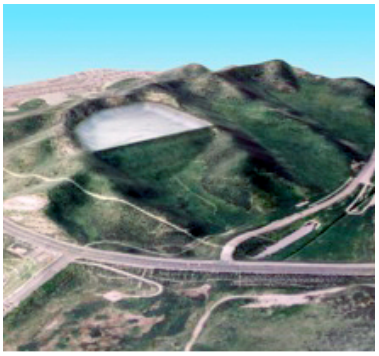
South Orange County Water Reliability Study

2013 Update





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A 2012 Update of the 2004 South Orange County Water Reliability Study

SECTION 1 BACKGROUND

Purpose of Report

Beginning around the year 2000, primarily following the December 13, 1999 failure of the Allen McColloch Pipeline (AMP), which interrupted imported water flow to certain South County communities, the water agencies in South Orange County (SOC) and Municipal Water District of Orange County (MWDOC) began examining system reliability risks and potential improvements in water systems to lengthen the time for which the local agencies could continue providing water to customers without partial outages or entire outages of the imported supply system into SOC. In 2004, the South Orange County Water Reliability Study (SOCWRS) was published. Considerable investments and improvements in the system reliability in SOC have been made based on recommendations from the 2004 report and much progress has been achieved in improving system reliability. A recent request was made to provide an overview of the 2004 Study and to update the analysis to the current times taking into account the improvements made to the system since 2004. Additional thoughts and updates since 2004 will also be incorporated into this summary document along with a discussion of "source" reliability issues, which were **NOT** covered in the 2004 report. A distinction between "system" and "source" reliability is provided below.

Introduction of Reliability Planning

For water agencies, water supply reliability means having the ability to continue supplying customer demands during three primary situations – emergency situations, hydrologic droughts, and regulatory droughts. To the average residential or business consumer of water, water reliability means the water arrives whenever the tap is turned on, 24 hours per day, 365 days per year. Risks or factors that can impact the ability of the regional or local water systems that result in **NOT** meeting demands 100 percent of the time fall into the following broad categories:

1. **Hydrology/climate change effects** – These factors affect the water supply anticipated from the State Water Project and Colorado River watersheds as well as local resources. Climate change may also affect local water demand due to effects of higher temperatures on evapotranspiration of plants in landscaping and agriculture. Appropriate assumptions for supply variations and use of storage in the Metropolitan Water District of Southern California (MET) import systems are also important to understand because Orange County and SOC will always rely to a great extent on imported water sources.

2. **Population projections** – These projections are driven by state and local assumptions for mortality, immigration/emigration, and birth rate and can vary depending on demographics, healthcare, the economy, and cultural/social attributes (e.g., family size).

3. **Regulatory, legal, and environmental factors** – Water supply and demand can be affected by state and federal policies (e.g., pumping restrictions, required conservation, lawsuits, Endangered Species Act).

4. **Natural/man-made disasters** – Earthquakes will interrupt delivery of imported supplies for uncertain durations (depending on the location and severity of the earthquake). Power supply interruptions could temporarily interrupt supply deliveries. Pipeline failures and maintenance shutdowns can affect water reliability.

Most of these events are beyond the ability of the Orange County water community to control from within Orange County. What can be controlled are the production, distribution, and storage of water under various assumptions to determine if and where vulnerabilities exist. We can also examine the risks facing MET with respect to our imported supplies to determine potential future impacts to supplies coming to Orange County, which will likely always make up between 40 and 50 percent of our supplies. To understand water reliability in Orange County, we need to understand the following:

- How probable are the risks identified above?
- Which scenarios are plausible?
- What are the consequences of those scenarios?
- What steps can be taken to mitigate shortage risk and at what cost?
- What policy decisions are needed?
- What information is useful?
- What information gaps exist?
- Should we conduct a quantitative or a qualitative analysis? How do we communicate this information efficiently and effectively to our agencies and the public for decision-making purposes?

Understanding System versus Source Reliability

Reliability issues facing Orange County include both “source” and “system” reliability. The definitions of each are provided below:

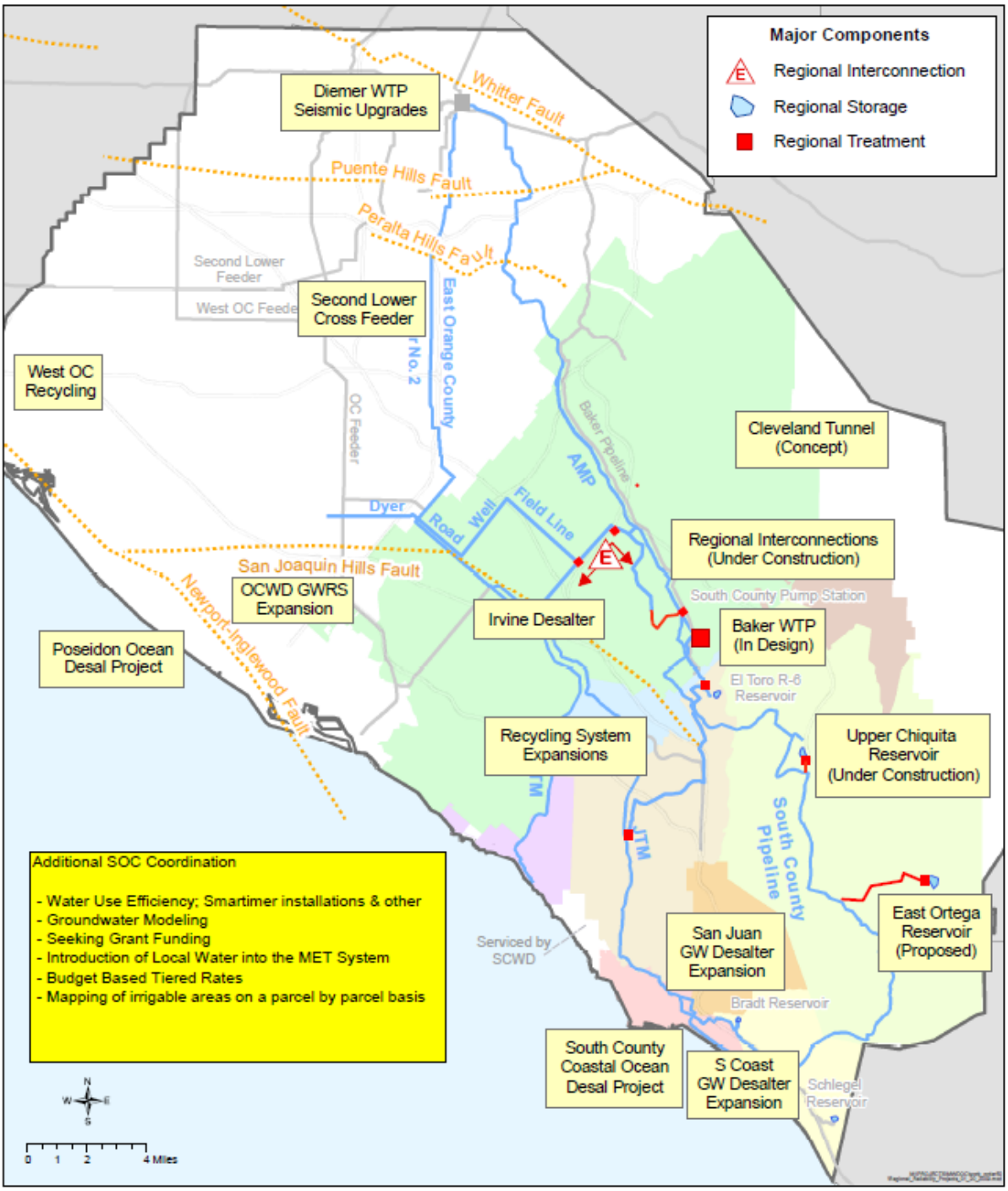
- **System Reliability** – having the infrastructure to continue meeting customer needs with various parts of the local or regional system out of order. We typically think in terms of days or weeks for durations of outages, although an outage of the Colorado River Aqueduct, the State Water Project, or even parts of the MET system could be out of operation for much longer following a major earthquake.
- **Source Reliability** – having the water to put into the system on a sustainable basis into the future (main risks are extended drought, regulatory restrictions, and climate change impacts that impose or create delivery shortages on MET). We would typically be looking at shortages affecting us for durations of 1 to 3 years or longer.
- Local Projects that develop a new source of supply provide **both SYSTEM** and **SOURCE** benefits.
- Emergency Only Projects provide only **SYSTEM** benefits.

2004 South County Reliability Study Participating Agencies

The southern portion of MWDOC's service area that was the focus of 2004 SOCWRS is served by eight retail water agencies:

- El Toro Water District
- Laguna Beach Water District
- Moulton Niguel Water District
- City of San Clemente
- City of San Juan Capistrano
- Santa Margarita Water District
- South Coast Water District
- Trabuco Canyon Water District

Irvine Ranch Water District (IRWD) also participated in several aspects of the study including assistance on system interconnections. The following figure provides an overview of the area and depicts projects implemented or studied in the 2004 Study or since 2004. Also provided is a figure showing the regional water system in Orange County.



MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

Figure 1 **Orange County Regional Water Reliability Projects**


to/from Central Pool
ORANGE COUNTY RESERVOIR
LA HABRA
BREA
LOWER FEEDER
YORBA LINDA FEEDER
San Bernardino County
MET DIEMER FILTRATION PLANT
LOWER FEEDER
Los Angeles County
FULLERTON
WEST OC FEEDER
YORBA LINDA WATER DISTRICT
Riverside County
LA PALMA
BUENA PARK
GOLDEN STATE WC PLACENTIA/YL
ANAHEIM
SANTIAGO LATERAL
from Lake Mathews
to/from Central Pool
ANAHEIM
SERRANO WATER DISTRICT
2ND LOWER FEEDER
GOLDEN STATE WC WEST OC
WEST OC FEEDER
ORANGE
EAST ORANGE COUNTY FEEDER NO. 2
ORANGE PARK ACRES MUTUAL
WEST OC WATER BD. FEEDER NO. 2
WEST OC WATER BD. FEEDER NO. 1
GARDEN GROVE
ORANGE COUNTY FEEDER
EOCWD RETAIL ZONE
SEAL BEACH
WESTMINSTER
SANTA ANA
TUSTIN
ALLEN MCCOLLOCH PIPELINE
BAKER PIPELINE
GOLDEN STATE WC EAST OC
FOUNTAIN VALLEY
IRVINE RANCH WATER DISTRICT
MESA CONSOLIDATED WATER DISTRICT
HUNTINGTON BEACH
TRABUCO CANYON WATER DISTRICT
OC-44 LINE
OC-88 SOUTH COUNTY PUMP STATION
EOCF NO. 2
AUFDENKAMP TRANSM. MAIN
JOINT REG. TM
Pacific Ocean
EL TORO RESERVOIR
NEWPORT BEACH
BIG CANYON RESERVOIR
EL TORO WATER DISTRICT
SANTA MARGARITA WATER DISTRICT
COAST SUPPLY LINE
EASTERN TRANS MAIN
JOINT REGIONAL TRANSM. MAIN
MOULTON NIGUEL WATER DISTRICT
SOUTH COUNTY PIPELINE
EMERALD BAY SERVICE DISTRICT
LAGUNA BEACH CWD
SAN JUAN CAPISTRANO
SOUTH COAST WATER DISTRICT
SAN CLEMENTE
LOCAL TRANSMISSION MAIN
WATER IMPORTATION PIPELINE
San Diego County
N
W
E
S
0
2.5
5
10
Miles
OC Water Retailers and Transmission Mains
Untreated Water Pipeline
MET Treated Water Pipeline
Joint MET/Local Agency Pipeline
Joint Local Agency Pipeline
Major Water Facility
Reservoirs
MUNICIPAL WATER DISTRICT OF ORANGE COUNTY
Figure 2
Produced for the Municipal Water District of Orange County (MWDOC)
by The Center for Demographic Research (CDR), CSU Fullerton
Data Sources: MWDOC, CDR
February 2007
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Review of Key Findings from the 2004 South County Reliability Study

Key findings or conclusions from the 2004 SOC Reliability Study included:

1. Approximately 97 percent of South Orange County's **potable** water supply is imported from Northern California and the Colorado River. This water is treated locally at the Diemer Filtration Plant in Yorba Linda and delivered via two aging pipelines: the East Orange County Feeder No. 2 and the AMP.

2. An emergency outage of the Diemer Filtration Plant, which is situated adjacent to the Whittier Fault in Yorba Linda, is judged to be the most severe supply risk to SOC. The AMP has experienced one major failure and two minor leaks since its construction in 1980 as well as having been shut down at various times for inspection and repairs. The major failure occurred in December 1999 due to a pressure surge, and was repaired and restored to service in 9 days by MET construction crews.

3. The East Orange County Feeder No. 2, a MET-operated pipeline, is considered to be in good condition, but it is aging, having been constructed in 1961. An outage of this pipeline has a smaller impact in SOC because the AMP and South County Pipeline, the major extension of the AMP into SOC, provides about 50 percent greater capacity than the East Orange County Feeder No. 2.

4. There are a number of faults in Orange County that could cause earthquake-induced failures of pipelines or the Diemer Filtration Plant. The most significant is the Whittier-Elsinore Fault Zone and, to a lesser extent, the Peralta Hills Fault, Puente, San Joaquin Hills Thrust Fault, and the Newport-Inglewood Fault Zone. Knowledge of seismic forces has advanced significantly since the design and construction of the system serving Orange County. Design standards for protection of structures from major earthquakes have also changed. The map provided shows the major water transmission lines in Orange County along with the earthquake fault system (Figure 2).

5. Projects, such as water recycling, groundwater desalters, and Water Use Efficiency (WUE) efforts improve water supply reliability and reduce the extent of shortages, and therefore the number and size of reliability improvements.

6. One of the key issues identified in 2004 was the need to characterize the magnitude of economic impacts of water shortages, both short-term system types of outages (10 days to 60 days in duration) as well as longer-term drought impacts of 1 to 3 years. To complete this effort, MWDOC retained the services of the Orange County Business Council. The resulting estimates of economic losses in SOC due to water supply shortage are shown in Table 1. The losses increase with both intensity of the water outage, and with duration. The cause of the water supply shortage is not specified; it could be a feeder break, a drought, or other cause. The economic losses range from a 10-day outage, 20 percent shortage case of $61 million to a 30-day outage, 40 percent shortage case of $403 million. More severe outages of 80 percent extending over 30 and 60 days, respectively, would incur very large economic losses mounting from $821 million to $1.72 billion. The numbers illustrate the tremendous potential cost to SOC from water system outages.

Table 1 Economic Impact of Potable Water Shortages in South OC				
Intensity	**Duration (Days)**			
(% Shortage)	10	20	30	60
	Millions of Dollars			
20% Shortage	$61	$125	$191	$409
40% Shortage	$131	$265	$403	$846
60% Shortage	$197	$399	$606	$1,273
80% Shortage	$269	$542	$821	$1,715
Source: OCBC Study 2004. Estimates based on 2002 values.				

South Orange County Water Reliability Program Improvements Since 2004

The 2004 SOCWRS plan led to the development and construction of emergency water supply facilities through joint efforts of several of the SOC agencies. The basic goal of the 2004 effort was to provide about 2 weeks of water supply that would enable the agencies to sustain interruptions during planned system outages of the imported water system and emergency outages of short duration and magnitude. Significant progress has been achieved with pursuit of the following projects:

- Upper Chiquita Emergency Storage Reservoir (750 acre-feet [AF])
- Irvine Ranch Water District Regional Emergency Supply Interconnection Project (maximum capacity of about 30 cubic feet per second [cfs])
- Local agencies continued their expansion of recycled systems
- Local agencies added substantial groundwater production facilities (South Coast Water District and City of San Juan Capistrano)
- The El Toro Water District (ETWD) R-6 Reservoir was expanded by ETWD and, by way of a three-way agreement, emergency storage capacity was shared in the facility with Moulton Niguel Water District (MNWD) and Santa Margarita Water District (SMWD) to improve their system reliability.
- Currently under final design is the Baker Water Treatment Plant, which would use the Baker Aqueduct, an untreated delivery pipeline from MET's Lower Feeder. This pipeline can also draw water from Irvine Lake and will provide significant emergency storage and treated supplies to the area during periods of emergency outages to the imported system. This project has a plant capacity of 28 million gallons per day (mgd; 43.5 cfs) and average yield of 28,300 AF per year with 21,500 AF per year to be delivered to the South County Pipeline.

These major emergency supply projects have greatly improved SOC's ability to sustain short-term supply disruptions from several days in the year 2000 to about 16 days or more in 2012, depending on the level of demands. Table 2 demonstrates the benefits of storage capacity gained via the construction of Upper Chiquita Reservoir to provide reliability protection to the South County area.

Table 2
Upper Chiquita Reservoir Emergency Supply Ability
Volume = 750 acre-feet

Withdrawal Rate (cubic feet per second)	Days of Supply	Approximate Number of Household Supplied Over the Period
50	7.5	109,000
40	9.4	87,000
30	12.5	65,000
23	16.3	50,000
10	37.5	22,000

(1) Assumes starting reservoir is full and that an average household uses about 300 gallons per day. SMWD uses the statistic that 168,000 households can be supplied for one week at a use of 200 gallons per day.

(2) The South Orange Coastal Ocean Desalination Project would provide about 23 cfs and hence would supply about 50,000 households under similar conditions.

What is Being Protected by System and Source Reliability?

When we consider what is at risk from deficiencies in system and source reliability, the following thoughts come to mind. Having a system without water or with less water than is typically needed results in an impact to our way of life.

- If customers (residential and business) are inconvenienced for a short duration, it is probably understandable and acceptable depending on the cause/reason for the shortage.
- If customers are inconvenienced by a very extreme event, even if for a long time, it is probably also understandable but less acceptable. The logic for acceptance is that we cannot protect against all natural and man-made risks.
- If landscape has to be sacrificed to deal with longer-term outages, it may or may not be acceptable (landscape losses could be significant).
- If jobs and income are lost as a result of outages, it is probably not acceptable. Estimating impact to business and to specific areas is difficult. One measure of the value being protected in any area is the Gross Domestic Product, used as a proxy of "protecting the local economy". Table 3 provides a conceptual estimate of the Gross Domestic Product by each of the South County water agency service areas, allocated from Total County Numbers by a combination of employment and population numbers for each water agency service area. It is an approximation of what is being protected.

As was noted in the September 2003 Study by MWDOC and the Orange County Business Council, "Determining the Value of Water Supply Reliability in Orange County, California":

> "Understanding the value of water supply reliability gives planners a tool to aid in assessing infrastructure projects that can increase reliability and will help to communicate the importance of securing and maintaining a reliable water supply and delivery system."

Table 3
Gross Domestic Product Estimate
for South OC Area Water Agencies

Retail Water Agency	**$Billion** [1]
El Toro WD	$ 2.9
Emerald Bay SD	$ 0.0
Laguna Beach CWD **not including EBSD**	$ 1.0
Moulton Niguel WD	$ 8.8
San Clemente	$ 2.2
San Juan Capistrano	$ 1.8
Santa Margarita WD	$ 6.2
South Coast WD	$ 1.8
Trabuco Canyon WD	$ 0.4
South Orange County Group	**$ 25.0**
Total Orange County	$ 195.3

[1] Allocation of the County Gross Domestic Product down to the water agency level is based 50% on population and 50% on employment statistics among the agencies. The $195.3 billion in 2012 for the total County Gross Domestic Product was estimated by Chapman University's Center for Economic Research.

SECTION 2
WATER DEMANDS AND LOCAL SUPPLY SOURCES IN SOUTH ORANGE COUNTY IN 2020

SECTION 2
Water Demands and Local Supply Sources in South Orange County in 2020

Demands in the SOC area are projected by the local agencies to increase from a current demand level of approximately 108,000 AF per year to 130,000 AF per year by 2020 based on anticipated development plans. The projections for each agency are provided in Table 4. Unlike North Orange County, which has a large groundwater basin, the SOC area has very limited local groundwater and has had to rely heavily (almost exclusively for potable water) on imported water to meet its needs. In addition to significant Water Use Efficiency (WUE) programs, the area has also developed large-scale recycled water landscape irrigation supplies, which are projected to reach 20 percent of total demand by 2020. Out of the eight SOC agencies, six rely between 90 and 100 percent on imported water, one relies 70 percent on imported water, and one agency will have almost zero reliance on imported water to meet their potable needs. The City of San Juan Capistrano, which overlies the lower San Juan Basin area, has developed brackish groundwater supply and is projected to get almost entirely off of the imported water system (see section on SJBA groundwater supplies).

Table 4

South OC Area Water Demands and Supplies
IN 2020
Acre-Feet

Water Supplier	2011-12 Total Water Demands	2020 Total Water Demand [1]	2020 Recycled Water Usage	2020 Potable Water Demand	2020 Potable Ground Water [2]	2020 Required Imported Water	2020 Dependence on Import
El Toro WD	10,017	9,750	1,350	8,400		8,400	100.0%
Laguna Beach CWD	3,556	4,420	200	4,220		4,220	100.0%
Moulton Niguel WD	34,159	38,000	8,700	29,300		29,300	100.0%
San Clemente	9,823	10,840	1,830	9,010	500	8,510	94.5%
San Juan Capistrano	7,797	9,650	1,950	7,700	7,450	250	3.2%
Santa Margarita WD	32,234	43,991	9,603	34,388	116	34,272	99.7%
South Coast WD	7,058	8,495	1,200	7,295	2,200	5,095	69.8%
San Onofre Service Area	754	1,084	0	1,084		1,084	100.0%
Trabuco Canyon WD	3,299	4,429	1,035	3,394		3,394	100.0%
Total	108,697	130,659	25,868	104,791	10,266	94,525	90.2%
(includes San Onofre)							
San Juan Groundwater Basin					9,650		

[1] Total water demand has already been reduced by water conservation efforts. Source: agency responses to MWDOC 5-Year Demands Survey, Spring 2012 except no response received from Laguna Beach CWD, San Juan Capistrano, and Trabuco Canyon WD, so previous information is used for these.

[2] Includes planned expansions. Special cases:

SMWD GW shown is a private well; it is a potential emergency demand on SMWD.

TCWD's GW source is seasonal, and TCWD has does not project it as a reliable supply.

SECTION 3
OPTIONS FOR DEVELOPMENT OF ADDITIONAL NON-MET SUPPLIES

SECTION 3
Options for Development of Additional Non-MET Supplies

The purpose of this report is to provide a 2012 update to the SOCWRS to evaluate risks and opportunities. Development of additional local supplies and/or reductions of demands via WUE measures are key to improving reliability. Based upon the evaluations subsequent to this report, it may be advantageous to develop projects that improve system and source reliability to more fully protect the area from longer periods of imported supply system outages and shortages. Key projects that will help include:

Local System Improvement Projects
- Expansion of Recycling and WUE
- Lower San Juan Creek Groundwater Management
- South Orange Coastal Ocean Desalination Project
- Poseidon Huntington Beach Project

System Only Improvement Projects
- Second Lower Cross Feeder Project
- Expansion of the Irvine Interconnection Project
- Connection to the Orange County Water District (OCWD) Groundwater Basin
- Additional Reservoir Projects

Supplemental Import Projects
- Cadiz Water Project
- IRWD Strand Ranch Banking Project
- San Diego County Ocean Desalination

A description of these options follows.

Water Recycling and Water Use Efficiency Efforts

The demands presented in Table 4 are for 2020 and assume that implementation of WUE measures have already reduced demands to the level shown. The development of recycled water is also shown for each agency.

The SOC agencies have done an admirable job of implementing WUE programs over the years. It has been estimated that demands in SOC would be about 16% higher today were it not for implementation of programs such as:

- Toilet & shower retrofits
- Smart Irrigation Controller Programs
- Irrigation System Retrofits
- Outreach and education regarding WUE
- Water Pricing Programs such as Tiered Rates or Water Budget Based Rate Structures
- Landscape Contractor Certification Programs

WUE is one of the least costly "supply" programs that can be implemented. Ongoing investments in WUE should continue in accordance with the WUE Master Plan development that is underway by MWDOC and slated for a summer 2013 adoption.

Implementation of WUE Programs has another impact on demands and that is the "hardening" of demands during water shortage events. As customers become more and more efficient with their water use, it becomes more and more difficult to cut back on demands when requested to do so for water shortage or emergency events (demand curtailment). The role of demand curtailment when responding to emergency situations will be discussed further as it applies to emergency response scenarios in a later section of the report. The demands provided in Table 4 already assume a reduction for WUE.

In the 1990s, the U.S. Bureau of Reclamation (BUREC) led a major planning study, the goal of which was to identify recycling projects in Southern California to recommend for federal funding. The study was titled "Southern California Comprehensive Water Reclamation and Reuse Study Phase II" and became known by its acronym SCCWRRS. Orange County was one of the four regions studied. The SOCWRRS final report was published in 2002 (links below for the Executive Summary and the Short-Term Implementation Plan).

http://www.usbr.gov/lc/socal/reports/sccwrrs/ExecSumm.pdf
http://www.usbr.gov/lc/socal/reports/sccwrrs/AppC_ImplementationPlan.pdf

The BUREC gathered descriptions of agencies' proposed recycling projects, and devised some multi-agency projects. The projects were categorized as Short-Term (on-line by 2010) and Long-Term (on-line by 2040). The Short-Term projects in the South OC area (and in the immediately adjacent San Diego County area) were grouped into an "Upper Oso" Short-Term Implementation Plan (STIP) and a "San Juan" STIP. The individual projects were:

- ETWD new tertiary plant, and new distribution system
- MNWD expansion of system off Plant 3A
- MNWD expansion of system off Joint Regional Plant
- SMWD expansion of system off the SMWD Oso Creek Plant
- SMWD new system off the SMWD Chiquita Plant
- South Coast WD and Capistrano Valley WD new systems off a new Latham Recycling Plant
- San Clemente expansion of system off its San Clemente Recycling Plant
- Camp Pendleton new system off Camp Pendleton Plant #12

These new projects totaled of about 20,000 AF/yr of recycled water. The study's economics model showed greater benefits than costs, from a total societal perspective, for each STIP (the benefit analysis was not shown by individual project).

Federal aid is typically structured as no more than 25 percent of a recycled water project's capital cost. The SCCWRRS program did not move forward in Orange County because of lack of funding, although expansions of individual systems have continued by mostly all of the agencies. A renewed interest and a regional approach could be pursued to review opportunities for joint facilities and economies of scale, particularly for construction of regional seasonal storage for recycled water. Typically, seasonal storage is required for expansion of recycled water systems beyond a certain point to store water in the winter for use during higher demand

periods in the summer months. SMWD has identified a location that could potentially serve multiple agencies.

Groundwater Supplies from the San Juan Basin Authority

The SJBA was formed in 1963 by four agencies: City of San Juan Capistrano, South Coast Water District, SMWD and MNWD. The SJBA was formed to resolve water rights and to develop the water resources of the Lower San Juan Basin. The SJBA holds a water right in the amount of 10,702 AF per year that is partially assigned to the City of San Juan Capistrano for its groundwater recovery plant. The community of San Juan Capistrano is the second oldest city in California, established with the construction of Mission San Juan Capistrano in 1776, and has relied on surface and groundwater flows from that time, adding imported water into the mix in the 1960s. A number of wells have been constructed over the years in the lower basin. The City has a water right of 3,325 AF per year under application to the SWRCB and has water rights assigned to it by the SJBA. South Coast Water District was originally formed in 1932, was enlarged by subsequent consolidations, and holds a water right to San Juan Creek in the amount of 1,300 AF per year. MNWD and SMWD were formed under the California Water District Act. Both agencies overlie the San Juan Basin but do not have groundwater resources or water rights in the lower basin except through the SJBA.

Work is being completed at this time to quantify the long-term sustainable yield that can be developed from the basin and will also take a look at augmenting the basin yield. The following issues are being examined:

- Expansion of extraction facilities (consideration of radial wells)
- Conservation of storm water and return flows by artificial recharge (spreading) including off-channel spreading and detention basins
- Reduction of water losses to increase yield by eradication of non-native phreatophytes (e.g., Arundo donax)
- Recharge of the basin with recycled water supplies
- The SOC Ocean Desalination (SOCOD) Project offers the opportunity to salvage groundwater losses and to provide a seawater intrusion control barrier by creating a pumping trough via the slant well intake system. The SOCOD Project also provides the opportunity to recover about 50 percent of the upstream groundwater desalter brines that are now discharged to the ocean. These lower salinity brines can augment the ocean feedwater to the project.

Currently, the production of groundwater in the San Juan Groundwater Basin is on the order of 6,000 to 7,000 AF. The SJBA agencies are looking to increase their current production of groundwater from the basin to whatever can be supported on a long-term sustainable basis out of the basin. The groundwater modeling work and the Groundwater Management Plan that is nearing completion will examine the long-term sustainable level of groundwater production. Based on preliminary modeling, the target level of annual pumping probably ranges between 8,000 to 10,000 AF per year between dry and wet years. It should be noted that the Groundwater Management Plan and basin operating strategies will need to account for any groundwater that will be produced via the SOCOD Project via underflow from the basin if the SOCOD Project is to move forward.

South Orange Coastal Ocean Desalination Project

Over the past several years, MWDOC has been working with five SOC agencies (South Coast Water District, City of San Juan Capistrano, MNWD, City of San Clemente, and the Laguna Beach County Water District) in the development of the SOCOD Project. A key part of the project work is the ongoing investigation into the use of slant beach intake wells to produce saline groundwater from the marine aquifer extension of the San Juan Creek alluvial channel. This channel extends for a few miles offshore within the continental shelf. The use of slant wells provides multiple benefits: development of new, drought-proof, and reliable potable water supply; improved water quality; conservation of groundwater losses to the ocean; opportunities for recovery of groundwater desalter brines through blending with the SOCOD Project slant well feedwater supply; and development of a pumping extraction trough covering the width of the San Juan Creek alluvial channel to provide an effective barrier for seawater intrusion control. The project has the potential to improve both source and system reliability. Currently, MWDOC and the five local agencies are working toward a decision in the spring of 2013 regarding whether to proceed ahead with the project. The SOCOD Project is currently planned to pump about 32,000 AF per year from the slant beach intake wellfield, which would include about 95 percent ocean water and 5 percent brackish water from the groundwater basin (about 1,600 AF per year from the groundwater basin). Potable water produced from the SOCOD plant is estimated at 16,000 AF per year.

Poseidon Huntington Beach Project

Poseidon Resources, Inc. has been working with MWDOC and about 20 local agencies over the past several years to examine the terms and conditions for developing a 50 mgd ocean desalination project in Huntington Beach (annual production is estimated at 56,000 AF). Poseidon has now completed a Water Purchase Agreement with San Diego County Water Authority for the Carlsbad Ocean Desalination Project and construction has started. Information made public in that process, along with specifically developed information in Orange County regarding the cost of integrating the Huntington Beach water into the local water systems, will give agencies an opportunity to decide about investments in this new source of supply. A number of South County Agencies are included in the process and have requested the ability to receive water from the project during emergency situations. The capacities currently being reviewed by the South County agencies are provided in Table 5:

Table 5
Potential Participation in the Poseidon Huntington Beach Project by South Orange County Agencies

	Letter of Interest	
Participant	**AF/yr**	**CFS**
El Toro WD	3,000	4.1
Laguna Beach CWD	1,000	1.4
Moulton Niguel WD	4,000	5.5
Santa Margarita WD	5,000	6.9
South Coast WD	3,000	4.1
Trabuco Canyon WD	750	1.0
Total SOC	16,750	23.1

Second Lower Cross Feeder Project

MET primarily supplies Orange County with imported treated water from the Diemer Treatment Plant through the East Orange County Feeder No. 2 (EOCF2) and AMP. Small amounts of treated water are supplied from the Weymouth Water Treatment Plant through the Orange County Feeder (OCF), although most of the water delivered through the OCF is also supplied from the Diemer Plant. Concerns have been raised regarding the heavy dependence on the Diemer Plant as the primary source of imported water. The Diemer Plant is subject to significant seismic risks that could render it incapable of meeting Orange County demands for an extended period.

The Second Lower Cross Feeder (SLCF) concept has been discussed for a number of years. It was originally considered as an accelerated component of the Central Pool Augmentation (CPA) project, which would have allowed for the routing of water from a new treatment plant in Riverside County to two delivery points in Orange County, and ultimately to Los Angeles County. Limited amounts of treated water from the Jensen Water Treatment Plant (WTP) can supply Orange County via the Sepulveda Feeder to the Lower Feeder (LF) and Second Lower Feeder (SLF), to the EOCF2 near the Diemer Treatment Plant. It was proposed that an SLCF could increase the amount of Jensen water that could be moved throughout Orange County during emergencies. The SLCF was sized at 84 inches diameter to deliver 400 cfs west to the Central Pool. At this size, preliminary evaluations indicated that, under optimal conditions in 2010, the SLCF could also deliver a maximum of 100 cfs of Jensen water east to the EOCF2 during emergency outages of the Diemer Plant. Subsequent studies led to the deferment of the CPA project, clarification of MET reliability policies, and revised construction estimates for the SLCF that ultimately led to the SLCF project being placed on hold where it remains with respect to MET.

MWDOC formed a workgroup in 2011 of interested agencies and formed a “choice” program in 2012 with ten agencies to re-examine the potential alignments and costs of a smaller 48” diameter pumped SLCF as an emergency-only project. A consultant was hired to conduct detailed alignment studies and prepare a detailed cost estimate for the “emergency only project”. The cost estimate was completed and presented to the agencies in January 2013. The pipeline was sized at 48-inches in diameter to convey up to 100 cfs along a 16,000 feet alignment in the cities of Orange and Anaheim, with crossings of the Santa Ana River and the 57 Freeway. The project cost, projected out to 2016 (the mid-point of construction), is $51 million.

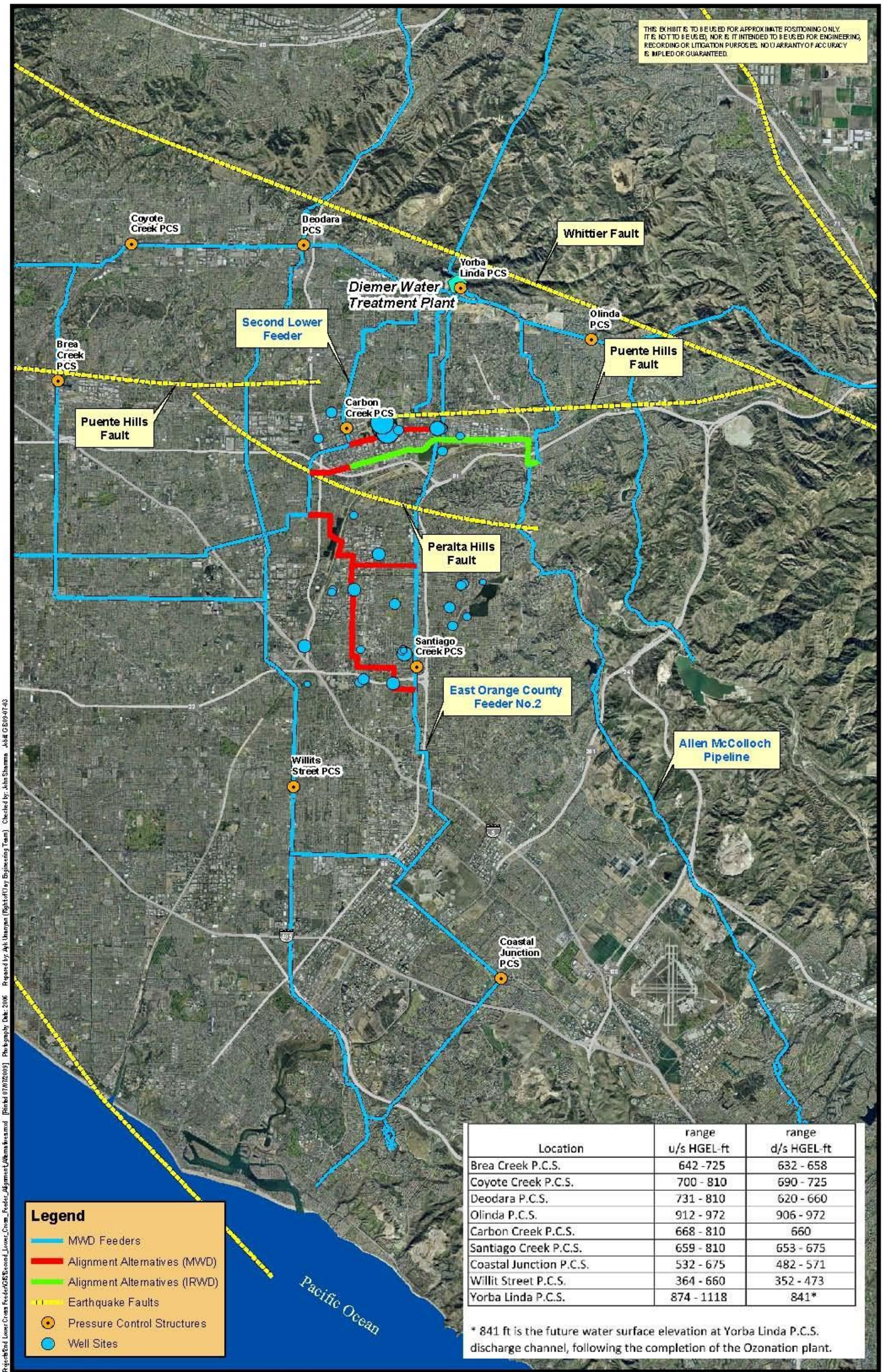
The consultant’s memo was distributed to the Participant’s in draft form and on January 29, MWDOC conducted a meeting with the Agencies. They requested more time to review and comment on the report, at which time we will wrap it up. The key comments and recommended next steps include:

- It was noted that MET was still looking at hydraulics and options for providing water, but what may be more important is to approach MET to confirm their policy of allocating water during times of emergency. MET staff have indicated that MET does not have a formal policy and so it will have to be approached at a high level.

- Comments from the group indicated a lack of support for a $51 million stand-alone "emergency-only" project. A downsized emergency only project may be supportable or a project with multiple uses (emergency MET water, emergency groundwater, normal groundwater). MWDOC has requested the Consultant to prepare a second cost estimate for a 30 cfs conveyance facility.
- The group generally recommended developing a multiple use project where costs could be spread over multiple benefits and more certainty on the availability of water from MET (current and future) would be needed to move forward.
- MWDOC is working on the following:
    - Discuss with MET the hydraulic modeling issues and potential service from both the Jensen and the Weymouth Plants.
    - Discuss with MET the policy issue of water allocations or availability of water during an emergency situation.
    - Look for opportunities for multiple benefit projects, primarily with OCWD.

The current Participating agencies are:

1. Anaheim
2. El Toro WD
3. Golden State WC
4. Irvine Ranch WD
5. Laguna Beach CWD
6. Moulton Niguel WD
7. San Clemente
8. San Juan Capistrano
9. Santa Margarita WD
10. South Coast WD



Location	range u/s HGEL-ft	range d/s HGEL-ft
Brea Creek P.C.S.	642 -725	632 - 658
Coyote Creek P.C.S.	700 - 810	690 - 725
Deodara P.C.S.	731 - 810	620 - 660
Olinda P.C.S.	912 - 972	906 - 972
Carbon Creek P.C.S.	668 - 810	660
Santiago Creek P.C.S.	659 - 810	653 - 675
Coastal Junction P.C.S.	532 - 675	482 - 571
Willit Street P.C.S.	364 - 660	352 - 473
Yorba Linda P.C.S.	874 - 1118	841*

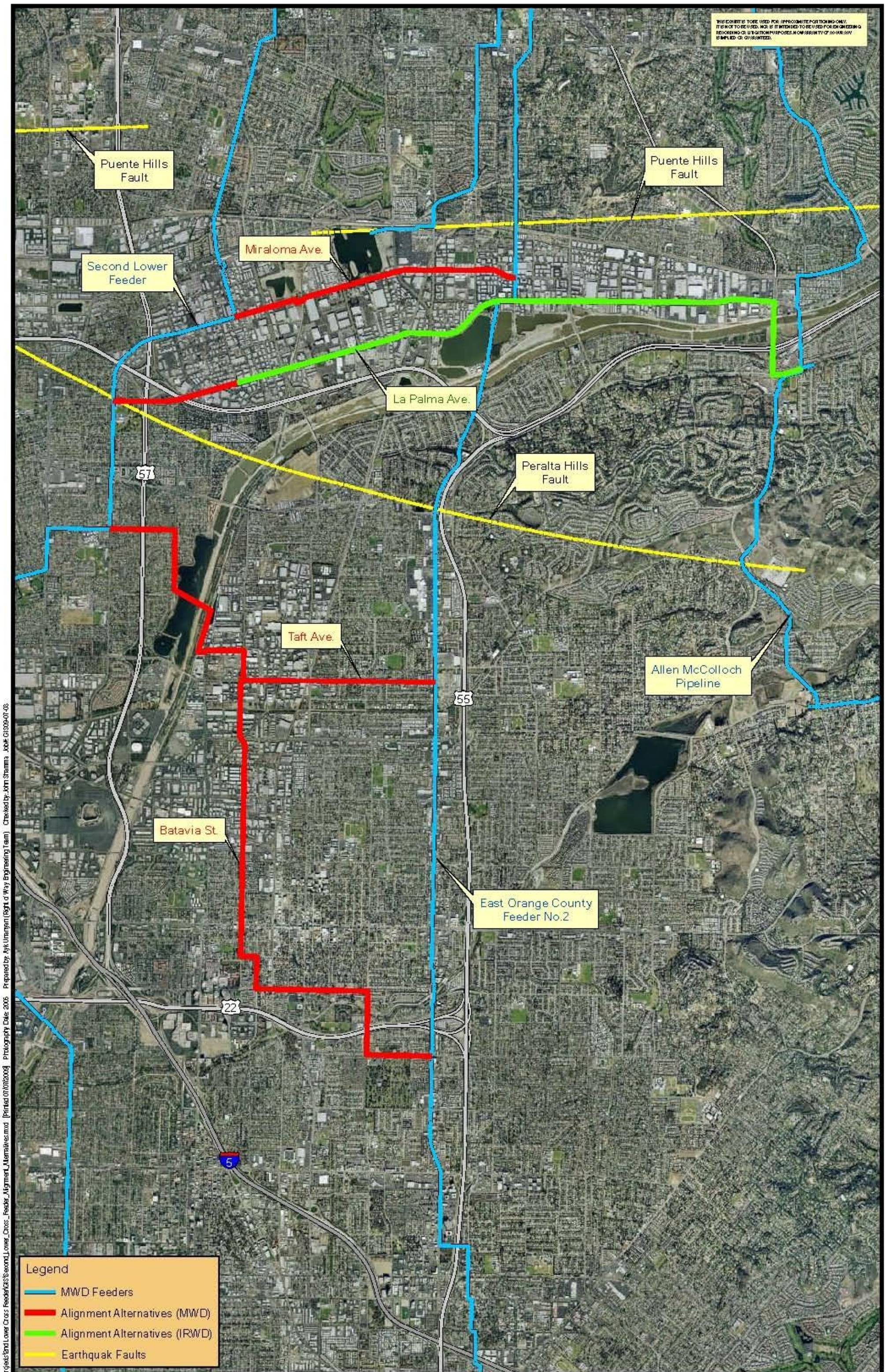
* 841 ft is the future water surface elevation at Yorba Linda P.C.S. discharge channel, following the completion of the Ozonation plant.

The Metropolitan Water District of Southern California
Corporate Resources Group

Figure 3.1

Second Lower Cross Feeder
General Overview Map - Sheet 1 of 3

Miles 0 2 4



The Metropolitan Water District of Southern California
Corporate Resources Group

Figure 3.2

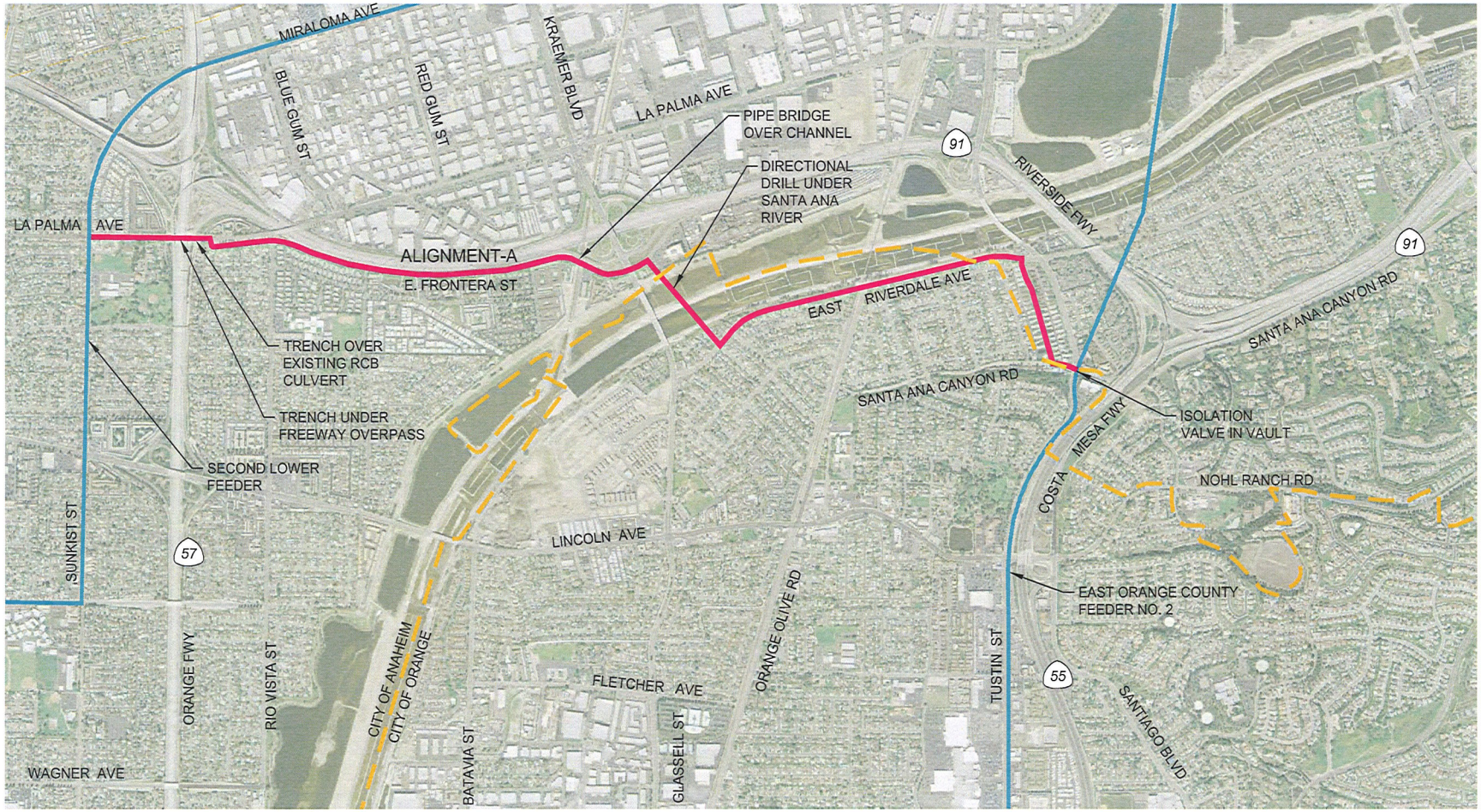
Secon Lower Cross Feeder
Alignment Alternatives - Sheet 2 of 3

Feet
0 3,500 7,000

The Metropolitan Water District of Southern California
Corporate Resources Group

Figure 3.3

Second Lower Cross Feeder
Alignment Alternative - Sheet 3 of 3



LEGEND:

- EXISTING WATER TRANSMISSION MAINS
- SLCF ALTERNATIVE ALIGNMENT
- CITY LIMITS

GRAPHIC SCALE

0 1500' 3000'

SCALE: 1" = 1500'

N

Figure 3.4

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY
SECOND LOWER CROSS FEEDER

DLM Engineering / DUDEK

Expansion of the Irvine Interconnection Project

The IRWD Interconnection Project was developed and put into place following approval of a 2006 Agreement between MWDOC, OCWD, and IRWD to allow MET water or OCWD groundwater exchanged with MET water to be delivered via the IRWD system into SOC. The Agreement provides that the maximum conveyance of water for the Phase 1 Program will not exceed 50 cfs of water for more than 30 days per incident, or a maximum of 3,000 AF per incident. An "incident" shall mean an emergency outage or planned shutdown condition related to a single event, such as a pipeline break or planned repair.

The South County Agencies paid about $20 million for new improvements and a buy-in to the IRWD system to enable the nominal exchange of 30 cfs of water during emergency events. IRWD's analysis of "excess capacity" in the IRWD system to convey the water was estimated monthly to the year 2025. The amount of capacity guaranteed by IRWD under this arrangement to the South County Agencies occurs via a flow-rate reserved by IRWD, to be used on the highest priority basis for obtaining imported water or groundwater deemed exchanged with imported water at the IRWD Interconnection Projects in the event of either planned or emergency outage conditions, based on Table 6.

Table 6 reflects the decrease in the flow-rate reservation that will occur over time as growth occurs in IRWD's service area. IRWD shall not be obligated to supply more than the flow rates shown in Table 6, or any flow after 2029, but shall exercise reasonable efforts to provide

Table 6

Average IRWD Flow Rate Reserved for South County (cfs)

Calendar Years	2005 - 2009	2010 – 2014	2015 - 2019	2020- 2024	2025- 2029	2030
January	20	25	21.5	18.5	16	0
February	21.5	26.5	23	20.5	18.5	0
March	20.5	25.5	22	19.5	17	0
April	16.5	20.5	16	12.5	9	0
May	14.5	18	12	7.5	3	0
June	12.5	15.5	7	1.5	0	0
July	10.5	13	1.5	0	0	0
August	10.5	13	1.5	0	0	0
September	9	12	0	0	0	0
October	12	15.5	6.5	1	0	0
November	15	18	13	8.5	4.5	0
December	18	21	18	15	11.5	0

additional available water, if the additional supply **will not** require a curtailment of IRWD customer demand. The South County Agencies will share any such additional flow rate on the basis of each South County Agency's respective Capacity Right. As used herein, "flow-rate reservation" means a reservation of a first-priority right to receive delivery of water through or by means of the applicable conveyance and other facilities, under and subject to all of the terms and conditions set forth in this Agreement and subject to availability of the water from the contemplated supply sources, and shall not mean any ownership, leasehold, or any other possessory interest in the facilities or delivery system or capacity therein. The South County Agencies shall be responsible for the purchase and delivery of water made available by IRWD through the IRWD Interconnection Projects.

The flow-rate reservation is intended only for emergency outage or planned shutdown conditions during which imported water supply deliveries into SOC are curtailed, eliminated, or unavailable for a period lasting up to 30 days, and not for drought or other source reliability uses. No South County Agency shall treat the flow-rate reservation or use the IRWD Interconnection Project capacity as other than a short-term emergency right, in calculating its water supply availability for purposes of urban water management plans, water supply assessments, water supply verifications, will-serve letters, or similar purposes. Table 7 illustrates how the water is to be shared among the South County Agencies.

Table 7
IRWD Interconnection Capacity Allocation

Agencies	Nominal Capacity Allocation (cfs)	Capacity Allocation (%)
City of San Clemente	3	10.00%
Laguna Beach County Water District	2	6.67%
Moulton Niguel Water District	16.5	55.00%
Santa Margarita Water District	7.5	25.00%
South Coast Water District	1	3.33%
Total	30 [1]	100.00%

[1] The actual capacity varies by month and by year and by IRWD system capabilities per the Table 6 above

Without any changes, the capacity provided via the Interconnection Agreement is reduced each year until it goes to zero in 2030. An "expansion" of the IRWD Interconnection Project could take several forms:

- Development of additional capacity in the IRWD system for delivery to SOC
- Delivery of capacity via a different alignment or through different facilities
- Determination by IRWD that the buildup in capacity needed for their customers has changed, resulting in addition capacity for exchange with MET water

Connection to the OCWD Groundwater Basin

In one sense, the IRWD Interconnection Project is a connection to the OCWD groundwater basin on an exchange basis using the IRWD system. Other concepts have been discussed whereby a South County investment would allow transfer of previously stored MET water to South County for either emergency or source reliability (drought protection) purposes. Concepts that have been discussed over the years include a "pump-in" to the regional import system that would allow the water to be conveyed to South County Agencies. The management of the OCWD basin prohibits export of local water out of the basin. A 2001 study between MWDOC and OCWD estimated that construction of a wellfield in Anaheim or Orange pumping into the EOCF2 would result in cost of about $175 per AF (in 2001 dollars) to produce and convey (treatment consisted only of chloramination) the groundwater to South County under a base loaded operation. An emergency only operation would be much more expensive on a per unit basis. These costs do not include the cost of the water or wheeling charges that might apply (would have to be previously stored MET water). Today's cost for storing water in the OCWD basin would likely be on the order of $700 per AF for untreated water, including a small storage fee. Typically, a small portion of the water is lost each year from storage accounts. Without a cooperative "joint use" project whereby the basin area shares in the use of the facilities for normal operations and the SOC area uses the facilities during an emergency operation, the cost of the water from the project could be quite expensive. Joint use projects could be beneficial for both parties.

Additional Reservoir Projects

Upper Chiquita Reservoir was constructed by SMWD and completed in 2011 at a cost of about $50 million to provide 750 AF of storage. Storage capacity was provided to other agencies via agreements. Other locations and other sites could be considered for providing regional storage capacity. SMWD has at least one other reservoir site under consideration (East Ortega) for either recycled or potable water storage (or both).

The storage owned in Upper Chiquita Reservoir is provided in Table 8.

Table 8
Upper Chiquita Reservoir Capacity Ownership

Agency	Nominal Capacity Allocation (AF)	Capacity Allocation (%)
City of San Clemente	83.8	11.2%
South Coast Water District	51.0	6.8%
Moulton Niguel Water District	276.3	36.9%
Santa Margarita Water District	288.0	38.5%
San Juan Capistrano	50.0	6.6%
Total	749.1	100.00%

Cadiz Water Project

The proposed Cadiz Project could provide a new Southern California water supply by actively managing a groundwater basin that is part of a 1,300 square-mile watershed in eastern San Bernardino County. Water that would otherwise evaporate would be collected and conserved for beneficial use. If approved and put into operation, the project would then convey the conserved water to SMWD and to other Southern California water providers. A future phase of the proposed project could include the ability to store water underground in the Cadiz aquifer where the water could be used in dry years. If implemented, the Cadiz Project would diversify water portfolio for participating agencies and help drought-proof the area to ensure its water demands are met regardless of the state's supply. The project requires use of MET's Colorado River Aqueduct to convey the water into Southern California coastal plain. The expected costs of the water are $1,100 to $1,500 per AF including all delivery and treatment charges for water into the MET service area.

IRWD Strand Ranch Banking Project

Over the past 5 years, IRWD has developed the Strand Ranch Water Banking Project. The project is up and operational, and as of the end of 2012, will have about 36,000 AF in storage. The wellhead and pipeline project will be completed by the end of 2012. IRWD is looking to expand the project via the purchase of the Stockdale West Ranch, which provides the ability to increase the total storage capacity of the project from 50,000 AF to approximately 75,000 AF. IRWD's goal is to develop 100,000 AF of storage. MWDOC has briefly discussed with IRWD the concept of having additional Orange County partners in the project. The cost of land in the Central Valley is getting more expensive and additional increments of storage may cost more than have already been invested. IRWD's cost of water from the bank is typically between MET's Tier 1 and Tier 2 costs when delivered to Orange County. The market for dry year water supplies in the Central Valley area for non-bank participants ranges from $300 to $550 per AF. The cost to pump, convey, wheel, and treat the water for delivery into Southern California for agencies other than IRWD, would likely be in the range of $1,200 to $1,500 per AF. IRWD is open to continuing discussions.

San Diego County Ocean Desalination

San Diego County Water Authority (SDCWA) is looking at ocean desalination projects at a number of locations. The one closest to Orange County is the Camp Pendleton Project. In 2009, SDCWA completed an engineering feasibility-level study on the development of a seawater reverse osmosis (SWRO) desalination facility located in the southwest region of Camp Pendleton. Several sites to construct a large-scale desalination facility were identified along the Camp Pendleton coastline during numerous reconnaissance-level siting studies and discussions with Camp Pendleton personnel. After approximately 1 year of discussions and preliminary evaluations, two sites were identified by Camp Pendleton personnel as being feasible to locate a desalination facility, while considering impacts to base training and operations.

The feasibility study evaluated the two alternative sites to locate the desalination facility; the marine environment for seawater intake and concentrate discharge pipelines; and the conveyance pipeline alignment for delivering water back to the Water Authority's aqueduct system. The objective of the feasibility-level study was to evaluate potential constraints that would limit or eliminate options for the design and operation of the proposed desalination facility, and related project infrastructure in the proposed project area. The project area consists

of the estuary and nearshore marine habitat associated with the mouth of the Santa Margarita River (SMR), the southwest region of Camp Pendleton, the San Luis Rey River (SLRR) corridor in Oceanside, and existing Water Authority easements in San Diego County north of Vista. Finally, the study examined the constructability, cost-effectiveness, and potential design constraints of a seawater desalination facility located at either of the two proposed site alternatives in Camp Pendleton. SDCWA is looking at potential plant sizes up to 150 mgd. The estimated cost of water from the Camp Pendleton locations was $1,400 to $1,500 per AF in 2009, without the cost of integration of the water into SOC. MWDOC staff estimated the per AF amortized cost of a pipeline and pump station cost and calculated the need for about 500 feet of lift to bring the water to Orange County. The total cost (capital + operations and maintenance [O&M]) for conveying the water to Orange County was about $500 per AF. Above a certain flow rate, the water would have to be pumped into the South County Pipeline at an additional cost (not included in the estimate). The overall cost of the water in Orange County from the Camp Pendleton Project would be about $1,900 to $2,000 per AF in 2009 dollars. MWDOC will continue to monitor these efforts at a low level, but the cost of the water (including the cost of conveying it to Orange County) makes this an expensive option to pursue.

SECTION 4
MET SOURCES OF SUPPLY TO SOC

SECTION 4
MET Sources of Supply to SOC

MET's 2010 Integrated Resources Plan (IRP) provides an indication of MET's reliability to 2035 under a range of conditions based upon 82 years of recorded hydrologies and actual flows. The IRP indicates that MET will be reliable under most of these conditions through 2035 based on existing and anticipated developments in their supply portfolio from the Colorado River and the State Water Project (SWP) as well as their local water resources management and development program (increased conservation and recycling to meet 20 x 2020 goals and groundwater recovery and ocean desalination).

Key assumptions associated with the MET IRP reliability analysis are listed below:

1. Climate change is not directly considered. It is handled by way of the "buffer" assumption of an additional WUE savings or recycled water development of 200,000 AF per year by the year 2020.

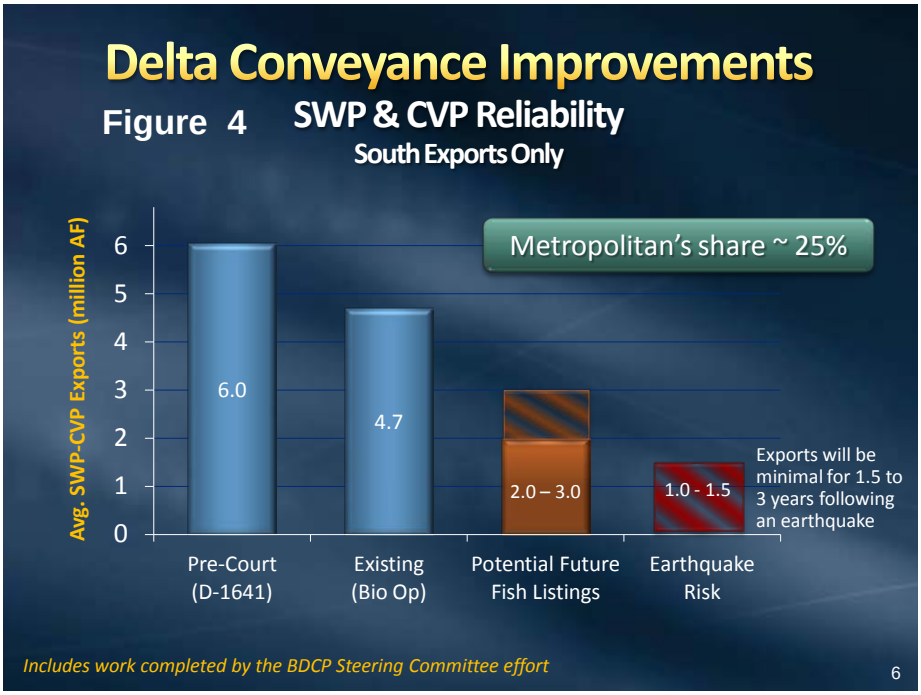
2. The IRP simulation hydrologies are based on 82 years of record and assume a repeat of the range of conditions actually experienced. Recent Colorado River hydrology has been outside of this historical range. None of the climate change models in use at this time predict a wetter Southwest United States, and virtually all models indicate warmer and drier trends. Based on paleostudies of tree rings and other evidence, we know that longer periods of drought can occur than have occurred during the 82 years of records covering the historical period. Again, this issue is handled via the "buffer supply".

3. Retail demands within the MET service area are lower due to general demographics (about 360,000 AF lower than previously outlined in the year 2030). In addition, full compliance for the 20 x 2020 goal through reduction in imported demand due to WUE efforts and recycling will further reduce demands. Compliance with the 20 x 2020 will result in actual reductions estimated at 14 percent (380,000 AF per year). MET has assumed a "buffer" and a full 20 percent reduction in demands and/or increases in water recycling of 580,000 AF (20 percent). All of these items result in a lower projected demand on MET for water. MET is updating its demand forecasts in 2013, which may show an even lower demand scenario.

4. The IRP provides a full Colorado River Aqueduct under virtually all years. MET has plans underway to develop resources to be conveyed in the Colorado River Aqueduct that would exceed the carrying capacity of the facility at 1,250,000 AF per year. Storage capacity allowed in Lake Mead also helps improve the reliability of this source.

5. MET's assumptions with respect to future Bay-Delta fixes and assumptions of the SWP reliability are as follows:
   - MET's basic assumption on the yield of the SWP is based on the State of California's Department of Water Resources 2009 report "The State Water Project Delivery Reliability Report 2009" dated August 2010, which takes into account the impacts from the biological opinions adopted in 2008 and 2009.
   - MET has assumed that supplies to the SWP will improve before 2015. This is because operational improvements and increases in yield have already been achieved by DWR staff via tracking the turbid water where the Delta Smelt like to hide and using the information to operate the pumps.

- MET assumes completion of the Bay-Delta conveyance facility before 2025 to improve MET's source reliability back to where it was prior to the biological opinions.
- Because of the assumption noted above on the lower level of demands on MET, compliance with the 20 x 2020 demand reduction goal on a regional basis and the potential of an additional local "buffer" supply, MET's reliability has been greatly improved even if the Delta Fix does not result in the levels of supply included above.
- The figure below provides an overview of the Reliability of the Delta Conveyance Improvements and indicates decreasing reliability in the absence of a "solution".



6. The IRP counts on heavy utilization of MET storage capacity and storage accounts to store water in normal and wet years and withdraw water in dry years. This has dramatically increased MET's reliability.

7. The IRP assumes development of new local resources within the MET service area (predominantly water recycling) in the amount of 102,000 AF (over and above the other local resources).

8. MET's IRP has "adaptability" built in to allow changes in direction as trends are discerned and as events evolve.

9. System Reliability is not well covered in the 2010 MET IRP document. This is discussed in detail below.

Given the preceding discussion, it is apparent that much uncertainty exists in providing cost and reliability estimates for imported water out into future years beyond the near term. This is especially true given the Bay-Delta Conservation Plan (BDCP) implementation issues, such as the Endangered Species Act, with potential climate change and hydrologies outside of the 82-year period of history.

SECTION 5
MET 2010 SYSTEM RELIABILITY DISCUSSION

SECTION 5
MET 2010 System Reliability Discussion

MET's 2010 IRP only addresses "system" reliability in a broad-brush manner by stating that they have emergency storage within Southern California that would allow the demands for MET water to be met for a 6-month period assuming a 25 percent demand curtailment and full production out of all local facilities. Earthquakes and natural disasters can strike at many locations along the delivery route – in the Delta, along the SWP, in southern California and in Orange County – each of these potential episodes has its own implications for water supply planning. MET's previous assumption that both aqueducts could be fully operational within a 6 month period following a major earthquake may need more detailed technical review considering the importance of these assumptions. MET is now conducting additional work on emergency outage scenarios. Critical scenarios are listed in Table 9. These scenarios were compiled by MWDOC and reflect thinking going on in the local, regional, MET and State system, including the analyses being conducted by the California Department of Water Resources in the Delta Risk Management Studies and the Preliminary Seismic Risk Analysis Associated with Levee Failures in the Sacramento – San Joaquin Delta.

Methods for characterizing reliability can vary from complex empirical models (black boxes), which can be difficult to describe to stakeholders, to scenario-based assessments that can be criticized as too simplistic. MWDOC has typically used qualitative assessments to portray reliability. These qualitative assessments have provided a simple tool to convey Orange County's water reliability and are believed to continue to be the appropriate approach.

An example of MWDOC's proposed "scenario" approach to depicting water reliability is shown in Table 10. This scenario depicts outages of the SWP and Colorado River Aqueducts for extended periods under different demand and storage assumptions. The demand assumptions include a "suppressed" demand scenario assuming a collective demand curtailment of 25% on the import systems over the various periods. The "higher" demand scenario assumes that demands remain about normal on the import systems. These draft assumptions need to be further explored, but the example is illustrative of what might occur. This type of scenario analysis can provide useful information, especially looking at where regional storage is located and how it might help regional recovery efforts when these types of events occur. The MET work on this issue is expected to produce information within the next year. In this example scenario of catastrophic extended loss of imported water sources, multi-year shortages would range from 20 to 40 percent at the MWDOC level. Local agency reliability could vary. Scenarios such as this one can be augmented with economic impact information such that stakeholders can determine what level of reliability/supply interruption is appropriate for planning purposes.

Table 9
Major Earthquake Risks to SOC

Fault	Potential Damages	Recovery Period	Emergency Supply Sources	Shortages
Bay Area	Delta Levee Failure - Salt Water Intrusion	6 months to 3 years	• Kern County GW • Pyramid/Castaic Lake • Perris Reservoir • Lake Mathews • Diamond Valley Reservoir • Groundwater Basins • Local Supplies	Shortages would increase in the future with longer recovery periods. MET supply and demand analysis required. OC GW Basin operation for emergency supply.
San Andreas	Edmonston PP severe damages	up to 3 years	• Castaic Lake • Perris Reservoir • Lake Mathews • Diamond Valley Reservoir • Groundwater Basins • Local Supplies	Shortages would be more severe than a Bay Area Earthquake and would increase in the future with longer recovery periods. Demands would be reduced due to widespread damage to the region. MET supply and demand analysis required OC GW Basin operation for emergency supply.
	Tehachapi - Carley V Porter Tunnel severed	up to 2 years		
	East Branch Aqueduct severe damages	up to 3 years		
	Colorado River Aqueduct severe damages	up to 6 months		
	Transmission System Damages	up to 6 months		
San Jacinto	East Branch SWP	up to 1 year	• West Branch SWP • Castaic Lake • Perris Reservoir • Lake Mathews • Diamond Valley Reservoir • Groundwater Basins • Local Supplies	Shortages would be less severe than for the prior two scenarios.
	Colorado River Aqueduct	up to 6 months		
	Transmission System Damages	up to 6 months		
Whittier/Elsinore	Lower Feeder	up to 2 months	• Irvine Lake/Baker WTP • IRWD Interconnection • Upper Chiquita Reservoir • San Juan GW Desalters	Shortages would become more severe after 3 weeks
	Yorba Linda Feeder	up to 2 months		
	Diemer WTP	up to 2 months		
	Orange County Feeder	up to 1 month		

Table 10
Scenario Plan for San Andreas 7.8 M Earthquake
Knocking Out the State Water Project and Colorado River Aqueduct

	Suppressed Demand					Higher Demand			
	San Andreas - SWP & CRA Outage					San Andreas - SWP & CRA Outage			
	6 months	1 year	2 year	3 year		6 months	1 year	2 year	3 year
MET Demand	750	1,500	1,500	1,500		1,000	2,000	2,000	2,000
MET Supply									
CRA	0	0	1,200	1,200		0	0	1,200	1,200
SWP - Delta Expor	0	0	0	0		0	0	0	0
San Luis Res	0	0	0	0		0	0	0	0
Kern GW	0	0	0	0		0	0	0	0
SWP Res - So Cal	200	400	0	0		200	400	0	0
Lake Mathews	50	100	0	0		50	100	0	0
DVL	400	600	0	0		400	600	0	0
MET CUP	50	100	0	0		50	100	0	0
Total	700	1,200	1,200	1,200		700	1,200	1,200	1,200
Shortage	-50	-300	-300	-300		-300	-800	-800	-800
Percent Shortage	0	0	0	0		0	0	0	0

NOTES:

1. Scenario is a San Andreas Fault 7.8 M Earthquake. SWP out of service 3 years, CRA out of service 1 year. MET does not believe the CRA will be out of service for longer than 6 months.
2. Suppressed demand assumes a 25% reduction in demand on MET; higher demand represents normal level of demands on MET.
3. MET SWP Area GW Storage Programs: Maximum Annual Take = 368,000 AF; Max Storage Capacity 1,400,000; Storage as of June 30, 2011 = 370,000 AF
4. San Luis Reservoir DWR Capacity = 1,060,000 AFy; MET at 50%
5. SWP Res in So Cal: Pyramid Res Cap = 171,200 AF, Castaic Lake Cap = 323,700 fy, and Perris Res Cap = 131,450 AF. Total = 626,350 AF; Assume 400,000 AF available for emergency use
6. Lake Mathews Cap = 182,000 AF - dedicated for regulatory seasonal storage; assume 100,000 AF available for emergency use
7. DVL Cap = 810,000 AF with Emergency Storage = 400,000 AFy; remainder normally reserved for seasonal operating storage; assumed an additional 200,000 AF for emergency use
8. MET CUP Maximum Storage Capacity = 211,895; Maximum Take = 70,298 AFy; Balance on June 30, 2011 = 29,079 AF

SECTION 6
LOCAL RELIABILITY PLANNING

SECTION 6
Local Reliability Planning

Outage Durations for Planning Purposes

The following inputs are required to evaluate local system reliability issues and determine the number of days of supply that can be provided by local agencies under various outages of the import system.

- Demand at the time of the emergency
- Time of year
- Expected level of demand curtailment
- Whether it is a planned or unplanned emergency
- What local sources are available during the outage
- The duration of the outage
- What amounts of water are available in storage at the time of the outage

MET conducted a regional evaluation of the relative risks to its facilities from earthquakes and categorized recovery times for four types of defined events, as summarized in Table 11 from the 2004 SOCWRS. In addition to the recovery times noted, MET also provided a more detailed assessment of the time required for repair of a complex failure of the AMP. One location investigated in the report was at the AMP crossing under the Santa Ana River. Based on the preceding information, the outage planning criteria for the 2004 study were established as shown in Table 12.

Table 11
MET Infrastructure Reliability and Protection Plan
Defined Events and Recovery Times

Defined Event	Type of Failure	Recovery Time
Nominal Single Event	Single location pipe failure due to earthquake, operational occurrences, or third-party incidents	3 to 10 days
Recovery Plan Event	Multiple location pipe failures due to a moderate earthquake	14 to 21 days
Complex Single Event	Single location pipe failure in a difficult location with interfering utilities	21 to 31+ days
Extreme Event	Failures at treatment plants and distribution system due to seismic events that significantly exceed design criteria	1 to 6 months

Table 12
MET Facility Emergency Outage Planning Criteria From the 2004 SOCWRS

MET Orange County Facility	Recovery Time (Days)
Diemer Filtration Plant	31
EOCF#2	10
Allen McColloch Pipeline • Complex Failures - Santa Ana River Undercrossing - Tunnel at Peralta Hills Fault	31
• Single Pipe Failure	10

For the purpose of the 2004 SOCWRS, an outage of the Diemer Filtration Plant was assumed to require a recovery time of 1 month, rather than a longer duration as indicated in the range shown in Table 11. The potential for a failure on the AMP at either side of its under-crossing of the Santa Ana River has been considered by MET and was estimated to require 31.5 days to repair the line breaks. The longer repair time, when compared to a single simple line break, is due to the depth of the pipe and several interfering overlying utilities, including a storm channel. The major change in knowledge since the 2004 study is a better understanding of the impacts a major earthquake could have, seriously curtailing exports from the Bay-Delta region for 1.5 to 3 years following an earthquake. A single earthquake could also simultaneously interrupt the southern portion of the SWP and the Colorado River Aqueduct until they can be repaired (see Table 9).

Reliability Planning – Role of Demand Curtailment 2004 Study and Today

Demand curtailment is defined as the amount that demands can be expected to be reduced during any particular event. It is a means to extend the available supply and is easier to do for shorter durations, days to a week, rather than for a month or two. Demand curtailment, rationing, or allocations entails accepting the economic risks and public relations problems should a major outage occur in the regional system and the planned curtailment does not materialize. Because the damages from a major earthquake to Orange County are considered substantial and would cause significant damage or disruption to the economy and well being of the citizenry, it is considered prudent to invest in more reliable systems, but also to evaluate the role demand curtailment can play in responding to an emergency situation.

In the December 1999 AMP pipe failure incident, a combination of voluntary and mandatory demand curtailment resulted in a reduction in potable water demand by about 25 percent in SOC (some agencies who turned off all outdoor irrigation reduced consumption by as much as 43 percent). Fortunately, that outage occurred in the mid-winter and lasted only for 9 days and the second pipeline delivering water into SOC was still intact. Severe hardships and economic losses would likely have mounted if the outage had continued for a longer period or had occurred in the middle of the summer.

Further, consumers, although willing to do their part if called upon, generally dislike forced demand curtailment and rationing and would prefer other solutions. Also, where WUE efforts are strong, demand becomes “hardened”, making further curtailment even more difficult. In the 2004 Study, assumptions for demand curtailment of 25 percent were used for a 10-day outage and 15 percent for a 31-day outage. Subsequent to the 2004 study, SMWD and MNWD developed an “assumed demand curtailment pattern” that they believe would occur in response to a catastrophic event. During such an event, given the regional call and media alerts that would go out to the public requesting significant levels of conservation, and given the exhaustive media coverage of such an event, the levels of demand curtailment that would be expected would be significant. Figure 5 and Table 13 show a synthesized expected consumer response. The basis is as follows:

- **Day 0**: demands are being met at the time the event occurs.
- **Day 1**: the assumption is that demands remain at that level (too soon for demand response to occur).
- **Day 2 through Day 5**: demands continue to decline as consumers respond to requests to minimize water use and curtail outdoor demands; demands reach 65 percent of the pre-event level at Day 5.

- **Day 6 through 9**: demands remain at 65 percent of the pre-event level.
- **Day 10**: if the event is to be extended, there would be massive responses to conserve/manage existing supplies for the duration of the event. Demands are assumed at 50 percent of the pre-event level.
- Figure 5 below provides the level of demands each day in the assumed response.

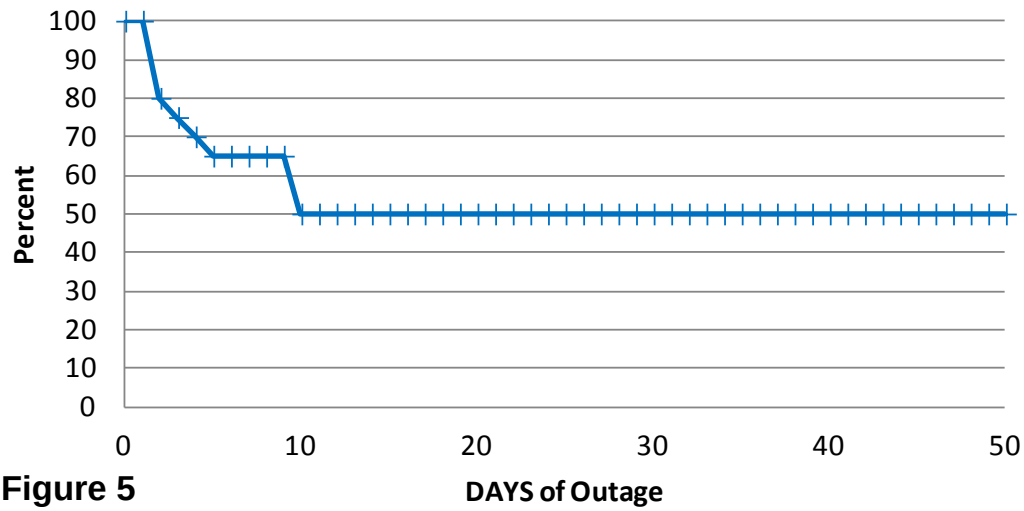


Figure 5

Table 13
Assumed Level of Demands During a Major Emergency Event

Day After Event	Percent of Normal Demand
0	100
1	100
2	80
3	75
4	70
5	65
6	65
7	65
8	65
9	65
10	50

The preceding information can be used to generate outage assumptions for longer and longer durations to examine the overall demand curtailment that would occur, as shown in Table 14.

Table 14
Average Demand Curtailment Over Length of Event

Duration of Event in Days	Percent
10	30
15	37
20	40
25	42
30	43
31	44
35	44
40	45
45	46

This concept on demand curtailment differs considerably from the analysis completed in 2004 and results in estimates of higher reliability or longer periods of time under which demands can continue to be met.

2012 Status of System Reliability for the SOC Agencies (Days of Supply without MET)

The question was posed to the South County Agencies workgroup in discussions in late 2012 and early 2013 "what should be the basis of evaluating reliability issues among the various agencies and can we develop a single agreed upon basis?" The discussions led to the following comments and input:

1. Each agency needs to be able to set its own goals and plans for reliability, so the concept of adopting a "common standardized methodology" was not supported by the group. The group agreed the report should note that each agency is unique in their water resources and facilities mix and may have policy differences and directions from the governing board or council when they analyze, develop and implement their reliability plans.
2. The group did not support using annual average demands with no curtailment as "the recommended planning scenario", although they did note that it was one of the several criteria that should be presented. The group felt that an important part of the message to be conveyed is one of "responding to emergency situations, including seeking demand curtailments from consumers". In that sense it is incumbent on each agency to set and communicate expectations with consumers.
3. The group suggested starting with a summer outage analysis where the starting demands would be higher than annual average. The response would include a goal of expected demand curtailment (each agency could set their own). It is incumbent on each agency to understand the need they have for implementing their emergency plans to achieve the desired level for lowering of demands by the public during emergency situations. In some cases this will be voluntary and in other cases, for example, it will be crews sent out to lock out irrigation meters to enforce curtailment.
4. Each agency, on a policy basis, has the responsibility for setting its planning goals and how to meet them and also to understand the responsibility for not meeting the goals, e.g., achieving a lower level of demand curtailment results in running out of water sooner in a regional outage situation.
5. For the study, the group suggested that the "range of days off of the MET system" should be provided using several different methods of analysis instead of just a single analysis.
6. It was noted by IRWD in their reliability plan that it was easier for them to cut back from a "max month" because of higher outdoor uses. The IRWD Board evaluated the degree of cutbacks to determine the level of cutbacks that would impact the quality of life and used this information in their decision-making process.
7. Some noted that a simpler discussion and more general concept than "days off of MET" is needed to drive home what will happen in an emergency situation to allow the elected folks and the public to understand the implications. Others noted that "days off of MET" when talking about a 10, 20 or 30 day outage is useful, but not when you extend it to 6 months or longer. It was noted that the social and economic impacts to the public increase significantly with increasing outage duration.

8. The group had a discussion on direct potable reuse and when it might become a component of our normal or emergency supplies. It was reported that the California Legislature had passed a law requiring the Department of Public Health to examine standards for direct and indirect potable reuse by 2016.

Based on the group recommendations, the following discussion will examine several criteria that could be used for reliability planning purposes. In the discussions and analyses below, the projects that were developed since 2004 are:

- Irvine Interconnections
- Upper Chiquita Reservoir
- Baker Treatment Plant

A spreadsheet analysis was developed to allow flexibility for each agency to evaluate its own reliability. The spreadsheet was developed by MWDOC to include a number of variables that can be changed by each agency conducting their own analyses, as follows:

- Peaking Factors – The factor to be applied should correspond to the period being evaluated. Peaking factors used for various periods have included:
    - Peak Month = 1.35 times annual average
    - Annual Average = 1.00 times annual average
    - Peak Week = 1.70 times annual average
    - Peak 2-Week (Summer Month Demand) = 1.52 times annual average
    - Figure 6 below provides the monthly hydrograph of demands for the South County area.

- Curtailment Factors – Curtailment factors used have included the following:
    - 15 percent factor used in the 2004 SOCWRS for a 30-day outages
    - 25 percent factor used in the 2004 SOCWRS for a 15-day outages
    - 44 percent factor from the SMWD and MNWD analysis

- Irvine Interconnection Project Capacity can be set in the analysis between 0 and 20 cfs. In accordance with the agreements with IRWD, the Irvine Interconnection Project capacity varies by month and by year. The capacity goes to 0 by 2030. To simplify the assumptions, we have shown the Interconnection capacity at either 0 cfs or 20 cfs; it can be set at any number in the analysis calculations.

- **NEW** Constant Supply or **NEW** Storage – New projects can be added into the analysis to examine the additional benefits provided. Two inputs (either capacity or volume of storage) can be entered for any agency or a collective amount for the group can be added to understand the impacts on reliability for any particular agency or for the group.

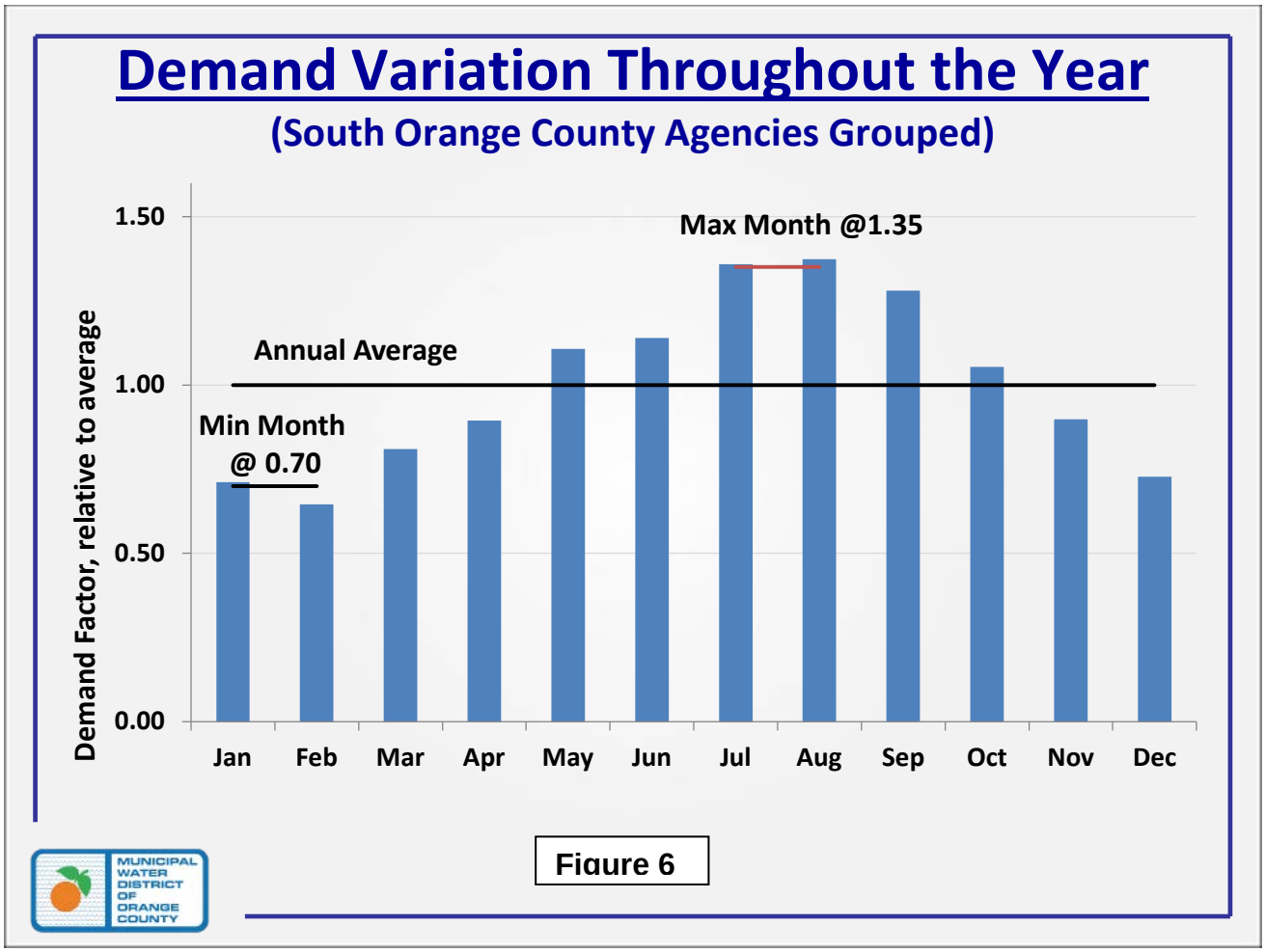

Demand Variation Throughout the Year
(South Orange County Agencies Grouped)
Demand Factor, relative to average
1.50
1.00
0.50
0.00
Max Month @1.35
Annual Average
Min Month
@ 0.70
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

Figure 6

Use of Water Stored in System Reservoirs

Use of Reservoir Storage - Each local agency has capacity in various storage systems, either tanks or reservoirs. The storage is provided for the following reasons:

- Regulatory storage to meet hourly variations in demand within an agencies water system
- Fire fighting purposes
- Emergency storage to allow agencies to continue meeting demands with outages or operational issues within the local or regional system

In the reliability planning work, MWDOC and the SOC agencies have used the following general criteria:

- For planned outages, agencies have the ability to top off storage before the event starts. The planning criteria required by MET and MWDOC are for agencies to have the minimum capability to sustain interruptions of the imported system of 7 days at an average annual demand levels. This is deemed sufficient time to repair and replace portions of the import system.
- For emergency outages, we do not know when the emergency will strike nor do we know the duration of the outage. Emergencies can occur anywhere from when the local reservoirs are at their minimum point during the day (typically late afternoon and evening) to when the reservoirs are full (typically night time/early morning).
- Regional reservoirs are typically held at more constant storage levels (e.g., Bradt Reservoir, ETWD R-6, Upper Chiquita)
- To account for these variations for purposes of reliability estimating, the 2004 SOCWRS assumptions were that 30 percent of tank storage was available for emergency situations and that 97 percent of regional storage remains available.
- More recent discussions with the agencies indicated that most of the agencies operate their systems in the upper ranges of storage. Many if not all indicated that they typically keep their reservoirs at 50 to 70 percent full, including fire flow capacity. Most agencies indicated that a better assumption is to use 50 percent of the tank storage as being available for emergency purposes, unless actual operating strategies indicate otherwise. MNWD has indicated that the assumption for their reservoirs for supplying emergency water is to use 65 percent of their capacity, and Laguna Beach County Water District (LBCWD) has indicated a better assumption for them is 37.5 percent.

Table 15 provides the analysis on the availability of storage in the systems of the local agencies.

Table 15

Existing Potable Water Storage Volume, and Portion Available for Emergency Response

by retailer in the South OC Area, and the SDCWA area supplied by SCWD

	Regional Reservoirs							Local Reservoirs			Total Available	Total Available
					J		*J avail*	*L*		*L avail*	= *J avail* + *L avail*	= *J avail* + *L avail*
Agency	El Toro R-6 Res. MG	Upper Chiquita Reservoir MG	Bradt Res. MG	Schle-gel Res. MG	Gross Joint Res. Vol. [1] (MG)	fraction for emerg. use	Avail. Joint Res. Vol. (MG)	Gross Local Res. Vol. [1] (MG)	fraction for emerg. use	Avail. Res. Volume (MG)	**Storage Available for Emergency** (MG)	**Storage Available for Emergency** (AF)
El Toro WD	124.5				124.5	97%	120.8	12.0	50%	6.0	127	389
Laguna Beach CWD					-			34.0	37.5%	12.8	13	39
Moulton Niguel WD	13.0	90.0	2.35		105.4	97%	102.2	72.0	65%	46.8	149	457
San Clemente		27.3	28.87	7.0	63.2	97%	61.3	22.1	50%	11.1	72	222
San Juan Capistrano		16.3	0.51		16.8	97%	16.3	14.8	50%	7.4	24	73
Santa Margarita WD	137.5	93.8			231.3	97%	224.4	102.5	50%	51.3	276	845
South Coast WD		16.6	12.56		29.2	97%	28.3	21.6	50%	10.8	39	120
So Coast WD -SDCWA			3.71	5.0	8.7	97%	8.4		50%	-	8	26
Trabuco Canyon WD					-			10.0	50%	5.0	5	15
South OC + SDCWA	***275.0***	***244.0***	***48.0***	***12.0***	***579***		***561.6***	***289.0***		***151.1***	***713***	**2,186**

[1] Year 2011 storage volumes reported to MWDOC.

Development of Reliability Analyses Criteria

Figure 7 provides an overview of a number of criteria that could be used in the system reliability analysis. Based on the variables used, the current analysis of "days off of the MET system" ranges from less than 10 days to as high as 45 days.

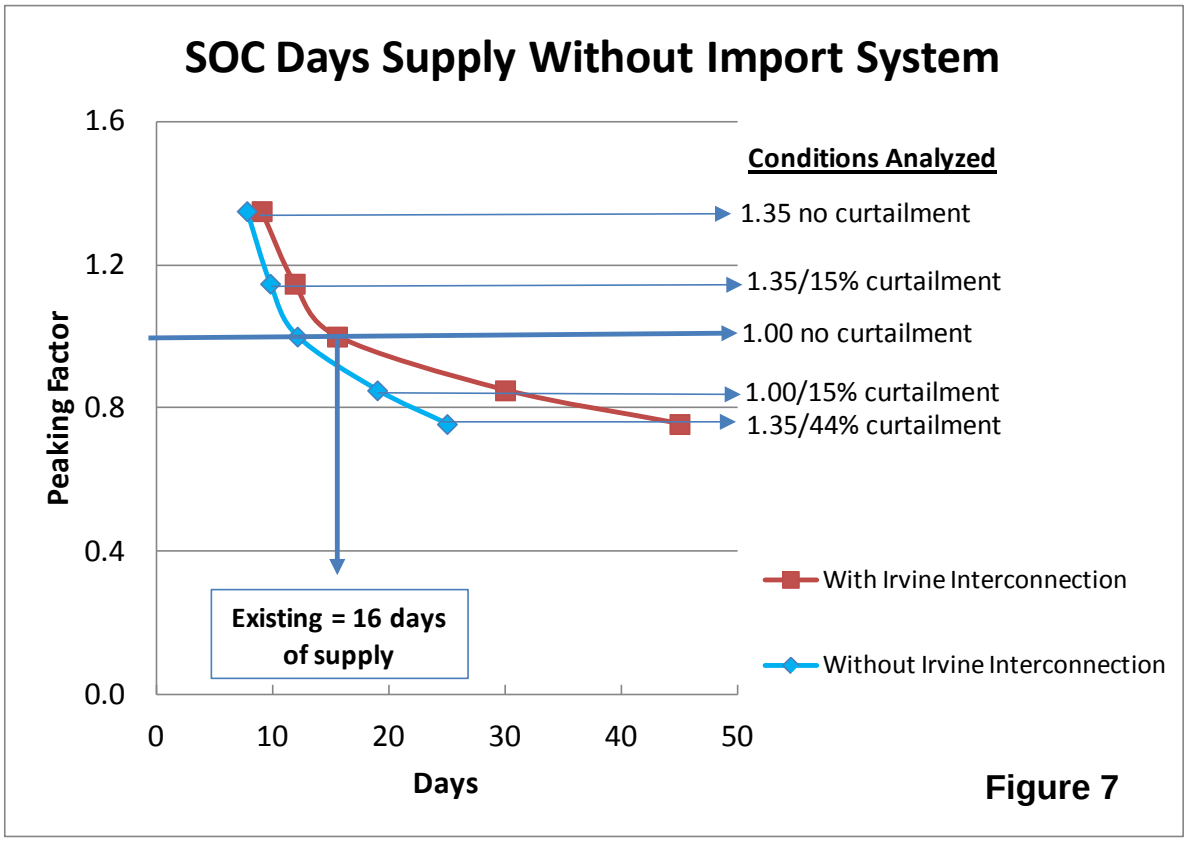


Figure 7

From more restrictive to less restrictive, the following criteria could be used:

Table 16; Option 1: Peaking Factor of 1.35, Demand Curtailment of 15%

Table 17, Option 2: Peaking Factor of 1.00, Demand Curtailment of 0%

Table 18, Option 3: Peaking Factor of 1.35, Demand Curtailment of 25%

Mathematically, options 2 and 3 are nearly the same

Table 19, Option 4: Peaking Factor of 1.35, Demand Curtailment of 44%

Table 20 provides a side by side comparison of all four options for each agency both with and without the Irvine Interconnection Project. Table 21 shows how much capacity on a cfs basis is needed to reach 30 days or 60 days of supply without the MET system under Options 2 or 3.

Table 16
Days Off the Metropolitan System in Year 2020
with Existing System and with Reliability Projects Added

	Demands for Potable Water						Constant Supplies							Storage			Days Off MET
INPUT ASSUMPTIONS=>			**1.35**	**15%**						**20.0**	**cfs**						
Agency	2020 Potable Demand [1] AF/yr	2020 Avg. Annual Potable Demand cfs	2020 Peaked Potable Demand cfs	Demand Curtail-ment cfs	2020 Potable Daily Demand AF/day		Max. **Potable Ground Water** Prod. [3] AF/day	**Trabuco WTP** AF/Day	**Baker WTP** AF/Day	IRWD Inter-conn. Pct.	**IRWD to SOC Inter-Conn.** [4] AF/day	**New Constant Supply** AF/day		**Existing Storage** Available [2] for Emergency (AF)	**New Storage** (AF)		**Days Off MET** [5]
El Toro WD	8,400	11.6	15.7	-2.3	26.4				9.9					389			**24**
Laguna Beach CWD	4,220	5.8	7.9	-1.2	13.3					0.1	2.6			39			**4**
Moulton Niguel WD	29,300	40.5	54.6	-8.2	92.1				25.8	0.6	21.8			457			**10**
San Clemente	9,010	12.4	16.8	-2.5	28.3		4.8			0.1	4.0			222			**11**
San Juan Capistrano	7,700	10.6	14.4	-2.2	24.2		20.4							73			**19**
Santa Margarita WD	34,388	47.5	64.1	-9.6	108.1		0.2		25.8	0.3	9.9			845			**12**
South Coast WD	7,295	10.1	13.6	-2.0	22.9		6.0			0.0	1.3			120			**8**
SDCWA San Onofre	1,084	1.5	2.0		4.0									26			**6**
Trabuco Canyon WD	3,394	4.7	6.3	-0.9	10.7		0.0	12.0	4.0					15			**N/A**
Total SOC + San Onofre	104,791	144.8	195.4	-29.0	330.0		31.4	12.0	65.4	1.0	39.7	0.0		2,186	0		12
												0.0	**cfs**				

[1] Demand Projections collected by MWDOC from the retail agencies in Spring 2012. Excludes demands that will be met by recycled water/non-potable supplies.

[2] Based on gross storage volumes reported to MWDOC. Includes Upper Chiquita Reservoir. For large reservoirs, 97% of gross volume is assumed available for emergency use, but for small tanks, 50% of gross volume is assumed available for emergency use for all agencies except MNWD 65% and LBCWD 37.5%.

[3] Assumes both the San Juan and the Capistrano Beach groundwater recovery plants are operating, but no groundwater production from Trabuco Canyon WD wells.

[4] Per Agreement, IRWD water is less and less available with time. By 2020 it is available only in months Oct.-Jun, with smaller amounts in the warmer of these months. For this calculation , it is assumed that IRWD water is a variable, either 0 or 20 cfs.

[5] Number of days that agency can supply demands at the demand level shown absent Metropolitan treated water supply. MET untreated water is assumed to be available, via the Baker Pipeline.

Table 17
Days Off the Metropolitan System in Year 2020
with Existing System and with Reliability Projects Added

	Demands for Potable Water						Constant Supplies							Storage			Days Off MET
INPUT ASSUMPTIONS=>			**1.00**	**0%**						**20.0**	**cfs**						
Agency	2020 Potable Demand [1] AF/yr	2020 Avg. Annual Potable Demand cfs	2020 Peaked Potable Demand cfs	Demand Curtail-ment cfs	2020 Potable Daily Demand AF/day		Max. **Potable Ground Water** Prod. [3] AF/day	**Trabuco WTP** AF/Day	**Baker WTP** AF/Day	IRWD Inter-conn. Pct.	**IRWD to SOC Inter-Conn.** [4] AF/day	**New Constant Supply** AF/day		**Existing Storage** Available [2] for Emergency (AF)	**New Storage** (AF)		**Days Off MET** [5]
El Toro WD	8,400	11.6	11.6	0.0	23.0				9.9					389			**30**
Laguna Beach CWD	4,220	5.8	5.8	0.0	11.6					0.1	2.6			39			**4**
Moulton Niguel WD	29,300	40.5	40.5	0.0	80.3				25.8	0.6	21.8			457			**14**
San Clemente	9,010	12.4	12.4	0.0	24.7		4.8			0.1	4.0			222			**14**
San Juan Capistrano	7,700	10.6	10.6	0.0	21.1		20.4							73			**107**
Santa Margarita WD	34,388	47.5	47.5	0.0	94.2		0.2		25.8	0.3	9.9			845			**14**
South Coast WD	7,295	10.1	10.1	0.0	20.0		6.0			0.0	1.3			120			**9**
SDCWA San Onofre	1,084	1.5	1.5		3.0									26			**9**
Trabuco Canyon WD	3,394	4.7	4.7	0.0	9.3		0.0	12.0	4.0					15			**N/A**
Total SOC + San Onofre	104,791	144.8	144.8	0.0	287.1		31.4	12.0	65.4	1.0	39.7		**cfs**	2,186		**AF**	16

= Input Number

[1] Demand Projections collected by MWDOC from the retail agencies in Spring 2012. Excludes demands that will be met by recycled water/non-potable supplies.

[2] Based on gross storage volumes reported to MWDOC. Includes Upper Chiquita Reservoir. For large reservoirs, 97% of gross volume is assumed available for emergency use, but for small tanks, 50% of gross volume is assumed available for emergency use for all agencies except MNWD 65% and LBCWD 37.5%.

[3] Assumes both the San Juan and the Capistrano Beach groundwater recovery plants are operating, but no groundwater production from Trabuco Canyon WD wells.

[4] Per Agreement, IRWD water is less and less available with time. By 2020 it is available only in months Oct.-Jun, with smaller amounts in the warmer of these months. For this calculation , it is assumed that IRWD water is a variable, either 0 or 20 cfs.

[5] Number of days that agency can supply demands at the demand level shown absent Metropolitan treated water supply. MET untreated water is assumed to be available, via the Baker Pipeline.

Table 18
Days Off the Metropolitan System in Year 2020
with Existing System and with Reliability Projects Added

	Demands for Potable Water						Constant Supplies							Storage			Days Off MET
INPUT ASSUMPTIONS=>			**1.35**	**25%**						**20.0**	**cfs**						
Agency	2020 Potable Demand [1] AF/yr	2020 Avg. Annual Potable Demand cfs	2020 Peaked Potable Demand cfs	Demand Curtail-ment cfs	2020 Potable Daily Demand AF/day		Max. **Potable Ground Water** Prod. [3] AF/day	**Trabuco WTP** AF/Day	**Baker WTP** AF/Day	IRWD Inter-conn. Pct.	**IRWD to SOC Inter-Conn.** [4] AF/day	**New Constant Supply** AF/day		**Existing Storage** Available [2] for Emergen cy (AF)	**New Storage** (AF)		**Days Off MET** [5]
El Toro WD	8,400	11.6	15.7	-3.9	23.3				9.9					389			**29**
Laguna Beach CWD	4,220	5.8	7.9	-2.0	11.7					0.1	2.6			39			**4**
Moulton Niguel WD	29,300	40.5	54.6	-13.7	81.3				25.8	0.6	21.8			457			**14**
San Clemente	9,010	12.4	16.8	-4.2	25.0		4.8			0.1	4.0			222			**14**
San Juan Capistrano	7,700	10.6	14.4	-3.6	21.4		20.4							73			**77**
Santa Margarita WD	34,388	47.5	64.1	-16.0	95.4		0.2		25.8	0.3	9.9			845			**14**
South Coast WD	7,295	10.1	13.6	-3.4	20.2		6.0			0.0	1.3			120			**9**
SDCWA San Onofre	1,084	1.5	2.0		4.0									26			**6**
Trabuco Canyon WD	3,394	4.7	6.3	-1.6	9.4		0.0	12.0	4.0					15			**N/A**
Total SOC + San Onofre	104,791	144.8	195.4	-48.4	291.6		31.4	12.0	65.4	1.0	39.7	0.0		2,186	0		15
												0.0	**cfs**				

[1] Demand Projections collected by MWDOC from the retail agencies in Spring 2012. Excludes demands that will be met by recycled water/non-potable supplies.

[2] Based on gross storage volumes reported to MWDOC. Includes Upper Chiquita Reservoir. For large reservoirs, 97% of gross volume is assumed available for emergency use, but for small tanks, 50% of gross volume is assumed available for emergency use for all agencies except MNWD 65% and LBCWD 37.5%.

[3] Assumes both the San Juan and the Capistrano Beach groundwater recovery plants are operating, but no groundwater production from Trabuco Canyon WD wells.

[4] Per Agreement, IRWD water is less and less available with time. By 2020 it is available only in months Oct.-Jun, with smaller amounts in the warmer of these months. For this calculation , it is assumed that IRWD water is a variable, either 0 or 20 cfs.

[5] Number of days that agency can supply demands at the demand level shown absent Metropolitan treated water supply. MET untreated water is assumed to be available, via the Baker Pipeline.

Table 19
Days Off the Metropolitan System in Year 2020
with Existing System and with Reliability Projects Added

	Demands for Potable Water						Constant Supplies							Storage			Days Off MET
INPUT ASSUMPTIONS=>			**1.35**	**44%**						**20.0**	**cfs**						
Agency	2020 Potable Demand [1] AF/yr	2020 Avg. Annual Potable Demand cfs	2020 Peaked Potable Demand cfs	Demand Curtail-ment cfs	2020 Potable Daily Demand AF/day		Max. **Potable Ground Water** Prod. [3] AF/day	**Trabuco WTP** AF/Day	**Baker WTP** AF/Day	IRWD Inter-conn. Pct.	**IRWD to SOC Inter-Conn.** [4] AF/day	**New Constant Supply** AF/day		**Existing Storage** Available [2] for Emergency (AF)	**New Storage** (AF)		**Days Off MET** [5]
El Toro WD	8,400	11.6	15.7	-6.9	17.4				9.9					389			**52**
Laguna Beach CWD	4,220	5.8	7.9	-3.5	8.7					0.1	2.6			39			**6**
Moulton Niguel WD	29,300	40.5	54.6	-24.0	60.7				25.8	0.6	21.8			457			**35**
San Clemente	9,010	12.4	16.8	-7.4	18.7		4.8			0.1	4.0			222			**22**
San Juan Capistrano	7,700	10.6	14.4	-6.3	15.9		20.4							73			**N/A**
Santa Margarita WD	34,388	47.5	64.1	-28.2	71.2		0.2		25.8	0.3	9.9			845			**24**
South Coast WD	7,295	10.1	13.6	-6.0	15.1		6.0			0.0	1.3			120			**15**
SDCWA San Onofre	1,084	1.5	2.0		4.0									26			**6**
Trabuco Canyon WD	3,394	4.7	6.3	-2.8	7.0		0.0	12.0	4.0					15			**N/A**
Total SOC + San Onofre	104,791	144.8	195.4	-85.1	218.8		31.4	12.0	65.4	1.0	39.7	0.0		2,186	0		31
												0.0	**cfs**				

[1] Demand Projections collected by MWDOC from the retail agencies in Spring 2012. Excludes demands that will be met by recycled water/non-potable supplies.

[2] Based on gross storage volumes reported to MWDOC. Includes Upper Chiquita Reservoir. For large reservoirs, 97% of gross volume is assumed available for emergency use, but for small tanks, 50% of gross volume is assumed available for emergency use for all agencies except MNWD 65% and LBCWD 37.5%.

[3] Assumes both the San Juan and the Capistrano Beach groundwater recovery plants are operating, but no groundwater production from Trabuco Canyon WD wells.

[4] Per Agreement, IRWD water is less and less available with time. By 2020 it is available only in months Oct.-Jun, with smaller amounts in the warmer of these months. For this calculation , it is assumed that IRWD water is a variable, either 0 or 20 cfs.

[5] Number of days that agency can supply demands at the demand level shown absent Metropolitan treated water supply. MET untreated water is assumed to be available, via the Baker Pipeline.

Table 20
Days Off of MET Under Various Assumptions in 2020

	Irvine Interconnection = 20 cfs				Irvine Interconnection = 0 cfs			
Agency	1.35 Peaking Less 15% Demand Curtailment	1.00 Peaking Less 0% Demand Curtailment	1.35 Peaking Less 25% Demand Curtailment	1.35 Peaking Less 44% Demand Curtailment	1.35 Peaking Less 15% Demand Curtailment	1.00 Peaking Less 0% Demand Curtailment	1.35 Peaking Less 25% Demand Curtailment	1.35 Peaking Less 44% Demand Curtailment
El Toro WD	24	30	29	52	24	30	29	52
Laguna Beach CWD	4	4	4	6	3	3	3	4
Moulton Niguel WD	10	14	14	35	7	8	8	13
San Clemente	11	14	14	22	9	11	11	16
San Juan Capistrano	19	107	77	No Shortage	19	107	77	No Shortage
Santa Margarita WD	12	14	14	24	10	12	12	19
South Coast WD	8	9	9	15	7	9	8	13
SDCWA San Onofre	6	9	6	6	6	9	6	6
Trabuco Canyon WD	No Shortage	No Shortage	No Shortage	No Shortage	No Shortage	No Shortage	No Shortage	No Shortage
Grouped Total	12	16	15	31	10	12	12	20

Table 21		
New Supply (CFS) Needed to Achieve 30 or 60 Days off MET [1]		
Assumes Irvine Interconnection = 20 cfs [2]		
Agency	30 Days	60 Days
El Toro WD	0.0	3.3
Laguna Beach CWD	3.8	4.1
Moulton Niguel WD	8.8	12.5
San Clemente	4.3	6.1
San Juan Capistrano	0.0	0.0
Santa Margarita WD	15.0	22.1
South Coast WD	4.3	5.3
SDCWA San Onofre	1.1	1.3
Trabuco Canyon WD	0.0	0.0
Total Group (not sum of above)	33.0	51.0
Sum of Above	37.2	54.7
[1] Note: Based on annual average demands and no curtailment.		
[2] Irvine Interconnection capacity declines over time		

SECTION 7
ACCOUNTING FOR MULTIPLE BENEFITS OF PROJECTS USING THE SOCOD PROJECT AS AN EXAMPLE

SECTION 7
Accounting for Multiple Benefits of Projects Using the SOCOD Project as an Example

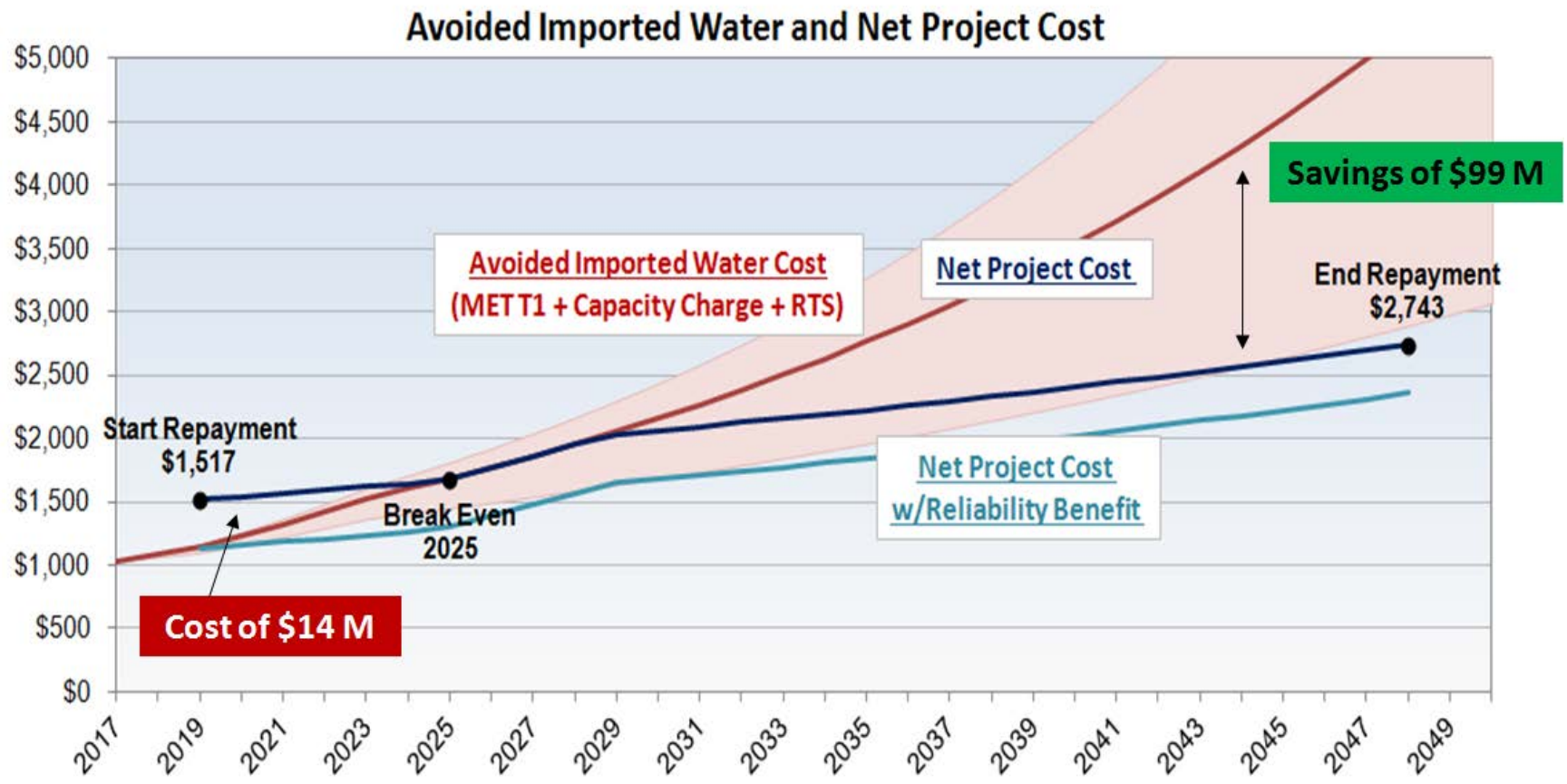
As previously discussed, local projects that develop new sources of supply provide both source and system reliability benefits. Typically, when evaluating new projects, the costs of the new supply are compared to the cost of MET water. This is only a one-dimensional analysis of a two-dimensional benefit. Not only will the project offset the cost of MET water (benefit #1), but it can also improve system reliability (benefit #2). The question is how to account for this in an analysis.

The sample output from an annual cost comparison of the SOCOD Project analysis compared to the cost of importing MET water is shown in Figure 8. For the assumptions made in the analysis, the chart shows the following:

- The Unit Cost of the project, as a sum of the amortized capital plus O&M and energy costs.
- The avoided cost of not having to import the amount of the water the project produces. This is a combination of the Tier 1 water costs plus the amount of avoided costs for the Capacity Charge and the Readiness to Serve Charge.
- The comparisons between the first two components are graphed for a 30-year period.
- An additional part of the analysis indicates where the lines will cross, and the lower right hand portion of the figure provides a Net Present Value of the cost comparison between the project cost and MET water costs accumulated on a Present Value basis between the project startup and the cross-over point, after the cross-over point, and over the life of the project. For example, in the sample provided, the cost of the project water is initially higher than the cost of MET water. The project participants would pay $14 M more in water costs up to the point of the cross-over and would receive a benefit after the cross-over of $99 M, resulting in an overall net benefit of $85 M. This is only one "sample" analysis of the SOCOD project. For actual decision-making purposes, a number of assumptions will be run to fully understand the sensitivity of the project economics to the baseline assumptions.
- This analysis provides only a one dimensional analysis. Another benefit provided by the project is the ability to continue providing water into the local system in the event of an outage of the import system. This benefit can be valued based on the recent Upper Chiquita Reservoir project. Upper Chiquita Reservoir was constructed at a cost of $50 Million and can provide 23 cfs of emergency supplies for 15 days. The SOCOD Project can provide 23 cfs continuously. Assuming the SOC System Reliability Goal is set at 30 days, an additional benefit created by the SOCOD project is equivalent to two Upper Chiquita Reservoirs valued at $100 M. Taking this benefit into account by amortizing it at the same rate and period as the overall project results in lowering the "cost" line (shown below by a second "project cost line" by about $385 dollars per AF (amortized cost of $100M). Accounting for the second benefit does not truly lower the cost of the project, but it does help identify and account for both benefits of the project including replacing MET water and providing an additional system reliability benefit.

This technique can be used for other types of benefits that can be quantified and for other types of projects that have multiple benefits. This technique results in the SOCOD project looking financially solid within about 1 or 2 years of startup of the project under this scenario compared to 10 years without accounting for this benefit.

Figure 8 Accounting for Multiple Project Benefits



SECTION 8
MET/MWDOC MODIFICATIONS TO THE WATER SUPPLY ALLOCATION PLAN

SECTION 8
MET/MWDOC Modifications to the Water Supply Allocation Plan

Another issue that has been identified with the development of local projects is whether or not the local project "gets full credit" under a Water Supply Allocation Plan (WSAP). Typically, local projects are not developed solely to be operated during drought years. Operation of the project in non-drought years helps keep the agency and the region out of droughts and improves the source reliability of the region. However, when the time comes for "rationing" or "allocating" supplies among the region, developers of local projects expect that their "shortages"/reliability would be less than agencies that have not developed local supplies.

The MET and MWDOC WSAPs are based on the "need" for imported water, plus other adjustments. The WSAP methodology does not distinguish between types or costs of local supplies (e.g., groundwater, groundwater treatment, recycled water, or ocean water desalination) or whether they are potable or non-potable in considering the "need" for imported water. The formula, in the simplest sense, is the retail demand less local supply, with several adjustments. Although an agency that develops local supplies is always in better shape under a WSAP compared to an agency that does not develop local supplies, the formula does not readily allow an agency to appreciably modify its reliability and does not provide the developer of a local project a 1 for 1 credit during a WSAP. This is viewed by some as a "disincentive" to developing additional local projects. The policy question to be addressed is whether or not a method to address this "disincentive" can be achieved at the MWDOC or MET level. MET has been reluctant to address this issue in discussions over the past several years due to facing an argument of entitlement of the water during a drought allocation. SDCWA considered the same issue and addressed it as outlined below at the SDCWA level and NOT at the MET level. Staff will continue working on options for addressing this within the MWDOC service area. If this issue cannot be resolved, it may be a barrier to implementation of "expensive" local projects.

Excerpt from SDCWA WSAP

The section below, Local Projects Development, is an excerpt from the SDCWA WSAP. The purpose of the adjustment is to reallocate a portion of supplies that SDCWA receives from MET to recognize investments made in local projects such as groundwater development, recycled water, and ocean water desalination. MET's WSAP does not include such an adjustment.

> ***"Local Projects Development***
> *The development of highly reliable in-region supplies, such as brackish groundwater recovery, recycled water, and seawater desalination result in a dual benefit. They add to the region's supply diversity and are a dependable source during shortages of imported water. An adjustment is made for the regional benefit of these annually reliable supplies. The adjustment recognizes both the investment made by the local agency and the regional financial contribution made by the Water Authority. Similar to the base period calculation time frame, a three-year average of beneficial use from these reliable supplies is employed to calculate the adjustment. The Local Projects Development adjustment is 30 percent of the three-year average. In addition to the incentive from the adjustment, the member agency will be able to utilize 100 percent of their local project's supply that is available during a drought."*

SECTION 9
PROJECTED COST OF MET WATER

SECTION 9
Projected Cost of MET Water

MET has recently updated the projected cost of water out to 2017. MET staff believes the near-term projection of rates provides a reasonable estimate of the rates for the next several years. Many factors that will result in upward pressure on the MET rates have been reflected in these projections including a lower water sales assumption. The effect of a lower water sales assumption by MET is more conservative and, hence, is able to provide more flexibility for covering unexpected rate impacts in the future. Discussions with MET staff indicated that out-year projections beyond 2017 would best be covered by looking at a range of escalation factors from 3 percent on the low side to 6 percent on the high side.

The future cost of water from MET is sensitive to a number of variables, making it difficult to develop an accurate long-term projection. Following are potential issues that could impact rates:

- Energy issues – The impact of the State Cap and Trade is not factored in and is really unknown at this time. Higher energy rates are forecast, both because of the desire by the State to have a higher mix of renewable energy sources and due to expansions needed in the Statewide electrical distribution system. MET is also facing a particular nuance of the AB-32 legislation from 2008 whereby the electricity they import for deliveries on the Colorado River Aqueduct that is above the power generation they receive from Hoover hydroelectric power may be assessed by California Air Resources Board as an “energy generator” in the state. MET is working hard on relief from the California Air Resources Board, but so far their requests have been ignored. The impact of this decision could impact MET costs on the order of $7M per year.
- Bay-Delta Conservation Plan (BDCP) – Future costs of the BDCP have been factored into the near-term forecasts with the remaining portion of the costs to be included in the escalation range. The most recent estimate of costs for the fix, assuming MET pays for about 25%, is the cost of water for capital amortization and O&M costs are on the order of $200 per AF on the MET water rates. Depending on what actually occurs, the costs could likely be either higher or lower, but would probably tend to cluster towards a higher cost. These are factored in between now and 2026 when the project is expected to start-up.
- MET Rehabilitation and Repair (R&R) Costs of Infrastructure (PAYGO funding) – MET has over $6 billion of investments in the ground not including their share of the SWP. These assets require periodic R&R. MET had an asset management analysis done some years ago. MET staff currently feels that the $125 M per year they spend on Pay-as-you-go (PAYGO) funding is sufficient at this time, especially given the market cost of construction projects. As inflation picks up, the spending over time will have to pick up to keep in step with the facility needs.
- SWP R&R – It is widely reported that the SWP is not maintained in nearly as good a condition as the MET facilities. Currently, the SWP is limited by facility conditions to about 70% of the delivery capacity of the SWP and the power supply generation has been reduced because of the failure at the Oroville facilities. MET has included some additional costs of future requests for SWP R&R funding in their budget (higher than what the State is requesting). This may or may not be sufficient to cover the deficiencies in the SWP needs. The SWP contracts expire in 2035 and as the contracts are

renewed, it is possible that the renewed contracts will allow for additional levels of R&R funding without rate increases, as the original debt costs of the SWP expire. MET and DWR are currently looking at options for the R&R needs.

- Treatment Costs – The full capital and O&M costs associated with the ozone retrofit project at all five of MET's treatment plants are fully captured in the near-term water rates.
- Pension/Health Costs – MET pension costs are already built into the rate projections. Other Post Employment Benefits (OPEB) have about a $500 million unfunded liability. MET believes they can eliminate the exposure with an annual contribution of about $50 M per year over the next 10 years. This is not fully reflected in the water rates. The other possibility is that by setting a more conservative assumption on water sales, any excess revenue, should it occur, could be used to fund this liability.

- MET staff is examining methods to increase their fixed revenue. One such method is to change the basis of future AV tax revenue so that the percentage of tax levy remains fixed into the future at the current level rather than having the tax levy transition to zero between now and 2035 as planned. The additional tax levy, if successful, would tend to hold rates down in the future because of the estimated $90 million or so in fixed revenue that would accrue each year.

Figures 9 and 10 provide a historical and projected estimate of the cost of MET water. Discussions with MET staff indicate that outyear cost projection beyond 2017 ranging from an annual escalation of about 3% per year on the low side to about 6% per year on the high side can be expected. Discussions with various sources in the industry note more cost pressures pushing rates towards the higher side of this range.

Figure 9: MWD Water Rate History (1980-2012)

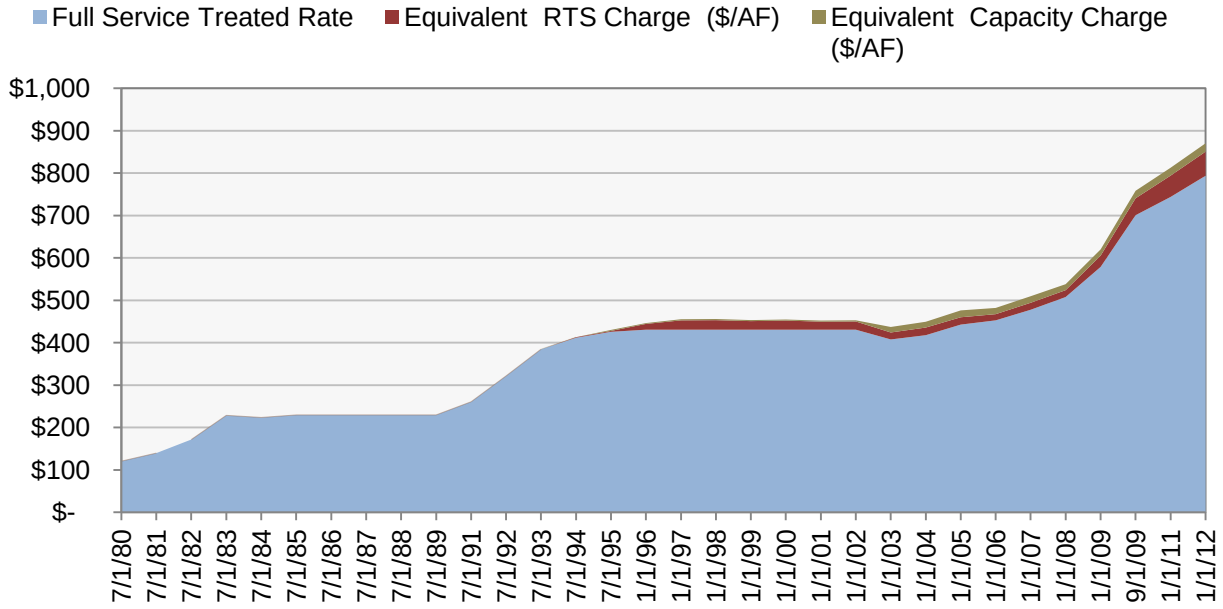
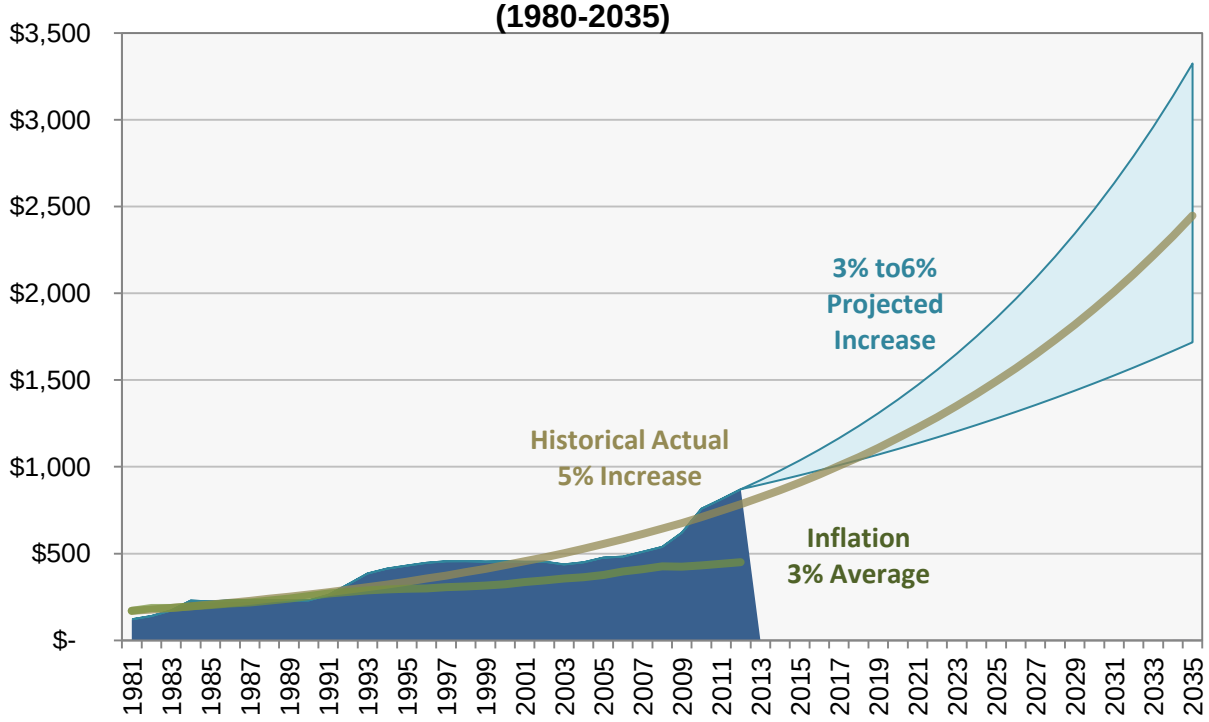


Figure 10: Historical and Projected MWD Water Rates (1980-2035)



SECTION 10
CONCLUSIONS AND RECOMMENDATIONS

SECTION 10 – CONCLUSIONS AND RECOMMENDATIONS

Conclusions

There is much uncertainty involved in providing cost and reliability estimates for imported water out into future years beyond the near term. Resolution of the BDCP Project and putting it into operation is many years away (at least 14 years at the earliest). Therefore, it is incumbent on agencies to examine the options for new sources of supply that can be developed locally. New local supplies provide two benefits: source reliability and system reliability. These sources remain under local control and can provide certainty over the long run. We must also recognize the vulnerability of the regional imported system from the SWP and the Colorado River and understand that these sources of supply can be interrupted in the event of earthquakes. Although MET has many resources, entities within Southern California could suffer significant levels of shortages for long periods of time. A scenario analysis completed herein indicates that shortages from MET could be on the order of 20 to 40 percent over a multiple-year period.

The following conclusions should be noted:

1. The South OC area is about 90% dependent on imported water for drinking water supply, and this dependence will continue into the future. The South OC area has between 12 and 31 days of drinking water supply given a complete outage of the imported water system. The reliability varies from agency to agency.

2. Orange County will always be dependent to a large extent on supplies from the SWP and the CRA. Supplies from the SWP carry the greatest uncertainty out into the future. The dependence in SOC is higher than in general for Orange County. Rough estimates of current and future dependence are provided below:

Table 22: Dependence of Orange County and South Orange County on Imported Supplies

	Orange County		SOC	
	Today	Future	Today	Future
Imported Supplies	50%	40%	90%	70%
SWP	25%	20%	45%	35%
CRA	25%	20%	45%	35%

3. Fixing the Bay-Delta is part of MET's IRP and will improve our water source reliability:
   - We have a great opportunity now.
   - It will take 10 to 20 years or more and will be expensive.

4. Our imported sources of water from MET are continually under attack, although the MET IRP says that we are fully reliable out to 2035, primarily because:
   - Demands are lower.
   - Local supplies are projected to increase.
   - The development and use of the storage capacity by MET results in MET demonstrating a high reliability.

5. Earthquakes pose a major hazard to the vital water conveyance facilities that deliver water to Orange County from hundreds of miles away. The State Water Project is vulnerable to disruption in the event of a large earthquake along the Hayward Fault in the Bay-Delta. Failure of the Bay-Delta levees could cause a loss of the State Water source for several years. "Fixing" the Bay-Delta to prevent such a loss will take 10 to 20 years. The single largest risk exposure to Orange County with respect to System Reliability is from earthquakes that could disrupt SWP flows for more than 1 year. Localized earthquake risks also exist and could result in long-term outages.

6. The South OC area in particular, can develop local water reliability projects while the Bay-Delta fix is in process. Local projects can have multiple benefits:
   - Potable projects are more flexible than non-potable projects.
   - Emergency projects only provide benefits during an outage event. These types of projects include expansion of the Irvine Interconnection, the Second Lower Cross Feeder Project and additional reservoir storage.
   - Local projects that produce new sources of supplies have two benefits. These types of projects include ocean desalination, groundwater desalting, water use efficiency projects and water recycling. These projects provide reliability during outages and a new source of supply.

7. South OC area agencies have a variety of reliability goals. Ten years ago our goal was to get to 7 to 10 days of ability of meeting demands without the MET system and this goal has been achieved. Today, the study suggests that agencies begin thinking about goals of having between 30 days and 60 days of supplies in the absence of the imported water system, i.e. the ability to withstand outages of the import system for 30 days to 60 days duration.
   - Under Criteria Options 2 & 3, 33 cfs of additional potable water supply are required to achieve a reliability duration of 30 days and 51 cfs of additional supply is required to achieve a reliability duration of 60 days. The needs could be higher or lower under different criteria. These needs would be 20 cfs higher if the flows from the Irvine Interconnection project are not renewed.

Recommendations

Recommendations are as follows:

1. Each agency needs to be able to set its own goals and plans for reliability, so the concept of adopting a "common standardized methodology" is **NOT** recommended. In this regards, each agency has unique circumstances and may have policy differences and directions from the governing board or council for their reliability plans. It is therefore incumbent on each agency to set and communicate expectations with consumers regarding emergency events. The responsibility for not meeting the goals, e.g., achieving a lower level of demand curtailment results in running out of water sooner in a regional outage situation must be considered.

2. Several different criteria should be utilized for agencies to better understand the "range of days off of the MET system" that can be achieved. The study outlined performance under four options:

Option 1: Peaking Factor of 1.35, Demand Curtailment of 15%

Option 2: Peaking Factor of 1.00, Demand Curtailment of 0%

Option 3: Peaking Factor of 1.35, Demand Curtailment of 25%

Mathematically, options 2 and 3 are nearly the same

Option 4: Peaking Factor of 1.35, Demand Curtailment of 44%

3. The study suggests that agencies begin thinking about goals of having between 30 days and 60 days of supplies in the absence of the imported water system.

4. Specific projects that should receive heightened attention are:
   - The SLCF Project
   - Development of San Juan Groundwater Basin
   - The SOCOD Project developed in conjunction with management of the San Juan Groundwater Basin.
   - Methods to expand the Irvine Interconnection project to deliver additional supplies or for a period of time beyond 2030 should be examined.

5. Continued support should be provided for the Bay-Delta Fix, as it is an essential element of source reliability in Southern California; local water reliability projects should be pursued during the 10 to 20 years that the Bay-Delta fix is in process.

6. Implementation of WUE efforts and recycling efforts among the agencies should remain at the top of the list.

7. The agencies should work on a more formal process to determine where the next investment should be made. Suggested criteria to use as a starting point include:
   - Cost & Yield (capital and O&M) and retail rate impacts; typically evaluated on a Net Present Value comparison of alternatives; must answer the questions of what is the reliability premium over imported supplies and what benefits are being provided.
   - Distance from the source (closer is better)
     - Age of system components
     - Number of major fault crossings
   - Reliability improvement of the option being considered (more is better)
     - Diversification of sources
     - Water quality improvements – higher quality is better
     - Risks/Implementability issues (simpler is preferred)
       - Institutional/Legal – simpler is better
       - Environmental – least risk is better
       - Sustainability – more/simpler is better
       - Political – less is better
     - Local Control – more is better
     - Energy exposure – less is better
     - Other vulnerability – less is better
       - Other project factors – to be determined