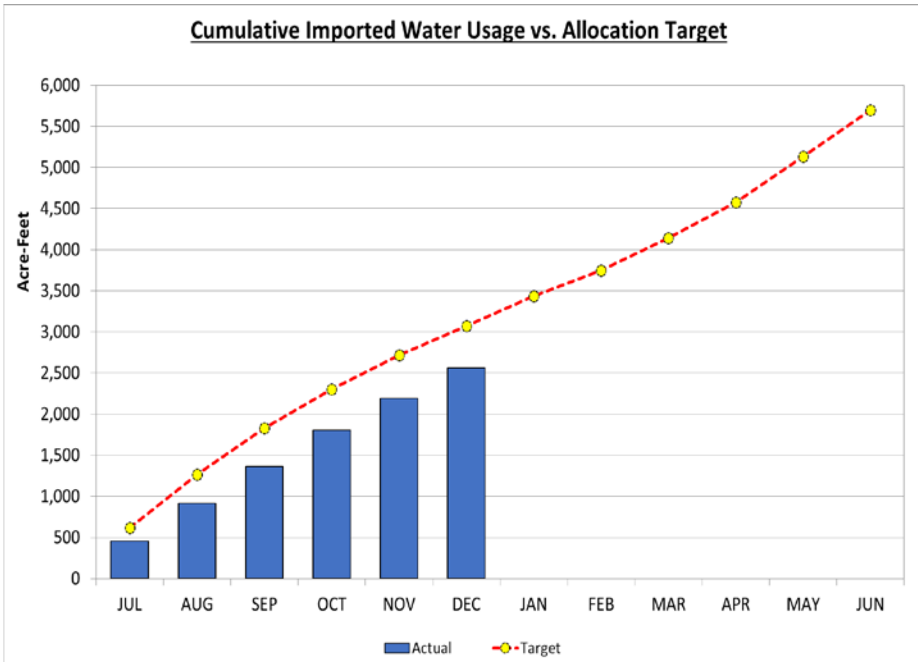
Tracking and Reporting

In preparing for allocations, it is important to track the amount of water the region and each client agency is using monthly. This data is important to help MWDOC and client agencies project their annual usage, evaluate their current demands, and avoid any over usage that will result in allocation penalties. MWDOC will provide water use monthly reports upon request or when necessary that will compare each client agency's current cumulative imported usage to their allocation target (Based off historical monthly percentages of imported usage). In addition, MWDOC will provide quarterly reports on its cumulative retail usage compared to its allocation baseline.

To develop these reports, MWDOC will need to work closely with each client agency to get their local supply data on a monthly basis. This data will not only be used by MWDOC to track monthly usage, but also by MET to assess MWDOC's total projected water demands.

Below in Figure 5.2 is an example of the type of monthly report MWDOC will provide to each client agency during the allocation period.

Figure 5.2
Example of a Client Agency's Monthly Usage Report



Key Dates for Implementation

If a regional shortage is declared, the allocation period will cover twelve consecutive months, e.g. July 1st of a given year through June 30. Barring unforeseen large-scale circumstances, the Regional Shortage Level will be set for the entire allocation period, which will provide the client agencies an established water supply shortage allocation amount. Figure 5.3 Illustrates the Metropolitan timeline for allocations during a two year period.

Figure 5.3: Metropolitan Water District
Adopted Allocation Timeline

Year	Month	Year 1 Board Allocation Decision	Year 1 Allocation Year	Year 2 Board Allocation Decision	Year 2 Allocation Year
YEAR 1	January				
	February				
	March				
	April	**Declaration**			
	May				
	June				
	July		**Effective Period** Continuous Tracking of Member Agency Local Supply and Imported Water Use		
	August				
	September				
	October				
	November				
	December				
YEAR 2	January				
	February				
	March				
	April			**Declaration**	
	May				
	June				
	July				**Effective Period** Continuous Tracking of Member Agency Local Supply and Imported Water Use
	August		**Assess Penalties**		
	September				
	October				
	November				
	December				
YEAR 3	January				
	February				
	March				
	April				
	May				
	June				

It is important to note that MWDOC does not anticipate calling for allocation unless the MET Board declares a shortage through it WSAP; and no later than 30 days from MET's declaration will MWDOC announce allocation to its client agencies.

Revisiting the Plan

Calculating the amount of imported water each client agency receives during a water shortage is not an easy task. The key objective in developing this allocation plan is to ensure that a proper and fair distribution of water is given to each client agency. However, due to the complexity of this issue and the potential for unforeseen circumstances that may occur during an allocation year, MWDOC offers the opportunity to review and refine components of this plan where deemed necessary.

The MWDOC staff and client agencies have the opportunity to revisit the plan and offer any recommendations to the MWDOC Board that will improve the method, calculation, and approach of this plan.

MET has a similar process which will allow opportunity to review their plan when deemed necessary.

Appendix A

List of Acronyms:

AF- Acre-feet
M&I- Municipal and Industrial
MET-Metropolitan Water District of Southern California
SWRCB-State Water Resources Control Board
WSAP-Water Supply Allocation Plan

Definitions:

Extraordinary Increases in Production: water production efforts that increase local supplies during an allocation year such as purchasing water transfers.

Groundwater Recovery: The extraction and treatment of groundwater making it usable for a variety of applications by removing high levels of chemicals and/or salts.

In-lieu deliveries: MET-supplied water bought to replace water that would otherwise be pumped from the groundwater basin.

Overproducing groundwater yield: Withdrawal (removal) of groundwater over a period of time that exceeds the recharge rate of the supply aquifer. Also referred to as overdraft or mining the aquifer.

Seawater Barrier: The injection of water into wells along the coast to protect the groundwater basin from seawater intrusion. The injected water acts like a wall, blocking seawater that would otherwise migrate into groundwater basins as a result of pumping inland.

Appendix B

Metropolitan’s Draft Water Supply Allocation Plan

MET Final Water Supply Allocation Pl

Appendix C

MWDOC Growth Adjustment Table per Client Agency

Population of MWDOC Retail Water Agencies

Water Agency	Jan-13	Jan-14	Avg of 2013 & 2014
Brea	41,129	42,181	**41,655**
Buena Park	82,053	82,364	**82,209**
East Orange CWD Retail Zone	3,233	3,247	**3,240**
El Toro WD	48,453	48,628	**48,541**
Fountain Valley	57,129	57,590	**57,360**
Garden Grove	175,096	175,873	**175,485**
Golden State Water Company	167,779	168,561	**168,170**
Huntington Beach	193,873	196,041	**194,957**
Irvine Ranch WD	357,781	369,724	**363,753**
La Habra	60,989	61,455	**61,222**
La Palma	15,890	15,946	**15,918**
Laguna Beach CWD includ. Emerald Bay Service District	20,130	20,204	**20,167**
Mesa Water	105,779	106,152	**105,966**
Moulton Niguel WD	168,301	169,405	**168,853**
Newport Beach	65,404	65,551	**65,478**
Orange	137,814	138,182	**137,998**
San Clemente	50,757	50,960	**50,859**
San Juan Capistrano	37,943	38,491	**38,217**
Santa Margarita WD	152,245	153,358	**152,802**
Seal Beach	23,543	23,618	**23,581**
Serrano WD	6,408	6,437	**6,423**
South Coast WD	34,672	34,816	**34,744**
Trabuco Canyon WD	12,588	12,640	**12,614**
Tustin	67,445	67,700	**67,573**
Westminster	92,939	93,322	**93,131**
Yorba Linda WD	73,378	73,990	**73,684**
Total of MWDOC Agencies	**2,252,751**	**2,276,436**	**2,264,594**

Source: Center for Demographic Research, CSU Fullerton, December 2014. CDR's estimates were based on the 2010 Census. Water agency counts were made for the actual area served, which may be different than the political boundary. Numbers are tied to the State Dept. of Finance numbers for total population of Orange County.

Water Agency	Growth % from 2012 to 2013	Growth % from 2013 to 2014	Avg Growth % 2013 to 2014
Brea	1.13%	2.56%	1.84%
Buena Park	0.62%	0.38%	0.50%
East Orange CWD Retail Zone	0.56%	0.43%	0.50%
El Toro WD	0.56%	0.36%	0.46%
Fountain Valley	0.71%	0.81%	0.76%
Garden Grove	0.19%	0.44%	0.32%
Golden State Water Company	0.87%	0.47%	0.67%
Huntington Beach	0.61%	1.12%	0.87%
Irvine Ranch WD	2.68%	3.34%	3.01%
La Habra	0.53%	0.76%	0.65%
La Palma	0.75%	0.35%	0.55%
Laguna Beach CWD includ. Emerald Bay Service District	0.60%	0.37%	0.48%
Mesa Water	0.58%	0.35%	0.47%
Moulton Niguel WD	0.78%	0.66%	0.72%
Newport Beach	0.51%	0.22%	0.37%
Orange	0.59%	0.27%	0.43%
San Clemente	0.55%	0.40%	0.48%
San Juan Capistrano	0.89%	1.44%	1.17%
Santa Margarita WD	0.55%	0.73%	0.64%
Seal Beach	0.59%	0.32%	0.45%
Serrano WD	0.60%	0.45%	0.52%
South Coast WD	0.61%	0.42%	0.51%
Trabuco Canyon WD	0.55%	0.41%	0.48%
Tustin	0.63%	0.38%	0.50%
Westminster	0.64%	0.41%	0.53%
Yorba Linda WD	1.11%	0.83%	0.97%
Total of MWDOC Agencies	**0.95%**	**1.05%**	1.00%

Appendix D

MWDOC Conservation Hardening Credit Table per Client Agency

Member Agency	GPCD Baseline	GPCD for 2014	Change in GPCD	AF Savings
Brea	288.58	246.61	**41.97**	**1,983**
Buena Park	199.59	165.57	**34.02**	**3,138**
East Orange CWD includ. Tustin	196.19	170.20	**25.99**	**2,065**
El Toro WD	214.96	185.54	**29.42**	**1,748**
Fountain Valley	192.48	184.64	**7.84**	**506**
Garden Grove	166.11	133.16	**32.95**	**6,491**
Golden State Water Company	175.11	146.27	**28.84**	**5,445**
Huntington Beach	163.73	141.79	**21.94**	**4,818**
Irvine Ranch WD	304.13	244.30	**59.83**	**24,778**
La Habra	160.60	150.19	**10.41**	**717**
La Palma	154.88	123.75	**31.13**	**556**
Laguna Beach CWD includ. EBSD	203.74	173.46	**30.28**	**685**
Mesa WD	191.25	166.35	**24.90**	**2,961**
Moulton Niguel WD	236.66	194.91	**41.75**	**7,922**
Newport Beach	258.85	239.36	**19.49**	**1,431**
Orange	231.08	210.84	**20.24**	**3,134**
San Clemente	198.09	178.51	**19.58**	**1,118**
San Juan Capistrano	236.93	206.65	**30.28**	**1,306**
Santa Margarita WD	235.06	201.77	**33.29**	**5,719**
Seal Beach	157.34	147.07	**10.27**	**272**
Serrano WD	485.61	468.88	**16.73**	**121**
South Coast WD	205.86	196.91	**8.95**	**349**
Trabuco Canyon WD	314.13	270.88	**43.25**	**612**
Tustin	191.31	164.21	**27.10**	**2,055**
Westminster	145.76	120.75	**25.01**	**2,614**
Yorba Linda WD	299.73	272.75	**26.98**	**2,236**

[*] The "GPCD Baseline" is the highest Ten-year average from 2004 to present, and includes Recycled water in order to normalize the conservation savings
Source: MWDOC 20% by 2020 OC Regional Alliance Model updated in 2014

WSAP GPCD.pdf

APPENDIX E

Notification of Public and Service Area Suppliers

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

Street Address:
18700 Ward Street
Fountain Valley, California 92708

Mailing Address:
P.O. Box 20895
Fountain Valley, CA 92728-0895

(714) 963-3058
Fax: (714) 964-9389
www.mwdoc.com

March 1, 2016

Ms. Mitzi Ortiz
City Clerk
City of Aliso Viejo
12 Journey, Suite 100
Aliso Viejo, CA 92656-5335

Dear Ms. Ortiz:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

The Municipal Water District of Orange County (MWDOC) is in the process of preparing its 2015 Urban Water Management Plan (UWMP). UWMPs are prepared by California's urban water suppliers to support their long-term resource planning and ensure adequate water supplies are available to meet existing and future water demands. Every urban water supplier that either provides over 3,000 acre-feet of water annually or serves 3,000 or more connections is required to prepare an UWMP every five years.

Pursuant to the requirement of California Water Code, Division 6, Part 2.6 Urban Water Management Planning, Section 10621 (b), every urban water supplier required to prepare a plan 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 the urban water supplier will be reviewing the plan and considering amendments or changes to the plan.

This letter is intended to notify your agency that MWDOC is in the process of preparing the 2015 UWMP. Based on MWDOC's current schedule, a draft will be available for review prior to the public hearing, which is tentatively scheduled for May 2016.

If your agency would like more information or has any questions, please contact Harvey De La Torre at 714/593-5027 or hdelatorre@mwdoc.com

Sincerely,

Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

Street Address:
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March 1, 2016

Ms. Linda Andal
City Clerk
City of Anaheim
200 South Anaheim Boulevard
Anaheim, CA 92805

Dear Ms. Andal:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

The Municipal Water District of Orange County (MWDOC) is in the process of preparing its 2015 Urban Water Management Plan (UWMP). UWMPs are prepared by California's urban water suppliers to support their long-term resource planning and ensure adequate water supplies are available to meet existing and future water demands. Every urban water supplier that either provides over 3,000 acre-feet of water annually or serves 3,000 or more connections is required to prepare an UWMP every five years.

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Sincerely,

Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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March 1, 2016

Ms. Lillian Harris-Neal
City Clerk
City of Brea
1 Civic Center Circle
Brea, CA 92821

Dear Ms. Harris-Neal:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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If your agency would like more information or has any questions, please contact Harvey De La Torre at 714/593-5027 or hdelatorre@mwdoc.com

Sincerely,

Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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March 1, 2016

Ms. Shalice Tilton
City Clerk
City of Buena Park
6650 Beach Boulevard
Buena Park, CA 90621

Dear Ms. Tilton:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Sincerely,

Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

Street Address:
18700 Ward Street
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March 1, 2016

Ms. Brenda Green
City Clerk
City of Costa Mesa
77 Fair Drive
Costa Mesa, CA 92628-1200

Dear Ms. Green:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Sincerely,

Karl W. Seckel
Assistant Manager

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March 1, 2016

Ms. Denise Basham
City Clerk
City of Cypress
5275 Orange Avenue
Cypress, CA 90630

Dear Ms. Basham:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Sincerely,

Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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March 1, 2016

Ms. Kathy Ward
City Clerk
City of Dana Point
33282 Golden Lantern Street, Suite 203
Dana Point, CA 92629

Dear Ms. Ward:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

The Municipal Water District of Orange County (MWDOC) is in the process of preparing its 2015 Urban Water Management Plan (UWMP). UWMPs are prepared by California's urban water suppliers to support their long-term resource planning and ensure adequate water supplies are available to meet existing and future water demands. Every urban water supplier that either provides over 3,000 acre-feet of water annually or serves 3,000 or more connections is required to prepare an UWMP every five years.

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Sincerely,

Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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March 1, 2016

Mr. Rick Miller
City Clerk
City of Fountain Valley
10200 Slater Avenue
Fountain Valley, CA 92708

Dear Mr. Miller:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

The Municipal Water District of Orange County (MWDOC) is in the process of preparing its 2015 Urban Water Management Plan (UWMP). UWMPs are prepared by California's urban water suppliers to support their long-term resource planning and ensure adequate water supplies are available to meet existing and future water demands. Every urban water supplier that either provides over 3,000 acre-feet of water annually or serves 3,000 or more connections is required to prepare an UWMP every five years.

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This letter is intended to notify your agency that MWDOC is in the process of preparing the 2015 UWMP. Based on MWDOC's current schedule, a draft will be available for review prior to the public hearing, which is tentatively scheduled for May 2016.

If your agency would like more information or has any questions, please contact Harvey De La Torre at 714/593-5027 or hdelatorre@mwdoc.com

Sincerely,

Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

Street Address:
18700 Ward Street
Fountain Valley, California 92708

Mailing Address:
P.O. Box 20895
Fountain Valley, CA 92728-0895

(714) 963-3058
Fax: (714) 964-9389
www.mwdoc.com

March 1, 2016

Ms. Lucinda Williams
City Clerk
City of Fullerton
303 West Commonwealth Avenue
Fullerton, CA 92832-1775

Dear Ms. Williams:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Sincerely,

Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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Fountain Valley, California 92708

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Fax: (714) 964-9389
www.mwdoc.com

March 1, 2016

Ms. Kathy Bailor
City Clerk
City of Garden Grove
11222 Acacia Parkway
Garden Grove, CA 92840

Dear Ms. Bailor:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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Fax: (714) 964-9389
www.mwdoc.com

March 1, 2016

Ms. Joan Flynn
City Clerk
City of Huntington Beach
2000 Main Street
Huntington Beach, CA 92648

Dear Ms. Flynn:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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Fountain Valley, California 92708

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P.O. Box 20895
Fountain Valley, CA 92728-0895

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Fax: (714) 964-9389
www.mwdoc.com

March 1, 2016

Ms. Molly McLaughlin
City Clerk
City of Irvine
One Civic Center Plaza
Irvine, CA 92606-5208

Dear Ms. McLaughlin:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Sincerely,

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Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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Fountain Valley, California 92708

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P.O. Box 20895
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Fax: (714) 964-9389
www.mwdoc.com

March 1, 2016

Ms. Tamara Mason
City Clerk
City of La Habra
201 East La Habra Boulevard
La Habra, CA 90633-0337

Dear Ms. Mason:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Sincerely,

Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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www.mwdoc.com

March 1, 2016

Ms. Lisette Chel
City Clerk
City of Laguna Beach
505 Forest Avenue
Laguna Beach, CA 92651

Dear Ms. Chel:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Sincerely,

Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

Street Address:
18700 Ward Street
Fountain Valley, California 92708

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P.O. Box 20895
Fountain Valley, CA 92728-0895

(714) 963-3058
Fax: (714) 964-9389
www.mwdoc.com

March 1, 2016

Ms. Melissa Au-Yeung
Assistant to the City Manager/ City Clerk
City of Laguna Hills
24035 El Toro Road
Laguna Hills, CA 92653

Dear Ms. Au-Yeung:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Sincerely,

Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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18700 Ward Street
Fountain Valley, California 92708

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P.O. Box 20895
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www.mwdoc.com

March 1, 2016

Ms. Eileen Gomez
City Clerk
City of Laguna Niguel
30111 Crown Valley Parkway
Laguna Niguel, CA 92677

Dear Ms. Gomez:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Sincerely,

Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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18700 Ward Street
Fountain Valley, California 92708

Mailing Address:
P.O. Box 20895
Fountain Valley, CA 92728-0895

(714) 963-3058
Fax: (714) 964-9389
www.mwdoc.com

March 1, 2016

Ms. Yolie Trippy
Deputy City Clerk
City of Laguna Woods
24264 El Toro Road
Laguna Woods, CA 92637

Dear Ms. Trippy:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Sincerely,

Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

Street Address:
18700 Ward Street
Fountain Valley, California 92708

Mailing Address:
P.O. Box 20895
Fountain Valley, CA 92728-0895

(714) 963-3058
Fax: (714) 964-9389
www.mwdoc.com

March 1, 2016

Ms. Stephanie Smith
City Clerk
City of Lake Forest
25550 Commercentre Drive
Lake Forest, CA 92630

Dear Ms. Smith:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

Street Address:
18700 Ward Street
Fountain Valley, California 92708

Mailing Address:
P.O. Box 20895
Fountain Valley, CA 92728-0895

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Fax: (714) 964-9389
www.mwdoc.com

March 1, 2016

Ms. Windmera Quintanar
City Clerk
City of Los Alamitos
3191 Katella Avenue
Los Alamitos, CA 90720-5600

Dear Ms. Quintanar:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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Fountain Valley, California 92708

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(714) 963-3058
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www.mwdoc.com

March 1, 2016

Ms. Karen Hamman
City Clerk/Director of Community Relations
City of Mission Viejo
200 Civic Center
Mission Viejo, CA 92691

Dear Ms. Hamman:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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Fountain Valley, California 92708

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P.O. Box 20895
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Fax: (714) 964-9389
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March 1, 2016

Ms. Leilani Brown
City Clerk
City of Newport Beach
100 Civic Center Drive
Newport Beach, CA 92660

Dear Ms. Brown:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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P.O. Box 20895
Fountain Valley, CA 92728-0895

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March 1, 2016

Ms. Mary Murphy
City Clerk
City of Orange
300 East Chapman Avenue
Orange, CA 92866

Dear Ms. Murphy:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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March 1, 2016

Mr. Patrick Melia
City Clerk
City of Placentia
401 East Chapman Avenue
Placentia, CA 92870

Dear Mr. Melia:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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Fountain Valley, California 92708

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www.mwdoc.com

March 1, 2016

Ms. Amy Diaz
City Clerk
City of Rancho Santa Margarita
22112 El Paseo
Rancho Santa Margarita, CA 92688

Dear Ms. Diaz:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

The Municipal Water District of Orange County (MWDOC) is in the process of preparing its 2015 Urban Water Management Plan (UWMP). UWMPs are prepared by California's urban water suppliers to support their long-term resource planning and ensure adequate water supplies are available to meet existing and future water demands. Every urban water supplier that either provides over 3,000 acre-feet of water annually or serves 3,000 or more connections is required to prepare an UWMP every five years.

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Fountain Valley, California 92708

Mailing Address:
P.O. Box 20895
Fountain Valley, CA 92728-0895

(714) 963-3058
Fax: (714) 964-9389
www.mwdoc.com

March 1, 2016

Ms. Joanne Baade
City Clerk
City of San Clemente
100 Avenida Presidio
San Clemente, CA 92673

Dear Ms. Baade:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

The Municipal Water District of Orange County (MWDOC) is in the process of preparing its 2015 Urban Water Management Plan (UWMP). UWMPs are prepared by California's urban water suppliers to support their long-term resource planning and ensure adequate water supplies are available to meet existing and future water demands. Every urban water supplier that either provides over 3,000 acre-feet of water annually or serves 3,000 or more connections is required to prepare an UWMP every five years.

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This letter is intended to notify your agency that MWDOC is in the process of preparing the 2015 UWMP. Based on MWDOC's current schedule, a draft will be available for review prior to the public hearing, which is tentatively scheduled for May 2016.

If your agency would like more information or has any questions, please contact Harvey De La Torre at 714/593-5027 or hdelatorre@mwdoc.com

Sincerely,

Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

Street Address:
18700 Ward Street
Fountain Valley, California 92708

Mailing Address:
P.O. Box 20895
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www.mwdoc.com

March 1, 2016

Ms. Maria Morris
City Clerk
City of San Juan Capistrano
32400 Paseo Adelanto
San Juan Capistrano, CA 92675

Dear Ms. Morris:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Sincerely,

Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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Fountain Valley, California 92708

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P.O. Box 20895
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Fax: (714) 964-9389
www.mwdoc.com

March 1, 2016

Ms. Maria Huizar
City Clerk
City of Santa Ana
20 Civic Center Plaza
Santa Ana, CA 92702

Dear Ms. Huizar:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Sincerely,

Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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18700 Ward Street
Fountain Valley, California 92708

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Fax: (714) 964-9389
www.mwdoc.com

March 1, 2016

Ms. Jill Ingram
City Manager
City of Seal Beach
211 8th Street
Seal Beach, CA 90740

Dear Ms. Ingram:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Sincerely,

Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

Street Address:
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Fountain Valley, California 92708

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P.O. Box 20895
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March 1, 2016

Ms. Patricia Vazquez
City Clerk
City of Stanton
7800 Katella Ave.
Stanton, CA 90680

Dear Ms. Vazquez:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Sincerely,

Karl W. Seckel

Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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March 1, 2016

Ms. Erica Rabe
City Clerk Services Supervisor
City of Tustin
300 Centennial Way
Tustin, CA 92780

Dear Ms. Rabe:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Sincerely,

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Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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March 1, 2016

Mr. Jarad Hildenbrand
City Manager/City Clerk
City of Villa Park
17855 Santiago Boulevard
Villa Park, CA 92861

Dear Mr. Hildenbrand:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Sincerely,

Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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Fountain Valley, California 92708

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March 1, 2016

Ms. Amanda Jensen
City Clerk
City of Westminster
8200 Westminster Boulevard
Westminster, CA 92683

Dear Ms. Jensen:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Sincerely,

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Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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18700 Ward Street
Fountain Valley, California 92708

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P.O. Box 20895
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www.mwdoc.com

March 1, 2016

Mr. Todd Litfin
City Attorney
City of Yorba Linda
4845 Casa Loma Avenue
Yorba Linda, CA 92886-8714

Dear Mr. Litfin:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

Street Address:
18700 Ward Street
Fountain Valley, California 92708

Mailing Address:
P.O. Box 20895
Fountain Valley, CA 92728-0895

(714) 963-3058
Fax: (714) 964-9389
www.mwdoc.com

March 1, 2016

Mr. Hugh Nguyen
Clerk-Recorder
County of Orange
10 Civic Center Plaza
Santa Ana, CA 92701

Dear Mr. Nguyen:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Sincerely,

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Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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18700 Ward Street
Fountain Valley, California 92708

Mailing Address:
P.O. Box 20895
Fountain Valley, CA 92728-0895

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Fax: (714) 964-9389
www.mwdoc.com

March 1, 2016

Ms. Marilyn Thoms
Watershed Manager
County of Orange/Public Works
2301 N. Glassel St.
Orange, CA 92865

Dear Ms. Thoms:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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www.mwdoc.com

March 1, 2016

Ms. Lisa Ohlund
General Manager
East Orange County Water District
185 N. McPherson Road
Orange, CA 92869-3720

Dear Ms. Ohlund:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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Fountain Valley, California 92708

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March 1, 2016

Mr. Robert Hill
General Manager/ Assistant Secretary
El Toro Water District
24251 Los Alisos Boulevard
Lake Forest, CA 92630

Dear Mr. Hill:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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March 1, 2016

Mr. Michael Dunbar
General Manager
Emerald Bay Service District
600 Emerald Bay
Laguna Beach, CA 92651

Dear Mr. Dunbar:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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March 1, 2016

Mr. Paul Cook
General Manager
Irvine Ranch Water District
P.O. Box 57000
Irvine, CA 92619-7000

Dear Mr. Cook:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

The Municipal Water District of Orange County (MWDOC) is in the process of preparing its 2015 Urban Water Management Plan (UWMP). UWMPs are prepared by California's urban water suppliers to support their long-term resource planning and ensure adequate water supplies are available to meet existing and future water demands. Every urban water supplier that either provides over 3,000 acre-feet of water annually or serves 3,000 or more connections is required to prepare an UWMP every five years.

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Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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March 1, 2016

Ms. Renae Hinchey
General Manager / Board Secretary
Laguna Beach County Water District
306 Third Street
Laguna Beach, CA 92651

Dear Ms. Hinchey:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

The Municipal Water District of Orange County (MWDOC) is in the process of preparing its 2015 Urban Water Management Plan (UWMP). UWMPs are prepared by California's urban water suppliers to support their long-term resource planning and ensure adequate water supplies are available to meet existing and future water demands. Every urban water supplier that either provides over 3,000 acre-feet of water annually or serves 3,000 or more connections is required to prepare an UWMP every five years.

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Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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March 1, 2016

Mr. Paul Shoenberger
General Manager
Mesa Water
1965 Placentia Avenue
Costa Mesa, CA 92627

Dear Mr. Shoenberger:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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If your agency would like more information or has any questions, please contact Harvey De La Torre at 714/593-5027 or hdelatorre@mwdoc.com

Sincerely,

Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

Street Address:
18700 Ward Street
Fountain Valley, California 92708

Mailing Address:
P.O. Box 20895
Fountain Valley, CA 92728-0895

(714) 963-3058
Fax: (714) 964-9389
www.mwdoc.com

March 1, 2016

Ms. Joone Lopez
General Manager
Moulton Niguel Water District
27500 La Paz Road
Laguna Niguel, CA 92677-3489

Dear Ms. Lopez:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

The Municipal Water District of Orange County (MWDOC) is in the process of preparing its 2015 Urban Water Management Plan (UWMP). UWMPs are prepared by California's urban water suppliers to support their long-term resource planning and ensure adequate water supplies are available to meet existing and future water demands. Every urban water supplier that either provides over 3,000 acre-feet of water annually or serves 3,000 or more connections is required to prepare an UWMP every five years.

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March 1, 2016

Mr. Dan Ferons
General Manager
Santa Margarita Water District
26111 Antonio Parkway
Rancho Santa Margarita, CA 92688

Dear Mr. Ferons:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

The Municipal Water District of Orange County (MWDOC) is in the process of preparing its 2015 Urban Water Management Plan (UWMP). UWMPs are prepared by California's urban water suppliers to support their long-term resource planning and ensure adequate water supplies are available to meet existing and future water demands. Every urban water supplier that either provides over 3,000 acre-feet of water annually or serves 3,000 or more connections is required to prepare an UWMP every five years.

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Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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March 1, 2016

Mr. Michael Markus
General Manager
Orange County Water District
18700 Ward Street
Fountain Valley, CA 92708

Dear Mr. Markus:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Sincerely,

Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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March 1, 2016

Mr. Jerry Vilander
General Manager
Serrano Water District
18021 East Lincoln Street
Villa Park, CA 92861-6446

Dear Mr. Vilander:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Sincerely,

Karl W. Seckel
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MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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March 1, 2016

Mr. Hector Ruiz
General Manager
Trabuco Canyon Water District
32003 Dove Canyon Drive
Trabuco Canyon, CA 92679

Dear Mr. Ruiz:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Sincerely,

Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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March 1, 2016

Mr. Marc Marcantonio
General Manager
Yorba Linda Water District
1717 East Miraloma Ave.
Placentia, CA 92870

Dear Mr. Marcantonio:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

The Municipal Water District of Orange County (MWDOC) is in the process of preparing its 2015 Urban Water Management Plan (UWMP). UWMPs are prepared by California's urban water suppliers to support their long-term resource planning and ensure adequate water supplies are available to meet existing and future water demands. Every urban water supplier that either provides over 3,000 acre-feet of water annually or serves 3,000 or more connections is required to prepare an UWMP every five years.

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Sincerely,

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Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

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P.O. Box 20895
Fountain Valley, CA 92728-0895

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www.mwdoc.com

March 1, 2016

Mr. Jeffrey Kightlinger
General Manager
Metropolitan Water District of Southern CA
700 North Alameda Street
Los Angeles, CA 90012

Dear Mr. Kightlinger:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Sincerely,

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March 1, 2016

Ms. Danielle Gerardo
Administrative Assistant/Secretary
Midway City Sanitary District
14451 Cedarwood Avenue
Westminster, CA 92683

Dear Ms. Gerardo:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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March 1, 2016

Ms. Maria Ayala
Clerk of the Board
Orange County Sanitation District
10844 Ellis Ave.
Fountain Valley, CA 92708

Dear Ms. Ayala:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Sincerely,

Karl W. Seckel
Assistant Manager

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

Street Address:
18700 Ward Street
Fountain Valley, California 92708

Mailing Address:
P.O. Box 20895
Fountain Valley, CA 92728-0895

(714) 963-3058
Fax: (714) 964-9389
www.mwdoc.com

March 1, 2016

Mr. Dan Ferons
Co-Administrator
San Juan Basin Authority
26111 Antonio Parkway
Rancho Santa Margarita, CA 92688

Dear Mr. Ferons:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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March 1, 2016

Ms. Kelly Berry
Clerk of the Board
Santa Ana Watershed Project Authority
11615 Sterling Ave.
Riverside, CA 92503

Dear Ms. Berry:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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March 1, 2016

Ms. Betty Burnett
General Manager
South Orange County Wastewater Authority
34156 Del Obispo
Dana Point, CA 92629

Dear Ms. Burnett:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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March 1, 2016

Ms. Chris Montana
Clerk of the Board
Sunset Beach Sanitary District
P.O. Box 1185
Sunset Beach, CA 90742

Dear Ms. Montana:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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March 1, 2016

Mr. Jim Byerrum
Treasurer
California Domestic Water Co.
15111 Whittier Blvd., Suite 220
Whittier, CA 90603

Dear Mr. Byerrum:

NOTICE OF PREPARATION OF THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY'S 2015 URBAN WATER MANAGEMENT PLAN

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Sincerely,

Karl W. Seckel
Assistant Manager

AFFIDAVIT OF PUBLICATION

STATE OF CALIFORNIA,)
) ss.
County of Orange)

I am a citizen of the United States and a resident of the County aforesaid; I am over the age of eighteen years, and not a party to or interested in the above entitled matter. I am the principal clerk of **The Orange County Register**, a newspaper of general circulation, published in the city of Santa Ana, County of Orange, and which newspaper has been adjudged to be a newspaper of general circulation by the Superior Court of the County of Orange, State of California, under the date of November 19, 1905, Case No. A-21046, that the notice, of which the annexed is a true printed copy, has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following dates, to wit:

May 2, 9, 2016

"I certify (or declare) under the penalty of perjury under the laws of the State of California that the foregoing is true and correct":

Executed at Santa Ana, Orange County, California, on

Date: May 9, 2016

Signature

The Orange County Register
625 N. Grand Ave.
Santa Ana, CA 92701
(714) 796-2209

PROOF OF PUBLICATION

NOTICE OF PUBLIC HEARING

2015 URBAN WATER MANAGEMENT PLAN

Municipal Water District of Orange County ("MWDOC"), has directed the preparation of a 2015 Urban Water Management Plan ("UWMP") for the MWDOC service area pursuant to the Urban Water Management Planning Act ("Act"). Adoption of the 2015 UWMP is required under the Act by July 1, 2016.

The Act requires that an urban water supplier hold a public hearing before adopting a plan. MWDOC's public hearing is scheduled for May 18, 2016 at 8:30 a.m. and will take place at the MWDOC Board Room located in the MWDOC Administration Building at 18700 Ward Street, Fountain Valley CA 92708.

For additional information regarding the public hearing, please contact Maribeth Goldsby, MWDOC Board Secretary, at (714)593-5006.

Published: Orange County Register May 2, 9, 2016 10156597

AFFIDAVIT OF PUBLICATION

STATE OF CALIFORNIA,)
) ss.
County of Orange)

I am a citizen of the United States and a resident of the County aforesaid; I am over the age of eighteen years, and not a party to or interested in the above entitled matter. I am the principal clerk of **The Orange County Register**, a newspaper of general circulation, published in the city of Santa Ana, County of Orange, and which newspaper has been adjudged to be a newspaper of general circulation by the Superior Court of the County of Orange, State of California, under the date of November 19, 1905, Case No. A-21046, that the notice, of which the annexed is a true printed copy, has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following dates, to wit:

May 2, 9, 2016

"I certify (or declare) under the penalty of perjury under the laws of the State of California that the foregoing is true and correct":

Executed at Santa Ana, Orange County, California, on

Date: May 9, 2016

Signature

The Orange County Register
625 N. Grand Ave.
Santa Ana, CA 92701
(714) 796-2209

PROOF OF PUBLICATION

NOTICE OF PUBLIC HEARING

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Published: Orange County Register May 2, 9, 2016 10156597

APPENDIX F

Adopted UWMP Resolution

RESOLUTION NO. 2029

**RESOLUTION OF THE BOARD OF DIRECTORS OF
THE MUNICIPAL WATER DISTRICT OF ORANGE COUNTY
ADOPTING THE
2015 URBAN WATER MANAGEMENT PLAN**

WHEREAS, the California Urban Water Management Planning Act requires urban water suppliers providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually prepare and adopt, in accordance with prescribed requirements, an urban water management plan every five years; and

WHEREAS, the California Urban Water Management Planning Act specifics the requirements and procedures for adopting such Urban Water Management Plans; and

WHEREAS, the Board of Directors of the Municipal Water District of Orange County has duly reviewed, discussed, and considered such Urban Water Management Plan and has determined the 2015 Urban Water Management Plan to be consistent with the California Urban Water Management Planning Act and to be an accurate representation of the water resource plan for the Municipal Water District of Orange County.

NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of the Municipal Water District of Orange County that, on May 18, 2016 this District hereby adopts this 2015 Urban Water Management Plan for submittal to the state of California.

Said Resolution was adopted, on roll call, by the following vote:

AYES:	Directors Finnegan, Hinman, Osborne, Tamaribuchi & Thomas
NOES:	Director Barbre
ABSENT:	Director Dick
ABSTAIN:	None

I hereby certify that the foregoing is a true and correct copy of Resolution No. 2029adopted by the Board of Directors of Municipal Water District of Orange County at its meeting held on May 18, 2016.

ATTEST:

Maribeth Goldsby

Maribeth Goldsby, Secretary
Municipal Water District of Orange County

APPENDIX G

BUMP Methodology/OC Reliability Study

Final Technical Memorandum #1

To: *Karl Seckel, Assistant Manager/District Engineer*
Municipal Water District of Orange County

From: *Dan Rodrigo, Senior Vice President, CDM Smith*

Date: *April 20, 2016*

Subject: Orange County Reliability Study, Water Demand Forecast and Supply Gap Analysis

1.0 Introduction

In December 2014, the Municipal Water District of Orange County (MWDOC) initiated the Orange County Reliability Study (OC Study) to comprehensively evaluate current and future water supply and system reliability for all of Orange County. To estimate the range of potential water supply gap (difference between forecasted water demands and all available water supplies), CDM Smith developed an OC Water Supply Simulation Model (OC Model) using the commercially available Water Evaluation and Planning (WEAP) software. WEAP is a simulation model maintained by the Stockholm Environment Institute (http://www.sei-us.org/weap) that is used by water agencies around the globe for water supply planning, including the California Department of Water Resources.

The OC Model uses indexed-sequential simulation to compare water demands and supplies now and into the future. For all components of the simulation (e.g., water demands, regional and local supplies) the OC Model maintains a given index (e.g., the year 1990 is the same for regional water demands, as well as supply from Northern California and Colorado River) and the sequence of historical hydrology. The planning horizon of the model is from 2015 to 2040 (25 years). Using the historical hydrology from 1922 to 2014, 93 separate 25-year sequences are used to generate data on reliability and ending period storage/overdraft. For example, sequence one of the simulation maps historical hydrologic year 1922 to forecast year 2015, then 1923 maps to 2016 … and 1947 maps to 2040. Sequence two shifts this one year, so 1923 maps to 2015 … and 1948 maps to 2040.

The OC Model estimates overall supply reliability for MET using a similar approach that MET has utilized in its 2015 Draft Integrated Resources Plan (MET IRP). The model then allocates available imported water to Orange County for direct and replenishment needs. Within Orange County, the OC Model simulates water demands and local supplies for three areas: (1) Brea/La Habra; (2) Orange County Basin; (3) South County; plus a Total OC summary (see Figure 1).

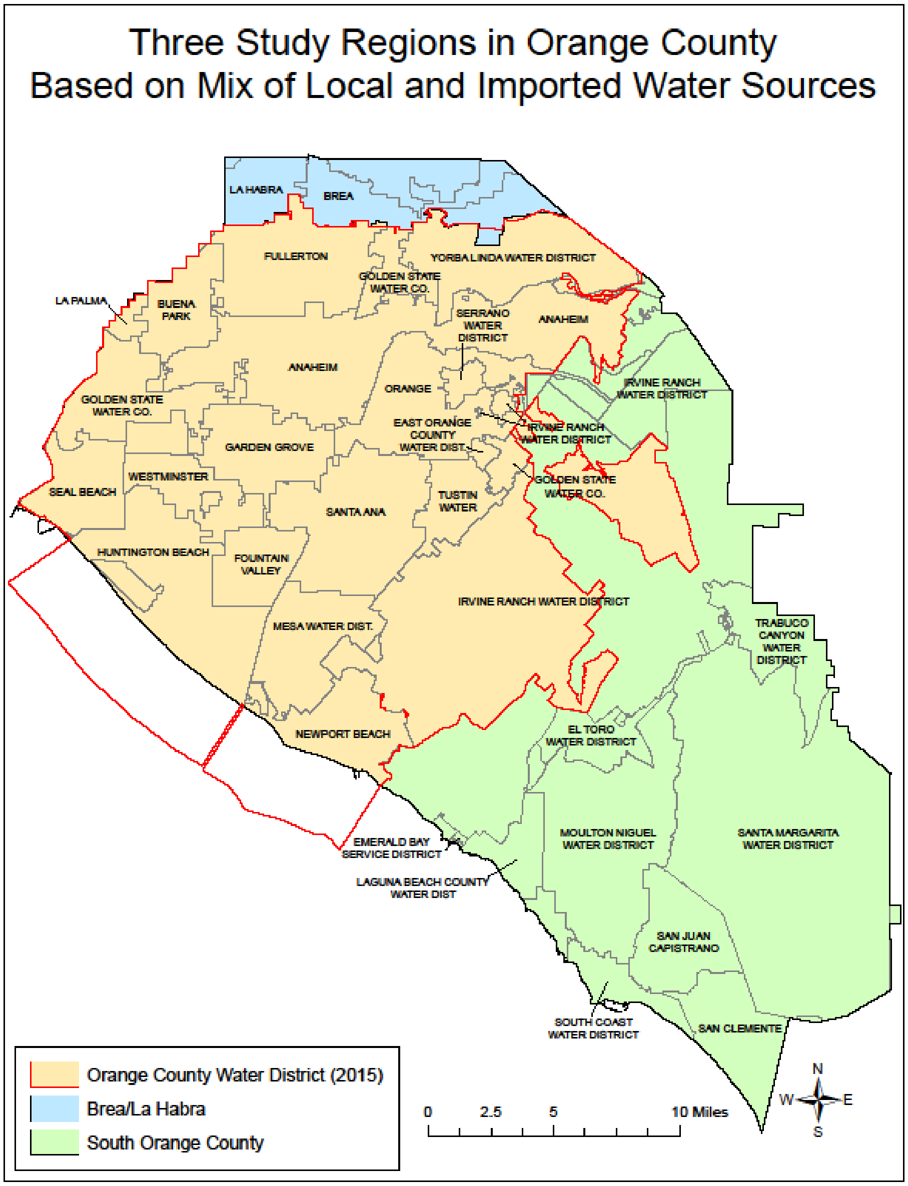

Figure 1. Geographic Areas for OC Study

The OC Model also simulates operations of the Orange County Groundwater Basin (OC Basin) managed by the Orange County Water District (OCWD). Figure 2 presents the overall model schematic for the OC Model, while Figure 3 presents the inflows and pumping variables included in the OC Basin component of the OC Model. A detailed description of the OC Model, its inputs, and all technical calculations is documented in Technical Memorandum #2: Development of OC Supply Simulation Model.

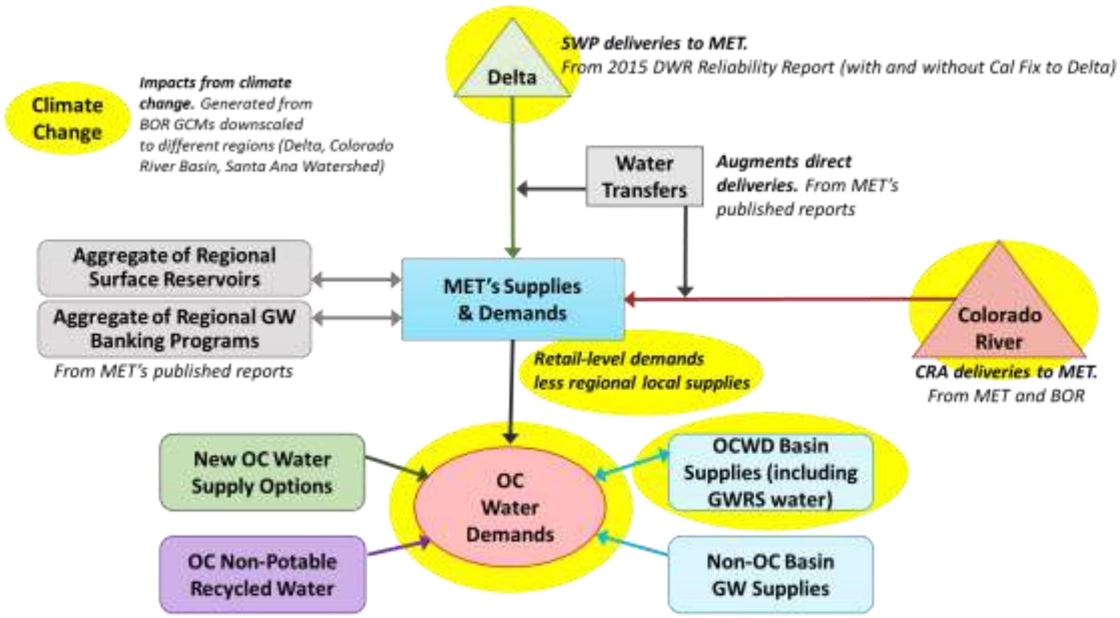

Figure 2. Overall Schematic for OC Model

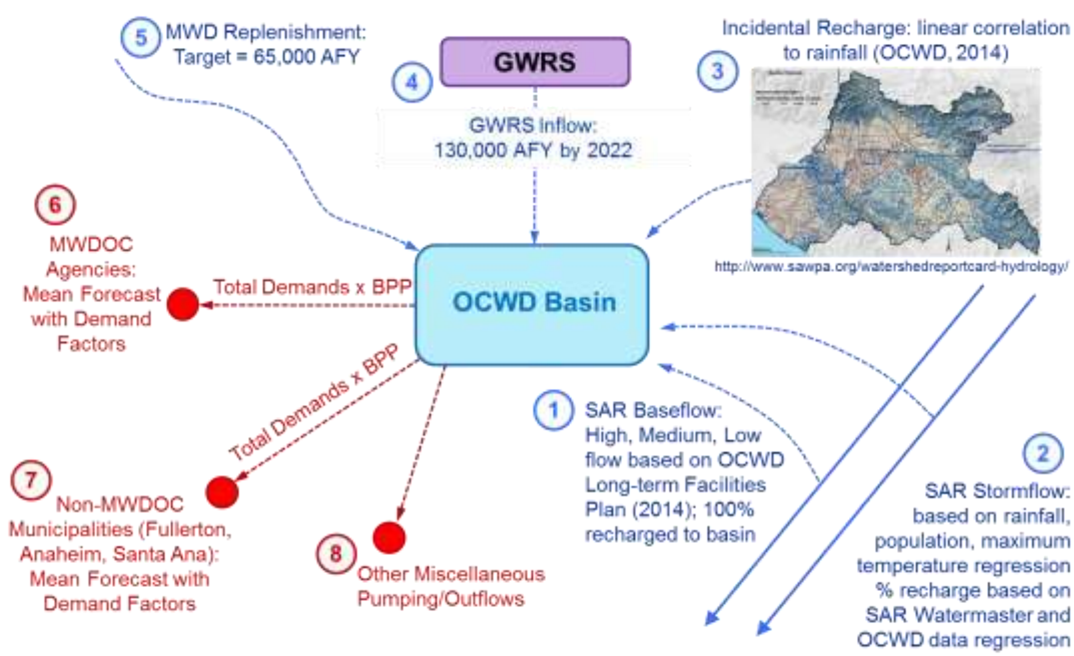

Figure 3. Inflows and Pumping Variables for OC Basin Component of OC Model

The modeling part of this evaluation is a necessity to deal with the number of issues impacting water supply reliability to Orange County. Reliability improvements in Orange County can occur due to water supply investments made by MET, the MET member agencies outside of Orange County, or by Orange County agencies. In this sense, future decision-making regarding reliability of supplies should not take place in a vacuum, but should consider the implications of decisions being made at all levels.

This technical memorandum summarizes the water demand forecast for Orange County and the water supply gap analysis that was generated using the OC Model. The outline for this technical memorandum is as follows:

- Section 1: Water Demand Forecast for Orange County
- Section 2: Planning Scenarios
- Section 3: Water Supply Gap
- Section 4: Conclusions
- Section 5: References

2.0 Water Demand Forecast for Orange County

The methodology for the water demand forecast uses a modified water unit use approach. In this approach, water unit use factors are derived from a baseline condition using a sample of water agency billing data and demographic data. In early 2015, a survey was sent by MWDOC to all water agencies in Orange County requesting Fiscal Year (FY) 2013-14 water use by billing category (e.g., single-family residential, multifamily residential, and non-residential). In parallel, the Center for Demographic Research (CDR) in Orange County provided current and projected demographics for each water agency in Orange County using GIS shape files of agency service areas. Water agencies were then placed into their respective areas (Brea/La Habra, OC Basin, South County), and water use by billing category were summed and divided by the relevant demographic (e.g., single-family water use ÷ single-family households) in order to get a water unit use factor (expressed as gallons per day/demographic unit).

In addition, the water agency survey collected information on total water production. Where provided, the difference between total water production and billed water use is considered non-revenue water. Table 1 summarizes the results of the water agency survey information and calculates the water unit use factors for the three areas within Orange County.

Table 1. Water Use Factors from Survey of Water Agencies in Orange County (FY 2013-14)

	SF Res		MF Res		Com/Instit.		Indust.		Non Revenue	
	Units[1]	Unit Use[2]	Units	Unit Use	Units	Unit Use	Units	Unit Use	total acc	%
Basin Area										
ANAHEIM	50,030	441	58,618	193	169,902	90	19,260	160	63,004	7%
BUENA PARK	16,455	346	8,600	224	31,566	137	4,837	39	19,004	11%
FOUNTAIN VALLEY	12,713	336	6,964	141	30,282	124	2,093	134	17,149	13%
FULLERTON	26,274	454	22,575	176	60,839	115	6,251	398	31,557	5%
GARDEN GROVE	31,400	422	17,580	295	48,394	134	7,221	163	No data	
GSWC	38,038	383	17,218	215	58,901	122	6,857	68		
HUNTINGTON BEACH	44,605	297	35,964	154	69,266	99	10,355	58	52,855	6%
IRVINE RANCH WATER DISTRICT	39,182	444	80,854	196	263,393	80	39,484	207	85,508	9%
MESA WATER DISTRICT	16,585	320	23,173	215	80,999	97	4,832	87	No data	
NEWPORT BEACH	19,455	329	15,517	177	59,754	86			26,517	5%
ORANGE	28,545	470	15,483	246	96,606	97	No data		35,363	9%
SANTA ANA	35,547	461	42,027	288	151,008	96			No data	
TUSTIN	11,788	505	9,435	253	25,265	79	1,293	92	14,178	3%
WESTMINSTER	17,648	318	10,973	215	24,148	109	976	84	20,379	5%
YORBA LINDA WATER DISTRICT	22,046	586	3,746	249	22,164	120	2,745	230	No data	
Weighted Average		**411**		**211**		**97**		**167**		**7.3%**
South County										
IRVINE RANCH WATER DISTRICT	16,581	444	12,864	196	32,554	80			22,730	9%
MOULTON NIGUEL WATER DISTRICT	47,673	345	17,077	189	70,067	156	Included in		55,149	10%
SAN CLEMENTE	12,047	361	9,045	186	22,921	119	commerical/		No data	
SAN JUAN CAPISTRANO	7,176	502	6,146	206	16,483	158	institutional		11,277	3%
SANTA MARGARITA WATER DISTRICT	36,022	436	19,885	268	37,241	254	category		54,129	2%
Weighted Average		**397**		**216**		**158**				**65%**
Brea/La Habra										
BREA	9,094	425	6,898	160	42,654	93	5,931	140	No data	
LA HABRA	11,995	436	8,051	177	17,331	90	680	135	13,674	6%
Weighted Average		**431.06**		**169.31**		**92.13**		**139.49**		**6%**

[1]Units represent:
SF Res = SF accounts or SF housing (CDR) if SF account data looks questionable.
MF Res = total housing (CDR) minus SF units.
Com/Instit = total employment (CDR) minus industrial employment (CDR).
Industrial = industrial employment (CDR).
[2]Unit Use represents billed water consumption (gallons/day) divided by units.

To understand the historical variation in water use and to isolate the impacts that weather and future climate has on water demand, a statistical model of monthly water production was developed. The explanatory variables used for this statistical model included population, temperature, precipitation, unemployment rate, presence of mandatory drought restrictions on water use, and a cumulative measure of passive and active conservation. Figure 4 presents the results of the statistical model for the three areas and the total county. All models had relatively high correlations and good significance in explanatory variables. Figure 5 shows how well the statistical model performs using the OC Basin model as an example. In this figure, the solid blue line represents actual per capita water use for the Basin area, while the dashed black line represents what the statistical model predicts per capita water use to be based on the explanatory variables.

Using the statistical model, each explanatory variable (e.g., weather) can be isolated to determine the impact it has on water use. Figure 6 presents the impacts on water use that key explanatory variables have in Orange County.

Regression Parameters	Basin Area	South Orange County	Brea / La Habra	OC Total
Adjusted R^2 *	0.90	0.91	0.89	0.91
Standard Error **	0.07	0.09	0.09	0.07
Explanatory Variable Significance***	All at <0.0001	All at <0.0001	All at <0.0001	All at <0.0001

* Adjusted R^2 greater than 0.70 considered good overall correlation.
** Standard Errors less than 0.10 considered good overall predictive models.
*** Explanatory Variables are considered statistically significant (valid) at the 0.05 level or less.

Figure 4. Results of Statistical Regression of Monthly Water Production

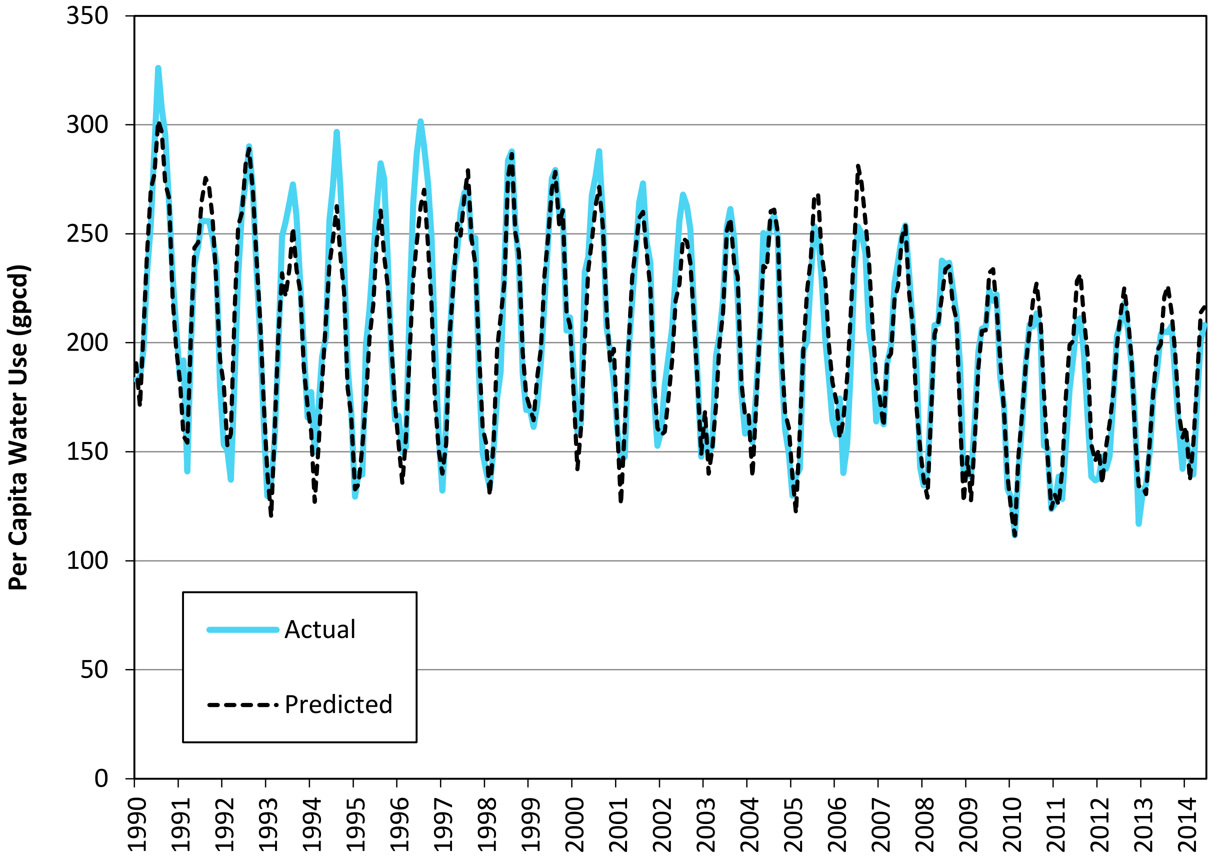

Figure 5. Verification of Statistical Water Use Model

Impacts (% impact on per capita use)	Basin Area	South Orange County	Brea / La Habra	OC Total
Hot/Dry Weather*	+6%	+9%	+6%	+6%
Cool/Wet Weather**	-4%	-7%	-5%	-5%
Economic Recession***	-13%	-12%	-13%	-13%
Drought Conservation	-6%	-5%	-5%	-6%
Passive/Active Cons. (Since 1990)	-20%	-17%	-7%	-19%

*FY 2013-14 for Hot/Dry Weather, relative to average (1990-2014).
**FY 1997-98 for Cool/Wet Weather, relative to average (1990-2014).
*** Comparing unemployment for FY 2009-10 to average (1990-2014).

Figure 6. Impacts of Key Variables on Water Use

2.1 Base Demand Forecast (No Additional Conservation post 2014)

For the purposes of this analysis three types of water conservation were defined. The first type is passive conservation, which results from codes and ordinances, such plumbing codes or model landscape water efficient ordinances. This type of conservation requires no financial incentives and grows over time based on new housing stock and remodeling of existing homes. The second type is active conservation, which requires incentives for participation. The SoCal Water$mart grant that is administered by MET, through its member agencies, provides financial incentives for approved active water conservation programs such as high efficiency toilets and clothes washer retrofits. The third type is extraordinary conservation that results from mandatory restrictions on water use during extreme droughts. This type of conservation is mainly behavioral, in that water customers change how and when they use water in response to the mandatory restrictions. In droughts past, this type of extraordinary conservation has completely dissipated once water use restrictions were lifted—in other words curtailed water demands fully "bounced back" (returned) to pre-curtailment use levels (higher demand levels, within a relatively short period of time (1-2 years).

The great California Drought, which started around 2010, has been one of the worst droughts on record. It has been unique in that for the last two years most of the state has been classified as extreme drought conditions. In response to this epic drought, Governor Jerry Brown instituted the first-ever statewide call for mandatory water use restrictions in April 2015, with a target reduction of 25 percent. Water customers across the state responded to this mandate, with most water agencies seeing water demands reduced by 15 to 30 percent during the summer of 2015. Water agencies in Southern California also ramped up incentives for turf removal during this time. Because of the unprecedented nature of the drought, the statewide call for mandatory water use restrictions, and the success of turf removal incentives it was assumed that the bounce back in water use after water use restrictions are lifted would take longer and not fully recover. For this study, it was assumed (hypothesized) that unit use rates would take 5 years to get to 85 percent and 10 years to get to 90 percent of pre-drought water use levels. After 10 years, it was assumed that water unit use rates would remain at 90 percent of pre-drought use levels throughout the planning period—reflecting a long-term shift in water demands. Table 2 presents the assumed bounce back in water unit use rates (derived from Table 1) for this drought.

Table 2. Bounce Back in Water Unit Use from Great California Drought

Water Billing Sector	Time Period	Brea/La Habra Unit Use (gal/day)	OC Basin Unit Use (gal/day)	South County Unit Use (gal/day)
Single-Family Residential	2015	431	411	397
	2020	366	349	337
	2025 to 2040	388	369	357
Multifamily Residential	2015	169	211	216
	2020	144	179	183
	2025 to 2040	152	190	194
Commercial *(or combined commercial/ industrial for South County)*	2015	92	97	158
	2020	78	83	134
	2025 to 2040	83	87	142
Industrial	2015	139	167	NA
	2020	119	142	NA
	2025 to 2040	126	150	NA

* Units for single-family and multifamily are households, units for commercial and industrial are employment.

Table 3 presents the demographic projections from CDR for the three areas. These projections were made right after the most severe economic recession in the United States and might be considered low given that fact. In fact, *draft* 2015 demographic forecasts do show higher numbers for 2040.

Table 3. Demographic Projections

Demographic	Time Period	Brea/La Habra	OC Basin	South County	Total Orange County
Single-Family Housing	2020	20,463	386,324	133,989	540,776
	2030	20,470	389,734	138,709	548,913
	2040	20,512	392,387	142,008	554,907
Multifamily Housing	2020	18,561	453,758	118,306	590,625
	2030	19,113	468,972	125,030	613,115
	2040	19,585	478,362	126,736	624,683
Commercial Employment *(or combined commercial/ industrial employment for South County)*	2020	63,909	1,254,415	255,050	1,573,374
	2030	64,961	1,304,353	266,553	1,635,867
	2040	65,743	1,343,509	271,808	1,681,060
Industrial Employment	2020	6,583	138,474	NA	145,057
	2030	6,552	137,763	NA	144,315
	2040	6,523	137,066	NA	143,589

To determine the water demand forecast with no additional (post 2014) water conservation, the water unit use factors in Table 2 are multiplied by the demographic projections in Table 3; then a non-revenue percentage is added to account for total water use (see Table 1 for non-revenue water percentage). These should be considered normal weather water demands. Using the statistical results shown back in Figure 4, demands during dry years would be 6 to 9 percent greater; while during wet years demands would be 4 to 7 percent lower. Table 4 summarizes the demand forecast with no additional conservation post 2014. In year 2040, the water demand with no additional conservation for the total county is forecasted to be 617,466 acre-feet per year (afy). In 2014, the actual county water demand was 609,836; in 2015, the demand was 554,339 and the projected forecast for 2016 is 463,890. This represents a total water demand growth of only 1.25 percent from 2014 to 2040. In contrast, total number of households for the county is projected to increase 4.24 percent for the same period; while county employment is projected to increase by 6.22 percent.

Table 4. Normal Weather Water Demand Forecast with No Additional Conservation Post 2014

Brea / La Habra

	Baseline Demand Forecast (no new conservation)					
	SF AFY	MF AFY	COM AFY	IND AFY	Non Rev AFY	Total AFY
2015	9,404	3,140	6,190	1,033	1,186	20,953
2020	8,397	2,992	5,605	874	1,072	18,941
2025	8,894	3,262	6,033	921	1,147	20,257
2030	8,913	3,342	6,105	917	1,157	20,434
2035	8,913	3,501	6,163	913	1,169	20,659
2040	8,919	3,513	6,205	909	1,173	20,719

South County

	Baseline Demand Forecast (no new conservation)					
	SF AFY	MF AFY	COM AFY	IND AFY	Non Rev AFY	Total AFY
2015	56,181	26,940	41,990		7,507	132,616
2020	50,644	24,300	38,355		6,798	120,097
2025	55,512	27,191	42,443		7,509	132,655
2030	56,832	27,562	43,280		7,660	135,335
2035	57,350	27,884	43,970		7,752	136,956
2040	57,635	28,047	44,459		7,809	137,950

OC Basin

	Baseline Demand Forecast (no new conservation)					
	SF AFY	MF AFY	COM AFY	IND AFY	Non Rev AFY	Total AFY
2015	175,544	100,997	127,252	26,027	30,087	459,907
2020	150,978	91,182	116,082	22,015	26,618	406,874
2025	161,270	99,782	127,803	23,190	28,843	440,889
2030	162,368	101,780	131,640	23,073	29,320	448,181
2035	162,772	103,766	134,543	22,958	29,683	453,722
2040	162,969	105,890	137,083	22,840	30,015	458,797

Total Orange County

	Baseline Demand Forecast (no new conservation)					
	SF AFY	MF AFY	COM AFY	IND AFY	Non Rev AFY	Total AFY
2015	241,129	131,076	175,431	27,059	38,780	613,476
2020	210,019	118,473	160,042	22,889	34,488	545,911
2025	225,676	130,236	176,279	24,111	37,499	593,801
2030	228,113	132,685	181,025	23,990	38,137	603,950
2035	229,034	135,151	184,676	23,871	38,604	611,338
2040	229,524	137,450	187,747	23,750	38,996	617,466

2.2 Future Passive and Baseline Active Water Conservation

2.2.1 Future Passive Water Conservation

The following future passive water conservation estimates were made:

- High efficiency toilets – affecting new homes and businesses (post 2015) and remodels
- High efficiency clothes washers – affecting new homes (post 2015)
- Model Water Efficient Landscape Ordinance – affecting new homes and businesses (post 2015)

High Efficiency Toilets

A toilet stock model was built tracking different flush rates over time. All new homes (post 2015) are assumed to have one gallon per flush toilets. This model also assumes a certain amount of turn-over of older toilets due to life of toilet and remodeling rates. This analyses was done for single-family, multifamily and non-residential sectors. The following assumptions were made:

- Number of toilet flushes is 5.5 per person per day for single-family and multifamily homes.
- Household size is calculated from CDR data on persons per home. In single-family, household size decreases over time.
- Number of toilet flushes is 2.5 per employee per day for non-residential.
- Replacement/remodeling rates are 7% per year for 5 gal/flush toilet; 6% per year for 3.5 gal/flush toilets; and 5% per year for 1.6 gal/flush toilets.

Table 5 shows this toilet stock model for the OC Basin for single-family and non-residential sectors as an example.

Table 5. Toilet Stock Model for OC Basin (example)

OC Basin Single-Family										
#		Total	Portion of Homes with Gal/Flush Toilets						Savings	Savings
Flushes	Year	Housing	7	5	3.5	1.6	1	Av Flush	(GPD/H)	(AFY)
17.40	2000	348,114	3,133	53,261	123,232	168,487	-	2.84		
17.40	2013	379,999	-	4,794	27,111	348,094	-	1.78		
17.40	2015	381,806	-	4,122	23,858	313,285	40,541	1.69		
17.37	2020	386,324	-	2,680	16,700	234,964	131,980	1.50	3.32	1,435
17.31	2025	389,734	-	-	11,690	176,223	201,821	1.35	5.98	2,610
17.23	2030	392,387	-	-	8,183	132,167	252,037	1.25	7.54	3,312
17.14	2035	393,363	-	-	5,728	99,125	288,509	1.19	8.64	3,806
17.05	2040	393,840	-	-	4,010	74,344	315,486	1.14	9.43	4,159

OC Basin Non-Residential										
#			Portion of Emp with Gal/Flush Toilets						Savings	Savings
Flushes	Year	Empl	7	5	3.5	1.6	1	Av Flush	(GPD/E)	(AFY)
3,298,440	2015	1,319,376	-	13,194	131,938	461,782	712,463	1.50		
3,510,508	2020	1,404,203	-	8,576	92,356	346,336	956,935	1.34	0.41	641
3,633,438	2025	1,453,375	-	5,574	64,649	259,752	1,123,399	1.23	0.67	1,083
3,729,448	2030	1,491,779	-	3,623	45,255	194,814	1,248,087	1.16	0.84	1,404
3,801,693	2035	1,520,677	-	2,355	31,678	146,111	1,340,533	1.12	0.96	1,635
3,864,600	2040	1,545,840	-	1,531	22,175	109,583	1,412,551	1.08	1.04	1,808

High Efficiency Clothes Washers

It was assumed that all new clothes washers sold after 2015 would be high efficiency and roughly save 0.033 afy per washer[1]. These savings would only apply to new homes (post 2015), and only for the single-family sector.

Model Water Efficient Landscape Ordinance (2015)

The new California Model Water Efficient Landscape Ordinance (MWELO) will take place in 2016. For single-family and multifamily homes it will require that 75 percent of the irrigable area be California Friendly landscaping with high efficiency irrigation systems, with an allowance that the remaining 25 percent can be turf (high water using landscape). For non-residential establishments it will require 100 percent of the irrigable area to be California Friendly landscaping with high efficiency irrigation systems (and no turf areas). There are exemptions for non-potable recycled water systems and for parks and open space. To calculate the savings from this ordinance a parcel database provided by MWDOC was analyzed. This database had the total irrigable area and turf area delineated for current parcels. For each parcel, a target water savings was set depending on the sector. For residential parcels, 25 percent of the total irrigable area was assumed to be turf and the savings from a non-compliant parcel was estimated. For each square feet of turf conversion the estimate savings is 0.00013 afy[1]. Table 6 summarizes the per parcel savings for the total county using this method.

Table 6. Estimated Parcel Savings from MWELO for Total Orange County

Parcel Type	Number of Parcels	Total Irrigable Area (sq. feet)	Current Turf Area (sq. feet)	Turf Conversion (sq. feet)*	Turf Conversion (sq. ft / parcel)	Conservation Savings (afy/parcel)
Single-Family Residential	527,627	2,114,679,368	897,177,779	368,507,937	698	0.091
Multifamily Residential	555,255	155,315,983	51,697,361	12,868,365	23	0.003
Businesses (Non-Residential)	1,623,307	499,127,269	212,043,667	212,043,667	131	0.017

* Assumes 25% turf conversion for single-family and multifamily, and 100% for businesses.

The conservation savings in afy/parcel where then multiplied by new homes and businesses (post 2015), assuming a 75 percent compliance rate.

2.2.2 Future Baseline Active Water Conservation

To estimate a baseline water savings from future active water conservation measures, the actual average annual water savings for the last seven years for the SoCal Water$mart program within Orange County were analyzed. A continuation of this program through 2040 at similar annual implementation rates was assumed to be representative of a baseline estimate for active water conservation into the future.

[1] Per MET's SoCal Water$mart conservation estimates, table provided by MWDOC (2015).

New active conservation measures or more aggressive implementation of existing active conservation will be evaluated as part of a portfolio analysis of water demand and supply options in Phase 2 of the OC Study.

2.2.3 Total Future Water Conservation Savings

Combing future passive and active water conservation results in a total estimated water savings, which is summarized in Table 7. The total passive and active conservation for the total Orange County is shown in Figure 7.

Table 7. Future Passive and Baseline Active Water Conservation Savings

Brea/La Habra Area

	Single-Family Savings (AFY)					Multifamily Savings (AFY)				Non-Residential Savings (AFY)			
	MWELO	HEC Pass	Toilets	Active	Total	MWELO	Toilets	Active	Total	MWELO	Toilets	Active	Total
2020	186	32	78	8	304	11	51	5	67	63	32	17	112
2025	169	33	131	15	348	13	85	10	108	79	52	34	166
2030	166	34	163	30	394	16	106	20	142	91	67	68	226
2035	156	34	186	61	437	21	127	40	188	101	77	136	314
2040	149	34	203	79	465	21	137	53	211	108	85	177	370

OC Basin

	Single-Family Savings (AFY)					Multifamily Savings (AFY)				Non-Residential Savings (AFY)			
	MWELO	HEC Pass	Toilets	Active	Total	MWELO	Toilets	Active	Total	MWELO	Toilets	Active	Total
2020	272	148	1,435	221	2,076	61	1,217	171	1,449	759	641	556	1,956
2025	430	260	2,610	441	3,742	96	2,165	342	2,603	1,199	1,083	1,112	3,394
2030	542	347	3,312	883	5,084	118	2,738	684	3,540	1,542	1,404	2,224	5,170
2035	557	379	3,806	1,766	6,509	139	3,182	1,369	4,690	1,801	1,635	4,447	7,883
2040	544	395	4,159	2,472	7,570	162	3,537	1,916	5,615	2,026	1,808	6,226	10,059

South County

	Single-Family Savings (AFY)					Multifamily Savings (AFY)				Non-Residential Savings (AFY)			
	MWELO	HEC Pass	Toilets	Active	Total	MWELO	Toilets	Active	Total	MWELO	Toilets	Active	Total
2020	558	251	507	116	1,432	11	335	160	506	582	119	329	1,029
2025	812	406	877	232	2,326	22	599	321	942	960	202	657	1,819
2030	972	514	1,148	463	3,097	25	761	642	1,428	1,133	257	1,314	2,704
2035	990	556	1,332	927	3,805	27	876	1,283	2,187	1,275	298	2,628	4,201
2040	967	580	1,480	1,112	4,139	29	969	1,540	2,537	1,376	327	3,154	4,857

Total County

	Single-Family Savings (AFY)					Multifamily Savings (AFY)				Non-Residential Savings (AFY)			
	MWELO	HEC Pass	Toilets	Active	Total	MWELO	Toilets	Active	Total	MWELO	Toilets	Active	Total
2020	1,017	431	2,020	344	3,812	83	1,602	337	2,022	1,404	792	901	3,097
2025	1,411	698	3,618	688	6,416	132	2,848	673	3,653	2,238	1,337	1,803	5,378
2030	1,680	895	4,624	1,377	8,575	159	3,606	1,346	5,111	2,766	1,728	3,606	8,100
2035	1,704	969	5,325	2,754	10,752	188	4,185	2,692	7,065	3,177	2,010	7,212	12,399
2040	1,660	1,009	5,842	3,663	12,175	212	4,643	3,509	8,363	3,510	2,219	9,557	15,286

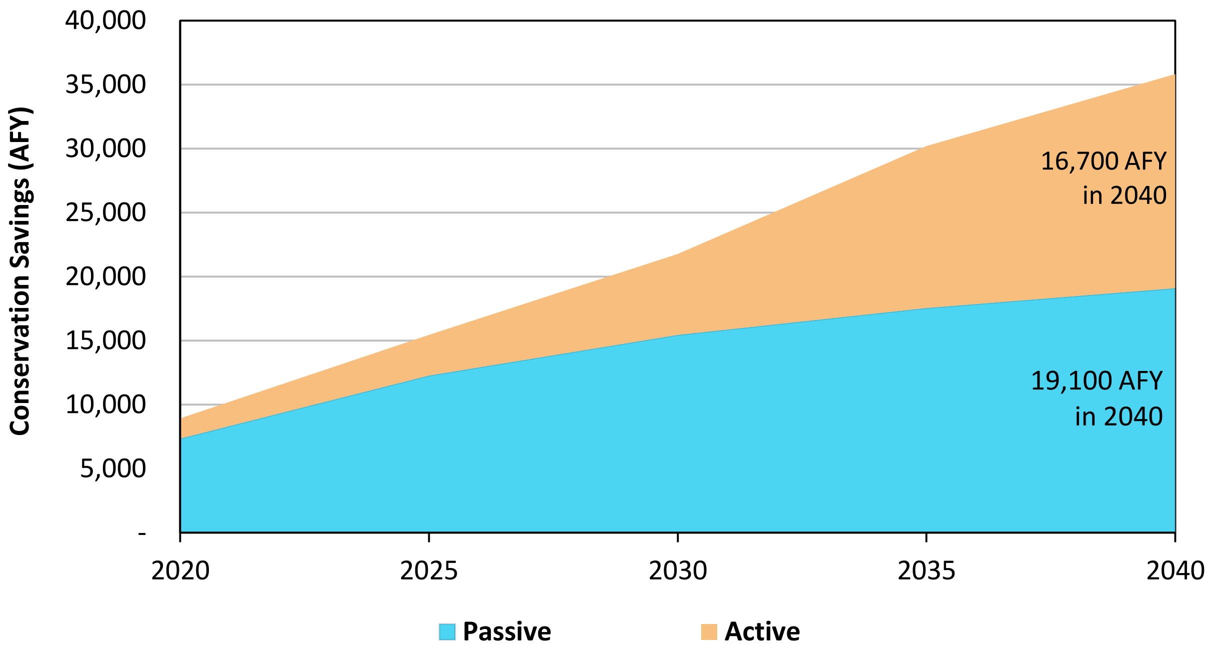

Figure 7. Total Water Conservation in Orange County

1.3 With Conservation Demand Forecast

Subtracting the future water conservation savings shown in Table 7 from the base water demand forecast shown in Table 4 results in the water demand forecast with conservation that is used to model potential water supply gaps for the OC Study. Table 8 presents the demand forecast by area and total Orange County, while Figure 8 presents the historical and forecasted water demands for total Orange County.

Note: Price elasticity of water demand reflects the impact that changes in retail cost of water has on water use. Theory states that if price goes up, customers respond by reducing water use. A price elasticity value of -0.2 implies that if the real price of water increases by 10%, water use would decrease by 2%. Price elasticity is estimated by detailed econometric water demand models, where price can be isolated from all other explanatory variables. Many times price is correlated with other variables making it difficult to estimate a significant statistical value. In addition, there is a potential for double counting reduction in water demand if estimates of future conservation from active programs are included in a demand forecast because customers who respond to price take advantage of utility-provided incentives for conservation. MET's 2015 IRP considers the impact of price elasticity in their future water demand scenarios, but does not include future active conservation in its demand forecast. The OC Study included future estimates of water conservation from active conservation, and thus did not include a price elasticity variable in its statistical modeling of water demand. Including both price elasticity and active conservation would have resulted in "double counting" of the future water savings.

Table 7. Water Demand Forecast with Conservation

Brea / La Habra

	With Conservation Demand				
	SF AFY	MF AFY	CII AFY	Non Rev AFY	Total AFY
2020	8,094	2,925	6,368	1,043	18,429
2025	8,546	3,154	6,789	1,109	19,598
2030	8,519	3,200	6,796	1,111	19,626
2035	8,475	3,313	6,762	1,113	19,663
2040	8,454	3,302	6,745	1,110	19,611

OC Basin

	With Conservation Demand				
	SF AFY	MF AFY	CII AFY	Non Rev AFY	Total AFY
2020	148,902	89,733	136,077	26,230	400,941
2025	157,528	97,180	147,532	28,157	430,396
2030	157,284	98,240	149,476	28,350	433,350
2035	156,263	99,076	149,552	28,342	433,233
2040	155,399	100,275	149,797	28,383	433,854

South County

	With Conservation Demand				
	SF AFY	MF AFY	CII AFY	Non Rev AFY	Total AFY
2020	49,212	23,793	37,326	6,620	116,951
2025	53,186	26,250	40,624	7,204	127,263
2030	53,735	26,135	40,575	7,227	127,672
2035	53,545	25,697	39,769	7,141	126,151
2040	53,496	25,509	39,602	7,116	125,725

Total Orange County

	With Conservation Demand				
	SF AFY	MF AFY	CII AFY	Non Rev AFY	Total AFY
2020	206,207	116,451	179,770	33,893	536,321
2025	219,260	126,583	194,945	36,470	577,257
2030	219,537	127,575	196,848	36,688	580,647
2035	218,283	128,086	196,082	36,596	579,047
2040	217,349	129,087	196,144	36,610	579,189

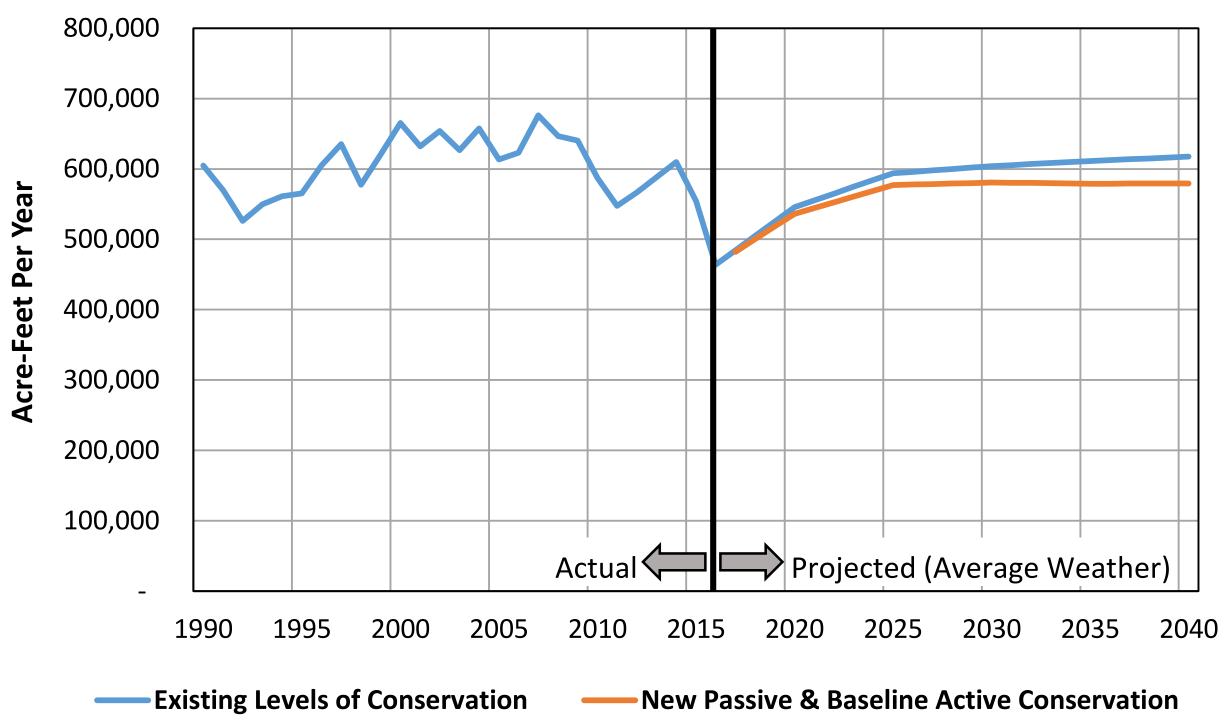

Figure 8. Water Demand Forecast for Total Orange County

3.0 Planning Scenarios

At the start of the Orange County Water Reliability Study, a workgroup was formed made up of representatives from Orange County water agencies. This OC Workgroup met 13 times during the

12-month Phase 1 of the study. During the first four meetings of the OC Workgroup, three basic planning scenarios emerged, each with and without a California WaterFix to the Delta—thus resulting in six scenarios in total. While there was discussion on assigning probabilities or weights to these planning scenarios, consensus was not reached on which scenario was more probable than the others. Assignment of the likelihood that one scenario is more probable than the others will be revisited in Phase 2 of the Orange County Reliability Study. There was, however, general agreement that all of the scenarios represent plausible future outcomes and thus all scenarios should be evaluated in terms of assessing potential water supply gaps (difference between forecasted water demands and existing water supplies). It is important to note that the purpose of estimating the water supply gaps for Orange County is to determine what additional MET and Orange County water supply investments are needed for future reliability planning. Thus, other than the California WaterFix to the Delta, all planning scenarios assume no new additional regional or Orange County water supply investments, with a couple of exceptions. In Orange County, it was assumed that existing and planned non-potable recycling projects would build additional supplies out into the future. It was also assumed that the OCWD GWRS Phase 3 expansion project would be implemented by 2022 to increase the recycled supplies for groundwater replenishment from 100,000 afy to 130,000 afy.

To develop the planning scenarios, the OC Workgroup considered the following parameters:

- California WaterFix to Sacramento-San Joaquin Delta (Cal Fix), which impacts the reliability of the State Water Project.
- Regional MET water demands and supplies, which impacts the availability of water from MET and supply reliability for Orange County.
- Orange County water demands, which impacts the supply reliability for Orange County.
- Santa Ana River baseflows, which impacts the replenishment of the OC Basin and the supply reliability for the water agencies within the OC Basin.
- Climate variability impacts on regional and local water demands and supplies, which impacts the availability of water from MET and the supply reliability for Orange County.

The definition of the six scenarios are:

- **Scenario 1a - Planned Conditions, No Cal Fix:** Essentially represents MET's IRP planning assumptions, with very little climate variability impacts (only impacting Delta supplies and not through 2040), no California Fix to the Delta, and no new regional or OC water supply investments.
- **Scenario 1b - Planned Conditions, with Cal Fix:** Same as Scenario 1a, but with new supply from the California Fix to the Delta beginning in 2030.

- **Scenario 2a - Moderately Stressed Conditions, No Cal Fix:** Moderate levels of climate variability impacts (affecting Delta, Colorado River, and Santa Ana watershed), slightly lower regional local supplies than MET assumes in IRP, 4% higher demand growth reflecting climate impacts and higher demographic growth, no California Fix to the Delta, and no new regional or OC water supply investments. The higher demand growth and fewer local supplies reflects potential future impacts if our existing demographics are low and if local supplies become more challenged, a continuation of the trend in recent times.

- **Scenario 2b - Moderately Stressed Conditions, with Cal Fix:** Same as 2a, but with new supply from California Fix to the Delta beginning in 2030.

- **Scenario 3a - Significantly Stressed Conditions, No Cal Fix:** Significant levels of climate variability impacts (affecting Delta, Colorado River, and Santa Ana watershed), 8% higher demand growth reflecting climate impacts and higher demographic growth, no California Fix to the Delta, and no new regional or OC water supply investments.

- **Scenario 3b - Significantly Stressed Conditions, with Cal Fix:** Same as 3a, but with new supply from California Fix to the Delta beginning in 2030.

All of these scenarios were deemed plausible and likely carry about the same likelihood of occurring. While no attempt was made to specifically assign the probability of any one of the six scenarios occurring over the others, some might postulate that Scenario 2 would be the most likely to occur given that most climate experts believe we are already seeing evidence of climate variability impacts today. But even with this postulation, assigning a probability to the success of the Cal Fix would be difficult at this time.

4.0 Water Supply Gap

To plan for future water supply reliability, a gap between forecasted water demands and existing supplies (plus planned projects that are a certainty) should be estimated. In past planning efforts, this gap is often done for average conditions or at best, using one reference drought condition. However, due to recent droughts and environmental restrictions in the Delta, a more sophisticated approach to estimating the potential water supply gap is needed. The OC Model, described in detail in TM #2: Development of OC Supply Simulation Model, uses "indexed-sequential" simulation to evaluate regional water demands and supplies, and Orange County water demands and supplies. All model demands and supply sources are referenced to the same hydrologic index—meaning that if a repeat of the year 1991 occurred, the OC Model would represent the availability of Delta water supplies in 1991 to MET, the availability of Colorado River water supplies in 1991 to MET, and the local Santa Ana watershed conditions in 1991. The OC Model also preserves the historical sequence of the hydrologic years. This is necessary because the source of availability of Delta and Colorado River water supplies are hydrologic models run by California Department of Water Resources (DWR) and the Bureau of Reclamation (BOR). These hydrologic models incorporate water rights (or contract rights) and storage conditions that are run using a specific sequence of hydrologic conditions. Both MET IRP and OC modeling of water supply maintain these sequences in order to preserve the accuracy of the DWR and BOR model inputs. The hydrologic period used by the OC Model is 1922 to 2014 (which differs from MET's IRP which is 1922 to 2012). The forecast period is 2015 to 2040. Thus, in the OC Model there are 93 25-year sequences that are mapped to the forecast period. When the year 2014 is reached in any of the sequences, the next year wraps back around starting in 1922. Table 8 illustrates how the indexed-sequential method works.

Table 8. Illustration of Indexed-Sequential Supply Simulation

Forecast Year	Hydrologic Simulation Year – Sequence 1	Hydrologic Simulation Year – Sequence 2	. . .	Hydrologic Simulation Year – Sequence 93
2015	1922	1923		2014
2016	1923	1924		1922
.	.	.		.
.	.	.		.
.	.	.		.
2040	1947	1948		1946

Using the SWP system as an index, approximately 12 of the 93 historical hydrologic years (13 percent) are considered critically dry; 20 years (22 percent) are considered very wet; and the remaining 61 years (65 percent) are along the below-normal, normal, and above-normal spectrum.

4.1 Assumptions for Supply Gap Analysis

Figure 9 presents the overall assumptions for the water supply gap analysis. Figure 10 presents more specific assumptions regarding groundwater in the OC Basin. In addition to these assumptions, the following summarizes some of the differences between the MET IRP and the supply gap analysis for the OC Study:

- **Simulation Period:** MET IRP uses a historical hydrology from 1922 to 2012; while the OC Study uses a historical hydrology from 1922 to 2014—capturing the recent drought.
- **Cal Fix:** When the Cal Fix is included, MET IRP assumes that new supply from Cal Fix begins in 2020, based on the assumption that a "commitment" to move forward with the Cal Fix project will result in regulatory relief, beginning in 2020; while the OC Study assumes that supplies from Cal Fix begins when project is fully operational in 2030.
- **Water Conservation:** MET IRP only includes new passive conservation in their demand forecast (with new active conservation being reserved as a new supply option); while the OC Study assumes new passive and baseline new active conservation for water demands in Orange County (additional new active conservation will be evaluated in Phase 2 of the OC Study).

- **Climate Variability:** MET IRP only includes minimal impacts of climate variability for Delta water supplies through 2030; while the OC Study includes a range of climate scenario impacts on water supplies from Delta, Colorado River and Santa Ana Watershed through 2040.

Water Demands (AFY)	FY 2014 Actual	FY 2015 Actual	2025 Projected	2040 Projected
MET Demands*	2,300,000	1,850,000	1,920,000	2,028,000
OCWD Basin Demands**	453,000	410,000	425,000	434,000
OC Total Demands**	610,000	554,000	565,000	579,000

* With future passive conservation only ** With future passive and baseline new active conservation

OC Groundwater (AFY)	Brea/La Habra	Net OC Basin	South County	Total
Groundwater Supply	15,000*	188,500**	10,000	213,500

* Based on firm yield from La Habra Basin and groundwater purchases from Main San Gabriel Basin.
** Includes GWRS, SAR baseflows, SAR stormflows, incidental recharge, MET replenishment, and miscellaneous pumping.

OC Non-Potable Recycled Water (AFY)	2015	2040
OC Basin Recycled Water	22,000	27,700
South County Recycled Water	23,900	41,800
Total	45,900	69,500

Note: Irvine Ranch Water District (IRWD) is split between the Basin and South County

Figure 9. Overall Assumptions for Water Supply Gap Analysis

OC Basin Groundwater (AFY)	Near-Term	Long-Term	Range Within Model
Groundwater Replenishment System (GWRS)	100,000	130,000	100,000 to 130,000
SAR Baseflow (mid level assumption)	53,000	53,000	34,000 to 53,000
SAR Stormflow (average of all hydrologies)	53,000	53,000	6,000 to 150,000
SAR Incidental Recharge (average of all hydrologies)	59,000	59,000	20,000 to 140,000
MET Replenishment (average of all hydrologies)*	54,000	34,000	0 to 65,000
BEA Outflows	-22,000	-9,000	-22,000 to -9,000
Misc. Pumping (golf courses, etc.)	-8,500	-8,500	-8,500
Net Groundwater for OC Basin Agencies	**288,500**	**311,500**	**168,000 to 455,000**

* While OCWD replenishment target is 65,000 AFY, replenishment water is not assumed to be taken during very wet years when SAR stormflows are high, and only a portion of replenishment water is available during years in which MET is in allocation of imported water.

Figure 10. Assumptions for Groundwater in OC Basin

4.2 Availability of Water from MET

Key to the assessment of water reliability for Orange County is estimating the availability of imported water from MET under a wide range of scenarios. Availability of MET water to Orange County is a function of the water demands on MET and the reliability of imported water from the Colorado River and Delta to MET, supplemented by withdrawals from various MET storage accounts.

4.2.1 Demands on MET

MET water demands represent that difference between regional retail water demands (inclusive of groundwater replenishment) and regional local supplies (which includes groundwater, Los Angeles Aqueducts, surface reservoirs, groundwater recovery, recycled water, and seawater desalination). Table 9 presents the MET demand forecast under normal/average weather conditions.

A significant challenge for MET in terms of reliability planning is it represents the "swing" water supply for the region. This compounds the variability on demands on MET due to weather and hydrology. For retail water demands, variations in weather can cause water use to change ± 5 to 9 percent in any given year due to varying demands for irrigation and cooling. In addition to retail water demand variability, local supplies can vary ± 80 percent for the Los Angeles Aqueducts and ± 55 percent for surface reservoirs. Thus, the variability for demands on MET in any given year can be ± 15 to 25 percent. This fact alone makes storage so key in assuring supply reliability for MET and the region.

Table 9. Demands on MET

Total Demand (AFY)	2020	2030	2040
Retail M&I	3,707,546	3,865,200	3,954,814
Retail Agricultural	169,822	163,121	159,537
Seawater Barrier	66,500	66,500	66,500
Replenishment	292,777	272,829	272,847
Total Demand	**4,236,645**	**4,367,650**	**4,453,698**
Local Supplies (AFY)			
Groundwater Production	1,308,101	1,321,220	1,322,197
Surface Production	113,705	113,705	113,705
Los Angeles Aqueduct	261,100	264,296	267,637
Seawater Desalination	50,637	50,637	50,637
Groundwater Recovery	142,286	158,816	162,688
Recycled Water	425,131	468,862	495,698
Other Non-Metropolitan Imports	13,100	13,100	13,100
Total Local Supplies	**2,314,061**	**2,390,637**	**2,425,663**
Demand On MET (AFY)			
Consumptive Use	1,743,866	1,826,245	1,880,131
Seawater Barrier	11,635	8,708	5,877
Replenishment	167,083	142,060	142,027
Total Net Demand on Metropolitan	**1,922,584**	**1,977,013**	**2,028,035**

4.2.2 Supplies from Colorado River and Delta

MET's water supply from the Colorado River, via the Colorado River Aqueduct (CRA), has historically been the backbone to MET's supply reliability. Before the settlement agreement between lower Colorado River Basin states and water agencies that use Colorado River water within California, MET kept the CRA full at 1.2 million acre-feet (maf) per year or nearly at that level in many years. The settlement agreement requires California to live within its 4.4 maf apportionment, and dictates how Colorado River water within California is prioritized. This eliminated most of the surplus water that MET was using to keep the CRA full. To deal with this challenge, MET has developed a number of water transfers and land fallowing programs to mitigate the impacts of the settlement agreement. The 2015 MET IRP is assuming that it will maintain minimum CRA supply of 0.90 maf, with a goal of a full CRA during dry years, when needed (although it is not specified exactly how that will occur).

For the OC Study, we have assumed similar baseline assumptions as the MET IRP, but have added some uncertainties with regard to climate scenarios under Scenario 2 and more significant impacts under Scenario 3. Under significant climate scenario impacts (Scenario 3), where the BOR simulates that Lake Mead elevation would fall below 1,000 feet about 80 percent of the time, the OC Study assumed MET would get a proportionate share of shortages that are allocated by BOR. Exactly how BOR would manage water shortages when Lake Mead elevation falls below 1,000 is uncharted territory, but assuming some proportional allocation of Colorado River water among the Lower Basin states and within California is a plausible scenario. Figure 11 presents the assumed CRA water supplies to MET for the OC Study with (Scenario 3) and without (Scenarios 1 & 2) significant climate scenario impacts. Under the significant climate scenario (Scenario 3), there is a 50 percent probability that CRA deliveries would be below 815,000 afy and a 20 percent probability that CRA deliveries would be below 620,000 afy.

The other main source of imported water available to MET is from the Delta and is delivered to Southern California via the State Water Project (SWP). Although MET's contract for SWP water is 2.0 maf, it has never received that amount. Prior to the QSA (in 2003) when MET relied more heavily on CRA supplies, the maximum water taken by MET from the SWP exceeded 1.1 maf in only three years (1989, 1990 and 2000). Beginning in 2001, MET has tried to maximize their delivery of SWP water. In very wet years, MET typically receives about 1.7 maf of supply from the SWP (about 80 to 85% of their total contract). More typically, MET receives closer to 1.2 maf of supply from the SWP (about 60% of their maximum contract). Droughts and environmental regulatory restrictions in the Delta have greatly impacted the reliability of SWP supply. Biological opinions regarding endangered species not only limit Delta exports during dry years, but have greatly impacted exports during more normal years when water agencies such as MET are counting on such water for storage replenishment.

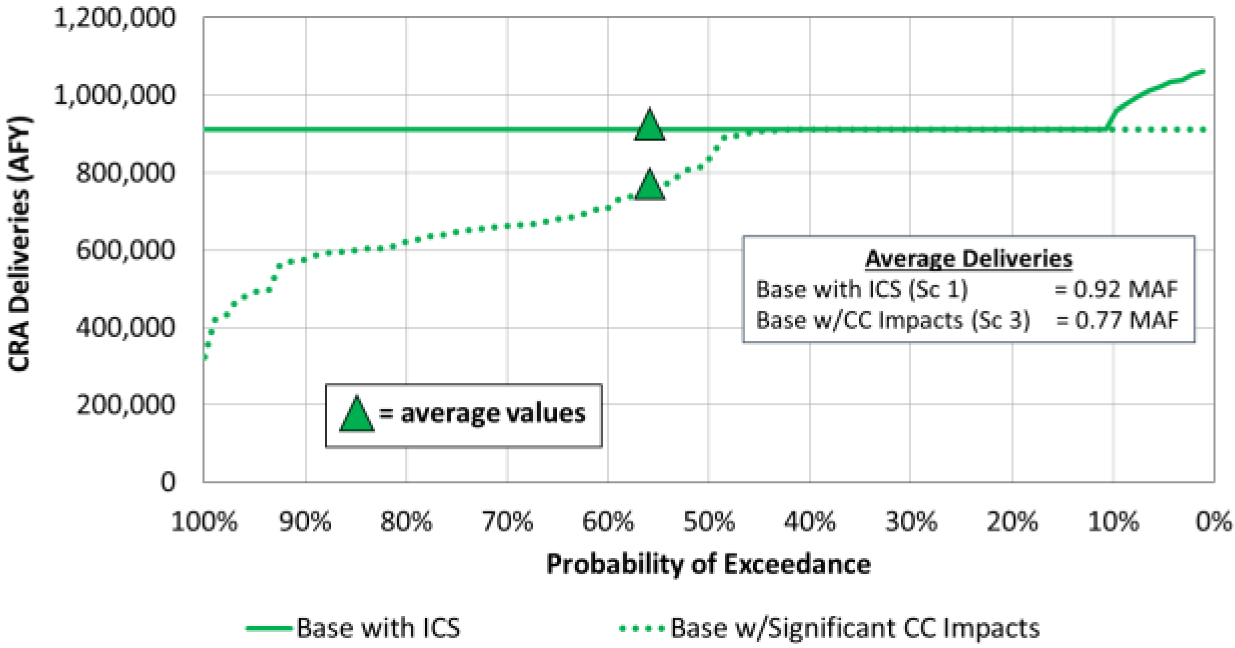

Figure 11. Colorado River Aqueduct Deliveries to MET

To stabilize the decline in SWP deliveries, California has committed to the California WaterFix (Cal Fix) and California EcoRestore. In the long-term, the preferred alternative identified in Cal Fix is expected to increase SWP deliveries (above what they otherwise would have been) by providing more flexible water diversions through improved conveyance and operations. It is important to note that the Cal Fix does not generate **NEW** water supplies per se, but allows supplies lost due to regulatory restrictions to be regained. This project would also provide much needed resiliency during seismic events in the Delta. The new conveyance and diversion facilities will allow for increased water supply reliability and a more permanent solution for flow-based environmental standards. The anticipated implementation of the Cal Fix is expected to be around 2030. Assuming a more flexible, adaptive management strategy, MET is assuming that if Cal Fix moves forward that regulatory relief from further biological opinions in the Delta would occur and SWP deliveries would return to pre-biological opinion deliveries as soon as 2020. However, some might argue this is an optimistic assumption, and there is no certainty that such relief would occur until the project is operational. Therefore for the GAP analysis, the OC Study assumed that improved SWP deliveries from Cal Fix would begin in 2030.

Climate variability can further reduce the reliability of SWP deliveries. The source of water that is pumped from the Delta originates in the Sierra Nevada Mountains as snowpack. It is widely accepted by climate and hydrology experts that climate scenario impacts on snowpack-driven water supplies is even more significant because even a fraction of a degree increase leads to early snowmelt which reduces the ability to capture river flows in surface reservoirs. Using methods described in TM#2, CDM Smith and its climate scenario expert Dr. David Yates estimated the potential impacts to the SWP under significant climate scenario. These estimates are similar to earlier work that California DWR did on climate scenario impacts on SWP reliability. Figure 12 presents the full range of SWP deliveries to MET with and without Cal Fix and with and without significant climate scenario impacts. As shown, the Cal Fix greatly improves the reliability of SWP supplies to MET—with an average increase in supply (restoration of supplies compared to the no project alternative) of over 400,000 afy. Significant climate scenario reduces SWP deliveries by an average of 200,000 afy, even with the Cal Fix.

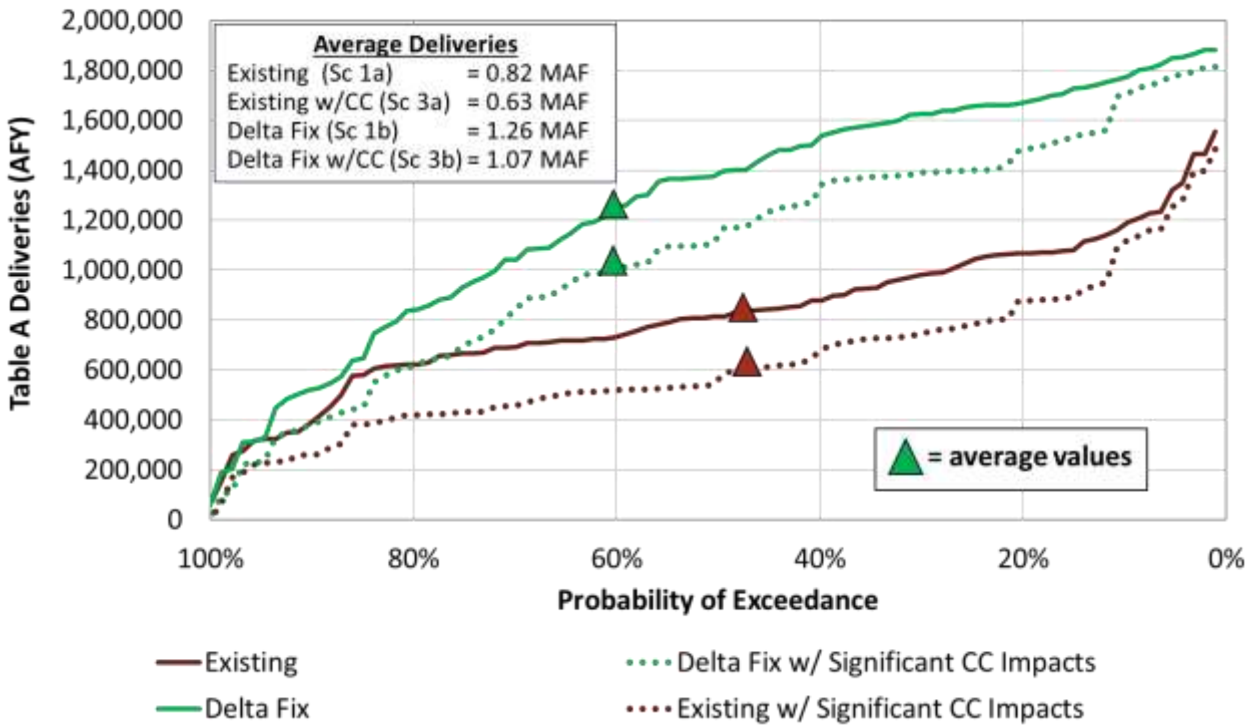

Figure 12. State Water Project Deliveries to MET

4.2.3 Overall MET Reliability

In addition to CRA and SWP water, MET has significant surface storage and groundwater storage programs. MET also has a number of water transfers in the Central Valley. These investments have been critical for the region's supply reliability during droughts. However, since the first MET IRP in 1996 MET has had to allocate its imported water to its member agencies three in the last seven years.

Using the indexed-sequential simulation method described in TM#2, MET water reliability can be illustrated for several hydrologic sequences. Figures 13, 14 and 15 utilize just 2 of the 93 hydrology sequences to demonstrate how the analysis works. Figure 13 shows the MET demands and supplies without a Cal Fix for the forecast period 2015 to 2040 with the last 25-year hydrologic sequence of 1989 to 2014 imposed. In other words, forecast year 2015 is 1989, 2016 is 1990 … and 2040 is 2014. Of all the 93 possible 25-year hydrologic sequences, this one is the worst in terms of cumulative supply shortages.

Figure 14 shows Met demands and supplies without a Cal Fix for a more normal hydrology sequence imposed on the forecast period (this sequence begins with 1950 and ends in 1975). Even with a normal hydrology, there are still some water shortages in the later years. Figure 15, shows this same hydrology (1950 to 1975) but with a Cal Fix. Under this scenario, regional storage replenishes greatly and shortages in the later years are eliminated.

When all 93 hydrologic sequences are simulated, and under all six scenarios representing various climate scenarios and Cal Fix assumptions, the probability of MET shortages exceeding 15 percent can be derived. A regional 15 percent shortage is similar to the allocation MET imposed in 2015. Figure 16 presents this probability of MET shortage. The results presented here for Scenario 1 with and without Cal Fix are similar to those presented in MET's Draft IRP.

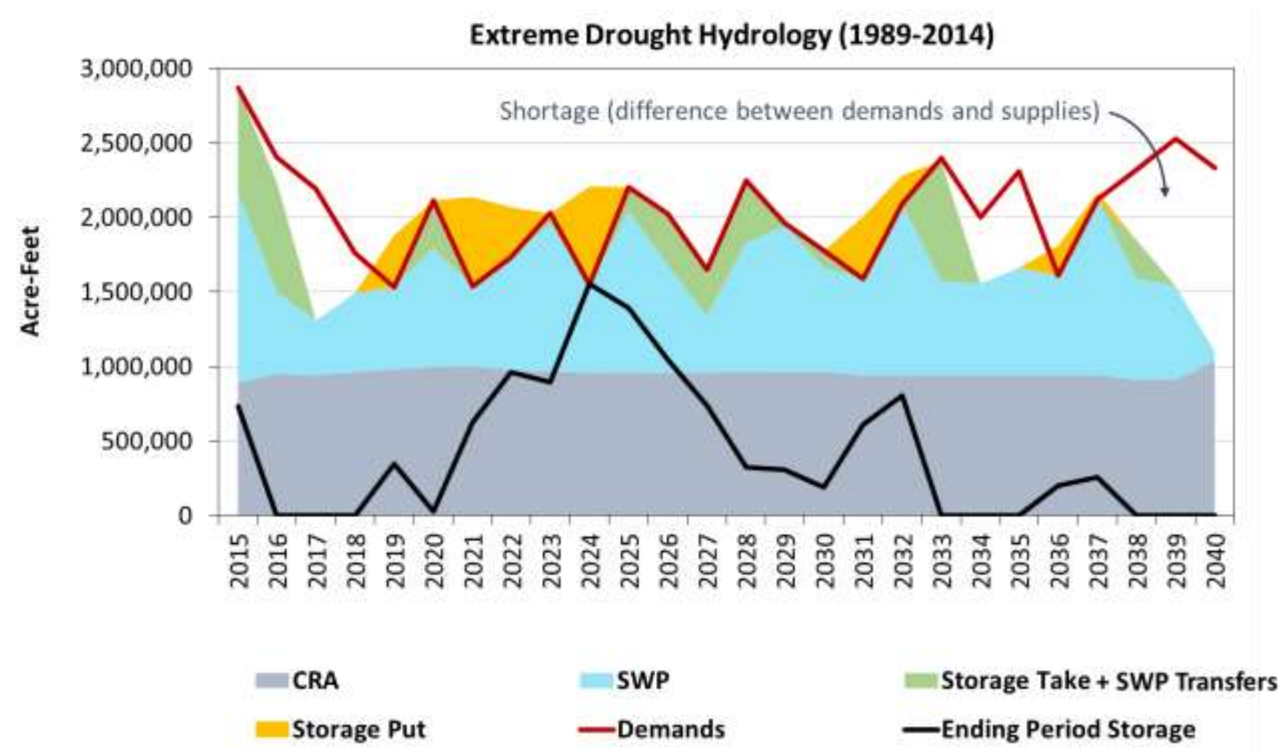

Figure 13. MET Reliability under Drought, for Scenario 1a (no Climate variability, no Cal Fix)

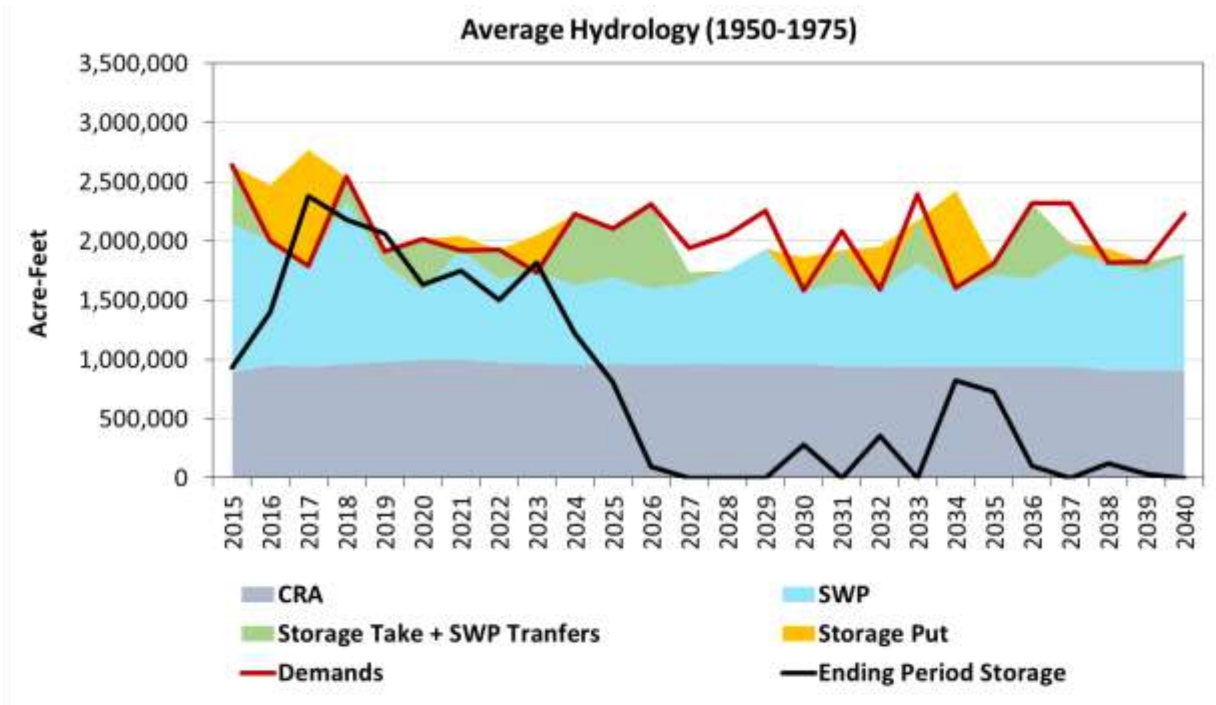

Figure 14. MET Reliability under Average Hydrology, for Scenario 1a (no Climate variability, no Cal Fix)

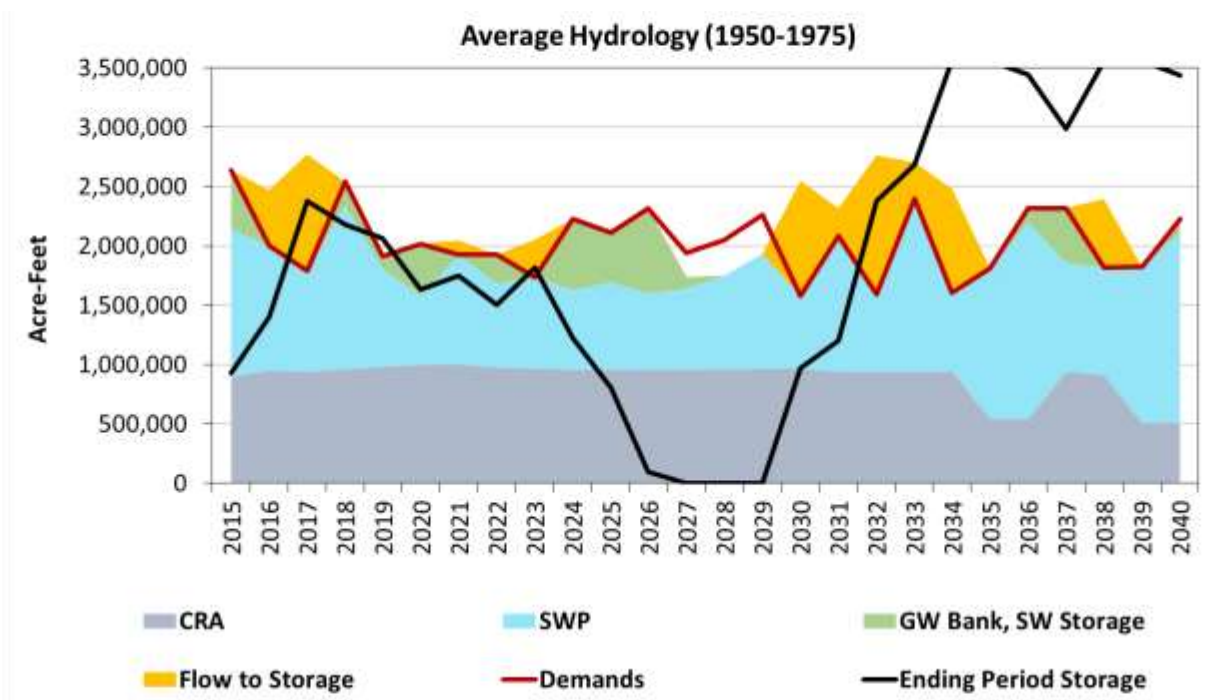

Figure 15. MET Reliability under Average Hydrology, for Scenario 1b (no Climate variability, with Cal Fix)

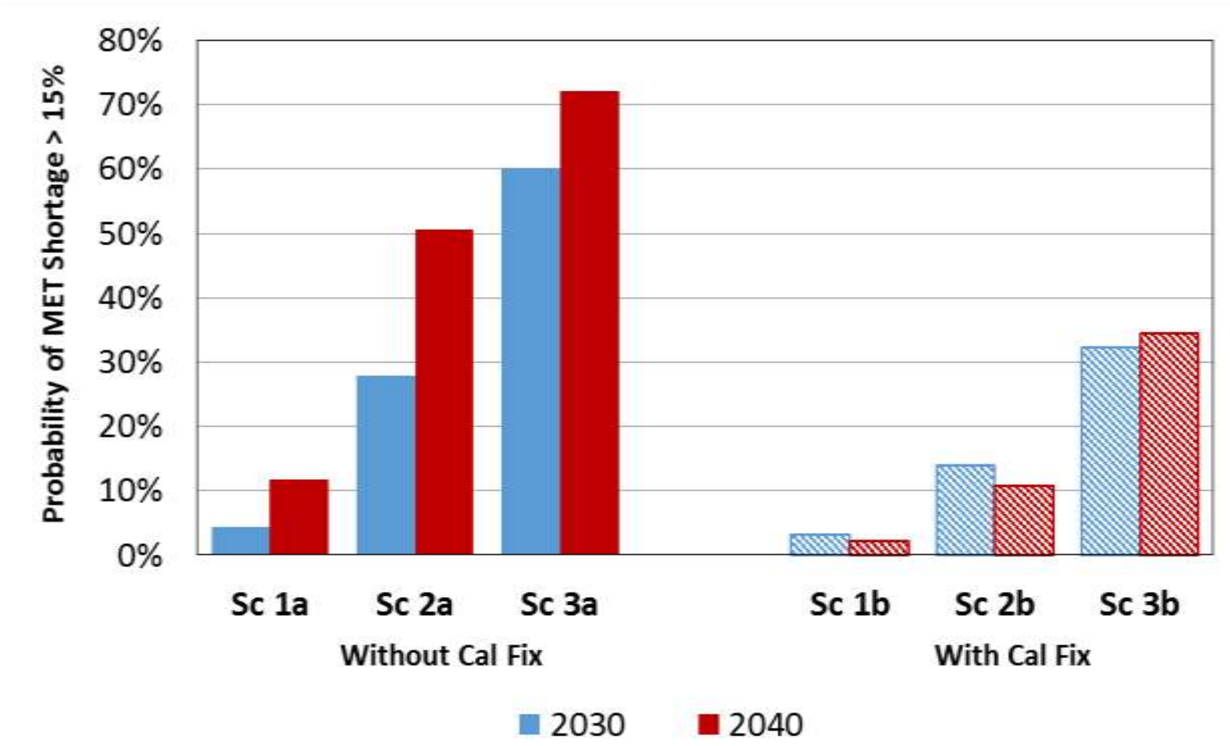

Figure 16. MET Supply Reliability (Percent of Time MET Supply Shortage Greater than 15%)

As shown in Figure 16, the impacts of climate variability (Scenarios 2 and 3) can be significant in increasing the probability and magnitude of MET shortages. In 2040, significant climate scenario (Scenario 3) can increase the probability of shortage by 60 percent without Cal Fix. The analysis also shows the enormous benefit that Cal Fix can have on MET reliability, decreasing the probability of shortage from 50 percent in 2040 to 10 percent under Scenario 2.

4.3 Orange County Water Supply Gap

When MET shortages occur, imported water is allocated to Orange County based on MET's current drought allocation formula. For the OC Basin, the estimation of the water supply gap required that the OC Model be able to simulate the way OCWD manages the OC Basin. The OC Basin's Basin Production Percentage (BPP) was set in the model to look forward each year and estimate all inflows to the basin, then set the BPP so that the cumulative overdraft in the basin would not exceed 500,000 af. In addition, the model does not allow the change in overdraft to exceed certain thresholds—essentially trying to keep some managed overdraft in the basin.

Note: Modeling the management of the OCWD basin is complex, especially with respect to future uncertainties. The discussion of this effort herein was an initial attempt to reflect on how the BPP could be set within the context of a modeling effort. Since this initial effort, CDM Smith and OCWD have met a number of times to refine the analysis for the Phase 2 effort. The refined analysis will be documented in the final Project Technical Memorandum.

Figure 17 presents a simulation of the OC Basin for the forecast period of 2015 to 2040, under an extreme drought hydrology of 1989 to 2014. Under Scenario 1, with no climate scenario and no Cal Fix, Figure 17 shows the pumping from the basin (blue line), the sources of inflows to the basin (shaded color areas), the cumulative basin overdraft (red line), and the BPP (dashed black line read on right-hand axis).

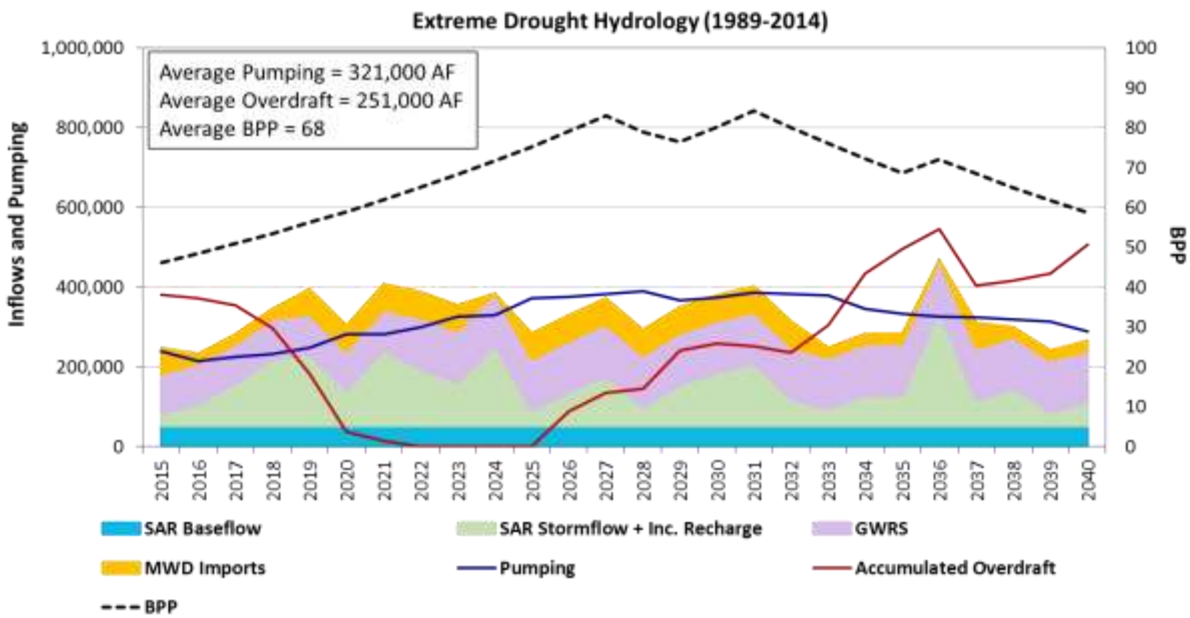

Figure 17. Simulation of OC Basin under Drought, for Scenario 1a (no Climate scenario, no Cal Fix)

When the other local Orange County water supplies from the Brea/La Habra and South County areas are added to the simulation, the OC Model estimates the overall supply reliability for the OC County total. Using all 93 hydrologic sequences, a probability chart can be created. The probability chart shows the percent time that any water shortage occurs and to what magnitude. Figure 18 shows the overall reliability for OC County total for Scenarios 1a, 2a and 3a (no Cal Fix) for the year 2040. As shown on this chart, there is a 50 percent chance that some level of shortage occurs for Scenario 1a. This probability of some shortage occurring increases to 80 percent for Scenario 2a and 98 percent for Scenario 3a. The average shortages are 32,000 afy, 74,000 afy, and 126,000 afy for Scenarios 1a, 2a, and 3a respectively.

Figure 19 compares Scenarios 1, 2, and 3 with and without the Cal Fix. As shown in Figure 19, the Cal Fix dramatically reduces the probability of shortages and thus the average shortages. The average shortages under the Cal Fix are 5,000 afy, 17,000 afy, and 64,000 afy for Scenarios 1b, 2b, and 3b respectively. The one thing to note, however, is that the maximum shortages (which occur about 1 to 3 percent of the time) are not reduced substantially with the Cal Fix. These maximum shortages may require a multipronged strategy to minimize or eliminate, such as new base-loaded supplies, storage, water transfers and mandatory restrictions on some water uses.

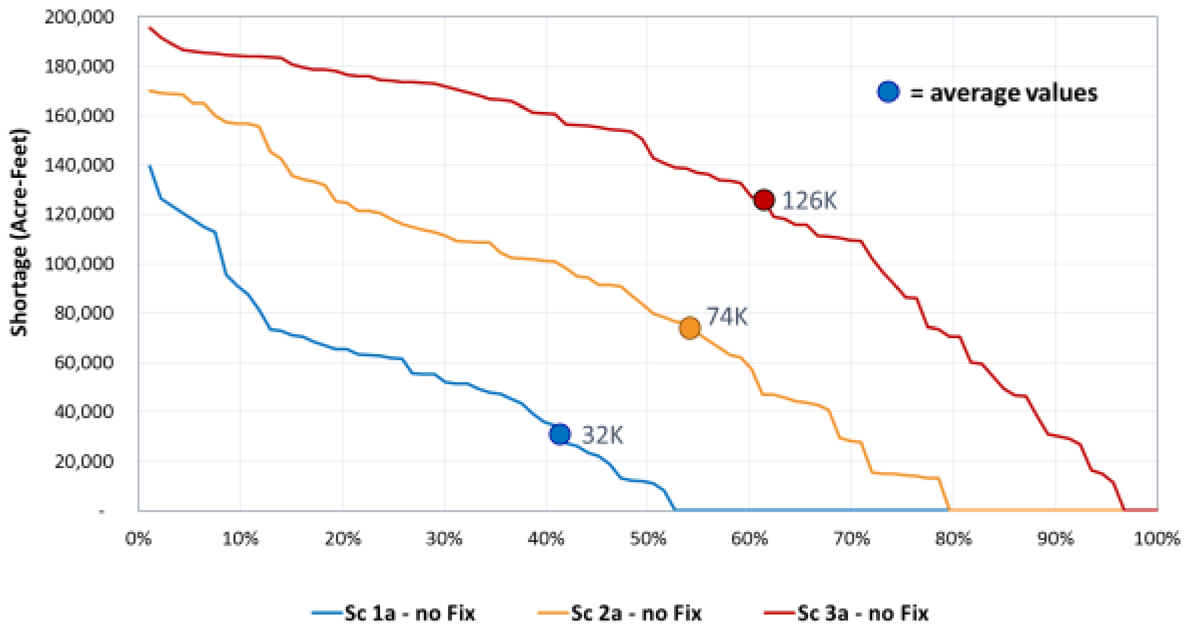

Figure 18. Probability of Water Shortages (Gap) for Orange County Total, No Cal Fix

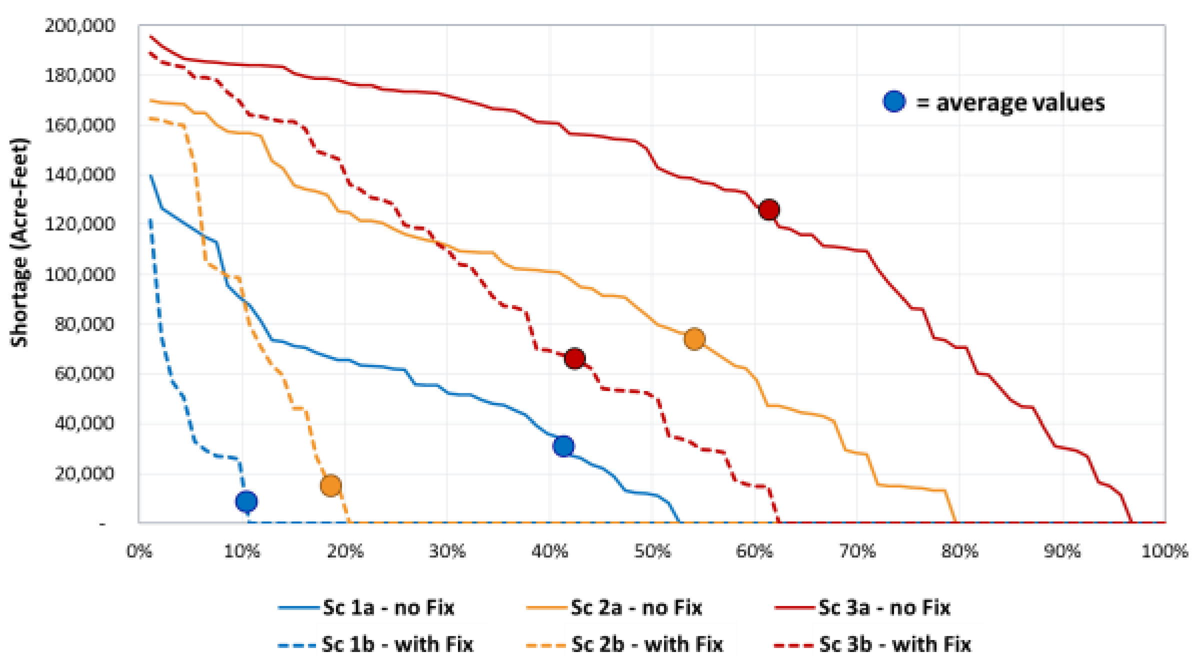

Figure 19. Probability of Water Shortages (Gap) for Orange County Total, with Cal Fix

This supply reliability analysis was done for all three areas of the Orange County, Brea/La Habra, OC Basin, and South County. The average water shortages (averaged for all 93 hydrologic sequences) are shown in Table 10 for all six scenarios.

Table 10. Summary of Average Water Supply Gap for Orange County Areas (acre-feet year)

Area	Scenario 1		Scenario 2		Scenario 3	
Brea / La Habra	**a – no Fix**	**b – with Fix**	**a – no Fix**	**b – with Fix**	**a – no Fix**	**b – with Fix**
2020	110 (1%)	110 (1%)	160 (1%)	160 (1%)	250 (1%)	250 (1%)
2040	820 (4%)	130 (1%)	1,800 (9%)	430 (2%)	3,100 (15%)	1,600 (8%)
OC Basin	**a – no Fix**	**b – with Fix**	**a – no Fix**	**b – with Fix**	**a – no Fix**	**b – with Fix**
2020	3,800 (1%)	3,800 (1%)	5,300 (1%)	5,300 (1%)	9,300 (2%)	9,300 (2%)
2040	19,000 (5%)	2,800 (1%)	49,000 (12%)	11,000 (3%)	85,000 (20%)	42,000 (10%)
South County	**a – no Fix**	**b – with Fix**	**a – no Fix**	**b – with Fix**	**a – no Fix**	**b – with Fix**
2020	2,100 (2%)	2,100 (2%)	3,000 (3%)	3,000 (3%)	4,800 (4%)	4,800 (4%)
2040	12,000 (9%)	1,900 (2%)	23,000 (18%)	5,600 (4%)	38,000 (28%)	20,000 (15%)
OC Total	**a – no Fix**	**b – with Fix**	**a – no Fix**	**b – with Fix**	**a – no Fix**	**b – with Fix**
2020	6,000 (1%)	6,000 (1%)	8,500 (2%)	8,500 (2%)	14,000 (3%)	14,000 (3%)
2040	32,000 (6%)	4,800 (1%)	74,000 (13%)	17,000 (3%)	126,000 (21%)	64,000 (11%)

* Numbers in parentheses ( ) represent % of water demand.

5.0 Conclusions

While no attempt was made during Phase 1 of the OC Study to assign the likelihood of any one of the six scenarios occurring over the others, some might postulate that Scenario 2 would be the most likely to occur given that most climate experts believe we are already seeing evidence of climate variability impacts today. This all said, a number of observations can be made from this study, which are:

1. The most sensitive model parameters are:

    - Whether or not the Cal Fix is implemented, and by when
    - The extent that climate variability impacts our supply reliability, which can take many forms:
        - Loss of the snowpack in the Sierras and Rocky's affecting imported water
        - Higher reservoir evapotranspiration
        - Reduced groundwater recharge statewide and locally
        - Increased water demands for irrigation and cooling from higher temperatures
        - Requires increase storage to capture and utilize available supplies

2. The range in water supply gaps carry different implications, namely:
    - Under Scenario 1a (no climate variability, no Cal Fix), supply shortages are fairly manageable, with average shortages in 2040 being about 6% of demand with an occurrence of about 4 in 10 years.
    - Under Scenario 2a (moderate climate variability, no Cal Fix), supply shortages require moderate levels of new investments, with average shortages in 2040 being about 13% of demands with an occurrence of about 5 in 10 years.
    - Under Scenario 3a (significant climate variability, no Cal Fix), supply shortages require significant levels of new investments, with average shortages in 2040 being about 21% of demands with an occurrence of about 6 in 10 years.
    - Scenarios with Cal Fix <u>significantly reduce average shortages</u> by 85% for Scenario 1, by 77% for Scenario 2, and by 50% for Scenario 3 in 2040.
    - Modest shortages begin in 2020, 8,500 AF per year on average (about 2% of demands) with an occurrence of about 1 in 10 years
3. Decisions made by Orange County water agencies to improve water supply reliability with local water supply investments should consider the following:
    - The large influence of the Cal Fix. MET and Orange County are much more reliable with the Cal Fix; however, the following questions are posed:
        - What is the implication for triggering Orange County supply investments as long as the Cal Fix is an uncertainty?
        - How long should Orange County wait to see where the Cal Fix is headed? 3, 5 or 10 years?
        - What types of Orange County supply investment decisions would be beneficial whether or not the Cal Fix proceeds ahead?
    - MET is potentially undertaking a NEW Indirect Potable Reuse project.
        - What are the implications of this project for decision-making in Orange County?
    - Other MET investments in its recommended 2015 IRP.
        - What success rate does Orange County attribute to these planned MET water supply investments?
        - Will the success rate be influenced by the Cal Fix? (e.g., additional storage without Cal Fix may not provide much benefit if there is no replenishment water during normal hydrologic years)

Phase 2 of the OC Study seeks to address these observations in a collaborative way by providing insights as to the various cost implications of different portfolios made up from MET, the MET member agencies and Orange County water supply options and to discuss policy implications for MET and Orange County. The combined information from Phases 1 and 2 would give local decision makers both an idea of the risk of water supply shortages under a wide range of plausible scenarios, and the range of cost implications for mitigating the shortages. The intent of the OC Study, however, is to not to make any specific recommendations as to which supply options should be implemented, but rather present common information in an objective manner for local decision making.

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