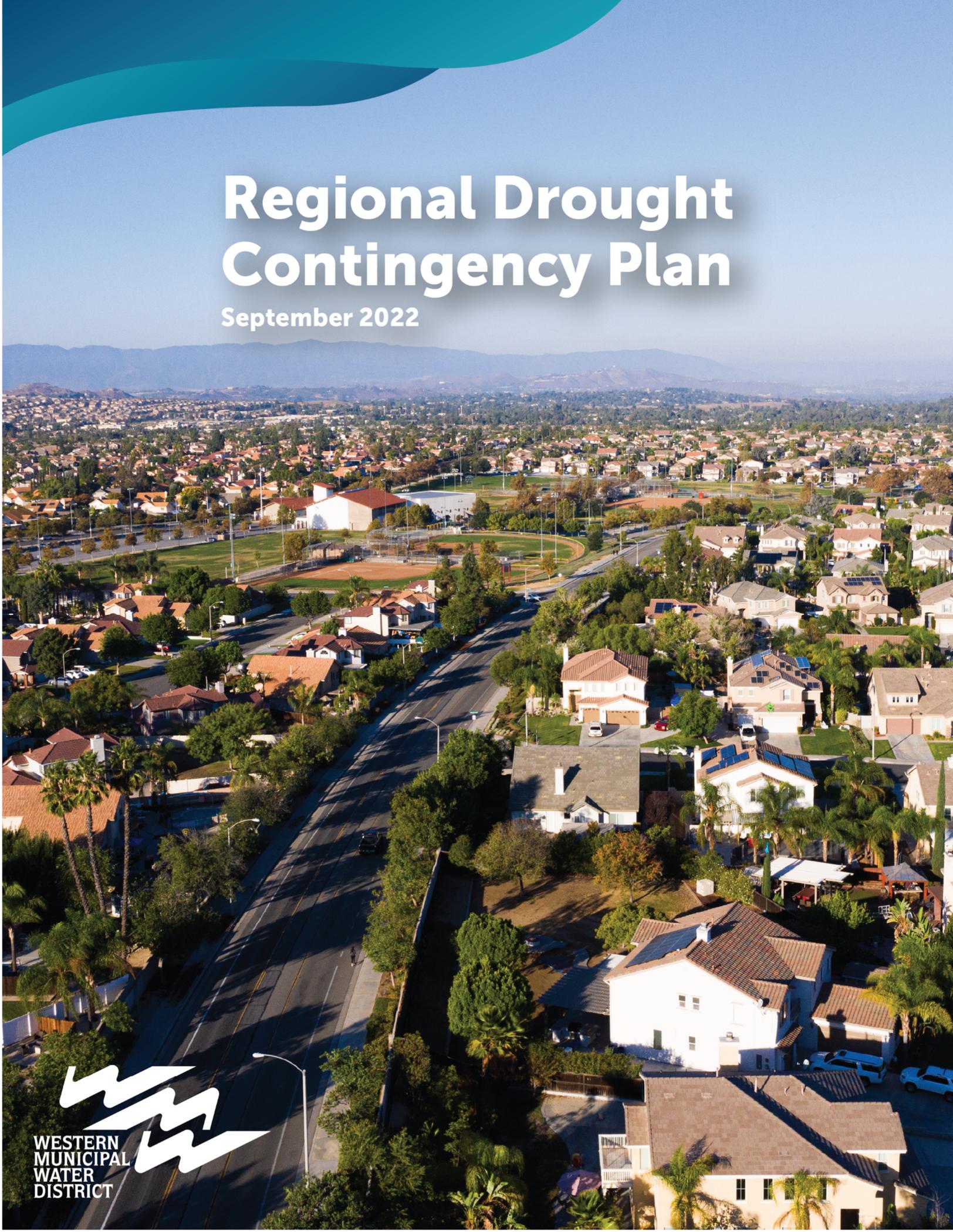


# Regional Drought Contingency Plan

September 2022



WESTERN  
MUNICIPAL  
WATER  
DISTRICT



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# Acronyms and Abbreviations

AF	acre-feet
AFY	acre-feet per year
Board	Western’s Board of Directors
CCTAG	Climate Change Technical Advisory Group
CDA	Chino Basin Desalter Authority
cfs	cubic feet per second
CRA	Colorado River Aqueduct
DAP	Drought Allocation Plan
DCP	Drought Contingency Plan
DMF	Drought Monitoring Framework
DWR	California Department of Water Resources
EMWD	Eastern Municipal Water District
EOWR	Engineering Operations Water Resources
ET	evapotranspiration
EVMWD	Elsinore Valley Municipal Water District
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
HUC	Hydrologic Unit Code
IEUA	Inland Empire Utilities Agency
IRP	Integrated Water Resources Plan
JCSD	Jurupa Community Services District
JPA	joint powers authority
MAF	million acre-feet
MWD	Metropolitan Water District of Southern California
O&M	operation and maintenance
Portal	Regional Drought Portal
RCWD	Rancho California Water District
RCSA	Rubidoux Community Services District
RHWC	Riverside Highland Water Company
RO	reverse osmosis
RPU	Riverside Public Utilities
SGMA	Sustainable Groundwater Management Act
SBBA	San Bernardino Basin Area
SWP	State Water Project
UWMP	Urban Water Management Plan
VIC	Variable Infiltration Capacity
WSAP	Water Shortage Allocation Plan
WRCRWA	Western Riverside County Regional Wastewater Authority
WRCRWTP	Western Riverside County Regional Wastewater Treatment Plant
WSCP	Water Supply Shortage Contingency Plan
WTP	Water Treatment Plant
WWRF	Western Water Recycling Facility

# 1 Introduction

Western Municipal Water District (Western) was formed in 1954 and provides water supply, wastewater treatment and disposal, and water resource management to nearly one million people in a service area covering roughly 527-square miles. As a member agency of the Metropolitan Water District of Southern California (MWD), Western provides wholesale water to the region within its service area, which includes the cities of Corona, Norco and Riverside and the water agencies serving Box Springs, Eagle Valley, Elsinore Valley, Temescal Valley, and Temecula. Western also directly serves water to approximately 25,000 retail customers in the unincorporated areas of El Sobrante, Eagle Valley Temescal Creek, Woodcrest, Lake Mathews, March Air Reserve Base and Rainbow, as well as portions of the cities of Riverside and Murrieta.

With drought and emergency situations continuously a threat to water supply, Western has had a Drought Contingency Plan (DCP) in place since 1992 and a Water Supply Shortage Contingency Plan (WSCP) in place since 2009. Both plans focus on shortages in imported water supply from MWD, since this source has historically comprised the largest proportion of Western's total supply, it is the most variable and is the biggest driver in terms of year-to-year water supply conditions. Western's existing plans are limited in their scope because they only discuss customer actions to reduce imported water supply. Western needs a comprehensive, proactive, robust plan that considers drought impacts to local water supplies and infrastructure that could help Western customers in times of drought.

To increase water supply reliability and proactively address the region's concern with drought, in 2021 Western embarked on the preparation of a regional DCP, funded in part by the United States Bureau of Reclamation (Reclamation). The regional DCP has many elements in common with elements of Western's Urban Water Management Plan (UWMP)/WSCP. The UWMP/WSCP is used to ensure water supplies are available to meet current and future demands, and to manage and mitigate water shortage conditions. These elements include supply and demand analysis, climate change vulnerability, and water shortage response actions. Therefore, the UWMP/WSCP and regional DCP were largely prepared in parallel as a joint project with a coordinated schedule and approach. The elements of the regional DCP are described below in [Section 1.1](#).

As part of this joint project, Western performed outreach and engagement with various stakeholder groups which is described in [Section 1.2](#). Part of this outreach and engagement involved establishing a Drought Task Force, which as described in [Section 1.3](#), was comprised of community leaders and water agency staff representing diverse water needs and planning expertise to inform the DCP and UWMP development. Together with the Drought Task Force, Western developed several overarching goals and guiding principles to inform development of the DCP, which was prepared with input from the Drought Task Force via several workshops and project information requests in 2021 and 2022. These goals and principles, along with details related to the DCP development process and its elements are summarized in [Section 1.4](#) and [1.5](#). The regional DCP was formally adopted by Western on July 20, 2022. Details related to this adoption and final submittal to Reclamation are provided in [Section 1.6](#).

## 1.1 DCP Elements

The DCP is organized into the following eight chapters in alignment with Reclamation's Drought Response Program Framework:

- **Chapter 1: Introduction** – this section describes the elements of the DCP, outreach and engagement performed during the development of the DCP, and regional drought goals and guiding principles used to develop the DCP. This section also describes the DCP development process, and information related to plan adoption and submittal.
- **Chapter 2: Background** – this section briefly describes the regional water suppliers, along with key water resource supplies and regional water demand to provide a critical foundation for the DCP.
- **Chapter 3: Regional Drought Monitoring Framework (DMF)** – the regional DMF establishes a process for monitoring near- and long-term water availability and developing a framework for predicting the probability of future droughts or confirming an existing drought.
- **Chapter 4: Vulnerability Assessment** – the vulnerability assessment aims to improve the understanding of climate change impacts on future water demand in Western's wholesale service area and the sources of Western's water supplies during normal and drought periods.
- **Chapter 5: Mitigation Actions** – this section describes projects or programs that can be implemented ahead of a drought to lessen the future impacts of drought.
- **Chapter 6: Response Actions** – this section describes near-term actions to address the demand side of the water balance in periods where water supply cannot meet demand.
- **Chapter 7: Operational and Administrative Framework** – the operational and administrative framework identifies who is responsible for implementing each element of the DCP and the process and schedule for monitoring, evaluating, and updating the DCP.

## 1.2 Outreach and Engagement

Western actively engaged with diverse stakeholder groups throughout the development of the DCP. The various stakeholder groups involved with the DCP and their role are summarized below in [Table 1-1](#). Each stakeholder group and the methods of outreach and engagement are described in the following sections.

TABLE 1-1: KEY STAKEHOLDERS AND ROLES

		ROLE FOR DCP			
		INFORM / EDUCATE	GATHER PERCEPTIONS / OPINIONS	ADVISE	DECIDE
STAKEHOLDER GROUP	Drought Task Force	X	X	X	
	Engineering, Operations, Water Resources (EOWR) Committee	X	X	X	
	Western Board of Directors				X
	General Public	X	X		
		<b>OUTREACH</b> One-way communication to educate, inform		<b>ENGAGEMENT</b> Multi-directional communication to inform plan decisions	

## 1.3 Drought Task Force

As previously noted, the DCP was developed in parallel with the UWMP/WSCP. As part of this consolidated effort, Western recruited, convened, and engaged a Drought Task Force comprised of 29 organizations represented by knowledgeable community leaders who can offer diverse, informed perspectives to support effective drought contingency planning. The members of the Drought Task Force organized by stakeholder segment group are presented in [Table 1-2](#). All retail water agencies in Western's service area are represented on the Drought Task Force.

TABLE 1-2: DROUGHT TASK FORCE MEMBERS

SEGMENT	PERCENT REPRESENTATION	ORGANIZATION
Environmental and Conservation Groups	10%	Inland Empire Resource Conservation District Inland Empire Waterkeeper Riverside-Corona Resource Conservation District
Environment and Social Justice	3%	Center for Community Action and Environmental Justice
Regional Government	7%	Riverside County Flood Control and Water Conservation District Western Riverside Council of Governments
Research	7%	University of California, Riverside Water Resources Institute
Local Government	3%	City of Murrieta
Retail: Customer Stakeholder	17%	Altman Plants March Air Reserve Base Vons/Kroger Riverside County Woodcrest Municipal Advisory Council
Tribal Representatives	4%	Pechanga Tribal Government
Water Agency: Regional	14%	Eastern Municipal Water District Metropolitan Water District of Southern California San Bernardino Valley Municipal Water District Santa Ana Watershed Project Authority
Water Agency: Retail Agencies in Western Service Area	34%	Box Springs Mutual Water Company City of Corona City of Norco Elsinore Valley Municipal Water District Jurupa Community Services District Rancho California Water District Riverside Highland Water Company Riverside Public Utilities Rubidoux Community Services District Temescal Valley Water District

### 1.3.1 Western Engineering, Operations, and Water Resources (EOWR) Committee

Western's EOWR Committee serves as an advisor to DCP (and UWMP) development. To keep the EOWR Committee informed and provide opportunity for input on key plan milestones, Western staff provided project updates during public meetings spanning the DCP development. The EOWR Committee was provided the opportunity to review and provide comment on the draft DCP.

### 1.3.2 Western Board of Directors

Western's Board of Directors (Board) is the formal decision-making body that adopts the DCP (and UWMP) and recommends it for submittal to Reclamation. To keep the Board informed, Western staff provided periodic updates at public meetings, spanning the DCP development.

### 1.3.3 General Public

To reach all customers within Western's service area, Western created a specific web page for the DCP and UWMP, available at [wmwd.com/UWMP](http://wmwd.com/UWMP). This webpage provides another opportunity for interested individuals to learn about the DCP and UWMP planning efforts, view the Drought Task Force participants and workshop schedules, subscribe to project updates, review and comment on both plans, and provides links to past resources or plans.

### 1.3.4 Other Stakeholder Outreach

Western coordinated with MWD to provide information on projected supplies and demands within Western's wholesale service area. MWD prepared estimates of Western's wholesale demand for imported water and provided their estimates to Western for inclusion in both the UWMP and the DCP. Western also coordinated with each of the retail water agencies in their service area to obtain updated supply and demand projections for inclusion in the Western wholesale supply reliability analysis, which is included in this DCP and the UWMP.

## 1.4 Regional Drought Goals and Guiding Principles

Regional drought goals and guiding principles were identified for the DCP early in the planning process. The regional drought goals identify the key intended outcomes that the DCP is both informed and shaped around, while the guiding principles guide the implementation of the DCP towards achieving these goals. The regional drought goals for the DCP are:

1. Ensure equity
2. Define regional shortage conditions
3. Build resiliency
4. Facilitate consistent communication
5. Sustainability and environmental stewardship
6. Achieve planning consistency

During the initial workshops, Drought Task Force members were engaged to answer prompt questions spanning six goal categories. The questions within each goal category that were posed to the group are shown in [Table 1-3](#).

TABLE 1-3: REGIONAL DROUGHT GOALS AND PROMPT QUESTIONS USED TO DEVELOP THE DCP GUIDING PRINCIPLES

DCP Goals	Questions
<b>1</b> <b>Ensure Equity</b>	How do we ensure our drought responses don't put an unfair burden on some constituents or stakeholders?  How do we achieve broad and diverse benefits for our region?
<b>2</b> <b>Define Regional Shortage Conditions</b>	How should our region define "drought" (e.g., based on precipitation, surface/groundwater levels, available supply, etc.).  Would certain definitions of "drought" adversely affect your constituents more than others?
<b>3</b> <b>Build Resiliency</b>	How do we better use the water we already have (local and imported) so we can effectively endure drought conditions as they arise?
<b>4</b> <b>Facilitate Consistent Communication</b>	How do we facilitate consistent and effective communication among stakeholders in the plan development, plan implementation, and periodic plan updates?
<b>5</b> <b>Sustainability and Environmental Stewardship</b>	Within the broad categories of climate impact, sustainability and environmental stewardship, what outcomes should be prioritized?  What does success in this category look like to area ecosystems, wildlife, ocean health, water quality, etc.?
<b>6</b> <b>Achieve Planning Consistency</b>	What other plans within the region do we need to align with?  What will it take to achieve that alignment?

The Drought Task Force provided a diverse set of responses to these questions (see [Appendix H](#)), which were used to develop six guiding principles for the development and implementation of the DCP ([Figure 1-1](#)).

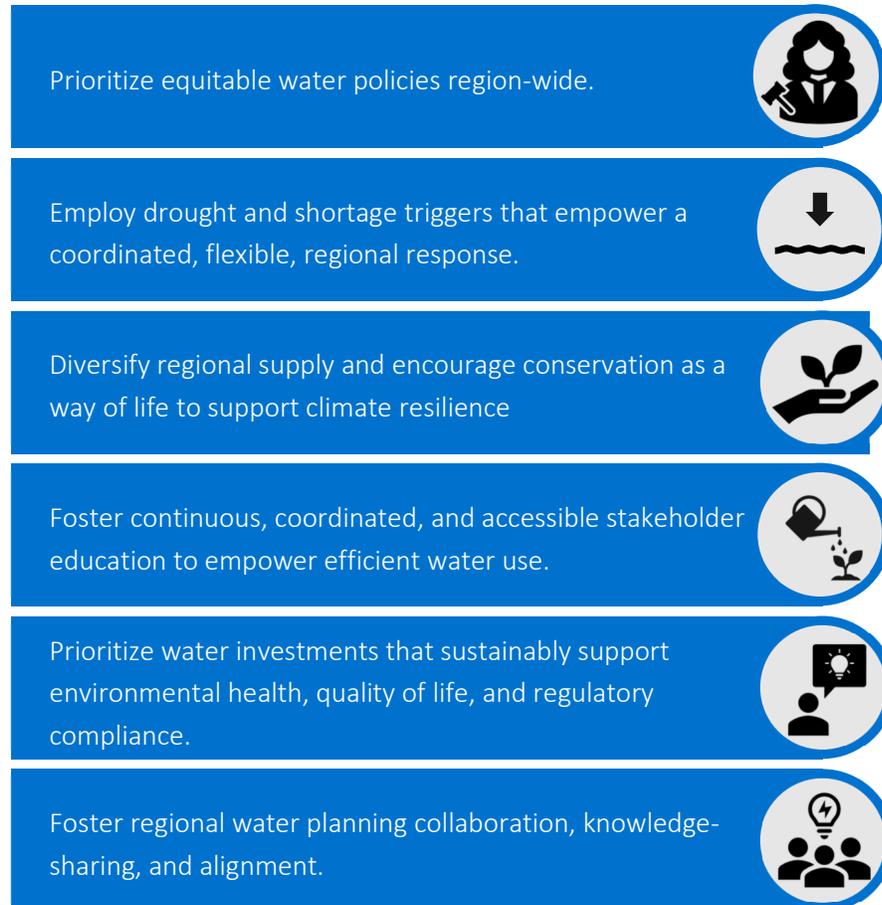


FIGURE 1-1: GUIDING PRINCIPLES FOR THE DCP TASK FORCE

## 1.5 DCP Development Process

With these goals and guiding principles, development of the DCP was organized into five key steps, which include:



For each step, [Table 1-4](#) describes the associated activities and connection with Western’s 2020 UWMP, the workshops that were convened with the Drought Task Force to complete each step, and any resulting deliverables.

TABLE 1-4: KEY STEPS INVOLVED IN DEVELOPING THE DCP

	<b>Step 1</b> Determine Future Demands	<b>Step 2</b> Evaluate Existing Supply Reliability	<b>Step 3</b> Develop Future Supply & Response / Mitigation Options	<b>Step 4</b> Develop Implementation Plan	<b>Step 5</b> Document the Plan
<b>Activities/Connection with UWMP</b>	DCP uses UWMP demand projections	DCP develops robust Climate Change Vulnerability Assessment and informs UWMP Drought Risk Assessment and Supply Reliability Analysis	DCP builds on drought response actions from UWMPs and WSCP; develops a drought monitoring framework, defines mitigation activities and projects to build drought resilience	DCP identifies process for implementing drought monitoring, initiating actions during drought conditions, and communicating with the public	DCP establishes a process for future updates to keep the plan dynamic and undergo public review and adoption process
<b>Associated Task Force Workshops and Engagement</b>	Workshop 1 January 22, 2021		Workshop 2 February 10, 2021	Workshop 3 August 23, 2021	Workshop 4 December 16, 2021
			Mitigation Actions Survey December 2021- January 2022	Workshop 5 April 21, 2022	
<b>Outcome/Deliverables</b>	Prepared wholesale and retail demand projections consistent with 2020 UWMPs	Climate Change Vulnerability Assessment Technical Memorandum (TM)	Drought Monitoring TM  Mitigation Actions TM	Draft DCP	Draft DCP

As shown in [Table 1-4](#), five workshops were held between January 22, 2021, and April 21, 2022, to provide key input related to the completion of each of the five steps. A summary of the discussion points and any input received during each of these workshops is provided in [Appendix H](#). A survey was also distributed to the Drought Task Force in December 2021 to provide input on the mitigation actions included in the DCP. In addition to the draft DCP, three interim deliverables that informed the development of the DCP were prepared as shown in [Table 1-4](#). The Drought Task Force was provided the opportunity for review and input on these deliverables between January and April 2022 ([Table 1-5](#)).

TABLE 1-5: OPPORTUNITIES FOR REVIEW AND INPUT ON THE DCP AND ITS INTERIM DELIVERABLES

		Deliverable			
		CLIMATE CHANGE VULNERABILITY ASSESSMENT TM	DROUGHT MONITORING TM	MITIGATION ACTIONS TM	DRAFT DCP
Activity	Task Force Review	Review and input: February 2022	Review and input: February 2022	Review and input: March 2022	Review and input: April, May 2022
	Western Review	Review and input: January, February 2022	Review and input: January, February 2022	Review and input: February 2022	Review and input: March, April 2022

## 1.6 Plan Adoption and Submittal

The final DCP was formally adopted by Western on July 20, 2022. A copy of the Adoption Resolution is included in [Appendix I](#). Western made a copy of the final DCP available on its website within 30 days after the adoption.

# 2 Background

To provide a critical foundation for the DCP, [Chapter 2](#) defines the services areas for water suppliers within the region along with regional water supplies and associated infrastructure and projected regional demands.

## 2.1 Water Supplier Service Areas

Wholesale water within the region is supplied by Western Wholesale to 14 retail water agencies, including Western Retail. Water suppliers within the region are described in the subsections below.

### 2.1.1 Western Wholesale

Western supplies water on both a wholesale (Western wholesale) and a retail (Western retail) basis. The Western Wholesale service area encompasses 527 square miles that spans from the northern Riverside County boundary to the southern Riverside County boundary ([Figure 2-1](#)). It is also bounded by the Riverside County line to the west and by Eastern Municipal Water District (EMWD) to the east. The estimated population within the Western wholesale service area in 2020 and future population projections as documented in Western’s 2020 UWMP are provided in [Table 2-1](#).

**Regional Water Suppliers**

- Western Wholesale
- Box Springs Mutual Water District
- City of Corona
- City of Norco
- Eagle Valley Mutual Water Company
- Elsinore Valley Municipal Water District
- Home Gardens County Water District
- Jurupa Community Services District
- Rancho California Water District
- Riverside Highlands Water Company
- Riverside Public Utilities
- Rubidoux Community Services District
- Santa Ana River Water Company
- Temescal Valley Water District
- Western Retail

TABLE 2-1: POPULATION PROJECTIONS FOR THE REGION

	2020	2025	2030	2035	2040	2045
WESTERN WHOLESAL	979,634	1,025,334	1,077,603	1,131,288	1,177,721	1,225,915

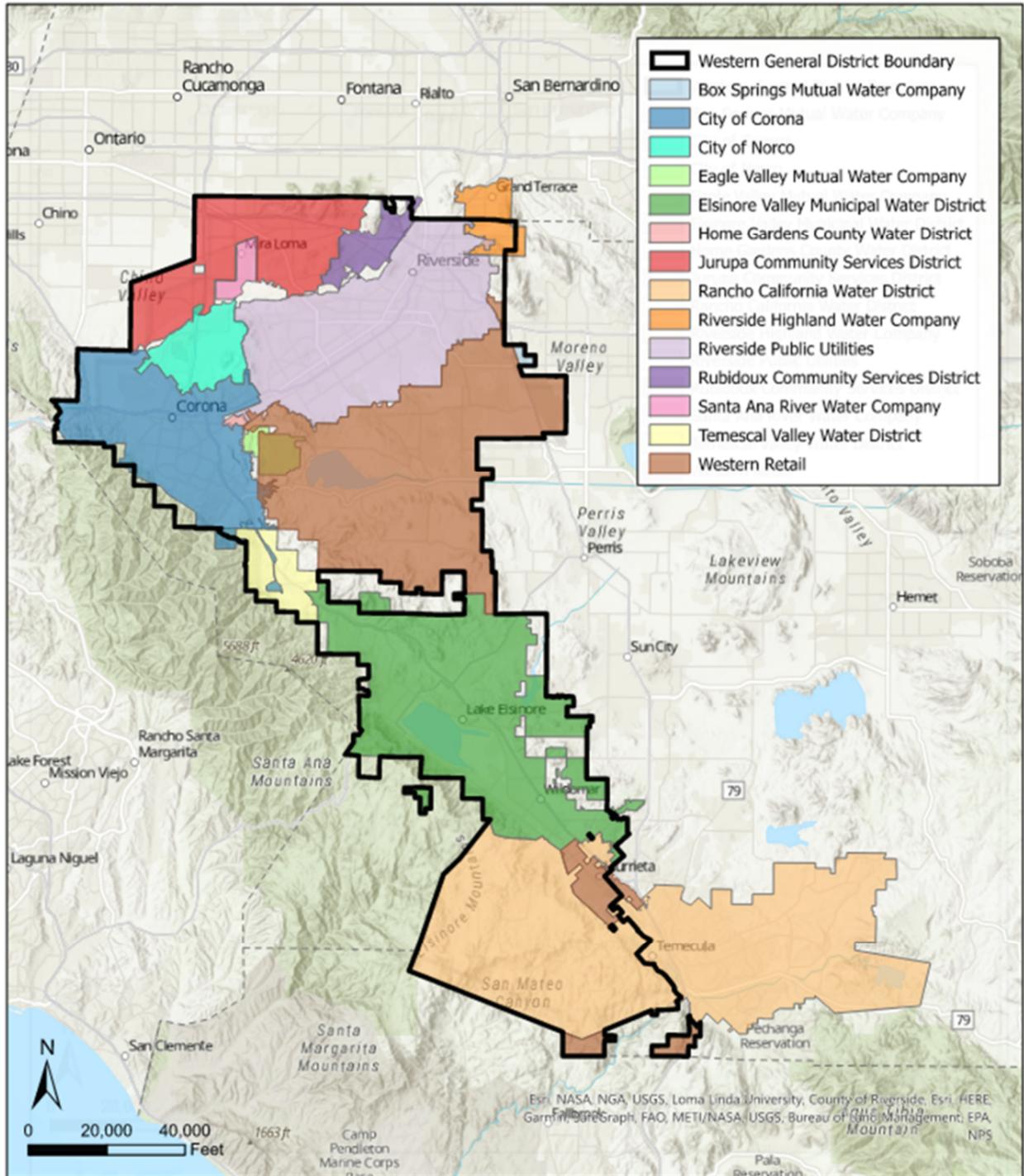


FIGURE 2-1: WESTERN WHOLESALE SERVICE AREA AND CUSTOMERS

As a member agency of MWD, Western provides wholesale supplemental water to the region within its service area, which includes 14 retail water agencies. Of the retail water agencies in the Western wholesale service area, eight received wholesale water from Western wholesale in 2020. These agencies are referred to as wholesale customers in this DCP. Western considers Western retail a wholesale customer and is therefore included in the wholesale system descriptions throughout this document. In addition to purchasing wholesale treated and untreated water from Western wholesale, most of these retail agencies deliver local surface and groundwater and/or recycled water within their respective service areas.

The remaining six retail agencies solely utilize local supplies, currently. It is anticipated that some of these six may utilize Western wholesale supplies in the future as the region grows (refer to [Section 2.2, Regional Water Supply](#)).

### 2.1.2 Box Springs Mutual Water Company

Box Springs Mutual Water Company provides water services for roughly 600 customers in Moreno Valley, covering a 0.7 square mile area along Interstate 215. Box Springs Mutual Water Company serves less than 3,000 customers and does not supply more than 3,000 acre-feet of water annually, and thus is not required to prepare a UWMP.

### 2.1.3 City of Corona

The City of Corona's service area, which encompasses approximately 39 square miles, is located in the northwestern portion of Riverside County and includes the unincorporated communities of El Cerrito, Coronita, and parts of Temescal Canyon. In 2020, the City of Corona served a population of approximately 170,000 through over 45,000 municipal connections.

### 2.1.4 City of Norco

The City of Norco has a service area of approximately 15 square miles, located in the northwestern portion of Riverside County. In 2020, the City of Norco served a population of approximately 28,000 through 7,500 municipal connections.

### 2.1.5 Eagle Valley Mutual Water Company

Eagle Valley Mutual Water Company serves a 4.8 square mile area located on the eastern border of the City of Corona's service area, northwest of Lake Mathews. Eagle Valley Mutual Water Company serves less than 3,000 customers and does not supply more than 3,000 acre-feet of water annually, and thus is not required to prepare a UWMP.

### 2.1.6 Elsinore Valley Municipal Water District

Located in southwestern Riverside County and eastern Orange County and covering nearly 100 square miles, Elsinore Valley Municipal Water District (EVMWD) provides water services to its Elsinore and Temescal Divisions, which comprise the cities of Lake Elsinore and Canyon Lake, portions of Wildomar and Murrieta, and unincorporated portions of Riverside County and Orange County. In 2020, EVMWD

served a population of approximately 164,000 and provided potable water through over 44,000 active connections.

### 2.1.7 Home Gardens County Water District

Home Gardens County Water District covers a 0.5 square mile area and provides water services for residents in Corona. Home Gardens County Water District serves less than 3,000 customers and does not supply more than 3,000 acre-feet of water annually, and thus is not required to prepare a UWMP.

### 2.1.8 Jurupa Community Services District

The Jurupa Community Services District (JCSD) service area covers approximately 41 square miles of northwest Riverside County and includes all of the City of Eastvale, approximately 65 percent of the City of Jurupa Valley, and small portions of the City of Norco and unincorporated Riverside County. In 2020, JCSD served a population of approximately 131,000 through over 33,000 municipal connections.

### 2.1.9 Rancho California Water District

The Rancho California Water District (RCWD) service area covers approximately 155 square miles and is bounded on the southeast by the Santa Ana Mountains and on the northeast by Gavilan Hills. RCWD serves the area known as Rancho California, which includes the city of Temecula, portions of the city of Murrieta, and unincorporated areas of Riverside County. In 2020, RCWD served a population of approximately 151,000 through over 45,000 municipal connections.

### 2.1.10 Riverside Highlands Water Company

Riverside Highland Water Company (RHWC) is a private company serving the City of Grand Terrace, the Highgrove area of Riverside County and small portions of San Bernardino County and the City of Colton. In 2020, RHWC served a population of nearly 21,000 through over 5,300 municipal connections.

### 2.1.11 Riverside Public Utilities

The Riverside Public Utilities (RPU) service area is approximately 75 square miles, of which approximately 70 square miles are located in Riverside's City limits. The remaining 5 square miles consist mainly of unincorporated land within the County of Riverside. In 2020, RPU served a population of over 310,000 through over 66,000 municipal connections.

### 2.1.12 Rubidoux Community Services District

The Rubidoux Community Services District (RCSD) service area covers approximately 8 square miles and provides water service to approximately 7.7 square miles. In 2020, RCSD served a population of nearly 37,000 through over 6,300 municipal service connections.

### 2.1.13 Santa Ana River Water Company

The Santa Ana River Water Company covers a 3.1 square mile area and provides water services for residents in Jurupa Valley. The Santa Ana River Water Company serves less than 3,000 customers and

does not supply more than 3,000 acre-feet of water annually, and thus is not required to prepare a UWMP.

#### 2.1.14 Temescal Valley Water District

Situated at the foothills of the Cleveland National Forest, Temescal Valley Water District is located in the Temescal Valley in western Riverside County. Temescal Valley Water District's service area covers roughly 11 square miles and sits between the Cities of Corona and Lake Elsinore. In 2020, Temescal Valley Water District served a population of over 16,000 through over 6,300 municipal service connections.

#### 2.1.15 Western Retail

Western retail provides water to nearly 25,000 direct customer connections, such as single-family residences or commercial businesses, within its retail service area. Western's retail service area is comprised of the Riverside service area, Murrieta service area, and Rainbow service area. These three service areas are collectively referred to as Western retail and cover a total of 104 square miles and serve water to an estimated population of nearly 100,000.

The Riverside service area includes a portion of the City of Riverside and unincorporated areas of Riverside County, including the communities of El Sobrante, Eagle Valley, Lake Matthews, March Air Reserve Base, Temescal Creek, and Woodcrest.

In 2005, Western took ownership of the Murrieta County Water District as a separate retail service area, now called the Murrieta service area. The entire area lies within the city of Murrieta.

Western Retail also serves a very small area, called the Rainbow service area, in an area just south of the city of Temecula in the unincorporated portion of Riverside County.

## 2.2 Regional Water Supply

This section summarizes all of the water supplies available to the region including imported water and a variety of local groundwater, surface water, and recycled water sources. Each source is described in [Section 2.2.2](#).

### 2.2.1 Regional Supply Summary

An overview of the water sources used by each agency within Western's service area is shown in [Table 2-2](#). This summary highlights the diversity of water supply portfolios among the water agencies in the region. As a result, each agency is impacted differently by drought, driving a need for regional solutions that are flexible and adaptable to different community needs.

Based on the historical water use for each of Western's retail agencies from 2017 to 2019, almost half of Western's retail agencies rely on imported water as a major supply source, but local groundwater is the largest source of supply for the region ([Figure 2-2](#)).

TABLE 2-2: CURRENT WATER SOURCES BY AGENCY

Agency	Imported Water	Groundwater	Surface Water	Recycled Water <sup>1</sup>
Western Wholesale	X	X		
Western Retail	X	X		X
Box Springs Mutual Water District	X	X		
City of Corona	X	X		X
City of Norco	X	X		X
Eagle Valley Mutual Water Company	X	X		
Elsinore Valley Municipal Water District	X	X	X	X
Home Gardens County Water District		X		X
Jurupa Community Services District		X		X
Rancho California Water District	X	X		X
Riverside Highlands Water Company		X		
Riverside Public Utilities		X		X
Rubidoux Community Services District	X	X		
Santa Ana River Water Company		X		
Temescal Valley Water District	X	X		X

<sup>1</sup> Includes recycled water sources that are not currently used but may be in the future.

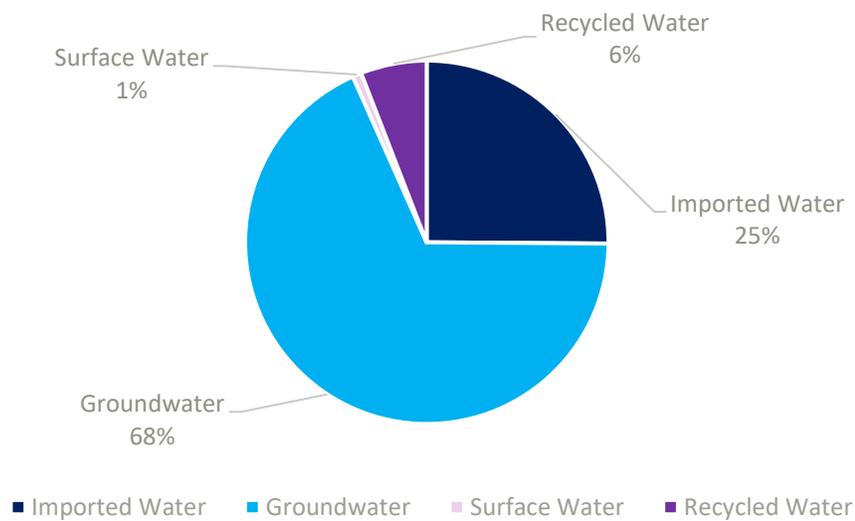


FIGURE 2-2: PERCENT REGIONAL WATER USE BY SOURCE

### 2.2.2 Sources of Supply

This section describes each of the water supplies available to the region.

### 2.2.2.1 Imported Water

Western purchases imported water from MWD and sells to wholesale customers within Western’s service area. MWD imports water from the State Water Project (SWP) which is owned and operated by the California Department of Water Resources (DWR) and conveys water from the Bay-Delta to Southern California via the California Aqueduct, and from the Colorado River through the Colorado River Aqueduct (CRA) which is owned and operated by MWD. The supply mix varies depending on the availability of SWP supplies, which varies every year, much more significantly than the Colorado River supply. During the current drought, water allocations from SWP are significantly reduced, leading to a greater proportion of Colorado River supplies in MWD’s supply mix.

Western Wholesale receives treated imported water from MWD’s Mills Water Treatment Plant (WTP) and Skinner WTP, in addition to raw water which is delivered directly to wholesale customers from various connections to MWD’s system. Western Wholesale also owns and operates the Mills Gravity Line, which distributes treated water from the Mills WTP to the Western retail Riverside service area and several other wholesale customers.

Western has a ten-year purchase agreement with MWD for a Tier 1 annual maximum of 105,783 acre-feet per year (AFY) with a minimum Purchase Order Commitment for 70,522 AFY, effective January 1, 2015 to December 31, 2024. Western can purchase additional water beyond the purchase agreement maximum at MWD’s higher Tier 2 rate. Western plans to renew the purchase order agreement in the future and the annual maximum and minimum will be revised as needed to meet anticipated use at that time. Each year, member agencies advise MWD of how much water they anticipate they will need during the next five years. MWD then works with member agencies to develop forecasts of long-term future water supply.

Additional wholesalers within the region include EMWD, who also provides imported water to the portion of Rancho California Water District (RCWD) that falls within EMWD’s wholesale service area and to Western’s Murrieta Retail System.



### 2.2.2.2 Groundwater

The region also uses local groundwater from seven different groundwater basins: the San Bernardino Basin Area (SBBA), Chino Basin, Riverside-Arlington Basin, Temescal Basin, Bedford-Coldwater Basin, Elsinore Valley Basin, and Temecula Valley Basin. The locations of these basins are shown in [Figure 2-3](#). Four of these basins (Bedford-Coldwater Basin, Elsinore Valley Basin, Riverside-Arlington Basin, and the Temescal Basin) are managed by a Groundwater Sustainability Agency (GSA) as required by the Sustainable Groundwater Management Act (SGMA). Under SGMA, these basins are categorized into one of four categories: high-, medium-, low-, or very-low priority. The Elsinore Valley and Temescal Basins are both classified as medium priority, and the Bedford-Coldwater and Riverside-Arlington Basins are both classified as very low priority. The remaining three basins (Chino Basin, SBBA, Temecula Valley Basin) are adjudicated (note that the Riverside-Arlington Basin is a sub-basin of the partly adjudicated Riverside Basin). These basins are managed by a Watermaster to manage the ownership of water rights and water use with goals similar to that of SGMA. Groundwater basin management activities are further described further in [Section 3.1.2](#). While much of the groundwater in the region is of high quality and does not require treatment, the groundwater in some areas has historically been degraded by elevated concentrations of Total Dissolved Solids (TDS), nitrate, and other contaminants from industrial sources. Several groundwater desalination facilities are in operation in the region to recover groundwater high in TDS so it can be used for potable supply.

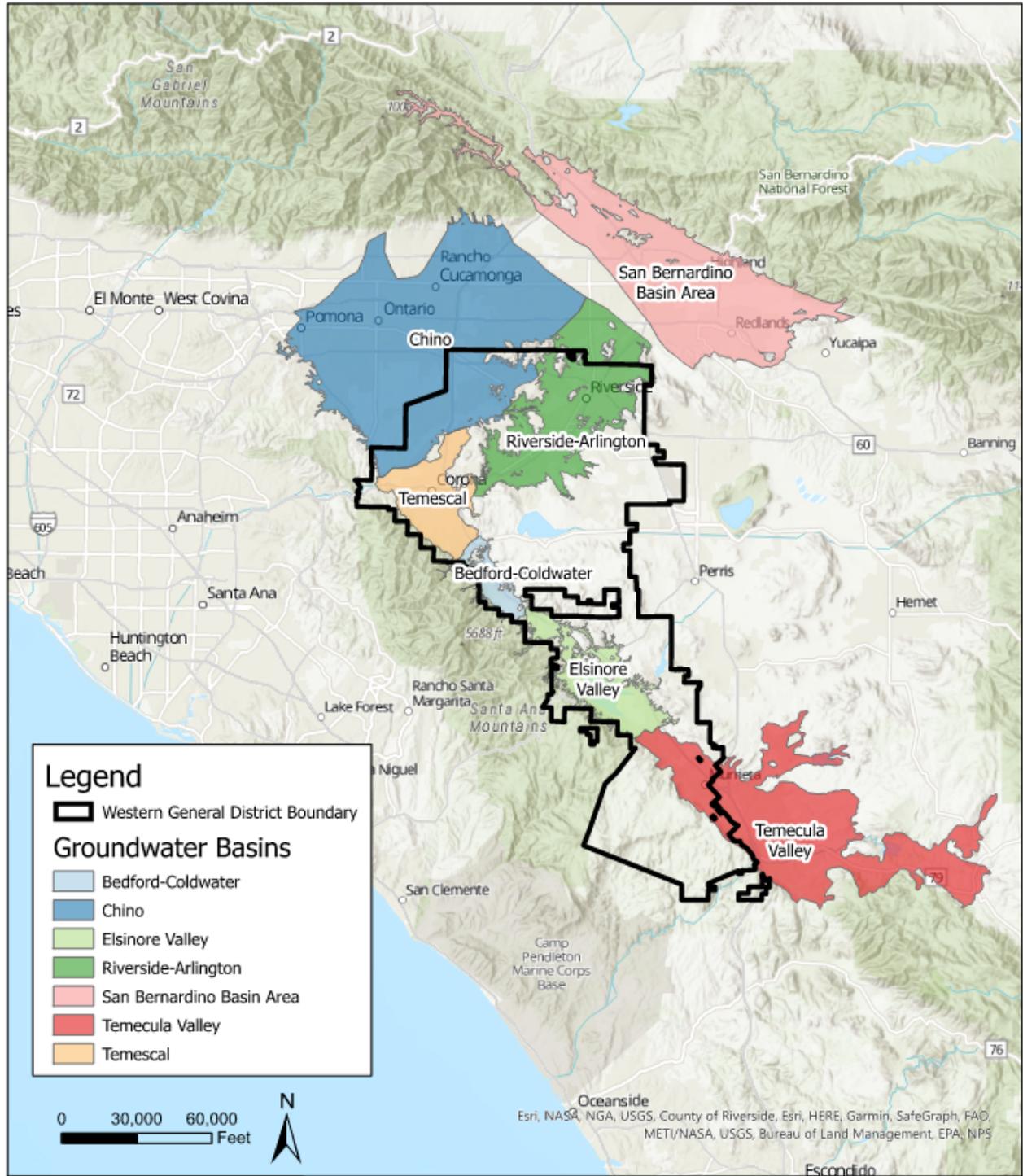


FIGURE 2-3: LOCAL GROUNDWATER BASINS

### Arlington Desalter

Western extracts groundwater from the Riverside-Arlington basin and operates the Arlington Desalter, a reverse-osmosis (RO) groundwater treatment facility that began operation in 1990. The Arlington Desalter serves two purposes: providing a local source of potable water for Western wholesale customers and decreasing subsurface outflow of low-quality groundwater to the Temescal Basin. The capacity of the Arlington Desalter is 5,000 AFY. The City of Norco is the primary user of Arlington Desalter as a supply source, but water can also be delivered to the City of Corona or JCSD.



### Chino Desalter

Similar to the Arlington Desalter, Chino Desalter facilities have been constructed to provide a local source of potable water and decrease subsurface outflow of low-quality groundwater to the Santa Ana River.

The Chino Basin Desalter Authority (CDA) oversees operation of the Chino Desalter facilities. The Chino Desalter is comprised of two facilities: Chino I and Chino II. These facilities remove salts from Chino Basin groundwater that is high in TDS using RO and ion exchange treatment technologies. Chino I is located in Chino and began operation in 2000, with an initial capacity of 9,000 AFY. It is operated and maintained by Inland Empire Utilities Agency (IEUA). Jurupa Community Services District (JCSD) operates and maintains the Chino II facility in Jurupa Valley. Chino II began operation in 2006 and initially treated up to 11,820 AFY. In 2016, the Chino II facility was expanded to treat up to 21,000 AFY (2).

The City of Norco, JCSD, Santa Ana River Water Company and Western Retail each own a portion of the capacity in Chino I and/or Chino II, along with the cities of Chino, Chino Hills and Ontario, which are within IEUA's service area.

### Chino Desalter



### Temescal Desalter

The Temescal Desalter is owned and operated by the City of Corona and uses RO treatment to recover Temescal Basin groundwater high in TDS. Temescal Desalter produces 10 million gallons of potable water each day.

#### 2.2.2.3 Recycled Water

Several retail water agencies in the region also use recycled water to meet non-potable demands. Recycled water sources in the region include:

- Western Water Recycling Facility (WWRF)
- Western Riverside County Regional Wastewater Authority (WRCRWA) Treatment Plant, administered and operated by Western through the Western WRCRWA joint powers authority (JPA) composed of the cities of Norco and Corona, Home Gardens Sanitary District, Jurupa Community Services District, and Western
- City of Corona water reclamation facilities WRF1, WRF2 and WRF3
- EVMWD Regional Water Recycling Facility
- EVMWD Railroad Canyon Water Recycling Facility
- EVMWD Horsethief Canyon Water Recycling Facility
- Santa Rosa Water Reclamation Facility, administered and operated by RCWD through the Santa Rosa Regional Resources Authority (SRRRA) JPA composed of EVMWD, RCWD, and Western.

- City of Riverside Water Quality Control Plant
- Temecula Valley Water Reclamation facility, owned and operated by Temescal Valley Water District



**Western Riverside County Regional  
Wastewater Authority Treatment  
Plant**

#### 2.2.2.4 Surface Water

EVMWD uses surface water from Canyon Lake, also referred to as Railroad Canyon Reservoir. Recently, Canyon Lake has experienced water quality issues and is currently not an active supply source for EVMWD. EVMWD is working to install a treatment system to recover the supply and anticipates resuming use by 2025.

#### 2.2.2.5 Stormwater

Capturing stormwater for supplemental groundwater recharge is a key strategy in the region to increase local supplies, enhance long term sustainability of local groundwater basins and help mitigate the effects of climate change on local supplies. There are various stormwater capture facilities throughout the region that recharge local groundwater basins and additional projects are currently under development. Each of Western’s retail agencies meeting the definition of an urban water supplier (either publicly or privately owned, providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually) is required to complete an UWMP that provides details on their specific stormwater capture facilities. Refer to each agency’s UWMP for additional details on stormwater capture facilities within the region.



## 2.3 Regional Water Demand

Based on water use data provided by the retail water agencies in the region, the total water use within the region has ranged from approximately 224,000 AF to more than 247,000 AF in the last five years as shown in [Figure 2-4](#). In 2020, the total water demand in the region was approximately 233,800 AFY.

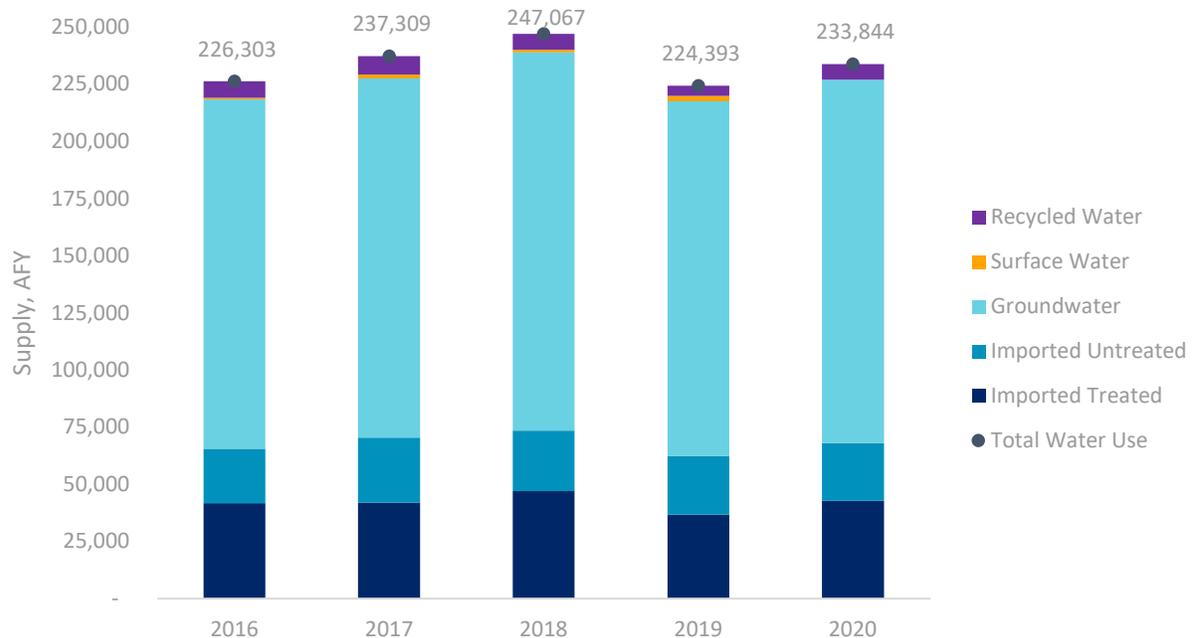


FIGURE 2-4: 2016-2020 REGIONAL WATER USE BY SOURCE, AFY

To estimate future demands for the region, the 2020 water demand was scaled in proportion to the projected population growth in the region from 2025 to 2045, as shown in [Table 2-1](#) and the results are presented in [Table 2-3](#). These values represent average or normal year demands and do not account for future increases in water use efficiency or for impacts of climate change. Impacts of climate change on future demands are discussed in [Chapter 4](#) and the future water demands accounting for climate change impacts are presented in [Section 4.4](#). Refer to Western’s 2020 UWMP for

TABLE 2-3: TOTAL REGIONAL DEMAND PROJECTIONS

	2025	2030	2035	2040	2045
TOTAL DEMAND	244,895	256,534	268,727	281,499	294,878

Refer to Western’s retail agency UWMPs for additional details on water usage by sector within the region.

## 2.4 Land Uses within Service Area

Existing and projected land use within Western’s wholesale service area are provided in Western’s UWMP. Currently, municipal, commercial, industrial, institutional, and landscape accounts for 57 percent of land use within Western’s general service area, with 35 percent vacant land and 8 percent agriculture. Once buildout is complete, over 90 percent of demand will be used by municipal, commercial, industrial, institutional, and landscape accounts.

Once buildout occurs, more water demands will be needed to meet the needs of the community, requiring more imported supplies if no new water supplies are created. Climate change is expected to increase outdoor usage, requiring more water to maintain residential turf landscapes, and irrigation for

commercial and educational properties. In addition, with more intense storms, increasing temperature, and more evapotranspiration, the agriculture industry will need to rely on Western for more reliable water.

# 3 Drought Monitoring

The regional DMF establishes a process for monitoring near- and long-term water availability and developing a framework for predicting the probability of future droughts or confirming an existing drought. To monitor for near- and long-term water availability, Western will continue to use its current drought monitoring efforts as described in [Section 3.1](#). Predicting the probability of future droughts or confirming an existing drought will be accomplished through development of a Regional Drought Portal and ongoing Drought Task Force meetings as described in [Section 3.2](#). The DMF is built upon individual stakeholders' efforts to monitor and define droughts within their respective areas and aims to improve regional coordination and information sharing regarding droughts and shortages. The DMF was informed through collaboration with the Drought Task Force during Workshop 3 – see [Appendix H](#) for the framework which was used to develop the DMF and the general input received.

## 3.1 Current Drought Monitoring Efforts

The region's current drought monitoring efforts provide the process for monitoring near- and long-term water availability. This includes monitoring groundwater availability through well-established frameworks such as SGMA. This section summarizes these efforts for the various stakeholders and programs within the Western service area. The regional stakeholders range from large (MWD) to small (Box Springs) and each has a different approach to monitoring conditions in their respective areas. The summaries for each stakeholder or program focus on how droughts and water shortages are currently predicted and defined. A crosswalk evaluation of the various stakeholder drought monitoring efforts highlights similarities and differences among the efforts at the conclusion of this section ([Table 3-3](#)).

### 3.1.1 MWD Water Shortage Allocation Plan and Western Drought Allocation Plan

MWD's Water Shortage Allocation Plan (WSAP) is MWD's policy and formula for equitably allocating available water supplies to member agencies during extreme water shortages when MWD determines it is unable to meet all its demands. MWD's WSAP identifies ten levels of shortage designed to reduce demands by up to 50 percent of the WSAP's calculated base demand ([Table 3-1](#)). [Table 3-1](#) is an example from MWD's WSAP, which provides estimated savings by each WSAP level using a hypothetical base demand of one million acre-feet (MAF).

If MWD implements a WSAP allocation, Western will implement its Drought Allocation Plan (DAP) that passes through MWD's WSAP actions for imported water shortages to Western wholesale customers. The DAP was prepared by Western in conjunction with its wholesale customers and mirrors the 10 stages of MWD's WSAP. The DAP establishes a means to allocate limited imported water supplies among Western's imported water agencies if MWD implements various stages of its WSAP. Initially developed in 2008, the DAP was updated in 2015 to reflect changes from MWD and the potential impacts of future droughts. The DAP establishes water allocations based on several variables including base period demand, conservation, growth, regional shortage, availability of local supplies, retail water

agency dependence on imported supplies, and conservation demand hardening. The allocation method was designed to be equitable on the wholesale level, while helping to minimize hardships experienced by retail agencies and the customers they serve throughout the region. The allocation methodology in the DAP was updated for consistency with MWD’s WSAP and agreed upon by Western’s wholesale customers.

The WSAP and DAP do not require Western’s wholesale customers to reduce demands during shortage, rather they incentivize demand reduction through fees for excessive use. MWD charges penalties for use above an allocation established by implementing one of the ten stages of its WSAP and Western’s DAP passes any penalties charged through to the respective wholesale customers that contributed to accruing the penalties. Demand reductions are voluntary and supplies beyond the allocation can still be purchased at higher penalty rates.

TABLE 3-1: MWD WSAP LEVELS AND ASSOCIATED PERCENT REDUCTIONS

WSAP Regional Shortage Level	Approximate Percent Reduction	Example Base Demand	Estimated Demand Reduction
1	5%	1.0 MAF	50,000
2	10%		100,000
3	15%		150,000
4	20%		200,000
5	25%		250,000
6	30%		300,000
7	35%		350,000
8	40%		400,000
9	45%		450,000
10	50%		500,000

### 3.1.2 Groundwater Basin Management

As previously discussed in [Section 2.2](#), the region uses local groundwater from seven different groundwater basins, including: the SBBA, Chino Basin, Riverside-Arlington Basin, Temescal Basin, Bedford-Coldwater Basin, Elsinore Valley Basin, and Temecula Valley Basin.

Four of these basins (Bedford-Coldwater Basin, Elsinore Valley Basin, Riverside-Arlington Basin, and the Temescal Basin) are managed by a GSA as required by SGMA. SGMA requires medium- and high-priority basins to develop a Groundwater Sustainability Plan (GSP). Each of the GSAs which manage these basins have developed or are in the process of developing a GSP, with the goals of:

- Developing water budgets
- Assessing groundwater storage
- Developing sustainable management criteria, undesirable results, and minimum thresholds to protect the basin for future supply.
- Identifying projects needed to ensure future sustainability of supplies

This includes the Riverside-Arlington Basin which although was classified as a very-low priority basin, is being proactively managed to ensure its reliability into the future.

The remaining three basins (Chino Basin, SBBA, Temecula Valley Basin) are adjudicated. SGMA requires each adjudicated basin to submit by April 1, of each year, a report containing the following information to the extent available for the portion of the basin subject to the adjudication:

1. Groundwater elevation data
2. Groundwater extraction for the preceding year
3. Surface water supply used for or available for use for groundwater recharge or in-lieu use
4. Total water use
5. Change in groundwater storage

Both of these frameworks provide the mechanisms to monitor groundwater availability in the near- and long-term to ensure that the groundwater basins relied upon by the region are sustainably managed into the future.

### 3.1.3 Water Shortage Contingency Plans

Urban wholesale and retail water suppliers that provide water for municipal purposes to more than 3,000 customers or serving more than 3,000 acre-feet annually must adopt an UWMP every five years demonstrating water supply reliability under normal as well as drought conditions. As part of the UWMP, a standalone WSCP must also be prepared, which develops a framework for preparing for and responding to water shortages.

As part of this framework, each WSCP must identify how droughts and water shortages are predicted and defined. The Water Code outlines six standard water shortage levels that correspond to a gap in supply compared to normal year availability. The six standard water shortage levels correspond to progressively increasing estimated shortage conditions (up to 10, 20, 30, 40, 50 percent, and greater than 50 percent shortage compared to the normal reliability condition) and align with the response actions that a water supplier would implement to meet the severity of the impending shortages ([Table 3-2](#)). Each urban water supplier must comply with the six standard levels or include a cross-reference relating its existing shortage categories to the six standard water shortage levels.

TABLE 3-2: WATER CODE STANDARD STAGES

Shortage Level	Percent Shortage Range
1	Up to 10%
2	Up to 20%
3	Up to 30%
4	Up to 40%
5	Up to 50%
6	>50%

Beginning by July 1, 2022, every urban water supplier (wholesale and retail) that is required to prepare a WSCP as part of its UWMP must conduct an Annual Water Supply and Demand Assessment (Annual Assessment). The Annual Assessment is an evaluation of the near-term outlook for supplies and demands to determine whether the potential for a supply shortage exists and whether there is a need to trigger a WSCP shortage stage and response actions in the current calendar year to maintain supply reliability. The procedures used in conducting the Annual Assessment must be specified in the WSCP and must include, at a minimum:

1. The written decision-making process that an urban water supplier will use each year to determine its water supply reliability.
2. The key data inputs and assessment methodology used to evaluate the urban water supplier's water supply reliability for the current year and one dry year, including the following:
  - Current year unconstrained demand, considering weather, growth, and other influencing factors, such as policies to manage current supplies to meet demand objectives in future years, as applicable.
  - Current year available supply, considering hydrological and regulatory conditions in the current year and one dry year. The Annual Assessment may consider more than one dry year solely at the discretion of the urban water supplier.
  - Existing infrastructure capabilities and plausible constraints.
  - A defined set of locally applicable evaluation criteria that are consistently relied upon for each Annual Assessment.
  - A description and quantification of each source of water supply.

Western Wholesale and Western Retail, along with the majority of Western's retail agencies, at least in part, use the Annual Assessment to determine whether the potential for a supply shortage exists and to enact its water shortage stages.

Both Western Wholesale and Western Retail are subject to the WSCP requirements and a single WSCP has been developed to meet the requirements for both systems. With the exception of Box Springs Mutual Water Company and Eagle Valley Mutual Water Company, all of Western's retail agencies are also subject to the WSCP requirements, and each agency has prepared a standalone WSCP. A summary of the water shortage stages and indicators used to predict and define droughts is provided from each respective WSCP in [Table 3-3](#). A greater summary of the water shortage levels, corresponding percent

shortages, and triggers used by each agency, along with any agency-specific tasks associated with each agency’s annual assessment are provided in [Appendix E](#).

TABLE 3-3: SUMMARY OF STAKEHOLDER WATER SHORTAGE CONTINGENCY PLAN CONTENTS

Agency	Indicator	Stage 1		Stage 2		Stage 3		Stage 4		Stage 5		Stage 6	
		Supply Reduction (%)	Water Supply Condition/Trigger										
Western Wholesale	Annual water supply and demand assessment	< 10%	Total supply able to meet ≥ 90% of projected demand	10-20%	Total supply able to meet ≥ 80% of projected demand	20-30%	Total supply able to meet ≥ 70% of projected demand	30-40%	Total supply able to meet ≥ 60% of projected demand	40-50%	Total supply able to meet ≥ 50% of projected demand	>50%	Total supply able to meet < 50% of projected demand
Western Retail	Annual water supply and demand assessment	< 10%	Total supply able to meet ≥ 90% of projected demand	10-20%	Total supply able to meet ≥ 80% of projected demand	20-30%	Total supply able to meet ≥ 70% of projected demand	30-40%	Total supply able to meet ≥ 60% of projected demand	40-50%	Total supply able to meet ≥ 50% of projected demand	>50%	Total supply able to meet < 50% of projected demand
City of Corona	Available supply and the correspondence of a supply deficit	10%	No supply deficit	20%	Up to 1,373 AFY deficit	30%	Up to 5,996 AFY deficit	40%	Up to 10,618 AFY deficit	50%	Up to 15,240 AFY deficit	>50%	> 15,240 AFY deficit
City of Norco	Annual water supply and demand assessment	< 5%	Total supply able to meet ≥ 95% of projected demand	5-20%	Total supply able to meet ≥ 80% of projected demand	20-30%	Total supply able to meet ≥ 70% of projected demand	30-40%	Total supply able to meet ≥ 60% of projected demand	40-50%	Total supply able to meet ≥ 50% of projected demand	N/A	N/A
Elsinore Valley Municipal Water District	Hydrologic limitation in supply (i.e., a prolonged period of below-normal precipitation and runoff), limitations or failure of supply and treatment infrastructure, or both	< 5%	Total supply able to meet ≥ 95% of projected demand	5-10%	Total supply able to meet ≥ 90% of projected demand	10-25%	Total supply able to meet ≥ 75% of projected demand	25-40%	Total supply able to meet ≥ 60% of projected demand	≥50%	Total supply able to meet ≤ 50% of projected demand	N/A	N/A
Jurupa Community Services District	Characterizing current year and one dry year and groundwater limitations (Annual Assessment)	10%	Total supply able to meet ≥ 90% of projected demand	20%	Total supply able to meet ≥ 80% of projected demand	30%	Total supply able to meet ≥ 70% of projected demand	40%	Total supply able to meet ≥ 60% of projected demand	50%	Total supply able to meet ≥ 50% of projected demand	> 50%	Total supply able to meet < 50% of projected demand
Temescal Valley Water District	Available supply and the reduction in total supply	0%	Normal conditions – no reduction in supply	10%	Total supply able to meet ≥ 90% of projected demand	25%	Total supply able to meet ≥ 75% of projected demand	50%	Total supply able to meet ≥ 50% of projected demand	≥50%	Total supply able to meet ≤ 50% of projected demand	N/A	N/A

Agency	Indicator	Stage 1		Stage 2		Stage 3		Stage 4		Stage 5		Stage 6	
		Supply Reduction (%)	Water Supply Condition/Trigger	Supply Reduction (%)	Water Supply Condition/Trigger	Supply Reduction (%)	Water Supply Condition/Trigger	Supply Reduction (%)	Water Supply Condition/Trigger	Supply Reduction (%)	Water Supply Condition/Trigger	Supply Reduction (%)	Water Supply Condition/Trigger
Rancho California Water District	Long and short-term supply deficiencies; immediate emergency water shortage response; emergency declaration of state or federal agency	0-10%	District is experiencing short-term and long-term effects of recent and/or on-going drought conditions	10-20%	District is experiencing short-term and long-term effects of recent and/or on-going drought conditions	20-30%	3b- Annual supply is projected to be up to 10 percent less than annual demand. 3c- Annual supply is projected to be greater than 10 percent and up to 20 percent less than annual demand	30-40%	4a, 4b- Annual supply is projected to be greater than 20 percent and up to 30 percent less than annual demand. 4c- Annual supply is projected to be greater than 30 percent, and up to 40 percent, less than annual demand	40-50%	5a, 5b- Annual supply is projected to be greater than 40 percent, and up to 50 percent, less than annual demand. 5c- Annual supply is projected to be more than 50 percent less than annual demand	N/A	N/A
Riverside Highland Water Company	Under the State’s direction (with the exception of a catastrophic failure of infrastructure) or during the annual assessment	10%	Total supply able to meet ≥ 90% of projected demand	25%	Total supply able to meet ≥ 75% of projected demand	35%	Total supply able to meet ≥ 65% of projected demand	50%	Total supply able to meet < 50% of projected demand	N/A	N/A	N/A	N/A
Riverside Public Utilities	Long and short-term supply deficiencies; immediate emergency water shortage response; emergency declaration of state or federal agency	0%	Total supply able to meet 100% of projected demand	< 15%	Total supply able to meet ≥ 85% of projected demand	15-20%	Total supply able to meet ≥ 80% of projected demand	20-50%	Total supply able to meet ≥ 50% of projected demand	>50%	Total supply able to meet < 50% of projected demand	N/A	N/A
Rubidoux Community Services District	Characterizing current year and one dry year and groundwater limitations	10%	Adequate supply to cover 10% shortage	20%	Adequate supply to cover 20% shortage	30%	Total supply able to meet ≥ 70% of projected demand	40%	Total supply able to meet ≥ 60% of projected demand	50%	Total supply able to meet ≥ 50% of projected demand	>50%	Total supply able to meet < 50% of projected demand

**Notes:**

Box Springs Mutual Water Company, Eagle Valley Mutual Water Company, and Santa Ana River Water Company are also stakeholders served by Western Wholesale but are not required to prepare WSCPs.

### 3.1.4 California Water Watch

DWR has developed the California Water Watch, a website that brings together data from a variety of sources to allow viewers to obtain a quick snapshot of the state’s water conditions at the scale of their local watershed. The website allows viewers to query information (precipitation, temperature, reservoirs, streamflow, groundwater, snowpack, soil moisture, and vegetation conditions) on maps and show user-defined boundary areas of interest (Hydrologic Unit Code-8 watersheds, counties, water agencies, groundwater sustainability agencies, or drinking water providers). The website was released to the public in early January 2022 and is available at: <https://cww.water.ca.gov/>.

## 3.2 Regional Coordination and Framework

This section outlines the proposed coordination and information sharing frameworks for predicting the probability of future droughts or confirming an existing drought, which include a Regional Drought Portal (portal) and Stakeholder/Drought Task Force meetings. The portal is featured as a mitigation action in this DCP to assist the region in reducing the future impacts of drought. These frameworks were developed in collaboration with the Drought Task Force, with the goals of supporting existing activities and programs and improving regional collaboration, coordination, and information sharing regarding droughts and shortages. Currently, the regional drought portal is at the conceptual phase, and will be further scoped, planned, and designed following development of the DCP. Note that the specific roles and responsibilities related to implementation of these frameworks are described in [Chapter 7](#).

**DWR’s California Water Watch allows viewers to query information (precipitation, temperature, reservoirs, streamflow, groundwater, snowpack, soil moisture, and vegetation conditions) on maps and show user-defined boundary areas of interest (HUC-8 watersheds, counties, water agencies, groundwater sustainability agencies, or drinking water providers). California Water Watch is available online at <https://cww.water.ca.gov/>**

### 3.2.1 Develop a Regional Drought Portal

The portal would provide a platform to post, collect, and disseminate key datasets identified as being pertinent to regional drought planning and response. In addition, regional stakeholders could post messages and updates to be shared with the Drought Task Force members. To accommodate both public accessibility and coordination around potentially sensitive topics, it is proposed that the portal include a public facing feature as well as the functionality to allow Drought Task Force members to log in and communicate and share internally. A mock-up of the regional portal has been prepared for the purposes of this DCP (see [Appendix A](#)).

This portal could be designed consistent with DWR’s California Water Watch, which includes many of the datasets, features, and components described below. Western could leverage this existing framework and incorporate supplemental data as needed to custom-build this portal such that it includes information that is pertinent to Western and the region as a whole.

### 3.2.1.1 Potential Datasets

There are several potential datasets for inclusion into the portal that could help facilitate a better understanding of local and statewide conditions.

Groundwater levels and precipitation are two key datasets that could be incorporated into the portal to assess local conditions. Other local datasets that could be incorporated into the regional portal include:

- MWD WSAP level
- MWD storage levels
- MWD delivered volumes
- Riverside County drought declaration status
- Supply and demand projections (i.e., Results from the Annual Assessments)
- Gallons per capita per day
- Water agency shortages (WSCP stages)

Key statewide datasets that could be incorporated into the portal include:

- Reservoir levels
- Current year State Water Project (SWP) Allocation
- Colorado River DCP Stage
- Regional drought indices
- The U.S. Drought Monitor
- California Water Watch (see Section 3.1.4)
- Palmer Drought Indices
- Counties in the state with drought emergency proclamations

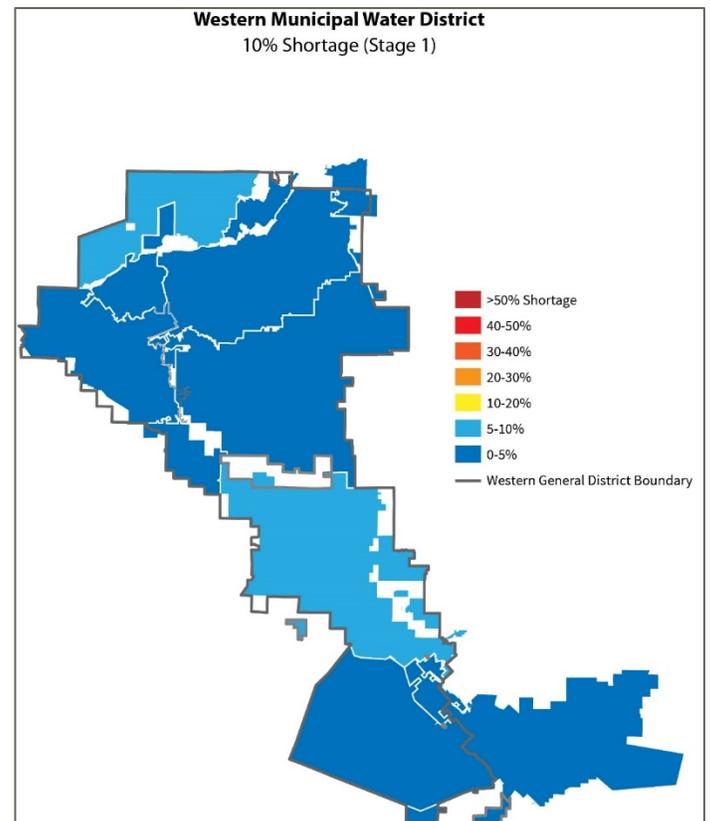


FIGURE 3-1: REGIONAL DROUGHT PORTAL DEPICTING WATER AGENCY SHORTAGES

The potential datasets which could be incorporated into the portal were developed based on engagement with the Drought Task Force and are described in greater detail in [Appendix E](#). Some of the datasets are published by third parties and, where appropriate, links would be provided to the source. Uploading other agreed upon datasets and information would be facilitated by standardized forms and templates on the portal.

### 3.2.2 Framework for Regional Coordination and Drought Monitoring

In addition to the information sharing framework that is proposed as part of the Regional Drought Portal, the Drought Task Force will assemble periodically following adoption of the DCP to further share information, collaborate, and coordinate. The Drought Task Force would be convened at a frequency to be determined based on the conditions in the region and within the supply catchment areas. The below descriptions of the indicator data, triggers, and meeting frequency are intended to generate discussion with the expectation that all will be refined based on input from Western and the Drought Task Force members.

#### 3.2.2.1 Drought Task Force Meeting Goals

The meetings would provide a forum for the members to review data, share updates, and coordinate drought responses and messaging. Specific messaging and messaging strategies will be covered in greater detail in the response actions, which is **Chapter 6** of the DCP.

#### 3.2.2.2 Regional Water Shortage Stages

While there is an abundance of local and regional data available to inform the Drought Task Force about drought conditions, it is difficult to identify a subset of data that is both efficient to compile and relevant to the majority of the Drought Task Force. Therefore, meeting frequency will be established based on drought conditions as defined by:

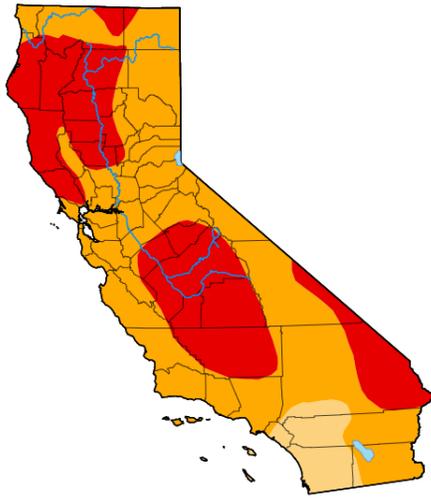
- The U.S. Drought Monitor
- California Water Watch local and statewide water conditions
- Implementation of the MWD WSAP
- Governor of California Statewide Drought Emergency Proclamation in Riverside County
- The percentages of the agencies in the region experiencing shortage

#### **U.S. Drought Monitor**

The U.S. Drought Monitor (available at: <https://droughtmonitor.unl.edu>) is a map produced on a weekly basis showing the parts of the U.S. that are in drought (**Figure 3-2**). The map is produced by several authors from the National Drought Mitigation Center, the U.S. Department of Agriculture, and the National Oceanic and Atmospheric Administration using various numerical inputs and ground truthing using hundreds of observers across the country. The map uses five classifications, D0 through D4, as shown in **Table 3-4**. Local conditions within the DCP region as defined by the U.S. Drought Monitor will be used as a direct trigger to convene the Drought Task Force.

# California

Home > California



**Map released: Thurs. March 24, 2022**

Data valid: March 22, 2022 at 8 a.m. EDT

**Intensity**

- None
- D0 (Abnormally Dry)
- D1 (Moderate Drought)
- D2 (Severe Drought)
- D3 (Extreme Drought)
- D4 (Exceptional Drought)
- No Data

**Authors**

United States and Puerto Rico Author(s):  
**Adam Hartman**, NOAA/NWS/NCEP/CPC

Pacific Islands and Virgin Islands Author(s):  
**Richard Heim**, NOAA/NCEI

*The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.*

FIGURE 3-2: U.S. DROUGHT MONITOR MAP FOR CALIFORNIA (U.S. DROUGHT MONITOR, 2022)

TABLE 3-4: U.S. DROUGHT MONITOR CATEGORIES AND ASSOCIATED POTENTIAL IMPACTS

Category	Description	Possible Impacts
D0	Abnormally Dry	Going into drought: <ul style="list-style-type: none"> <li>• Short-term dryness slowing planting, growth of crops or pastures</li> </ul> Coming out of drought: <ul style="list-style-type: none"> <li>• Some lingering water deficits</li> <li>• Pastures or crops not fully recovered</li> </ul>
D1	Moderate Drought	<ul style="list-style-type: none"> <li>• Some damage to crops, pastures</li> <li>• Streams, reservoirs, or wells low, some water shortages developing or imminent</li> <li>• Voluntary water-use restrictions requested</li> </ul>
D2	Severe Drought	<ul style="list-style-type: none"> <li>• Crop or pasture losses likely</li> <li>• Water shortages common</li> <li>• Water restrictions imposed</li> </ul>
D3	Extreme Drought	<ul style="list-style-type: none"> <li>• Major crop/pasture losses</li> <li>• Widespread water shortages or restrictions</li> </ul>
D4	Exceptional Drought	<ul style="list-style-type: none"> <li>• Exceptional and widespread crop/pasture losses</li> <li>• Shortages of water in reservoirs, streams, and wells creating water emergencies</li> </ul>

### **MWD Water District of Southern California WSAP Implementation**

As shown previously in [Table 3-1](#), MWD’s WSAP identifies ten levels of shortage designed to reduce demands by up to 50 percent. Based on the level of shortage, MWD adjusts each member agency’s minimum allocation, and provides a retail impact adjustment to ensure that agencies with a high level of dependence on MWD are not impacted inequitably at the retail level when compared to other agencies. These values are summarized in [Table 3-5](#). The WSAP regional shortage level as defined by MWD will be used as a direct trigger to convene the Drought Task Force.

TABLE 3-5: MWD WSAP ADJUSTMENTS BY SHORTAGE LEVEL

WSAP Regional Shortage Level	Approximate Percent Reduction	Wholesale Minimum Percentage	Maximum Retail Impact Adjustment Percentage
1	5%	92.5%	2.5%
2	10%	85.0%	5.0%
3	15%	77.5%	7.5%
4	20%	70.0%	10%
5	25%	62.5%	12.5%
6	30%	55.0%	15.0%
7	35%	47.5%	17.5%
8	40%	40.0%	20.0%
9	45%	32.5%	22.5%
10	50%	25.0%	25%

### Governor of California Statewide Drought Emergency Proclamation

In times of drought, and in anticipation of related impacts, the Governor of California has the authority to issue a Proclamation of a State of Emergency due to drought on a county-by-county basis. As of October 19, 2021, all 58 counties in California, including Riverside County, are under a drought emergency declaration. These declarations ease environmental and other regulations to speed drought responses. Proclamation of a State Emergency will be used as a direct trigger to convene the Drought Task Force.

### Agencies within the Western Service Area with Declared Shortage

There are a total of 14 agencies included in this regional DCP and the percentage of agencies in a declared shortage will be used as a direct trigger to convene the Drought Task Force. Note that, of the 14 agencies, three are not required to prepare a UWMP and accompanying WSCP, including Box Springs Mutual Water Company, Eagle Valley Mutual Water Company, and Santa Ana River Water Company. As a result, these agencies do not rely on the WSCP framework to declare shortages.

#### 3.2.2.3 Regional Triggers and Stages for Drought Task Force Meetings

**Table 3-6** outlines the criteria and triggers for convening the Drought Task Force based on the conditions in the region and within the supply catchment areas. If one or more triggers is met, the meeting frequency will be increased to the corresponding interval.

TABLE 3-6: REGIONAL TRIGGERS AND STAGES FOR DROUGHT TASK FORCE MEETINGS

Regional Drought Stage	Meeting Frequency	Triggers				
		Drought Monitor (DCP Region)	MWD WSAP/ Similar Action	Agencies in Declared Shortage*	Statewide Drought Proclamation	Riverside County Drought Proclamation
Normal	Annual	None-Abnormally Dry	--	None	--	--
Watch	Quarterly	Moderate-Extreme Drought	Levels 1 and 2	3 or more	Drought	Drought
Alert	Monthly	Exceptional Drought	Levels 3 thru 5	6 or more	Drought	Drought
Emergency	Weekly	Exceptional Drought	Levels 6 and 10	10 or more	Drought	Drought

\* Not including state mandated shortage

# 4 Vulnerability Assessment

The study of climate change impacts on water resources is continuously yielding new models and updated local and regional datasets. This continuous improvement makes it necessary to narrow the selection of data sources and methods of data analysis most applicable to local conditions. The vulnerability assessment performed as part of this regional DCP aims to improve the understanding of climate change impacts on future water demand in Western's wholesale service area and the sources of Western's water supplies during normal and drought periods.

This chapter describes the retrieval and analysis of climate data provided by DWR to project the impact of climate change on future water supplies and demands within Western's service area. The DWR climate data is assembled from the results of 20 global climate models, which best represent California's climate processes. Biases in the climate model results have been adjusted by simulating climate projections in terms of relative change from historical conditions rather than as absolute values. This is achieved by using historical hydrologic data in the state, which spans between 1915 and 2011. The resulting ratio of a simulated future value to the corresponding simulated historical value is referred to as a change factor. DWR projected climate change data is most appropriate for this analysis because it is the only climate projection dataset specifically developed to meet the requirements of water resources planners in California. The information contained in this chapter has been made available to Western's retail agencies for their use in their respective water resource planning efforts to reduce the data processing burden on individual agencies.

## Summary of Vulnerability Assessment Results

Overall, the results of the vulnerability assessments indicate:

- Projected **decreases** in water supplies from Santa Ana and Santa Margarita river basins under normal and drought (single year and multi-year) conditions relative to baseline conditions in 2020, due to projected decreases in precipitation and projected increases in surface water evaporation caused by increasing temperatures. Annual volumes of flow could be reduced by 4 to 7 percent from their 2020 levels in each basin by 2045. This potential decrease in volume of water available for diversion may require increased attention to understanding the adequacy and operational constraints of existing natural and artificial recharge systems in the service area.
- Projected **decreases** in precipitation and natural recharge under normal and multi-year drought years. However, a single dry year could still be wetter (up to 15 percent) under wet-warm future conditions compared to baseline conditions with precipitation occurring during a shorter rainy season (three instead of four months) with higher intensities (up to 0.4 inches).
- Projected **increases** in outdoor water uses under normal, single dry, and multi-year drought conditions, caused by projected temperature increases, which lead to higher evapotranspiration (ET) rates for landscaping, irrigated crops, and native vegetation. Average annual outdoor water use by customers served by Western within Western's wholesale and retail service areas could increase by up to 6 percent (17,198 acre-feet [AF]) relative to baseline conditions in 2020 under the most severe (Dry Hot) climate change scenario.

- Similar total demand projections based on a comparison of Western’s and MWD’s projected water budget projections under future climate conditions. If no new mitigation actions are implemented, the region’s dependence on imported surface water will increase.

These results are described in greater detail throughout [Chapter 4](#) which provides:

- Pertinent background information related to the requirements of both the regional DCP and Western’s 2020 UWMP, a general description of the impacts analyzed in the vulnerability assessment, and information about Western’s sources of information used in the assessment
- A description of the analysis approach and data sources chosen for the analysis
- Narrative discussions of the climate change factors calculated in multiple scenarios, and the resulting water supply and demand projections
- A comparison of Western water supply and demand projections resulting from the vulnerability assessment with regional projections prepared through the ongoing MWD 2020 Integrated Water Resources Plan (IRP) process
- Information for Western retail agencies who wish to perform a quantitative assessment of their projected water budgets using the climate change factors calculated as part of this vulnerability assessment and next steps for the region

Additional information related to the climate change vulnerability assessment performed as part of the preparation of this DCP can be found in [Appendix F](#).

## 4.1 Introduction

### 4.1.1 DCP and UWMP Requirements for Climate Change Analysis

In accordance with Sections 10610 to 10657 of the California Water Code, the UWMP requires the consideration of climate change impacts for drought planning because of the significant duration of recent droughts in California. This includes an analysis of projected future uses and the reliability of anticipated water supplies during a normal year, a single dry year, and drought lasting 5 consecutive dry water years. This drought risk assessment compares projected water supply sources with projected water use over the next 20 years, in 5-year increments.

A vulnerability assessment is required as part of the regional DCP to understand the characteristics and potential risk of future droughts and to develop appropriate mitigation and response actions. Since future droughts cannot be predicted by observed past drought information, the inclusion of a climate change analysis is needed to provide the incorporation of historic and future climate projections to assess the hydrological impacts of climate change on drought conditions, thereby creating a more effective plan. The regional DCP requires either a qualitative and/or quantitative assessment of a range of potential drought conditions derived from climate change information to determine the potential risk to critical resources.

Imported water projections are also required for preparing both the UWMP and regional DCP. However, the imported water projections for Western’s service area are being developed by MWD as part of their 2020 UWMP Drought Risk Assessment and the MWD 2020 IRP. MWD’s 2020 UWMP Drought Risk Assessment (dated June 2021) indicates that no service reliability concerns are projected for imported water during normal and drought periods before 2045 based on MWD’s projected demands for Western. For purposes of the UWMP, imported water supplies to Western can be assumed to be unchanged during normal years, single dry years, and 5-year dry periods.

However, the MWD 2020 IRP considered a range of more extreme potential future scenarios, which include: low demands with stable imported supplies, high demand with stable imported supplies, low demand with reduced imported supplies, and high demand with reduced imported supplies. The analysis found that service reliability issues could occur more frequently and generate increasingly more severe deficits of imported supplies under the high future demand scenarios in the 2045 time period.

The climate change analysis developed for Western, and described herein, supports the generation of alternative imported water supply demand projections, which are similar but slightly higher than MWD’s projections for Western. Coupled with the MWD 2020 IRP potential future of supply deficits, these analyses support the need for developing mitigation actions (see [Chapter 5](#)) to reduce or eliminate the future deficits.

#### 4.1.2 Description of Data Sources

DWR has developed statewide climate change datasets for use in water resource planning. The datasets depict climate conditions in California under historical and future climate conditions which are defined as follows:

1. Year 2030 future condition with projected climate and sea level conditions for a 30-year period, centered at 2030
2. Year 2070 future condition with projected climate and sea level conditions for a 30-year period, centered at 2070
3. Year 1995 historical condition with climate and sea level conditions for a 30-year period, centered at 1995

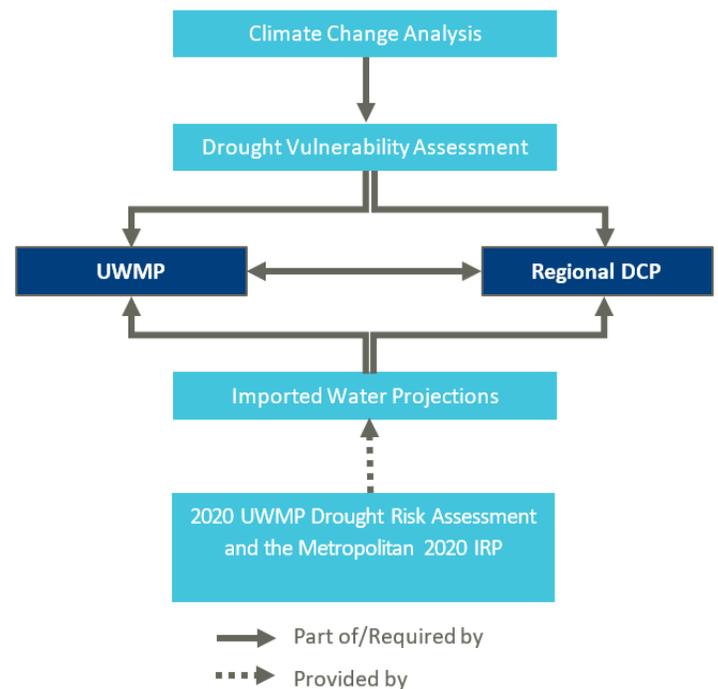


FIGURE 4-1: ROLE OF CLIMATE CHANGE ANALYSIS AND IMPORTED WATER PROJECTIONS IN THE DEVELOPMENT OF THE DCP AND UWMP

The 2030 and 2070 climate projections are based on an ensemble of 20 global climate projections selected by the DWR Climate Change Technical Advisory Group (CCTAG) as the most appropriate projections for California water resources evaluation and planning. The datasets are provided at a spatial resolution of 1/16th degree (approximately 3.75-mile grid cells) over California for each calendar month from 1915 through 2011.

DWR has also run the climate datasets run through a hydrologic model called the Variable Infiltration Capacity (VIC) model to simulate future hydrologic conditions and route runoff to the outlet of subbasins defined by each eight-digit Hydrologic Unit Code (HUC) in California. Streamflow change projections from the VIC model are provided as monthly time series from 1915 through 2011 for each HUC subbasin. DWR has applied the VIC model to perform hydrologic simulations under historical climate conditions and under projected future climate conditions in 2030 and 2070 over 8,000 grid cells statewide. Runoff from these grid cells have also been routed to the outlet of each eight-digit HUC watersheds in the state for use in the water resource planning.

Climate assessments are performed with a chain of models, each of which introduces some biases in the modeling process and derived products. To minimize the impact of such biases in decision processes, DWR presents the simulated climate projections in terms of relative change from historical conditions rather than as absolute values. For example, each monthly precipitation value simulated under 2030 conditions is divided by the precipitation value simulated for the same month under historical conditions, using the same chain of models. The resulting ratio of a simulated future value to the corresponding simulated historical value is referred to as a change factor. DWR has computed monthly time series of change factors for precipitation and ET in each VIC grid cell and the streamflow for each HUC-8 watershed. The resulting change factor datasets are available for retrieval and use in water resources planning from the publicly accessible SGMA Data Viewer (<https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer>). A more complete description of methods used in computing the climate datasets is provided in a publication entitled “Guidance for Climate Change Data Use During Groundwater Sustainability Plan Development” (DWR, 2018).

## 4.2 Climate Analysis Approach

### 4.2.1 Preprocessing Data for Western’s Service Area

The statewide climate datasets include 57 grid cells each with a spatial resolution of 1/16th degree (approximately 3.75-mile grid cells) for Western’s service area (**Figure 4-2**). Each grid cell contains 97 years of monthly time series (1915-2011) showing projected precipitation and ET changes under 2030 and 2070 climate conditions relative to 1995 conditions. The area of each grid cell which falls within the service area is estimated by spatially intersecting feature layers of the climate grid and Western’s service area boundary. Regional time series of projected precipitation and ET changes are computed from the cell time series by using an area-weighted average of data from grid cells which fall wholly or partially within the service area. Projections of future streamflow change were also retrieved for the Santa Ana River (HUC-18070203) and the Santa Margarita River (HUC-18070302) basins which provide surface water supplies to portions of the service area. Three potential climate conditions were considered for this analysis:

1. Drier future conditions with Extreme Warming (Dry Hot)
2. Median future conditions (Median)
3. Wetter future conditions with Moderate Warming (Wet Warm)

The two extreme scenarios (Dry Hot and Wet Warm) are constructed from a set of 10 global climate models. The first extreme scenario (Dry Hot) uses future projections from the 10 global climate models with least warming and least precipitation with the second extreme scenario (Wet Warm) using the 10 global models with the most warming and highest precipitation.

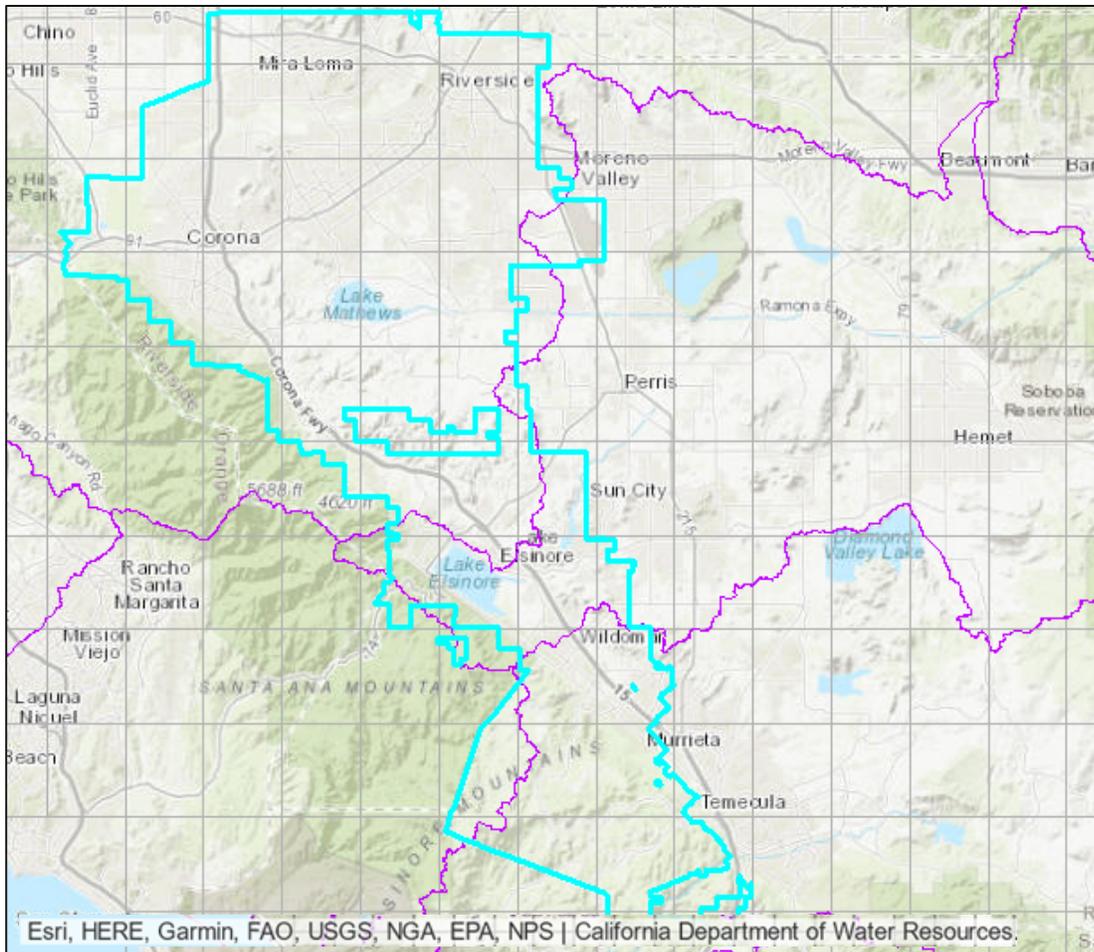


FIGURE 4-2: CLIMATE GRID CELLS AND WATERSHEDS COVERING WESTERN'S SERVICE AREA

#### 4.2.2 Analysis of Normal, Single, and Multi-Year Dry and Wet Periods

Every urban water supplier is required to assess water service reliability in normal year, single-dry year, and multiple-dry years lasting 5-years. For imported water supplies, the normal, wet, and dry years used by MWD, based on an historical analysis period of 1922 to 2004, are adopted for Western since it is the largest source of imported water. For local water supplies, year types are selected by reviewing time series data at two local precipitation gauges with extensive historical records. The monthly time series for the gauge at Riverside Fire Station 3 are available online in the DWR Bulletin 195 dating back to 1882

but were last updated in 2007. The California Irrigation Management Information System (CIMIS) #44 gauge at the University of California at Riverside has more current data available, extending from 1986 to present. For this analysis, the Riverside Fire Station 3 gauge is used because it has full coverage of the normal period of record (1922-2004) used in the imported water analysis. [Figure 4-3](#) shows the annual and 5-year rainfall from 1923 to 2004 with the wettest and driest 1-year and 5-year periods highlighted in blue and yellow, respectively.

TABLE 4-1: ANALYSIS PERIODS FOR NORMAL, SINGLE AND MULTI-YEAR DRY, AND WET PERIODS

YEAR TYPE	IMPORTED SUPPLIES	RIVERSIDE FS3 GAUGE	CIMIS #44 GAUGE
Normal	1922-2004	1922-2004	1986-2020
Single Dry-Year	1977	1989	2007
5-Year Dry	1988-1992	1971-1975	2005-2009
Single Wet-Year	1983	1983	-
5-Year Wet	1995-1999	1937-1941	-

The results shown in [Table 4-1](#) and [Figure 4-3](#) indicate that 1989 was the single driest year locally with 2.7 inches of rainfall, while 1977 was the driest year for imported water. The driest 5-year period for local supplies was from 1971 to 1975, while imported water supplies were lowest from 1988 to 1992. The single wettest year on record locally occurred in 1983, with 22.9 inches of rainfall. 1983 is also used as the single wettest year by MWD. The wettest 5-year period for local supplies was from 1937 to 1941, while imported water supplies were highest from 1995 to 1999. The single driest year and the driest 5-year period for the CIMIS #44 gauge are also provided in the table for reference.

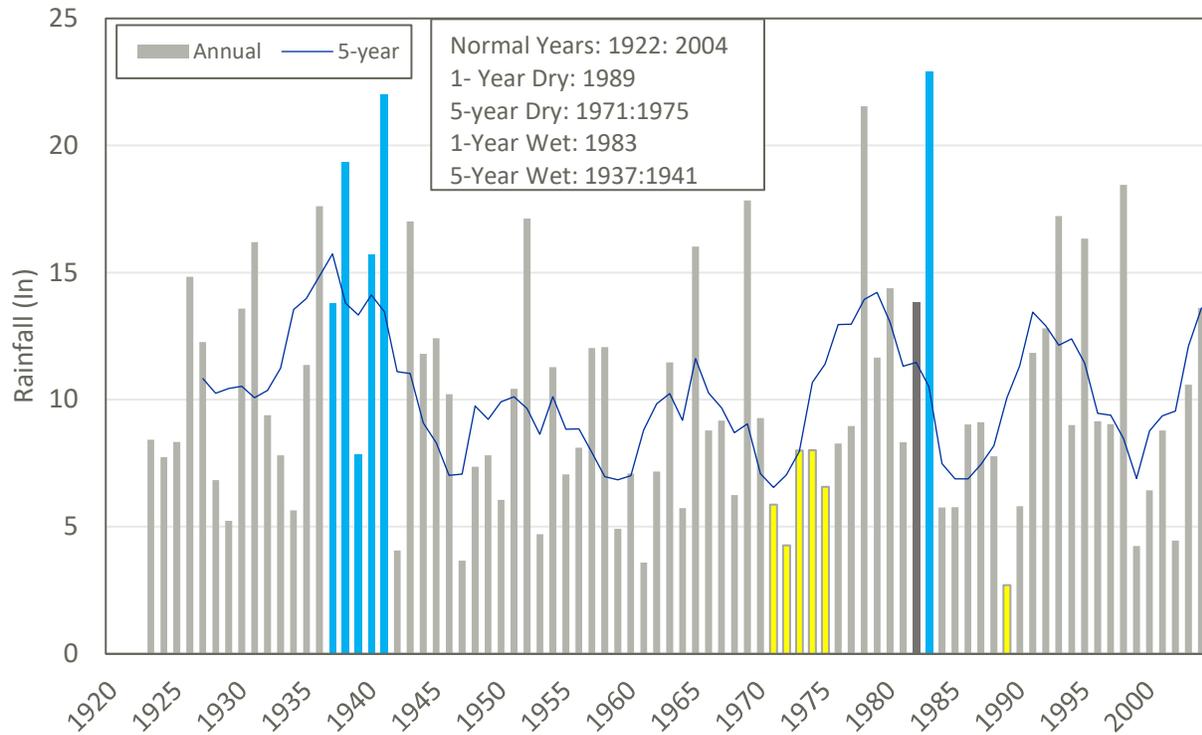


FIGURE 4-3: ANNUAL RAINFALL AT RIVERSIDE FIRE STATION 3

### 4.2.3 Computing Water Supply Change Factors

Local water sources used within Western’s service area include local groundwater from 12 different groundwater basins, surface water supplies from the Santa Ana and Santa Margarita River basins, recycled water from indoor water use, and reclaimed groundwater. Groundwater systems are recharged through a variety of water sources, including natural and artificial recharge.

Recycled water and reclaimed water can also be a source of supply for recharge of groundwater. Supplies of recycled water and reclaimed water which are sourced from indoor uses are largely insensitive to changes in climate. For this vulnerability assessment, three different sets of climate change results are computed for use with natural recharge, the Santa Ana River, and the Santa Margarita River sources, respectively.

For characterization of future changes in natural recharge, precipitation change projections from the DWR-provided climate change datasets are used. The 97-year monthly time series of precipitation for Western’s service area is used to compute Water Supply Change Factors which show percentage changes in mean monthly and mean annual precipitation under future 2030 and 2070 climate conditions relative to historical conditions under 1995 conditions. The 2030 and 2070 Water Supply Change Factors for natural recharge are computed for normal year, single dry year, single wet year, and 5-year wet and dry periods.

Characterization of future changes in the Santa Ana and Santa Margarita River basins are based on streamflow projections from the VIC model under 2030 and 2070 climate conditions. The streamflow projections are used to compute Water Supply Change Factors which show percentage changes in mean

monthly and mean streamflow under future 2030 and 2070 climate conditions relative to historical conditions under 1995 conditions. Change factors are similarly computed for normal year, single dry year, single wet year, and 5-year wet and dry periods.

Each set of Water Supply Change Factors is interpolated at 5-year intervals from 2020 to 2045. The 1995 to 2011 conditions are used to project climate change conditions out to 2030. Linear interpolation is used to determine the climate change factors between 2020 and 2030, based on the historic conditions from 2011 and the projected conditions for 2030. Different climate change conditions are anticipated between 2030 and 2070 because of the implementation of policies and practices that are expected to influence the rate of climate change further out in time. For the years between 2030 and 2070, linear interpolation is used for the 5-year increments based on the difference in projected conditions at 2030 and the projected conditions at 2070. Time series of Water Supply Change Factors are similarly interpolated at 5-year intervals for normal year, single dry year, single wet year, and 5-year wet and dry periods for application to local water sources for 2020 to 2045.

#### 4.2.4 Computing Water Demand Change Factors

Indoor and outdoor water uses are computed separately when considering climate impacts. Outdoor water use, particularly landscape irrigation, is sensitive to changes in climate while indoor water use is generally not sensitive. Plants require more water to sustain growth in a warmer climate, and users respond to increases in temperature by increasing landscape irrigation to keep their plants alive and flourishing. This increase in water requirement is characterized in climate models using the rate of ET which represents total amount of water released from soil, plants, and water bodies from the land surface to the atmosphere through evaporation and transpiration.

An area-weighted average of the ET data from the 57 cells is first computed to generate a single time series for Western's service area. The regional time series is used to compute Water Demand Change Factors which show percentage changes in mean monthly and mean annual ET under future 2030 and 2070 climate conditions relative to historical conditions under 1995 conditions. Similar values of 2030 and 2070 Water Demand Change Factors are computed for normal year, single dry year, single wet year, and 5-year wet and dry periods.

The Water Demand Change Factors are computed for 5-year intervals from 2020 to 2045 by interpolation. The 1995 to 2011 conditions are used to project climate change conditions out to 2030. Linear interpolation is used to determine the climate change factors between 2020 and 2030, based on the historic conditions from 2011 and the projected conditions for 2030. Different climate change conditions are anticipated between 2030 and 2070 because of the implementation of policies and practices that are expected to influence the rate of climate change further out in time. For the years between 2030 and 2070, linear interpolation is used for the 5-year increments based on the difference in projected conditions at 2030 and the projected conditions at 2070. The 5-year time series of Water Demand Change Factors are similarly interpolated for normal year, single dry year, single wet year and 5-year wet and dry periods for application to growth adjusted indoor water use projections for 2020 to 2045.

## 4.3 Local Climate Change Results

### 4.3.1 Water Supply Change Factor Results

The projected normal year precipitation under Dry Hot, Median and Wet Warm scenarios are presented in [Figure 4-4](#) through [Figure 4-6](#). Under all scenarios, changes become more extreme by 2045. The Dry Hot and Median scenario predict a decline in annual precipitation while the Wet Warm scenario projects a higher annual precipitation. The annual rainfall is predicted to decrease by 7.2 and 2.7 percent by 2045 under the Dry Hot and Median scenarios, respectively. However, the Wet Warm scenario predicts a 5 percent increase for the same timeline. Investigating the relative changes, all the projections indicate a lower precipitation during April and May, with the Dry Hot scenario exhibiting the greatest deviation from current monthly rainfall (77 percent by 2045). All projections show a higher precipitation in September with the highest projection of 166 percent by 2045 in the Wet Warm scenario. Detailed projected changes for rainfall under all the climate change scenarios are presented in [Appendix B \(Table B-1, B-2, and B-3\)](#).

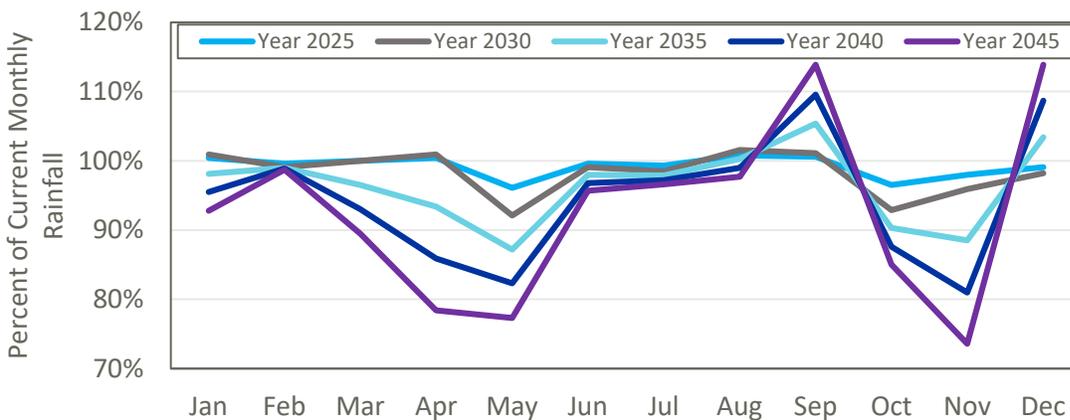


FIGURE 4-4: PROJECTED CHANGES IN RAINFALL UNDER DRY HOT FUTURE CLIMATE 2025 – 2045

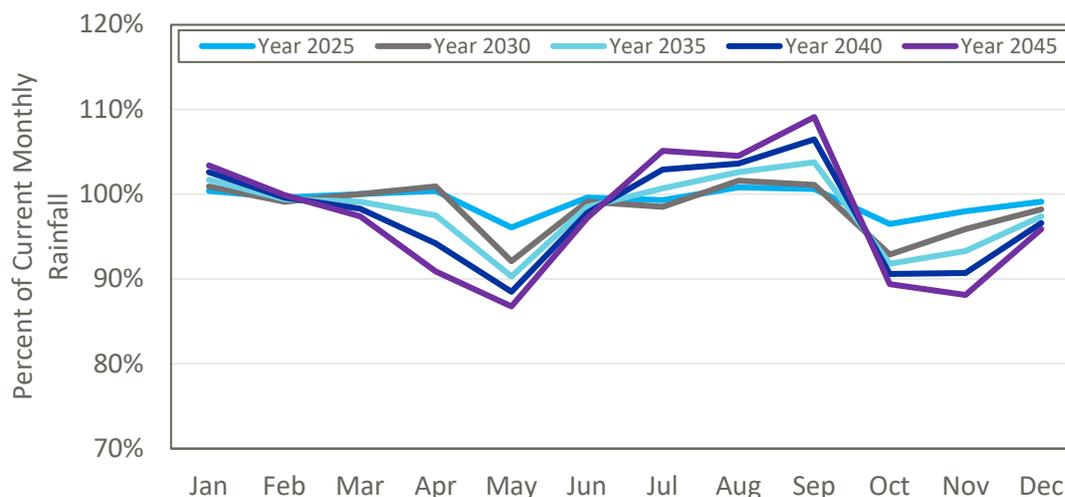


FIGURE 4-5: PROJECTED CHANGES IN RAINFALL UNDER MEDIAN FUTURE CLIMATE 2025 – 2045

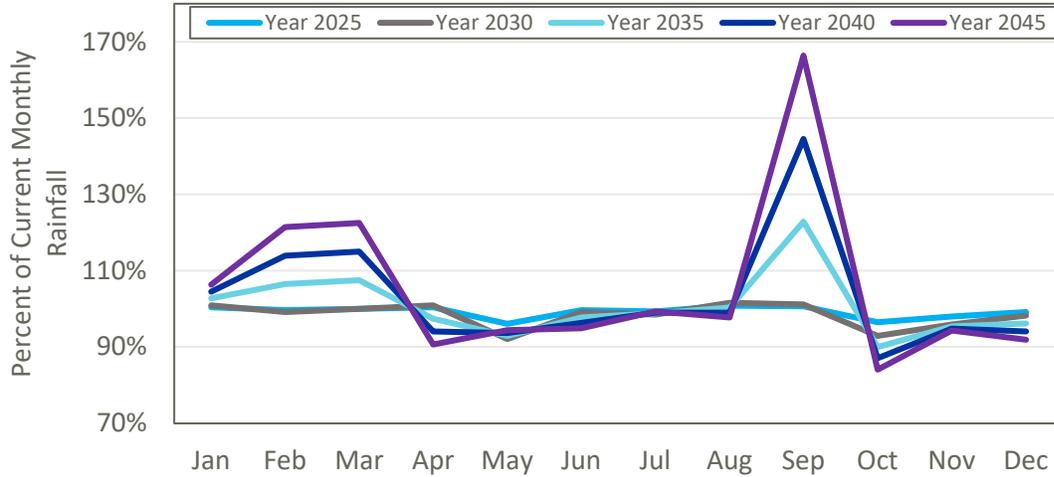


FIGURE 4-6: PROJECTED CHANGES IN RAINFALL UNDER WET WARM FUTURE CLIMATE 2025 - 2045

Figure 4-7 shows the predicted changes in absolute amounts of rainfall under various climate change scenarios in the year 2045. While the biggest relative changes are projected to occur in April, May, and September as shown in the previous Figure 4-4 through Figure 4-6, the biggest absolute changes occur during the most humid months of February and March with projections indicating up to a 0.5-inch increase from the current climate during February under the Wet Warm Scenario by 2045.

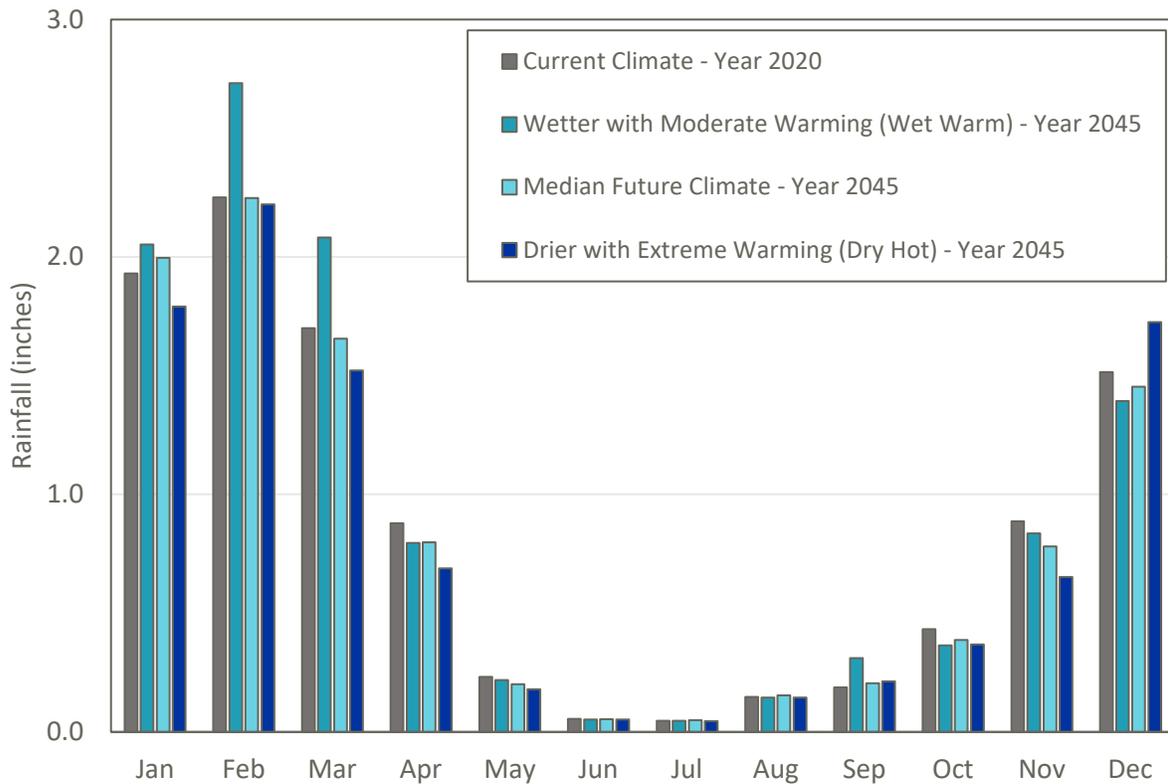


FIGURE 4-7: PROJECTED CHANGES IN NORMAL YEAR RAINFALL – 2045

**Figure 4-8** shows the projected changes in normal year groundwater supply in the year 2045. **Figure 4-8** shows a similar pattern to **Figure 4-7** with the biggest increase in supply during February and March (~8,000 AF) under the wet warm scenario compared to current climate conditions. The Dry Hot scenario projects declines during January and March with approximately 2,500 AF less groundwater recharge potential compared to the current conditions. On an annual basis, a total of 147,770 AF of groundwater supply is predicted under the Dry Hot scenario by 2045, while approximately 169,700 AF is predicted under the Wet Warm scenario by 2045, representing an increase of over 20,000 AF. Projections under the Median scenario results in a projected 153,600 AF of annual groundwater supply, which is generally consistent with current climate projections at 157,903 AF.

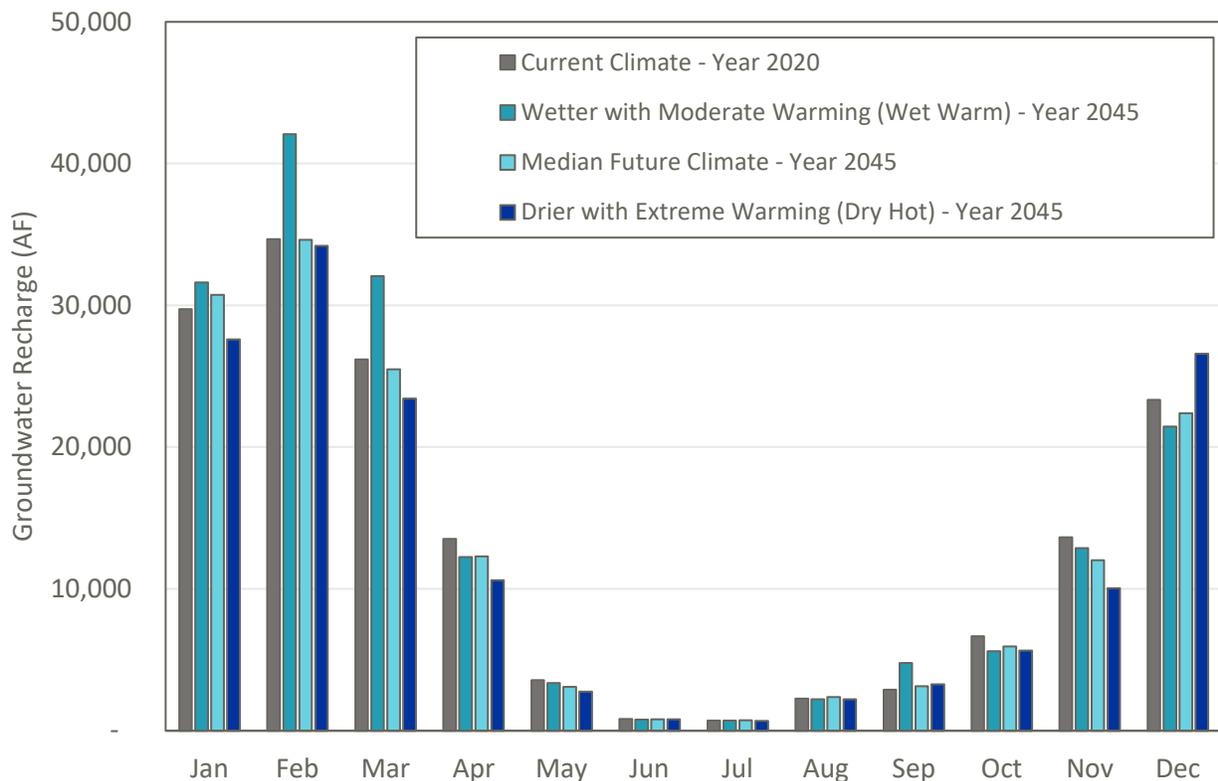


FIGURE 4-8: PROJECTED CHANGES IN NORMAL YEAR GROUNDWATER SUPPLY – 2045

**Figure 4-9** shows the projected changes in normal year flow for the Santa Ana River by 2045. The Dry Hot and Median scenarios project a 6.8 and 4.1 percent decrease in annual flow by 2045 relative to current climate, respectively, while the Wet Warm scenario projects a 14.8 percent higher annual flow by 2045. The Dry Hot scenario projects lower flow during high-flow months of February and March compared to the current conditions, with discharge decreasing by 32 cubic feet per second (cfs) in February, and 28 cfs in March. Conversely, the Wet Warm scenario projects higher flows during the same period, with discharge increasing by 108 cfs in February and nearly 78 cfs in March. Projected flows under the Median scenario are generally consistent with projected flows under the current climate. No notable deviations in flow from the current climate are projected under any of the climate change scenarios between May to December. Detailed projected changes for Santa Ana River flow under all the climate change scenarios are presented in **Appendix B (Table B-4, B-5, and B-6)**.

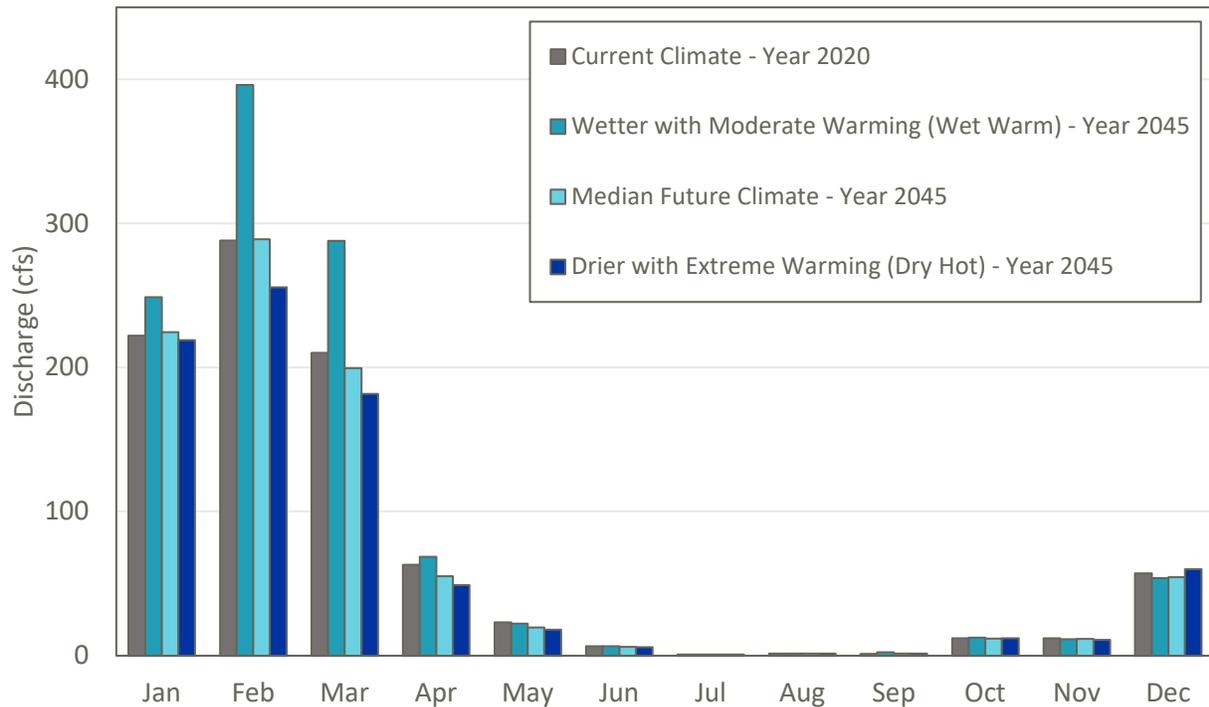


FIGURE 4-9: PROJECTED CHANGES IN NORMAL YEAR FLOW BY 2045: SANTA ANA RIVER

**Figure 4-10** shows the projected changes in normal year flow for the Santa Margarita River by 2045. While the Wet Warm scenario projects a 12 percent increase in annual flow by 2045, the Dry Hot and Median scenarios project decreases in annual flow of up to 6.8 percent and 4.1 percent respectively by 2045. Projected flows under the Median scenario are generally consistent with projected flows under the current climate. The Dry Hot scenario projects lower flows during February and March compared to the current conditions, with discharge decreasing by 21 cfs in February, and 12 cfs in March. Conversely, the Wet Warm scenario projects higher flows during the first quarter of calendar year with significantly higher flows (+43 cfs) during February and March. Detailed projected changes for Santa Margarita River flow under all the climate change scenarios are presented in [Appendix B \(Table B-7, B-8, and B-9\)](#).

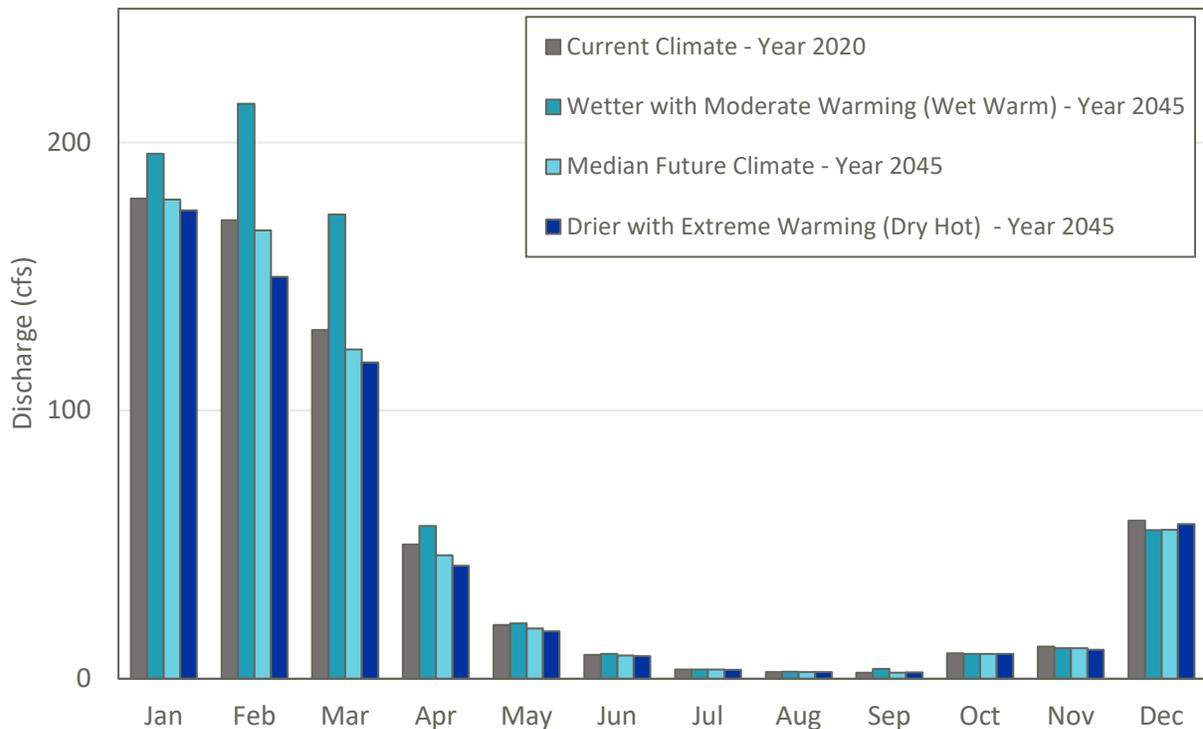


FIGURE 4-10: PROJECTED CHANGES IN NORMAL YEAR FLOW 2045: SANTA MARGARITA RIVER

These water supply change projections indicate that as climate change progresses, local water systems which rely on natural recharge through precipitation are likely to become more reliable water supply sources, while river supplies that are diverted for artificial recharge will continue to see high variability and are likely to become less reliable. Natural groundwater recharge will still occur in normal and dry years, but the timing of available water will change as precipitation will increasingly fall during a shorter rainy season with a longer dry season each year. Furthermore, the increase in temperatures over time will also lead to increases in evaporation from surface water bodies and land surface which will decrease the volume of water available for diversion from rivers. Increased attention should be paid to understanding the adequacy and operational constraints of natural and artificial recharge systems in the service area.

### 4.3.2 Water Demand Change Factor Results

Projected changes in outdoor demand from baseline conditions in 2020 under various climate change scenarios are shown in [Figure 4-11](#), [Figure 4-12](#), and [Figure 4-13](#). The water demand change factors are applied to outdoor water uses, which have been adjusted for future population growth and conservation measures. Indoor water uses are assumed to respond to future population growth and conservation as well but are not sensitive to climate change. All scenarios indicate an increase in the annual outdoor water demand, with the average annual outdoor water demand projected to increase by 6 percent for the Dry Hot scenario; 3.4 percent for the Median scenario; and 1.3 percent for the Wet Warm scenario.

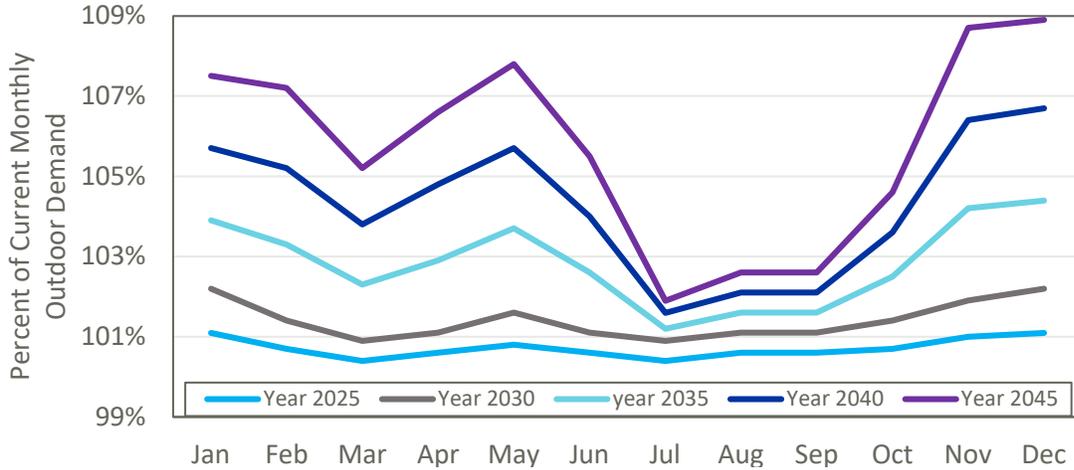


FIGURE 4-11: CHANGES IN OUTDOOR DEMAND UNDER DRY HOT FUTURE CLIMATE 2025 - 2045

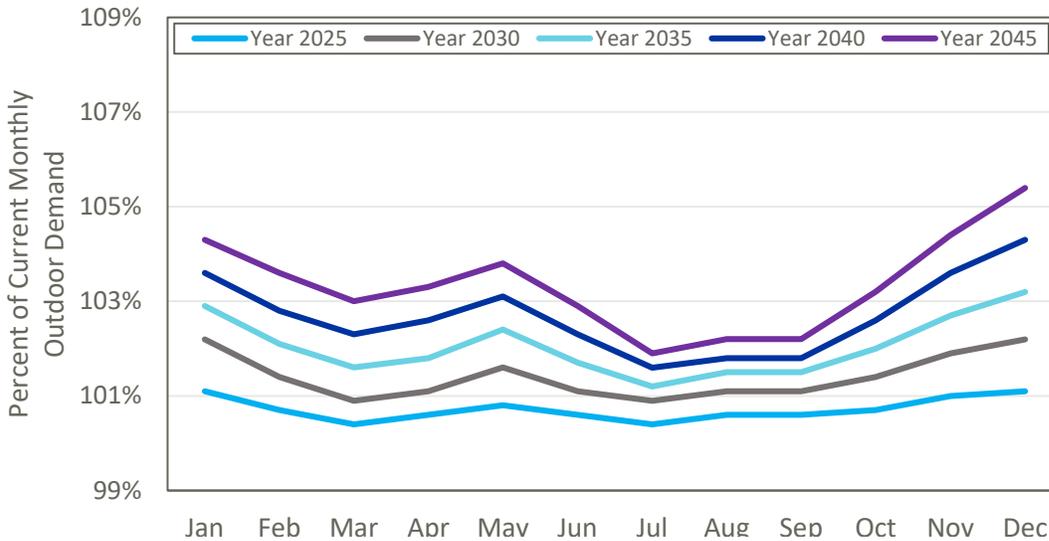


FIGURE 4-12: CHANGES IN NORMAL YEAR OUTDOOR DEMAND UNDER MEDIAN FUTURE CLIMATE 2025 - 2045

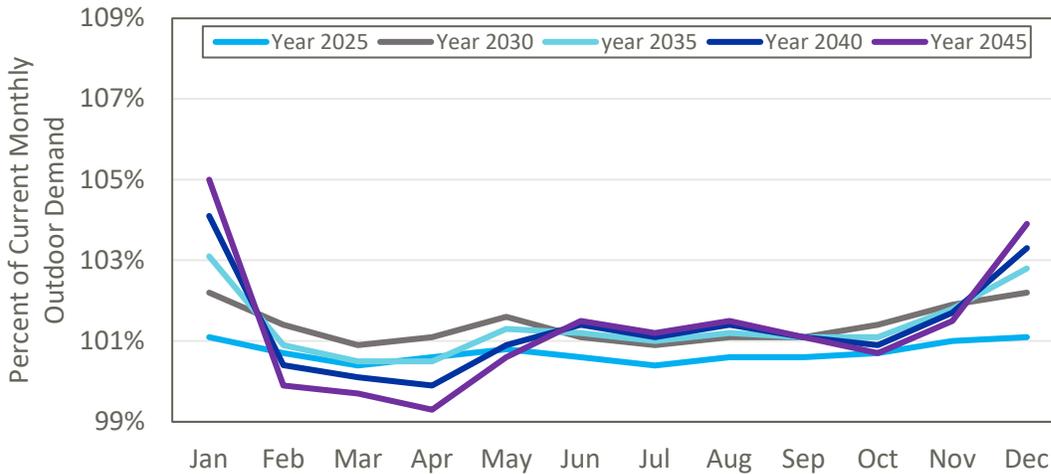


FIGURE 4-13: CHANGES IN OUTDOOR DEMAND UNDER WET WARM FUTURE CLIMATE 2025 - 2045

Figure 4-14 shows the absolute values of the outdoor water demand under various climate change scenarios compared to current conditions and normal conditions in 2045. The impacts of climate change on outdoor water demand are projected to be similar during normal and drought years over the next two decades. This is because climate change datasets show that temperatures are projected to increase over time, regardless of hydrologic conditions. These projected increases in temperature are estimated to increase ET rates for landscaping, irrigated agriculture, and native vegetation. Although the relative changes seem small, the absolute increase during the already high demands month of July and August are notable. On average, projected demand for customers served by Western within Western’s wholesale and retail service areas in 2045 assuming normal conditions is projected to increase by 6,200 AF in July and August from the projected demand under current climate conditions. This average increase in peak monthly demand (July and August) increases to nearly 6,700 AF under the Dry Hot scenario; 6,500 AF under the Wet Warm scenario; and 6,650 AF under the Median scenario. Detailed projected changes for outdoor water demand under all the climate change scenarios are presented in Appendix B (Table B-10, B-11, and B-12).

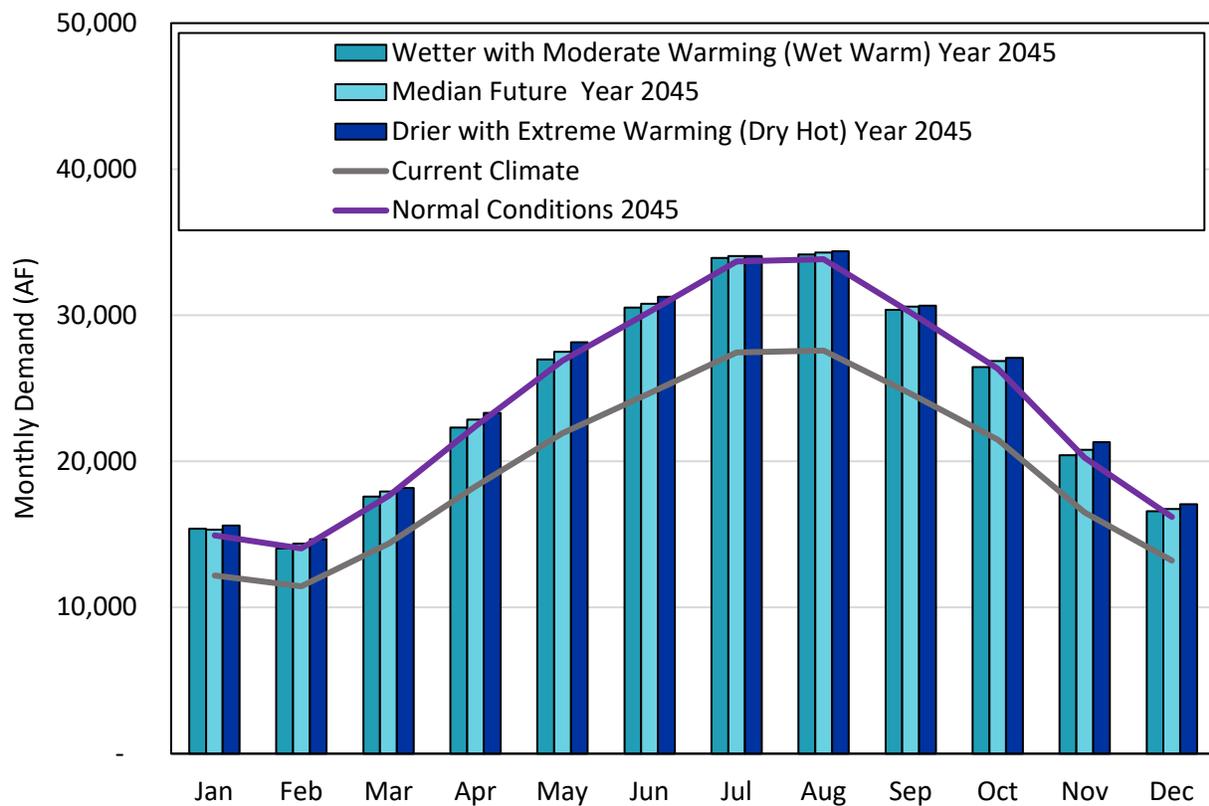


FIGURE 4-14: PROJECTED CHANGES IN NORMAL YEAR WATER DEMAND 2045

## 4.4 Future Water Supply Budgets

This analysis provides Western and its retail agencies with the ability to utilize the data in the DWR climate change projections and methods of climate change analysis for Western’s service area to develop water budgets and evaluate the impacts of climate change either qualitatively or quantitatively. The water budgets for the entire Western services area for each of the three climate change conditions are shown in [Table 4-2](#) through [Table 4-4](#). The water budgets developed for the Western service area include the following assumptions:

1. Climate change factors were applied to demand and groundwater production. Baseline demand was collected from Western’s 2020 UWMP. Baseline groundwater production was calculated as the difference between baseline demand and the summation of imported water supplied by MWD plus recycled water use.
2. Surface water production and recycling supplies were held constant at 2020 levels to help identify the need for mitigation actions.
3. Demand for imported supplies was calculated as the difference between total demand and total local supplies.

TABLE 4-2: WESTERN SERVICE AREA WATER BUDGET – DRIER FUTURE CONDITIONS WITH EXTREME WARMING

	2025	2030	2035	2040	2045
<b>Total Demand</b>	<b>245,910</b>	<b>260,841</b>	<b>275,618</b>	<b>281,921</b>	<b>295,777</b>
Groundwater Production	157,111	156,298	153,439	150,638	147,771
Surface Production	2,414	2,414	2,414	2,414	2,414
Recycling	6,908	6,908	6,908	6,908	6,908
Recycling - M&I and Agricultural	6,908	6,908	6,908	6,908	6,908
Total Local Supplies	166,433	165,620	162,761	159,960	157,093
Total Net Demand on Imported Water Supply	79,477	95,220	112,856	121,961	138,685

TABLE 4-3: WESTERN SERVICE AREA WATER BUDGET – MEDIAN FUTURE CLIMATE CONDITIONS

	2025	2030	2035	2040	2045
<b>Total Demand</b>	<b>245,910</b>	<b>258,614</b>	<b>271,889</b>	<b>285,842</b>	<b>300,509</b>
Groundwater Production	157,111	156,298	155,377	154,484	153,591
Surface Production	2,414	2,414	2,414	2,414	2,414
Recycling	6,908	6,908	6,908	6,908	6,908
Recycling - M&I and Agricultural	6,908	6,908	6,908	6,908	6,908
Total Local Supplies	166,433	165,620	164,699	163,806	162,913
Total Net Demand on Imported Water Supply	79,477	92,994	107,190	122,037	137,596

TABLE 4-4: WESTERN SERVICE AREA WATER BUDGET – WETTER FUTURE CONDITIONS WITH MODERATE WARMING

	2025	2030	2035	2040	2045
<b>Total Demand</b>	<b>245,910</b>	<b>258,614</b>	<b>270,834</b>	<b>283,668</b>	<b>297,076</b>
Groundwater Production	157,111	156,298	160,752	165,199	169,694
Surface Production	2,414	2,414	2,414	2,414	2,414
Recycling	6,908	6,908	6,908	6,908	6,908
Recycling – M&I and Agricultural	6,908	6,908	6,908	6,908	6,908
Total Local Supplies	166,433	165,620	170,074	174,521	179,016
Total Net Demand on Imported Water Supply	79,477	92,994	100,760	109,148	118,060

The MWD 2020 IRP also developed projected water supply budgets based on its four projected climate change conditions described previously. [Table 4-5](#) shows the MWD 2020 IRP projected total demand for Western’s service area and [Table 4-6](#) shows the MWD 2020 IRP projected imported water supply demand for Western, supplied by MWD, for each of MWD’s 2020 IRP climate change scenarios.

TABLE 4-5: MWD 2020 IRP PROJECTION OF WESTERN’S SERVICE AREA DEMAND

Projected Western Total Demand	2025	2030	2035	2040	2045
Scenario A	230,120	236,761	243,185	246,359	251,194
Scenario B	255,964	270,884	285,736	297,451	310,669
Scenario C	230,243	237,010	243,555	246,637	250,722
Scenario D	256,597	271,855	287,142	299,076	312,220

TABLE 4-6: MWD 2020 IRP PROJECTION OF WESTERN’S IMPORTED WATER SUPPLY DEMAND

Projected Western Demand on Imported Water Supply	2025	2030	2035	2040	2045
Scenario A	12,823	11,851	13,632	13,838	18,057
Scenario B	37,049	43,323	52,626	60,484	73,030
Scenario C	43,930	51,299	59,551	64,284	72,069
Scenario D	69,207	84,621	101,072	114,132	130,938

A comparison of Western and the MWD 2020 IRP total Western service area demand, [Figure 4-15](#), shows that Western’s projections are consistent with the MWD 2020 IRP. The MWD 2020 IRP projections of Western’s imported water supply demands are generally higher than the imported water supply demands calculated for Western in this climate change analysis, as illustrated in [Figure 4-16](#). However, these higher demands are generally attributable to the assumption in Western’s water budget that surface and recycled water production is held constant at 2020 levels, while the MWD 2020 IRP assumes growth in those two water supply sources.

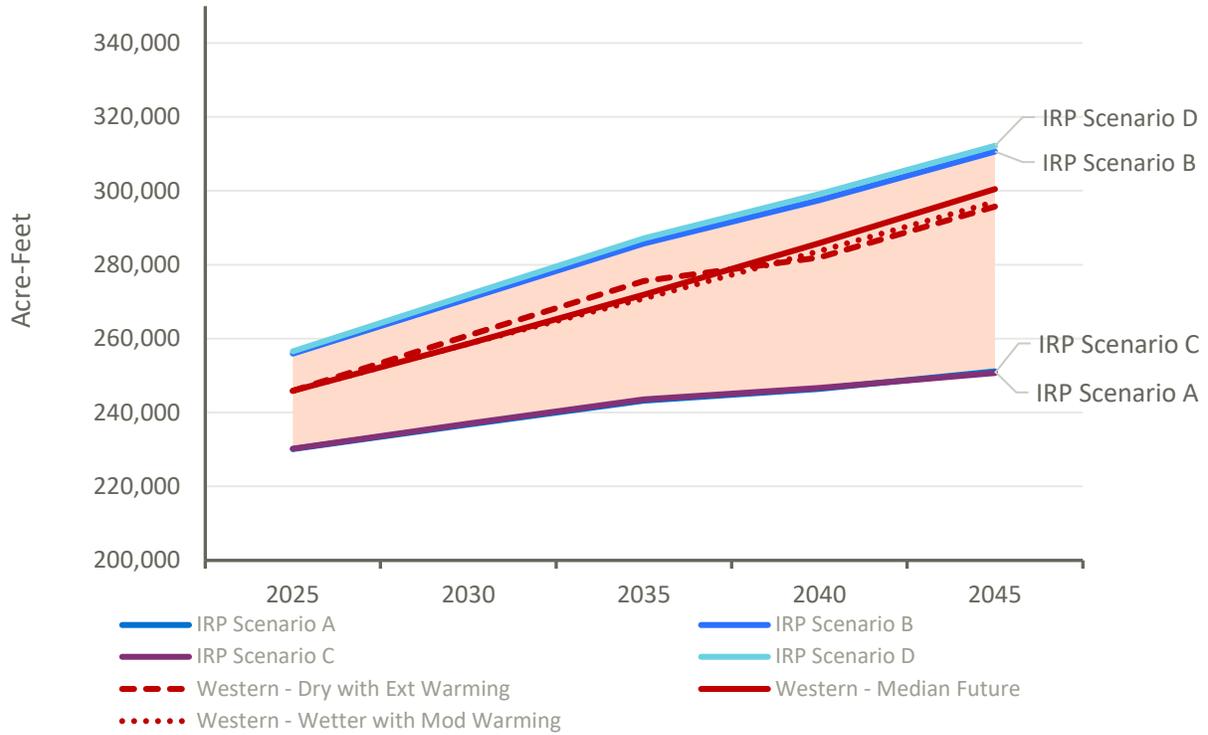


FIGURE 4-15: COMPARISON OF MWD 2020 IRP AND WESTERN SERVICE AREA TOTAL SUPPLY DEMANDS UNDER FUTURE CLIMATE SCENARIOS

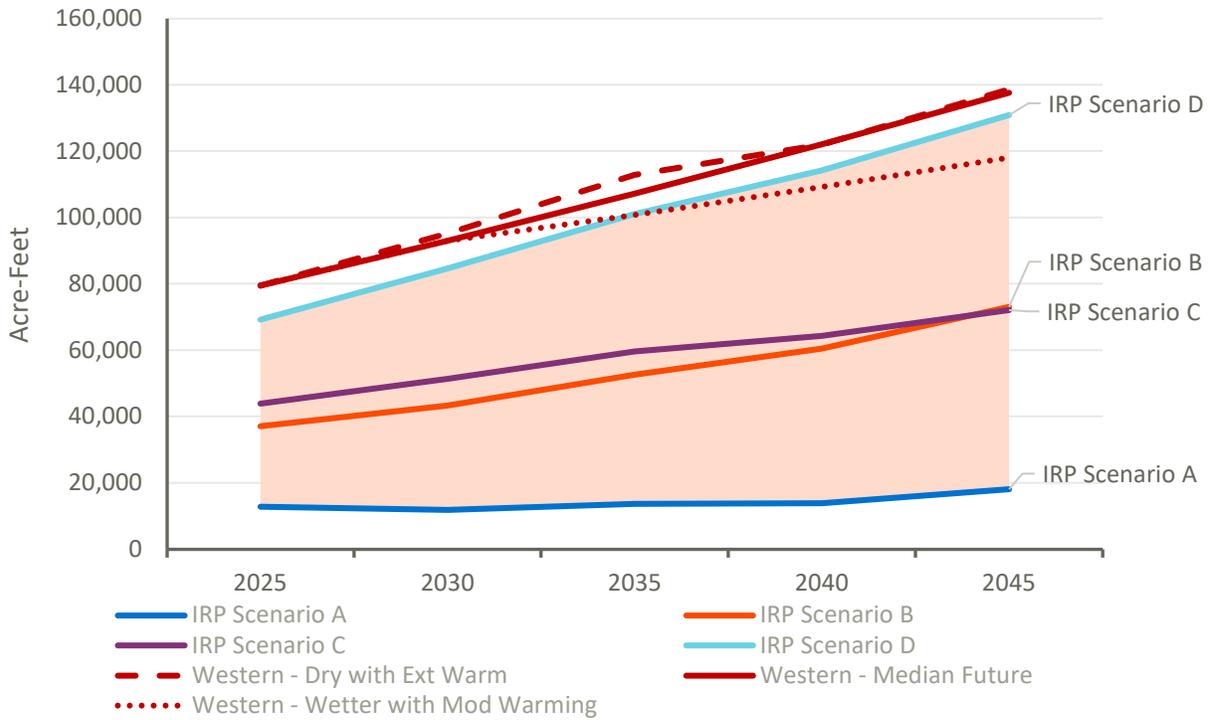


FIGURE 4-16: COMPARISON OF MWD 2020 IRP AND WESTERN IMPORTED WATER SUPPLY DEMANDS UNDER FUTURE CLIMATE SCENARIOS

## 4.5 Applying Results to Local Water Analysis

### 4.5.1 Computing Future Water Supply and Demand

For Western retail agencies wishing to perform a quantitative assessment of their projected water budgets, the computations needed to convert the percent change results presented in this analysis into quantitative estimates of future water supply and demand can be provided as worksheets upon request. Instructions on how to use these worksheets can also be made available upon request.

The monthly change factors developed as part of this analysis are useful for understanding how seasonal changes are contributing to the annual changes discussed in [Section 4.3](#). Monthly values are also useful for planning management actions and mitigation actions in the regional DCP. Monthly water supply and demand change factors computed for the service area are presented in [Appendix B](#).

### 4.5.2 Constraints and Limitations

The climate change vulnerability assessment performed as part of this regional DCP presents planning-level projections of climate impacts on water supplies and demand for Western’s service area during normal and drought periods. The results are intended for use by Western in preparing climate-impacted water supply and demand projections for its wholesale UWMP and regional DCP.

The results are not intended for use in other applications such as flood resilience planning, infrastructure design, or for making decisions about operating any specific structure. Flood resilience planning requires analysis of daily or finer temporal resolution using statistical methods to fit frequency distributions to extreme values. Infrastructure design and operations applications require more detailed analysis and ground-truthing of site-specific characteristics, operations and regulations that are not considered in this report.

Climate change can also impact water resources indirectly. For example, wildfire hazards are projected to increase in southern California with climate change. Wildfires can impact water resources by increasing water requirements for firefighting, changing surface vegetation and runoff patterns in burn areas, causing debris flows, and increasing siltation of reservoirs and hydraulic structures. Such secondary impacts of climate change on water resource are not captured in this study.

Future water supplies and demands can also be impacted by policy and regulatory decisions made at the local, state, and federal level. It is difficult to anticipate and quantify the impacts of policy and regulatory considerations that have not yet been made. Therefore, it is not the intention of this climate change vulnerability assessment to anticipate future policy or regulatory decisions and their impacts to future water supplies or demands.

### 4.5.3 Next Steps

The next step in the planning process is for Western and its member agencies to use the change factors and analysis provided in this analysis, if desired, to compute quantitative estimates of future supplies and demands during normal and drought years, incorporating the effects of climate change. The net change in future water supply for each member agency will depend on the percentage of their local

water supply that is sourced from the direct precipitation and natural recharge, Santa Margarita River, or Santa Ana River basins. Similarly, the net change in future water demand will depend on the percentage of outdoor water use and projections of future growth within each member agency's service area. The difference between net future water supply and net future water demand, if any, is the net water deficit that the agency will need to address by developing new management actions and projects. A calculated deficit, if any, would represent the minimum gap that would need to be addressed; however, it is prudent for water managers to consider additional management actions and projects to prepare for uncertain future conditions.

This analysis provides Western and its retail agencies with the ability to utilize the data in the DWR climate change projections and methods of climate change analysis for Western's service area to evaluate the impacts of climate change either qualitatively or quantitatively. Should a retail agency choose to use the analysis presented in this analysis, the agency may use the change factors provided in [Appendix B](#) to compute quantitative estimates of their future water supplies, demands and deficits. As previously noted, worksheets to convert the percent change results presented in this document into quantitative estimates of future water supply and demand can also be provided upon request.

# 5 Mitigation Actions

Mitigation actions are projects, programs, and strategies that are implemented prior to the occurrence of a drought to address potential risks and impacts and reduce the need for response actions. These actions are generally beneficial in increasing regional flexibility and resiliency during times of drought.

Within the framework of a DCP, these actions are generally developed in response to vulnerabilities identified through a Vulnerability Assessment. As detailed in [Chapter 4](#), the analysis and findings from the Vulnerability Assessment projected:

1. **Decreases** in supplies under normal and drought (single year and multi-year) conditions from two basins that provide surface water supplies to portions of the service area (Santa Ana and Santa Margarita Rivers)
2. **Decreases** in precipitation and natural recharge under normal and multi-year drought years
3. **Increases** in outdoor water uses under normal, single dry, and multi-year drought conditions
4. An **increase** in dependence on imported water if mitigation actions are not implemented

In response to these findings, Western and the Drought Task Force compiled a suite of mitigation actions for the DCP. The full suite of mitigation actions is spatially identified in [Section 5.1](#), [Figure 5-1](#) and summarized in [Appendix C](#) and [Appendix G](#).

This suite of mitigation actions that was developed in concert with the Drought Task Force includes projects that are in various stages of implementation, from pre-planning, planning, design, to construction, and the timelines projected for these projects are estimations. Many of these actions are included in stakeholder capital planning efforts, such as Western's Capital Improvement and Facilities Plan. However, numerous factors have the potential to impact implementation of these actions, such as funding availability, regulatory requirements, implementation complexities, and strategic planning priorities that are unique to each regional stakeholder. As such, inclusion of these actions into this regional DCP does not imply any commitment or obligation for future implementation. Furthermore, the mitigation actions presented are not intended to be exhaustive; thus, [Section 5.3](#) also provides guidance for establishing consistency with this DCP for projects that may be implemented in the future but are not included in the potential suite of mitigation actions.

There are numerous regional benefits that could be realized through the implementation of these potential mitigation actions. These benefits include increasing local supplies, promoting water conservation, enhancing water supply reliability, enhancing operational flexibility, and decreasing imported water supplies. Benefiting disadvantaged communities and promoting environmental justice, or the fair treatment of all people with respect to development, implementation and enforcement of environmental laws and regulations, are other benefits that could be realized by the region through the implementation of these potential mitigation actions. Several criteria were developed with consideration of these benefits to perform a preliminary evaluation of the potential mitigation actions,

which is described further in [Section 5.2](#). The results of the preliminary evaluation are detailed in [Appendix C](#).

Many of the potential mitigation actions included in this regional DCP would likely require compliance with the California Environmental Quality Act (CEQA). This regional DCP does not include a CEQA analysis, and any potential action that requires compliance with CEQA would need to be evaluated by the project proponent prior to implementation.

The region also developed a suite of other mitigation actions that are not yet in development but could be helpful for the region in mitigating the impacts of drought in the future. These potential mitigation actions are identified in [Section 5.3](#) and are summarized in [Appendix D](#).

## 5.1 Identification of Potential Mitigation Actions

In November 2021, the Drought Task Force was sent a survey that asked each organization to respond to the following question:

***What projects or programs does your organization have in development that would potentially mitigate drought impacts in the future?***

For the purposes of this regional DCP, the respondents were asked to categorize their responses into one of the following four categories:

1. **Supply/treatment:** Creation of access to additional water supplies that leverages existing water supply sources, creates new sources of supply, and/or improves treatment capacity in existing plants to treat new, more challenging local water supplies
2. **Interties:** Construction of new physical connections between agencies that would allow transfer of water supply between and among Drought Task Force members
3. **Storage:** Expansion of water storage capacity
4. **Operations and Management:** Changes in water management practices that do not require new or modified infrastructure
5. **Other:** Other projects or programs

The survey asked each organization to include as many key identifiers as possible for each mitigation action, including, but not limited to, the following:

1. Project stage (planning, design, construction)
2. Identification of regional partners
3. Implementation timeline/schedule (short-, mid-, and long-term action)
4. Estimated costs (capital and operation and maintenance [O&M])
5. Estimated annual water savings or estimation of the supplemental supplies created as a result of implementation

The survey also asked each organization to assess whether the mitigation action has the potential to provide any of the following regional benefits:

**1. Enhancing Regional Water Supply Reliability and Resiliency**

- 1.1 – Increasing local supplies
- 1.2 – Promoting water conservation
- 1.3 – Enhancing water supply reliability
- 1.4 – Enhancing operational flexibility
- 1.5 – Decreasing reliance on imported water supplies

**2. Prioritizing Social Equity**

- 2.1 – Benefiting disadvantaged communities (DAC)
- 2.1 – Promoting environmental justice

The survey responses were discussed with the Drought Task Force during Workshop 4 on December 16, 2021, which also provided the opportunity to solicit input from other organizations that were unable to respond by survey (see [Appendix H](#)). Additional mitigation actions were identified from agency responses to a MWD climate change survey conducted in early 2022. Though unrelated to the scope of this DCP, the MWD survey served a similar purpose of identifying regional projects to address water supply reliability and resiliency. From the survey responses, workshop input, and information from the MWD climate change survey, a total of 65 projects, programs, and strategies were identified for the DCP ([Figure 5-1](#)). A summary of these mitigation actions and their key identifiers are provided in [Appendix C](#).

As previously discussed, implementation of the mitigation actions could be impacted by numerous factors including funding availability, regulatory requirements, implementation complexities, and planning priorities. The Drought Task Force meetings together with Western’s Regional Drought Portal mitigation action (as described in [Section 3.2](#)) will be used to support implementation of the mitigation actions described in the DCP.

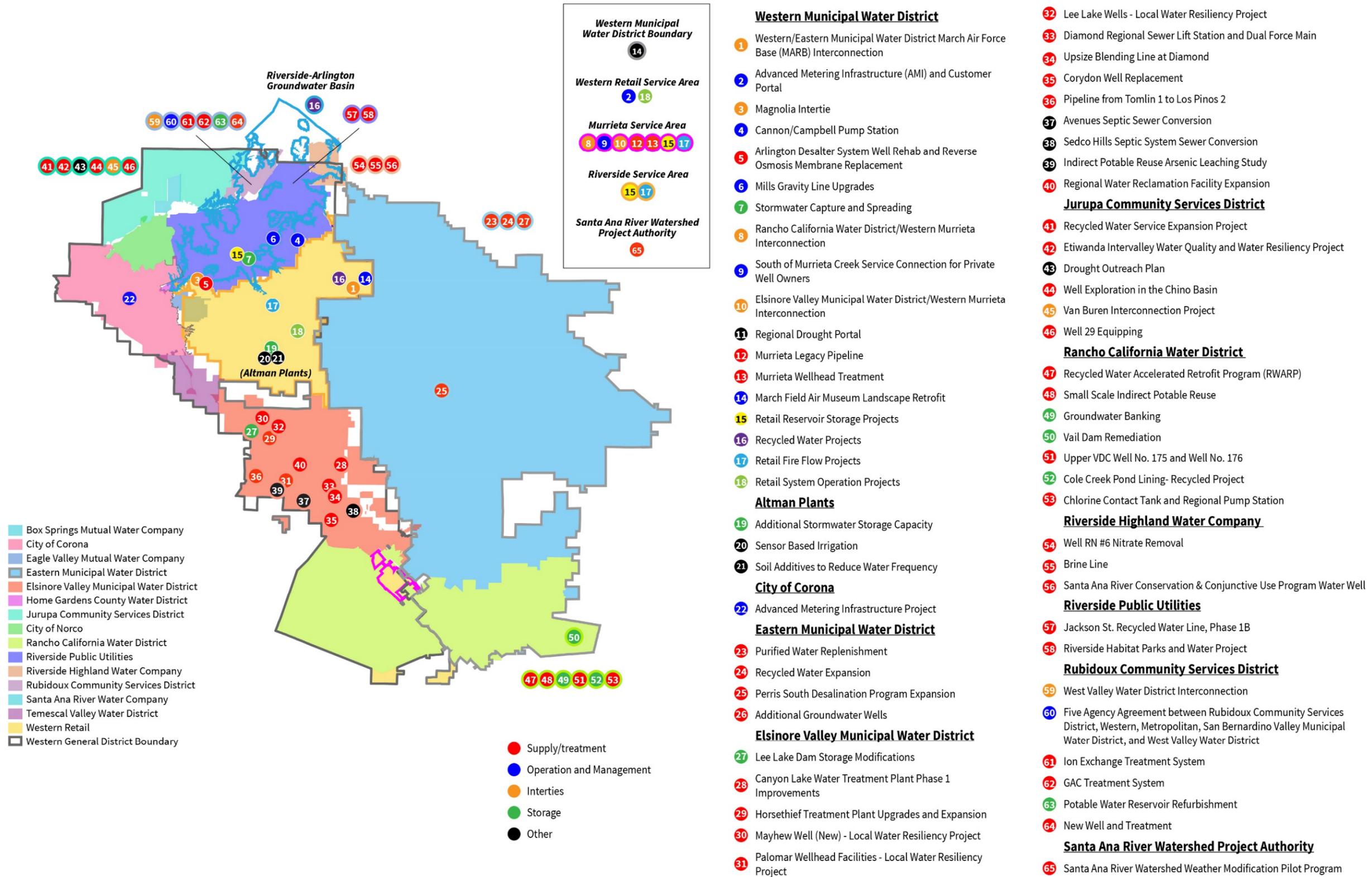


FIGURE 5-1: POTENTIAL SUITE OF MITIGATION ACTIONS FOR THE REGIONAL DCP

## 5.2 Preliminary Evaluation of Potential Mitigation Actions

A set of criteria were developed to perform a preliminary evaluation of the potential mitigation actions (Table 5-1). Each potential project was classified using the categorization for each criterion provided in Table 5-1. As a wholesaler, Western is not involved in the prioritization of agency projects. Prioritization of mitigation actions is agency driven and as part of the development of the DCP, Western provided each member of the Drought Task Force the opportunity to provide and prioritize their own projects. As such, this categorization does not represent a prioritization or ranking of the projects identified, nor are the provided criteria intended to be exhaustive. Rather, these criteria were developed to assist in the identification of the key aspects of each project for the purposes of this DCP. This preliminary evaluation could be used in future planning efforts to further inform regional priorities. Long term, Western will continue to meet with retail agencies on a regular basis to support them in prioritizing resiliency projects to address agency-specific concerns and needs.

TABLE 5-1: EVALUATION CRITERIA

Criteria	Categorization		
Enhance Regional Water Supply Reliability and Resiliency	Meets 3 or more of the regional benefits	Meets 2 of the regional benefits	Meets 1 of the regional benefits
Prioritize Social Equity	Benefits DAC and promotes environmental justice	Benefits DAC or promotes environmental justice	Does not benefit DAC or promote environmental justice
Regional Benefits	Regional action	Action involves multiple adjacent agencies	Single agency action
Timing/Schedule	Short-term action (1-3 years)	Mid-term action (3-5 years)	Long-term action (> 5 years)

The preliminary evaluation of the potential suite of mitigation actions with respect to the criteria and categorization identified above is provided in full in Appendix C. Details with respect to timing/schedule and the potential benefits associated with these mitigation actions are described below.

The 65 potential projects were grouped into short-, mid-, and long-term actions (Figure 5-2). Note that the potential timelines for the projects that are included in the DCP are estimates and as noted previously, depend upon many factors, such as the ability to secure funding, procurement, implementation complexities and permitting challenges, regional priorities, and other factors. However, with the estimates provided, 38 of the potential projects (or 58 percent) identified are projected for implementation in the short-term (by the end of 2024), with many of these projects already in the design or construction phase. Implementation for 12 of the potential projects (or 18 percent) is projected in the mid-term (by the end of 2026), and four of the potential projects are projected for implementation in the long-term (2027 and beyond). The remaining projects' timelines are currently uncertain.

	Short-Term	Mid-Term	Long-Term
Supply/ Treatment	5, 13, 24, 28, 29, 31, 32, 34, 36, 41, 46, 47, 51, 53-58, 61, 62, 64, 65	12, 23, 30, 33, 35, 40, 44	25, 26, 42
Interties	1, 3, 45, 59		
Storage	19, 52, 63	50	27
Operations and Management	2, 4, 14, 60	6, 22	
Other	20, 21, 39, 43	37, 38	
<b>TOTAL</b>	<b>38</b>	<b>12</b>	<b>4</b>

*Projects with unknown timeline: 7-11, 15-18, 48, 49 (11 total)*

FIGURE 5-2: POTENTIAL TIMELINE FOR MITIGATION ACTIONS

Of the 65 projects, programs, and strategies identified, 77 percent have the potential to enhance water supply reliability. Additionally, 69 percent of the projects have the potential to enhance operational flexibility, and 53 percent have the potential to decrease reliance on imported supplies. Forty-seven percent of the projects have the potential to increase local supplies. A subset of these projects also has the potential to either benefit DACs/promote environmental justice or promote water conservation (Figure 5-3). Many of the projects identified have multiple benefits and thus the percentages identified in Figure 5-3 do not sum to 100 percent.

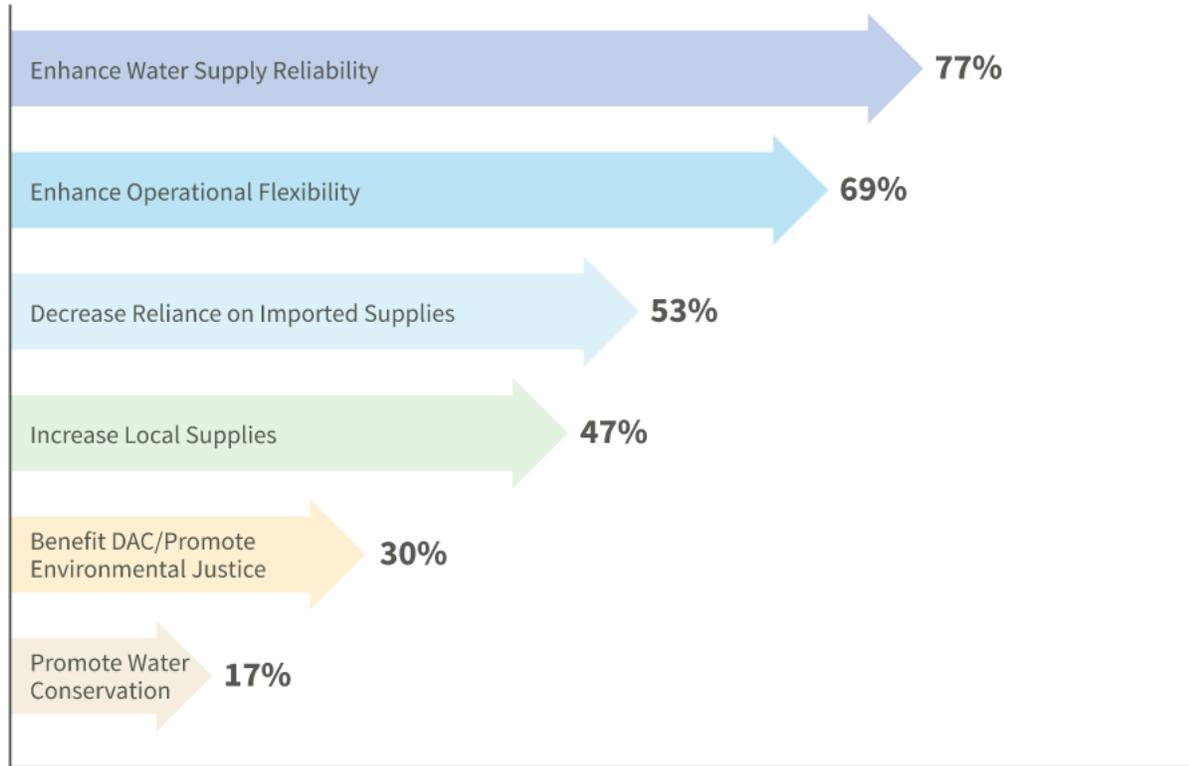


FIGURE 5-3: POTENTIAL BENEFITS OF THE REGIONAL DCP MITIGATION ACTIONS

As mentioned above, the implementation timelines for the projects that are included in the regional DCP are estimates and thus so is the timeline for when the benefits associated with these projects will be realized by the region. Some of the 65 projects identified above are also in the pre-planning phase, and their timelines are currently being evaluated. Including only those projects that currently have a projected implementation timeline, [Figure 5-4](#) shows the estimated timing for when the benefits associated with these projects could start to be realized. In 2022, a total of 25 projects are projected for implementation. These projects have shared benefits of enhancing water supply reliability (20 projects), decreasing reliance on imported supplies (17 projects), and increasing local supply (13 projects). By 2023, another 16 projects are projected for implementation, increasing the total project count to 41 projects, which similarly increases the cumulative number of projects in each benefit category<sup>1</sup>.

<sup>1</sup> Note that these project counts represent a bundling of 16 unique Western projects that were further grouped into additional categories based on common characteristics. These four projects are shown as #15-#18 on [Figure 5-1](#) and are summarized in [Appendix C](#).



FIGURE 5-4: POTENTIAL TIMELINE FOR MITIGATION ACTIONS AND REALIZATION OF BENEFITS WITHIN THE REGION

### 5.3 Other Proposed Mitigation Actions for Future Exploration

The November 2021 survey sent to the Drought Task Force also asked each organization to respond to the following question:

***What other project or programs do you think would be helpful for the region in mitigating the impacts of drought in the future?***

The responses received are depicted on [Figure 5-6](#) and summarized in [Appendix D](#). Similar to those potential projects previously defined, these potential projects were also grouped into the categories of supply/treatment, interties, storage, operation and management, and other. These projects, programs, and strategies also have similar shared benefits of enhancing regional water supply reliability and resiliency and prioritizing social equity. Of the 17 total projects, programs, and strategies identified, 64 percent have the potential to enhance water supply reliability. Additionally, nearly 60 percent of the projects have the potential to enhance operational flexibility, and nearly 30 percent have the potential to promote water conservation. Twenty-four percent of the projects identified have the potential to decrease reliance on imported supplies or to increase local supplies, and a subset of these projects also has the potential to benefit DACs and promote environmental justice ([Figure 5-5](#)).

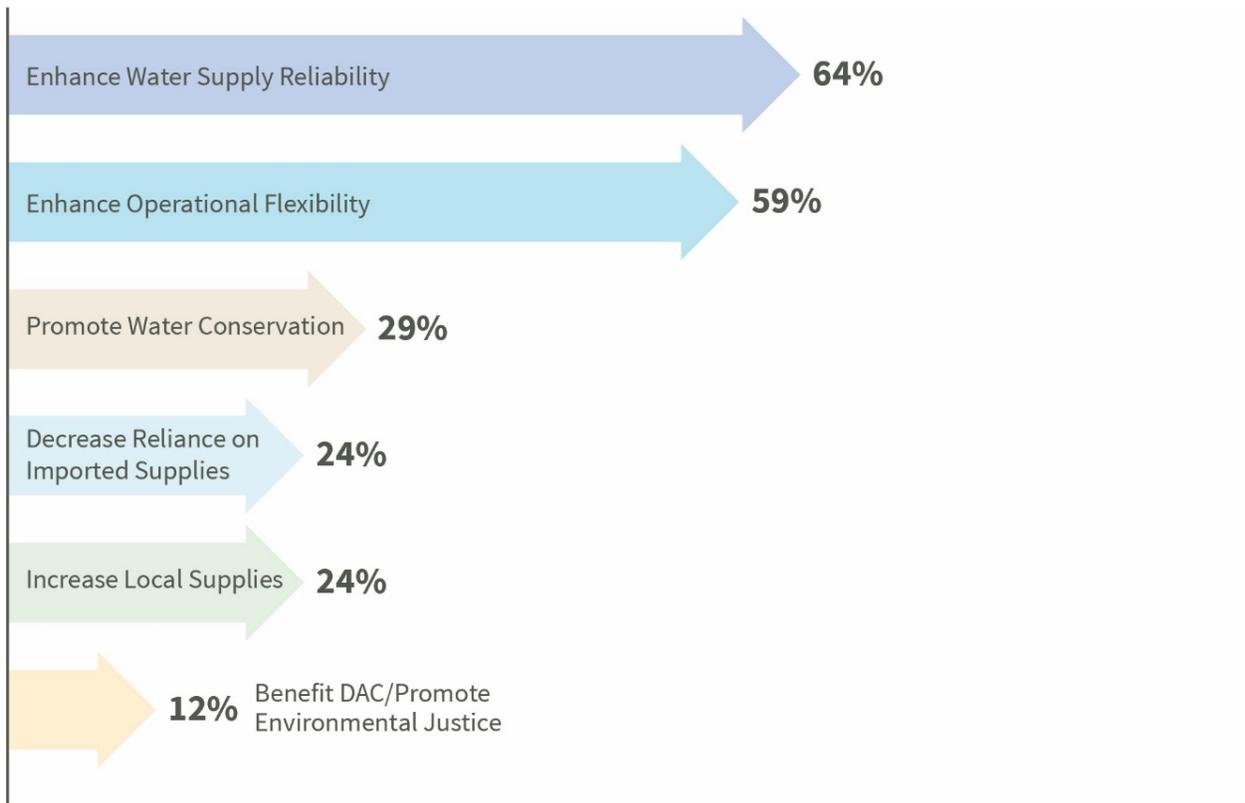


FIGURE 5-5: POTENTIAL BENEFITS OF THE OTHER MITIGATION ACTIONS PROPOSED BY THE DROUGHT TASK FORCE

These projects, along with a summary of their potential benefits, are summarized in [Appendix D](#).

The suite of actions included in the regional DCP is not exhaustive, as members of the Drought Task Force and other regional stakeholders may have other projects, programs, or strategies under development or consideration. In an effort to be inclusive of these potential future efforts, any future projects that provide any of the following benefits as previously described in [Section 5.1](#) are considered to be consistent with the goals and objectives of this DCP:

1. 1.1 – Increases local supplies
2. 1.2 – Promotes water conservation
3. 1.3 – Enhances water supply reliability
4. 1.4 – Enhances operational flexibility
5. 1.5 – Decreases imported water supplies

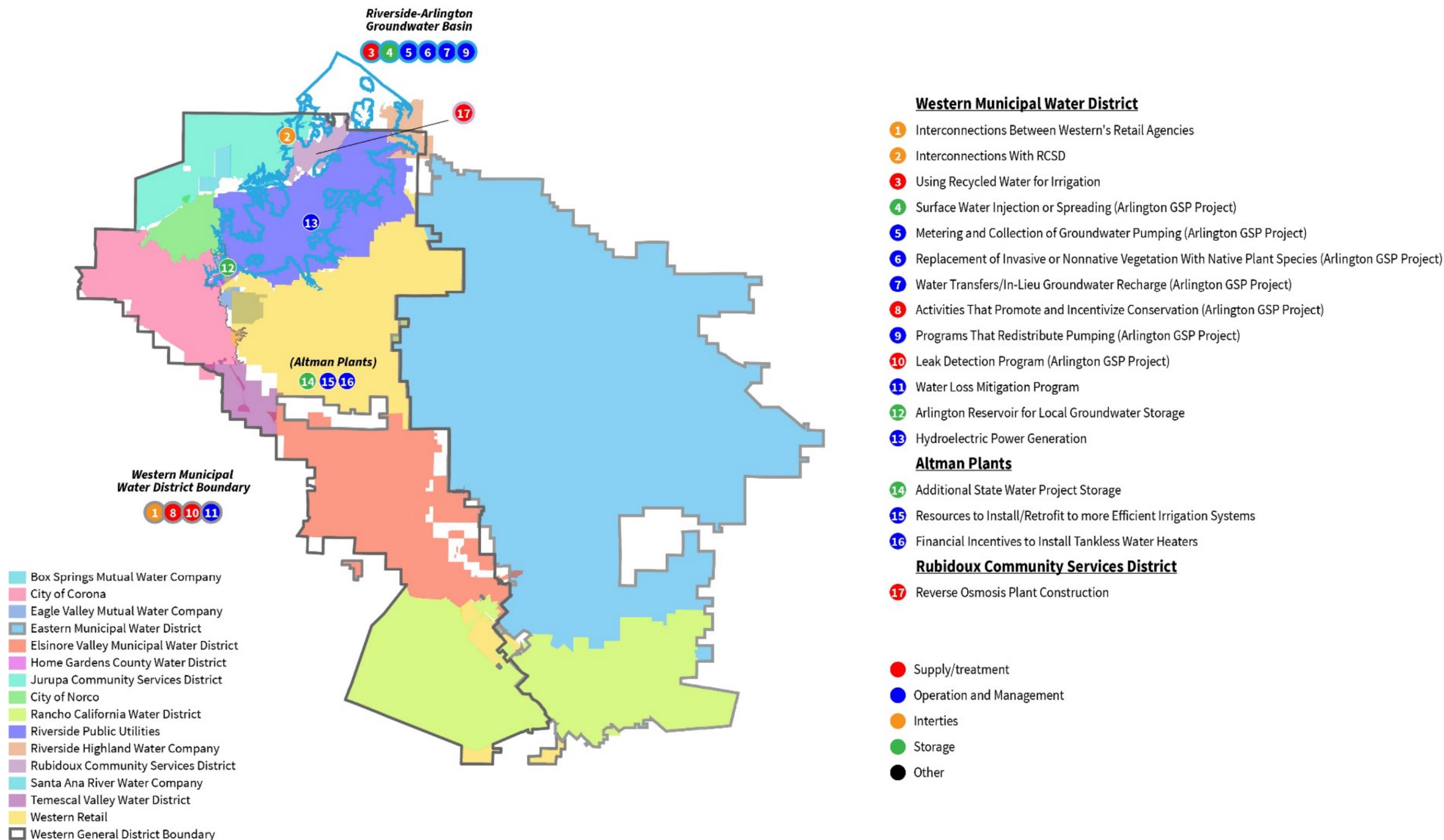


FIGURE 5-6: ADDITIONAL PROPOSED MITIGATION ACTIONS FOR FUTURE EXPLORATION

# 6 Drought Response Actions

Unlike mitigation actions, drought response actions are implemented during a drought to manage the limited supply and decrease the severity of immediate impacts. These actions are triggered by water shortage stages and can be quickly implemented to provide expeditious benefits.

## 6.1 Comparison of Agency Drought Response Actions

As outlined in [Chapter 3](#), Western wholesale and many of its retail agencies including Western retail all maintain WSCPs, which identify drought response actions corresponding to the various water shortage stages. The drought response actions of each agency reflect their individual water supply portfolios (see [Table 2-2](#) in [Chapter 2](#)) and the specific water shortage conditions associated with those portfolios. As a result, water shortage conditions and the accompanying response actions may vary within the region during times of drought. Consequently, to promote a DCP that is flexible and responsive to each of the agencies within the region, Western and its retail agencies will rely on the drought response actions provided in each agency's WSCP should a water shortage occur. The drought response actions included in each retail agency WSCP serve to address the vulnerabilities identified in [Chapter 4](#), which include:

1. **Decreases** in supplies under normal and drought (single year and multi-year) conditions from two basins that provide surface water supplies to portions of the service area (Santa Ana and Santa Margarita Rivers)
2. **Decreases** in precipitation and natural recharge under normal and multi-year drought years
3. **Increases** in outdoor water uses under normal, single dry, and multi-year drought conditions
4. An **increase** in dependence on imported water if mitigation actions are not implemented

Through the individual WSCPs, Western and its retail agencies have developed a variety of drought response actions under four categories, as follows:

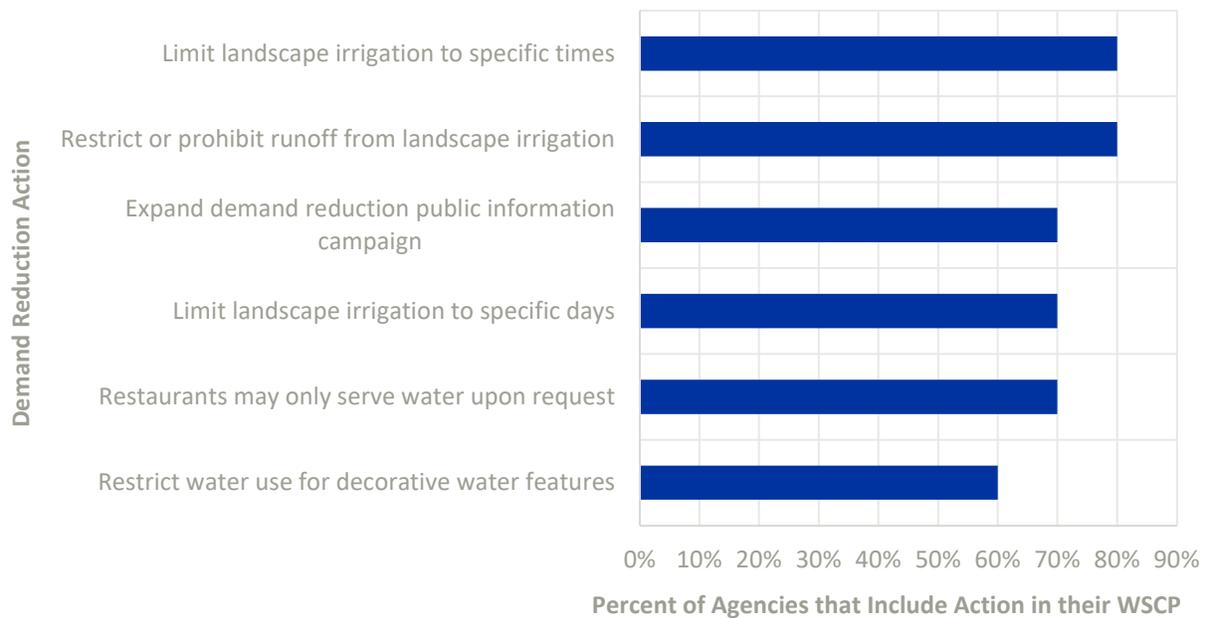
1. **Demand reduction actions** – strategies intended to offset supply shortages, e.g., public education and outreach campaigns, watering and other outdoor use restrictions, and rate structure changes
2. **Supply augmentation actions** – strategies intended to augment existing supplies, e.g., transfers, exchanges, or purchases of other supplies
3. **Operational changes** – operational changes that can be implemented to address water shortages on a short-term basis, e.g., improved monitoring, analysis and tracking of customer usage rates, or other operational changes related to demand reduction or supply augmentation
4. **Additional mandatory restrictions** – mandatory restrictions that are in place for various water shortage levels and are generally associated with enforcement actions and penalties, e.g., limitations on outdoor water use (volume, timing, location)

In the future, demand reduction and supply augmentation actions will help to address the decrease in supplies from the Santa Ana and Santa Margarita River basins, and operational changes and mandatory restrictions will help to address the vulnerabilities associated with decreases in precipitation and natural recharge and increases in outdoor water use.

The drought response actions included in each retail agency WSCP are provided in [Table 6-1](#) at the conclusion of this chapter and summarized below.

### **Demand Reduction Actions**

The most common demand reduction actions included in agency WSCPs are shown in [Figure 6-1](#).



**FIGURE 6-1: MOST COMMONLY ADOPTED DEMAND REDUCTION ACTIONS IN AGENCY WSCPS**

With the exception of the City of Norco and RCSD, all of Western’s retail agencies have specified landscape restrictions with regards to watering times as part of their WSCPs. Nearly 90 percent of these agencies also specify landscape restrictions with regards to watering days. The timing for when these restrictions go into effect varies based on the agency. Eighty percent of Western’s retail agencies also restrict or prohibit runoff from landscape irrigation, which is generally in effect at all times. The quantitative estimates of how landscape related restrictions could reduce the shortage gap vary by agency and water shortage level; however, based on those agencies that provide these estimates in their WSCPs:

- Restrictions on watering days and times have the potential to result in a demand reduction between 0 and 10 percent when implemented during the earlier stages of drought, while implementing more stringent requirements related to watering days and times during the later stages of drought has the potential to result in a demand reduction above 30 percent for select agencies.
- Prohibiting runoff from landscape irrigation has the potential to result in a demand reduction between 0 and 5 percent.

Public education and outreach, availability of water for public consumption in restaurant dining environments, and restrictions on water features are other demand reduction actions which are included in 60 to 70 percent of Western’s retail agency WSCPs. The timing for when the water feature restrictions take effect generally vary by agency, however, restrictions related to water availability in restaurants generally go into effect during the earlier stages of drought for most of the agencies that include this action. Public education and outreach are always in effect for those agencies who include this as a demand reduction action. Like the landscape restrictions, the quantitative estimates of how these restrictions could reduce the shortage gap vary by agency and water shortage level; however, based on those agencies that provide these estimates in their WSCPs:

- Various restrictions on water features provide the smallest reduction in demand of the three actions. Most agencies estimate that these restrictions could result in an incremental reduction in demand of one percent, however some agencies that specify more stringent restrictions related to water features particularly during the later stages of drought estimate a greater impact on demand reduction.
- Restrictions related to water availability in indoor dining environments are estimated to reduce demand on average by two percent, however some agencies estimate that these restrictions could have a greater impact on demand reduction.
- The estimated demand reduction as a result of public education and outreach reduction varies widely by agency, however agencies generally estimate that this action could reduce demand between 0 and 10 percent.

### **Supply Augmentation Actions**

Seventy percent of Western’s retail agencies have specified supply augmentation actions in their WSCPs, including transfers, exchanges, other purchases, or stored emergency supply:

- EVMWD – EVMWD can augment or supplement its water supplies through groundwater and/or imported water but does not anticipate using additional supply source during a water shortage. As such, EVMWD did not provide an estimate in their WSCP of how these actions would reduce the shortage gap.
- JCSD – JCSD can augment or supplement its water supplies by utilizing its full groundwater allocation in the Chino Basin and by using water held in the Chino Basin groundwater storage accounts. JCSD anticipates these actions would occur during the later stages of drought, which could reduce the shortage gap by up to 50 percent, depending on supply availability.
- RCWD – RCWD can purchase additional imported water to augment or supplement its water supplies. Local groundwater may be available for catastrophic events such as earthquakes. RCWD anticipates these supply augmentation actions could occur during any of the stages of drought, which could reduce the shortage gap by up to 100 percent, depending on supply availability.
- RHWC – RHWC currently maintains interconnections with the cities of San Bernardino, Colton, and Rialto which could be used to obtain supplemental water supply during the later stages of drought. RHWC estimates that these supply augmentation actions could reduce the shortage gap by up to 100 percent, depending on supply availability.

- RPU – RPU has agreements in place to access imported supply if needed and has several emergency interconnections that could provide supply in an emergency. RPU anticipates these supply augmentation actions would occur during any of the stages of drought and could result in a moderate reduction in the shortage gap, depending on supply availability.
- RCSD – RCSD can augment or supplement its water supplies by utilizing its full pumping capabilities in the Riverside South Groundwater Basin and depending on the nature of the shortage, through the intertie shared with JCSD for potable water. RCSD anticipates these supply augmentation actions could occur during any of the stages of drought. In the future, RCSD may also be able to purchase additional imported water from Western pending a connection with RPU. Utilizing RCSD’s full pumping capabilities in the Riverside South Groundwater Basin could reduce the shortage gap in the earlier stages of drought by up to 35 percent, with the shortage gap reduced by up to 40 percent in the later stages of drought, depending on supply availability.
- Western Retail – Western Retail maintains interconnections with the cities of Riverside and Corona, EMWD, and EVMWD, which could be used to obtain supplemental water supply during any of the stages of drought. Western Retail estimates that these interconnections could reduce the shortage gap by up to 100 percent, depending on supply availability.

### **Operational Changes**

Many of the demand reduction actions specified in the retailer WSCPs qualify as operational changes. That said, sixty percent of Western’s retail agencies identified stand-alone operational changes outside of the demand reduction actions that may be further used to reduce the gap between demand and available supplies:

- City of Norco – the city of Norco has created system flexibility through purchase agreements and interconnections and is exploring water exchange opportunities and transfers.
- EVMWD – EVMWD’s WSCP includes several potential operational changes that may be used during a water shortage including decreasing line flushing, increasing water patrols, and implementing or modifying drought rate structures or surcharges.
- JCSD – JCSD has budgeted for a pipeline replacement program to reduce water losses.
- RCWD – RCWD has developed a software tool that can be used to assess demand reduction during drought.
- RPU – RPU’s WSCP includes several potential operational changes that may be used during a water shortage, including expediting system improvements to reduce water losses and stopping or minimizing watering of park areas with potable water.
- RCSD – RCSD has a planned pipeline replacement program to reduce water losses.

### **Additional Mandatory Restrictions**

Western’s retail agencies have all identified a series of restrictions that will be implemented at different water shortage levels. These restrictions generally pertain to outdoor water use with regards to timing (watering days and times) and the use of specific fixtures (e.g., shut-off nozzles for hoses and the use of

recirculating pumps for outdoor water features), along with restrictions on agricultural and construction water use.

### 6.1.1 Agency Drought Response Actions Summary

The most common drought response actions included in the WSCPs for the region are shown below in [Figure 6-2](#). This data excludes drought response actions under several ‘other’ categories since a wide variety of actions can be included under each category. Limiting landscape irrigation to specific times and restricting or prohibiting runoff from landscape irrigation are the most common drought response actions and are included as actions in 80 percent of agency WSCPs. Limiting landscape irrigation to specific days, serving water only upon request in retail food establishments, and expanding demand reduction public information campaigns are other notable drought response actions, along with restricting water use for decorative water features, operational changes, and other mandatory restrictions.

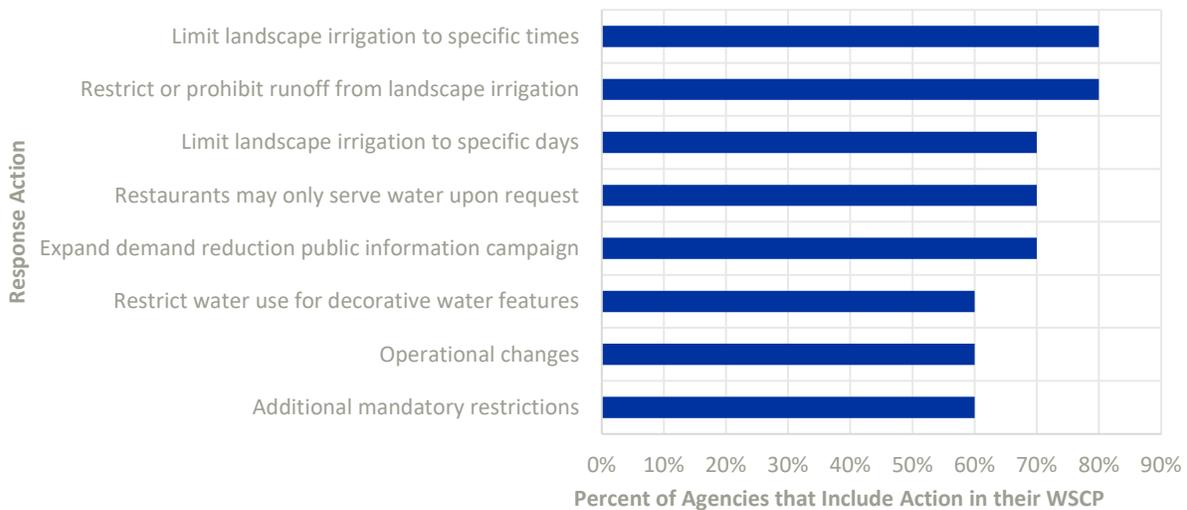


FIGURE 6-2: MOST COMMONLY INCLUDED DROUGHT RESPONSE ACTIONS IN AGENCY WSCPS

The drought response actions included in the fewest WSCPs for the region are shown below in [Figure 6-3](#). The following drought response actions are only implemented by 10 percent of agencies:

- Improving customer billing
- Increasing water waste patrols
- Allowing filling of swimming pools only when an appropriate cover is in place
- Transfers
- Exchanges

Decreasing line flushing, stored emergency supply, expanding supply augmentation public information campaigns, requiring covers for pools and spas, and implementing/modifying drought rate structures or

surcharges are other notable drought response actions least implemented amongst agencies in the region.

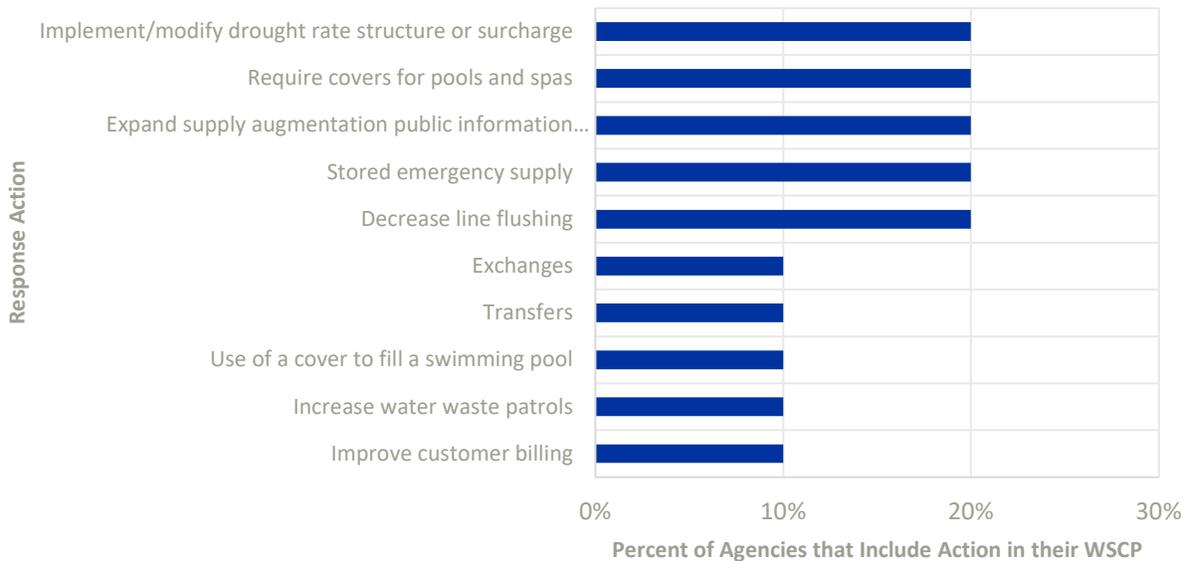


FIGURE 6-3: LEAST COMMONLY INCLUDED DROUGHT RESPONSE ACTIONS IN AGENCY WSCPS

As previously stated, Western and its retail agencies will rely on the drought response actions provided in each agency's WSCP to promote a DCP that is flexible and responsive to each of the agencies. Similar to the mitigation actions, Western is not involved in the prioritization of agency response actions. Prioritization of response actions is generally performed by each respective agency's Board of Directors. Additionally, implementation and enforcement of the response actions is also the responsibility of each of Western's retail agencies. Western's role is to understand when an agency is entering different shortage stages, and how they can support and assist with supply augmentation with the goal of unified drought response and messaging. This is facilitated through:

- A review of each agency's Annual Assessment which incorporates planned response actions for the next fiscal year and timing of the accompanying response actions.
- The planned Drought Task Force meetings included as part of Western's DMF which will provide the opportunity to discuss response actions being planned by each of the agencies along with potential implementation challenges.
- Communication of shortage stages through the Regional Drought Portal.

TABLE 6-1: SUMMARY OF RETAIL AGENCY WSCP DROUGHT RESPONSE ACTIONS

		Western Retail	City of Corona	City of Norco	EVMWD	JCSD	Temescal Valley Water District	Rancho California Water District	Riverside Highland Water Company	Riverside Public Utilities	RCSD
Demand Reduction Actions	Expand Public Information Campaign			X		X	X	X	X	X	X
	Improve Customer Billing							X			
	Offer Water Use Surveys					X		X			X
	Provide rebates on plumbing fixtures and devices	X		X				X		X	X
	Provide rebates for landscape irrigation efficiency	X		X			X	X		X	
	Provide rebates for turf replacement	X		X			X	X		X	
	Decrease line flushing			X						X	
	Increase water waste patrols					X					
	Moratorium or Net Zero Demand Increase on New Connections		X			X		X			
	Implement/Modify Drought Rate Structure or Surcharge							X			X
	Landscape - Restrict or prohibit runoff from landscape irrigation	X	X	X	X		X	X	X	X	
	Landscape - Limit landscape irrigation to specific times	X	X		X	X	X	X	X	X	
	Landscape - Limit landscape irrigation to specific days	X	X		X	X	X		X	X	
	Landscape - Prohibit certain types of landscape irrigation		X			X	X			X	
	Landscape - Prohibit all landscape irrigation	X	X				X		X		
	Landscape - Other landscape restriction or prohibition	X	X		X	X		X	X		
	CII - Lodging establishment must offer opt out of linen service				X	X		X		X	
	CII - Restaurants may only serve water upon request		X		X	X	X	X	X	X	
	CII - Other CII restriction or prohibition						X		X	X	
	Water Features - Restrict water use for decorative water features, such as fountains		X		X	X		X	X	X	
Pools and Spas - Require covers for pools and spas				X			X				
Pools - Allow filling of swimming pools only when an appropriate cover is in place				X							
Other water feature or swimming pool restriction	X	X		X		X	X	X	X		
Other	X	X		X	X	X	X	X	X	X	
Supply Augmentation	Expand Public Information Campaign			X							X
	Transfers										X
	Exchanges									X	
	Other Purchases	X			X			X	X		X
	Stored Emergency Supply					X				X	
	Other					X				X	X
<b>Operational Changes</b>				X	X	X		X		X	X
<b>Additional Mandatory Restrictions</b>		X	X	X	X			X		X	

## 6.2 Potential Enhancement of Drought Response Actions

The opportunity to discuss potential implementation of these actions and any need for a coordinated, regional response will be provided through the framework of the Drought Task Force meetings outlined as part of the Drought Monitoring Framework in [Chapter 3](#).

Although this DCP retains the potential drought response actions identified by each agency as part of their WSCP, the development of this DCP provided the opportunity for stakeholders to discuss how Western and its stakeholders can more effectively respond to drought on a regional level. During Workshop 2 held in February 2021, the following questions were discussed amongst the Drought Task Force:

- When we are in a drought, how should we respond?
- What types of actions have been most effective during previous droughts?
- What types of actions would be most difficult to implement or comply with, and why?

Discussion around these questions revealed alignment amongst many of the Drought Task Force members. A full summary of this discussion is provided in [Appendix H](#). The key takeaways from this discussion fell into three categories:

1. **Physical changes**
2. **Behavioral changes**
3. **Mandated changes**

**Physical changes** are defined as the installation or use of new equipment to expand conservation, such as low-flow fixtures. **Behavioral changes** are defined as voluntary end-user actions that increase conservation, such as reduced landscape irrigation time. **Mandated changes** are defined as mandated actions to reduce water use, such as mandated landscape watering days enforced by fines.

A summary of the key takeaways under each of these three categories is provided in [Table 6-2](#).

TABLE 6-2: CATEGORIES OF DROUGHT RESPONSE ACTIONS AND A SUMMARY OF KEY TAKEAWAYS FROM WORKSHOP 2

 <p><b>PHYSICAL CHANGES</b> Installation/use of new equipment to expand conservation (e.g., low-flow fixtures)</p>	 <p><b>BEHAVIORAL CHANGES</b> Voluntary end-user actions that increase conservation (e.g., reduced landscape irrigation time)</p>	 <p><b>MANDATED CHANGES</b> Mandated actions to reduce water use (e.g., landscape watering days enforced by fines)</p>
<ul style="list-style-type: none"> <li>• Use technology (like smart meters) to reveal leaks and opportunities to conserve</li> </ul>	<ul style="list-style-type: none"> <li>• Educate continuously in simple and accessible ways to incentivize smart water use, not just during droughts</li> <li>• Coordinated communication across agencies is important</li> <li>• Tiered pricing works well</li> <li>• So does peer pressure!</li> </ul>	<ul style="list-style-type: none"> <li>• Water restrictions alone don't work; especially for those who can't cut use further</li> <li>• Balance water reduction mandates with commitment to quality of life and connection to customer needs</li> </ul>

### 6.3 Recommendations

The key takeaways highlighted in [Section 6.2](#) are generally consistent with the drought response actions identified in individual agency WSCPs. While this DCP has been developed to promote the flexibility needed for Western and its retail agencies to implement response actions based on local conditions, the takeaways summarized in [Table 6-2](#) could provide a framework for:

- Guiding the development of new response actions during subsequent updates of agency WSCPs
- Coordinating regional response actions in collaboration with the Drought Task Force with the goals of improving awareness, education, and responsiveness; producing cost-savings through economies of scale; increasing opportunities for outside funding support (State, federal, other); and improvements to the design of the response through sharing of results/lessons learned

# 7 Operational and Administrative Framework

The operational and administrative framework identifies the roles, responsibilities, and related procedures necessary to implement the primary elements of the DCP:

1. Conduct drought monitoring – as described in [Chapter 3](#)
2. Coordinate response actions in connection with each agency’s WSCP – as described in [Chapter 6](#)
3. Implement mitigation actions – as described in [Chapter 5](#)

Updating the DCP is also part of the operational and administrative framework.

This chapter provides a summary of the responsibilities associated with the primary elements of the DCP and the roles that will carry forward these responsibilities. Following this summary is a discussion related to the DCP update process, which includes monitoring, evaluating, and updating the plan. A summary of the operational and administrative framework for this regional DCP is provided at the conclusion of this chapter.

## 7.1 Roles and Responsibilities

Western, its retail water agencies, and the Drought Task Force all retain responsibilities associated with the key elements of this plan.

**Western:** Western is responsible for estimating regional demand and supply projections, identifying infrastructure constraints that may impact supply delivery, comparing supply and demand estimates considering any infrastructure constraints and determining which Western shortage response stage and actions are recommended, strategic communication of regional response actions (as needed), participating in and assembling the Drought Task Force, implementing mitigation actions as part of ongoing planning efforts, updating the DCP, and updating/maintaining the regional drought portal in collaboration with Western’s retail agencies. These responsibilities are generally carried out through the following roles:

- a) Western Director of Water Resources
- b) Western Deputy Director of Water Resources
- c) Western Director of Finance
- d) Western Strategic Communications Manager
- e) Western Water Resources Specialist
- f) Western Operations Manager

[Table 7-1](#) provides the level of responsibility for each of these roles relative to the primary tasks described above.

TABLE 7-1: LEVEL OF RESPONSIBILITY FOR THE KEY ROLES AT WESTERN RELATIVE TO THE PRIMARY DCP RESPONSIBILITIES

	Western Director of Water Resources	Western Deputy Director of Water Resources	Western Director of Finance	Western Communications and Customer Experience Department	Western Water Resources Specialist	Western Operations Manager
Demand projections	I	A	I	I	R	I
Supply projections	I	A	I	I	R	I
Identify infrastructure constraints	I	A	I	I	C	R
Strategic communication of regional response actions	A	C	I	R	C	I
Assembly of the Drought Task Force	I	A	I	R	C	I
Implement mitigation actions as part of ongoing planning efforts	A	R	C	I	C	C
Update the DCP	A	C	I	C	R	I
Maintain/update regional drought portal	I	A	I	I	R	I

- R **Responsible** Assigned to complete the task
- A **Accountable** Has final decision-making authority and accountability for completion
- C **Consulted** An advisor or subject matter expert who is consulted before a decision or action
- I **Informed** Updated on decisions or actions

**Western Retail Water Agencies:** Western retail water agencies are responsible for providing demand and supply projections to Western for their respective service areas, participation in the Drought Task Force, initiating strategic communication of regional response actions, implementing mitigation actions as part of ongoing planning efforts, and updating the regional drought portal.

**Drought Task Force:** The Drought Task Force is responsible for collectively evaluating regional conditions, identifying, and planning for regional response actions, seeking approval for said response actions through appropriate Board approval (as needed), and communicating with customers once regional response actions have been initiated.

## 7.2 Drought Response Task Force Process

As previously discussed, the Drought Task Force is comprised of 29 members spanning various stakeholder segments within the region. Select triggers will be used to convene the Drought Task Force as part of the Drought Monitoring Framework as described in [Chapter 3](#). If one or more triggers is met, the meeting frequency will be increased to the corresponding interval as shown previously in [Table 3-6](#).

Once the Drought Task Force is convened, the group will meet to:

1. **Evaluate** regional conditions and **identify** which agencies/organizations are experiencing water shortage conditions
2. **Discuss** the need for a coordinated, regional response and **identify** potential regional response actions

Drought Task Force members may experience shortages and impacts of drought at varying times and degrees of severity due to nuances in supply and demand portfolios. It is important to enable and support each retailer as they enact shortage levels and response actions that are relevant and actionable in their service area. As a result, retailers are provided the flexibility to decide the degree to which they wish to participate, whether response actions are warranted consistent with their individual WSCPs, and communication protocols.

Once the Drought Task Force has met and identified potential regional response actions, Western and its retail agencies will individually plan for implementation of said response actions, which includes Board approval and strategic communication to customers as to what will be required and how to achieve the intended results.

## 7.3 Drought Contingency Plan Update

The DCP is a living document that is intended to be evaluated on an ongoing basis and subsequently updated as needed. Western will regularly review the DCP and make adjustments accordingly. This includes a post-drought evaluation to assess the effectiveness of the DCP once it has been implemented. This evaluation could include an analysis of the climatic and environmental aspects of the drought; its economic and social consequences; the extent to which pre-drought planning was useful in mitigating the impacts, in facilitating relief or assistance to stricken areas, and in post-recovery; and any other weaknesses or problems caused by or not covered by the DCP. Western will also update the DCP

consistent with the five-year UWMP report cycle to incorporate any significant changes to WSCPs, demand and supply projections, and additional mitigation actions

## 7.4 Operational and Administrative Framework Summary

**Table 7-2** summarizes the roles, responsibilities, and procedures associated with the operation and administration of the DCP.

TABLE 7-2: OPERATIONAL AND ADMINISTRATIVE FRAMEWORK SUMMARY

DCP Element	Roles	Responsibilities	Procedures
Conduct Drought Monitoring	Western Retail Water Agencies	Evaluate water supply reliability as part of the Annual Assessment	Compare supplies and demands and infrastructure constraints that may impact supply delivery. Determine which shortage response stage is recommended. Provide demand estimates to Western annually.
	Western	Develop annual supply and demand projections	Estimate unconstrained demands and available supplies for the coming year.
	Western	Identify infrastructure constraints	Identify any known MWD or Western infrastructure issues that may pertain to near-term water supply reliability.
	Western	Convene WSCP Team to conduct Wholesale Annual Assessment	Compare supplies and demands and discuss any infrastructure constraints that may impact supply delivery. Determine which Western shortage response stage is recommended.
	Western Western Retail Water Agencies	Maintain/update regional drought portal	Incorporate regional data and WSCP stage information into the regional drought portal consistent with the agreed upon frequency (to be determined).
	Western	Initiate Drought Task Force	Initiate the Drought Task Force based on regional triggers.
Coordinate Response Actions	Western Western Retail Water Agencies	Identify response actions	Based on the water shortage response stage identified during the Annual Assessment, determine which response actions are recommended.
	Drought Task Force	Evaluate regional conditions	Identify which agencies are experiencing water shortage conditions once the Drought Task Force has been initiated. Discuss the need for a regional response.
	Western Western Retail Water Agencies	Plan for response actions	Develop scope, schedule, and budget for implementation of response actions.
	Western Western Retail Water Agencies	Approval and implementation of response actions	By Western Board and retail agency Boards as needed.
	Western Western Retail Water Agencies	Communicate regional response actions	Communicate with customers as to what will be required and how to achieve the required results.
Implement Mitigation Actions	Western Western Retail Water Agencies	Ongoing evaluation and prioritization of mitigation actions	Continuation of regional planning efforts.
	Western Western Retail Water Agencies	Identify opportunities for funding and potential cost-sharing	Pursue funding opportunities, initiate agreements for cost-sharing.
	Western Western Retail Water Agencies	Implementation of mitigation actions	As needed, initiate design, environmental documentation, permitting, and construction.
Update DCP	Western	DCP evaluation	Conduct a post-drought evaluation.
	Western Western Retail Water Agencies	DCP update(s)	Comprehensive review of DCP and updates to the framework as needed.

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- U.S. Bureau of Reclamation (USBR). 2013. Climate Change Analysis for the Santa Ana River Watershed, Santa Ana Watershed Basin Study, California. Technical Memorandum No. 86-68210-2013-02. 2013.
- U.S. Drought Monitor. 2022. Available at: <https://droughtmonitor.unl.edu/>
- Western Municipal Water District. 2021. Urban Water Management Plan.

# Appendices

Appendix A – Conceptual Regional Drought Portal

# Western Municipal Water District Regional Drought Portal - Conceptual Design

*This conceptual Regional Drought Portal (portal) has been prepared as part of the development of the regional Drought Contingency Plan (DCP) for Western Municipal Water District (Western). The following slides present a mock-up of this conceptual portal, including a potential landing page and the potential datasets that could be integrated into the portal. Many of the datasets incorporated into this conceptual portal were developed based on engagement with the Drought Task Force. These datasets will be further refined in collaboration with Western and the Drought Task Force once the portal is scoped, planned, and designed.*

# Conceptual Design Outline

The pages that follow address the following components of the potential Regional Drought Portal:

- Landing page
- Dashboard
- Hydroclimate and Water Supply Conditions Maps
- Board of Directors/Summary Dashboard
- Forecasting
- User accessibility

# Landing Page

The landing page would provide an introduction to the website along with pertinent background information and a high level summary of current conditions



## Western Municipal Water District Drought Portal

### Example Landing Page

#### About This Website

The website allows viewers to query information (precipitation, temperature, reservoirs, streamflow, groundwater, snowpack, soil moisture, and vegetation conditions) on maps and show user-defined boundary areas of interest (HUC-8 watersheds, counties, water agencies, groundwater sustainability agencies, or drinking water providers). This website only provides data, it does not interpret or characterize the data for regulatory, administrative, or financial assistance purposes. Viewers seeking information about regulatory or financial assistance programs related to hydrologic conditions should consult the website of the specific program to determine the conditions that program uses to determine regulatory requirements

#### Drought Information

California often experiences multi-year dry conditions that trigger state and local response actions. Information about state response actions is available here and links to additional resources are provided below. Further background on drought in California is available [here](#). Drought means different things to different water users. Dry conditions turn into drought based on impacts, just as wet conditions may be harmless – until water overtops a levee and inundates a neighborhood or orchard. People and natural systems experience drought differently. Dry conditions can quickly impact ranchers grazing livestock, rural residents relying on private wells, or fish dependent upon small streams. Large urban water agencies with diverse water sources typically can buffer their customers from feeling the effects of multiple dry years.



Dashboard



Maps



Forecasting

#### More Information

##### **Governor’s Emergency Proclamations for Drought**

Counties covered by a current state-level emergency proclamation are shown [here](#).

**Federal Drought Monitor** The [U.S. Drought Monitor](#) is created weekly by the University of Nebraska, U.S. Department of Agriculture, and National Oceanic and Atmospheric Administration. It is a subjective blend of information drawn from a variety of sources. USDA uses it to identify agricultural producers’ eligibility for federal financial assistance programs. The U.S. Drought Monitor is not intended to characterize local water supply conditions; its website recommends that **“decision makers adopt an operational definition of drought for their own circumstances, incorporating local data such as grazing conditions or streamflow at a nearby gauge.”**

# Dashboard

The dashboard could provide the following charts/tables:

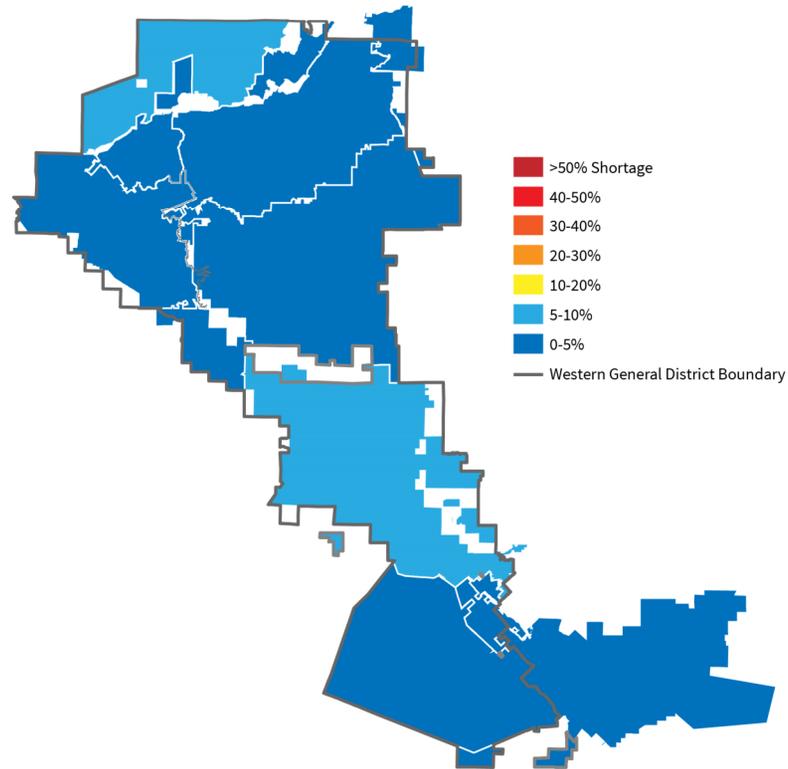
- WSCP stage map
- Water use charts/table
- Precipitation chart
- Temperature chart



## Western Municipal Water District Drought **Example Dashboard** – Drought Stage Map

### Western Municipal Water District

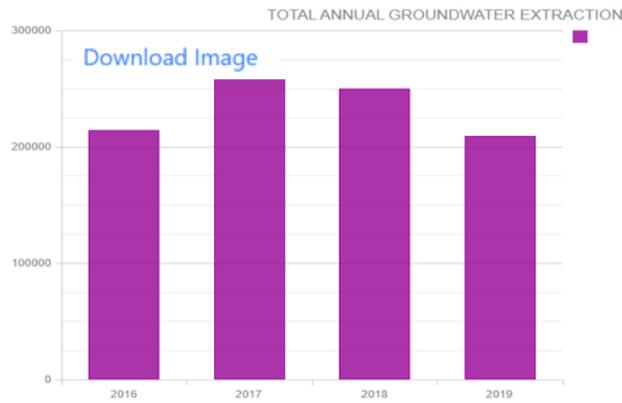
10% Shortage (Stage 1)



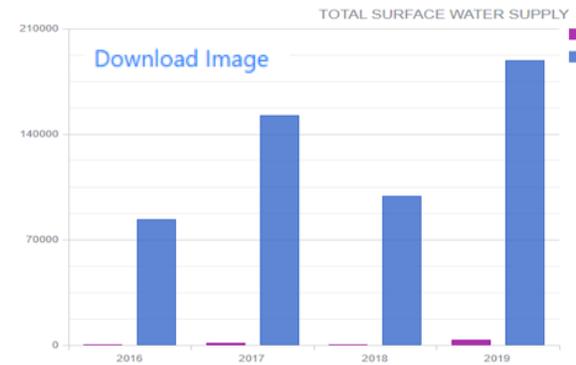


## Western Municipal Water District Drought **Example Dashboard** – Water Use and Groundwater Storage

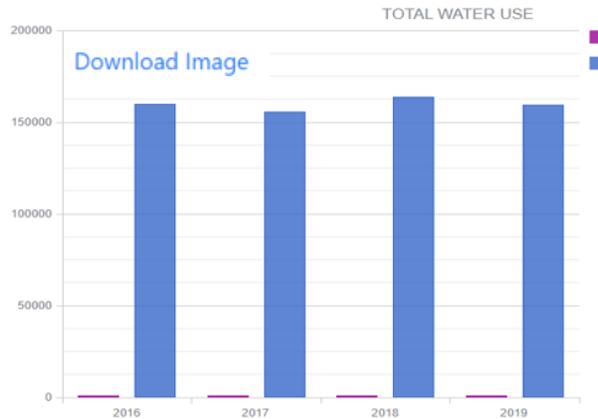
### Groundwater Use



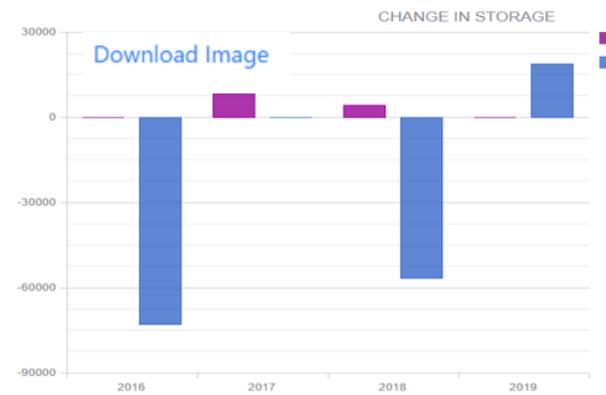
### Total Surface Water Supply



### Total Water Use

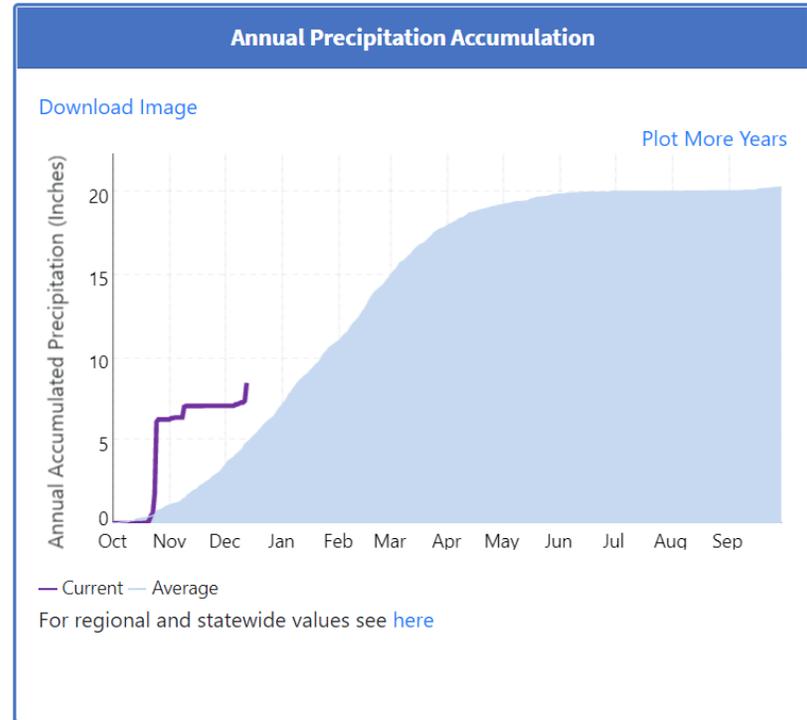
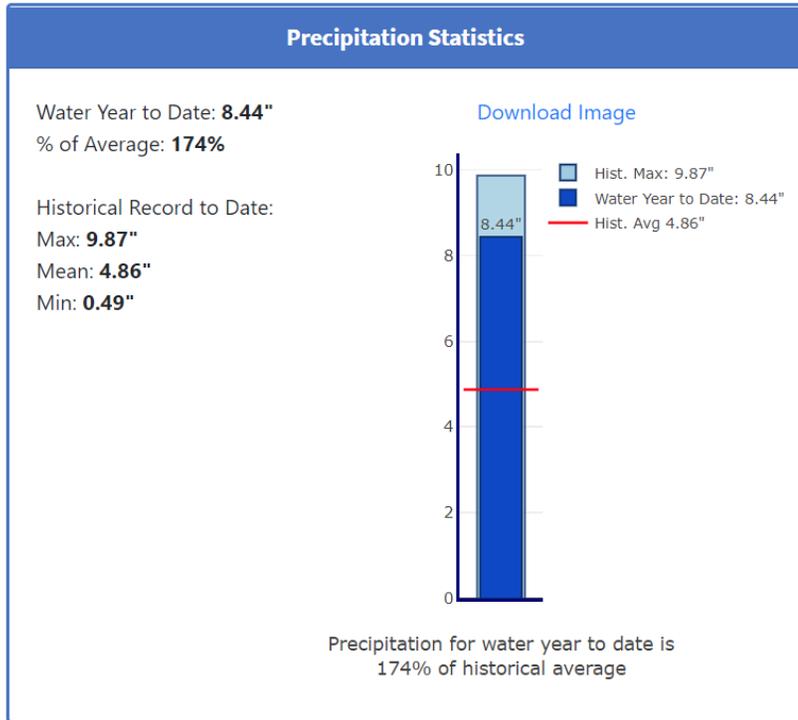


### Change In GW Storage





### Western Municipal Water District **Example Dashboard** – Precipitation Chart





### Western Municipal Water District **Example Dashboard** – Precipitation Chart

#### Annual Precipitation Accumulation Chart

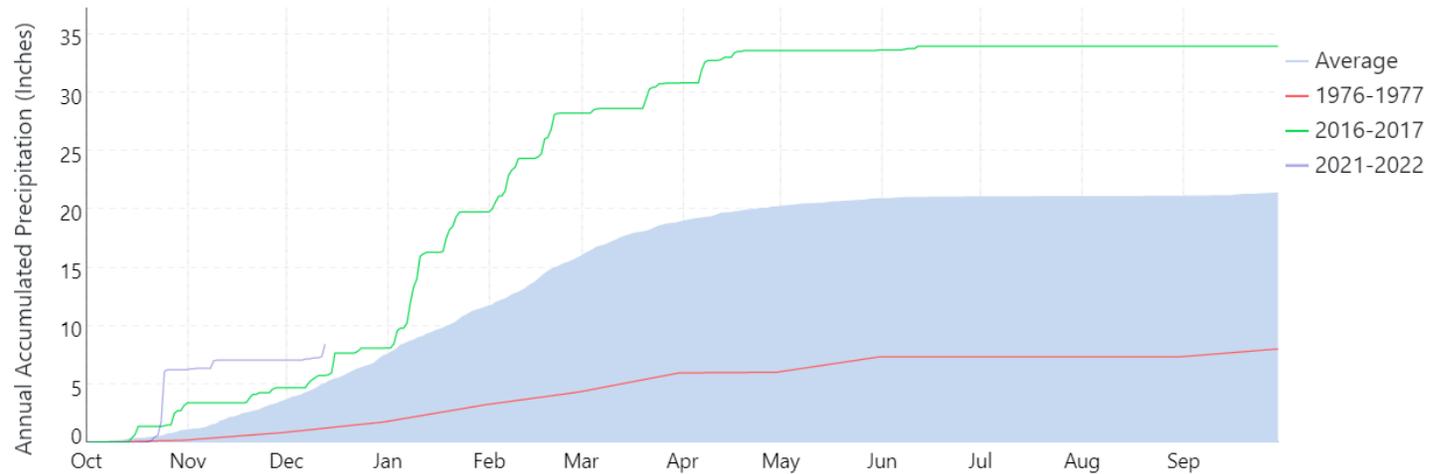
**Choose water years to plot:**

- 1976-1977
- 1982-1983
- 2000-2001
- 2001-2002
- 2002-2003
- 2003-2004
- 2004-2005
- 2005-2006
- 2006-2007
- 2007-2008
- 2008-2009
- 2009-2010
- 2010-2011
- 2011-2012
- 2012-2013
- 2013-2014
- 2014-2015
- 2015-2016
- 2016-2017
- 2017-2018
- 2018-2019
- 2019-2020
- 2020-2021
- 2021-2022
- Average

Redraw Chart

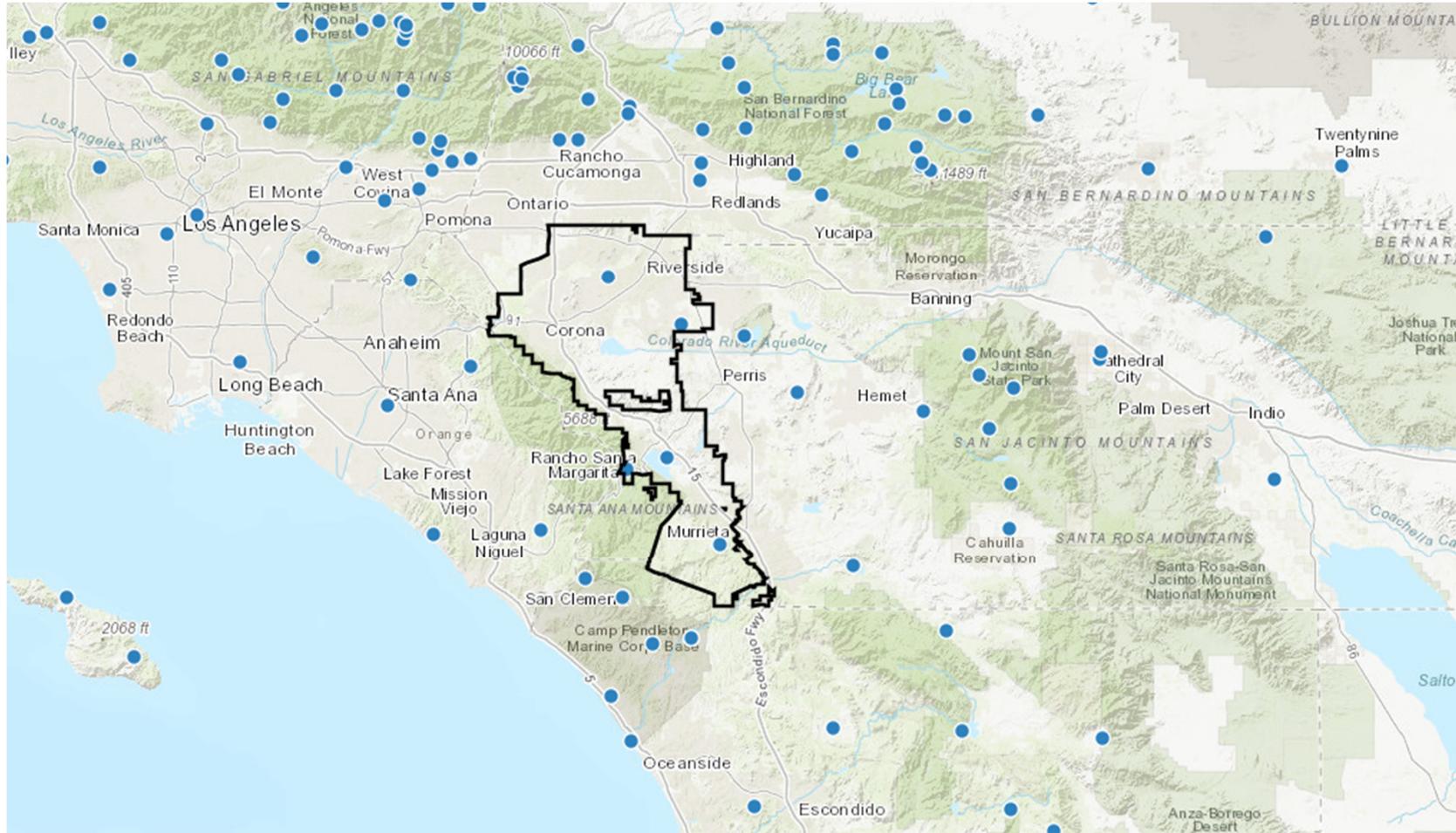
Reset

[Download Image](#)



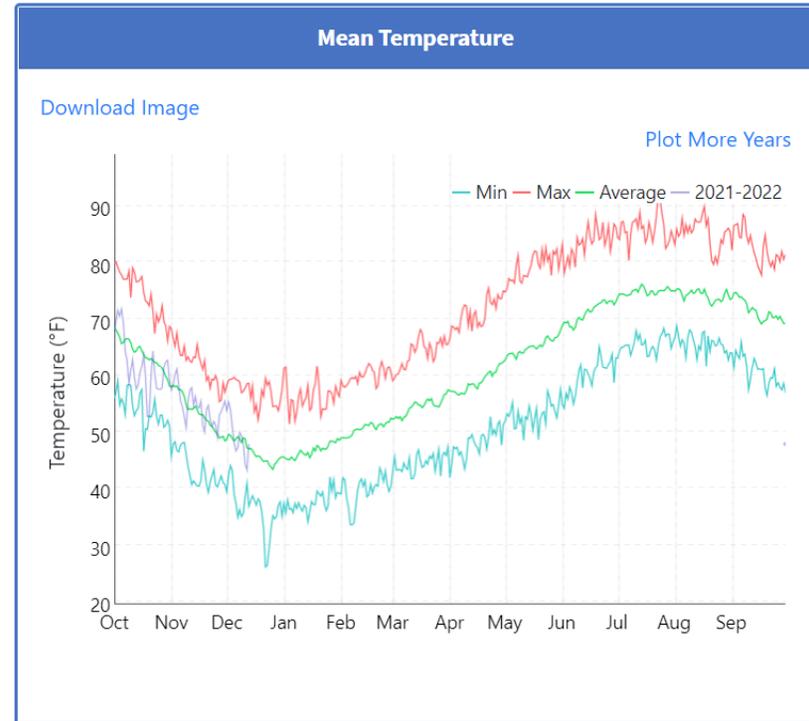
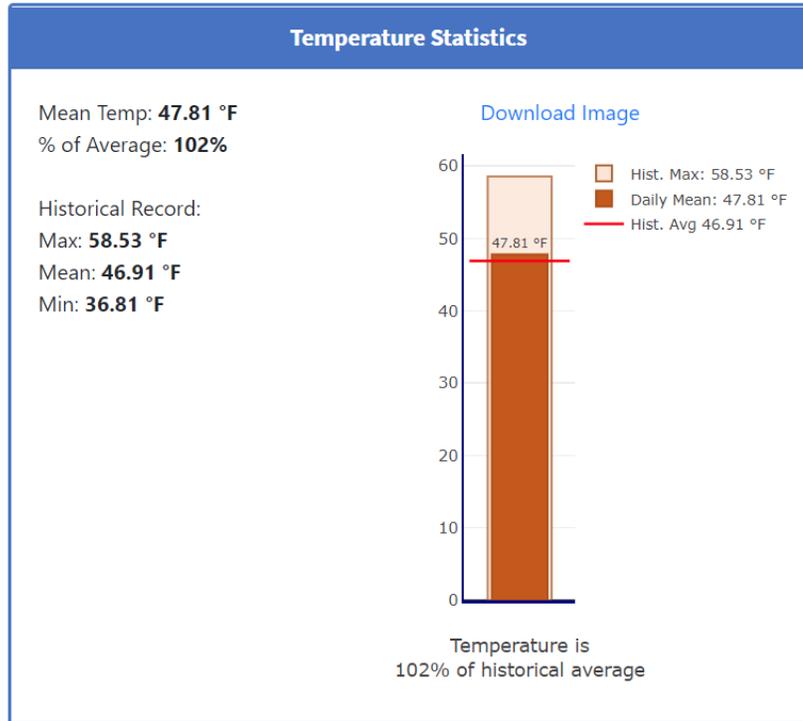


### Western Municipal Water District **Example Dashboard** – Precipitation Station Data





## Western Municipal Water District **Example Dashboard** – Temperature Chart





## Western Municipal Water District **Example Dashboard** – Temperature Chart

### Mean Temperature Chart

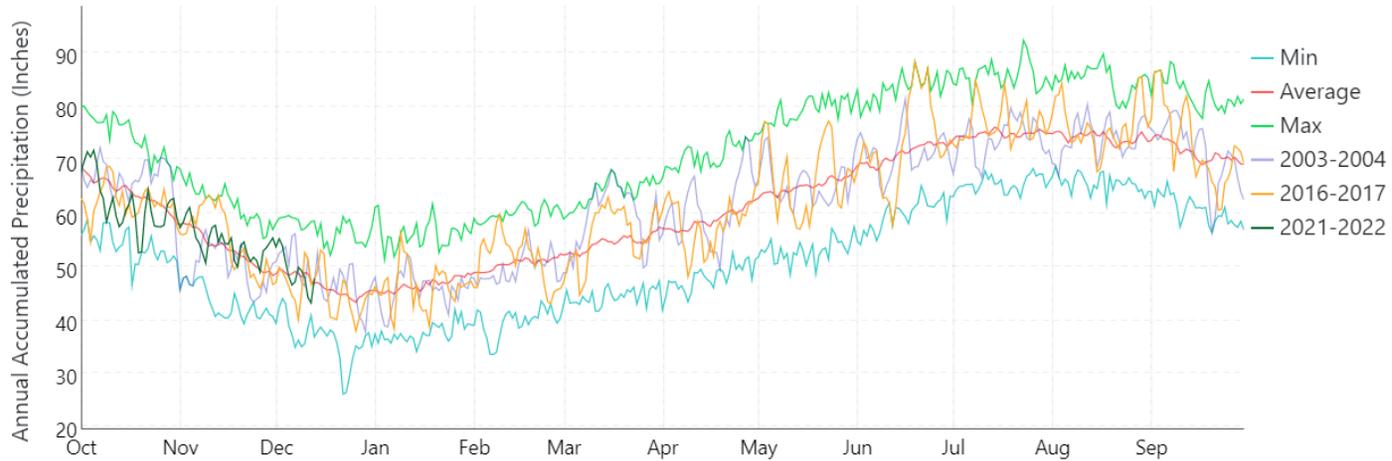
**Choose water years to plot:**

- 2000-2001
- 2001-2002
- 2002-2003
- 2003-2004
- 2004-2005
- 2005-2006
- 2006-2007
- 2007-2008
- 2008-2009
- 2009-2010
- 2010-2011
- 2011-2012
- 2012-2013
- 2013-2014
- 2014-2015
- 2015-2016
- 2016-2017
- 2017-2018
- 2018-2019
- 2019-2020
- 2020-2021
- 2021-2022
- Min
- Average
- Max

Redraw Chart

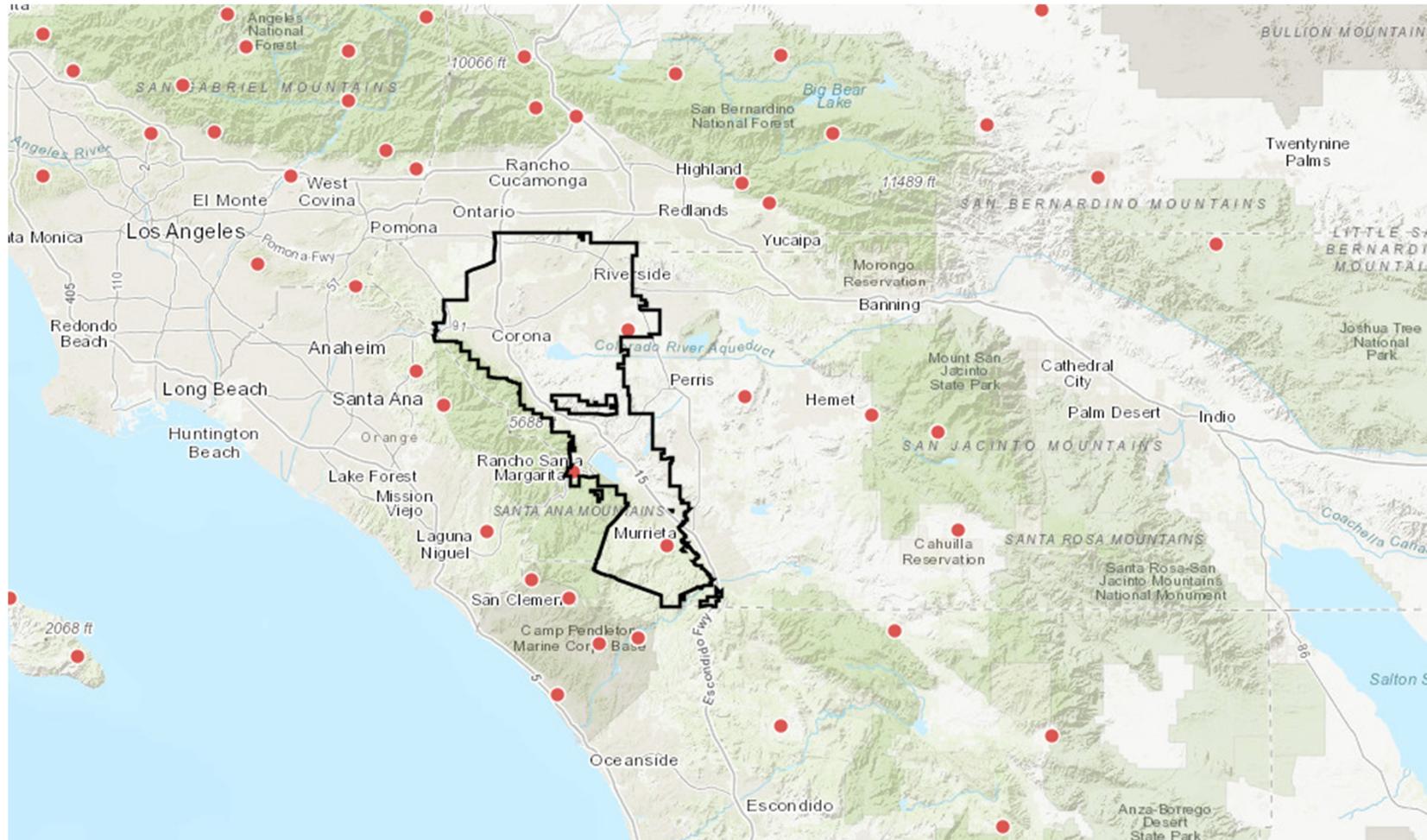
Reset

[Download Image](#)





### Western Municipal Water District **Example Dashboard** – Temperature Station Data



# Hydroclimate and Water Supply Conditions Maps

The Regional Drought Portal could provide a snapshot of hydroclimate and water supply conditions:

- Precipitation
- Temperature
- Reservoir
- Streamflow
- Snowpack
- Groundwater



Home



Dashboard



Maps



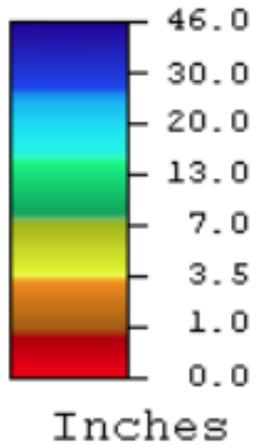
Forecasting



Login

Hydroclimate and Water Supply Conditions: [PRECIPITATION](#) [TEMPERATURE](#) [RESERVOIRS](#) [STREAMFLOW](#) [GROUNDWATER](#) [SNOWPACK](#) [SOIL MOISTURE](#) [VEGETATION CONDITIONS](#)

## Precipitation

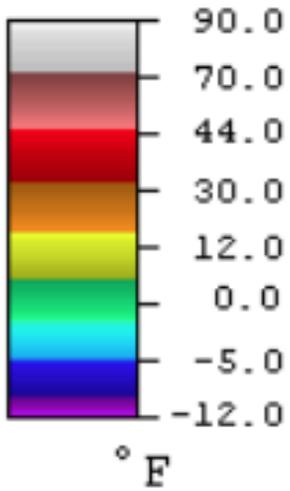


**Source:** Parameter-elevation Regressions on Independent Slopes Model (PRISM) Dataset Licensed from Oregon State University

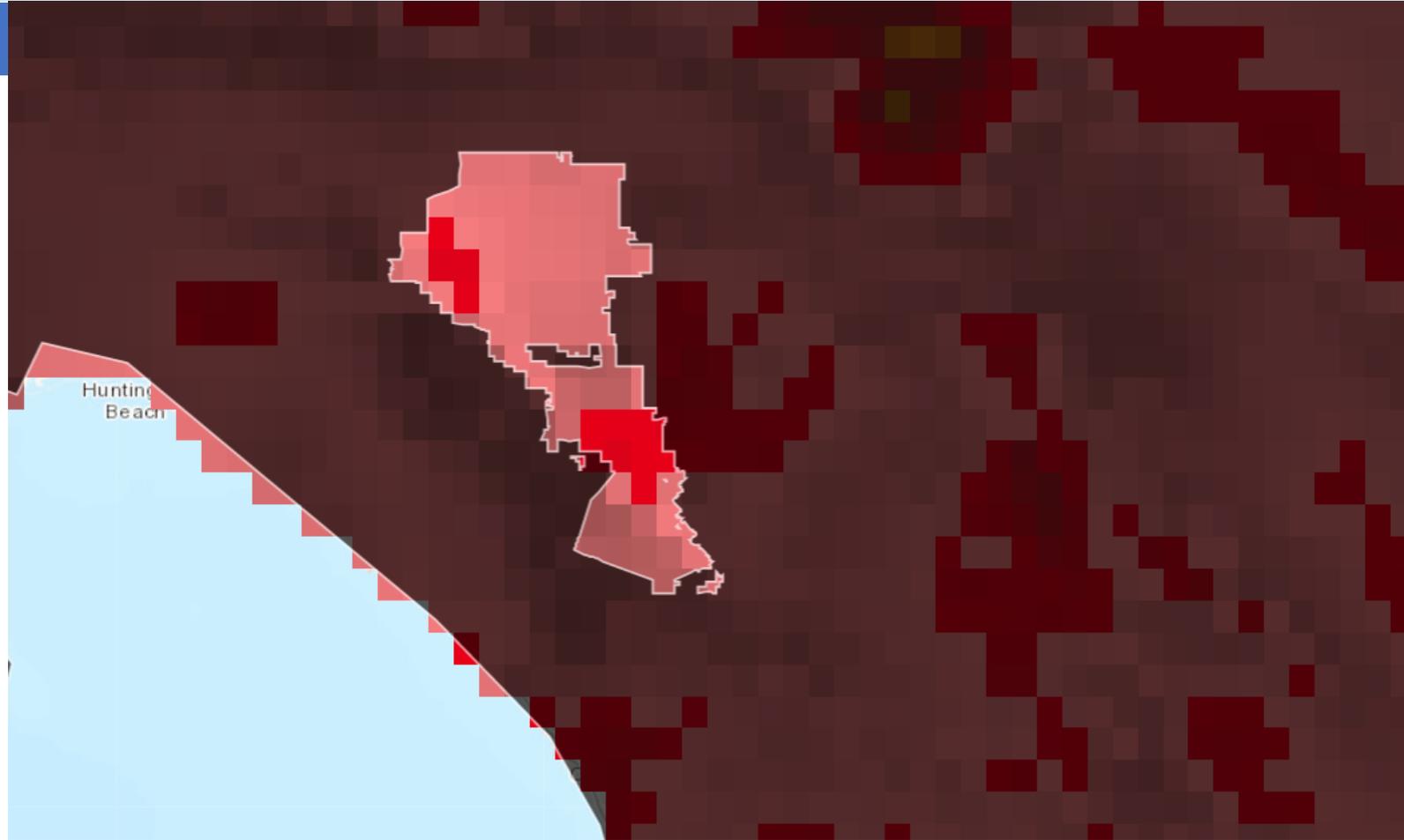




## Temperature



**Source:** Parameter-elevation Regressions on Independent Slopes Model (PRISM) Dataset Licensed from Oregon State University





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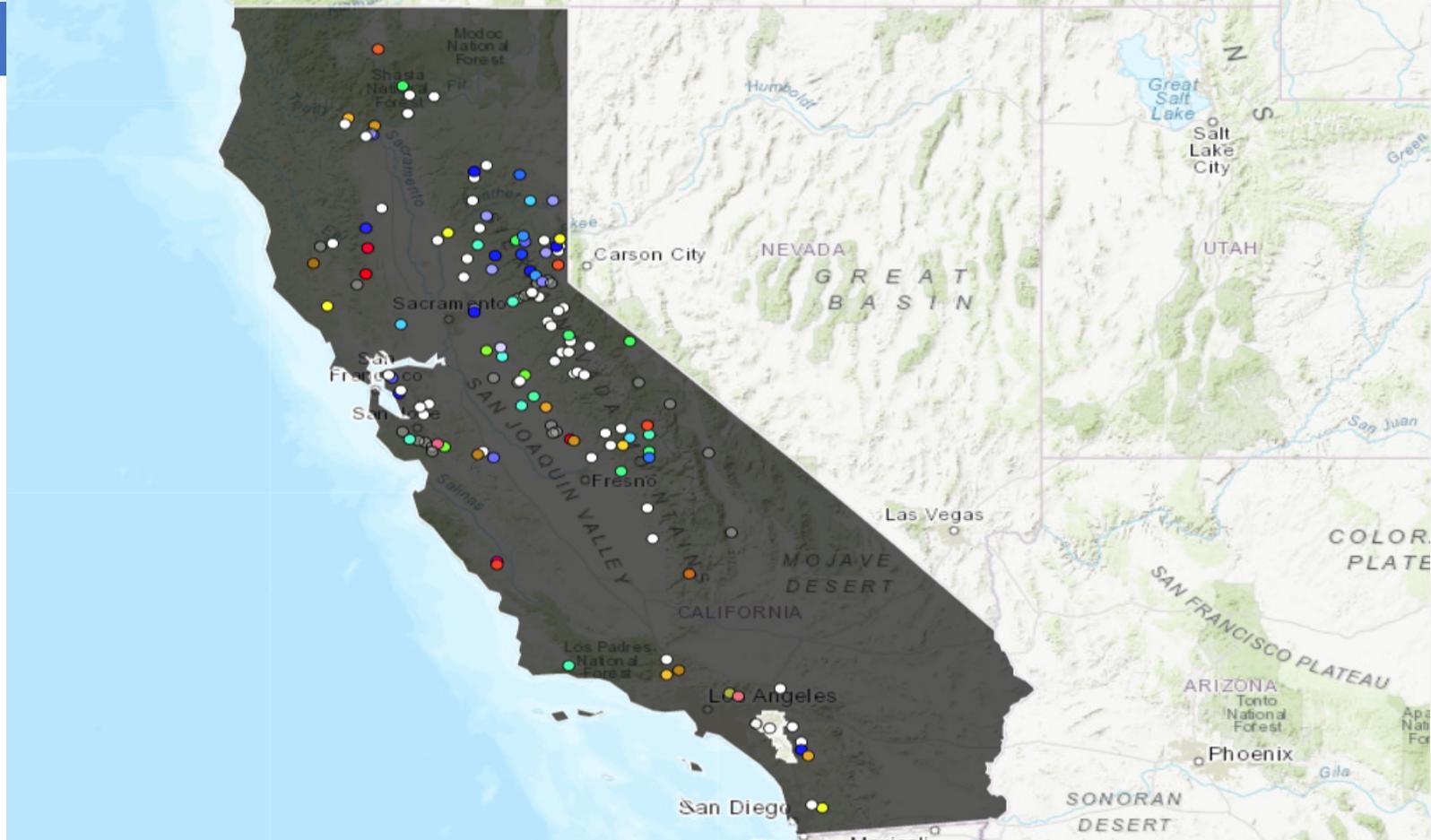
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Hydroclimate and Water Supply Conditions: [PRECIPITATION](#) [TEMPERATURE](#) [RESERVOIRS](#) [STREAMFLOW](#) [GROUNDWATER](#) [SNOWPACK](#) [SOIL MOISTURE](#) [VEGETATION CONDITIONS](#)

## Reservoir

- 90 - 100th Percentile
- 80 - 90th Percentile
- 70 - 80th Percentile
- 60 - 70th Percentile
- 50 - 60th Percentile
- 40 - 50th Percentile
- 30 - 40th Percentile
- 20 - 30th Percentile
- 10 - 20th Percentile
- 5 - 10th Percentile
- 0 - 5th Percentile

**Source:** DWR California Data Exchange Center (CDEC) for those reservoirs that have daily water level or storage data available





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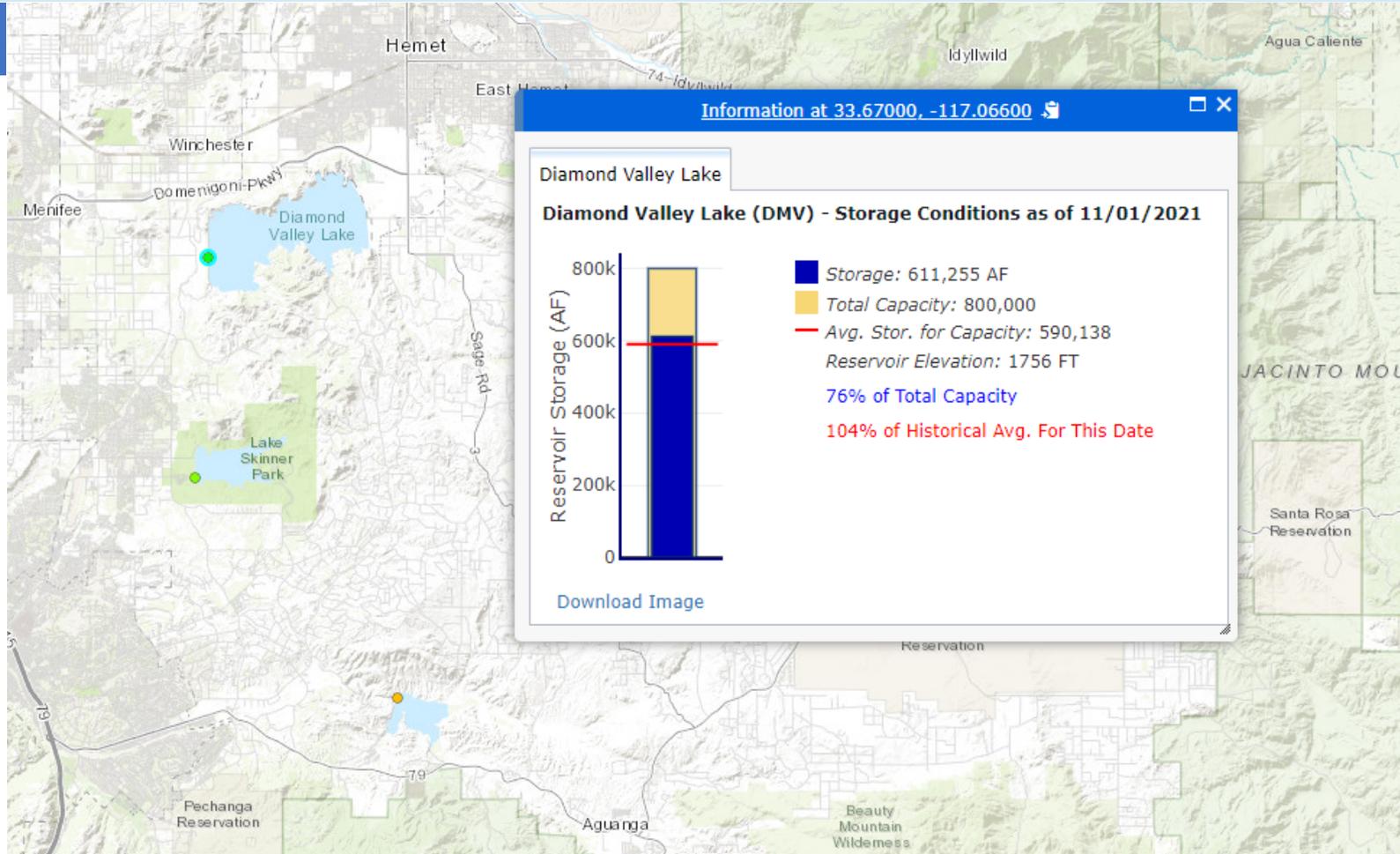
Login

Hydroclimate and Water Supply Conditions: [PRECIPITATION](#) [TEMPERATURE](#) [RESERVOIRS](#) [STREAMFLOW](#) [GROUNDWATER](#) [SNOWPACK](#) [SOIL MOISTURE](#) [VEGETATION CONDITIONS](#)

## Reservoir

- 90 - 100th Percentile
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- 70 - 80th Percentile
- 60 - 70th Percentile
- 50 - 60th Percentile
- 40 - 50th Percentile
- 30 - 40th Percentile
- 20 - 30th Percentile
- 10 - 20th Percentile
- 5 - 10th Percentile
- 0 - 5th Percentile

**Source:** DWR California Data Exchange Center (CDEC) for those reservoirs that have daily water level or storage data available

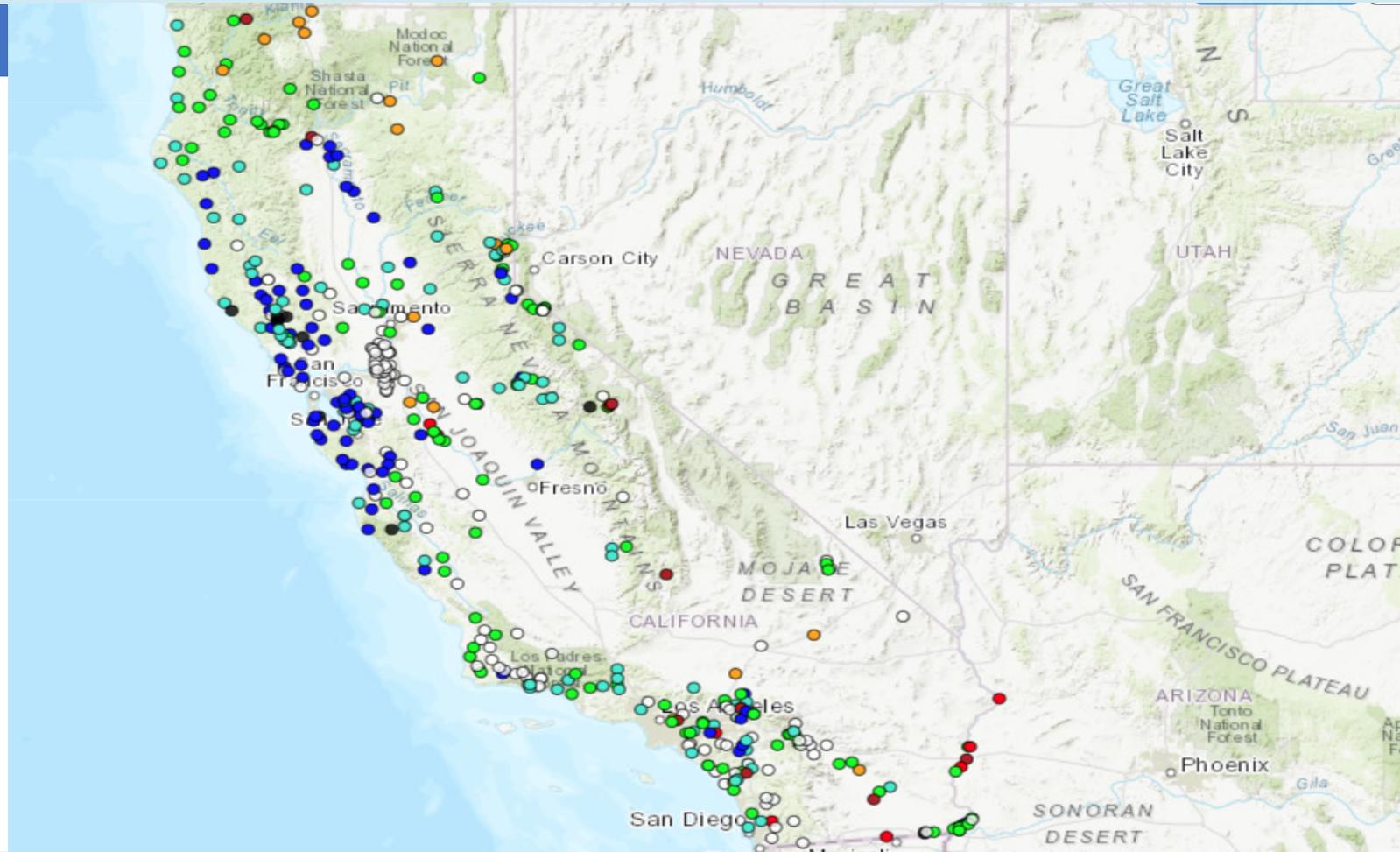




## Streamflow

- High
- > 90th Percentile
- 76th - 90th Percentile
- 25th - 75th Percentile
- 10th - 24th Percentile
- < 10th Percentile
- Low
- Not Ranked

Source: USGS





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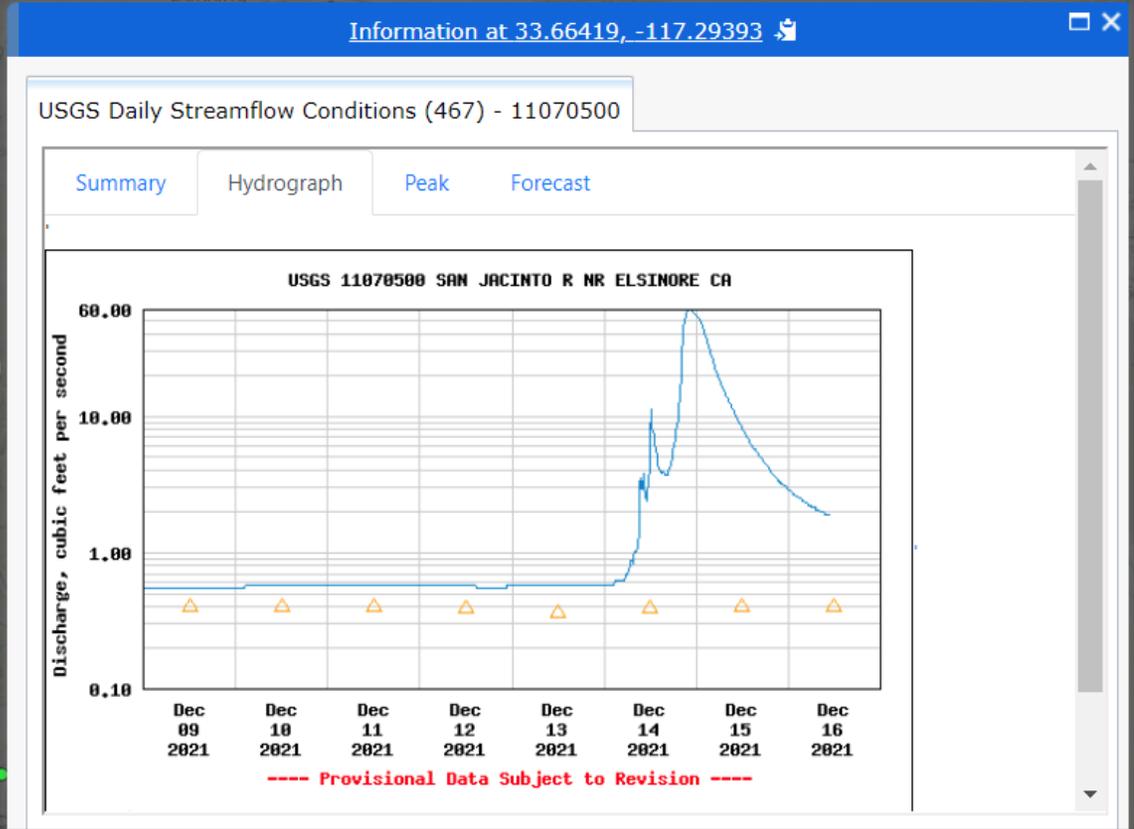
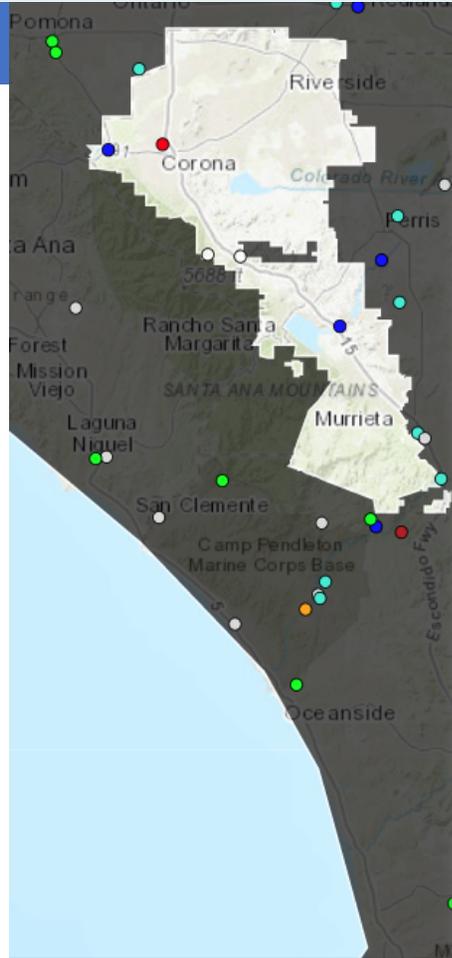


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## Streamflow

- High
- > 90th Percentile
- 76th - 90th Percentile
- 25th - 75th Percentile
- 10th - 24th Percentile
- < 10th Percentile
- Low
- Not Ranked

Source: USGS

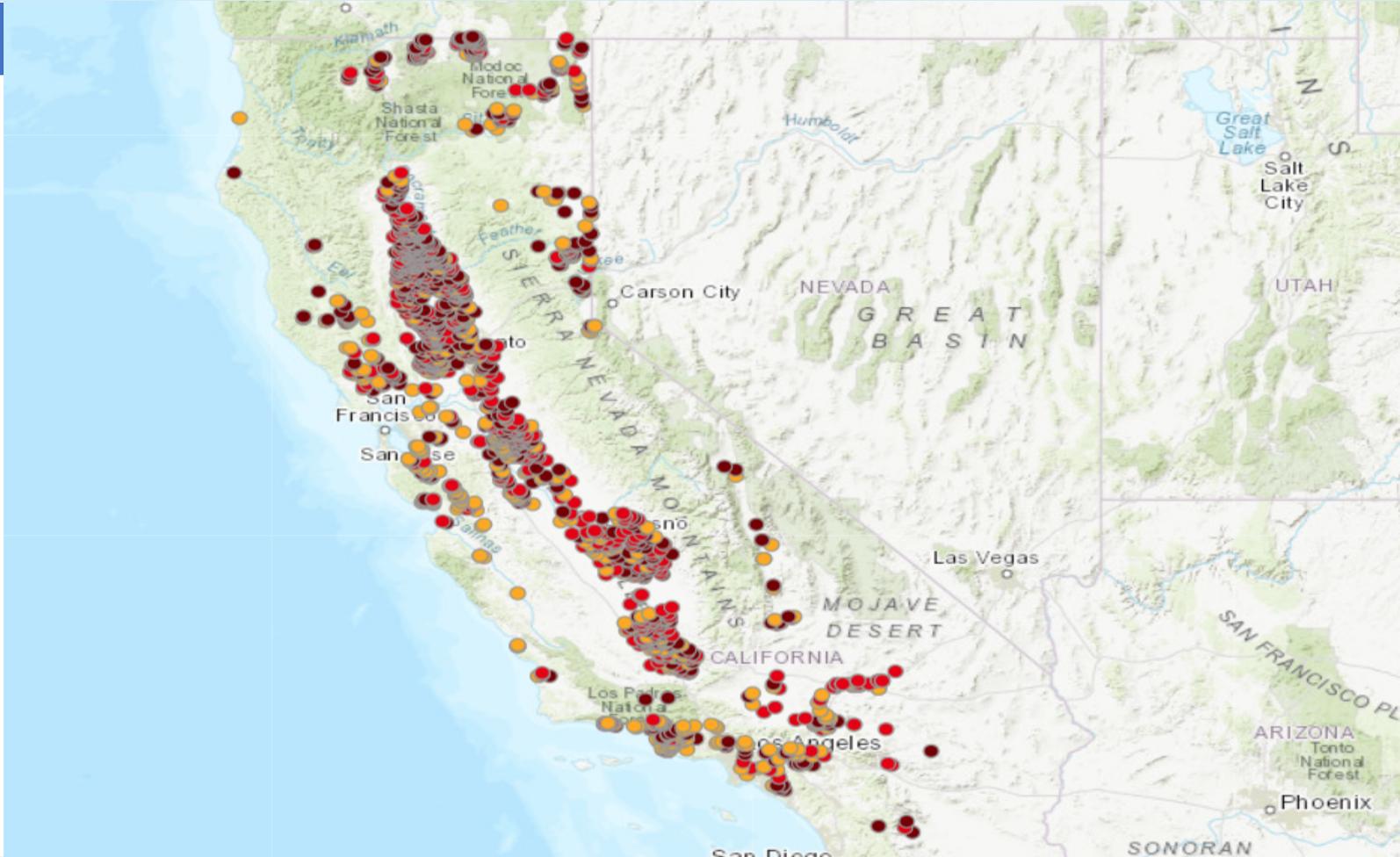




## Groundwater

- High
- >90 (Much Above Normal)
- 76-90 (Above Normal)
- 50-75 (Normal)
- 25-50 (Normal)
- 10-25 (Below Normal)
- <10 (Much Below Normal)
- Low
- Not Ranked

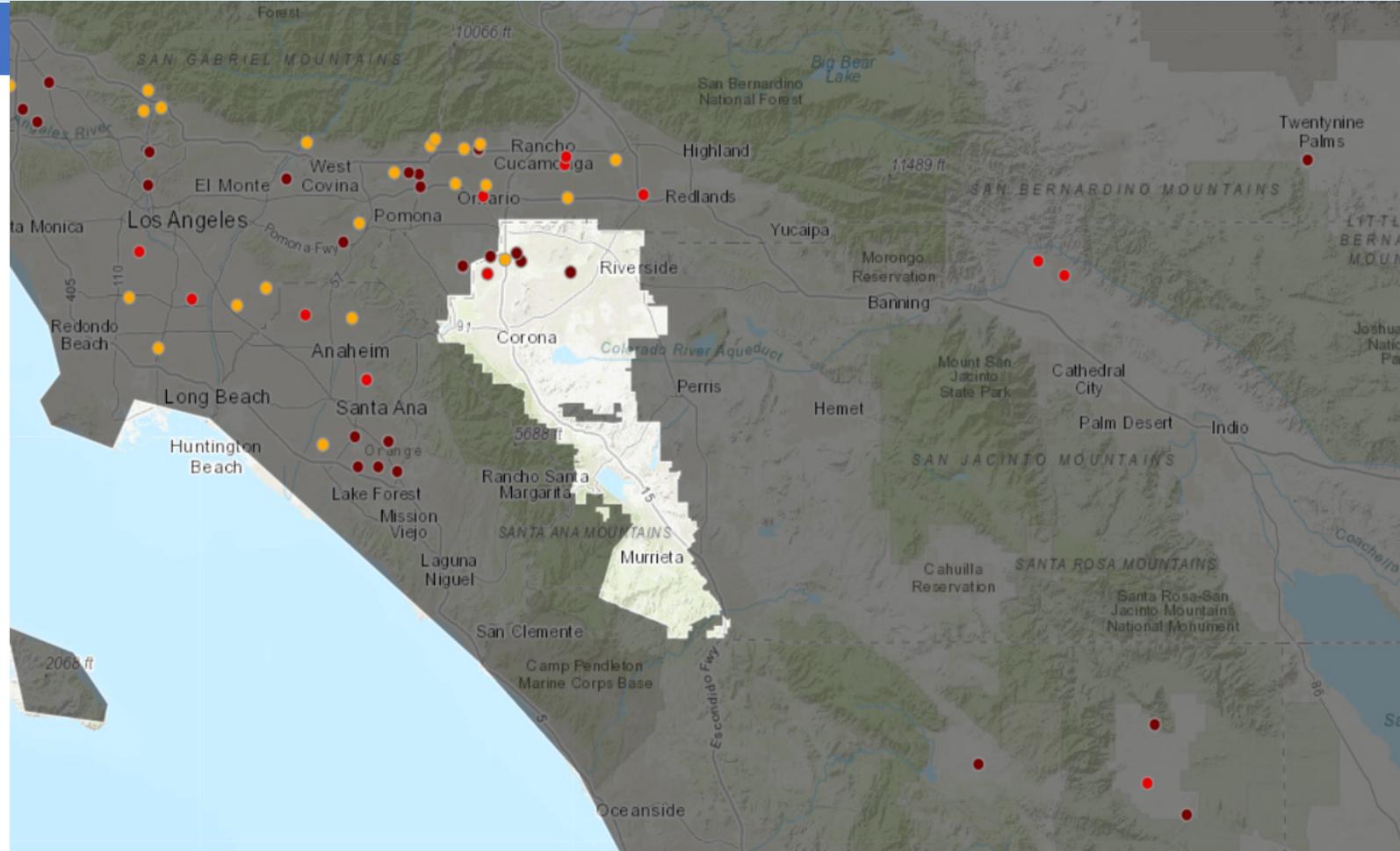
**Source:** DWR Sustainable Groundwater Management Act (SGMA) Data Viewer





# Groundwater

- High
- >90 (Much Above Normal)
- 76-90 (Above Normal)
- 50-75 (Normal)
- 25-50 (Normal)
- 10-25 (Below Normal)
- <10 (Much Below Normal)
- Low
- Not Ranked



**Source:** DWR Sustainable Groundwater Management Act (SGMA) Data Viewer

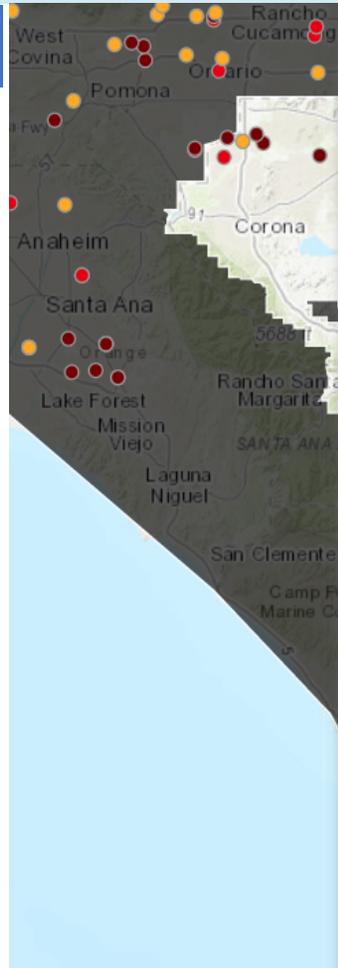
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## Groundwater

- High
- >90 (Much Above Normal)
- 76-90 (Above Normal)
- 50-75 (Normal)
- 25-50 (Normal)
- 10-25 (Below Normal)
- <10 (Much Below Normal)
- Low
- Not Ranked

**Source:** DWR Sustainable Groundwater Management Act (SGMA) Data Viewer



Information at 33.95890, -117.42620

DWR GW Level Percentile Statistics - 339589N1174262W001

Site Code: 339589N1174262W001

Well Completion Type: Single Well

Well Use Type: Observation

Well Depth (feet bgs): 62

Water Level

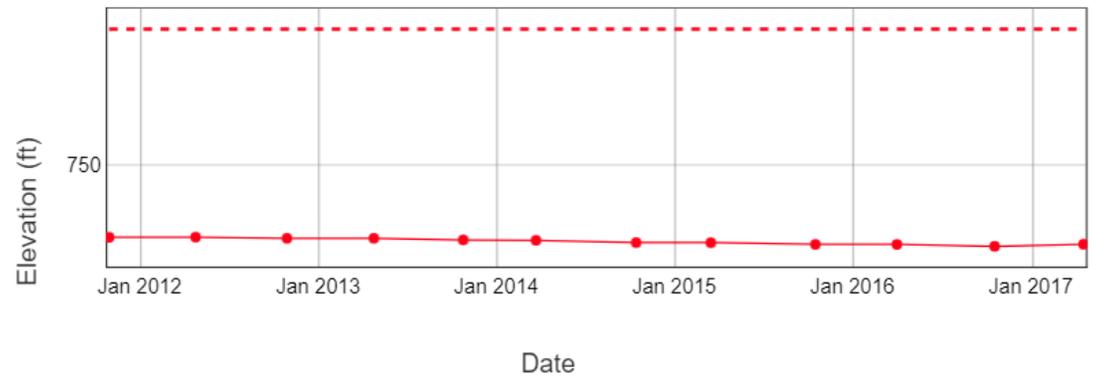
Groundwater Statistics

Water Year Type

[More Details on this Well](#)

[Download Image](#)

### Ground Levels for Well 385162N1215818W001



Date: (hover to see values)

-- GSE

— WSE



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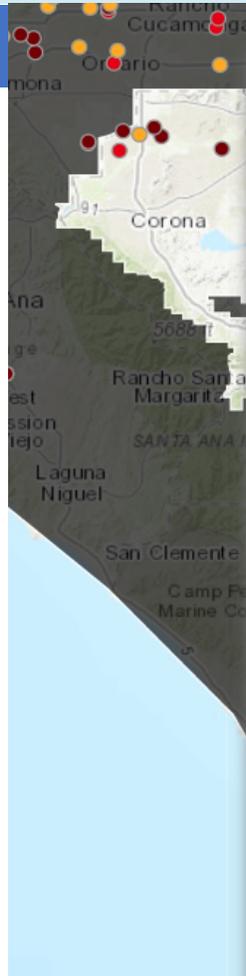
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## Groundwater

- High
- >90 (Much Above Normal)
- 76-90 (Above Normal)
- 50-75 (Normal)
- 25-50 (Normal)
- 10-25 (Below Normal)
- <10 (Much Below Normal)
- Low
- Not Ranked

Source: DWR Sustainable Groundwater Management Act (SGMA) Data Viewer



Information at 33.95890, -117.42620

### DWR GW Level Percentile Statistics - 339589N1174262W001

Site Code: 339589N1174262W001

Well Completion Type: Single Well

Well Use Type: Observation

Well Depth (feet bgs): 62

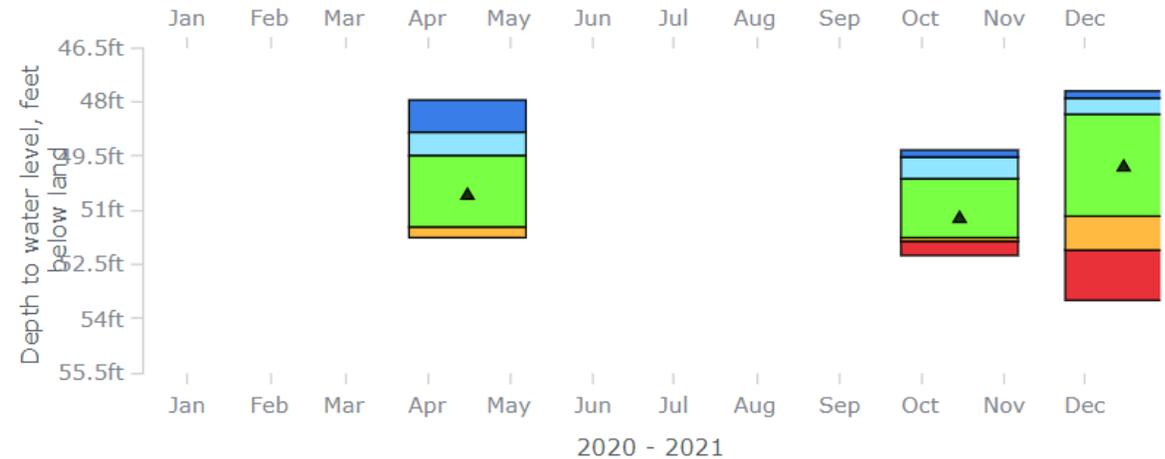
Water Level

Groundwater Statistics

[More Details on this Well](#)

[Download Image](#)

■ < 10  
 ■ 10 - 24  
 ■ 25 - 75  
 ■ 76 - 90  
 ■ > 90  
 ▲ Monthly Median  
 ◀ 1 / 2 ▶





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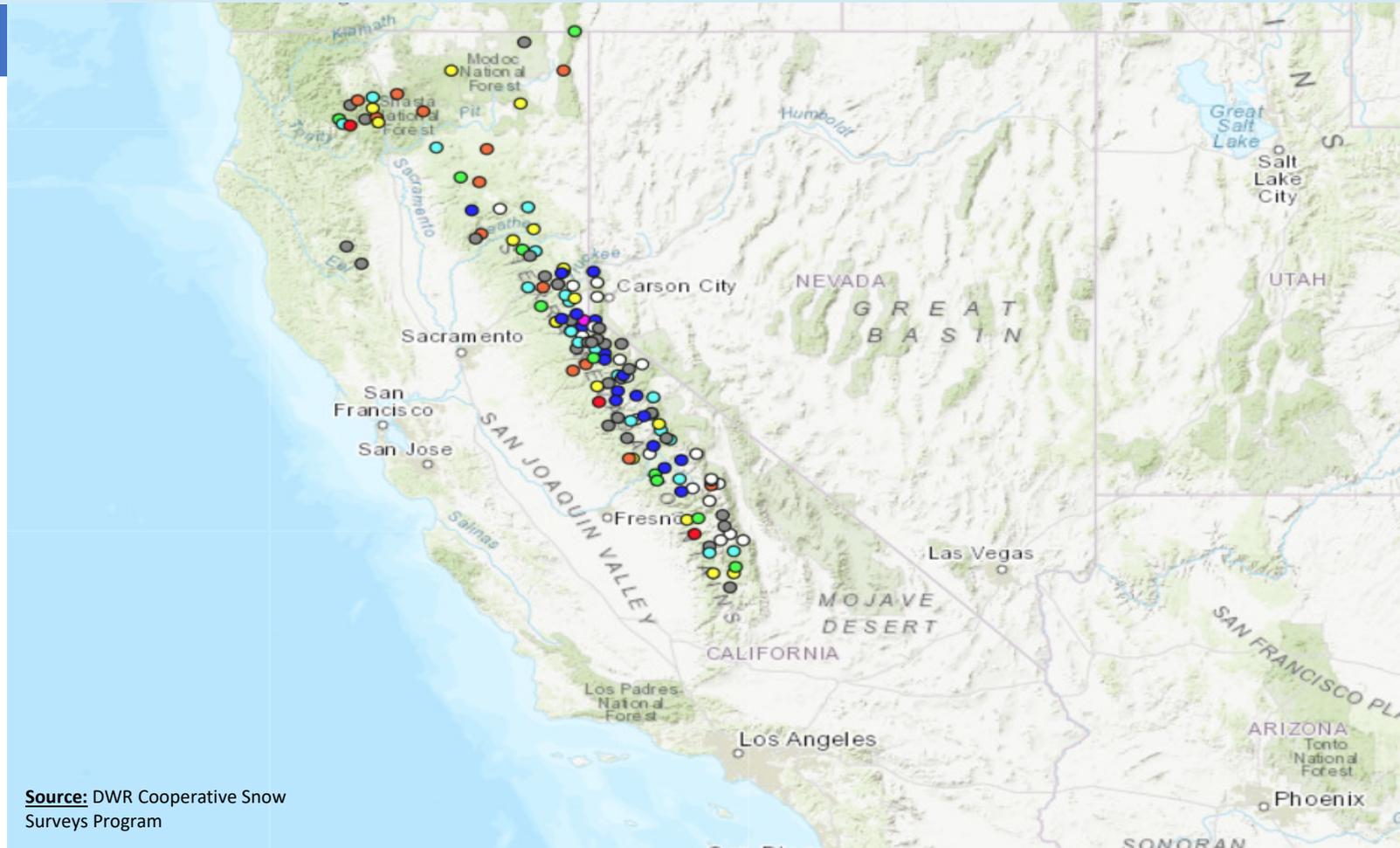


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## Snowpack

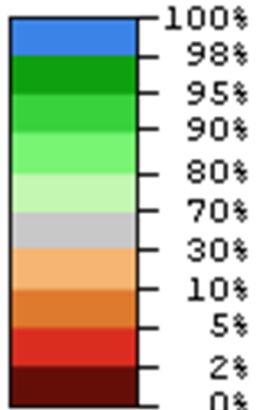
-  > 200%
-  180 - 200%
-  160 - 180%
-  140 - 160%
-  120 - 140%
-  100 - 120%
-  80 - 100%
-  60 - 80%
-  40 - 60%
-  0 - 40%



**Source:** DWR Cooperative Snow Surveys Program

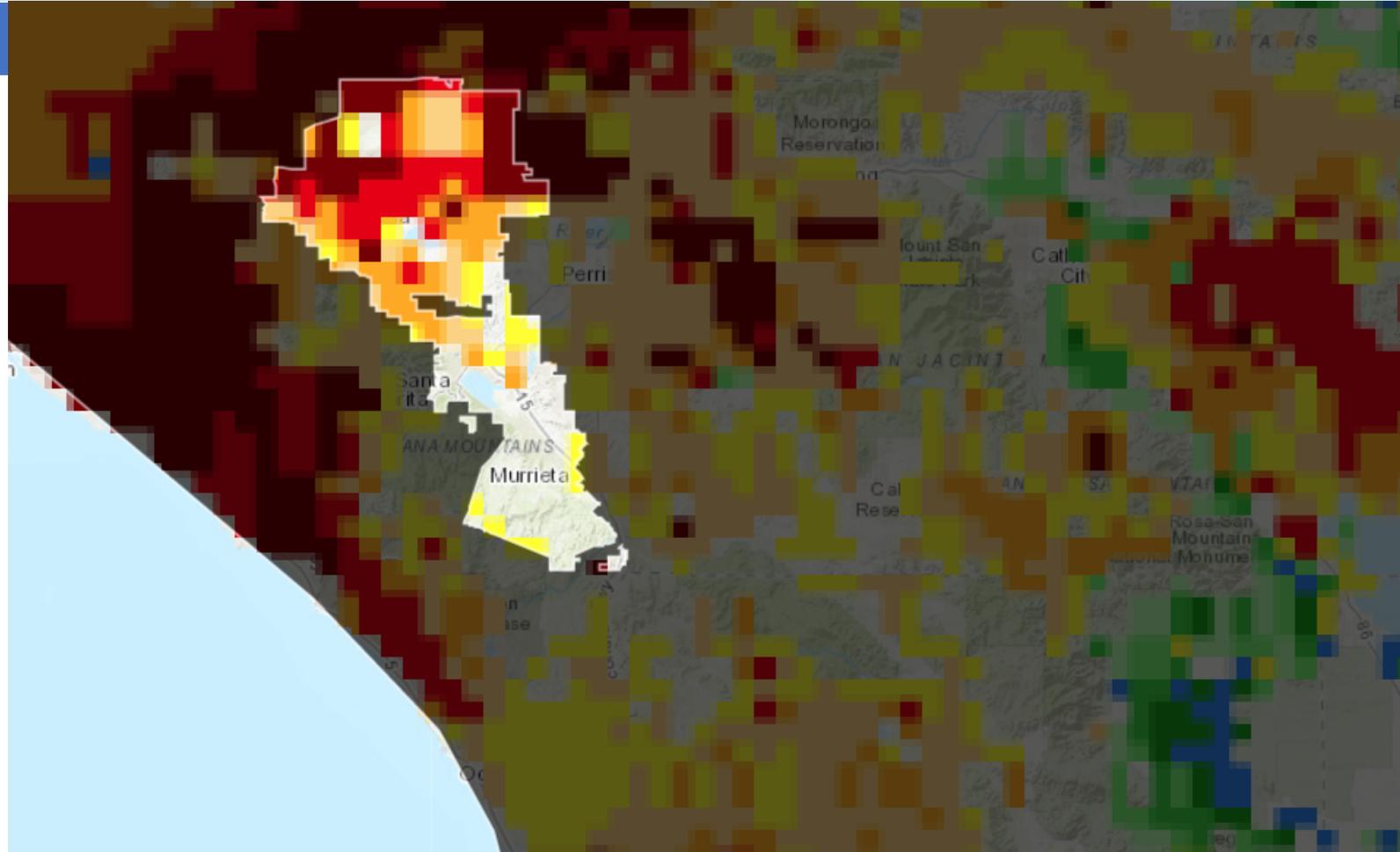


## Soil Moisture



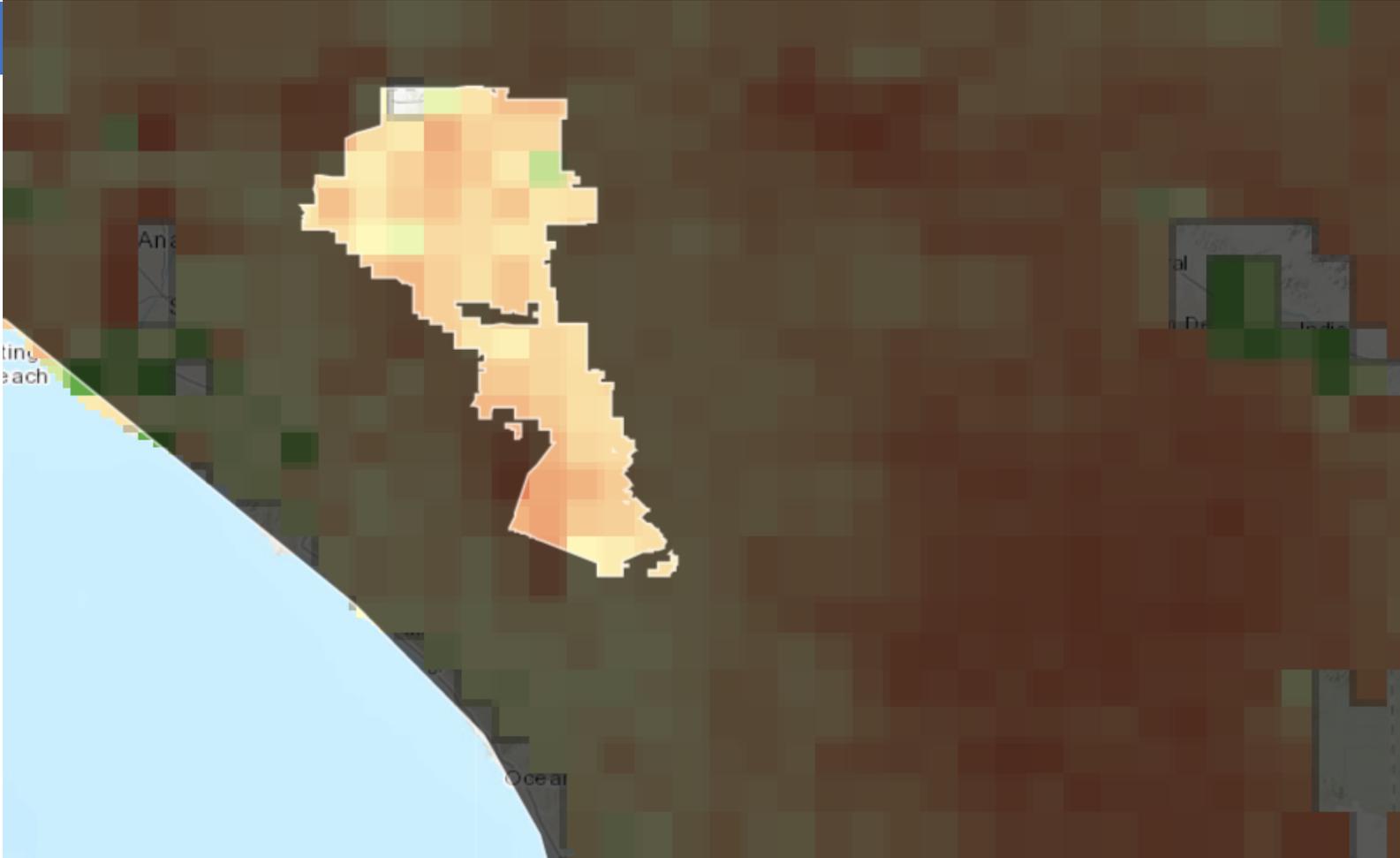
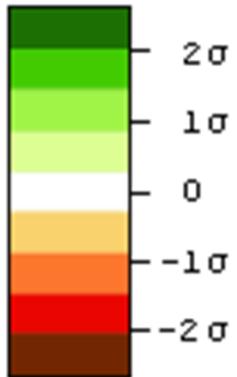
Percentage of Water by Volume

**Source:** Soil moisture is estimated from National Aeronautics and Space Administration satellite-based measurements (<https://www.drought.gov/data-maps-tools/nasa-sport-lis-soil-moisture-products>) for the top 100 centimeters of the soil surface.





## Vegetation Condition



$\sigma$ : Standard Deviation ET/PET (ESI)

**Source:** Vegetation conditions are represented by the evaporative stress index as provided daily by the National Aeronautics and Space Administration from satellite-based measurements (<https://www.drought.gov/data-maps-tools/evaporative-stress-index-esi>).

## Board of Directors/Summary Dashboard

Select data provided above could also potentially be consolidated into a dashboard. This dashboard would provide a central location for users to view key data used to assess local conditions which would be readily printable for sharing internally within each agency/organization that uses the portal, amongst the Drought Portal users, and/or with each agency's/organization's Board of Directors.

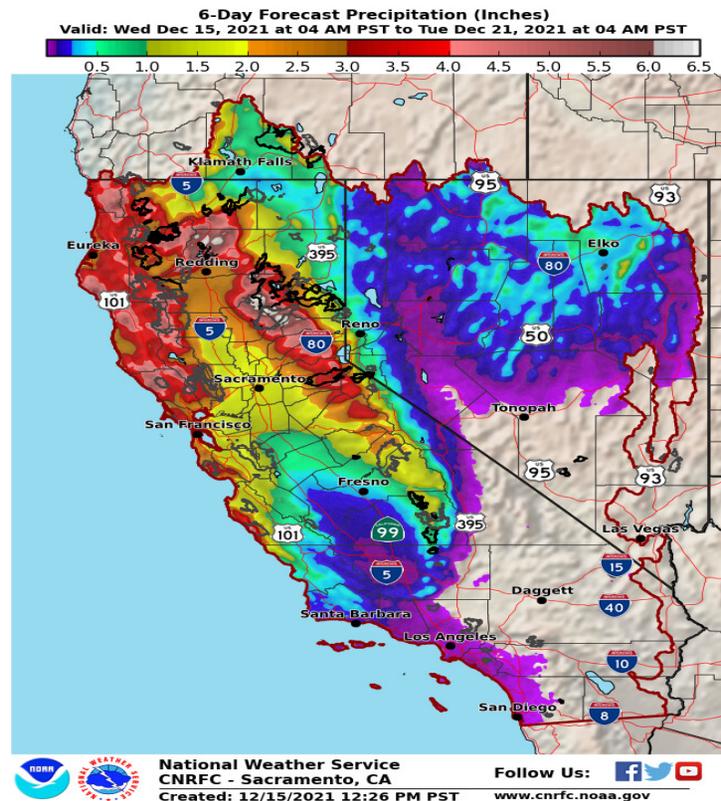
# Forecasting

The Regional Drought Portal could provide mid- to long-term forecasts for temperature and precipitation

## Example Forecasting Information

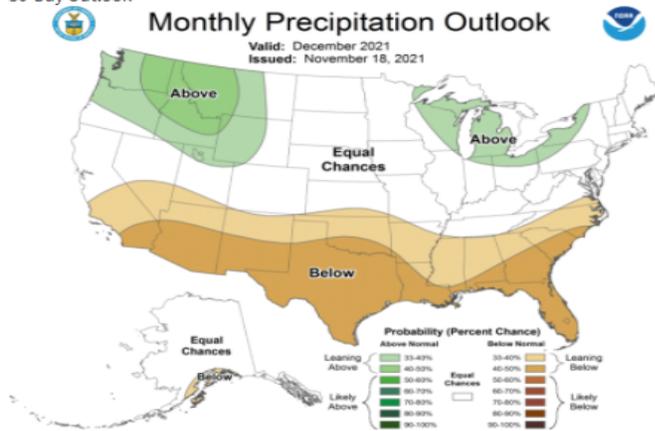
### Forecasting Information

For viewers wishing to see additional information beyond current hydrologic conditions, this page provides some graphics and links to weather and longer-range outlooks. As indicated below, most of the information is provided by the National Weather Service, but we also included some experimental forecasting products that DWR funded the University of California, San Diego to prepare.



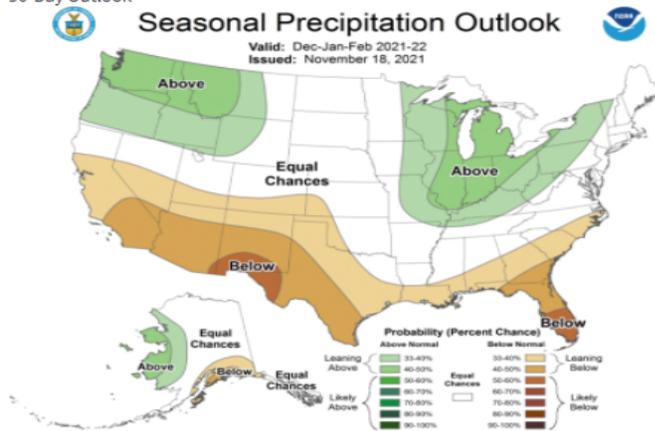
Example Forecasting Information

- 30-Day Outlook -

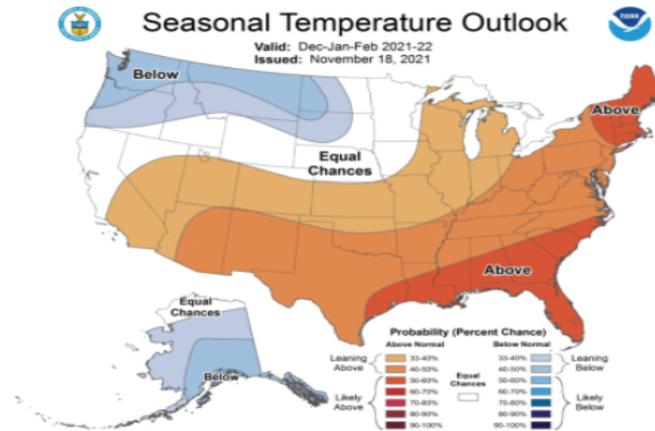
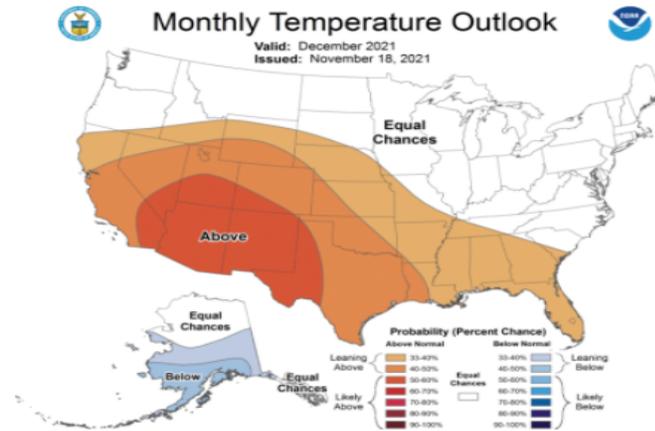


Source: <https://www.cpc.ncep.noaa.gov/products/predictions/30day/>

- 90-Day Outlook -



Source: [https://www.cpc.ncep.noaa.gov/products/predictions/long\\_range/seasonal.php?lead=1](https://www.cpc.ncep.noaa.gov/products/predictions/long_range/seasonal.php?lead=1)

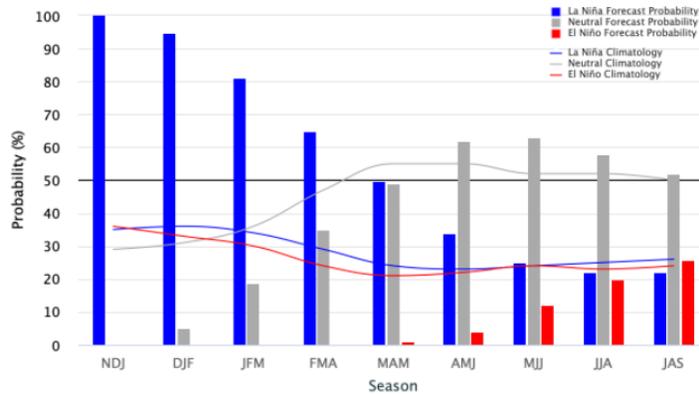




### Example Forecasting Information

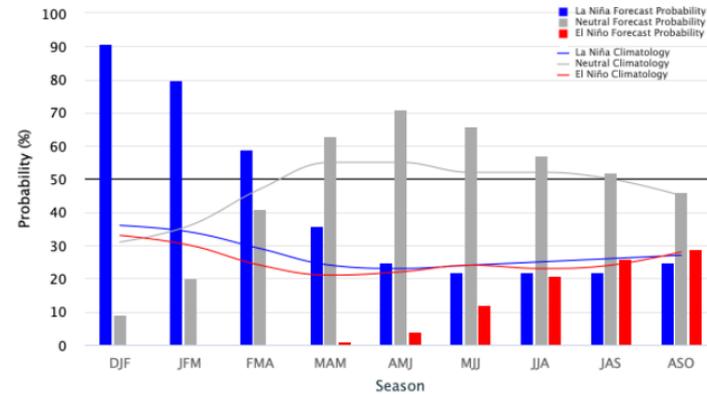
Early-December 2021 CPC/IRI Official Probabilistic ENSO Forecasts

ENSO state based on NINO3.4 SST Anomaly  
Neutral ENSO: -0.5 °C to 0.5 °C



Mid-December 2021 IRI/CPC Model-Based Probabilistic ENSO Forecasts

ENSO state based on NINO3.4 SST Anomaly  
Neutral ENSO: -0.5 °C to 0.5 °C



# User accessibility

Users could have the ability to:

- Enter their WSCP stage
- Enter drought related notes
- Add new notes and upload relevant documents
- Edit and view internal notes



### Western Municipal Water District Drought Notes

Comment Date	Commenter	Subject	Comment	Status	# Responses	Action
03/19/2021 09:50	Mike Doe	data issue 5	comments on 9:50am	Resolved	3	
03/19/2021 14:12	Anne Dosonpole	phone number for conACT a	missing phone number	Resolved	17	
03/26/2021 16:44	Jon Lite	water test	test it <i>again</i> .	Unresolved	0	



Appendix B – Monthly Water Supply and Demand Change  
Factors

TABLE B-1: PROJECTED CHANGES IN RAINFALL UNDER DRIER WITH EXTREME WARMING SCENARIO

YearType	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	YR2025	100.4%	99.6%	100.0%	100.4%	96.1%	99.6%	99.3%	100.8%	100.6%	96.5%	98.0%	99.1%
Normal	YR2030	100.9%	99.1%	100.0%	100.9%	92.1%	99.1%	98.5%	101.6%	101.1%	92.9%	95.9%	98.2%
Normal	YR2035	98.1%	99.0%	96.5%	93.4%	87.2%	98.0%	97.9%	100.3%	105.4%	90.3%	88.5%	103.4%
Normal	YR2040	95.5%	98.9%	93.0%	85.9%	82.3%	96.8%	97.2%	99.0%	109.6%	87.6%	81.0%	108.7%
Normal	YR2045	92.8%	98.7%	89.5%	78.4%	77.3%	95.7%	96.6%	97.7%	113.9%	85.0%	73.6%	113.9%
Dry_1Yr	YR2025	101.8%	99.6%	100.7%	103.7%	94.3%	100.0%	100.0%	100.0%	100.6%	93.8%	96.7%	99.9%
Dry_1Yr	YR2030	103.6%	99.1%	101.4%	107.4%	88.6%	100.0%	100.0%	100.0%	101.1%	87.7%	93.3%	99.7%
Dry_1Yr	YR2035	98.2%	96.8%	96.2%	102.4%	83.5%	100.0%	100.0%	100.0%	111.2%	79.2%	83.0%	124.8%
Dry_1Yr	YR2040	92.7%	94.5%	91.0%	97.3%	78.3%	100.0%	100.0%	100.0%	121.3%	70.7%	72.6%	149.8%
Dry_1Yr	YR2045	87.3%	92.2%	85.8%	92.2%	73.2%	100.0%	100.0%	100.0%	131.4%	62.1%	62.3%	174.9%
Dry_5Yr	YR2025	100.0%	97.8%	99.6%	100.4%	94.8%	99.7%	100.0%	101.2%	100.1%	95.2%	97.8%	98.1%
Dry_5Yr	YR2030	100.0%	95.6%	99.1%	100.9%	89.5%	99.4%	100.0%	102.4%	100.3%	90.5%	95.6%	96.3%
Dry_5Yr	YR2035	97.0%	100.1%	97.0%	93.4%	84.3%	97.9%	100.0%	100.8%	101.9%	85.0%	87.2%	105.3%
Dry_5Yr	YR2040	94.0%	104.7%	94.8%	85.9%	79.1%	96.4%	100.0%	99.1%	103.5%	79.6%	78.9%	114.3%
Dry_5Yr	YR2045	91.0%	109.3%	92.6%	78.4%	73.9%	94.9%	100.0%	97.5%	105.1%	74.2%	70.6%	123.3%
Wet_1Yr	YR2025	100.6%	100.4%	98.8%	98.9%	95.4%	100.0%	100.0%	100.0%	98.6%	97.2%	98.6%	101.0%
Wet_1Yr	YR2030	101.1%	100.9%	97.6%	97.9%	90.9%	100.0%	100.0%	100.0%	97.2%	94.4%	97.2%	101.9%
Wet_1Yr	YR2035	102.0%	98.8%	99.0%	94.9%	81.2%	100.0%	100.0%	93.9%	114.6%	96.3%	90.2%	99.5%
Wet_1Yr	YR2040	102.8%	96.7%	100.5%	91.8%	71.5%	100.0%	100.0%	87.7%	132.0%	98.2%	83.1%	97.1%
Wet_1Yr	YR2045	103.7%	94.6%	102.0%	88.8%	61.9%	100.0%	100.0%	81.6%	149.4%	100.0%	76.0%	94.8%
Wet_5Yr	YR2025	100.8%	100.4%	99.9%	100.1%	95.9%	99.9%	99.6%	100.6%	101.5%	96.9%	98.1%	99.3%
Wet_5Yr	YR2030	101.6%	100.9%	99.7%	100.3%	91.7%	99.7%	99.1%	101.1%	102.9%	93.8%	96.3%	98.5%
Wet_5Yr	YR2035	100.0%	98.4%	98.2%	93.8%	84.8%	99.2%	99.6%	100.1%	106.2%	91.5%	87.9%	102.0%
Wet_5Yr	YR2040	98.3%	95.9%	96.7%	87.4%	77.8%	98.7%	100.1%	99.2%	109.4%	89.4%	79.6%	105.5%
Wet_5Yr	YR2045	96.6%	93.5%	95.2%	80.9%	70.9%	98.2%	100.7%	98.2%	112.6%	87.2%	71.2%	109.0%

TABLE B-2: PROJECTED CHANGES IN RAINFALL UNDER MEDIAN SCENARIO

YearType	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	YR2025	100.4%	99.6%	100.0%	100.4%	96.1%	99.6%	99.3%	100.8%	100.6%	96.5%	98.0%	99.1%
Normal	YR2030	100.9%	99.1%	100.0%	100.9%	92.1%	99.1%	98.5%	101.6%	101.1%	92.9%	95.9%	98.2%
Normal	YR2035	101.7%	99.4%	99.1%	97.5%	90.3%	98.5%	100.7%	102.6%	103.8%	91.8%	93.3%	97.4%
Normal	YR2040	102.6%	99.6%	98.3%	94.2%	88.5%	97.8%	102.9%	103.6%	106.5%	90.6%	90.7%	96.6%
Normal	YR2045	103.4%	99.9%	97.4%	90.9%	86.8%	97.2%	105.1%	104.5%	109.1%	89.4%	88.1%	95.9%
Dry_1Yr	YR2025	101.8%	99.6%	100.7%	103.7%	94.3%	100.0%	100.0%	100.0%	100.6%	93.8%	96.7%	99.9%
Dry_1Yr	YR2030	103.6%	99.1%	101.4%	107.4%	88.6%	100.0%	100.0%	100.0%	101.1%	87.7%	93.3%	99.7%
Dry_1Yr	YR2035	103.9%	99.1%	100.5%	102.6%	86.2%	100.0%	100.0%	100.0%	106.1%	84.9%	88.8%	100.0%
Dry_1Yr	YR2040	104.1%	99.1%	99.7%	97.7%	83.8%	100.0%	100.0%	100.0%	111.1%	82.1%	84.3%	100.2%
Dry_1Yr	YR2045	104.3%	99.1%	98.8%	92.8%	81.4%	100.0%	100.0%	100.0%	116.1%	79.3%	79.8%	100.5%
Dry_5Yr	YR2025	100.0%	97.8%	99.6%	100.4%	94.8%	99.7%	100.0%	101.2%	100.1%	95.2%	97.8%	98.1%
Dry_5Yr	YR2030	100.0%	95.6%	99.1%	100.9%	89.5%	99.4%	100.0%	102.4%	100.3%	90.5%	95.6%	96.3%
Dry_5Yr	YR2035	100.9%	96.9%	98.2%	97.2%	87.3%	98.9%	100.0%	104.6%	101.0%	88.4%	92.6%	95.7%
Dry_5Yr	YR2040	101.8%	98.3%	97.3%	93.5%	85.1%	98.4%	100.0%	106.9%	101.8%	86.4%	89.7%	95.2%
Dry_5Yr	YR2045	102.6%	99.7%	96.4%	89.8%	82.9%	97.9%	100.0%	109.1%	102.5%	84.4%	86.8%	94.6%
Wet_1Yr	YR2025	100.6%	100.4%	98.8%	98.9%	95.4%	100.0%	100.0%	100.0%	98.6%	97.2%	98.6%	101.0%
Wet_1Yr	YR2030	101.1%	100.9%	97.6%	97.9%	90.9%	100.0%	100.0%	100.0%	97.2%	94.4%	97.2%	101.9%
Wet_1Yr	YR2035	101.8%	101.3%	98.0%	97.0%	87.8%	100.0%	100.0%	98.8%	103.1%	94.3%	97.8%	99.9%
Wet_1Yr	YR2040	102.6%	101.8%	98.4%	96.1%	84.7%	100.0%	100.0%	97.5%	109.0%	94.2%	98.3%	97.9%
Wet_1Yr	YR2045	103.3%	102.3%	98.8%	95.1%	81.7%	100.0%	100.0%	96.3%	114.9%	94.0%	98.9%	95.8%
Wet_5Yr	YR2025	100.8%	100.4%	99.9%	100.1%	95.9%	99.9%	99.6%	100.6%	101.5%	96.9%	98.1%	99.3%
Wet_5Yr	YR2030	101.6%	100.9%	99.7%	100.3%	91.7%	99.7%	99.1%	101.1%	102.9%	93.8%	96.3%	98.5%
Wet_5Yr	YR2035	102.7%	101.1%	99.2%	97.9%	89.3%	99.5%	100.7%	101.1%	105.0%	92.4%	92.1%	97.9%
Wet_5Yr	YR2040	103.8%	101.3%	98.7%	95.6%	86.9%	99.2%	102.2%	101.1%	107.1%	91.1%	88.0%	97.2%
Wet_5Yr	YR2045	104.9%	101.6%	98.2%	93.2%	84.5%	99.0%	103.7%	101.1%	109.2%	89.8%	83.9%	96.6%

TABLE B-3: PROJECTED CHANGES IN RAINFALL UNDER WETTER WITH MODERATE WARMING SCENARIO

YearType	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	YR2025	100.4%	99.6%	100.0%	100.4%	96.1%	99.6%	99.3%	100.8%	100.6%	96.5%	98.0%	99.1%
Normal	YR2030	100.9%	99.1%	100.0%	100.9%	92.1%	99.1%	98.5%	101.6%	101.1%	92.9%	95.9%	98.2%
Normal	YR2035	102.7%	106.5%	107.5%	97.4%	92.9%	97.7%	98.8%	100.3%	122.9%	90.0%	95.4%	96.1%
Normal	YR2040	104.5%	113.9%	115.0%	94.0%	93.6%	96.3%	99.0%	99.0%	144.6%	87.1%	94.8%	94.0%
Normal	YR2045	106.3%	121.4%	122.5%	90.6%	94.4%	94.9%	99.3%	97.7%	166.4%	84.1%	94.3%	91.9%
Dry_1Yr	YR2025	101.8%	99.6%	100.7%	103.7%	94.3%	100.0%	100.0%	100.0%	100.6%	93.8%	96.7%	99.9%
Dry_1Yr	YR2030	103.6%	99.1%	101.4%	107.4%	88.6%	100.0%	100.0%	100.0%	101.1%	87.7%	93.3%	99.7%
Dry_1Yr	YR2035	106.5%	105.6%	112.5%	101.7%	89.6%	100.0%	100.0%	100.0%	162.5%	86.8%	93.3%	91.7%
Dry_1Yr	YR2040	109.3%	112.2%	123.6%	96.0%	90.6%	100.0%	100.0%	100.0%	223.9%	86.0%	93.3%	83.6%
Dry_1Yr	YR2045	112.2%	118.7%	134.7%	90.3%	91.5%	100.0%	100.0%	100.0%	285.2%	85.2%	93.3%	75.5%
Dry_5Yr	YR2025	100.0%	97.8%	99.6%	100.4%	94.8%	99.7%	100.0%	101.2%	100.1%	95.2%	97.8%	98.1%
Dry_5Yr	YR2030	100.0%	95.6%	99.1%	100.9%	89.5%	99.4%	100.0%	102.4%	100.3%	90.5%	95.6%	96.3%
Dry_5Yr	YR2035	99.4%	111.4%	105.3%	97.0%	90.3%	98.2%	100.0%	100.5%	107.1%	86.9%	94.7%	93.4%
Dry_5Yr	YR2040	98.8%	127.2%	111.4%	93.3%	91.1%	96.9%	100.0%	98.7%	113.9%	83.3%	93.9%	90.5%
Dry_5Yr	YR2045	98.1%	143.1%	117.5%	89.5%	91.9%	95.6%	100.0%	96.8%	120.8%	79.8%	93.1%	87.6%
Wet_1Yr	YR2025	100.6%	100.4%	98.8%	98.9%	95.4%	100.0%	100.0%	100.0%	98.6%	97.2%	98.6%	101.0%
Wet_1Yr	YR2030	101.1%	100.9%	97.6%	97.9%	90.9%	100.0%	100.0%	100.0%	97.2%	94.4%	97.2%	101.9%
Wet_1Yr	YR2035	104.5%	106.0%	101.4%	95.5%	90.7%	100.0%	100.0%	92.7%	173.9%	86.2%	93.4%	98.6%
Wet_1Yr	YR2040	107.9%	111.1%	105.3%	93.2%	90.6%	100.0%	100.0%	85.5%	250.6%	78.0%	89.5%	95.2%
Wet_1Yr	YR2045	111.3%	116.3%	109.1%	90.8%	90.4%	100.0%	100.0%	78.2%	327.3%	69.7%	85.6%	91.9%
Wet_5Yr	YR2025	100.8%	100.4%	99.9%	100.1%	95.9%	99.9%	99.6%	100.6%	101.5%	96.9%	98.1%	99.3%
Wet_5Yr	YR2030	101.6%	100.9%	99.7%	100.3%	91.7%	99.7%	99.1%	101.1%	102.9%	93.8%	96.3%	98.5%
Wet_5Yr	YR2035	106.0%	106.8%	104.6%	97.7%	91.6%	98.7%	98.7%	100.5%	117.5%	89.8%	96.9%	97.0%
Wet_5Yr	YR2040	110.3%	112.8%	109.5%	95.1%	91.4%	97.7%	98.4%	99.9%	132.1%	85.9%	97.6%	95.4%
Wet_5Yr	YR2045	114.6%	118.8%	114.4%	92.5%	91.3%	96.7%	98.0%	99.3%	146.7%	82.0%	98.3%	93.9%

TABLE B-4: PROJECTED CHANGES IN SANTA ANA RIVER FLOW UNDER DRIER WITH EXTREME WARMING SCENARIO

YearType	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	YR2025	100.6%	100.1%	99.3%	97.6%	96.1%	98.0%	99.4%	100.1%	100.4%	99.4%	98.9%	99.7%
Normal	YR2030	101.1%	100.3%	98.5%	95.2%	92.1%	95.9%	98.9%	100.3%	100.9%	98.9%	97.9%	99.4%
Normal	YR2035	100.3%	96.4%	94.5%	89.3%	87.5%	93.6%	97.7%	99.9%	104.4%	98.8%	95.1%	101.3%
Normal	YR2040	99.4%	92.6%	90.5%	83.4%	82.9%	91.2%	96.5%	99.5%	107.9%	98.8%	92.4%	103.2%
Normal	YR2045	98.6%	88.7%	86.5%	77.6%	78.2%	88.9%	95.3%	99.2%	111.5%	98.8%	89.6%	105.1%
Dry_1Yr	YR2025	101.0%	100.4%	97.8%	97.8%	98.6%	99.7%	99.9%	100.0%	100.0%	98.9%	99.1%	99.9%
Dry_1Yr	YR2030	101.9%	100.9%	95.6%	95.6%	97.2%	99.4%	99.7%	100.0%	100.0%	97.9%	98.2%	99.7%
Dry_1Yr	YR2035	96.5%	96.3%	88.2%	90.0%	94.7%	98.2%	99.0%	99.6%	107.8%	98.2%	97.2%	99.7%
Dry_1Yr	YR2040	91.2%	91.8%	80.8%	84.4%	92.2%	96.9%	98.2%	99.2%	115.5%	98.4%	96.1%	99.7%
Dry_1Yr	YR2045	85.8%	87.3%	73.5%	78.9%	89.6%	95.6%	97.4%	98.9%	123.2%	98.7%	95.1%	99.7%
Dry_5Yr	YR2025	100.3%	98.6%	98.5%	97.2%	95.4%	97.6%	99.7%	100.0%	100.0%	99.4%	98.8%	98.9%
Dry_5Yr	YR2030	100.6%	97.2%	96.9%	94.4%	90.9%	95.2%	99.4%	100.0%	100.0%	98.9%	97.6%	97.9%
Dry_5Yr	YR2035	98.7%	93.2%	92.7%	89.2%	87.0%	93.5%	98.5%	99.6%	100.6%	97.8%	94.3%	98.8%
Dry_5Yr	YR2040	96.9%	89.2%	88.6%	83.9%	83.2%	91.8%	97.6%	99.2%	101.2%	96.8%	90.9%	99.7%
Dry_5Yr	YR2045	95.0%	85.2%	84.4%	78.7%	79.4%	90.2%	96.8%	98.9%	101.9%	95.7%	87.6%	100.7%
Wet_1Yr	YR2025	100.3%	101.3%	98.8%	97.4%	94.1%	92.5%	96.7%	100.7%	99.6%	96.5%	98.5%	99.4%
Wet_1Yr	YR2030	100.6%	102.7%	97.6%	94.8%	88.2%	85.0%	93.3%	101.4%	99.1%	92.9%	96.9%	98.9%
Wet_1Yr	YR2035	96.0%	97.2%	98.2%	89.9%	80.9%	81.5%	91.7%	99.6%	106.0%	104.7%	90.6%	101.7%
Wet_1Yr	YR2040	91.4%	91.7%	98.9%	85.0%	73.6%	77.9%	90.1%	97.8%	112.9%	116.5%	84.3%	104.5%
Wet_1Yr	YR2045	86.9%	86.2%	99.6%	80.0%	66.3%	74.3%	88.5%	95.9%	119.8%	128.2%	77.9%	107.3%
Wet_5Yr	YR2025	101.0%	101.1%	99.6%	97.2%	95.0%	96.9%	98.9%	100.4%	102.2%	100.1%	99.3%	99.9%
Wet_5Yr	YR2030	101.9%	102.2%	99.1%	94.4%	90.0%	93.8%	97.9%	100.9%	104.4%	100.3%	98.5%	99.7%
Wet_5Yr	YR2035	100.7%	99.1%	97.0%	88.2%	83.9%	91.3%	97.0%	100.5%	108.6%	100.5%	97.0%	105.9%
Wet_5Yr	YR2040	99.5%	96.0%	94.8%	82.0%	77.8%	88.8%	96.1%	100.1%	112.8%	100.8%	95.4%	112.1%
Wet_5Yr	YR2045	98.3%	92.9%	92.6%	75.7%	71.7%	86.3%	95.1%	99.7%	117.0%	101.0%	93.9%	118.2%

TABLE B-5: PROJECTED CHANGES IN SANTA ANA RIVER FLOW UNDER MEDIAN SCENARIO

YearType	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	YR2025	100.6%	100.1%	99.3%	97.6%	96.1%	98.0%	99.4%	100.1%	100.4%	99.4%	98.9%	99.7%
Normal	YR2030	101.1%	100.3%	98.5%	95.2%	92.1%	95.9%	98.9%	100.3%	100.9%	98.9%	97.9%	99.4%
Normal	YR2035	101.1%	100.3%	97.4%	92.5%	89.7%	94.9%	98.4%	100.2%	101.7%	98.4%	97.0%	98.0%
Normal	YR2040	101.1%	100.3%	96.2%	89.9%	87.4%	94.0%	98.1%	100.0%	102.6%	98.1%	96.1%	96.6%
Normal	YR2045	101.1%	100.3%	95.0%	87.2%	85.0%	93.0%	97.7%	99.9%	103.4%	97.7%	95.1%	95.2%
Dry_1Yr	YR2025	101.0%	100.4%	97.8%	97.8%	98.6%	99.7%	99.9%	100.0%	100.0%	98.9%	99.1%	99.9%
Dry_1Yr	YR2030	101.9%	100.9%	95.6%	95.6%	97.2%	99.4%	99.7%	100.0%	100.0%	97.9%	98.2%	99.7%
Dry_1Yr	YR2035	99.2%	99.4%	91.8%	92.4%	96.0%	98.9%	99.5%	99.9%	101.0%	97.4%	97.3%	99.6%
Dry_1Yr	YR2040	96.4%	97.9%	88.1%	89.2%	94.8%	98.4%	99.2%	99.8%	102.0%	96.8%	96.4%	99.5%
Dry_1Yr	YR2045	93.7%	96.4%	84.3%	86.0%	93.6%	97.9%	99.0%	99.6%	103.0%	96.3%	95.5%	99.3%
Dry_5Yr	YR2025	100.3%	98.6%	98.5%	97.2%	95.4%	97.6%	99.7%	100.0%	100.0%	99.4%	98.8%	98.9%
Dry_5Yr	YR2030	100.6%	97.2%	96.9%	94.4%	90.9%	95.2%	99.4%	100.0%	100.0%	98.9%	97.6%	97.9%
Dry_5Yr	YR2035	100.1%	96.0%	95.4%	91.8%	88.3%	94.2%	99.0%	99.9%	100.1%	98.2%	96.4%	96.2%
Dry_5Yr	YR2040	99.6%	94.8%	94.0%	89.1%	85.7%	93.2%	98.7%	99.8%	100.2%	97.5%	95.2%	94.5%
Dry_5Yr	YR2045	99.1%	93.6%	92.5%	86.4%	83.0%	92.3%	98.3%	99.6%	100.4%	96.9%	94.0%	92.8%
Wet_1Yr	YR2025	100.3%	101.3%	98.8%	97.4%	94.1%	92.5%	96.7%	100.7%	99.6%	96.5%	98.5%	99.4%
Wet_1Yr	YR2030	100.6%	102.7%	97.6%	94.8%	88.2%	85.0%	93.3%	101.4%	99.1%	92.9%	96.9%	98.9%
Wet_1Yr	YR2035	100.7%	102.7%	98.6%	93.9%	85.2%	83.0%	92.9%	100.8%	100.7%	92.4%	97.9%	95.7%
Wet_1Yr	YR2040	100.8%	102.7%	99.7%	92.9%	82.3%	81.0%	92.5%	100.2%	102.2%	91.8%	98.8%	92.6%
Wet_1Yr	YR2045	100.9%	102.7%	100.8%	91.9%	79.4%	78.9%	92.0%	99.6%	103.7%	91.2%	99.7%	89.6%
Wet_5Yr	YR2025	101.0%	101.1%	99.6%	97.2%	95.0%	96.9%	98.9%	100.4%	102.2%	100.1%	99.3%	99.9%
Wet_5Yr	YR2030	101.9%	102.2%	99.1%	94.4%	90.0%	93.8%	97.9%	100.9%	104.4%	100.3%	98.5%	99.7%
Wet_5Yr	YR2035	102.7%	103.1%	98.6%	91.5%	86.4%	92.4%	97.6%	100.8%	106.8%	100.5%	97.7%	98.2%
Wet_5Yr	YR2040	103.6%	104.1%	98.1%	88.5%	82.8%	91.1%	97.4%	100.8%	109.2%	100.8%	97.0%	96.7%
Wet_5Yr	YR2045	104.4%	105.0%	97.6%	85.5%	79.2%	89.8%	97.1%	100.8%	111.7%	101.0%	96.2%	95.2%

TABLE B-6: PROJECTED CHANGES IN SANTA ANA RIVER FLOW UNDER WETTER WITH MODERATE WARMING SCENARIO

YearType	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	YR2025	100.6%	100.1%	99.3%	97.6%	96.1%	98.0%	99.4%	100.1%	100.4%	99.4%	98.9%	99.7%
Normal	YR2030	101.1%	100.3%	98.5%	95.2%	92.1%	95.9%	98.9%	100.3%	100.9%	98.9%	97.9%	99.4%
Normal	YR2035	104.8%	112.7%	111.4%	99.7%	93.5%	97.0%	99.6%	100.2%	131.8%	100.5%	96.8%	97.6%
Normal	YR2040	108.4%	125.1%	124.2%	104.2%	94.8%	98.1%	100.4%	100.0%	162.8%	102.2%	95.8%	95.9%
Normal	YR2045	112.0%	137.5%	137.0%	108.6%	96.2%	99.2%	101.1%	99.9%	193.7%	103.8%	94.7%	94.1%
Dry_1Yr	YR2025	101.0%	100.4%	97.8%	97.8%	98.6%	99.7%	99.9%	100.0%	100.0%	98.9%	99.1%	99.9%
Dry_1Yr	YR2030	101.9%	100.9%	95.6%	95.6%	97.2%	99.4%	99.7%	100.0%	100.0%	97.9%	98.2%	99.7%
Dry_1Yr	YR2035	103.7%	116.0%	102.6%	101.7%	99.5%	101.2%	100.7%	100.4%	159.8%	107.9%	103.2%	103.1%
Dry_1Yr	YR2040	105.5%	131.2%	109.7%	107.8%	101.8%	103.0%	101.7%	100.8%	219.5%	117.9%	108.1%	106.5%
Dry_1Yr	YR2045	107.3%	146.4%	116.8%	113.9%	104.1%	104.7%	102.7%	101.1%	279.2%	127.9%	113.1%	109.9%
Dry_5Yr	YR2025	100.3%	98.6%	98.5%	97.2%	95.4%	97.6%	99.7%	100.0%	100.0%	99.4%	98.8%	98.9%
Dry_5Yr	YR2030	100.6%	97.2%	96.9%	94.4%	90.9%	95.2%	99.4%	100.0%	100.0%	98.9%	97.6%	97.9%
Dry_5Yr	YR2035	101.8%	104.1%	107.8%	97.9%	92.6%	96.5%	100.1%	100.2%	114.8%	97.4%	96.1%	95.8%
Dry_5Yr	YR2040	103.0%	110.9%	118.7%	101.3%	94.3%	97.7%	100.7%	100.5%	129.5%	96.0%	94.7%	93.7%
Dry_5Yr	YR2045	104.3%	117.7%	129.6%	104.7%	95.9%	99.0%	101.3%	100.8%	144.3%	94.6%	93.2%	91.6%
Wet_1Yr	YR2025	100.3%	101.3%	98.8%	97.4%	94.1%	92.5%	96.7%	100.7%	99.6%	96.5%	98.5%	99.4%
Wet_1Yr	YR2030	100.6%	102.7%	97.6%	94.8%	88.2%	85.0%	93.3%	101.4%	99.1%	92.9%	96.9%	98.9%
Wet_1Yr	YR2035	105.6%	111.5%	107.3%	99.2%	86.2%	85.3%	93.2%	97.8%	161.8%	108.2%	94.9%	94.4%
Wet_1Yr	YR2040	110.7%	120.4%	116.9%	103.6%	84.3%	85.4%	93.0%	94.1%	224.6%	123.5%	92.9%	90.1%
Wet_1Yr	YR2045	115.7%	129.3%	126.6%	108.0%	82.3%	85.6%	92.9%	90.5%	287.3%	138.8%	90.9%	85.7%
Wet_5Yr	YR2025	101.0%	101.1%	99.6%	97.2%	95.0%	96.9%	98.9%	100.4%	102.2%	100.1%	99.3%	99.9%
Wet_5Yr	YR2030	101.9%	102.2%	99.1%	94.4%	90.0%	93.8%	97.9%	100.9%	104.4%	100.3%	98.5%	99.7%
Wet_5Yr	YR2035	106.8%	117.2%	109.7%	98.0%	90.3%	94.6%	98.4%	100.6%	138.3%	104.8%	98.6%	97.1%
Wet_5Yr	YR2040	111.7%	132.2%	120.3%	101.6%	90.6%	95.5%	98.9%	100.3%	172.3%	109.2%	98.8%	94.4%
Wet_5Yr	YR2045	116.5%	147.2%	130.9%	105.1%	90.9%	96.3%	99.5%	100.1%	206.3%	113.7%	98.9%	91.8%

TABLE B-7: PROJECTED CHANGES IN SANTA MARGARITA RIVER FLOW UNDER DRIER WITH EXTREME WARMING SCENARIO

YearType	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	YR2025	100.3%	99.9%	99.6%	99.1%	98.8%	99.4%	99.6%	100.3%	100.3%	99.4%	98.9%	99.6%
Normal	YR2030	100.6%	99.7%	99.1%	98.2%	97.6%	98.9%	99.1%	100.6%	100.6%	98.9%	97.9%	99.1%
Normal	YR2035	99.6%	95.7%	96.3%	93.5%	94.5%	97.2%	98.0%	99.9%	102.9%	98.6%	95.1%	98.6%
Normal	YR2040	98.6%	91.7%	93.5%	88.8%	91.5%	95.5%	96.8%	99.3%	105.2%	98.3%	92.4%	98.1%
Normal	YR2045	97.6%	87.6%	90.7%	84.1%	88.4%	93.8%	95.7%	98.7%	107.6%	98.1%	89.6%	97.6%
Dry_1Yr	YR2025	100.7%	99.4%	100.1%	100.0%	99.6%	99.9%	100.0%	100.0%	100.0%	99.6%	99.9%	99.9%
Dry_1Yr	YR2030	101.4%	98.9%	100.3%	100.0%	99.1%	99.7%	100.0%	100.0%	100.0%	99.1%	99.7%	99.7%
Dry_1Yr	YR2035	96.9%	94.2%	96.1%	97.5%	97.1%	98.7%	99.2%	99.2%	100.4%	98.4%	98.7%	99.0%
Dry_1Yr	YR2040	92.4%	89.6%	91.8%	95.0%	95.0%	97.7%	98.5%	98.5%	100.8%	97.6%	97.7%	98.2%
Dry_1Yr	YR2045	88.0%	84.9%	87.6%	92.5%	93.0%	96.7%	97.8%	97.8%	101.1%	96.8%	96.7%	97.4%
Dry_5Yr	YR2025	100.0%	99.6%	99.1%	98.8%	98.9%	99.4%	99.7%	100.0%	99.9%	99.4%	98.9%	99.3%
Dry_5Yr	YR2030	100.0%	99.1%	98.2%	97.6%	97.9%	98.9%	99.4%	100.0%	99.7%	98.9%	97.9%	98.5%
Dry_5Yr	YR2035	97.6%	95.9%	95.3%	93.3%	95.0%	97.3%	98.5%	99.5%	100.5%	98.7%	95.1%	96.7%
Dry_5Yr	YR2040	95.3%	92.7%	92.5%	89.1%	92.1%	95.7%	97.6%	99.0%	101.2%	98.6%	92.4%	94.9%
Dry_5Yr	YR2045	92.9%	89.5%	89.6%	84.8%	89.2%	94.2%	96.8%	98.5%	102.0%	98.4%	89.6%	93.1%
Wet_1Yr	YR2025	99.9%	99.3%	96.3%	95.9%	92.8%	99.1%	99.4%	102.6%	100.3%	98.3%	97.0%	100.1%
Wet_1Yr	YR2030	99.7%	98.5%	92.5%	91.7%	85.6%	98.2%	98.9%	105.2%	100.6%	96.6%	94.1%	100.3%
Wet_1Yr	YR2035	97.1%	93.7%	94.0%	87.2%	78.8%	96.4%	97.5%	100.9%	100.8%	96.5%	87.5%	99.5%
Wet_1Yr	YR2040	94.4%	88.9%	95.5%	82.7%	72.0%	94.6%	96.2%	96.5%	101.1%	96.3%	80.9%	98.8%
Wet_1Yr	YR2045	91.8%	84.1%	97.0%	78.1%	65.2%	92.7%	95.0%	92.2%	101.3%	96.2%	74.3%	98.0%
Wet_5Yr	YR2025	100.3%	100.1%	98.5%	98.3%	98.3%	99.4%	99.7%	100.1%	101.2%	99.1%	99.1%	99.4%
Wet_5Yr	YR2030	100.6%	100.3%	96.9%	96.6%	96.6%	98.9%	99.4%	100.3%	102.4%	98.2%	98.2%	98.9%
Wet_5Yr	YR2035	97.7%	96.1%	96.1%	91.7%	93.3%	97.3%	98.4%	99.8%	107.0%	98.2%	96.8%	100.4%
Wet_5Yr	YR2040	94.9%	91.8%	95.3%	86.8%	90.1%	95.7%	97.4%	99.3%	111.6%	98.2%	95.3%	101.9%
Wet_5Yr	YR2045	92.1%	87.6%	94.5%	81.9%	86.8%	94.2%	96.4%	98.8%	116.2%	98.2%	93.9%	103.5%

TABLE B-8: PROJECTED CHANGES IN SANTA MARGARITA RIVER FLOW UNDER MEDIAN SCENARIO

YearType	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	YR2025	100.3%	99.9%	99.6%	99.1%	98.8%	99.4%	99.6%	100.3%	100.3%	99.4%	98.9%	99.6%
Normal	YR2030	100.6%	99.7%	99.1%	98.2%	97.6%	98.9%	99.1%	100.6%	100.6%	98.9%	97.9%	99.1%
Normal	YR2035	100.3%	99.1%	97.6%	96.1%	96.3%	98.2%	99.0%	100.3%	101.3%	98.4%	96.8%	97.5%
Normal	YR2040	100.1%	98.5%	96.1%	94.0%	94.9%	97.5%	98.9%	100.1%	102.0%	98.1%	95.8%	95.8%
Normal	YR2045	99.8%	97.8%	94.5%	91.9%	93.6%	96.9%	98.7%	99.8%	102.8%	97.7%	94.7%	94.1%
Dry_1Yr	YR2025	100.7%	99.4%	100.1%	100.0%	99.6%	99.9%	100.0%	100.0%	100.0%	99.6%	99.9%	99.9%
Dry_1Yr	YR2030	101.4%	98.9%	100.3%	100.0%	99.1%	99.7%	100.0%	100.0%	100.0%	99.1%	99.7%	99.7%
Dry_1Yr	YR2035	99.6%	97.3%	98.2%	98.6%	98.1%	99.2%	99.8%	100.0%	100.2%	98.7%	99.5%	99.5%
Dry_1Yr	YR2040	97.8%	95.7%	96.1%	97.3%	97.1%	98.7%	99.5%	100.0%	100.5%	98.4%	99.2%	99.2%
Dry_1Yr	YR2045	95.9%	94.2%	94.0%	95.9%	96.1%	98.2%	99.2%	100.0%	100.8%	98.0%	99.0%	99.0%
Dry_5Yr	YR2025	100.0%	99.6%	99.1%	98.8%	98.9%	99.4%	99.7%	100.0%	99.9%	99.4%	98.9%	99.3%
Dry_5Yr	YR2030	100.0%	99.1%	98.2%	97.6%	97.9%	98.9%	99.4%	100.0%	99.7%	98.9%	97.9%	98.5%
Dry_5Yr	YR2035	99.5%	98.2%	96.5%	95.6%	96.6%	98.1%	99.2%	99.9%	100.0%	98.4%	97.0%	97.0%
Dry_5Yr	YR2040	99.0%	97.3%	94.8%	93.6%	95.3%	97.3%	98.9%	99.8%	100.2%	98.1%	96.1%	95.4%
Dry_5Yr	YR2045	98.5%	96.4%	93.1%	91.6%	93.9%	96.5%	98.7%	99.6%	100.5%	97.7%	95.1%	93.9%
Wet_1Yr	YR2025	99.9%	99.3%	96.3%	95.9%	92.8%	99.1%	99.4%	102.6%	100.3%	98.3%	97.0%	100.1%
Wet_1Yr	YR2030	99.7%	98.5%	92.5%	91.7%	85.6%	98.2%	98.9%	105.2%	100.6%	96.6%	94.1%	100.3%
Wet_1Yr	YR2035	100.5%	98.1%	91.9%	90.4%	82.4%	97.6%	98.4%	102.0%	101.1%	95.6%	93.5%	97.2%
Wet_1Yr	YR2040	101.2%	97.7%	91.4%	89.0%	79.2%	96.9%	98.1%	98.7%	101.5%	94.7%	93.0%	94.1%
Wet_1Yr	YR2045	102.0%	97.4%	90.8%	87.7%	75.9%	96.3%	97.7%	95.4%	102.0%	93.7%	92.4%	91.0%
Wet_5Yr	YR2025	100.3%	100.1%	98.5%	98.3%	98.3%	99.4%	99.7%	100.1%	101.2%	99.1%	99.1%	99.4%
Wet_5Yr	YR2030	100.6%	100.3%	96.9%	96.6%	96.6%	98.9%	99.4%	100.3%	102.4%	98.2%	98.2%	98.9%
Wet_5Yr	YR2035	101.1%	100.4%	95.8%	94.6%	95.1%	98.3%	99.3%	100.5%	104.5%	98.1%	97.4%	96.9%
Wet_5Yr	YR2040	101.5%	100.5%	94.8%	92.5%	93.6%	97.8%	99.2%	100.8%	106.6%	97.9%	96.6%	95.0%
Wet_5Yr	YR2045	102.0%	100.7%	93.7%	90.5%	92.1%	97.3%	99.0%	101.0%	108.8%	97.8%	95.9%	93.0%

TABLE B-9: PROJECTED CHANGES IN SANTA MARGARITA RIVER FLOW UNDER WETTER WITH MODERATE WARMING SCENARIO

YearType	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	YR2025	100.3%	99.9%	99.6%	99.1%	98.8%	99.4%	99.6%	100.3%	100.3%	99.4%	98.9%	99.6%
Normal	YR2030	100.6%	99.7%	99.1%	98.2%	97.6%	98.9%	99.1%	100.6%	100.6%	98.9%	97.9%	99.1%
Normal	YR2035	103.5%	108.3%	110.5%	103.4%	99.4%	100.4%	100.0%	100.7%	122.4%	98.7%	97.0%	97.3%
Normal	YR2040	106.5%	116.8%	121.9%	108.7%	101.3%	101.9%	100.9%	100.8%	144.2%	98.6%	96.1%	95.5%
Normal	YR2045	109.4%	125.4%	133.2%	113.9%	103.1%	103.5%	101.8%	100.9%	166.0%	98.4%	95.1%	93.8%
Dry_1Yr	YR2025	100.7%	99.4%	100.1%	100.0%	99.6%	99.9%	100.0%	100.0%	100.0%	99.6%	99.9%	99.9%
Dry_1Yr	YR2030	101.4%	98.9%	100.3%	100.0%	99.1%	99.7%	100.0%	100.0%	100.0%	99.1%	99.7%	99.7%
Dry_1Yr	YR2035	103.2%	109.1%	105.9%	101.2%	99.9%	100.3%	100.2%	100.4%	121.2%	99.0%	99.8%	100.6%
Dry_1Yr	YR2040	105.0%	119.4%	111.5%	102.5%	100.7%	101.0%	100.5%	100.8%	142.5%	98.9%	100.0%	101.5%
Dry_1Yr	YR2045	106.8%	129.7%	117.0%	103.8%	101.4%	101.6%	100.8%	101.1%	163.8%	98.7%	100.1%	102.4%
Dry_5Yr	YR2025	100.0%	99.6%	99.1%	98.8%	98.9%	99.4%	99.7%	100.0%	99.9%	99.4%	98.9%	99.3%
Dry_5Yr	YR2030	100.0%	99.1%	98.2%	97.6%	97.9%	98.9%	99.4%	100.0%	99.7%	98.9%	97.9%	98.5%
Dry_5Yr	YR2035	101.8%	104.1%	106.2%	101.3%	99.3%	100.0%	100.2%	100.9%	108.7%	97.9%	96.8%	96.8%
Dry_5Yr	YR2040	103.5%	109.1%	114.1%	105.0%	100.8%	101.1%	100.9%	101.8%	117.6%	97.0%	95.8%	95.1%
Dry_5Yr	YR2045	105.2%	114.1%	122.1%	108.7%	102.2%	102.3%	101.7%	102.6%	126.5%	96.1%	94.7%	93.5%
Wet_1Yr	YR2025	99.9%	99.3%	96.3%	95.9%	92.8%	99.1%	99.4%	102.6%	100.3%	98.3%	97.0%	100.1%
Wet_1Yr	YR2030	99.7%	98.5%	92.5%	91.7%	85.6%	98.2%	98.9%	105.2%	100.6%	96.6%	94.1%	100.3%
Wet_1Yr	YR2035	104.4%	109.4%	114.0%	102.0%	87.7%	98.7%	99.2%	100.4%	116.0%	93.6%	91.8%	95.8%
Wet_1Yr	YR2040	109.0%	120.3%	135.6%	112.2%	89.7%	99.3%	99.6%	95.7%	131.4%	90.6%	89.5%	91.3%
Wet_1Yr	YR2045	113.7%	131.2%	157.1%	122.5%	91.7%	99.8%	100.0%	90.9%	146.8%	87.6%	87.2%	86.9%
Wet_5Yr	YR2025	100.3%	100.1%	98.5%	98.3%	98.3%	99.4%	99.7%	100.1%	101.2%	99.1%	99.1%	99.4%
Wet_5Yr	YR2030	100.6%	100.3%	96.9%	96.6%	96.6%	98.9%	99.4%	100.3%	102.4%	98.2%	98.2%	98.9%
Wet_5Yr	YR2035	104.8%	114.8%	126.4%	106.2%	100.7%	101.0%	101.2%	101.4%	157.6%	104.1%	99.1%	97.4%
Wet_5Yr	YR2040	108.9%	129.3%	155.9%	115.9%	104.7%	103.2%	103.0%	102.5%	212.8%	110.0%	100.0%	96.0%
Wet_5Yr	YR2045	113.1%	143.8%	185.4%	125.5%	108.8%	105.4%	104.7%	103.6%	268.0%	115.8%	101.0%	94.6%

TABLE B-10: PROJECTED CHANGES IN OUTDOOR DEMAND UNDER DRIER WITH EXTREME WARMING SCENARIO

YearType	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	YR2025	101.1%	100.7%	100.4%	100.6%	100.8%	100.6%	100.4%	100.6%	100.6%	100.7%	101.0%	101.1%
Normal	YR2030	102.2%	101.4%	100.9%	101.1%	101.6%	101.1%	100.9%	101.1%	101.1%	101.4%	101.9%	102.2%
Normal	YR2035	103.9%	103.3%	102.3%	102.9%	103.7%	102.6%	101.2%	101.6%	101.6%	102.5%	104.2%	104.4%
Normal	YR2040	105.7%	105.2%	103.8%	104.8%	105.7%	104.0%	101.6%	102.1%	102.1%	103.6%	106.4%	106.7%
Normal	YR2045	107.5%	107.2%	105.2%	106.6%	107.8%	105.5%	101.9%	102.6%	102.6%	104.6%	108.7%	108.9%
Dry_1Yr	YR2025	100.8%	100.6%	100.4%	100.4%	100.8%	100.6%	100.4%	100.6%	100.7%	100.8%	100.7%	100.8%
Dry_1Yr	YR2030	101.6%	101.1%	100.9%	100.9%	101.6%	101.1%	100.9%	101.1%	101.4%	101.6%	101.4%	101.6%
Dry_1Yr	YR2035	103.8%	103.7%	102.4%	102.2%	103.4%	102.1%	101.2%	101.8%	101.7%	103.0%	103.1%	102.6%
Dry_1Yr	YR2040	106.0%	106.2%	104.0%	103.5%	105.2%	103.1%	101.6%	102.6%	102.1%	104.3%	104.8%	103.6%
Dry_1Yr	YR2045	108.1%	108.8%	105.6%	104.9%	107.0%	104.0%	101.9%	103.3%	102.5%	105.6%	106.4%	104.5%
Dry_5Yr	YR2025	101.0%	100.7%	100.6%	100.6%	100.8%	100.6%	100.4%	100.6%	100.6%	100.7%	101.0%	101.1%
Dry_5Yr	YR2030	101.9%	101.4%	101.1%	101.1%	101.6%	101.1%	100.9%	101.1%	101.1%	101.4%	101.9%	102.2%
Dry_5Yr	YR2035	104.0%	103.4%	102.6%	103.1%	103.6%	102.3%	101.1%	101.6%	101.6%	102.5%	104.5%	104.5%
Dry_5Yr	YR2040	106.2%	105.5%	104.0%	105.0%	105.5%	103.5%	101.3%	102.1%	102.1%	103.6%	107.1%	106.9%
Dry_5Yr	YR2045	108.3%	107.5%	105.5%	106.9%	107.4%	104.8%	101.6%	102.6%	102.6%	104.6%	109.8%	109.3%
Wet_1Yr	YR2025	101.2%	100.6%	100.3%	100.6%	101.0%	100.7%	100.6%	100.6%	100.7%	101.2%	101.2%	101.1%
Wet_1Yr	YR2030	102.4%	101.1%	100.6%	101.1%	101.9%	101.4%	101.1%	101.1%	101.4%	102.4%	102.4%	102.2%
Wet_1Yr	YR2035	105.0%	103.5%	101.8%	103.3%	103.5%	103.3%	101.7%	101.5%	102.0%	103.2%	105.0%	105.1%
Wet_1Yr	YR2040	107.6%	106.0%	103.0%	105.5%	105.0%	105.2%	102.3%	101.8%	102.6%	104.1%	107.6%	108.1%
Wet_1Yr	YR2045	110.2%	108.4%	104.3%	107.7%	106.5%	107.2%	102.9%	102.2%	103.2%	104.9%	110.2%	111.0%
Wet_5Yr	YR2025	101.0%	100.6%	100.4%	100.6%	100.8%	100.6%	100.4%	100.6%	100.6%	100.7%	100.8%	101.0%
Wet_5Yr	YR2030	101.9%	101.1%	100.9%	101.1%	101.6%	101.1%	100.9%	101.1%	101.1%	101.4%	101.6%	101.9%
Wet_5Yr	YR2035	103.0%	103.1%	102.2%	102.9%	103.6%	102.7%	101.2%	101.6%	101.5%	102.2%	103.7%	103.3%
Wet_5Yr	YR2040	104.0%	105.0%	103.5%	104.8%	105.5%	104.3%	101.6%	102.1%	101.8%	103.1%	105.7%	104.8%
Wet_5Yr	YR2045	105.1%	106.9%	104.9%	106.6%	107.4%	105.9%	101.9%	102.6%	102.2%	103.9%	107.8%	106.2%

TABLE B-11: PROJECTED CHANGES IN OUTDOOR DEMAND UNDER MEDIAN SCENARIO

YearType	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	YR2025	101.1%	100.7%	100.4%	100.6%	100.8%	100.6%	100.4%	100.6%	100.6%	100.7%	101.0%	101.1%
Normal	YR2030	102.2%	101.4%	100.9%	101.1%	101.6%	101.1%	100.9%	101.1%	101.1%	101.4%	101.9%	102.2%
Normal	YR2035	102.9%	102.1%	101.6%	101.8%	102.4%	101.7%	101.2%	101.5%	101.5%	102.0%	102.7%	103.2%
Normal	YR2040	103.6%	102.8%	102.3%	102.6%	103.1%	102.3%	101.6%	101.8%	101.8%	102.6%	103.6%	104.3%
Normal	YR2045	104.3%	103.6%	103.0%	103.3%	103.8%	102.9%	101.9%	102.2%	102.2%	103.2%	104.4%	105.4%
Dry_1Yr	YR2025	100.8%	100.6%	100.4%	100.4%	100.8%	100.6%	100.4%	100.6%	100.7%	100.8%	100.7%	100.8%
Dry_1Yr	YR2030	101.6%	101.1%	100.9%	100.9%	101.6%	101.1%	100.9%	101.1%	101.4%	101.6%	101.4%	101.6%
Dry_1Yr	YR2035	102.6%	102.2%	101.6%	101.7%	102.2%	101.6%	101.2%	101.6%	101.7%	102.2%	102.2%	102.4%
Dry_1Yr	YR2040	103.6%	103.3%	102.3%	102.6%	102.8%	102.1%	101.6%	102.1%	102.1%	102.8%	103.1%	103.1%
Dry_1Yr	YR2045	104.5%	104.4%	103.0%	103.4%	103.4%	102.6%	101.9%	102.6%	102.5%	103.4%	103.9%	103.8%
Dry_5Yr	YR2025	101.0%	100.7%	100.6%	100.6%	100.8%	100.6%	100.4%	100.6%	100.6%	100.7%	101.0%	101.1%
Dry_5Yr	YR2030	101.9%	101.4%	101.1%	101.1%	101.6%	101.1%	100.9%	101.1%	101.1%	101.4%	101.9%	102.2%
Dry_5Yr	YR2035	102.7%	102.2%	101.8%	102.0%	102.4%	101.6%	101.2%	101.5%	101.6%	102.1%	102.7%	103.3%
Dry_5Yr	YR2040	103.6%	103.1%	102.6%	102.8%	103.1%	102.1%	101.6%	101.8%	102.1%	102.8%	103.6%	104.5%
Dry_5Yr	YR2045	104.4%	103.9%	103.3%	103.7%	103.8%	102.6%	101.9%	102.2%	102.6%	103.6%	104.4%	105.7%
Wet_1Yr	YR2025	101.2%	100.6%	100.3%	100.6%	101.0%	100.7%	100.6%	100.6%	100.7%	101.2%	101.2%	101.1%
Wet_1Yr	YR2030	102.4%	101.1%	100.6%	101.1%	101.9%	101.4%	101.1%	101.1%	101.4%	102.4%	102.4%	102.2%
Wet_1Yr	YR2035	103.2%	102.1%	101.3%	101.7%	102.4%	102.0%	101.6%	101.5%	101.7%	103.0%	103.1%	103.1%
Wet_1Yr	YR2040	104.1%	103.1%	102.0%	102.3%	102.9%	102.6%	102.1%	101.8%	102.1%	103.6%	103.8%	104.1%
Wet_1Yr	YR2045	104.9%	104.0%	102.8%	102.9%	103.3%	103.2%	102.6%	102.2%	102.5%	104.2%	104.5%	105.0%
Wet_5Yr	YR2025	101.0%	100.6%	100.4%	100.6%	100.8%	100.6%	100.4%	100.6%	100.6%	100.7%	100.8%	101.0%
Wet_5Yr	YR2030	101.9%	101.1%	100.9%	101.1%	101.6%	101.1%	100.9%	101.1%	101.1%	101.4%	101.6%	101.9%
Wet_5Yr	YR2035	102.7%	102.0%	101.6%	101.8%	102.2%	101.8%	101.2%	101.5%	101.5%	101.9%	102.6%	102.9%
Wet_5Yr	YR2040	103.6%	102.8%	102.3%	102.6%	102.8%	102.6%	101.6%	101.8%	101.8%	102.3%	103.6%	103.8%
Wet_5Yr	YR2045	104.4%	103.7%	103.0%	103.3%	103.4%	103.3%	101.9%	102.2%	102.2%	102.8%	104.5%	104.8%

TABLE B-12: PROJECTED CHANGES IN OUTDOOR DEMAND UNDER WETTER WITH MODERATE WARMING SCENARIO

YearType	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	YR2025	101.1%	100.7%	100.4%	100.6%	100.8%	100.6%	100.4%	100.6%	100.6%	100.7%	101.0%	101.1%
Normal	YR2030	102.2%	101.4%	100.9%	101.1%	101.6%	101.1%	100.9%	101.1%	101.1%	101.4%	101.9%	102.2%
Normal	YR2035	103.1%	100.9%	100.5%	100.5%	101.3%	101.2%	101.0%	101.2%	101.1%	101.1%	101.8%	102.8%
Normal	YR2040	104.1%	100.4%	100.1%	99.9%	100.9%	101.4%	101.1%	101.4%	101.1%	100.9%	101.7%	103.3%
Normal	YR2045	105.0%	99.9%	99.7%	99.3%	100.6%	101.5%	101.2%	101.5%	101.1%	100.7%	101.5%	103.9%
Dry_1Yr	YR2025	100.8%	100.6%	100.4%	100.4%	100.8%	100.6%	100.4%	100.6%	100.7%	100.8%	100.7%	100.8%
Dry_1Yr	YR2030	101.6%	101.1%	100.9%	100.9%	101.6%	101.1%	100.9%	101.1%	101.4%	101.6%	101.4%	101.6%
Dry_1Yr	YR2035	102.2%	101.1%	100.2%	101.0%	100.8%	101.2%	101.0%	101.2%	101.0%	100.2%	99.7%	100.7%
Dry_1Yr	YR2040	102.8%	101.1%	99.6%	101.1%	100.0%	101.4%	101.1%	101.4%	100.7%	98.8%	98.0%	99.7%
Dry_1Yr	YR2045	103.4%	101.1%	99.0%	101.2%	99.1%	101.5%	101.2%	101.5%	100.3%	97.3%	96.3%	98.8%
Dry_5Yr	YR2025	101.0%	100.7%	100.6%	100.6%	100.8%	100.6%	100.4%	100.6%	100.6%	100.7%	101.0%	101.1%
Dry_5Yr	YR2030	101.9%	101.4%	101.1%	101.1%	101.6%	101.1%	100.9%	101.1%	101.1%	101.4%	101.9%	102.2%
Dry_5Yr	YR2035	103.1%	101.4%	100.9%	100.4%	101.4%	101.2%	101.0%	101.2%	101.2%	101.5%	101.8%	103.2%
Dry_5Yr	YR2040	104.3%	101.4%	100.6%	99.7%	101.2%	101.4%	101.1%	101.4%	101.4%	101.6%	101.7%	104.3%
Dry_5Yr	YR2045	105.5%	101.4%	100.4%	98.9%	100.9%	101.5%	101.2%	101.5%	101.5%	101.7%	101.5%	105.4%
Wet_1Yr	YR2025	101.2%	100.6%	100.3%	100.6%	101.0%	100.7%	100.6%	100.6%	100.7%	101.2%	101.2%	101.1%
Wet_1Yr	YR2030	102.4%	101.1%	100.6%	101.1%	101.9%	101.4%	101.1%	101.1%	101.4%	102.4%	102.4%	102.2%
Wet_1Yr	YR2035	104.3%	100.5%	100.8%	100.3%	101.5%	101.7%	101.5%	101.2%	101.6%	102.9%	102.3%	103.0%
Wet_1Yr	YR2040	106.2%	99.9%	101.1%	99.4%	101.2%	102.1%	101.8%	101.4%	101.9%	103.4%	102.2%	103.8%
Wet_1Yr	YR2045	108.1%	99.3%	101.3%	98.6%	100.8%	102.5%	102.2%	101.5%	102.1%	103.8%	102.1%	104.6%
Wet_5Yr	YR2025	101.0%	100.6%	100.4%	100.6%	100.8%	100.6%	100.4%	100.6%	100.6%	100.7%	100.8%	101.0%
Wet_5Yr	YR2030	101.9%	101.1%	100.9%	101.1%	101.6%	101.1%	100.9%	101.1%	101.1%	101.4%	101.6%	101.9%
Wet_5Yr	YR2035	103.2%	100.6%	100.6%	100.5%	101.3%	101.4%	101.0%	101.2%	100.9%	101.1%	102.2%	102.7%
Wet_5Yr	YR2040	104.5%	100.1%	100.3%	99.9%	100.9%	101.6%	101.1%	101.4%	100.6%	100.9%	102.8%	103.6%
Wet_5Yr	YR2045	105.8%	99.7%	100.1%	99.3%	100.6%	101.8%	101.2%	101.5%	100.4%	100.7%	103.4%	104.4%

# Appendix C – Identification of Potential Mitigation Actions

TABLE C-1: IDENTIFICATION OF POTENTIAL MITIGATION ACTIONS AND THEIR KEY IDENTIFIERS

Project Number	Agency	Type of Mitigation Action	Project/Program Name	Location	Stage	Regional Partners	Timing/ Schedule	Estimated Capital Costs (\$ M)	Potential Benefits							Evaluation			
									Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DACs	Environmental Justice	Regional Water Supply Reliability and Resiliency	Prioritizing Social Equity	Regional Benefits	Timing/ Schedule
1	WMWD	Interties	WMWD/ EMWD MARB inter-connection	MARB	Construction	EMWD, MARB, March JPA	2022	\$12.3	X		X	X	X	X	X	Meets 3 or more of the regional benefits	Benefits DAC and promotes environmental justice	Action involves multiple adjacent agencies	Short-term action
2	WMWD	Operation and Management	AMI and Customer Portal	Retail Service Area	Construction		2022	\$3.6		X			X			Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
3	WMWD	Interties	Magnolia Intertie	Along Magnolia Ave near the Arlington Desalters	Design	Riverside Public Utilities, SAWPA	2023	\$1.3	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Regional action	Short-term action
4	WMWD	Operation and Management	Cannon/Campbell Pump Station	Near intersection of Cannon Road and Alessandro Blvd, Riverside	Design	Riverside Public Utilities, SAWPA	2023	\$12.5	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Regional action	Short-term action
5	WMWD	Supply/ Treatment	ADS Well Rehab and Reverse Osmosis Membrane Replacement	Arlington Desalter	Design		2023	\$2.2	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
6	WMWD	Operation and Management	MGL Upgrades	MGL	Design		2025	\$3.0		X	X	X				Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Mid-term action
7	WMWD	Storage	Stormwater Capture and Spreading	Victoria Recharge Basin	Other		Unknown	Unknown	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown
8	WMWD	Interties	RCWD/ WMWD Murrieta inter-connection	Murrieta	Planning	RCWD	Unknown	\$2.2								Meets less than 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Action involves multiple adjacent agencies	Unknown
9	WMWD	Operation and Management	South of Murrieta Creek Service Connection for Private Well Owners	Murrieta	Planning		Unknown	\$20.3			X	X		X	X	Meets 2 of the regional benefits	Benefits DAC and promotes environmental justice	Single agency action	Unknown
10	WMWD	Interties	EVMWD/ WMWD Murrieta interconnection	Murrieta	Planning	EVMWD	Unknown	\$9.0			X	X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Action involves multiple adjacent agencies	Unknown
11	WMWD	Other	Regional drought portal	WMWD	Planning		Unknown	Unknown								Meets less than 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown

Project Number	Agency	Type of Mitigation Action	Project/Program Name	Location	Stage	Regional Partners	Timing/ Schedule	Estimated Capital Costs (\$ M)	Potential Benefits							Evaluation			
									Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DACs	Environmental Justice	Regional Water Supply Reliability and Resiliency	Prioritizing Social Equity	Regional Benefits	Timing/ Schedule
12	WMWD	Supply/ Treatment	Murrieta Legacy Pipeline	Murrieta	Design		2026	\$5.0		X	X	X		X		Meets 3 or more of the regional benefits	Benefits DAC or promotes environmental justice	Single agency action	Mid-term action
13	WMWD	Supply/ Treatment	Murrieta Wellhead Treatment	Murrieta	Design		2025	\$8.0	X	X	X	X	X	X		Meets 3 or more of the regional benefits	Benefits DAC or promotes environmental justice	Single agency action	Mid-term action
14	WMWD	Operation and Management	March Field Air Museum Landscape Retrofit	March Field Air Museum	Design	March Field Air Museum	2024	\$0.23		X	X	X	X	X		Meets 3 or more of the regional benefits	Benefits DAC or promotes environmental justice	Action involves multiple adjacent agencies	Short-term action
15 – Retail Reservoir Storage Projects	WMWD	Storage	Murrieta 1280 Zone Storage	Murrieta	Planning		Unknown	\$7.3			X	X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown
	WMWD	Storage	2.7 MG Hidden Valley # 2 Tank	Riverside	Planning		Unknown	\$10.7			X	X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown
	WMWD	Storage	3 MG 2320 PZ Tank	Riverside	Planning		Unknown	\$11.9			X	X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown
	WMWD	Storage	5 MG Orangecrest #3 tank	Riverside	Planning		Unknown	\$19.9			X	X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown
	WMWD	Storage	1 MG El Nido # 2 Tank	Riverside	Planning		Unknown	\$4.0			X	X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown
16 – Recycled Water Projects	WMWD	Supply/ Treatment	Recycled Water System Expansion	WWRF	Planning		Unknown	\$34.4	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown
	WMWD	Storage	Artificial Recharge Using Recycled Water	Victoria Recharge Basin	Planning		Unknown	Unknown	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown

Project Number	Agency	Type of Mitigation Action	Project/Program Name	Location	Stage	Regional Partners	Timing/ Schedule	Estimated Capital Costs (\$ M)	Potential Benefits							Evaluation				
									Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DACs	Environmental Justice	Regional Water Supply Reliability and Resiliency	Prioritizing Social Equity	Regional Benefits	Timing/ Schedule	
	WMWD	Supply/ Treatment	PFAS Treatment on WWRF	Western Water Recycling Facility	Design	March Air Reserve Base; March JPA	2023	\$7.0	X		X	X	X	X	X		Meets 3 or more of the regional benefits	Benefits DAC and promotes environmental justice	Single agency action	Short-term action
	WMWD	Supply/ Treatment	Well 7	Riverside Basin	Design	SAWPA	2023	\$5.0	X		X	X	X				Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Regional action	Short-term action
17 – Retail Fire Flow Projects	WMWD	Operation and Management	Flow-Based Pump Station at Lockwood Tank for fireflow	WMWD	Design		2023	\$0.7			X	X					Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
	WMWD	Other	Expanded pipelines for fireflow service	Riverside	Planning		Unknown	\$7.0			X	X					Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown
	WMWD	Other	Expanded pipelines for fireflow service	Murrieta	Planning		Unknown	\$4.9				X		X	X		Meets less than 2 of the regional benefits	Benefits DAC and promotes environmental justice	Single agency action	Unknown
18 – Retail System Operation Projects	WMWD	Operation and Management	Operations Control Room	WMWD	Design		2023	\$0.2		X		X					Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
	WMWD	Operation and Management	Water Filling Stations	One at Western's Operations facility and one in the rural area of Gavilan Hills	Feasibility		2023	\$0.5			X	X		X	X		Meets 2 of the regional benefits	Benefits DAC and promotes environmental justice	Single agency action	Short-term action
	WMWD	Operation and Management	SCADA Master Plan Implementation	WMWD	Construction		2025	\$2.0		X	X	X					Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Mid-term action
	WMWD	Operation and Management	District Metered Areas	Retail Service Area	Planning		Unknown	Unknown		X		X					Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown
19	Altman Plants	Storage	Additional stormwater storage capacity	Perris, CA	Construction		2022	\$1.1	X		X		X				Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action

Project Number	Agency	Type of Mitigation Action	Project/Program Name	Location	Stage	Regional Partners	Timing/ Schedule	Estimated Capital Costs (\$ M)	Potential Benefits							Evaluation			
									Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DACs	Environmental Justice	Regional Water Supply Reliability and Resiliency	Prioritizing Social Equity	Regional Benefits	Timing/ Schedule
20	Altman Plants	Other	Sensor-based irrigation	Perris, CA	Planning		2022	\$0.5		X						Meets less than 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
21	Altman Plants	Other	Soil additives	Perris, CA	Design		2022	\$0.5		X						Meets less than 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
22	City of Corona	Operation and Management	Advanced Metering Infrastructure Project	City of Corona	Planning		2025	\$22.7		X			X			Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Mid-term action
23	EMWD	Supply/ Treatment	Purified Water Replenishment	EMWD	Planning		2025	Unknown	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Mid-term action
24	EMWD	Supply/ Treatment	Recycled Water Expansion	EMWD	Planning		2022	Unknown	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
25	EMWD	Supply/ Treatment	Perris South Desalination Program Expansion	EMWD	Design		2030	\$50.0	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Long-term action
26	EMWD	Supply/ Treatment	Additional groundwater wells	EMWD	Design		2030	Unknown	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Long-term action
27	EVMWD	Storage	Lee Lake Dam Storage Modifications	Lee Lake Dam			2027	\$70.0	X			X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Long-term action
28	EVMWD	Supply/ Treatment	Canyon Lake Water Treatment Plant Phase 1 Improvements	Canyon Lake Water Treatment Plant			2024	\$40.0	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action

Project Number	Agency	Type of Mitigation Action	Project/Program Name	Location	Stage	Regional Partners	Timing/ Schedule	Estimated Capital Costs (\$ M)	Potential Benefits							Evaluation				
									Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DACs	Environmental Justice	Regional Water Supply Reliability and Resiliency	Prioritizing Social Equity	Regional Benefits	Timing/ Schedule	
29	EVMWD	Supply/ Treatment	Horsethief Treatment Plant Upgrades and Expansion	Horsethief Canyon Water Reclamation Facility			2023	\$15.8	X					X			Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
30	EVMWD	Supply/ Treatment	Mayhew Well (New) - Local Water Resiliency Project	EVMWD			2026	\$8.0			X	X					Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Mid-term action
31	EVMWD	Supply/ Treatment	Palomar Wellhead Facilities - Local Water Resiliency Project	EVMWD			2022	\$5.0			X	X					Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
32	EVMWD	Supply/ Treatment	Lee Lake Wells - Local Water Resiliency Project	Lee Lake Basin			2022	\$5.5	X		X	X	X				Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action

Project Number	Agency	Type of Mitigation Action	Project/Program Name	Location	Stage	Regional Partners	Timing/ Schedule	Estimated Capital Costs (\$ M)	Potential Benefits							Evaluation				
									Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DACs	Environmental Justice	Regional Water Supply Reliability and Resiliency	Prioritizing Social Equity	Regional Benefits	Timing/ Schedule	
33	EVMWD	Supply/ Treatment	Diamond Regional Sewer Lift Station and Dual Force Main	Diamond Regional Sewer Lift Station			2025	\$60.0			X						Meets less than 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Mid-term action
34	EVMWD	Supply/ Treatment	Upsize Blending Line at Diamond	EVMWD			2024	\$3.0				X	X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
35	EVMWD	Supply/ Treatment	Corydon Well Replacement	EVMWD			2025	\$4.5			X	X					Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Mid-term action
36	EVMWD	Supply/ Treatment	Pipeline from Tomlin 1 To Los Pinos 2	EVMWD			2023	\$4.3		X					X		Meets less than 2 of the regional benefits	Benefits DAC or promotes environmental justice	Single agency action	Short-term action

Project Number	Agency	Type of Mitigation Action	Project/Program Name	Location	Stage	Regional Partners	Timing/ Schedule	Estimated Capital Costs (\$ M)	Potential Benefits							Evaluation			
									Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DACs	Environmental Justice	Regional Water Supply Reliability and Resiliency	Prioritizing Social Equity	Regional Benefits	Timing/ Schedule
37	EVMWD	Other	Avenues Septic to Sewer Conversion	EVMWD			2026	\$16.0			X					Meets less than 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Mid-term action
38	EVMWD	Other	SEDCO Hills Septic System Sewer Conversion	SEDCO Hills			2026	\$25.0			X					Meets less than 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Mid-term action
39	EVMWD	Other	Arsenic Leaching Study - IPR	EVMWD			2024	\$1.5	X		X		X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action

Project Number	Agency	Type of Mitigation Action	Project/Program Name	Location	Stage	Regional Partners	Timing/ Schedule	Estimated Capital Costs (\$ M)	Potential Benefits							Evaluation			
									Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DACs	Environmental Justice	Regional Water Supply Reliability and Resiliency	Prioritizing Social Equity	Regional Benefits	Timing/ Schedule
40	EVMWD	Supply/ Treatment	Regional Water Reclamation Facility Expansion	EVMWD RWRF			2025	\$150.0	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Mid-term action
41	JCSD	Supply/ Treatment	Recycled Water Service Expansion Project	The City of Eastvale and some areas within the City of Jurupa Valley	Design	IEUA, WRCRWA, City of Corona, City of Norco	2021	\$37.0	X		X	X	X	X		Meets 3 or more of the regional benefits	Benefits DAC or promotes environmental justice	Regional action	Short-term action
42	JCSD	Supply/ Treatment	Etiwanda Intervalley Water Quality and Water Resiliency Project (Phase 1-4)	Jurupa Valley, Fontana, Ontario, and Rancho Cucamonga	Design	CVWD	2030	\$241.0	X		X	X		X		Meets 3 or more of the regional benefits	Benefits DAC or promotes environmental justice	Action involves multiple adjacent agencies	Long-term action
43	JCSD	Other	Drought Outreach Plan	All of JCSD's service area.	Other	Agency specific	2021	Unknown		X					X	Meets less than 2 of the regional benefits	Benefits DAC or promotes environmental justice	Single agency action	Short-term action

Project Number	Agency	Type of Mitigation Action	Project/Program Name	Location	Stage	Regional Partners	Timing/ Schedule	Estimated Capital Costs (\$ M)	Potential Benefits							Evaluation				
									Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DACs	Environmental Justice	Regional Water Supply Reliability and Resiliency	Prioritizing Social Equity	Regional Benefits	Timing/ Schedule	
44	JCSD	Supply/ Treatment	Well Exploration in the Chino Basin	Jurupa Valley	Feasibility	Agency specific	2025	\$5.2	X		X	X	X	X			Meets 3 or more of the regional benefits	Benefits DAC or promotes environmental justice	Single agency action	Mid-term action
45	JCSD	Interties	Van Buren Interconnection Project			City of Riverside	2022	\$6.0	X		X	X	X				Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Action involves multiple adjacent agencies	Short-term action
46	JCSD	Supply/ Treatment	Well 29 Equipping				2022	\$5.3	X		X	X	X				Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
47	RCWD	Supply/ Treatment	Recycled Water Accelerated Retrofit Program	Entire Recycled Water System (City of Temecula and City of Murrieta)	Construction		2022	\$6.0			X		X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
48	RCWD	Supply/ Treatment	Small Scale IPR	Entire District	Planning		Unknown	\$20.0	X		X		X				Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown
49	RCWD	Storage	Groundwater Banking	Entire District	Conceptual		Unknown	Unknown	X		X	X					Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown
50	RCWD	Storage	Vail Dam Remediation	Vail Dam			2025	\$65.0	X		X	X	X				Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Mid-term action

Project Number	Agency	Type of Mitigation Action	Project/Program Name	Location	Stage	Regional Partners	Timing/ Schedule	Estimated Capital Costs (\$ M)	Potential Benefits							Evaluation			
									Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DACs	Environmental Justice	Regional Water Supply Reliability and Resiliency	Prioritizing Social Equity	Regional Benefits	Timing/ Schedule
51	RCWD	Supply/ Treatment	Upper VDC Well No. 175 and Well No. 176				2023	\$6.4	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
52	RCWD	Storage	Cole Creek Pond Lining-Recycled Project				2021	\$2.2			X					Meets less than 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
53	RCWD	Supply/ Treatment	Chlorine Contact Tank and Regional Pump Station				2022	\$16.1	X		X		X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
54	RHWC	Supply/ Treatment	Well RN #6 Nitrate Removal	12374 Michigan Street Grand Terrace, CA 92313	Design		2022	Unknown	X		X	X	X	X		Meets 3 or more of the regional benefits	Benefits DAC or promotes environmental justice	Single agency action	Short-term action
55	RHWC	Supply/ Treatment	Brine Line	Pipeline commences at the Ion Exchange System in Grand Terrace and terminates at the Inland Empire Brine Line	Design		2022	Unknown	X		X	X	X	X		Meets 3 or more of the regional benefits	Benefits DAC or promotes environmental justice	Single agency action	Short-term action
56	RHWC	Supply/ Treatment	Santa Ana River Conservation and Conjunctive Use Program Water Well	1450 East Washington, Colton Ca, 92324	Design	WMWD	2022	Unknown	X		X	X	X	X		Meets 3 or more of the regional benefits	Benefits DAC or promotes environmental justice	Regional action	Short-term action
57	RPU	Supply/ Treatment	Jackson St. Recycled Water Line, Phase 1B				2022	\$1.5			X	X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action

Project Number	Agency	Type of Mitigation Action	Project/Program Name	Location	Stage	Regional Partners	Timing/ Schedule	Estimated Capital Costs (\$ M)	Potential Benefits							Evaluation			
									Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DACs	Environmental Justice	Regional Water Supply Reliability and Resiliency	Prioritizing Social Equity	Regional Benefits	Timing/ Schedule
58	RPU	Supply/ Treatment	Riverside Habitat Parks and Water Project			SBVMWD	2023	\$25.0	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Action involves multiple adjacent agencies	Short-term action
59	RCSD	Interties	West Valley Water District Interconnection				2022	\$0.6	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
60	RCSD	Operation and Management	Five Agency Agreement between RCSD, Western, MWD, SBVMWD, and WVWD			MWD, WMWD, SBVMWD, WVMWD	2022	< \$0.1								Meets less than 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Regional action	Unknown
61	RCSD	Supply/ Treatment	Ion Exchange Treatment System				2021	\$4.0			X		X			Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
62	RCSD	Supply/ Treatment	GAC Treatment System				2021	\$1.3			X		X			Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action

Project Number	Agency	Type of Mitigation Action	Project/Program Name	Location	Stage	Regional Partners	Timing/ Schedule	Estimated Capital Costs (\$ M)	Potential Benefits							Evaluation			
									Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DACs	Environmental Justice	Regional Water Supply Reliability and Resiliency	Prioritizing Social Equity	Regional Benefits	Timing/ Schedule
63	RCSD	Storage	RCSD Potable Water Reservoir Refurbishment				2022	\$2.7			X	X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
64	RCSD	Supply/ Treatment	RCSD New Well and Treatment		Design		2025	\$3.0	X	X	X	X	X	X	X	Meets 3 or more of the regional benefits	Benefits DAC and promotes environmental justice	Action involves multiple adjacent agencies	Mid-term action
65	SAWPA	Supply/ Treatment	Santa Ana River Watershed Weather Modification Pilot Program		Design	SAWPA member agencies	2022	\$1.4	X		X	X	X	X		Meets 3 or more of the regional benefits	Benefits DAC or promotes environmental justice	Action involves multiple adjacent agencies	Short-term action

**Notes:**

CVWD: Cucamonga Valley Water District  
EMWD: Eastern Municipal Water District  
GAC: granulated activated carbon  
IPR: indirect potable reuse  
MARB: March Air Reserve Base  
MG: million gallon

MGL: Mills Gravity Line  
PFAS: per-and polyfluoroalkyl substances  
PZ: pressure zone  
RCSD: Rubidoux Community Services District  
RWRF: Regional Water Reclamation Facility  
SAWPA: Santa Ana Watershed Project Authority

SBVMWD: San Bernardino Valley Municipal Water District  
SCADA: supervisory control and data acquisition  
VDC: Valle De Los Caballos  
WMWD: Western Municipal Water District  
WVMWD: West Valley Water District

## Appendix D – Identification of other Proposed Mitigation Actions

TABLE D-1: IDENTIFICATION OF OTHER PROPOSED MITIGATION ACTIONS AND THEIR KEY IDENTIFIERS

Project Number	Agency	Type of Mitigation Action	Project/Program Description	Location	Potential Benefits						Other Notes/Comments	
					Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DAC		Environmental Justice
1	WMWD	Interties	Interconnections between WMWD's retail agencies		X		X	X	X			
2	WMWD	Interties	Interconnections with RCSD	Interconnections with RCSD			X	X		X	X	
3	WMWD	Supply/ Treatment	Irrigation with recycled water can offset groundwater pumping by utilizing treated wastewater for irrigation. Currently recycled water is not used as a source of irrigation in the basin.	Arlington Basin	X		X	X	X			Riverside-Arlington Groundwater Sustainability Plan (GSP) Project
4	WMWD	Storage	This project injects or spreads surface water, treated to drinking water standards, into basin aquifers to be used as underground storage reservoirs.	Arlington Basin	X		X	X	X			Riverside-Arlington GSP Project
5	WMWD	Operation and Management	Projects for the metering and collection of groundwater pumping in the Arlington Basin	Arlington Basin				X				Riverside-Arlington GSP Project
6	WMWD	Operation and Management	Replacement of invasive or nonnative vegetation with native plant species will not only have a positive impact on the health of an ecosystem but can also provide indirect aquifer recharge by decreasing evapotranspiration.	Arlington Basin		X						Riverside-Arlington GSP Project
7	WMWD	Operation and Management	Water Transfers/In-Lieu Groundwater Recharge would replace groundwater pumping, provide passive recharge, and could potentially allow an increase in groundwater in storage with the delivery of excess, treated to drinking water standards surface water to the Arlington Basin.	Arlington Basin			X	X				Riverside-Arlington GSP Project
8	WMWD	Supply/ Treatment	Activities that promote and incentivize conservation	WMWD		X						Riverside-Arlington GSP Project

Project Number	Agency	Type of Mitigation Action	Project/Program Description	Location	Potential Benefits							Other Notes/Comments
					Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DAC	Environmental Justice	
9	WMWD	Operation and Management	Programs that redistribute pumping can alter the timing of when groundwater extraction occurs or the location of groundwater is pumped, potentially from existing groundwater wells to new groundwater wells.	Arlington Basin			X	X				Riverside-Arlington GSP Project
10	WMWD	Supply/ Treatment	A leak detection program traces the flow of water from its source, through a water distribution system, to customers and for other uses with the review of records and data collected. Creation of a leak detection program would help ensure supplied water reaches its destination, supporting water conservation.	WMWD		X						Riverside-Arlington GSP Project
11	WMWD	Operation and Management	Water Loss Mitigation Program: Pipeline Repair; Repairing Aging infrastructure will help decrease water loss and help create more resilience in current water supplies during a drought.	WMWD			X	X				
12	WMWD	Storage	Arlington Reservoir for local groundwater storage	Arlington Desalter			X	X				
13	WMWD	Operation and Management	Hydroelectric Power Generation	MGL and Sterling			X	X				
14	Altman Plants	Storage	Additional storage for the State Water Project (Sites Reservoir)		X		X					
15	Altman Plants	Operation and Management	Additional resources for homeowners to install/retrofit to more efficient irrigation systems. Both educational outreach and financial incentives.			X						
16	Altman Plants	Operation and Management	Financial incentives for homeowners to install tankless water heaters.			X						
17	RCSD	Supply/ Treatment	Reverse Osmosis Plant Construction				X		X			

Appendix E – Drought Monitoring Framework TM

## Technical Memorandum

**To:** Drought Contingency Plan Task Force  
**From:** Drought Contingency Plan Development Team  
**CC:** Melissa Matlock, Western Municipal Water District  
**Date:** 9/27/2022  
**Re:** Western Municipal Water District – Drought Monitoring Framework

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Water Systems Consulting, Inc. (WSC) and GEI Consultants, Inc. (GEI) have been contracted by Western Municipal Water District (Western) for the preparation of its 2020 Urban Water Management Plan (UWMP) for submittal to the California Department of Water Resources (DWR) and a Drought Contingency Plan (DCP) for submittal to the United States Bureau of Reclamation (USBR). Pursuant to the development of the DCP and in collaboration with the Drought Task Force, Western has developed a Regional Drought Monitoring Framework (DMF), which is one of the key elements of the DCP. The following technical memorandum (TM) provides:

- A description of the DMF components, purpose, and benefits
- A description of current drought monitoring efforts within the region
- The proposed framework to facilitate regional coordination and drought monitoring

### 1 Introduction

The regional DMF establishes a process for monitoring near- and long-term water availability and developing a framework for predicting the probability of future droughts or confirming an existing drought. To monitor for near- and long-term water availability, Western will continue to use its current drought monitoring efforts as described in Chapter 2. Predicting the probability of future droughts or confirming an existing drought will be accomplished through development of a Regional Drought Portal and ongoing Drought Task Force meetings as described in Chapter 3. The DMF is built upon individual stakeholders' efforts to monitor and define droughts within their respective areas and aims to improve regional coordination and information sharing regarding droughts and shortages.

Stakeholders within the region may experience shortages and impacts of drought at varying times and degrees of severity due to nuances in supply and demand portfolios. It is important to enable and support each stakeholder as they enact shortage levels and response actions that are relevant and actionable in their service area, and to avoid implementing a regional framework that is overly rigid or prescriptive. This TM illustrates, through a summary of the region's current drought monitoring efforts, including stakeholders' individual activities and programs, that the region has considerable existing organizational structure and commitments dedicated to predicting, defining, and responding to droughts and shortages. The summary follows this introduction.

The DMF also provides proposed coordination and information-sharing frameworks that provide a mechanism for enhanced communication, collaboration, and coordination, in addition to existing programs and activities. These frameworks include developing a regional drought portal, and periodic Stakeholder/Drought Task Force meetings, which are described following the summary of the region's current drought monitoring efforts.

## **2 Current Drought Monitoring Efforts**

This includes monitoring groundwater availability through well-established frameworks such as the Sustainable Groundwater Management Act (SGMA). This section summarizes these efforts for the various stakeholders and programs within the Western service area. The regional stakeholders range from large (Metropolitan Water District of Southern California [MWD]) to small (Box Springs) and each has a different approach to monitoring conditions in their respective areas. The summaries for each stakeholder or program focus on how droughts and water shortages are predicted and defined. A crosswalk evaluation of the various stakeholder drought monitoring efforts highlights similarities and differences among the efforts at the conclusion of this section (Table 2-13).

### **2.1 MWD Water Shortage Allocation Plan and Western Drought Allocation Plan**

MWD's Water Shortage Allocation Plan (WSAP) is MWD's policy and formula for equitably allocating available water supplies to member agencies during extreme water shortages when MWD determines it is unable to meet all its demands. MWD's WSAP identifies ten levels of shortage designed to reduce demands by up to 50 percent of the WSAP's calculated base demand (Table 2-1). Table 2-1 is an example from MWD's WSAP, which provides estimated savings by each WSAP level using a hypothetical base demand of one million acre-feet (MAF).

If MWD implements a WSAP allocation, Western will implement its Drought Allocation Plan (DAP) that passes through MWD's WSAP actions for imported water shortages to Western wholesale customers. The DAP was prepared by Western in conjunction with its wholesale customers and mirrors the 10 stages of MWD's WSAP. The DAP establishes a means to allocate limited imported water supplies among Western's imported water agencies if MWD implements various stages of its WSAP. Initially developed in 2008, the DAP was updated in 2015 to reflect changes from MWD and the potential impacts of future droughts. The DAP establishes water allocations based on several variables including base period demand, conservation, growth, regional shortage, availability of local supplies, retail water agency dependence on imported supplies, and conservation demand hardening. The allocation method was designed to be equitable on the wholesale level, while helping to minimize hardships experienced by retail agencies and the customers they serve throughout the region. The allocation methodology in the DAP was updated for consistency with MWD's WSAP and agreed upon by Western's wholesale customers.

The WSAP and DAP do not require Western's wholesale customers to reduce demands during shortage, rather they incentivize demand reduction through fees for excessive use. MWD charges penalties for use above an allocation established by implementing one of the ten stages of its WSAP and Western's DAP passes any penalties charged through to the respective wholesale customers that contributed to accruing the penalties. Demand reductions are voluntary and supplies beyond the allocation can still be purchased at higher penalty rates.

**Table 2-1: MWD WSAP Levels and Associated Percent Reductions**

WSAP Regional Shortage Level	Approximate Percent Reduction	Example Base Demand	Estimated Demand Reduction
1	5%	1.0 MAF	50,000
2	10%		100,000
3	15%		150,000
4	20%		200,000
5	25%		250,000
6	30%		300,000
7	35%		350,000
8	40%		400,000
9	45%		450,000
10	50%		500,000

## 2.2 Groundwater Basin Management

The region uses local groundwater from seven different groundwater basins, including: the San Bernardino Basin Area (SBBA), Chino Basin, Riverside-Arlington Basin, Temescal Basin, Bedford-Coldwater Basin, Elsinore Valley Basin, and Temecula Valley Basin.

Four of these basins (Bedford-Coldwater Basin, Elsinore Valley Basin, Riverside-Arlington Basin, and the Temescal Basin) are managed by a Groundwater Sustainability Agency (GSA) as required by SGMA. Under SGMA, these basins are categorized into one of four categories: high-, medium-, low-, or very-low priority. SGMA requires medium- and high-priority basins to develop a Groundwater Sustainability Plan (GSP). Each of the GSAs which manage these basins have developed or are in the process of developing a GSP, with the goals of:

- Developing water budgets
- Assessing groundwater storage
- Developing sustainable management criteria, undesirable results, and minimum thresholds to protect the basin for future supply.
- Identifying projects needed to ensure future sustainability of supplies

This includes the Riverside-Arlington Basin which although was classified as a very-low priority basin, is being proactively managed to ensure its reliability into the future.

The remaining three basins (Chino Basin, SBBA, Temecula Valley Basin) are adjudicated (note that a part of the Riverside-Arlington Basin is also adjudicated). These basins are managed by a Watermaster to manage the ownership of water rights and water use with goals similar to that of SGMA. Annually, each adjudicated basin is generally required to report to DWR:

- Groundwater elevation data
- Groundwater extraction for the preceding year
- Surface water supply used for or available for use for groundwater recharge or in-lieu use
- Total water use
- Change in groundwater storage

Both of these frameworks provide the mechanisms to monitor groundwater availability in the near- and long-term to ensure that the groundwater basins relied upon by the region are sustainably managed into the future.

### 2.3 Water Shortage Contingency Plans

Urban wholesale and retail water suppliers that provide water for municipal purposes to more than 3,000 customers or serving more than 3,000 acre-feet annually must adopt an UWMP every five years demonstrating water supply reliability under normal as well as drought conditions. As part of the UWMP, a standalone Water Shortage Contingency Plan (WSCP) must also be prepared, which develops a framework for preparing for and responding to water shortages.

As part of this framework, each WSCP must identify how droughts and water shortages are predicted and defined. The Water Code outlines six standard water shortage levels that correspond to a gap in supply compared to normal year availability. The six standard water shortage levels correspond to progressively increasing estimated shortage conditions (up to 10, 20, 30, 40, 50 percent, and greater than 50 percent shortage compared to the normal reliability condition) and align with the response actions that a water supplier would implement to meet the severity of the impending shortages (Table 2-2). Each urban water supplier must comply with the six standard levels or include a cross-reference relating its existing shortage categories to the six standard water shortage levels.

**Table 2-2: Water Code Standard Stages**

Shortage Level	Percent Shortage Range
1	Up to 10%
2	Up to 20%
3	Up to 30%
4	Up to 40%
5	Up to 50%
6	>50%

Beginning by July 1, 2022, every urban water supplier (wholesale and retail) that is required to prepare a WSCP as part of its UWMP must conduct an Annual Water Supply and Demand Assessment (Annual Assessment). The Annual Assessment is an evaluation of the near-term outlook for supplies and

demands to determine whether the potential for a supply shortage exists and whether there is a need to trigger a WSCP shortage stage and response actions in the current calendar year to maintain supply reliability. The procedures used in conducting the Annual Assessment must be specified in the WSCP and must include, at a minimum:

- The written decision-making process that an urban water supplier will use each year to determine its water supply reliability.
- The key data inputs and assessment methodology used to evaluate the urban water supplier's water supply reliability for the current year and one dry year, including the following:
  - Current year unconstrained demand, considering weather, growth, and other influencing factors, such as policies to manage current supplies to meet demand objectives in future years, as applicable.
  - Current year available supply, considering hydrological and regulatory conditions in the current year and one dry year. The Annual Assessment may consider more than one dry year solely at the discretion of the urban water supplier.
  - Existing infrastructure capabilities and plausible constraints.
  - A defined set of locally applicable evaluation criteria that are consistently relied upon for each Annual Assessment.
  - A description and quantification of each source of water supply.

Both Western Wholesale and Western Retail, along with the majority of Western's retail agencies, at least in part use the Annual Assessment to determine whether the potential for a supply shortage exists and to enact its water shortage stages.

Western Wholesale and Western Retail are subject to the WSCP requirements and a single WSCP has been developed to meet the requirements for both systems. With the exception of Box Springs Mutual Water Company and Eagle Valley Mutual Water Company, all of Western's retail agencies are also subject to the WSCP requirements, and each agency has prepared a standalone WSCP. A summary of the water shortage stages and indicators used to predict and define droughts is provided below from each respective WSCP, along with a description of the process for the Annual Assessment, should the WSCP provide additional tasks or details that are supplemental to the procedures described above.

### *2.3.1 Western Wholesale*

Western Wholesale uses the six standard water shortage stages corresponding to progressive ranges of up to 10, 20, 30, 40, and 50 percent shortages and greater than 50 percent shortage compared to normal year availability. Available supply compared to normal year availability is used as a trigger for each of the six water shortage stages.

Western Wholesale uses the Annual Water Supply and Demand Assessment (Wholesale Annual Assessment) to determine whether the potential for a supply shortage exists. The Wholesale Annual Assessment occurs around the same timeframe each year (March through July 1). The key tasks under the Wholesale Annual Assessment include:

- Estimate unconstrained demands for the coming year using both single year and 5-year demand estimates from Western’s wholesale customers
- Estimate available supplies for the year, considering the following year will be dry
- Consider potential infrastructure constraints that may impact supply delivery
- Based on these assessments, if the potential for a shortage exists or if MWD has enacted a WSAP stage, determine which Western shortage response stage and actions are recommended to reduce/eliminate the shortage or to pass through the MWD WSAP

### 2.3.2 Western Retail

Similar to Western Wholesale, Western Retail uses the six standard water shortage stages corresponding to progressive ranges of up to 10, 20, 30, 40, and 50 percent shortages and greater than 50 percent shortage compared to normal year availability as defined under Ordinance 394 (enacted 2022). The six stages are provided in Table 2-3. Similar to Western Wholesale, available supply compared to normal year availability is used as a trigger for each of the five water shortage stages.

Western Retail also uses the Annual Water Supply and Demand Assessment (Retail Annual Assessment) to determine whether the potential for a supply shortage exists. The key tasks under the Retail Annual Assessment and expected timeframe are the same as those for Western Wholesale.

**Table 2-3: Western Retail Water Shortage Levels and Corresponding Percent Shortages**

Shortage Level	Percent Shortage Range	Ordinance 394 Water Shortage Condition
1	Up to 10%	Stage 1 – Water Supply Watch – Water Use Efficiency is a Way of Life
2	Up to 20%	Stage 2 – Water Supply Alert
3	Up to 30%	Stage 3 – Water Supply Reduction – Targeting Unsustainable Use
4	Up to 40%	Stage 4 – Water Supply Reduction – Targeting Inefficient Use
5	Up to 50%	Stage 5 – Water Supply Reduction – Targeting Outdoor Use
6	> 50%	Catastrophic Water Supply Loss – Targeting Indoor Use

### 2.3.3 City of Corona

The City of Corona under Ordinance 2962 (enacted 2009) uses the six standard water shortage levels corresponding to progressive ranges of up to 10, 20, 30, 40, and 50 percent shortages and greater than 50 percent shortage. Available supply and corresponding supply deficits in acre-feet per year (AFY) are used as triggers for each of the six water shortage stages as shown below in Table 2-4.

**Table 2-4: City of Corona Water Shortage Stages and Corresponding Available Supply/Supply Deficit**

Stage	Condition	Available Supply (AFY)	Supply Deficit (AFY)
0	At all times (no shortage)	46,222	None
1	10% Shortage	41,600	None
2	20% Shortage	36,978	1,373
3	30% Shortage	32,355	5,996
4	40% Shortage	27,733	10,618
5	50% Shortage	23,111	15,240
6	> 50% Shortage	< 23,111	> 15,240

Ordinance No. 2962 was enacted as an amendment to the Corona Municipal Code related to water conservation. Per Ordinance No. 2962, a water shortage may be caused by, but is not limited to, any or all of the following circumstances or events:

- A regional or statewide water supply shortage exists, and a regional public outreach campaign is being implemented asking or requiring persons to reduce water use
- Groundwater wells are inoperable or unusable (such as by power outages, mechanical failure, or contamination)
- Alternative water supplies are limited or unavailable
- Groundwater levels or groundwater quality is approaching levels that may require augmentation of the groundwater basin or other actions necessary to protect the groundwater basin as prescribed by DWR, California Department of Public Health, the Regional Water Quality Control Board, Riverside County, or some other regulatory body
- A major failure of any supply or distribution facility, whether temporary or permanent, occurs in the water distribution system of the state, MWD, the Western Municipal Water District, or city water facilities

The City of Corona’s WSCP aligns with the Annual Assessment activities listed previously in Section 2.3.

#### *2.3.4 City of Norco*

The City of Norco uses five water shortage levels corresponding to progressive ranges of up to 5, 20, 30, 40, and 50 percent shortages. Available supply, which is evaluated as part of the Annual Assessment, is used as a trigger for each of the five water shortage stages as shown in Table 2-5.

**Table 2-5: City of Norco Water Shortage Levels and Corresponding Percent Shortages**

Shortage Level	Percent Shortage Range	Water Shortage Condition
I	Up to 5%	Water Shortage Watch
II	Up to 20%	Water Shortage Caution
III	Up to 30%	Water Shortage Alert
IV	Up to 40%	Water Shortage Critical
V	Up to 50%	Water Shortage Emergency

The City of Norco’s WSCP aligns with the Annual Assessment activities listed previously in Section 2.3.

**2.3.5 Elsinore Valley Municipal Water District**

Under Ordinance 225 adopted in 2015, and as shown in Table 2-6, Elsinore Valley Municipal Water District (EVMWD) uses five water shortage levels corresponding to progressive ranges of up to 5, 10, 25, and 40 percent shortages, and greater than or equal to 50 percent shortage. EVMWD’s intent is to update these water shortage levels to be consistent with Western Wholesale.

**Table 2-6: Elsinore Valley Municipal Water District Water Shortage Levels and Corresponding Percent Shortages**

Shortage Level	Percent Shortage Range	EVMWD Ordinance 225 Stage
1	Up to 5%	Stage 1 – Water Supply Watch
2	Up to 10%	Stage 2 – Water Supply Alert
3	Up to 25%	Stage 3 – Mandatory Waste Reduction
4	Up to 40%	Stage 4 – Mandatory Outdoor Reductions
5	≥ 50%	Stage 5 – Mandatory Targeted Indoor/Outdoor Reductions –Catastrophic Failure or “Immediate Emergency”

EVMWD uses the following indicators to trigger a water shortage:

- Hydrologic limitation in supply (i.e., a prolonged period of below-normal precipitation and runoff)
- Limitations or failure of supply and treatment infrastructure
- Combination of both a hydrologic limitation in supply or limitation/failure of supply and treatment infrastructure

EVMWD’s WSCP aligns with the Annual Assessment activities listed previously in Section 2.3.

**2.3.6 Jurupa Community Services District**

Jurupa Community Services District (JCSD) uses the six standard water shortage stages corresponding to progressive ranges of up to 10, 20, 30, 40, and 50 percent shortages and greater than 50 percent shortage, compared to normal year availability (Table 2-7). As evaluated during the Annual Assessment, JCSD will use current year and one dry year scenarios, along with any groundwater limitations based on consultation with the Chino Basin Watermaster, to trigger a water shortage.

**Table 2-7: Jurupa Community Services District Water Shortage Levels and Corresponding Percent Shortages**

Shortage Level	Percent Shortage Range	Water Shortage Condition
1	Up to 10%	Drought Watch
2	Up to 20%	Drought Caution
3	Up to 30%	Drought Alert
4	Up to 40%	Drought Critical
5	Up to 50%	Drought Emergency
6	>50%	Drought Emergency

JCSD uses the Annual Assessment to determine whether the potential for a supply shortage exists. JCSD’s WSCP generally aligns with the Annual Assessment activities listed previously in Section 2.3.

*2.3.7 Temescal Valley Water District*

Temescal Valley Water District (TVWD) uses five water shortage levels corresponding to progressive ranges of 0, 10, 25, 50, and greater than 50 percent shortages. Available supply is used as a trigger for each of the four water shortage stages as shown in Table 2-8.

**Table 2-8: Temescal Valley Water District Water Shortage Levels and Corresponding Percent Shortages**

Shortage Level	Percent Shortage Range
1	Normal Conditions
2	Up to 10%
3	Up to 25%
4	Up to 50%
5	> 50%

TVWD’s WSCP aligns with the Annual Assessment activities listed previously in Section 2.3.

*2.3.8 Rancho California Water District*

As shown in Table 2-9, Rancho California Water District (RCWD) uses five water shortage stages corresponding to progressive ranges of up to 10, 20, 30, 40, and 50 percent shortages and greater than 50 percent shortage, compared to normal year availability.

**Table 2-9: Rancho California Water District Water Shortage Levels and Corresponding Percent Shortages**

Shortage Level	Percent Shortage Range	Water Shortage Condition
1	At all times (no shortage)	Water Shortage Watch
2	At all times (no shortage)	Water Shortage Alert
3a	At all times (no shortage)	Water Shortage Warning
3b	Up to 10%	
3c	Up to 20%	
4a	Up to 30%	Extreme Water Supply Emergency
4b, 4c	Up to 40%	
5a, 5b	Up to 50%	Catastrophic Water Supply Emergency
5c	> 50%	

For RCWD, the declaration of water shortage stages is made according to the level of shortage identified during RCWD’s Annual Assessment. Water shortage stages can also be triggered by unexpected or catastrophic events, or upon the declaration of a water shortage emergency by a state or federal agency.

RCWD’s WSCP aligns with the Annual Assessment activities listed previously in Section 2.3.

**2.3.9 Riverside Highland Water Company**

Riverside Highland Water Company (RHWC) uses four water shortage stages corresponding to progressive ranges of up to 10, 25, and 35 percent shortage, and greater than 50 percent shortage, compared to normal year availability (Table 2-10).

**Table 2-10: Riverside Highland Water Company Water Shortage Levels and Corresponding Percent Shortages**

Shortage Level	Percent Shortage Range	Water Supply Condition
1	Up to 10%	Normal Condition
2	Up to 25%	Water Alert Conditions
3	Up to 35%	Water Warning Conditions
4	≥ 50%	Water Emergency Conditions

With the exception of a catastrophic failure of infrastructure, RHWC does not anticipate enacting a water shortage stage except under the state’s direction, as occurred in 2014, or as identified under the Annual Assessment. As described in RHWC’s WSCP, the Annual Assessment occurs around the same timeframe each year (January through July 1) and generally aligns with the Annual Assessment activities listed previously in Section 2.3.

**2.3.10 Riverside Public Utilities**

Riverside Public Utilities (RPU) uses five water shortage stages corresponding to progressive ranges of 0, 15, 15-20, and 20-50 percent shortage, and greater than 50 percent shortage, compared to normal year availability (Table 2-11). These stages can be triggered when there is a water deficiency caused by limitations on supply or on RPU’s delivery system.

**Table 2-11: Riverside Public Utilities Water Shortage Levels and Corresponding Percent Shortages**

Shortage Level	Percent Shortage Range	Water Shortage Condition
1	0%	Normal Water Supply
2	< 15%	Minimum Water Shortage
3	15-20%	Moderate Water Shortage
4	20-50%	Severe Water Shortage
5	> 50%	Water Shortage Emergency

RPU's WSCP aligns with the Annual Assessment activities listed previously in Section 2.3.

*2.3.11 Rubidoux Community Services District*

Rubidoux Community Services District (RCSD) uses the six standard water shortage stages corresponding to progressive ranges of up to 10, 20, 30, 40, and 50 percent shortages and greater than 50 percent shortage, compared to normal year availability (Table 2-12). As evaluated during the Annual Assessment, RCSD will use current year and one dry year scenarios, along with any groundwater limitations based on consultation with the Western-San Bernardino Watermaster, to trigger a water shortage.

**Table 2-12: Rubidoux Community Services District Water Shortage Levels and Corresponding Percent Shortages**

Shortage Level	Percent Shortage Range
1	Up to 10%
2	Up to 20%
3	Up to 30%
4	Up to 40%
5	Up to 50%
6	>50%

RCSD's WSCP aligns with the Annual Assessment activities listed previously in Section 2.3.

Table 2-13: Summary of Stakeholder Water Shortage Contingency Plan Contents

Agency	Indicator	Stage 1		Stage 2		Stage 3		Stage 4		Stage 5		Stage 6	
		Supply Reduction (%)	Water Supply Condition/Trigger	Supply Reduction (%)	Water Supply Condition/Trigger	Supply Reduction (%)	Water Supply Condition/Trigger	Supply Reduction (%)	Water Supply Condition/Trigger	Supply Reduction (%)	Water Supply Condition/Trigger	Supply Reduction (%)	Water Supply Condition/Trigger
Western Wholesale	Annual water supply and demand assessment	< 10%	Total supply able to meet ≥ 90% of projected demand	10-20%	Total supply able to meet ≥ 80% of projected demand	20-30%	Total supply able to meet ≥ 70% of projected demand	30-40%	Total supply able to meet ≥ 60% of projected demand	40-50%	Total supply able to meet ≥ 50% of projected demand	>50%	Total supply able to meet < 50% of projected demand
Western Retail	Annual water supply and demand assessment	< 10%	Total supply able to meet ≥ 90% of projected demand	10-20%	Total supply able to meet ≥ 80% of projected demand	20-30%	Total supply able to meet ≥ 70% of projected demand	30-40%	Total supply able to meet ≥ 60% of projected demand	40-50%	Total supply able to meet ≥ 50% of projected demand	>50%	Total supply able to meet < 50% of projected demand
City of Corona	Available supply and the correspondence of a supply deficit	10%	No supply deficit	20%	Up to 1,373 AFY deficit	30%	Up to 5,996 AFY deficit	40%	Up to 10,618 AFY deficit	50%	Up to 15,240 AFY deficit	>50%	> 15,240 AFY deficit
City of Norco	Annual water supply and demand assessment	< 5%	Total supply able to meet ≥ 95% of projected demand	5-20%	Total supply able to meet ≥ 80% of projected demand	20-30%	Total supply able to meet ≥ 70% of projected demand	30-40%	Total supply able to meet ≥ 60% of projected demand	40-50%	Total supply able to meet ≥ 50% of projected demand	N/A	N/A
Elsinore Valley Municipal Water District	Hydrologic limitation in supply (i.e., a prolonged period of below-normal precipitation and runoff), limitations or failure of supply and treatment infrastructure, or both	< 5%	Total supply able to meet ≥ 95% of projected demand	5-10%	Total supply able to meet ≥ 90% of projected demand	10-25%	Total supply able to meet ≥ 75% of projected demand	25-40%	Total supply able to meet ≥ 60% of projected demand	≥50%	Total supply able to meet ≤ 50% of projected demand	N/A	N/A
Jurupa Community Services District	Characterizing current year and one dry year and groundwater limitations (Annual Assessment)	10%	Total supply able to meet ≥ 90% of projected demand	20%	Total supply able to meet ≥ 80% of projected demand	30%	Total supply able to meet ≥ 70% of projected demand	40%	Total supply able to meet ≥ 60% of projected demand	50%	Total supply able to meet ≥ 50% of projected demand	> 50%	Total supply able to meet < 50% of projected demand
Temescal Valley Water District	Available supply and the reduction in total supply	0%	Normal conditions – no reduction in supply	10%	Total supply able to meet ≥ 90% of projected demand	25%	Total supply able to meet ≥ 75% of projected demand	50%	Total supply able to meet ≥ 50% of projected demand	≥50%	Total supply able to meet ≤ 50% of projected demand	N/A	N/A
Rancho California Water District	Long and short-term supply deficiencies; immediate emergency water shortage response; emergency declaration of state or federal agency	0-10%	District is experiencing short-term and long-term effects of recent and/or on-going drought conditions	10-20%	District is experiencing short-term and long-term effects of recent and/or on-going drought conditions	20-30%	3b- Annual supply is projected to be up to 10 percent less than annual demand. 3c- Annual supply is projected to be greater than 10 percent and up to 20 percent less than annual demand	30-40%	4a, 4b- Annual supply is projected to be greater than 20 percent and up to 30 percent less than annual demand. 4c- Annual supply is projected to be greater than 30 percent, and up to 40 percent, less than annual demand	40-50%	5a, 5b- Annual supply is projected to be greater than 40 percent, and up to 50 percent, less than annual demand. 5c- Annual supply is projected to be more than 50 percent less than annual demand	N/A	N/A

Agency	Indicator	Stage 1		Stage 2		Stage 3		Stage 4		Stage 5		Stage 6	
		Supply Reduction (%)	Water Supply Condition/Trigger										
Riverside Highland Water Company	Under the State's direction (with the exception of a catastrophic failure of infrastructure) or during the annual assessment	10%	Total supply able to meet ≥ 90% of projected demand	25%	Total supply able to meet ≥ 75% of projected demand	35%	Total supply able to meet ≥ 65% of projected demand	50%	Total supply able to meet < 50% of projected demand	N/A	N/A	N/A	N/A
Riverside Public Utilities	Water deficiency caused by limitations on supply or by limitations on RPU's delivery system	0%	Total supply able to meet 100% of projected demand	< 15%	Total supply able to meet ≥ 75% of projected demand	15-20%	Total supply able to meet ≥ 80% of projected demand	20-50%	Total supply able to meet ≥ 50% of projected demand	>50%	Total supply able to meet < 50% of projected demand	N/A	N/A
Rubidoux Community Services District	Characterizing current year and one dry year and groundwater limitations	10%	Adequate supply to cover 10% shortage	20%	Adequate supply to cover 20% shortage	30%	Total supply able to meet ≥ 70% of projected demand	40%	Total supply able to meet ≥ 60% of projected demand	50%	Total supply able to meet ≥ 50% of projected demand	>50%	Total supply able to meet < 50% of projected demand

**Notes:**

Box Springs Mutual Water Company, Eagle Valley Mutual Water Company, and Santa Ana River Water Company are also stakeholders served by Western Wholesale but are not required to prepare WSCPs.

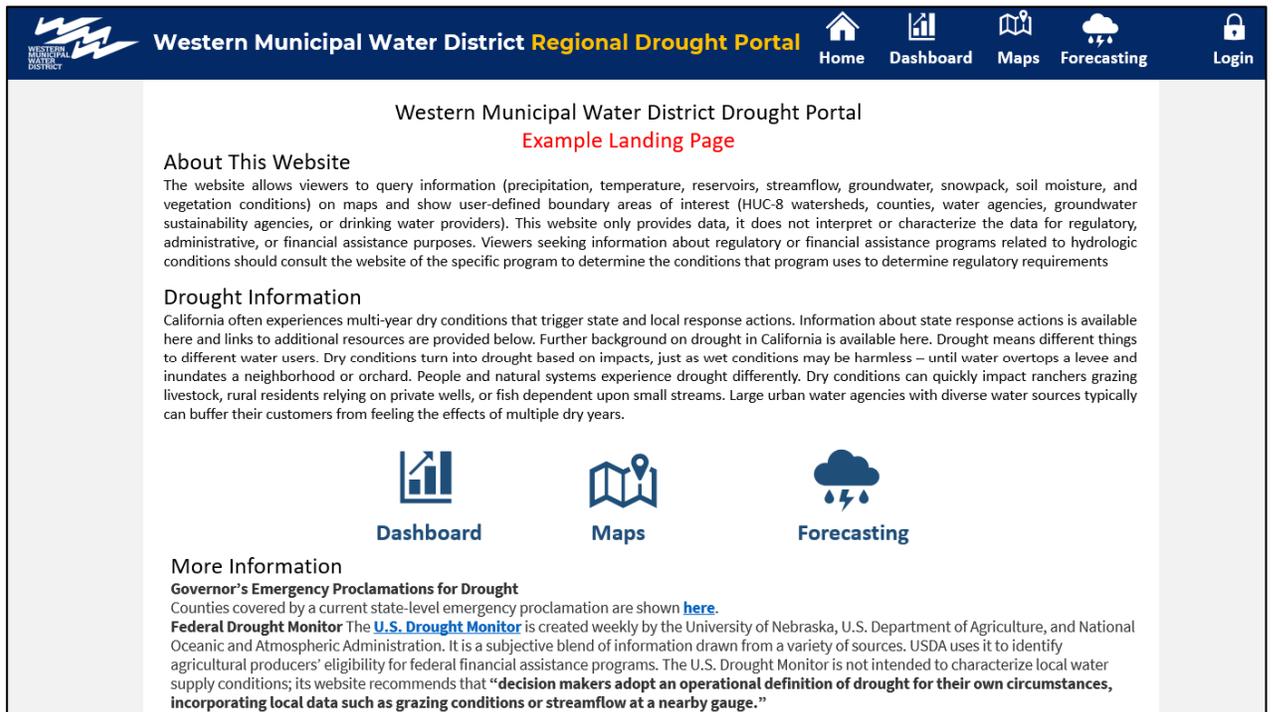
### 3 Regional Coordination and Framework

This section outlines the coordination and information sharing frameworks for predicting the probability of future droughts or confirming an existing drought, which include a Regional Drought Portal and Stakeholder/Drought Task Force meetings. The regional drought portal is also likely to be featured as a mitigation action in the DCP as to assist the region in reducing the future impacts of drought. These frameworks were developed in collaboration with the Drought Task Force based on feedback received at the August 23, 2021 virtual Drought Task Force workshop, with the goals of supporting existing activities and programs and improving regional collaboration, coordination, and information sharing regarding droughts and shortages. Currently, the regional drought portal is at the conceptual phase, but may be further planned and designed as part of the development of the DCP. Note that the specific roles and responsibilities related to implementation of these frameworks will be provided in the Operational and Administrative Framework to be developed at a later stage of the DCP process.

#### 3.1 Develop a Regional Drought Portal

The Regional Drought Portal (portal) would provide a platform to post, collect, and disseminate key datasets identified as being pertinent to regional drought planning and response. In addition, regional stakeholders could post messages and updates to be shared with the Drought Task Force members. To accommodate both public accessibility and coordination around potentially sensitive topics, it is proposed that the portal include a public facing feature as well as the functionality to allow task force members to log in and communicate and share internally. A mock-up of the regional portal has been prepared for the purposes of this TM (see Appendix A) and the potential landing page is shown below in Figure 3-1.

This portal could be designed consistent with DWR's California Water Watch, which includes many of the datasets, features, and components described below. Western could leverage this existing framework and incorporate supplemental data as needed to custom-build this portal such that it includes information that is pertinent to Western and the region as a whole. Additional information for DWR's California Water Watch is provided in Section 3.2.2.2.



**Figure 3-1: Conceptual Regional Drought Portal Landing Page**

### 3.1.1 Potential Datasets

There are several potential datasets for inclusion into the portal that could help facilitate a better understanding of local and statewide conditions. The datasets listed below were developed based on engagement with the Drought Task Force. Some of the datasets are published by third parties and, where appropriate, links would be provided to the source. Uploading other agreed upon datasets and information would be facilitated by standardized forms and templates on the portal.

#### 3.1.1.1 Datasets to Indicate Local Conditions

Groundwater levels and precipitation are two key datasets that could be incorporated into the portal to assess local conditions. Wells and rain gages to be included in the portal will be determined at a later date once the portal is scoped and piloted, but potential mock-ups of how groundwater and precipitation-related data could be displayed in the portal are shown in Figure 3-2 through Figure 3-6.

For those wells that are selected for inclusion into the portal, via DWR’s SGMA data viewer, there is the potential to depict:

- Groundwater levels relative to normal conditions at a regional scale (as shown in Figure 3-2)
- Groundwater surface elevations (as shown Figure 3-3) along with other key attributes for each well including well use type, well completion type, and total depth
- Monthly median groundwater levels (as shown in Figure 3-4)

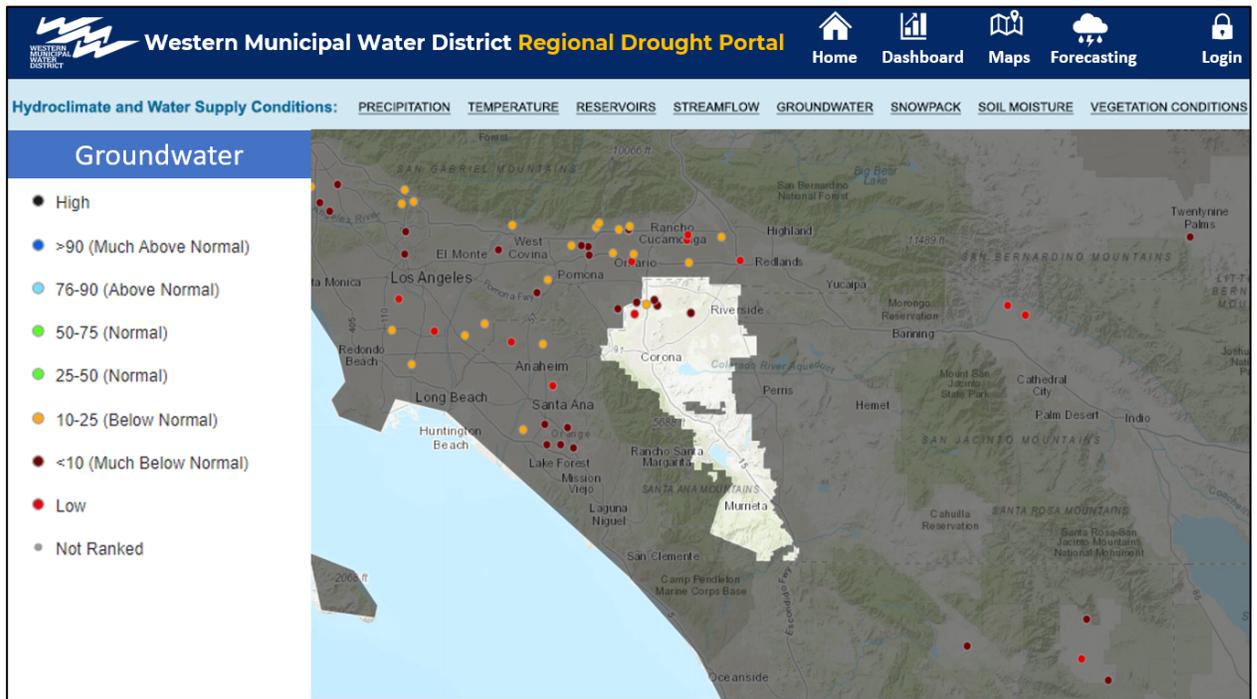


Figure 3-2: Conceptual Regional Drought Portal Depicting Regional Groundwater Levels

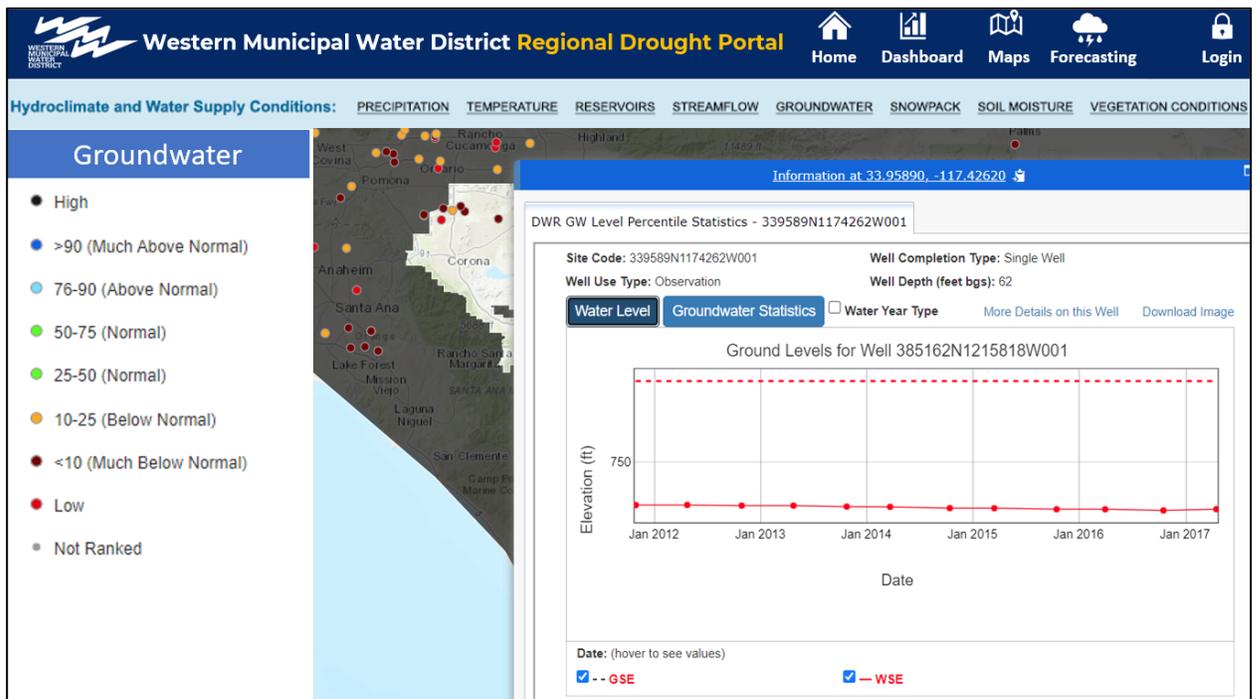
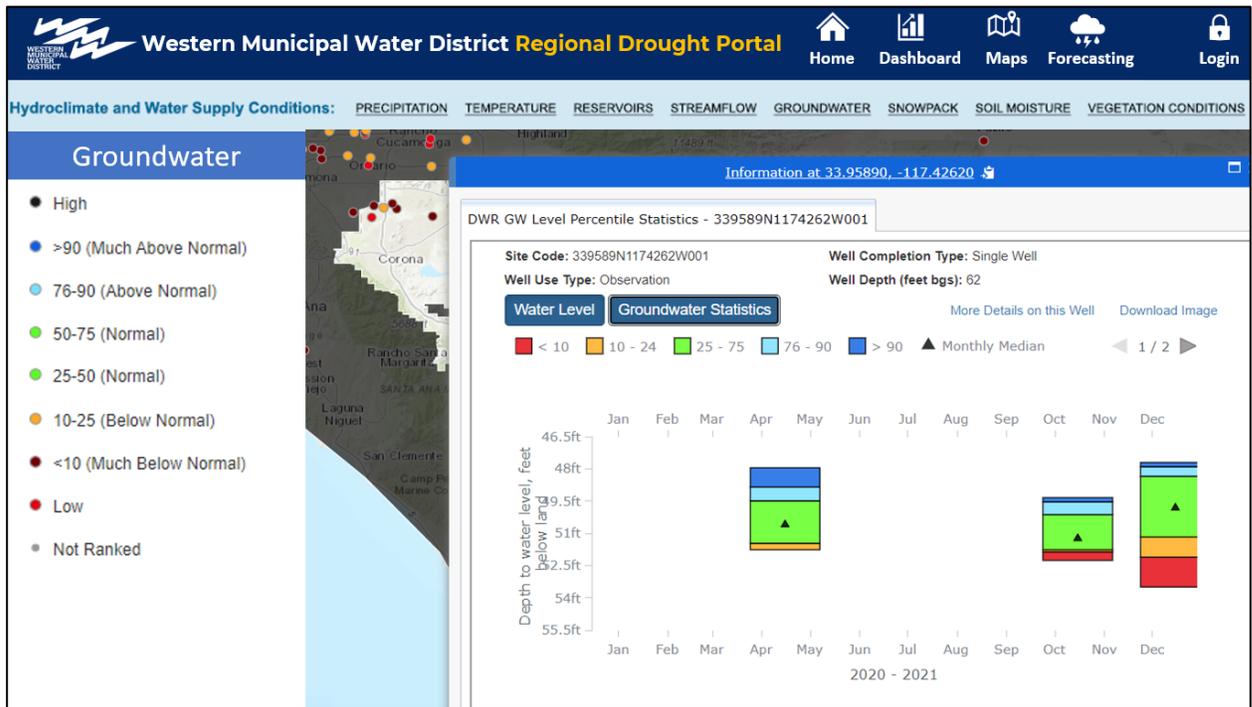


Figure 3-3: Conceptual Regional Drought Portal Depicting Groundwater Levels at the Local Level



**Figure 3-4: Conceptual Regional Drought Portal Depicting Monthly Median Groundwater Levels at the Local Level**

DWR’s SGMA data viewer includes data for those groundwater basins that are required to report data to DWR under SGMA. Other data sources would need to be explored for basins outside of this dataset.

Precipitation-related statistics for those rain gages selected for inclusion into the portal could be incorporated as follows:

- Total annual precipitation relative to the historical maximum, long-term mean, and historical minimum (as shown in Figure 3-5)
- Annual accumulation of precipitation by month relative to average (as shown in Figure 3-5). Data could also be manipulated to show the cumulative departure from the long-term mean.
- Annual average accumulation of precipitation by month relative to past water years (as shown in Figure 3-6)

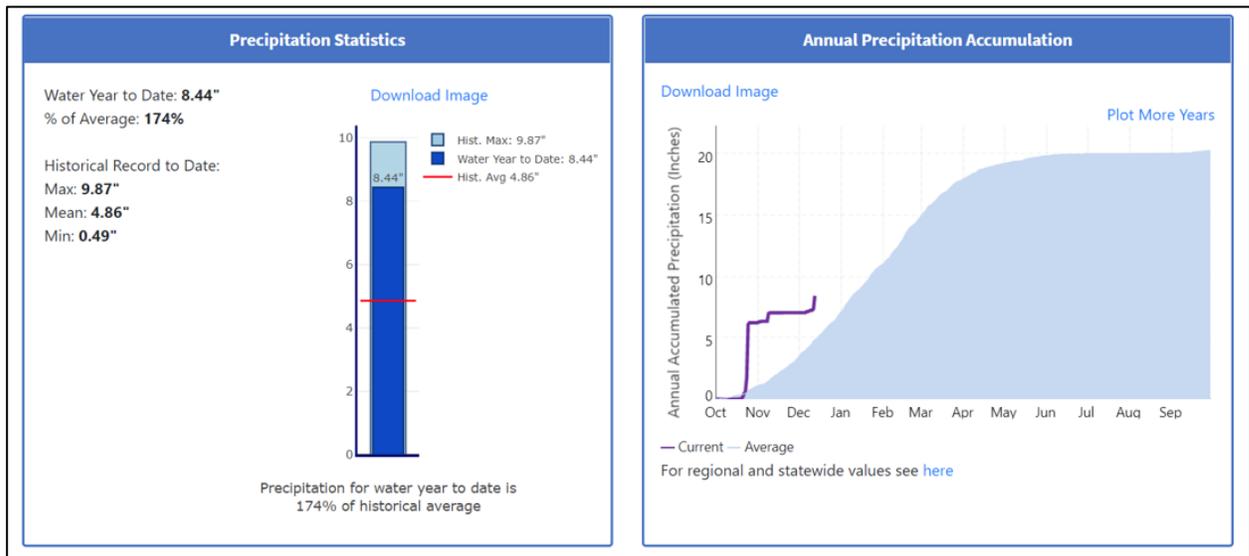


Figure 3-5: Conceptual Regional Drought Portal Depicting Local Precipitation Relative to Historical and Average

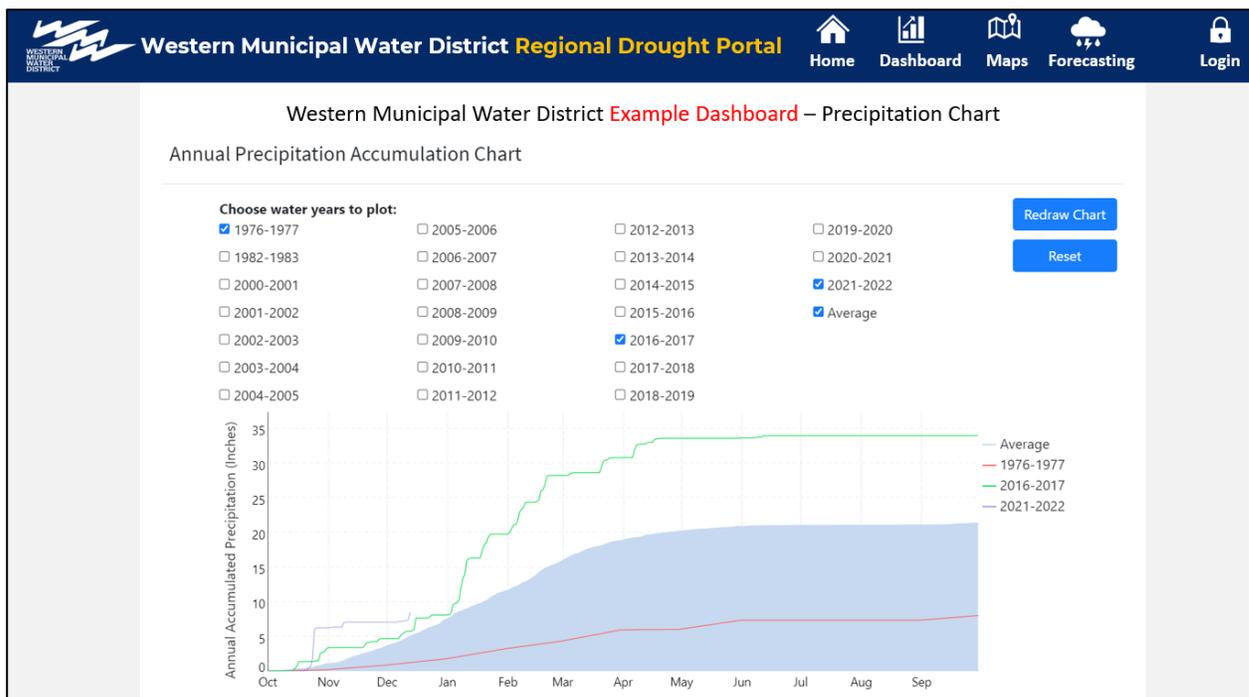


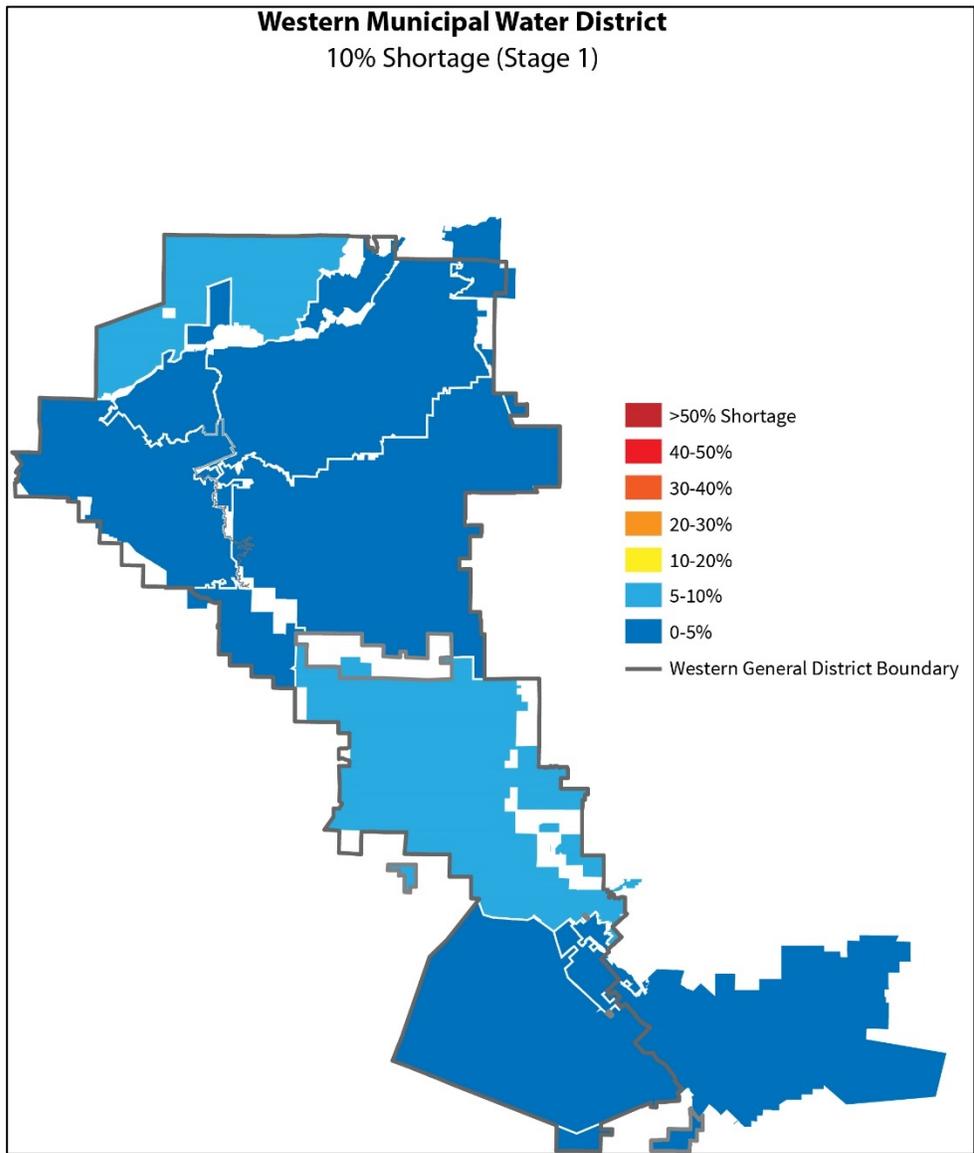
Figure 3-6: Conceptual Regional Drought Portal Depicting Annual Average Accumulation of Precipitation by Month Relative to Past Water Years

Precipitation data is available via the Parameter-elevation Regressions on Independent Slopes Model (PRISM) climate mapping system through Oregon State University. A licensing agreement with Oregon State University would be required to acquire this dataset. Other data sources might need to be explored once the rain gages for inclusion into the portal have been defined.

Other local datasets that could be incorporated into the regional portal include:

- MWD WSAP level
- MWD storage levels
- MWD delivered volumes
- Riverside County drought declaration status
- Supply and demand projections (i.e., Results from the Annual Assessments)
- Gallons per capita per day
  - a. This metric could be included on an individual agency basis or on a regional basis and is included as a reference for agencies to track responses in times of drought and shortage and to gage the relative effectiveness of their conservation efforts.
- Agency shortages

Shortages could be shown graphically on a map indicating individual shortage levels based on agency WSCP stages. This information would be updated by the regional stakeholders who would post on the portal when a shortage stage is declared in their service area. The map would then reflect that information (Figure 3-7).



**Figure 3-7: Conceptual Regional Drought Portal Depicting Regional WSCP Drought Stages**

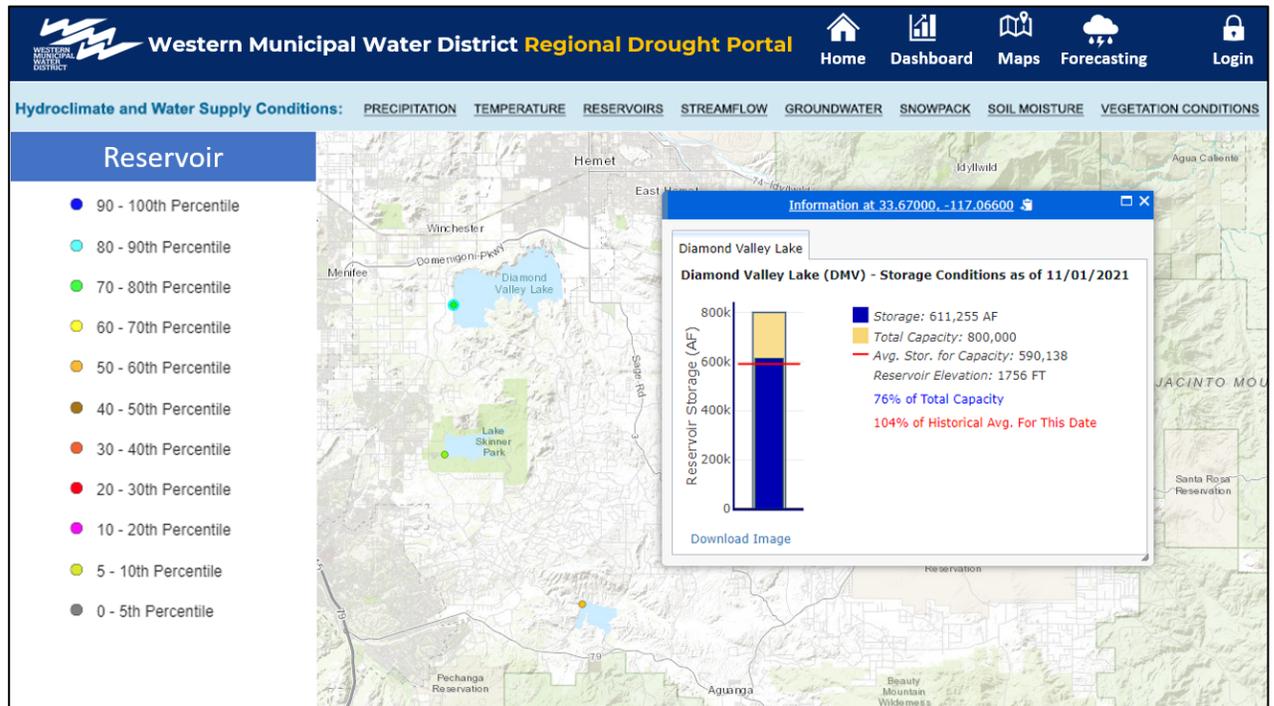
Links to the MWD data and the Riverside County drought declaration status, which are updated by a third party, would be provided within the portal. Projections and anticipated shortages would be updated manually by agencies on an annual basis, and as needed based on the Annual Assessment results and current WSCP stage of each agency.

**3.1.1.2 Datasets to Indicate Statewide Conditions**

Reservoir levels is one key dataset that could be incorporated into the Regional Drought Portal to assess statewide conditions. Reservoirs to be included in the portal will be determined at a later date once the portal is scoped and piloted, which will likely include major reservoirs in the Sacramento and Colorado River basins and local/regional reservoirs. A potential mock-up of how data for these reservoirs could be displayed in the portal is shown in Figure 3-8, including:

- Current storage (volume and percent of total capacity)
- Total capacity
- Average storage
- Reservoir elevation
- Reservoir's current water level relative to historical average

Some reservoir data in California could be acquired through the DWR California Data Exchange Center (CDEC) for those reservoirs that have daily water level or storage data available. Other data sources would need to be explored to include reservoirs outside of this dataset.



**Figure 3-8: Conceptual Regional Drought Portal Depicting Local Reservoir Levels**

Other key statewide datasets that could be incorporated into the regional portal include:

- Current year State Water Project (SWP) Allocation
- Colorado River DCP Stage
- Regional drought indices
  - The U.S. Drought Monitor
  - California Water Watch (see Section 3.2.2.2 below)
  - Palmer Drought Indices
- Counties in the state with drought emergency proclamations, which could be displayed graphically on a map (Figure 3-9)



**Figure 3-9: Conceptual Regional Drought Portal Depicting Counties Covered by a Current State-level Drought Emergency Proclamation**

Links to the current year SWP allocation, Colorado River DCP Stage, and regional drought indices, which are updated by a third party, would be provided within the portal. The map displaying the number of counties statewide with a drought emergency proclamation would be provided within the portal and updated automatically.

### 3.2 Framework for Regional Coordination and Drought Monitoring

In addition to the information sharing framework that is proposed as part of the Regional Drought Portal, the Drought Task Force will assemble periodically following adoption of the DCP to further share information, collaborate, and coordinate. The Drought Task Force would be convened at a frequency to be determined based on the conditions in the region and within the supply catchment areas. The below descriptions of the indicator data, triggers, and meeting frequency are intended to generate discussion with the expectation that all will be refined based on input from Western and the Drought Task Force members.

#### 3.2.1 Meeting Goals

The meetings would provide a forum for the members to review data, share updates, and coordinate drought responses and messaging. Specific messaging and messaging strategies will be covered in greater detail in the response actions, which is another element of the DCP.

### 3.2.2 Indicators for Meeting Frequency

While there is an abundance of local and regional data available to inform the task force about drought conditions, it is difficult to identify a subset of data that is both efficient to compile and relevant to the majority of the Drought Task Force. Therefore, meeting frequency will be established based on drought conditions as defined by:

- The U.S. Drought Monitor (which is produced in collaboration between the U.S. Drought Monitor National Drought Mitigation Center, the U.S. Department of Agriculture, and the National Oceanic and Atmospheric Administration)
- California Water Watch
- Implementation of the MWD WSAP
- Governor of California Statewide Drought Emergency Proclamation in Riverside County
- The percentages of the agencies in the region experiencing shortage

#### 3.2.2.1 U.S. Drought Monitor

The U.S. Drought Monitor is a map produced on a weekly basis showing the parts of the U.S. that are in drought. The map is produced by several authors from the National Drought Mitigation Center, the U.S. Department of Agriculture, and the National Oceanic and Atmospheric Administration using various numerical inputs and ground truthing using hundreds of observers across the country. The map uses five classifications, D0 through D4, as shown in Table 3-1.

**Table 3-1: U.S. Drought Monitor Categories and Associated Potential Impacts**

Category	Description	Possible Impacts
<b>D0</b>	Abnormally Dry	<p><u>Going into drought:</u></p> <ul style="list-style-type: none"> <li>• Short-term dryness slowing planting, growth of crops or pastures</li> </ul> <p><u>Coming out of drought:</u></p> <ul style="list-style-type: none"> <li>• Some lingering water deficits</li> <li>• Pastures or crops not fully recovered</li> </ul>
<b>D1</b>	Moderate Drought	<ul style="list-style-type: none"> <li>• Some damage to crops, pastures</li> <li>• Streams, reservoirs, or wells low, some water shortages developing or imminent</li> <li>• Voluntary water-use restrictions requested</li> </ul>
<b>D2</b>	Severe Drought	<ul style="list-style-type: none"> <li>• Crop or pasture losses likely</li> <li>• Water shortages common</li> <li>• Water restrictions imposed</li> </ul>
<b>D3</b>	Extreme Drought	<ul style="list-style-type: none"> <li>• Major crop/pasture losses</li> <li>• Widespread water shortages or restrictions</li> </ul>
<b>D4</b>	Exceptional Drought	<ul style="list-style-type: none"> <li>• Exceptional and widespread crop/pasture losses</li> <li>• Shortages of water in reservoirs, streams, and wells creating water emergencies</li> </ul>

### 3.2.2.2 California Water Watch

DWR has developed the California Water Watch, a website that brings together data from a variety of sources to allow viewers to obtain a quick snapshot of the state's water conditions at the scale of their local watershed. The website allows viewers to query information (precipitation, temperature, reservoirs, streamflow, groundwater, snowpack, soil moisture, and vegetation conditions) on maps and show user-defined boundary areas of interest (Hydrologic Unit Code-8 watersheds, counties, water agencies, groundwater sustainability agencies, or drinking water providers). The website was released to the public in early January and is available at: <https://cww.water.ca.gov/>

### 3.2.2.3 MWD WSAP Implementation

As shown previously in Table 2-1, MWD's WSAP identifies ten levels of shortage designed to reduce demands by up to 50 percent. Based on the level of shortage, MWD adjusts each member agency's minimum allocation, and provides a retail impact adjustment to ensure that agencies with a high level of dependence on MWD are not impacted inequitably at the retail level when compared to other agencies. These values are summarized in Table 3-2.

**Table 3-2: MWD WSAP Adjustments by Shortage Level**

<b>WSAP Regional Shortage Level</b>	<b>Approximate Percent Reduction</b>	<b>Wholesale Minimum Percentage</b>	<b>Maximum Retail Impact Adjustment Percentage</b>
1	5%	92.5%	2.5%
2	10%	85.0%	5.0%
3	15%	77.5%	7.5%
4	20%	70.0%	10%
5	25%	62.5%	12.5%
6	30%	55.0%	15.0%
7	35%	47.5%	17.5%
8	40%	40.0%	20.0%
9	45%	32.5%	22.5%
10	50%	25.0%	25%

### 3.2.2.4 Governor of California Statewide Drought Emergency Proclamation

In times of drought, and in anticipation of related impacts, the Governor of California has the authority to issue a Proclamation of a State of Emergency due to drought on a county-by-county basis. As of October 19, 2021, all 58 counties in California, including Riverside County, are under a drought emergency declaration. These declarations ease environmental and other regulations to speed drought responses.

### 3.2.2.5 Agencies within the Western Service Area with Declared Shortage

There is a total of 14 agencies included in this regional DCP and the percentage of agencies in a declared shortage will inform the frequency of the task force meetings. Note that, of the 14 agencies, three are not required to prepare a UWMP and accompanying WSCP, including Box Springs Mutual Water Company, Eagle Valley Mutual Water Company, and Santa Ana River Water Company. As a result, these agencies do not rely on the WSCP framework to declare shortages.

### 3.2.3 Regional Triggers and Stages for Drought Task Force Meetings

Table 3-3 outlines the criteria and triggers for convening the Drought Task Force based on the conditions in the region and within the supply catchment areas. If one or more triggers is met, the meeting frequency will be increased to the corresponding interval.

**Table 3-3: Regional Triggers and Stages for Drought Task Force Meetings**

Regional Drought Stage	Meeting Frequency	Triggers				
		Drought Monitor (DCP Region)	MWD WSAP/ Similar Action	Agencies in Declared Shortage*	Statewide Drought Proclamation	Riverside County Drought Proclamation
Normal	Annual	None-Abnormally Dry	--	None	--	--
Watch	Quarterly	Moderate-Extreme Drought	Levels 1 and 2	3 or more	Drought	Drought
Alert	Monthly	Exceptional Drought	Levels 3 thru 5	6 or more	Drought	Drought
Emergency	Weekly	Exceptional Drought	Levels 6 and 10	10 or more	Drought	Drought

\* Not including state mandated shortage

## Appendix A: Conceptual Regional Drought Portal

# Western Municipal Water District Regional Drought Portal - Conceptual Design

*This conceptual Regional Drought Portal (portal) has been prepared as part of the development of the regional Drought Contingency Plan (DCP) for Western Municipal Water District (Western). The following slides present a mock-up of this conceptual portal, including a potential landing page and the potential datasets that could be integrated into the portal. Many of the datasets incorporated into this conceptual portal were developed based on engagement with the Drought Task Force. These datasets will be further refined in collaboration with Western and the Drought Task Force once the portal is scoped, planned, and designed.*

# Conceptual Design Outline

The pages that follow address the following components of the potential Regional Drought Portal:

- Landing page
- Dashboard
- Hydroclimate and Water Supply Conditions Maps
- Board of Directors/Summary Dashboard
- Forecasting
- User accessibility

# Landing Page

The landing page would provide an introduction to the website along with pertinent background information and a high level summary of current conditions



## Western Municipal Water District Drought Portal

### Example Landing Page

#### About This Website

The website allows viewers to query information (precipitation, temperature, reservoirs, streamflow, groundwater, snowpack, soil moisture, and vegetation conditions) on maps and show user-defined boundary areas of interest (HUC-8 watersheds, counties, water agencies, groundwater sustainability agencies, or drinking water providers). This website only provides data, it does not interpret or characterize the data for regulatory, administrative, or financial assistance purposes. Viewers seeking information about regulatory or financial assistance programs related to hydrologic conditions should consult the website of the specific program to determine the conditions that program uses to determine regulatory requirements

#### Drought Information

California often experiences multi-year dry conditions that trigger state and local response actions. Information about state response actions is available here and links to additional resources are provided below. Further background on drought in California is available [here](#). Drought means different things to different water users. Dry conditions turn into drought based on impacts, just as wet conditions may be harmless – until water overtops a levee and inundates a neighborhood or orchard. People and natural systems experience drought differently. Dry conditions can quickly impact ranchers grazing livestock, rural residents relying on private wells, or fish dependent upon small streams. Large urban water agencies with diverse water sources typically can buffer their customers from feeling the effects of multiple dry years.



Dashboard



Maps



Forecasting

#### More Information

##### **Governor’s Emergency Proclamations for Drought**

Counties covered by a current state-level emergency proclamation are shown [here](#).

**Federal Drought Monitor** The [U.S. Drought Monitor](#) is created weekly by the University of Nebraska, U.S. Department of Agriculture, and National Oceanic and Atmospheric Administration. It is a subjective blend of information drawn from a variety of sources. USDA uses it to identify agricultural producers’ eligibility for federal financial assistance programs. The U.S. Drought Monitor is not intended to characterize local water supply conditions; its website recommends that **“decision makers adopt an operational definition of drought for their own circumstances, incorporating local data such as grazing conditions or streamflow at a nearby gauge.”**

# Dashboard

The dashboard could provide the following charts/tables:

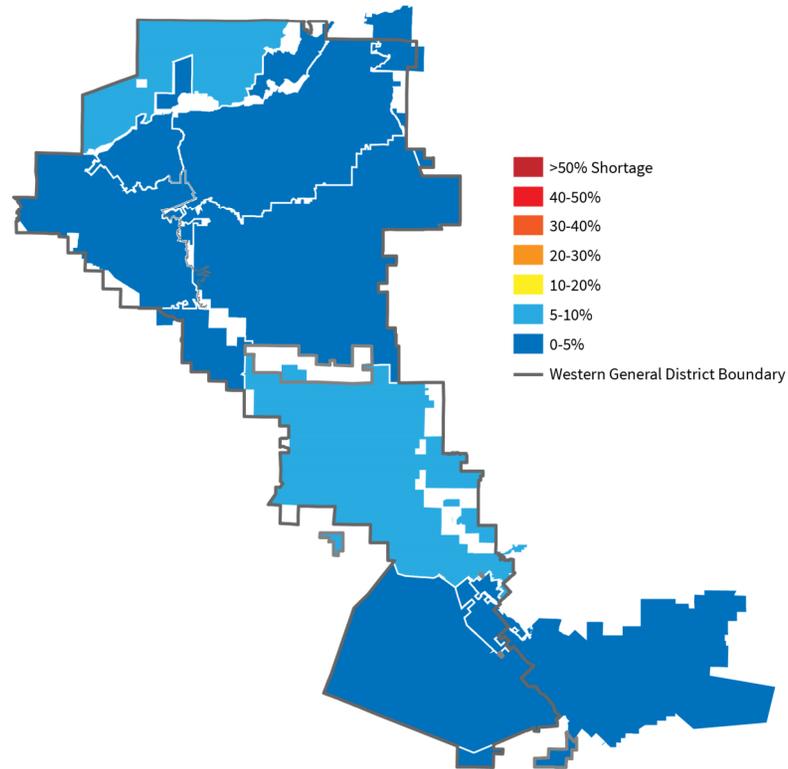
- WSCP stage map
- Water use charts/table
- Precipitation chart
- Temperature chart



## Western Municipal Water District Drought **Example Dashboard** – Drought Stage Map

### Western Municipal Water District

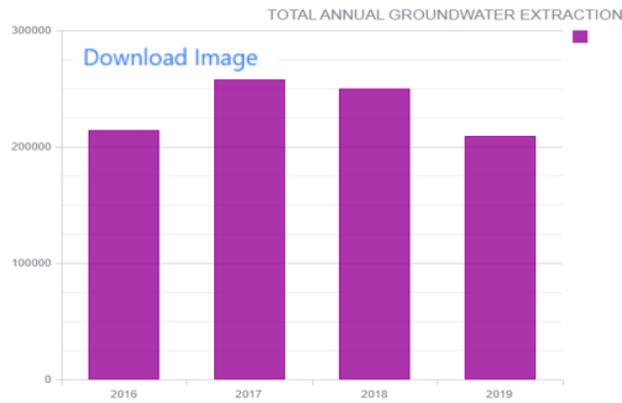
10% Shortage (Stage 1)



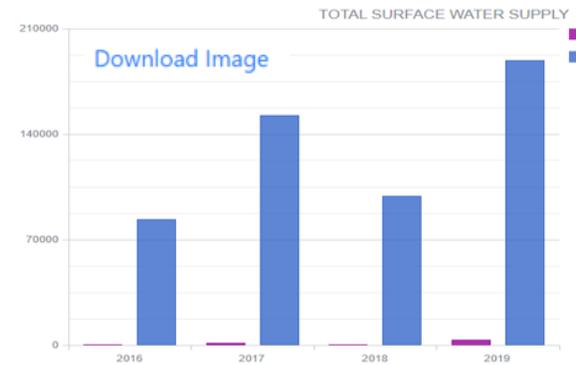


## Western Municipal Water District Drought **Example Dashboard** – Water Use and Groundwater Storage

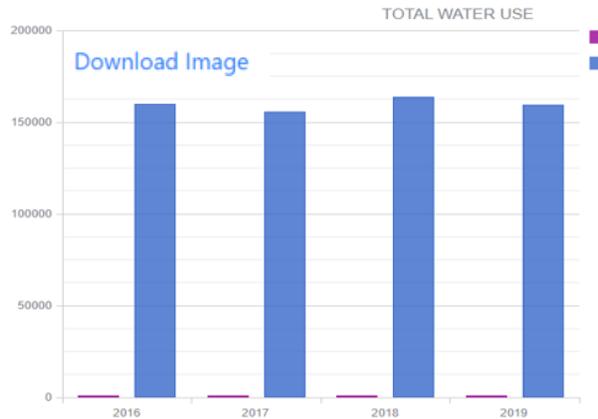
### Groundwater Use



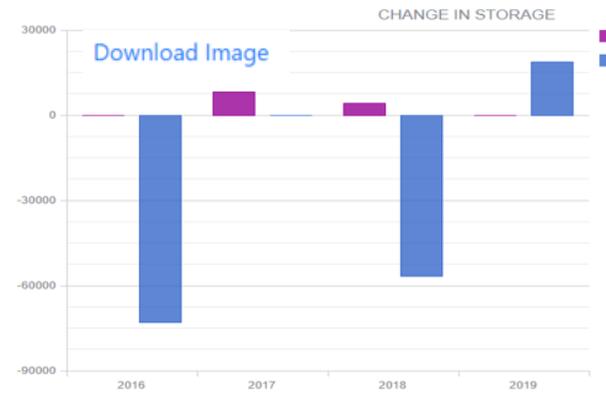
### Total Surface Water Supply



### Total Water Use

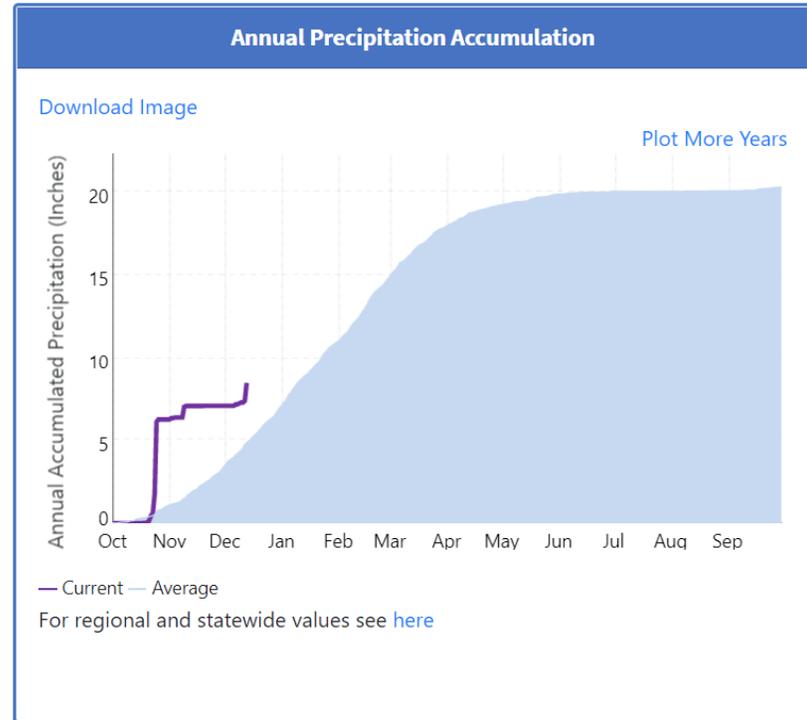
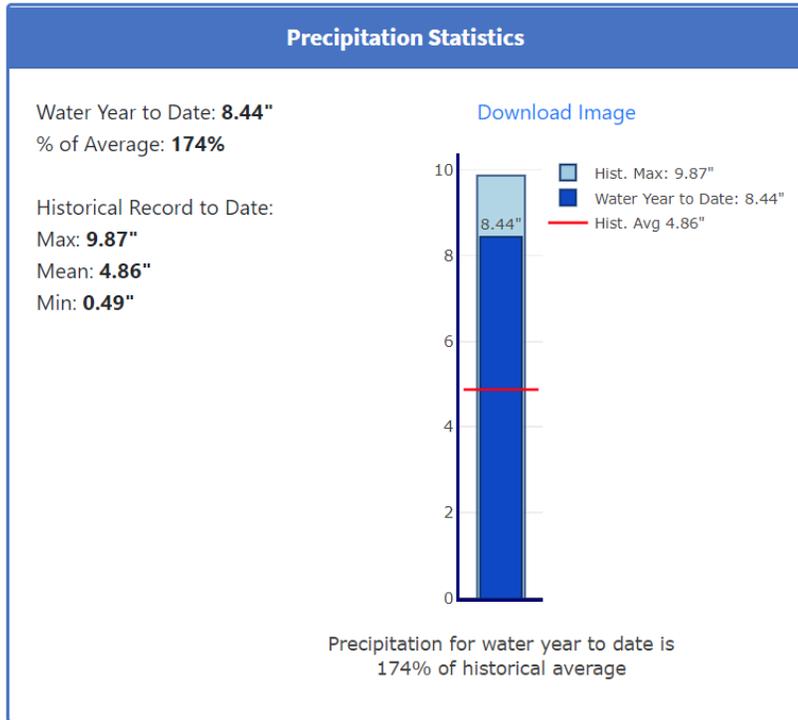


### Change In GW Storage





### Western Municipal Water District **Example Dashboard** – Precipitation Chart





### Western Municipal Water District **Example Dashboard** – Precipitation Chart

#### Annual Precipitation Accumulation Chart

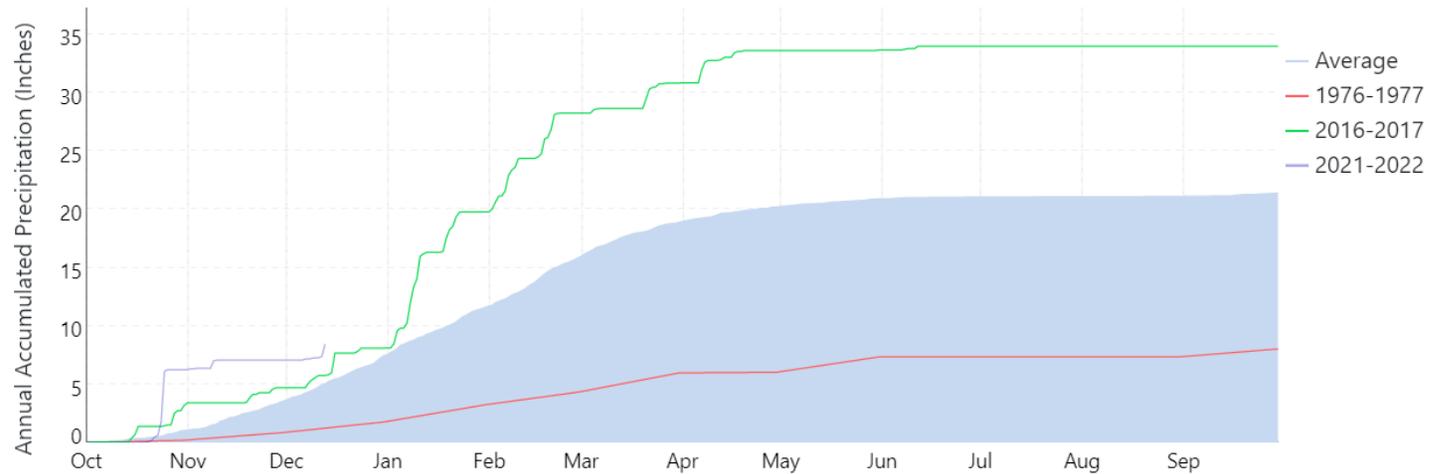
**Choose water years to plot:**

- 1976-1977
- 1982-1983
- 2000-2001
- 2001-2002
- 2002-2003
- 2003-2004
- 2004-2005
- 2005-2006
- 2006-2007
- 2007-2008
- 2008-2009
- 2009-2010
- 2010-2011
- 2011-2012
- 2012-2013
- 2013-2014
- 2014-2015
- 2015-2016
- 2016-2017
- 2017-2018
- 2018-2019
- 2019-2020
- 2020-2021
- 2021-2022
- Average

[Redraw Chart](#)

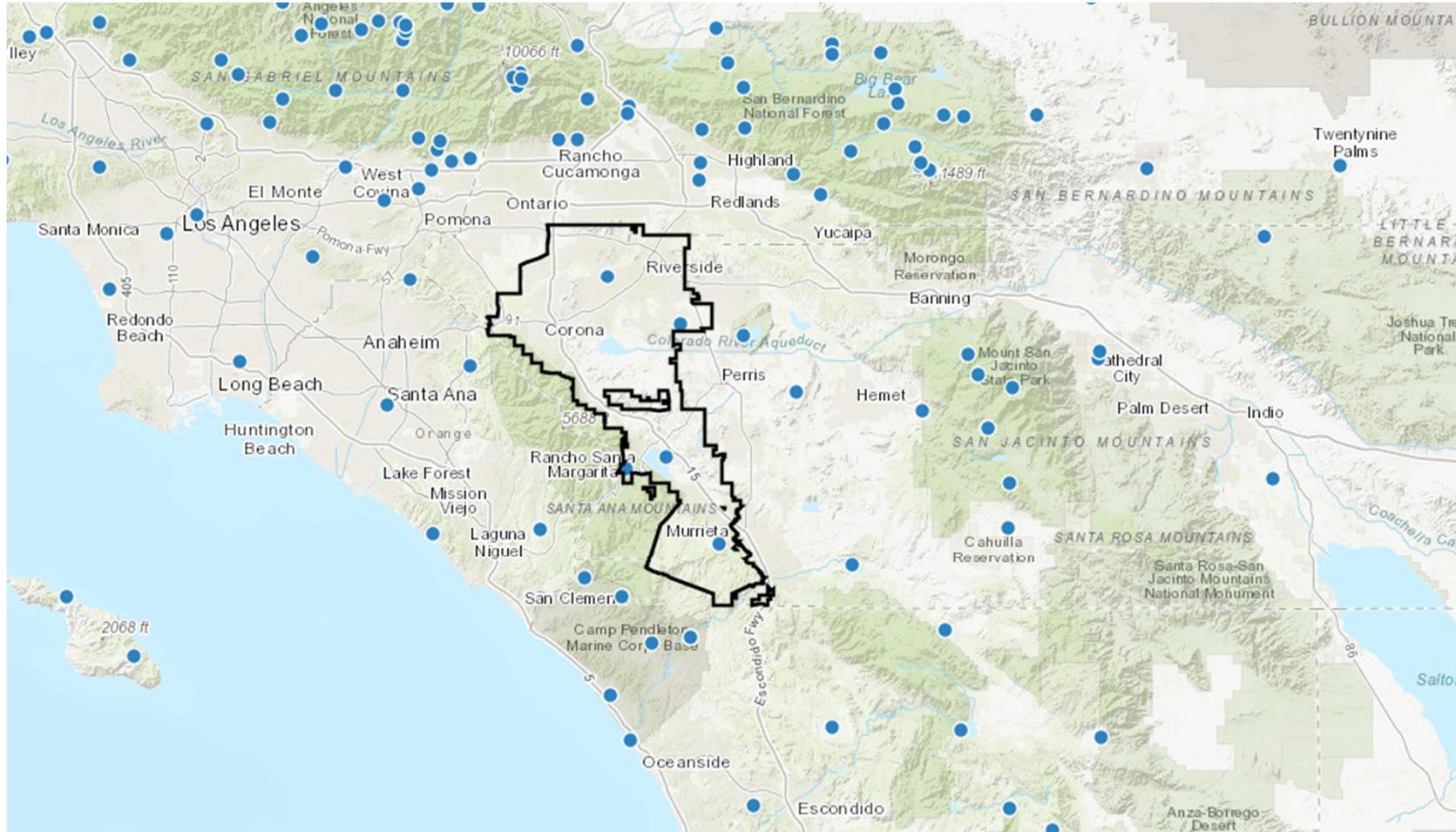
[Reset](#)

[Download Image](#)



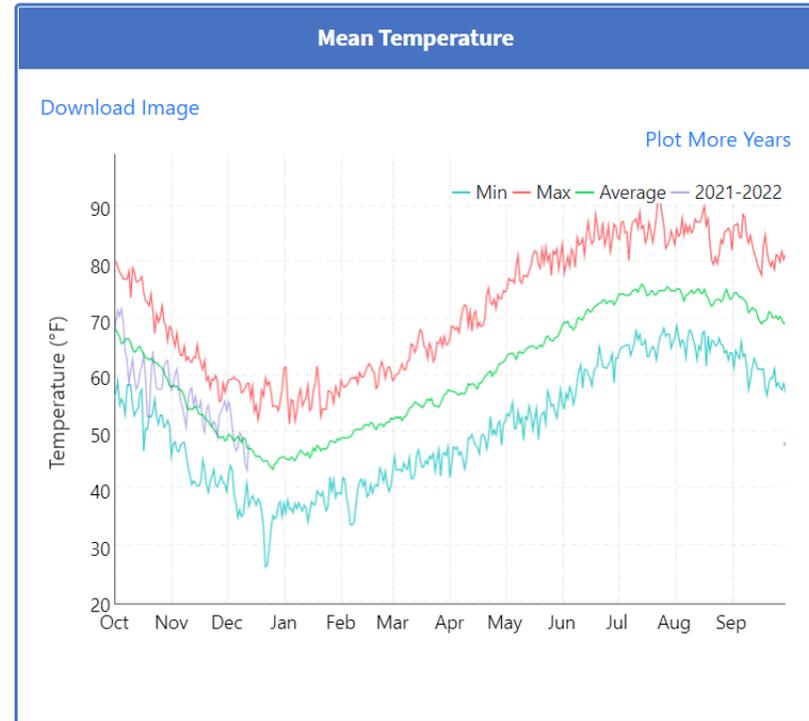
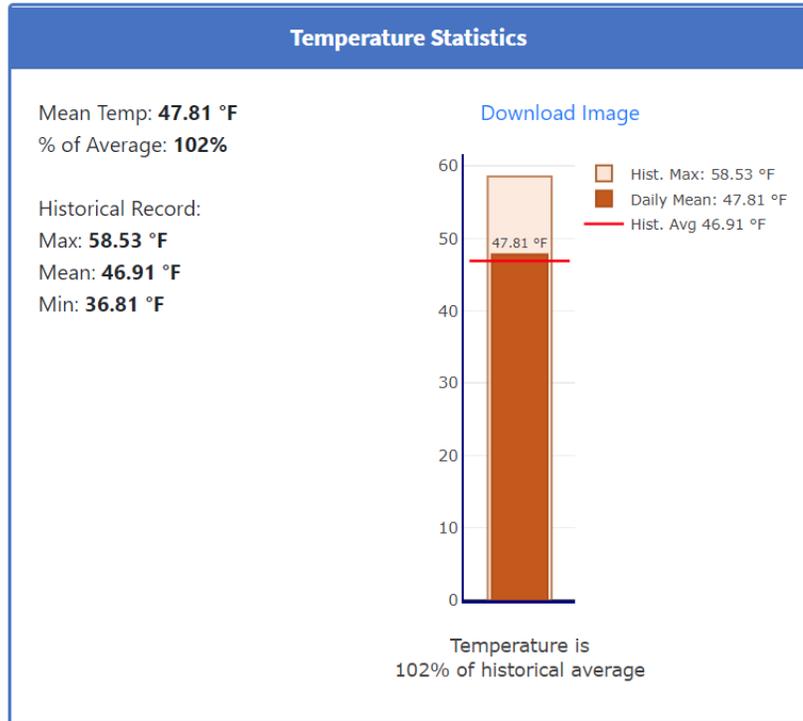


### Western Municipal Water District **Example Dashboard** – Precipitation Station Data





## Western Municipal Water District **Example Dashboard** – Temperature Chart





## Western Municipal Water District **Example Dashboard** – Temperature Chart

### Mean Temperature Chart

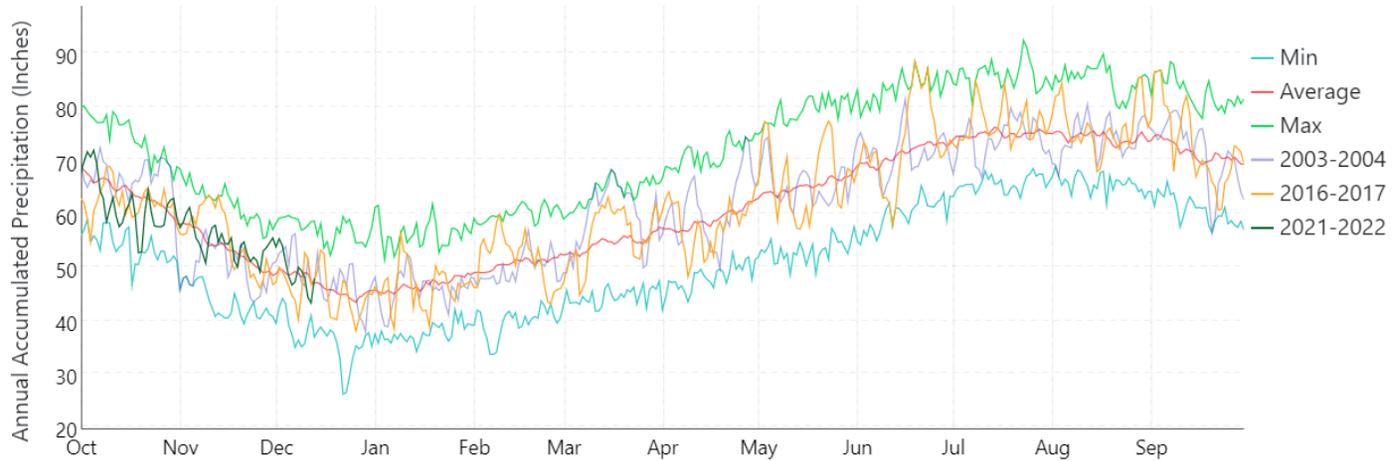
**Choose water years to plot:**

- 2000-2001
- 2001-2002
- 2002-2003
- 2003-2004
- 2004-2005
- 2005-2006
- 2006-2007
- 2007-2008
- 2008-2009
- 2009-2010
- 2010-2011
- 2011-2012
- 2012-2013
- 2013-2014
- 2014-2015
- 2015-2016
- 2016-2017
- 2017-2018
- 2018-2019
- 2019-2020
- 2020-2021
- 2021-2022
- Min
- Average
- Max

Redraw Chart

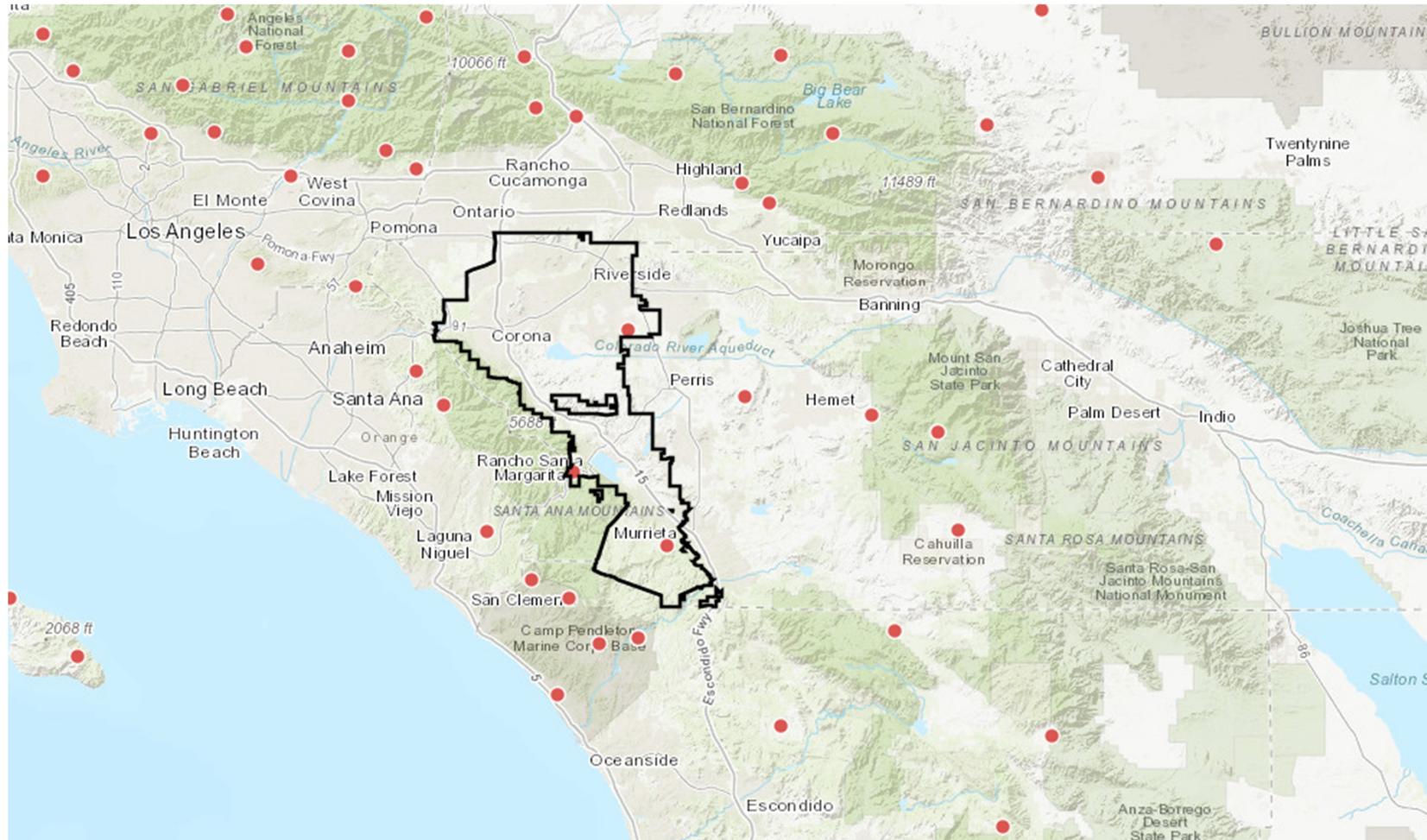
Reset

[Download Image](#)





### Western Municipal Water District **Example Dashboard** – Temperature Station Data



# Hydroclimate and Water Supply Conditions Maps

The Regional Drought Portal could provide a snapshot of hydroclimate and water supply conditions:

- Precipitation
- Temperature
- Reservoir
- Streamflow
- Snowpack
- Groundwater



Home



Dashboard



Maps

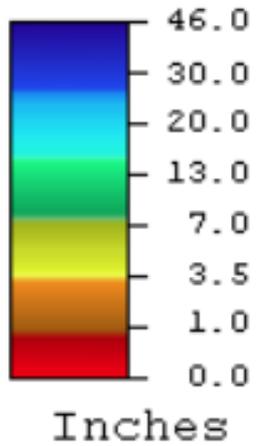


Forecasting



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## Precipitation

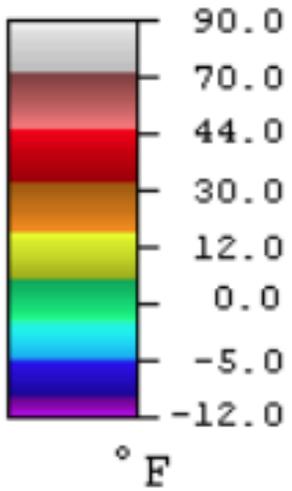


**Source:** Parameter-elevation Regressions on Independent Slopes Model (PRISM) Dataset Licensed from Oregon State University

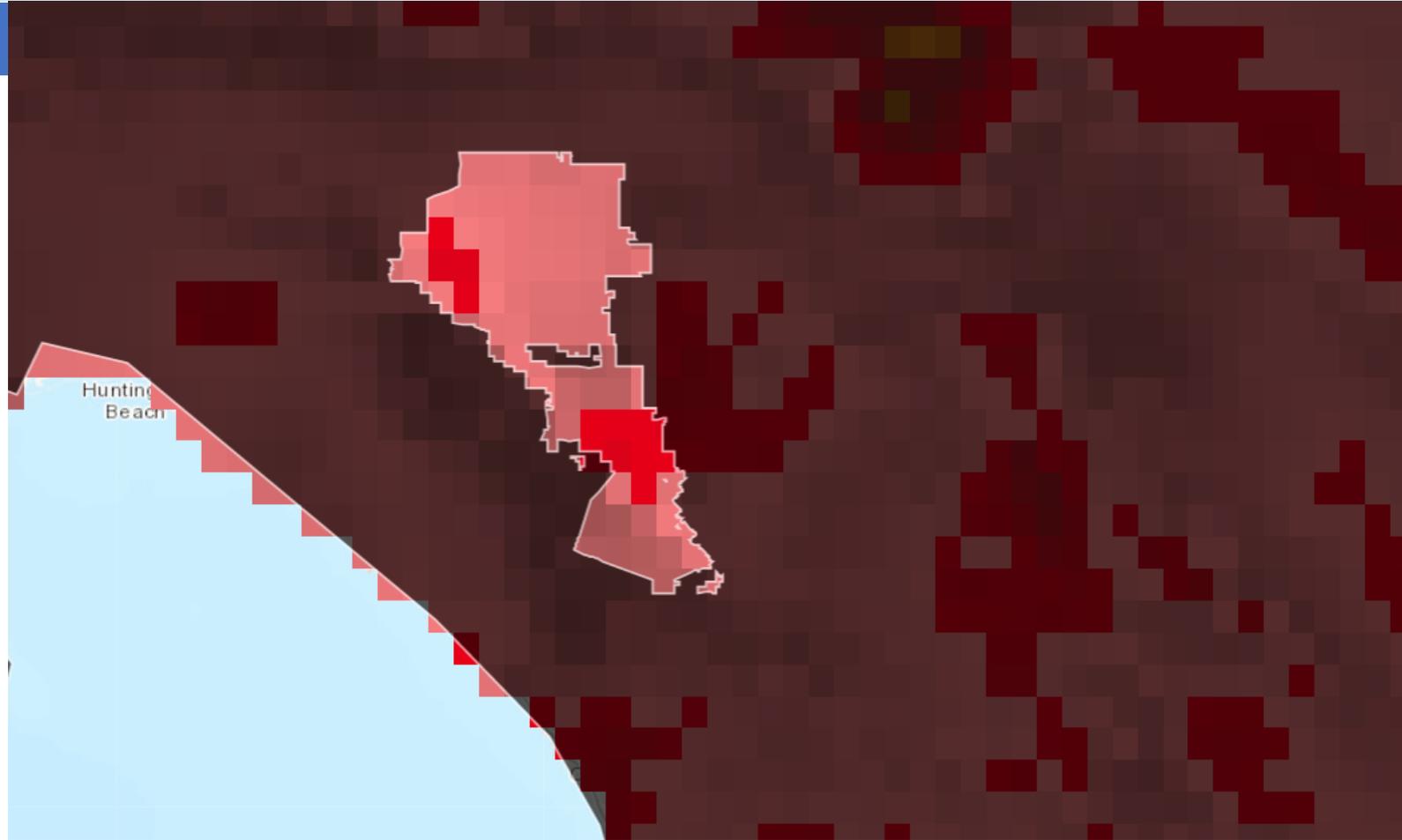




## Temperature



**Source:** Parameter-elevation Regressions on Independent Slopes Model (PRISM) Dataset Licensed from Oregon State University





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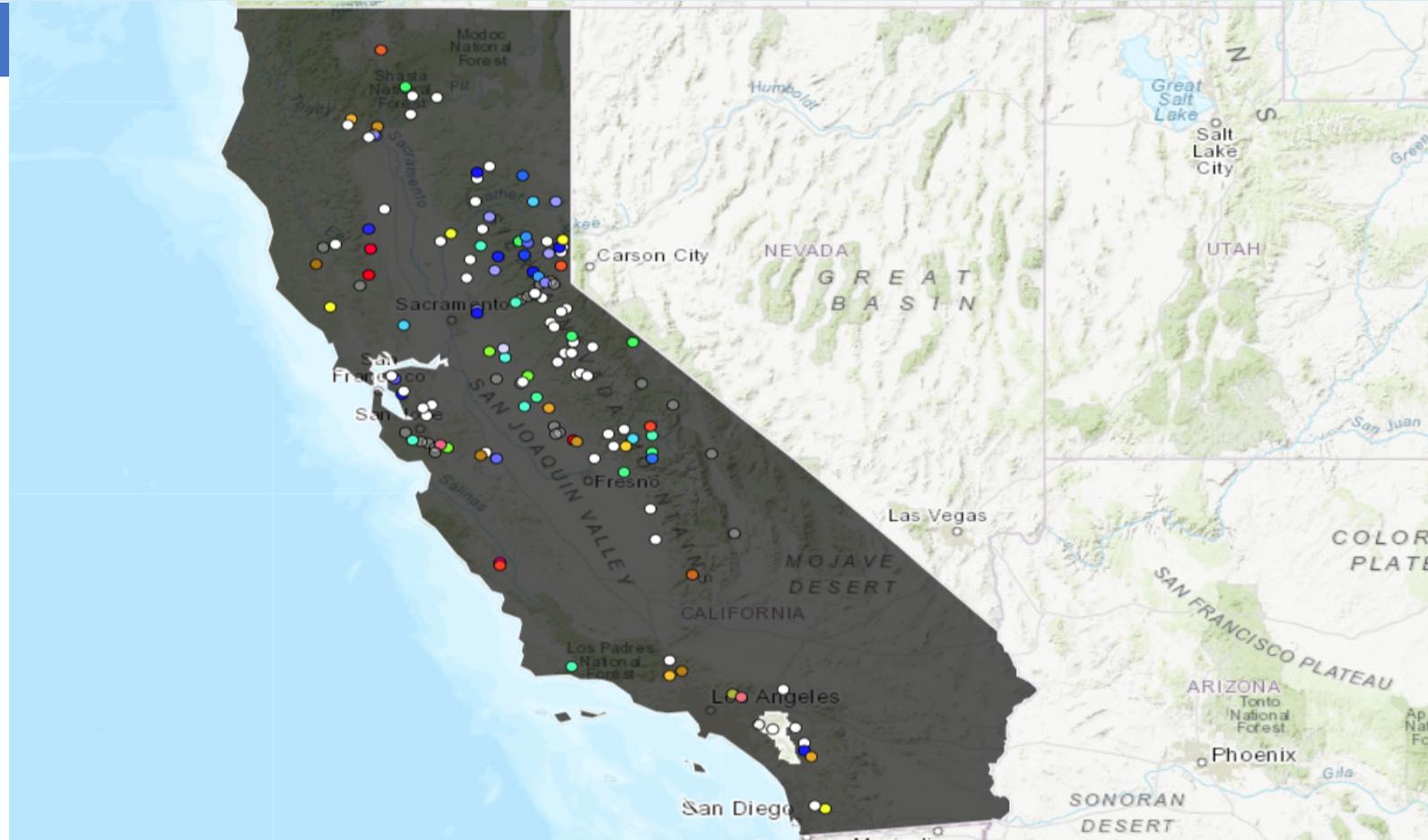
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## Reservoir

- 90 - 100th Percentile
- 80 - 90th Percentile
- 70 - 80th Percentile
- 60 - 70th Percentile
- 50 - 60th Percentile
- 40 - 50th Percentile
- 30 - 40th Percentile
- 20 - 30th Percentile
- 10 - 20th Percentile
- 5 - 10th Percentile
- 0 - 5th Percentile

**Source:** DWR California Data Exchange Center (CDEC) for those reservoirs that have daily water level or storage data available





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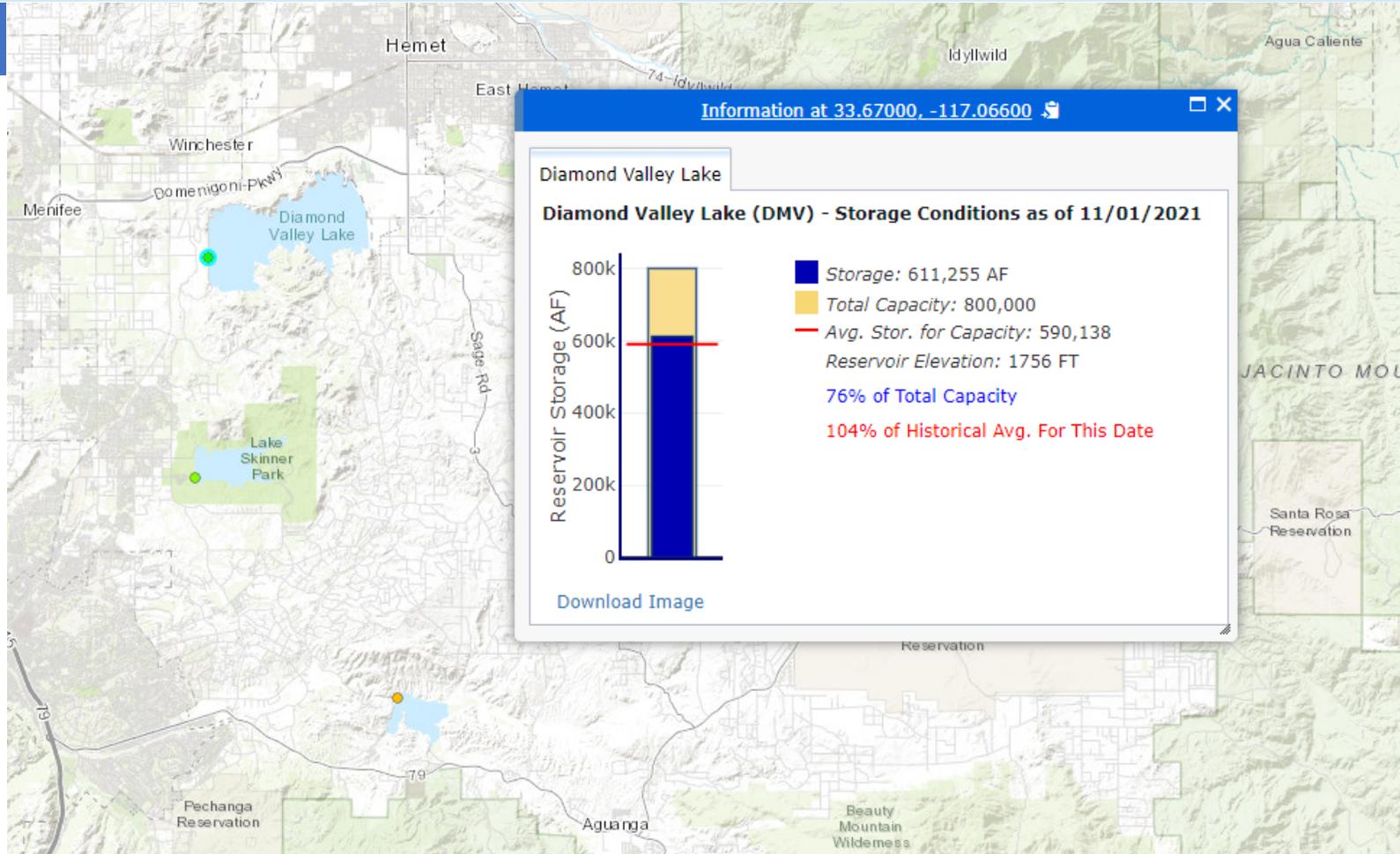


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## Reservoir

- 90 - 100th Percentile
- 80 - 90th Percentile
- 70 - 80th Percentile
- 60 - 70th Percentile
- 50 - 60th Percentile
- 40 - 50th Percentile
- 30 - 40th Percentile
- 20 - 30th Percentile
- 10 - 20th Percentile
- 5 - 10th Percentile
- 0 - 5th Percentile

**Source:** DWR California Data Exchange Center (CDEC) for those reservoirs that have daily water level or storage data available

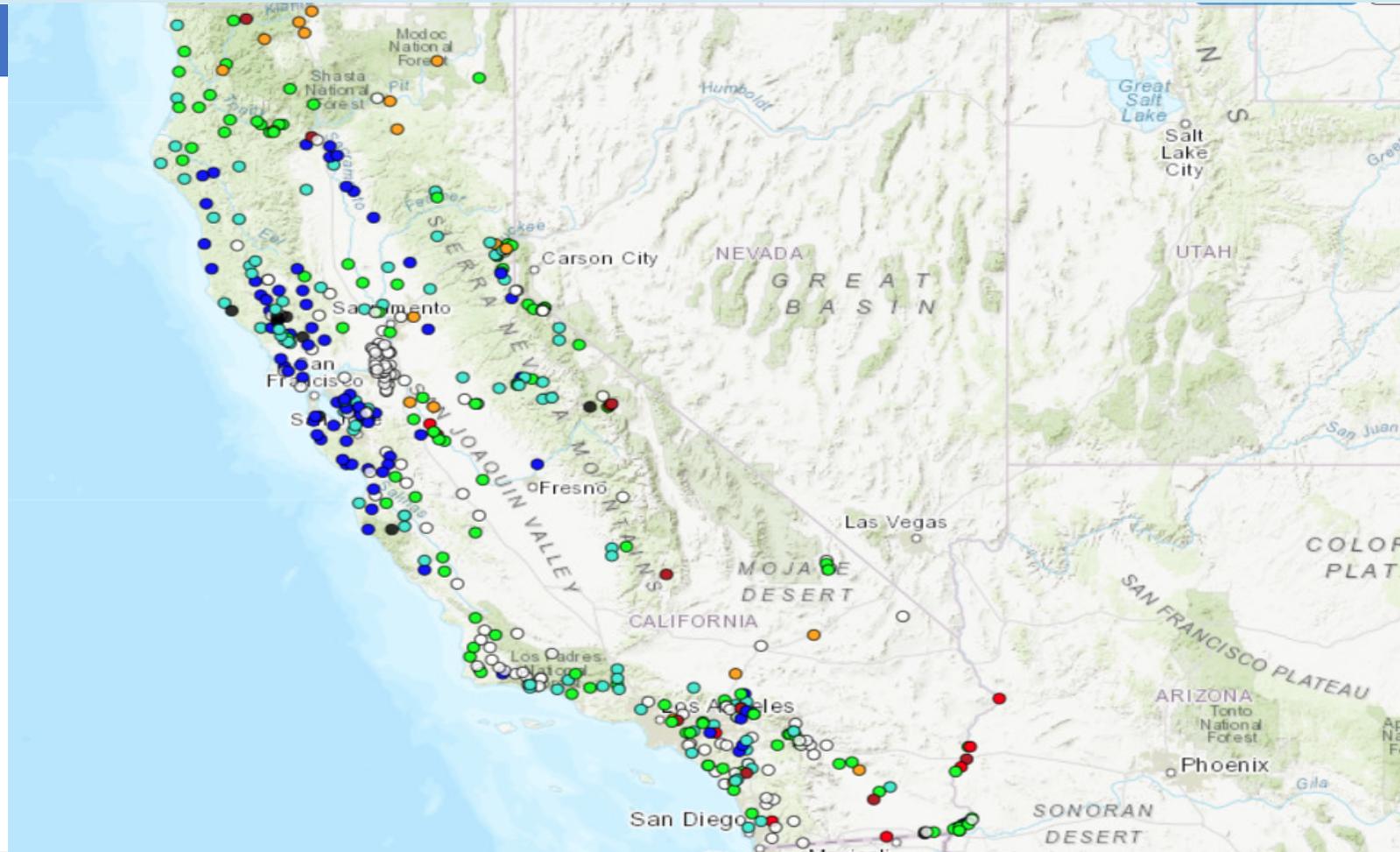




## Streamflow

- High
- > 90th Percentile
- 76th - 90th Percentile
- 25th - 75th Percentile
- 10th - 24th Percentile
- < 10th Percentile
- Low
- Not Ranked

Source: USGS





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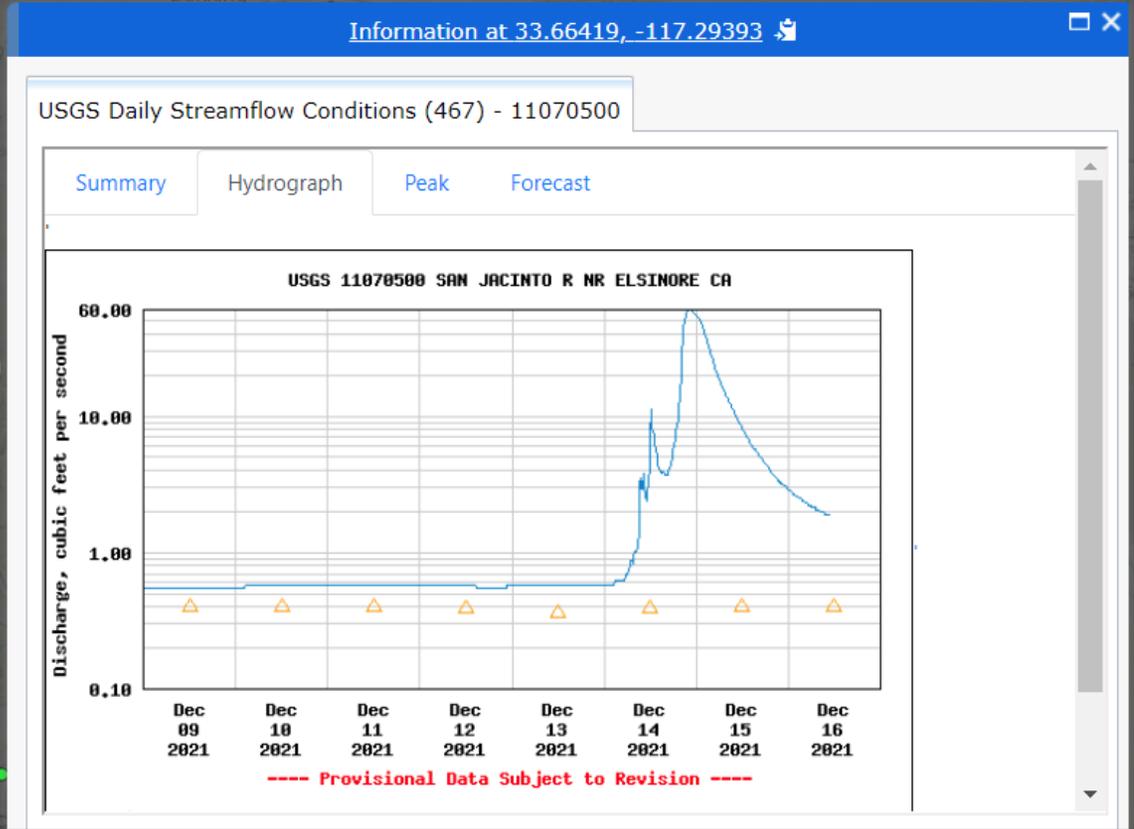
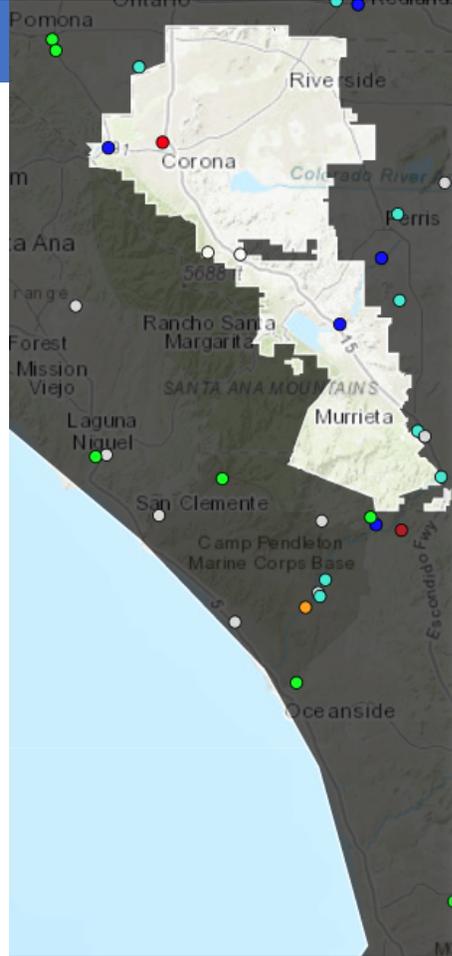


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## Streamflow

- High
- > 90th Percentile
- 76th - 90th Percentile
- 25th - 75th Percentile
- 10th - 24th Percentile
- < 10th Percentile
- Low
- Not Ranked

Source: USGS

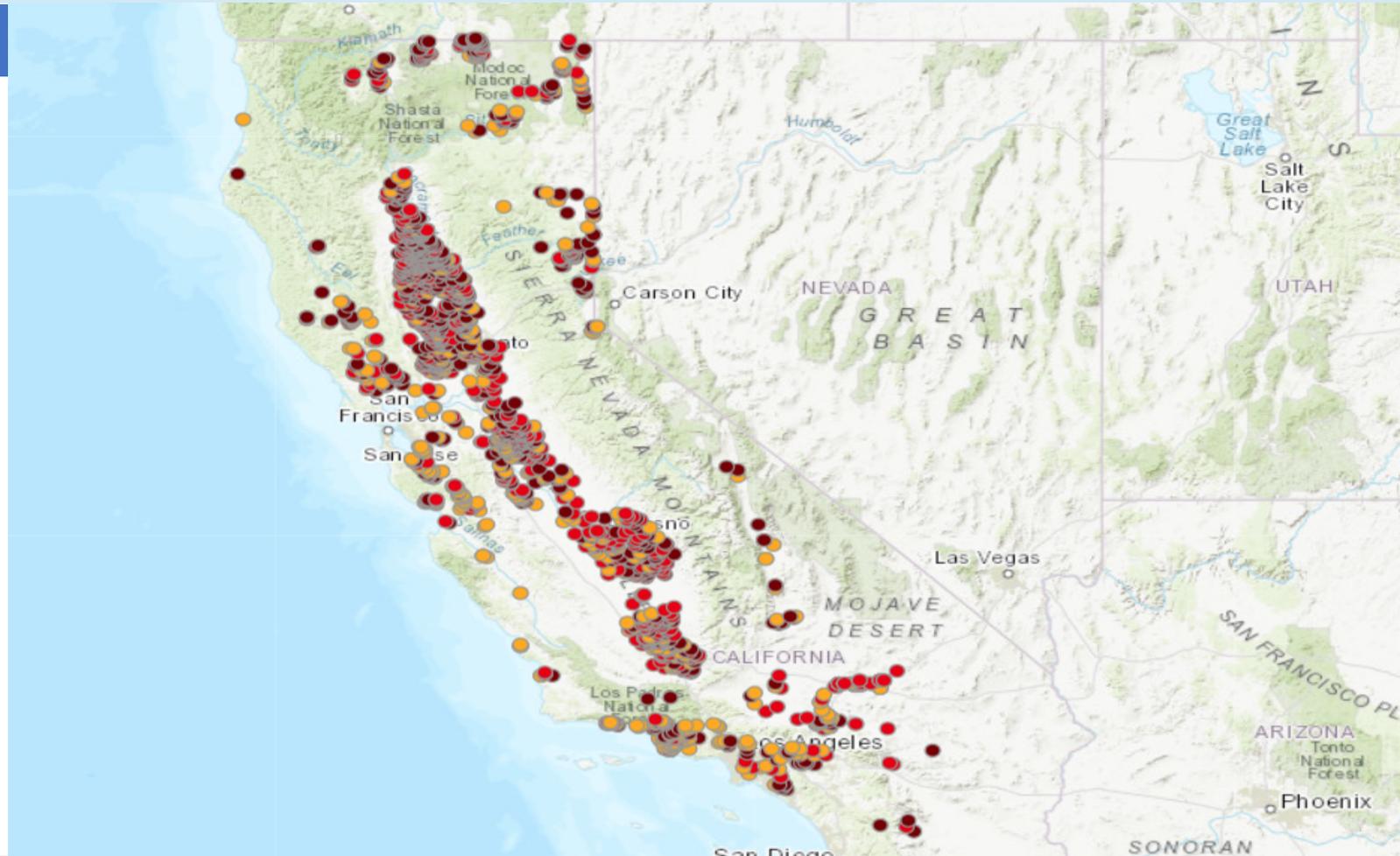




## Groundwater

- High
- >90 (Much Above Normal)
- 76-90 (Above Normal)
- 50-75 (Normal)
- 25-50 (Normal)
- 10-25 (Below Normal)
- <10 (Much Below Normal)
- Low
- Not Ranked

**Source:** DWR Sustainable Groundwater Management Act (SGMA) Data Viewer

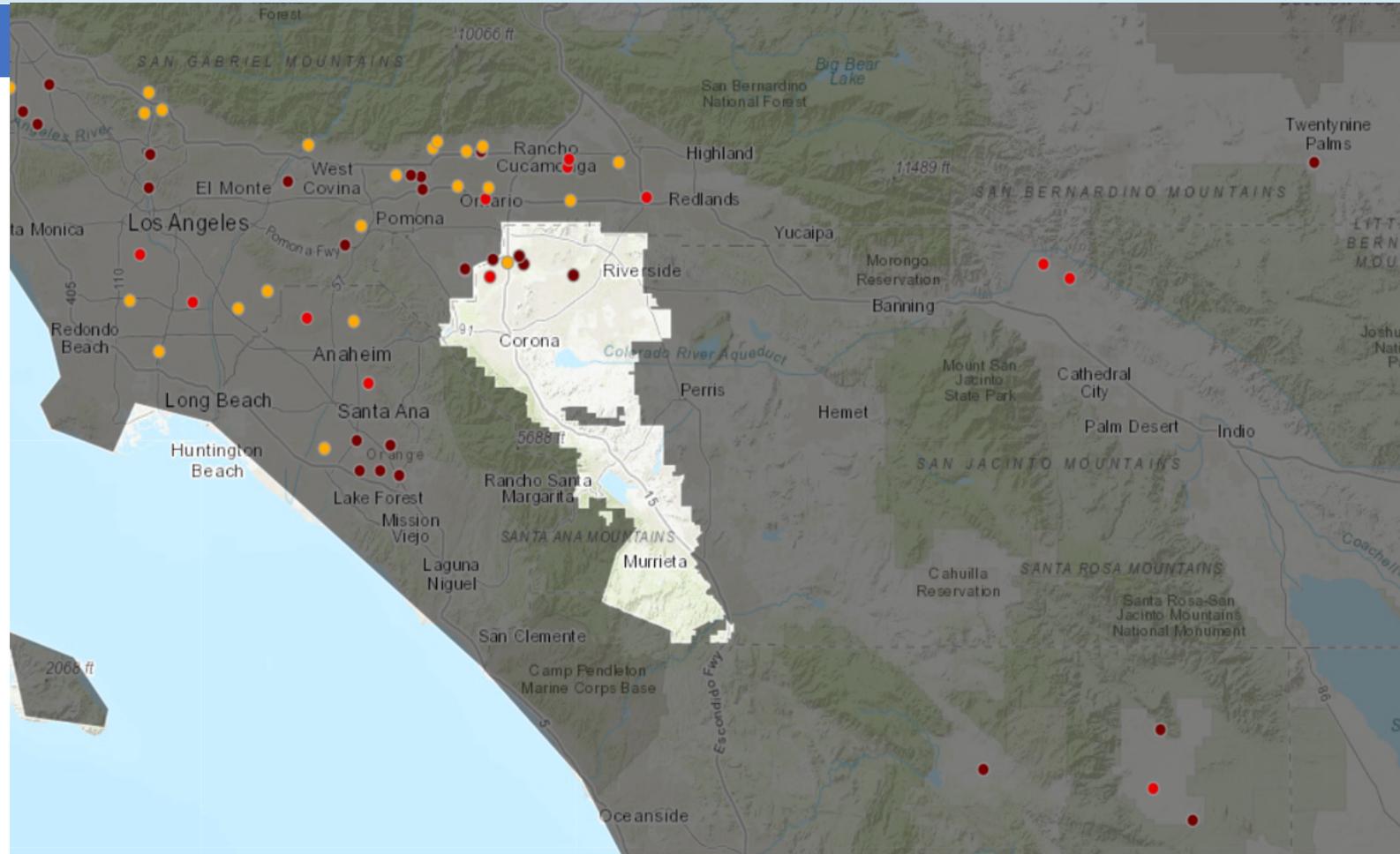


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## Groundwater

- High
- >90 (Much Above Normal)
- 76-90 (Above Normal)
- 50-75 (Normal)
- 25-50 (Normal)
- 10-25 (Below Normal)
- <10 (Much Below Normal)
- Low
- Not Ranked



**Source:** DWR Sustainable Groundwater Management Act (SGMA) Data Viewer

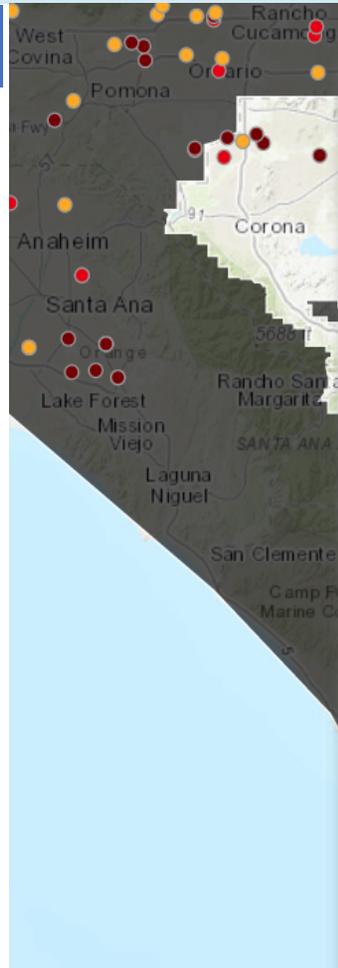
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## Groundwater

- High
- >90 (Much Above Normal)
- 76-90 (Above Normal)
- 50-75 (Normal)
- 25-50 (Normal)
- 10-25 (Below Normal)
- <10 (Much Below Normal)
- Low
- Not Ranked

Source: DWR Sustainable Groundwater Management Act (SGMA) Data Viewer



Information at 33.95890, -117.42620

DWR GW Level Percentile Statistics - 339589N1174262W001

Site Code: 339589N1174262W001

Well Completion Type: Single Well

Well Use Type: Observation

Well Depth (feet bgs): 62

Water Level

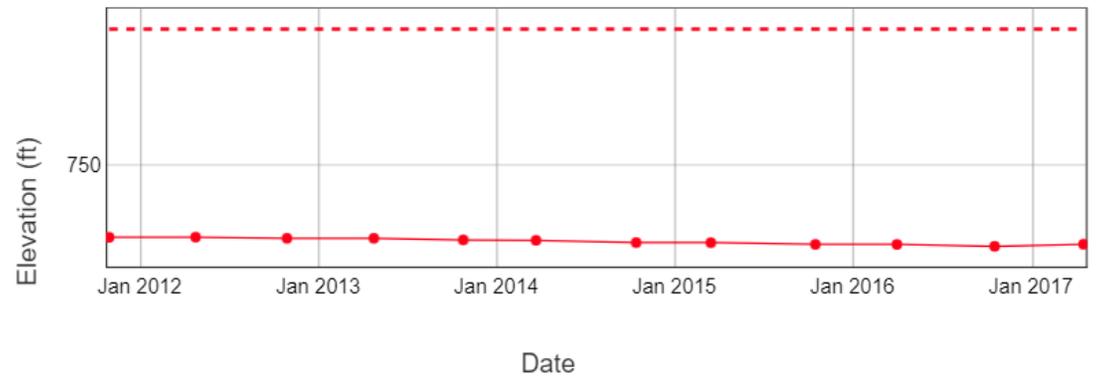
Groundwater Statistics

Water Year Type

[More Details on this Well](#)

[Download Image](#)

### Ground Levels for Well 385162N1215818W001



Date: (hover to see values)

-- GSE

— WSE



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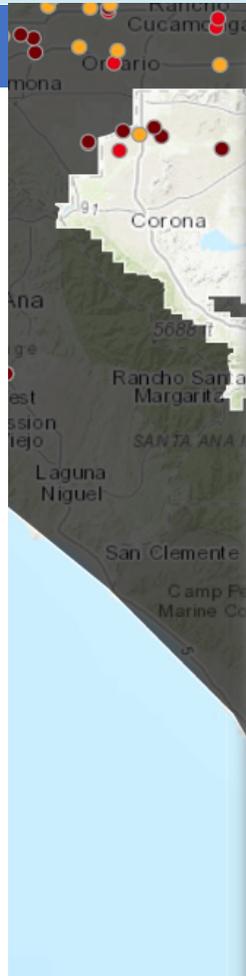
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## Groundwater

- High
- >90 (Much Above Normal)
- 76-90 (Above Normal)
- 50-75 (Normal)
- 25-50 (Normal)
- 10-25 (Below Normal)
- <10 (Much Below Normal)
- Low
- Not Ranked

Source: DWR Sustainable Groundwater Management Act (SGMA) Data Viewer



Information at 33.95890, -117.42620

### DWR GW Level Percentile Statistics - 339589N1174262W001

Site Code: 339589N1174262W001

Well Completion Type: Single Well

Well Use Type: Observation

Well Depth (feet bgs): 62

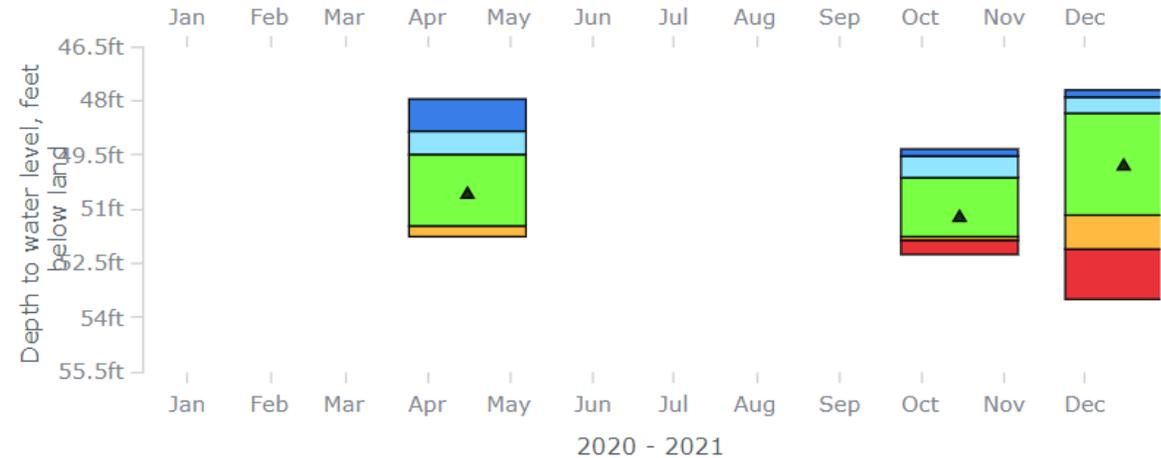
Water Level

Groundwater Statistics

[More Details on this Well](#)

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■ < 10  
 ■ 10 - 24  
 ■ 25 - 75  
 ■ 76 - 90  
 ■ > 90  
 ▲ Monthly Median  
 ◀ 1 / 2 ▶





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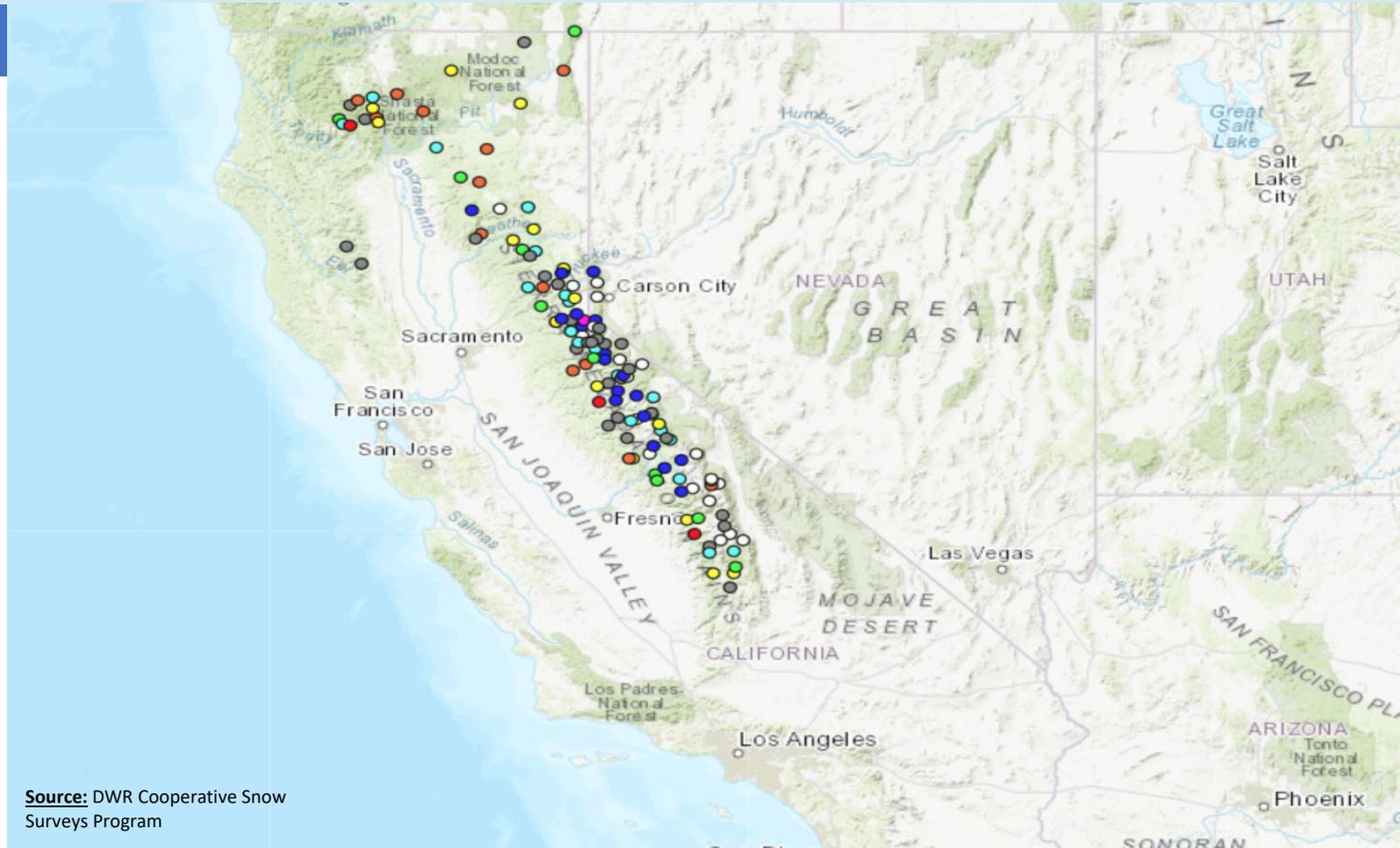


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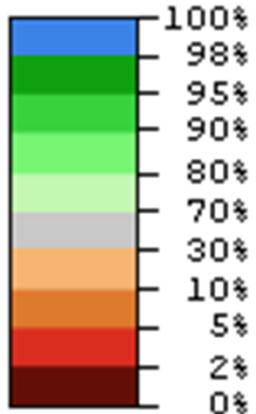
## Snowpack

- > 200%
- 180 - 200%
- 160 - 180%
- 140 - 160%
- 120 - 140%
- 100 - 120%
- 80 - 100%
- 60 - 80%
- 40 - 60%
- 0 - 40%



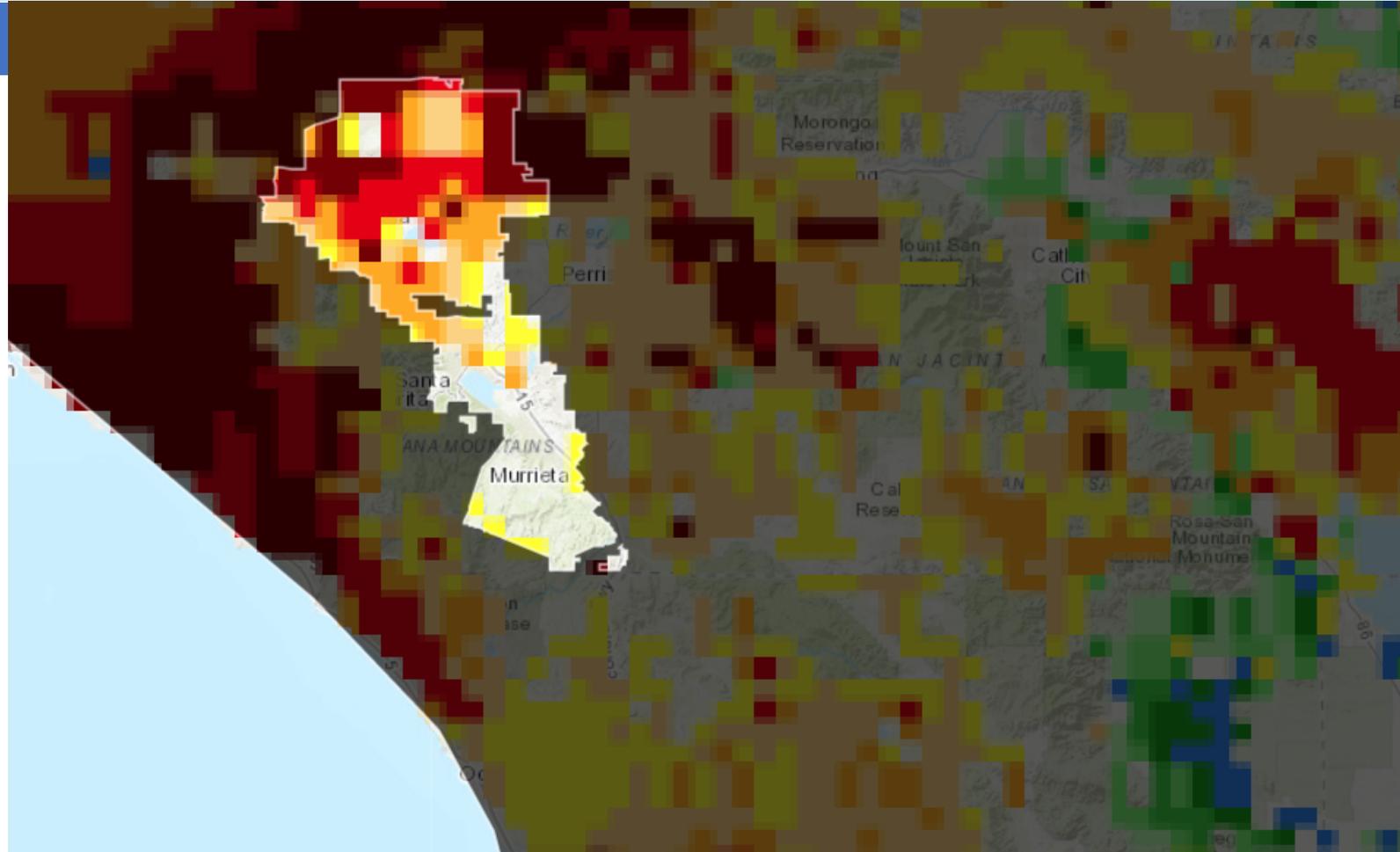


## Soil Moisture



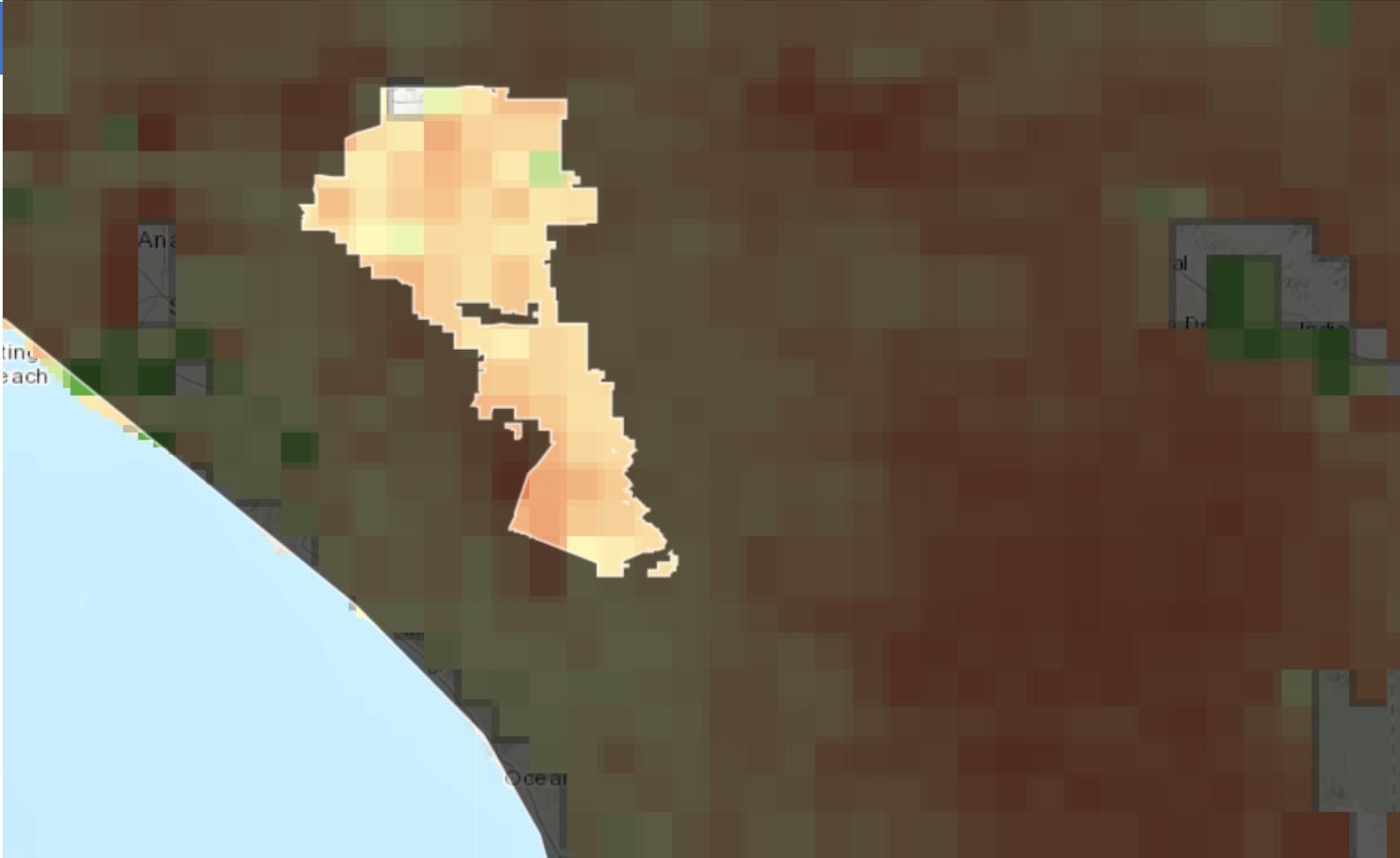
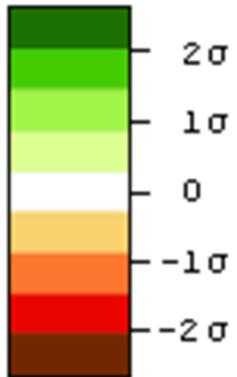
Percentage of Water by Volume

**Source:** Soil moisture is estimated from National Aeronautics and Space Administration satellite-based measurements (<https://www.drought.gov/data-maps-tools/nasa-sport-lis-soil-moisture-products>) for the top 100 centimeters of the soil surface.





## Vegetation Condition



$\sigma$ : Standard Deviation ET/PET (ESI)

**Source:** Vegetation conditions are represented by the evaporative stress index as provided daily by the National Aeronautics and Space Administration from satellite-based measurements (<https://www.drought.gov/data-maps-tools/evaporative-stress-index-esi>).

## Board of Directors/Summary Dashboard

Select data provided above could also potentially be consolidated into a dashboard. This dashboard would provide a central location for users to view key data used to assess local conditions which would be readily printable for sharing internally within each agency/organization that uses the portal, amongst the Drought Portal users, and/or with each agency's/organization's Board of Directors.

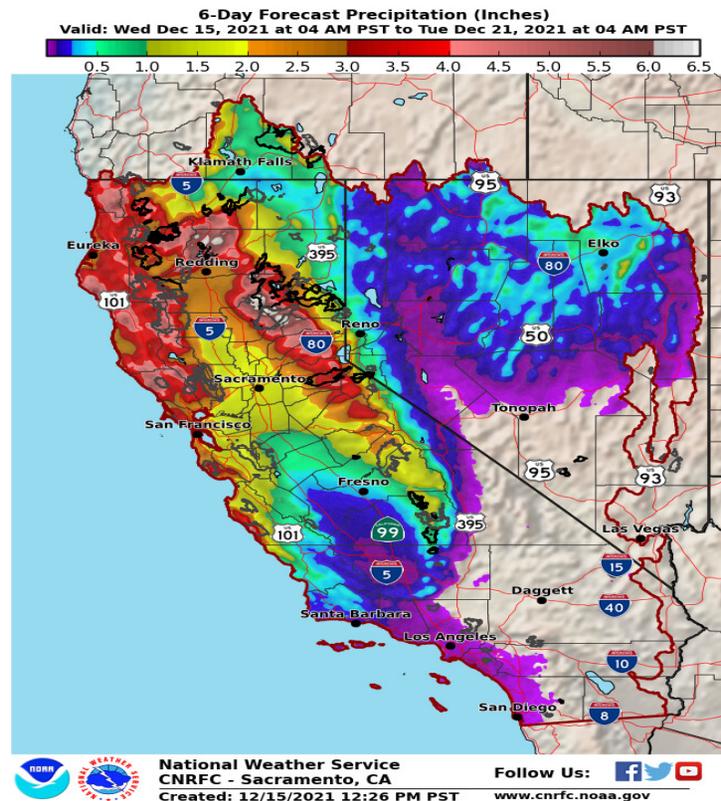
# Forecasting

The Regional Drought Portal could provide mid- to long-term forecasts for temperature and precipitation

## Example Forecasting Information

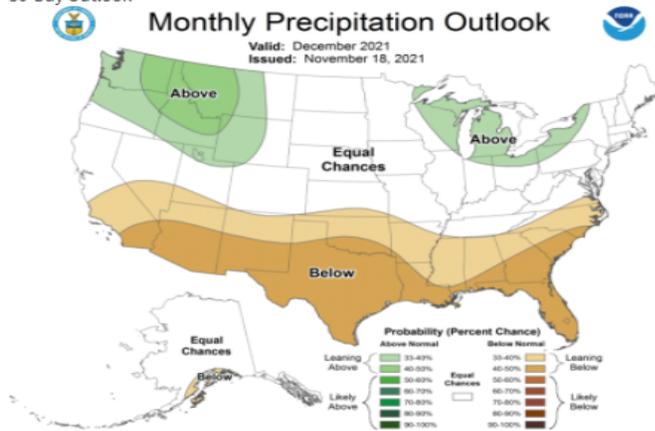
### Forecasting Information

For viewers wishing to see additional information beyond current hydrologic conditions, this page provides some graphics and links to weather and longer-range outlooks. As indicated below, most of the information is provided by the National Weather Service, but we also included some experimental forecasting products that DWR funded the University of California, San Diego to prepare.



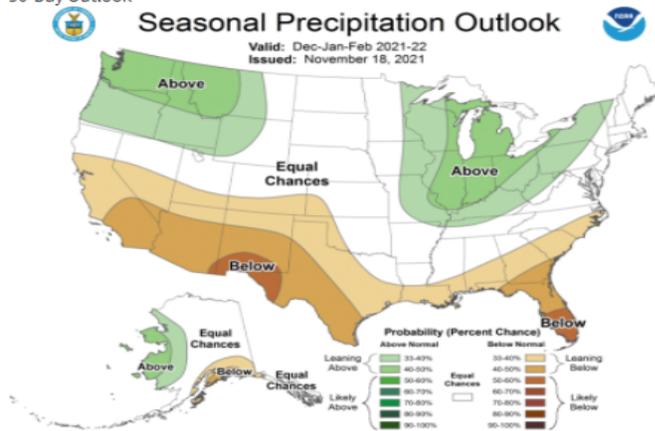
Example Forecasting Information

- 30-Day Outlook -

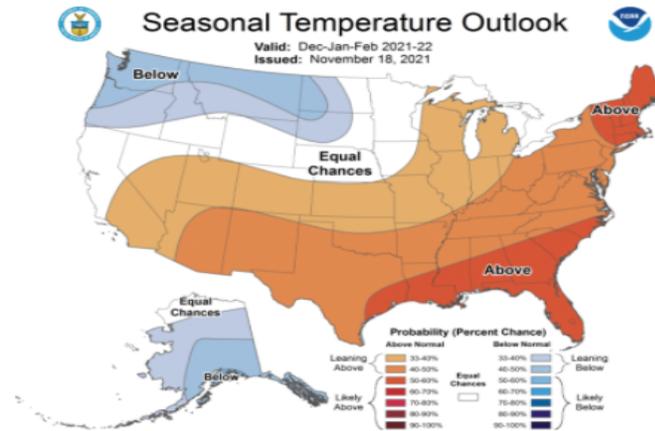
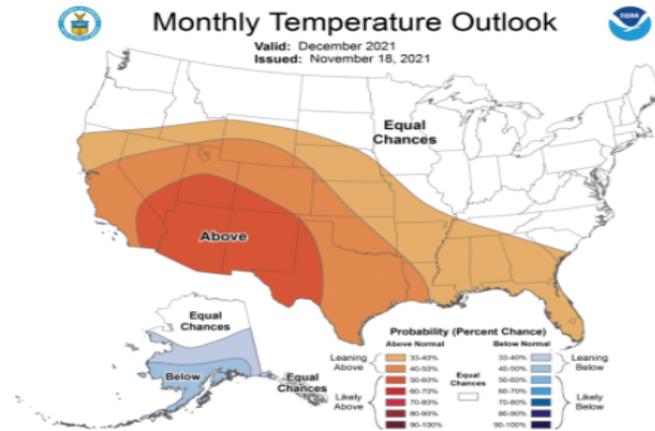


Source: <https://www.cpc.ncep.noaa.gov/products/predictions/30day/>

- 90-Day Outlook -



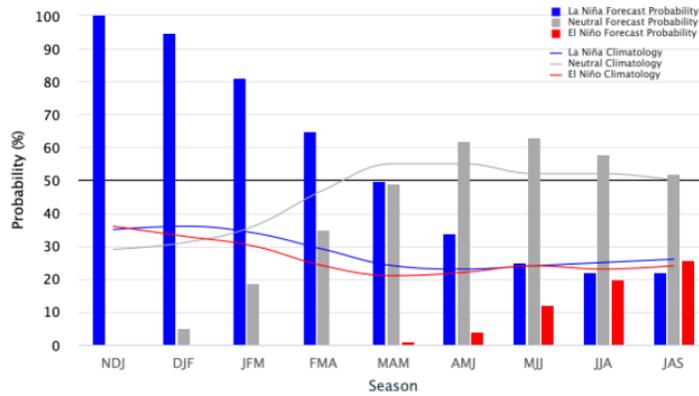
Source: [https://www.cpc.ncep.noaa.gov/products/predictions/long\\_range/seasonal.php?lead=1](https://www.cpc.ncep.noaa.gov/products/predictions/long_range/seasonal.php?lead=1)



### Example Forecasting Information

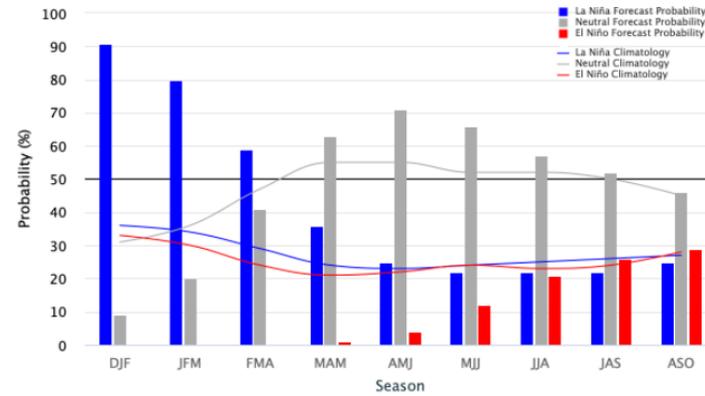
Early-December 2021 CPC/IRI Official Probabilistic ENSO Forecasts

ENSO state based on NINO3.4 SST Anomaly  
Neutral ENSO: -0.5 °C to 0.5 °C



Mid-December 2021 IRI/CPC Model-Based Probabilistic ENSO Forecasts

ENSO state based on NINO3.4 SST Anomaly  
Neutral ENSO: -0.5 °C to 0.5 °C



# User accessibility

Users could have the ability to:

- Enter their WSCP stage
- Enter drought related notes
- Add new notes and upload relevant documents
- Edit and view internal notes



### Western Municipal Water District Drought Notes

Comment Date	Commenter	Subject	Comment	Status	# Responses	Action
03/19/2021 09:50	Mike Doe	data issue 5	comments on 9:50am	Resolved	3	
03/19/2021 14:12	Anne Dosonpole	phone number for conACT a	missing phone number	Resolved	17	
03/26/2021 16:44	Jon Lite	water test	test it <i>again</i> .	Unresolved	0	



Appendix F – Climate Change Vulnerability Assessment TM

## Technical Memorandum

**To:** Drought Contingency Plan Task Force  
**From:** Drought Contingency Plan Development Team  
**CC:** Melissa Matlock, Western Municipal Water District  
**Date:** 9/6/2022  
**Re:** Western Municipal Water District – Climate Change Vulnerability Assessment

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### Executive Summary

This technical memorandum (TM) describes the retrieval and analysis of climate data provided by the California Department of Water Resources (DWR) to project the impact of climate change on future water supplies and demands within Western Municipal Water District's (Western) service area. The DWR climate data is assembled from the results of 20 global climate models, which best represent California's climate processes. Biases in the climate model results have been adjusted by simulating climate projections in terms of relative change from historical conditions rather than as absolute values. This is achieved by using historical hydrologic data in the state, which spans between 1915 and 2011. The resulting ratio of a simulated future value to the corresponding simulated historical value is referred to as a change factor. DWR projected climate change data is most appropriate for this analysis because it is the only climate projection dataset specifically developed to meet the requirements of water resources planners in California. Western is making this TM available to its retail agencies for their use in their respective water resource planning efforts to reduce the data processing burden on individual agencies. The results are intended for use by Western and Drought Task Force member organizations as they prepare a regional Drought Contingency Plan (DCP). This TM provides:

- A description of the area subject to the vulnerability assessment
- A description of the analysis approach and data sources chosen for the analysis
- Narrative discussions of the climate change factors calculated for local supply and demand conditions in multiple scenarios
- Discussion of the water supply and demand projections resulting from the vulnerability assessment
- Comparison of Western water supply and demand projections resulting from the vulnerability assessment with regional projections prepared through the ongoing Metropolitan Water District of Southern California (MWD) 2020 Integrated Water Resources Plan (IRP) process

## Summary of Findings

Projected changes in future water supplies and water demand are analyzed during a normal year, single dry and wet years and multi-year (5-year) dry and wet periods over the next 20 years, using climate projections developed for the water resources planning by DWR. This analysis of future climate impacts on water supplies and demands includes three potential future climate conditions: drier future conditions with extreme warming; median future conditions; and wetter future conditions with moderate warming. The detailed results of this analysis are presented in this TM. In summary, these results show:

- Projected decreases in water supplies from Santa Ana and Santa Margarita river basins under normal and drought (single year and multi-year) conditions relative to baseline conditions in 2020, due to projected decreases in precipitation and projected increases in surface water evaporation caused by increasing temperatures. Annual flows could be reduced by 4 to 7 percent in each basin by 2045. This potential decrease in volume of water available for diversion may require increased attention to understanding the adequacy and operational constraints of existing natural and artificial recharge systems in the service area.
- Projected decreases in precipitation and natural recharge under normal and multi-year drought years. However, a single dry year could still be wetter (up to 15 percent) under wet-warm future conditions compared to baseline conditions with precipitation occurring during a shorter rainy season (three instead of four months) with higher intensities (up to 0.4 inches).
- Projected increases in outdoor water uses under normal, single dry, and multi-year drought conditions, caused by projected temperature increases, which lead to higher evapotranspiration (ET) rates for landscaping, irrigated crops, and native vegetation. Average annual outdoor water use by customers served by Western within Western's wholesale and retail service areas could increase by up to 6 percent (17,198 acre-feet [AF]) under the most severe (Dry Hot) climate change scenario.
- Similar total demand projections based on a comparison of Western's and MWD's projected water budget projections under future climate conditions. If no new mitigation actions are implemented, the region's dependence on imported surface water will increase.

## 1. INTRODUCTION

The study of climate change impacts on water resources is continuously yielding new models and updated local and regional datasets. This continuous improvement makes it necessary to narrow the selection of data sources and methods of data analysis most applicable to local conditions. The scope of this vulnerability assessment is limited to improving the understanding of climate change impacts on future water demand in Western's wholesale service area and the sources of Western's water supplies during normal and drought periods.

The following section provides the background information for the requirements of both the regional DCP and the Urban Water Management Plan (UWMP), a general description of the impacts analyzed

in the vulnerability assessment, and information about Western's sources of information used in the assessment.

### **1.1 DCP and UWMP Requirements for Climate Change Analysis**

In accordance with Sections 10610 to 10657 of the California Water Code, the UWMP requires the consideration of climate change impacts for drought planning because of the significant duration of recent droughts in California. This includes an analysis of projected future uses and the reliability of anticipated water supplies during a normal year, a single dry year, and drought lasting 5 consecutive dry water years. This drought risk assessment compares projected water supply sources with projected water use over the next 20 years, in 5-year increments.

A vulnerability assessment is required as part of the regional DCP to understand the characteristics and potential risk of future droughts and to develop appropriate mitigation and response actions. Since future droughts cannot be predicted by observed past drought information, the inclusion of a climate change analysis is needed to provide the incorporation of historic and future climate projections to assess the hydrological impacts of climate change on drought conditions, thereby creating a more effective plan. The regional DCP requires either a qualitative and/or quantitative assessment of a range of potential drought conditions derived from climate change information to determine potential the risk to critical resources.

Imported water projections are also required for preparing both the UWMP and regional DCP. However, the imported water projections for Western's service area are being developed by MWD as part of their 2020 UWMP Drought Risk Assessment and the MWD 2020 IRP. MWD's 2020 UWMP Drought Risk Assessment (dated June 2021) indicates that no service reliability concerns are projected for imported water during normal and drought periods before 2045 based on MWD's projected demands for Western. For purposes of the UWMP, imported water supplies to Western can be assumed to be unchanged during normal years, single dry years, and 5-year dry periods.

However, the MWD 2020 IRP considered a range of more extreme potential future scenarios, which include: low demands with stable imported supplies, high demand with stable imported supplies, low demand with reduced imported supplies, and high demand with reduced imported supplies. The analysis found that service reliability issues could occur more frequently and generate increasingly more severe deficits of imported supplies under the high future demand scenarios in the 2045 time period.

The climate change analysis developed for Western, and described herein, supports the generation of alternative imported water supply demand projections, which are similar but slightly higher than MWD's projections for Western. Coupled with the MWD 2020 IRP potential future of supply deficits, these analyses support the need for developing mitigation actions to reduce or eliminate the future deficits.

## 1.2 Prior Climate Studies

Climate change is primarily caused by increasing global concentrations of greenhouse gases which lead to increases in temperature, disruption of the hydrologic cycle, and increased variability of precipitation. The regional impacts of climate change analyzed in two previous studies for the region, California's Fourth Climate Change Assessment (2018) and the United States Bureau of Reclamation (USBR) Santa Ana Watershed Study (2013), are summarized in this section.

The state of California produces periodic assessments on the potential impacts of climate change in the state and reports on potential adaptation responses as required by Executive Order #S-03-05. California's Fourth Climate Change Assessment includes a Statewide Summary Report (Bedsworth et al., 2018), nine regional summary reports, a climate justice summary report, and over 40 technical reports which translate climate science into actionable adaptation and resilience policies and plans. The Los Angeles Regional Report (Hall et al., 2018) summarizes climate science, impacts, and adaptation information for Ventura, Los Angeles, Orange, and the western parts of San Bernardino and Riverside counties. This study projects regional increases in average maximum temperatures of around 4 to 5 degrees Fahrenheit (°F) by the mid-21st century, and 5 to 8°F by the late 21st century. The hottest days of the year could become up to 10°F warmer for many locations in the region by the late 21st century.

California's report also projects small changes in average annual precipitation, and in the recurrence of extreme dry and wet years. However, rainfall intensification could result in more severe atmospheric river events and rainfall increases of up to 25 to 30 percent on the wettest days of the year. While these assessments provide information on the magnitude of regional climate impacts, they do not provide information about climate change impacts at a scale that is directly applicable to local watersheds, water supplies, and demands.

The USBR conducted a study of local climate change impacts in the Santa Ana River Watershed (USBR, 2013). The study used a groundwater screening tool to simulate monthly water balance changes in the Orange County, Upper Santa Ana Valley, and Elsinore/San Jacinto groundwater basins. Historical monthly time series of precipitation over the groundwater basin as well as municipal and industrial water demand were analyzed for the period 1990 to 2009. Future water supply was analyzed for the Santa Ana River Watershed using a hydrologic model to simulate streamflow using 112 different future climate conditions. The results show future increases in water demand and reservoir evaporation due to increased temperature. Smaller, long-term decreases in precipitation are also projected. The combined impacts of these changes include decreases in annual available surface water and increased reliance on groundwater. In the 2013 USBR study, groundwater was estimated to provide approximately 54 percent of total water supply.

The 2013 USBR study does not account for analysis methods instituted for studying and avoiding adverse impacts under California's Sustainable Groundwater Management Act (SGMA) which was passed by the state legislature in 2014. In particular, the 2013 USBR study used a transient climate change analysis method to generate a continuous future projection from the present through end of century. The results of a such a transient climate analysis cannot be used to analyze extreme events such as a single dry year or a multi-year drought as required under the UWMP regulations.

In summary, prior studies which include statewide and regional climate assessments provide relevant background information. However, they do not provide information on climate change impacts on local water supplies and demands within the Santa Margarita River basin and other service areas outside of the Santa Ana River basin or on the changing severity of future drought periods. This climate change vulnerability assessment aims to provide a uniform analysis of climate impacts for all areas of Western’s service area for use in regional water supply and drought planning.

### **1.3 Study Objectives**

The objectives of this vulnerability study are to:

1. Identify the appropriate datasets for use in this analysis,
2. Project the magnitude of climate-driven changes in water supply and demand for Western’s service area, and
3. Estimate the projected future impacts using the climate change factors applied to the water supply sources and water demands in the service area.

Temperature increases and changes in precipitation patterns with climate change are expected to shift the balance between local water supply and demand within Western’s service area and other parts of the state. Increases in temperature lead to increases in consumptive water use for irrigated agriculture and to maintain landscaping for residential, commercial, and recreational use. This increase in consumptive water use is compounded by increases in the portion of rainfall that is evaporated back into the atmosphere from open spaces and water bodies and consumed by native vegetation outside of urban areas. In addition, population growth within the plan area could also lead to expansion of demand.

Annual precipitation in southern California is highly variable and a significant portion of the regional rainfall is concentrated in winter months from November to April. There are typically years with much greater than average precipitation and years with much less than average precipitation. During wet years, seasonal precipitation replenishes aquifers, streams, rivers, and reservoirs which are the sources of water supply. During dry years, there is increased extraction of groundwater reserves to make up the deficit. Climate change is expected to increase the year-to-year variability in precipitation within the region as well as in other parts of the state from which imported water is sourced.

### **1.4 Description of Data Sources**

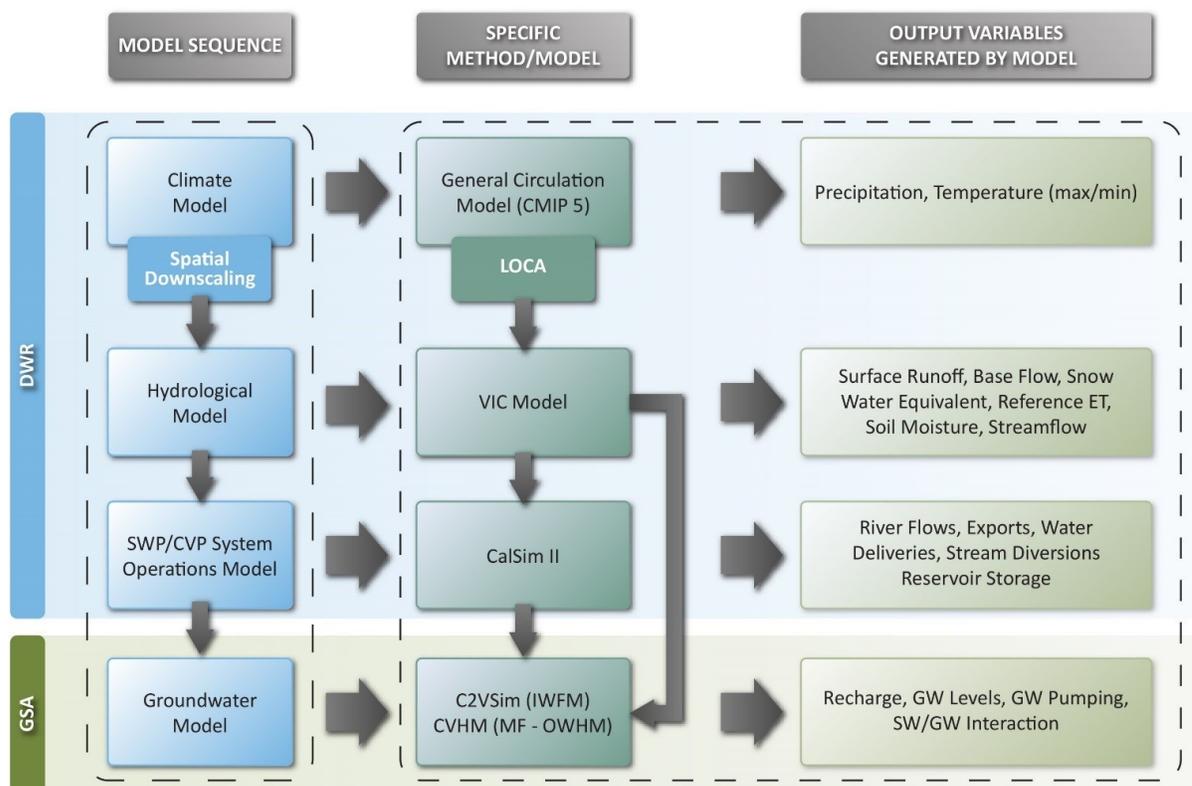
DWR has developed statewide climate change datasets for use in water resource planning. The datasets depict climate conditions in California under historical and future climate conditions which are defined as follows:

- Year 2030 future condition with projected climate and sea level conditions for a 30-year period, centered at 2030
- Year 2070 future condition with projected climate and sea level conditions for a 30-year period, centered at 2070

- Year 1995 historical condition with climate and sea level conditions for a 30-year period, centered at 1995

The 2030 and 2070 climate projections are based on an ensemble of 20 global climate projections selected by the DWR Climate Change Technical Advisory Group (CCTAG) as the most appropriate projections for California water resources evaluation and planning. The datasets are provided at a spatial resolution of 1/16th degree (approximately 3.75-mile grid cells) over California for each calendar month from 1915 through 2011.

Figure 1 shows an overview of the modeling processes used by DWR (highlighted with a blue background) in creating the statewide climate datasets which are used in this study. The bottom row of the image (highlighted with a green background) shows how individual groundwater sustainability agencies are expected to use the data in groundwater models to model groundwater conditions as they collaborate to attain sustainability objectives.

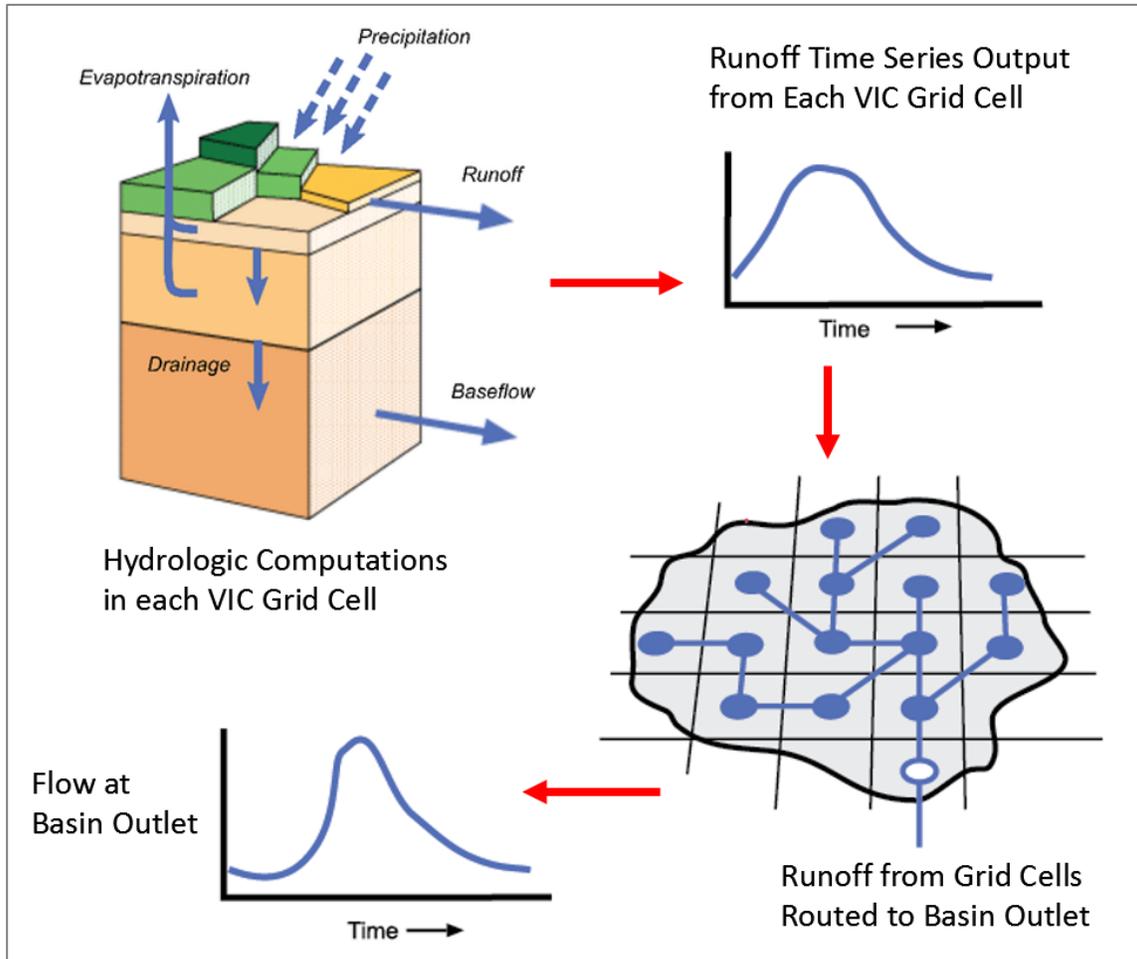


DWR: Department of Water Resources; GSA: Groundwater Sustainability Agency; SWP: State Water Project; CVP: Central Valley Project; LOCA: Localized Constructed Analogs; VIC: Variable Infiltration Capacity; CalSim: SWP & CVP Operations Model; C2VSim: California Central Valley Groundwater - Surface Water Simulation Model; IWF: Integrated Water Flow Model; CVHM: Central Valley Hydrologic Model; MF - OWHM: MODFLOW One Water Hydrologic Flow Model; ET: Evapotranspiration, SW: Surface Water; GW: Groundwater; CMIP 5: Coupled Model Intercomparison Project

**Figure 1: Overview of Modeling Processes Used by DWR in Creating the Statewide Climate Datasets (Source: DWR, 2018)**

DWR has also run the climate datasets through a hydrologic model called the Variable Infiltration Capacity (VIC) model to simulate future hydrologic conditions and route runoff to the outlet of subbasins defined by each eight-digit Hydrologic Unit Code (HUC) in California. Streamflow change

projections from the VIC model are provided as monthly time series from 1915 through 2011 for each HUC subbasin. As illustrated in Figure 2, the VIC model takes input climate variables such as precipitation and temperature, and it performs a series of hydrologic computations within each cell to output variables such as soil moisture, ET, and surface runoff within each cell. A streamflow routing algorithm, known as RVIC, is then used to route runoff from each cell to its associated subbasin outlet.



**Figure 2: Schematic of the VIC Model Showing Hydrologic Computations Within Each Grid Cell and Runoff Routing (Source: University of Washington Computational Hydrology Group, 2016)**

DWR has applied the VIC model to perform hydrologic simulations under historical climate conditions and under projected future climate conditions in 2030 and 2070 over 8,000 grid cells statewide. Runoff from these grid cells have also been routed to the outlet of each eight-digit HUC watersheds in the state for use in the water resource planning.

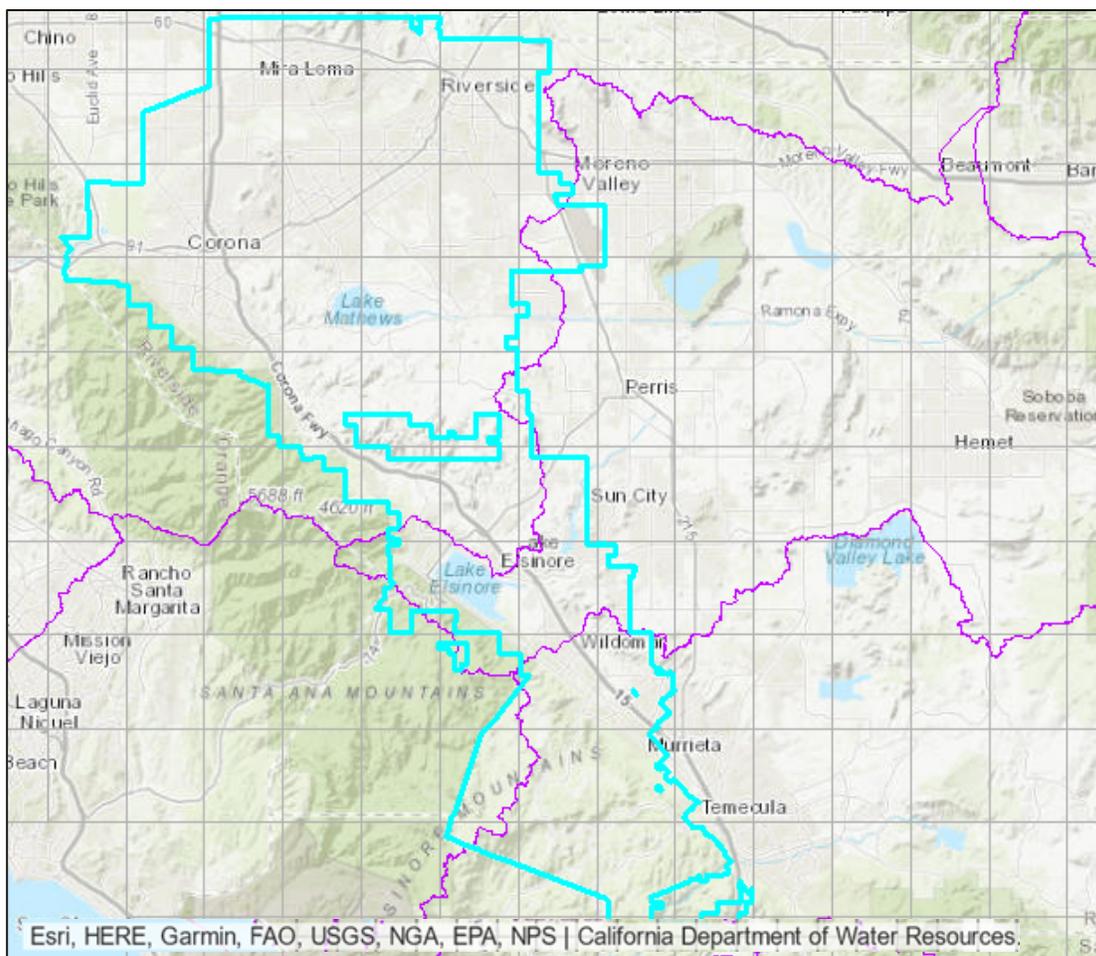
As previously shown in Figure 1, climate assessments are performed with a chain of models, each of which introduces some biases in the modeling process and derived products. To minimize the impact of such biases in decision processes, DWR presents the simulated climate projections in terms of relative change from historical conditions rather than as absolute values. For example, each monthly precipitation value simulated under 2030 conditions is divided by the precipitation value simulated for the same month under historical conditions, using the same chain of models. The resulting ratio of a

simulated future value to the corresponding simulated historical value is referred to as a change factor. DWR has computed monthly time series of change factors for precipitation and ET in each VIC grid cell and the streamflow for each HUC-8 watershed. The resulting change factor datasets are available for retrieval and use in water resources planning from the publicly accessible SGMA Data Viewer (<https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer>). A more complete description of methods used in computing the climate datasets is provided in a publication entitled “Guidance for Climate Change Data Use During Groundwater Sustainability Plan Development” (DWR, 2018).

## 2. CLIMATE ANALYSIS APPROACH

### 2.1. Preprocessing Data for Western’s Service Area

The statewide climate datasets include 57 grid cells each with a spatial resolution of 1/16th degree (approximately 3.75-mile grid cells) for Western’s service area (Figure 3).



**Figure 3: Climate Grid Cells and Watersheds Covering Western’s Service Area**

Each grid cell contains 97 years of monthly time series (1915-2011) showing projected precipitation and ET changes under 2030 and 2070 climate conditions relative to 1995 conditions. The area of each grid cell which falls within the service area is estimated by spatially intersecting feature layers of the climate grid and Western’s service area boundary. Regional time series of projected precipitation and ET

changes are computed from the cell time series by using an area-weighted average of data from grid cells which fall wholly or partially within the service area. Projections of future streamflow change were also retrieved for the Santa Ana River (HUC-18070203) and the Santa Margarita River (HUC-18070302) basins which provide surface water supplies to portions of the service area. Three potential climate conditions were considered for this analysis:

- Drier future conditions with Extreme Warming (Dry Hot)
- Median future conditions (Median)
- Wetter future conditions with Moderate Warming (Wet Warm)

The two extreme scenarios (Dry Hot and Wet Warm) are constructed from a set of 10 global climate models. The first extreme scenario (Dry Hot) uses future projections from the 10 global climate models with least warming and least precipitation with the second extreme scenario (Wet Warm) using the 10 global models with the most warming and highest precipitation.

## 2.2. Analysis of Normal, Single, and Multi-Year Dry and Wet Periods

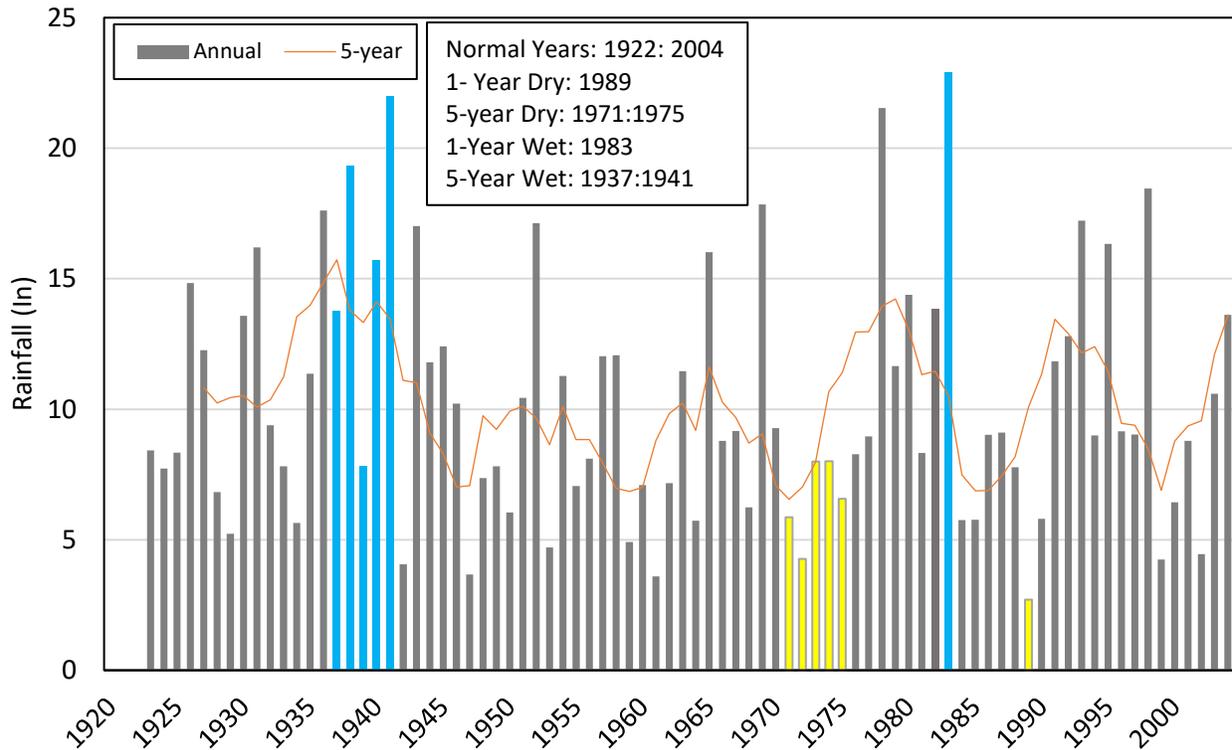
Every urban water supplier is required to assess water service reliability in normal year, single-dry year, and multiple-dry years lasting 5-years. For imported water supplies, the normal, wet, and dry years used by MWD, based on an historical analysis period of 1922 to 2004, are adopted for Western since it is the largest source of imported water. For local water supplies, year types are selected by reviewing time series data at two local precipitation gauges with extensive historical records. The monthly time series for the gauge at Riverside Fire Station 3 are available online in the DWR Bulletin 195 dating back to 1882 but were last updated in 2007. The California Irrigation Management Information System (CIMIS) #44 gauge has more current data available, extending from 1986 to present. For this analysis, the Riverside FS3 gauge is used because it has full coverage of the normal period of record (1922-2004) used in the imported water analysis. Figure 4 shows the annual and 5-year rainfall from 1923 to 2004 with the wettest and driest 1-year and 5-year periods highlighted in blue and yellow, respectively.

**Table 1: Analysis Periods for Normal, Single and Multi-Year Dry, and Wet Periods**

Year Type	Imported Supplies	Riverside FS3 Gauge	CIMIS #44 Gauge
Normal	1922-2004	1922-2004	1986-2020
Single Dry-Year	1977	1989	2007
5-Year Dry	1988-1992	1971-1975	2005-2009
Single Wet-Year	1983	1983	-
5-Year Wet	1995-1999	1937-1941	-

The results shown in Table 1 and Figure 4 indicate that 1989 was the single driest year locally with 2.7 inches of rainfall, while 1977 was the driest year for imported water. The driest 5-year period for local supplies was from 1971 to 1975, while imported water supplies were lowest from 1988 to 1992. The single wettest year on record locally occurred in 1983, with 22.9 inches of rainfall. 1983 is also used as the single wettest year by MWD. The wettest 5-year period for local supplies was from 1937 to 1941,

while imported water supplies were highest from 1995 to 1999. The single driest year and the driest 5-year period for the CIMIS #44 gauge are also provided in the table for reference.



**Figure 4: Annual Rainfall at Riverside Fire Station 3**

### 2.3. Computing Water Supply Change Factors

Local water sources used within Western’s service area include local groundwater from 12 different groundwater basins, surface water supplies from the Santa Ana and Santa Margarita river basins, recycled water from indoor water use, and reclaimed groundwater. Groundwater systems are recharged through a variety of water sources. These sources of recharge can be described as:

- Natural recharge is the portion of precipitation that infiltrates to the underlying aquifer within the same grid cell in which precipitation occurs. Changes in natural recharge are directly related to changes in precipitation in the grid cell.
- Artificial recharge (including injection systems) is water that is diverted from rivers and streams for the purpose of replenishing the underlying aquifer. Since artificial recharge relies on surface water and other remotely sourced water supplies, it is influenced by accumulative flow changes in the source watersheds.

Recycled water and reclaimed water can also be a source of supply for recharge of groundwater. Supplies of recycled water and reclaimed water which are sourced from indoor uses are largely insensitive to changes in climate. For this vulnerability assessment, three different sets of climate

change results are computed for use with natural recharge, the Santa Ana River, and the Santa Margarita River sources, respectively.

For characterization of future changes in natural recharge, precipitation change projections from the DWR-provided climate change datasets are used. The 97-year monthly time series of precipitation for Western's service area is used to compute Water Supply Change Factors which show percentage changes in mean monthly and mean annual precipitation under future 2030 and 2070 climate conditions relative to historical conditions under 1995 conditions. The 2030 and 2070 Water Supply Change Factors for natural recharge are computed for normal year, single dry year, single wet year, and 5-year wet and dry periods.

Characterization of future changes in the Santa Ana and Santa Margarita river basins are based on streamflow projections from the VIC model under 2030 and 2070 climate conditions. The streamflow projections are used to compute Water Supply Change Factors which show percentage changes in mean monthly and mean streamflow under future 2030 and 2070 climate conditions relative to historical conditions under 1995 conditions. Change factors are similarly computed for normal year, single dry year, single wet year, and 5-year wet and dry periods.

Each set of Water Supply Change Factors is interpolated at 5-year intervals from 2020 to 2045. The 1995 to 2011 conditions are used to project climate change conditions out to 2030. Linear interpolation is used to determine the climate change factors between 2020 and 2030, based on the historic conditions from 2011 and the projected conditions for 2030. Different climate change conditions are anticipated between 2030 and 2070 because of the implementation of policies and practices that are expected to influence the rate of climate change further out in time. For the years between 2030 and 2070, linear interpolation is used for the 5-year increments based on the difference in projected conditions at 2030 and the projected conditions at 2070. Time series of Water Supply Change Factors are similarly interpolated at 5-year intervals for normal year, single dry year, single wet year, and 5-year wet and dry periods for application to local water sources for 2020 to 2045.

## **2.4 Computing Water Demand Change Factors**

Indoor and outdoor water uses are computed separately when considering climate impacts. Outdoor water use, particularly landscape irrigation, is sensitive to changes in climate while indoor water use is generally not sensitive. Plants require more water to sustain growth in a warmer climate, and users respond to increases in temperature by increasing landscape irrigation to keep their plants alive and flourishing. This increase in water requirement is characterized in climate models using the rate of ET which represents total amount of water released from soil, plants, and water bodies from the land surface to the atmosphere through evaporation and transpiration.

The DWR datasets includes 57 grid cells each with a spatial resolution of 1/16th degree (approximately 3.75-mile grid cells) for Western's service area. Each grid cell contains 96 years of monthly time series (1915 to 2011) showing projected ET changes under 2030 and 2070 climate conditions. An area-weighted average of the ET data from the 57 cells is first computed to generate a single time series for Western's service area. The regional time series is used to compute Water Demand Change Factors which show percentage changes in mean monthly and mean annual ET under future 2030 and 2070

climate conditions relative to historical conditions under 1995 conditions. Similar values of 2030 and 2070 Water Demand Change Factors are computed for normal year, single dry year, single wet year, and 5-year wet and dry periods.

The Water Demand Change Factors are computed for 5-year intervals from 2020 to 2045 by interpolation. The 1995 to 2011 conditions are used to project climate change conditions out to 2030. Linear interpolation is used to determine the climate change factors between 2020 and 2030, based on the historic conditions from 2011 and the projected conditions for 2030. Different climate change conditions are anticipated between 2030 and 2070 because of the implementation of policies and practices that are expected to influence the rate of climate change further out in time. For the years between 2030 and 2070, linear interpolation is used for the 5-year increments based on the difference in projected conditions at 2030 and the projected conditions at 2070. The 5-year time series of Water Demand Change Factors are similarly interpolated for normal year, single dry year, single wet year and 5-year wet and dry periods for application to growth adjusted indoor water use projections for 2020 to 2045.

### 3. LOCAL CLIMATE CHANGE RESULTS

#### 3.1. Water Supply Change Factor Results

The projected normal year precipitation under Dry Hot, Median and Wet Warm scenarios are presented in Figure 5 through Figure 7. Under all scenarios, changes become more extreme by 2045. The Dry Hot and Median scenario predict a decline in annual precipitation while the Wet Warm scenario projects a higher annual precipitation. The annual rainfall is predicted to decrease by 7.2 and 2.7 percent by 2045 under the Dry Hot and Median scenarios, respectively. However, the Wet Warm scenario predicts a 5 percent increase for the same timeline. Investigating the relative changes, all the projections indicate a lower precipitation during April and May, with the Dry Hot scenario exhibiting the greatest deviation from current monthly rainfall (77 percent by 2045). All projections show a higher precipitation in September with the highest projection of 166 percent by 2045 in the Wet Warm scenario. Detailed projected changes for rainfall under all the climate change scenarios are presented in Appendix A (Table A1, Table A2, and Table A3).

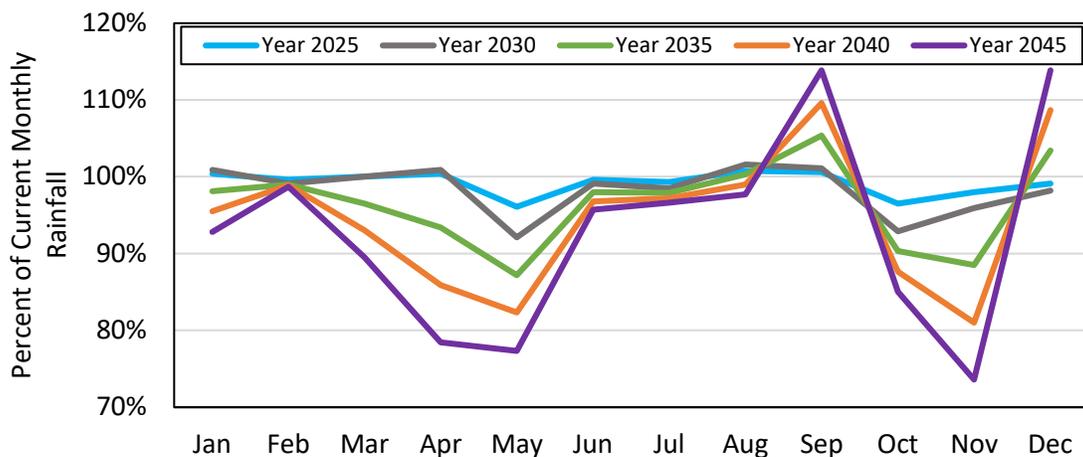
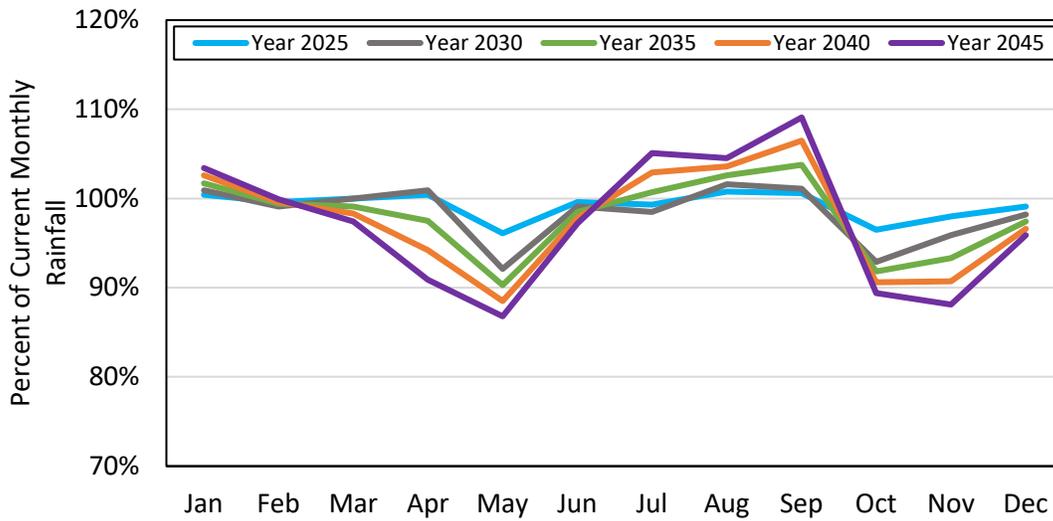
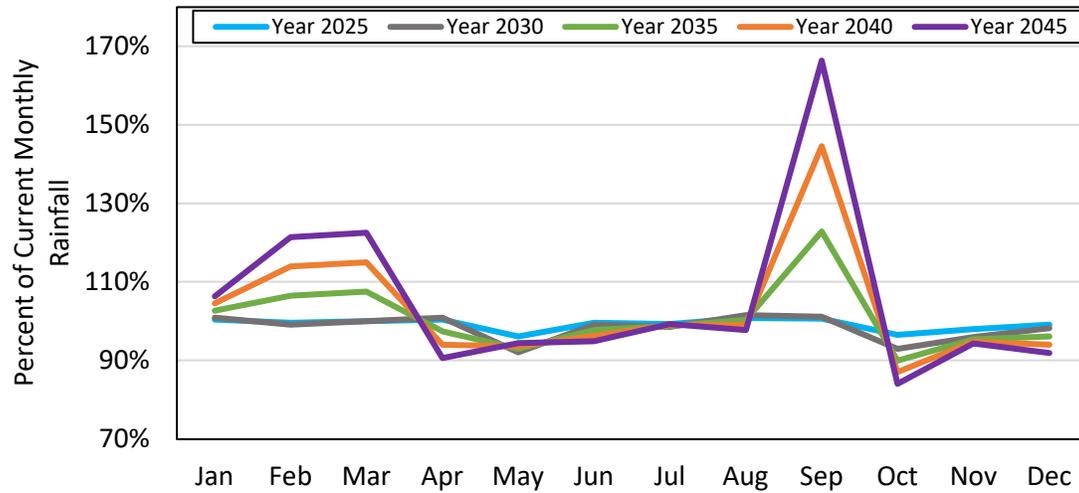


Figure 5: Projected Changes in Rainfall under Dry Hot Future Climate 2025 – 2045

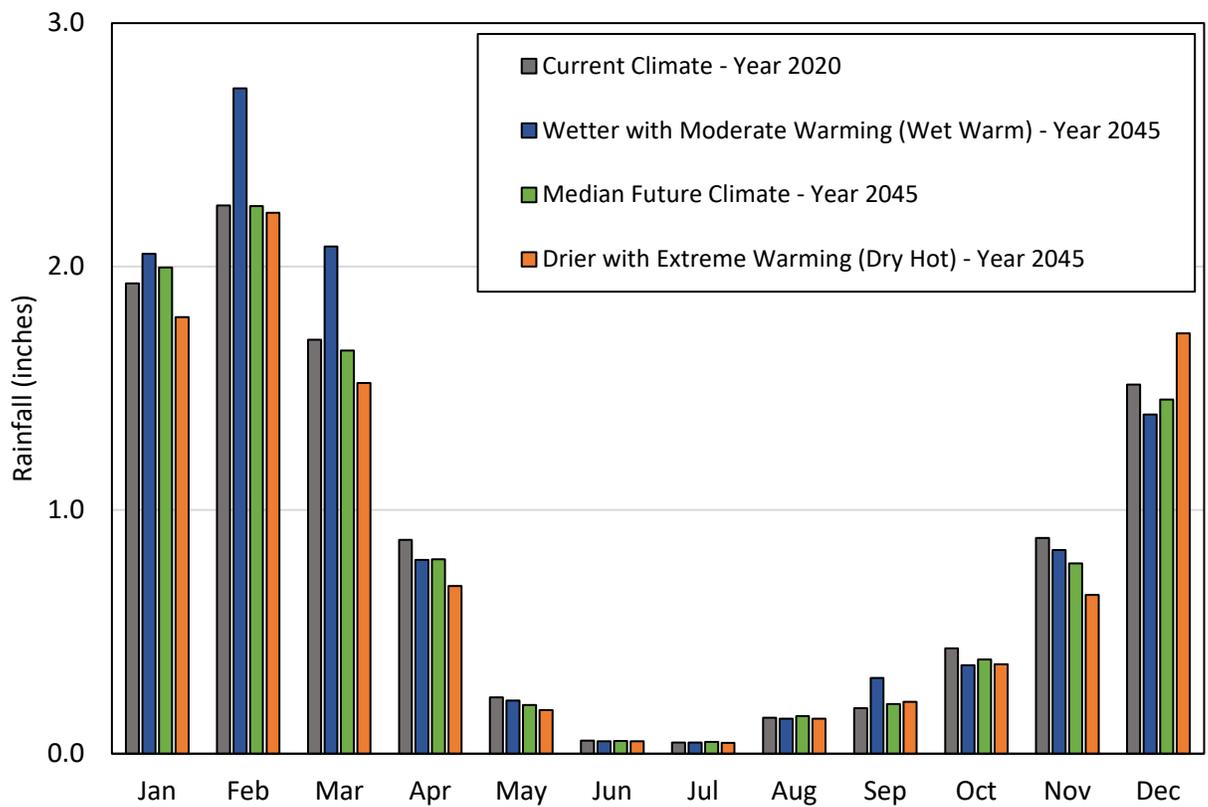


**Figure 6: Projected Changes in Rainfall under Median Future Climate 2025 – 2045**



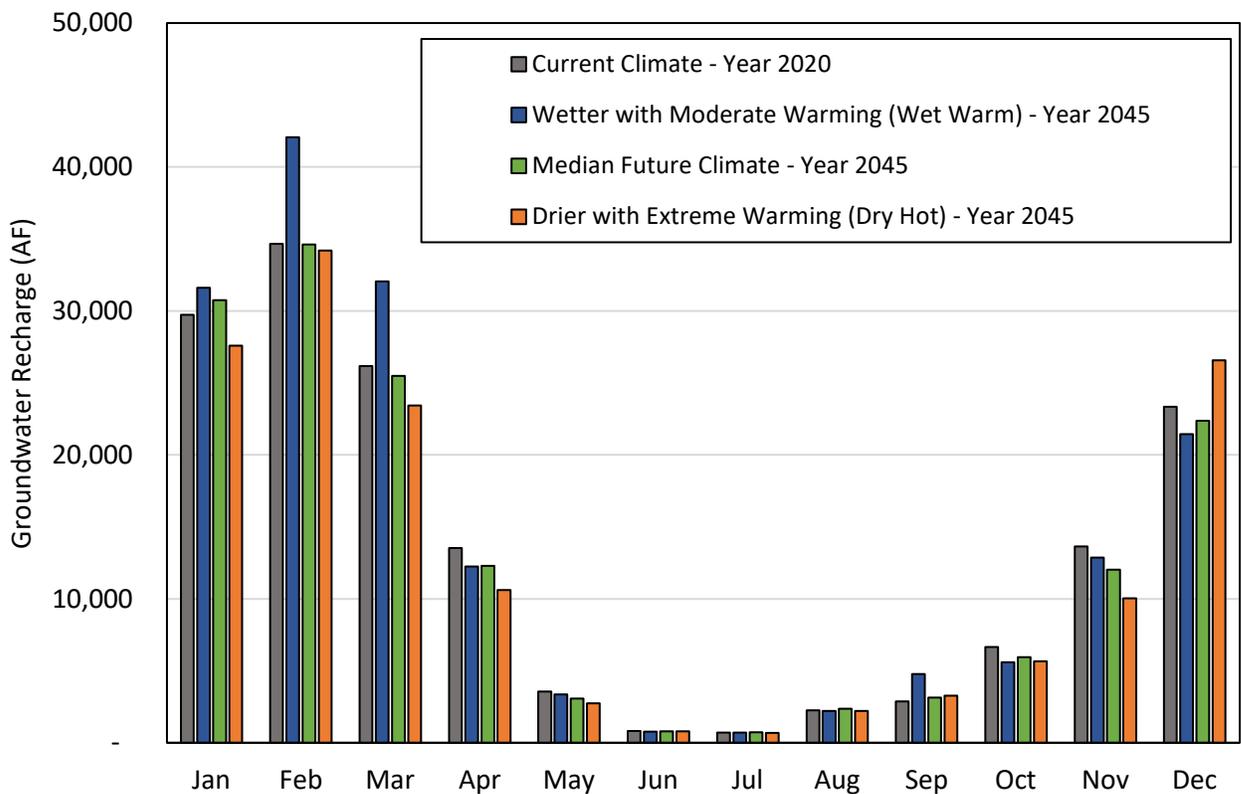
**Figure 7: Projected Changes in Rainfall under Wet Warm Future Climate 2025 - 2045**

Figure 8 shows the predicted changes in absolute amounts of rainfall under various climate change scenarios in the year 2045. While the biggest relative changes are projected to occur in April, May, and September as shown in the previous Figure 5 through Figure 7, the biggest absolute changes occur during the most humid months of February and March with projections indicating up to a 0.5-inch increase from the current climate during February under the Wet Warm Scenario by 2045.



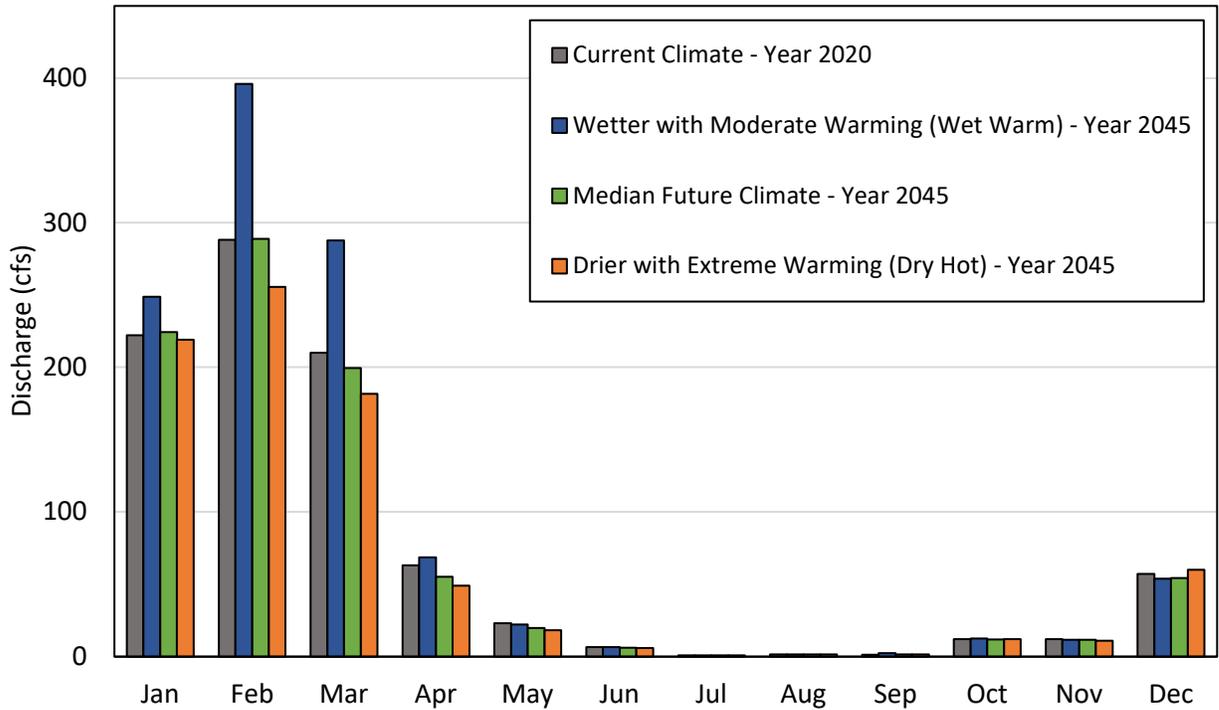
**Figure 8: Projected Changes in Normal Year Rainfall – 2045**

Figure 9 shows the projected changes in normal year groundwater supply in the year 2045. Figure 9 shows a similar pattern to Figure 8 with the biggest increase in supply during February and March (~8000 AF) under the wet warm scenario compared to current climate conditions. The Dry Hot scenario projects declines during January and March with approximately 2,500 AF less groundwater recharge potential compared to the current conditions. On an annual basis, a total of 147,770 AF of groundwater supply is predicted under the Dry Hot scenario by 2045, while approximately 169,700 AF is predicted under the Wet Warm scenario by 2045, representing an increase of over 20,000 AF. Projections under the Median scenario results in a projected 153,600 AF of annual groundwater supply, which is generally consistent with current climate projections at 157,903 AF.



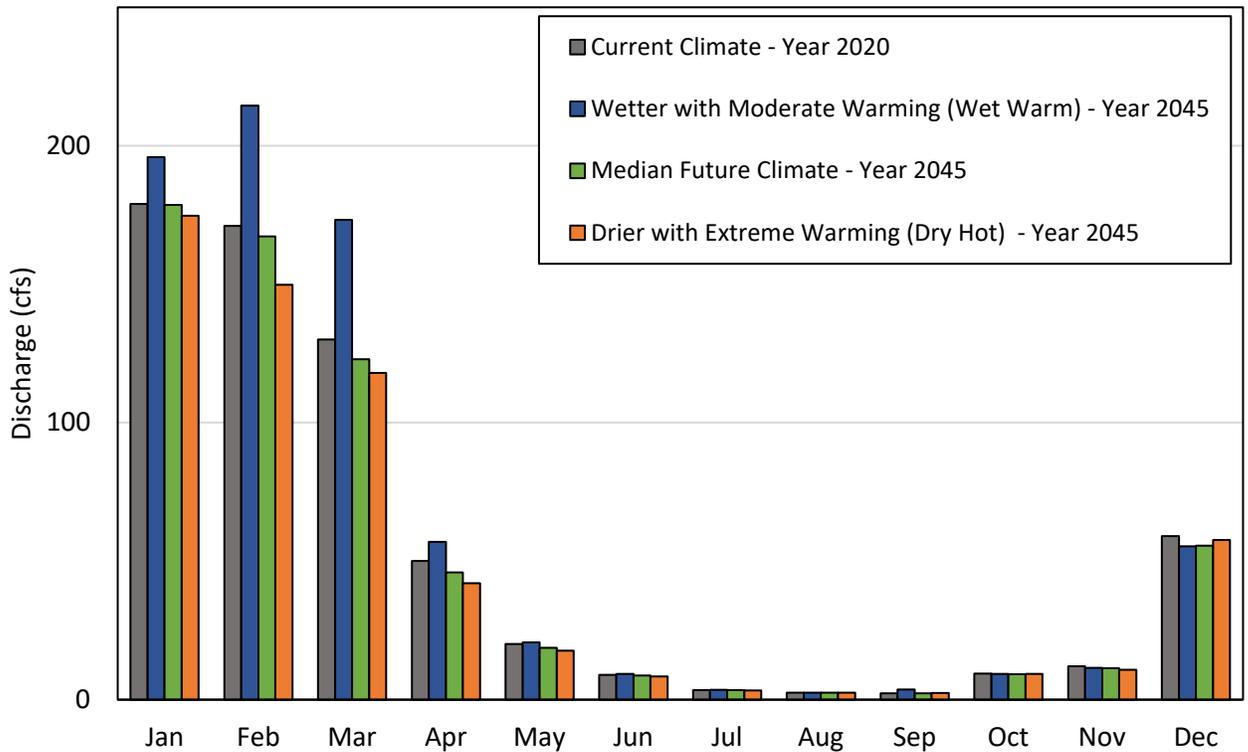
**Figure 9: Projected Changes in Normal Year Groundwater Supply – 2045**

Figure 10 shows the projected changes in normal year flow for the Santa Ana River by 2045. The Dry Hot and Median scenarios project a 6.8 and 4.1 percent decrease in annual flow by 2045 relative to current climate, respectively, while the Wet Warm scenario projects a 14.8 percent higher annual flow by 2045. The Dry Hot scenario projects lower flow during high-flow months of February and March compared to the current conditions, with discharge decreasing by 32 cubic feet per second (cfs) in February, and 28 cfs in March. Conversely, the Wet Warm scenario projects higher flows during the same period, with discharge increasing by 108 cfs in February and nearly 78 cfs in March. Projected flows under the Median scenario are generally consistent with projected flows under the current climate. No notable deviations in flow from the current climate are projected under any of the climate change scenarios between May to December. Detailed projected changes for Santa Ana River flow under all the climate change scenarios are presented in Appendix A (Table A4, Table A5 and Table A6).



**Figure 10: Projected Changes in Normal Year Flow by 2045: Santa Ana River**

Figure 11 shows the projected changes in normal year flow for the Santa Margarita River by 2045. While the Wet Warm scenario projects a 12 percent increase in annual flow by 2045, the Dry Hot and Median scenarios project decreases in annual flow of up to 6.8 percent and 4.1 percent respectively by 2045. Projected flows under the Median scenario are generally consistent with projected flows under the current climate. The Dry Hot scenario projects lower flows during February and March compared to the current conditions, with discharge decreasing by 21 cfs in February, and 12 cfs in March. Conversely, the Wet Warm scenario projects higher flows during the first quarter of calendar year with significantly higher flows (+43 cfs) during February and March. Detailed projected changes for Santa Margarita River flow under all the climate change scenarios are presented in Appendix A (Table A7, Table A8, and Table A9).



**Figure 11: Projected Changes in Normal Year Flow 2045: Santa Margarita River**

These water supply change projections indicate that as climate change progresses, local water systems which rely on natural recharge through precipitation are likely to become more reliable water supply sources, while river supplies that are diverted for artificial recharge will continue to see high variability and are likely to become less reliable. Natural groundwater recharge will still occur in normal and dry years, but the timing of available water will change as precipitation will increasingly fall during a shorter rainy season with a longer dry season each year. Furthermore, the increase in temperatures over time will also lead to increases in evaporation from surface water bodies and land surface which will decrease the volume of water available for diversion from rivers. Increased attention should be paid to understanding the adequacy and operational constraints of natural and artificial recharge systems in the service area.

### 3.2 Water Demand Change Factors Results

Projected changes in outdoor demand from baseline conditions in 2020 under various climate change scenarios are shown in Figure 12, Figure 13, and Figure 14. The water demand change factors are applied to outdoor water uses, which have been adjusted for future population growth and conservation measures. Indoor water uses are assumed to respond to future population growth and conservation as well but are not sensitive to climate change. All scenarios indicate an increase in the annual outdoor water demand, with the average annual outdoor water demand projected to increase by 6 percent for the Dry Hot scenario; 3.4 percent for the Median scenario; and 1.3 percent for the Wet Warm scenario.

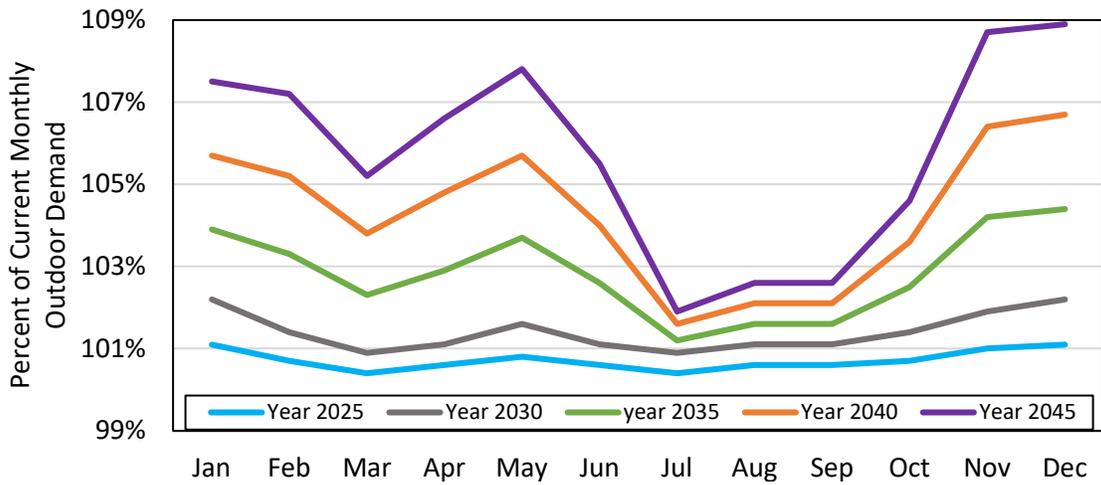


Figure 12: Changes in Outdoor Demand under Dry Hot Future Climate 2025 - 2045

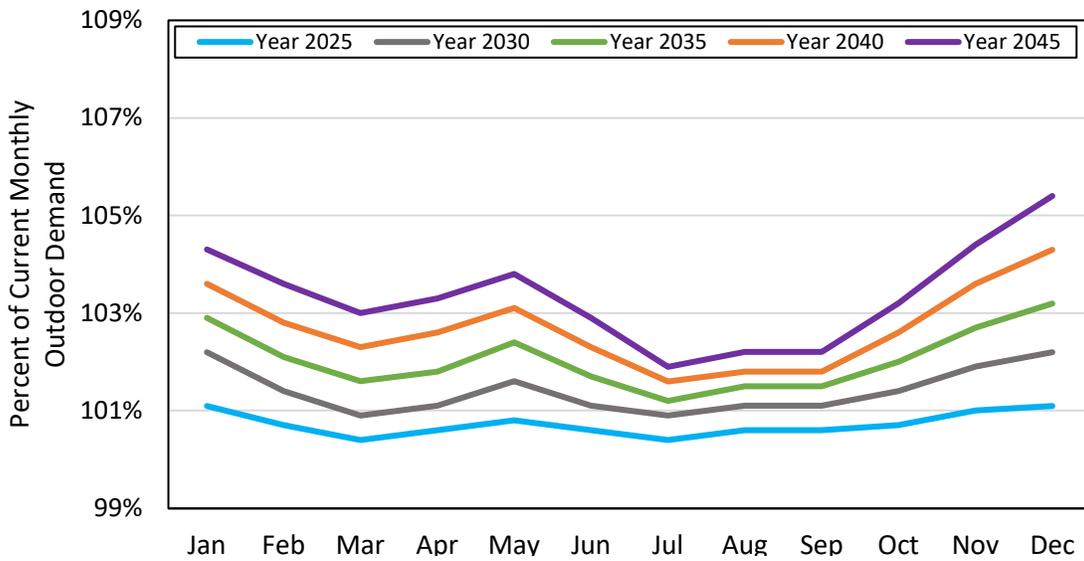


Figure 13: Changes in Normal Year Outdoor Demand under Median Future Climate 2025 - 2045

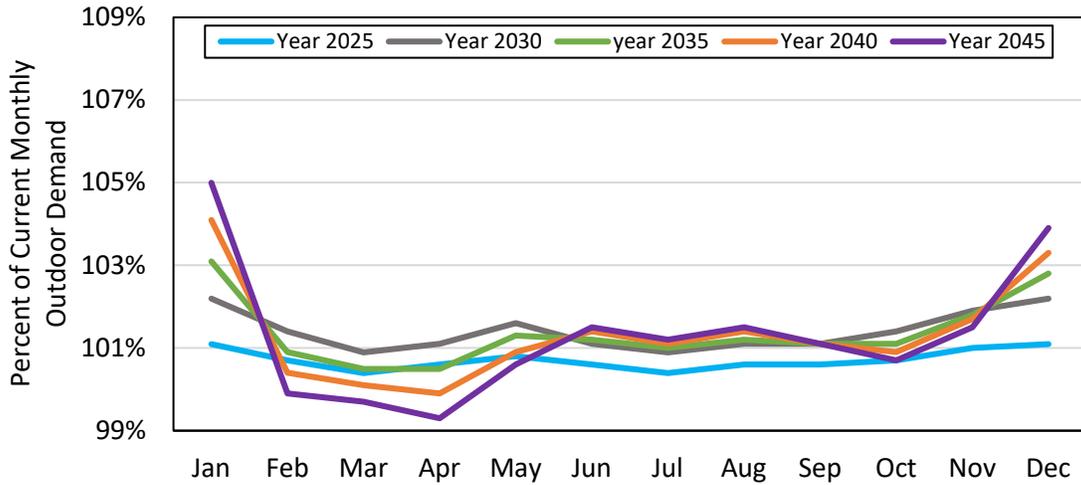


Figure 14: Changes in Outdoor Demand under Wet Warm Future Climate 2025 - 2045

Figure 15 shows the absolute values of the outdoor water demand under various climate change scenarios compared to current conditions and normal conditions in 2045. The impacts of climate change on outdoor water demand are projected to be similar during normal and drought years over the next two decades. This is because climate change datasets show that temperatures are projected to increase over time, regardless of hydrologic conditions. These projected increases in temperature are estimated to increase ET rates for landscaping, irrigated agriculture, and native vegetation. Although the relative changes seem small, the absolute increase during the already high demands month of July and August are notable. On average, projected demand for customers served by Western within Western’s wholesale and retail service areas in 2045 assuming normal conditions is projected to increase by 6,200 AF in July and August from the projected demand under current climate conditions. This average increase in peak monthly demand (July and August) increases to nearly 6,700 AF under the Dry Hot scenario; 6,500 AF under the Wet Warm scenario; and 6,650 AF under the Median scenario. Detailed projected changes for outdoor water demand under all the climate change scenarios are presented in Appendix A (Table A10,

Table A11, and Table A12).

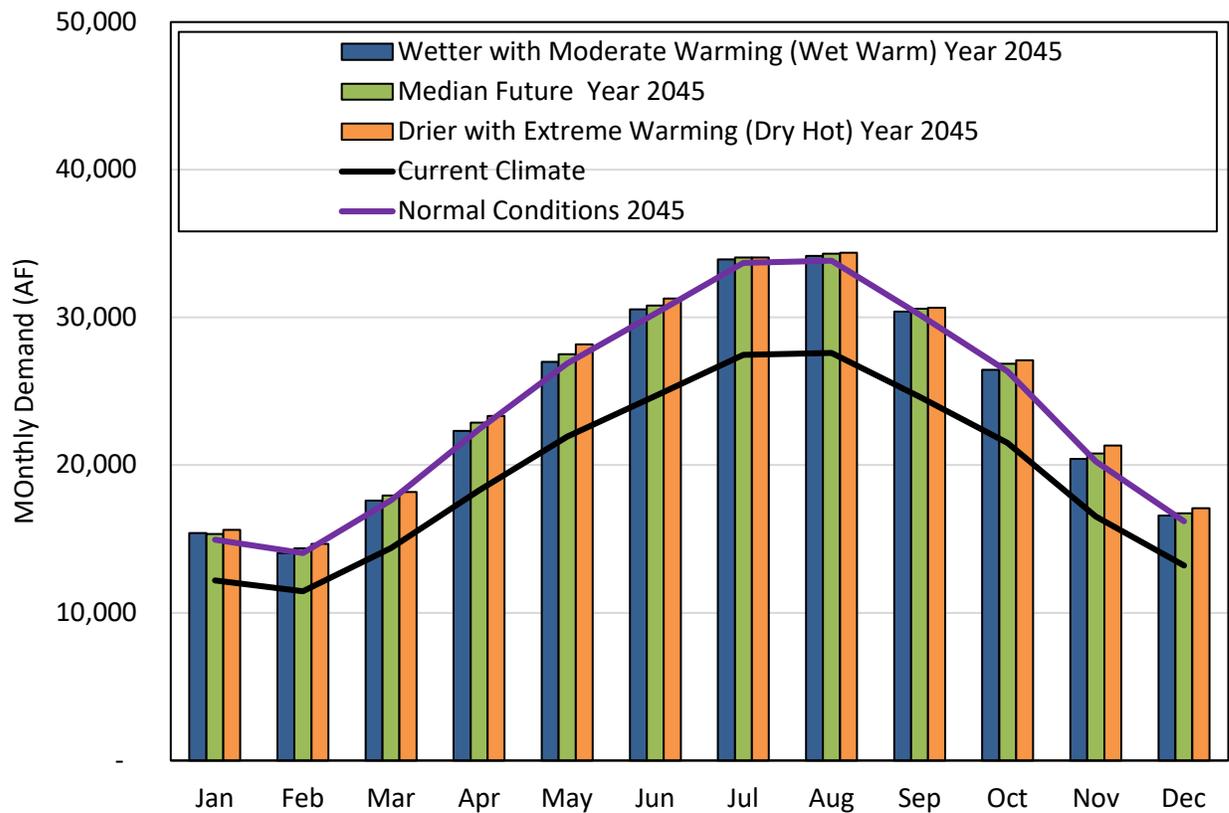


Figure 15: Projected Changes in Normal Year Water Demand 2045

#### 4. FUTURE WATER SUPPLY BUDGETS

Climate change impacts on future water supplies and demands will inform development of the regional DCP.

This TM provides Western and its retail agencies with the ability to utilize the data in the DWR climate change projections and methods of climate change analysis for Western’s service area to develop water budgets and evaluate the impacts of climate change either qualitatively or quantitatively. The water budgets for the entire Western services area for each of the three climate change conditions are shown in Table 2 through Table 4. The water budgets developed for the Western service area include the following assumptions.

- Climate change factors were applied to demand and groundwater production. Baseline demand was collected from Western’s 2020 UWMP. Baseline groundwater production was calculated as the difference between baseline demand and the summation of imported water supplied by MWD plus recycled water use.
- Surface water production and recycling supplies were held constant at 2020 levels to help identify the need for mitigation actions.
- Demand for imported supplies was calculated as the difference between total demand and total local supplies.

**Table 2: Western Service Area Water Budget – Drier Future Conditions with Extreme Warming**

	2025	2030	2035	2040	2045
<b>Total Demand</b>	<b>245,910</b>	<b>260,841</b>	<b>275,618</b>	<b>281,921</b>	<b>295,777</b>
Groundwater Production	157,111	156,298	153,439	150,638	147,771
Surface Production	2,414	2,414	2,414	2,414	2,414
Recycling	6,908	6,908	6,908	6,908	6,908
Recycling - M&I and Agricultural	6,908	6,908	6,908	6,908	6,908
<b>Total Local Supplies</b>	<b>166,433</b>	<b>165,620</b>	<b>162,761</b>	<b>159,960</b>	<b>157,093</b>
<b>Total Net Demand on Imported Water Supply</b>	<b>79,477</b>	<b>95,220</b>	<b>112,856</b>	<b>121,961</b>	<b>138,685</b>

**Table 3: Western Service Area Water Budget – Median Future Climate Conditions**

	2025	2030	2035	2040	2045
<b>Total Demand</b>	<b>245,910</b>	<b>258,614</b>	<b>271,889</b>	<b>285,842</b>	<b>300,509</b>
Groundwater Production	157,111	156,298	155,377	154,484	153,591
Surface Production	2,414	2,414	2,414	2,414	2,414
Recycling	6,908	6,908	6,908	6,908	6,908
Recycling - M&I and Agricultural	6,908	6,908	6,908	6,908	6,908
<b>Total Local Supplies</b>	<b>166,433</b>	<b>165,620</b>	<b>164,699</b>	<b>163,806</b>	<b>162,913</b>
<b>Total Net Demand on Imported Water Supply</b>	<b>79,477</b>	<b>92,994</b>	<b>107,190</b>	<b>122,037</b>	<b>137,596</b>

**Table 4: Western Service Area Water Budget – Wetter Future Conditions with Moderate Warming**

	2025	2030	2035	2040	2045
<b>Total Demand</b>	<b>245,910</b>	<b>258,614</b>	<b>270,834</b>	<b>283,668</b>	<b>297,076</b>
Groundwater Production	157,111	156,298	160,752	165,199	169,694
Surface Production	2,414	2,414	2,414	2,414	2,414
Recycling	6,908	6,908	6,908	6,908	6,908
Recycling – M&I and Agricultural	6,908	6,908	6,908	6,908	6,908
<b>Total Local Supplies</b>	<b>166,433</b>	<b>165,620</b>	<b>170,074</b>	<b>174,521</b>	<b>179,016</b>
<b>Total Net Demand on Imported Water Supply</b>	<b>79,477</b>	<b>92,994</b>	<b>100,760</b>	<b>109,148</b>	<b>118,060</b>

The MWD 2020 IRP also developed projected water supply budgets based on its four projected climate change conditions described previously. Table 5 shows the MWD 2020 IRP projected total demand for Western’s service area and Table 6 shows the MWD 2020 IRP projected imported water supply demand for Western, supplied by MWD, for each of MWD’s 2020 IRP climate change scenarios.

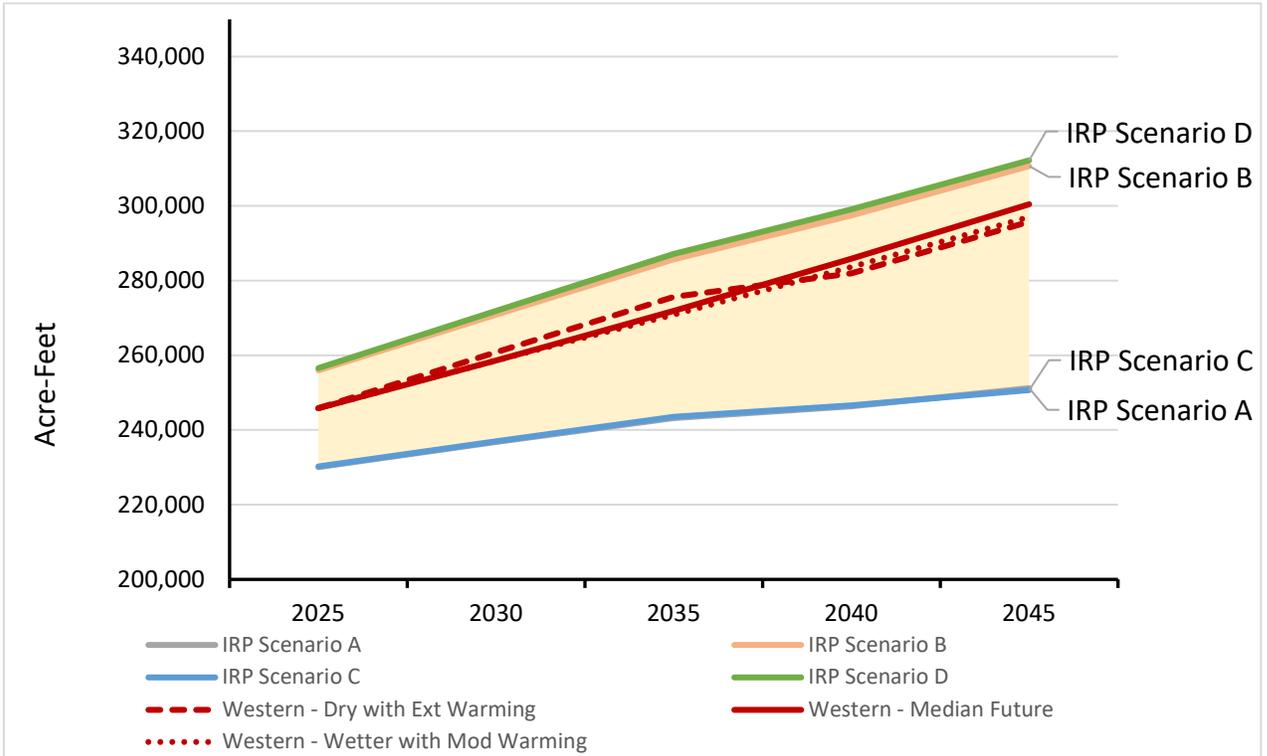
**Table 5: MWD 2020 IRP Projection of Western’s Service Area Demand**

	2025	2030	2035	2040	2045
<b>Projected Western Total Demand</b>					
Scenario A	230,120	236,761	243,185	246,359	251,194
Scenario B	255,964	270,884	285,736	297,451	310,669
Scenario C	230,243	237,010	243,555	246,637	250,722
Scenario D	256,597	271,855	287,142	299,076	312,220

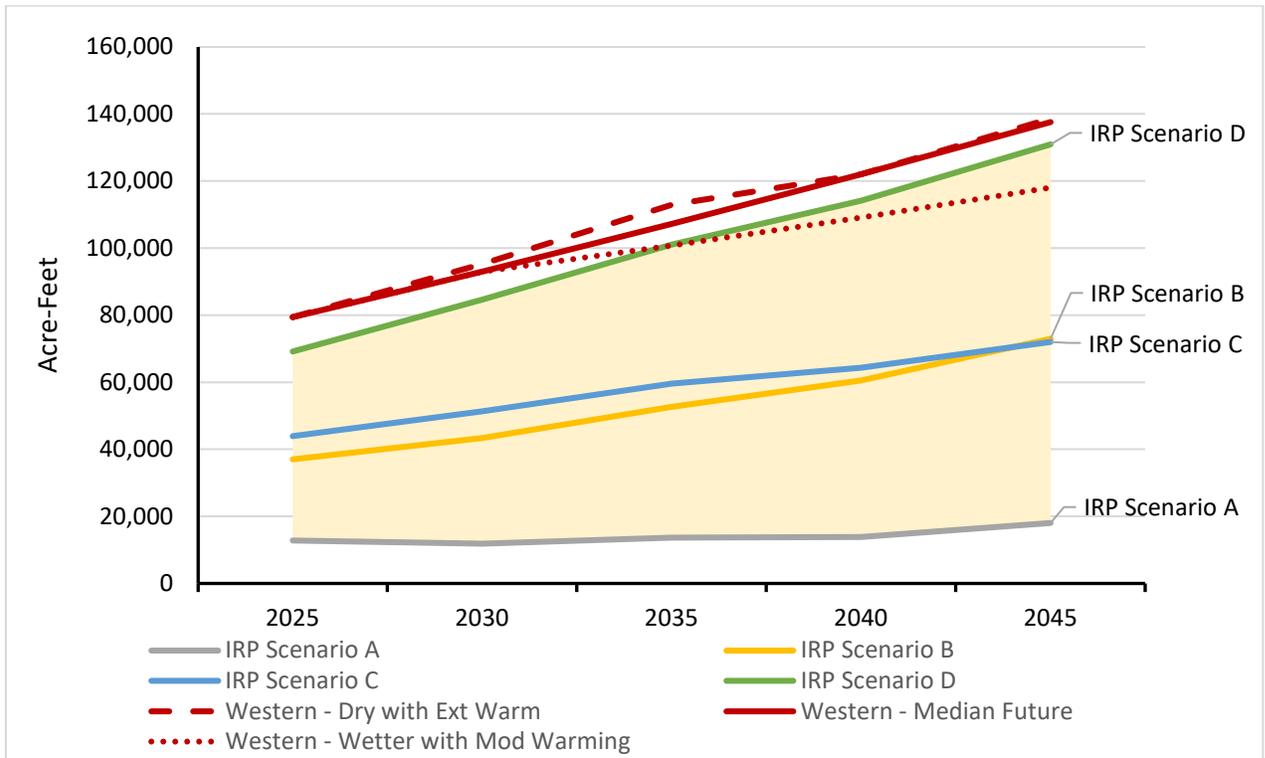
**Table 6: MWD 2020 IRP Projection of Western’s Imported Water Supply Demand**

	2025	2030	2035	2040	2045
<b>Projected Western Demand on Imported Water Supply</b>					
Scenario A	12,823	11,851	13,632	13,838	18,057
Scenario B	37,049	43,323	52,626	60,484	73,030
Scenario C	43,930	51,299	59,551	64,284	72,069
Scenario D	69,207	84,621	101,072	114,132	130,938

A comparison of Western and the MWD 2020 IRP total Western service area demand, Figure 16, shows that Western’s projections are consistent with the MWD 2020 IRP. The MWD 2020 IRP projections of Western’s imported water supply demands are generally higher than the imported water supply demands calculated for Western in this climate change analysis, as illustrated in Figure 17. However, these higher demands are generally attributable to the assumption in Western’s water budget that surface and recycled water production is held constant at 2020 levels, while the MWD 2020 IRP assumes growth in those two water supply sources.



**Figure 16: Comparison of MWD 2020 IRP and Western Service Area Total Supply Demands Under Future Climate Scenarios**



**Figure 17: Comparison of MWD 2020 IRP and Western Imported Water Supply Demands Under Future Climate Scenarios**

## 5. APPLYING RESULTS TO LOCAL WATER ANALYSIS

### 5.1. Computing Future Water Supply and Demand

For Western retail agencies wishing to perform a quantitative assessment of their projected water budgets, the computations needed to convert the percent change results presented in this TM into quantitative estimates of future water supply and demand can be provided as worksheets upon request. Instructions on how to use these worksheets can also be made available upon request.

The monthly change factors developed as part of this analysis are useful for understanding how seasonal changes are contributing to the annual changes discussed in Section 3 of this report. Monthly values are also useful for planning management actions and mitigation actions in the regional DCP. Monthly water supply and demand change factors computed for the service area are presented in Appendix A which consists of the following 12 tables:

- Table A1: Monthly Rainfall Change Factors: Drier with Extreme Warming Scenario
- Table A2: Monthly Rainfall Change Factors: Median Scenario
- Table A3: Monthly Rainfall Change Factors: Wetter with Moderate Warming Scenario
- Table A4: Monthly Santa Ana River Flow Change Factors: Drier with Extreme Warming Scenario
- Table A5: Monthly Santa Ana River Flow Change Factors: Median Scenario

- Table A6: Monthly Santa Ana River Flow Change Factors: Wetter with Moderate Warming Scenario
- Table A7: Monthly Santa Margarita River Flow Change Factors: Drier with Extreme Warming Scenario
- Table A8: Monthly Santa Margarita River Flow Change Factors: Median Scenario
- Table A9: Monthly Santa Margarita River Flow Change Factors: Wetter with Moderate Warming Scenario
- Table A10: Monthly Water Demand Change Factors: Drier with Extreme Warming Scenario
- Table A11: Monthly Water Demand Change Factors: Median Scenario
- Table A12: Monthly Water Demand Change Factors: Wetter with Moderate Warming Scenario

## **5.2. Constraints and Limitations**

This TM presents planning-level projections of climate impacts on water supplies and demand for Western’s service area during normal and drought periods. The results are intended for use by Western in preparing climate-impacted water supply and demand projections for its wholesale UWMP and regional DCP.

The results are not intended for use in other applications such as flood resilience planning, infrastructure design, or for making decisions about operating any specific structure. Flood resilience planning requires analysis of daily or finer temporal resolution using statistical methods to fit frequency distributions to extreme values. Infrastructure design and operations applications require more detailed analysis and ground-truthing of site-specific characteristics, operations and regulations that are not considered in this report.

Climate change can also impact water resources indirectly. For example, wildfire hazards are projected to increase in southern California with climate change. Wildfires can impact water resources by increasing water requirements for firefighting, changing surface vegetation and runoff patterns in burn areas, causing debris flows, and increasing siltation of reservoirs and hydraulic structures. Such secondary impacts of climate change on water resource are not captured in this study.

Future water supplies and demands can also be impacted by policy and regulatory decisions made at the local, state, and federal level. It is difficult to anticipate and quantify the impacts of policy and regulatory considerations that have not yet been made. Therefore, it is not the intention of this report to anticipate future policy or regulatory decisions and their impacts to future water supplies or demands.

## **5.3. Next Steps**

The next step in the planning process is for Western and its member agencies to use the change factors and analysis provided in this TM, if desired, to compute quantitative estimates of future supplies and demands during normal and drought years, incorporating the effects of climate change. The net change in future water supply for each member agency will depend on the percentage of their local water

supply that is sourced from the direct precipitation and natural recharge, Santa Margarita River, or Santa Ana River basins. Similarly, the net change in future water demand will depend on the percentage of outdoor water use and projections of future growth within each member agency's service area. The difference between net future water supply and net future water demand, if any, is the net water deficit that the agency will need to address by developing new management actions and projects. A calculated deficit, if any, would represent the minimum gap that would need to be addressed; however, it is prudent for water managers to consider additional management actions and projects to prepare for uncertain future conditions.

This TM provides Western and its retail agencies with the ability to utilize the data in the DWR climate change projections and methods of climate change analysis for Western's service area to evaluate the impacts of climate change either qualitatively or quantitatively. Should a retail agency choose to use the analysis presented in this TM, the agency may use the change factors provided in Appendix A to compute quantitative estimates of their future water supplies, demands and deficits. As previously noted, worksheets to convert the percent change results presented in this TM into quantitative estimates of future water supply and demand can also be provided upon request.

## **6. REFERENCES**

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**Appendix A: Detailed Projected  
Changes in Rainfall, Outdoor Demand,  
Santa Margarita River Flow and Santa  
Ana River Flow under all scenarios.**

**Table A1: Projected Changes in Rainfall under Drier with Extreme Warming Scenario**

YearType	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	YR2025	100.4%	99.6%	100.0%	100.4%	96.1%	99.6%	99.3%	100.8%	100.6%	96.5%	98.0%	99.1%
Normal	YR2030	100.9%	99.1%	100.0%	100.9%	92.1%	99.1%	98.5%	101.6%	101.1%	92.9%	95.9%	98.2%
Normal	YR2035	98.1%	99.0%	96.5%	93.4%	87.2%	98.0%	97.9%	100.3%	105.4%	90.3%	88.5%	103.4%
Normal	YR2040	95.5%	98.9%	93.0%	85.9%	82.3%	96.8%	97.2%	99.0%	109.6%	87.6%	81.0%	108.7%
Normal	YR2045	92.8%	98.7%	89.5%	78.4%	77.3%	95.7%	96.6%	97.7%	113.9%	85.0%	73.6%	113.9%
Dry_1Yr	YR2025	101.8%	99.6%	100.7%	103.7%	94.3%	100.0%	100.0%	100.0%	100.6%	93.8%	96.7%	99.9%
Dry_1Yr	YR2030	103.6%	99.1%	101.4%	107.4%	88.6%	100.0%	100.0%	100.0%	101.1%	87.7%	93.3%	99.7%
Dry_1Yr	YR2035	98.2%	96.8%	96.2%	102.4%	83.5%	100.0%	100.0%	100.0%	111.2%	79.2%	83.0%	124.8%
Dry_1Yr	YR2040	92.7%	94.5%	91.0%	97.3%	78.3%	100.0%	100.0%	100.0%	121.3%	70.7%	72.6%	149.8%
Dry_1Yr	YR2045	87.3%	92.2%	85.8%	92.2%	73.2%	100.0%	100.0%	100.0%	131.4%	62.1%	62.3%	174.9%
Dry_5Yr	YR2025	100.0%	97.8%	99.6%	100.4%	94.8%	99.7%	100.0%	101.2%	100.1%	95.2%	97.8%	98.1%
Dry_5Yr	YR2030	100.0%	95.6%	99.1%	100.9%	89.5%	99.4%	100.0%	102.4%	100.3%	90.5%	95.6%	96.3%
Dry_5Yr	YR2035	97.0%	100.1%	97.0%	93.4%	84.3%	97.9%	100.0%	100.8%	101.9%	85.0%	87.2%	105.3%
Dry_5Yr	YR2040	94.0%	104.7%	94.8%	85.9%	79.1%	96.4%	100.0%	99.1%	103.5%	79.6%	78.9%	114.3%
Dry_5Yr	YR2045	91.0%	109.3%	92.6%	78.4%	73.9%	94.9%	100.0%	97.5%	105.1%	74.2%	70.6%	123.3%
Wet_1Yr	YR2025	100.6%	100.4%	98.8%	98.9%	95.4%	100.0%	100.0%	100.0%	98.6%	97.2%	98.6%	101.0%
Wet_1Yr	YR2030	101.1%	100.9%	97.6%	97.9%	90.9%	100.0%	100.0%	100.0%	97.2%	94.4%	97.2%	101.9%
Wet_1Yr	YR2035	102.0%	98.8%	99.0%	94.9%	81.2%	100.0%	100.0%	93.9%	114.6%	96.3%	90.2%	99.5%
Wet_1Yr	YR2040	102.8%	96.7%	100.5%	91.8%	71.5%	100.0%	100.0%	87.7%	132.0%	98.2%	83.1%	97.1%
Wet_1Yr	YR2045	103.7%	94.6%	102.0%	88.8%	61.9%	100.0%	100.0%	81.6%	149.4%	100.0%	76.0%	94.8%
Wet_5Yr	YR2025	100.8%	100.4%	99.9%	100.1%	95.9%	99.9%	99.6%	100.6%	101.5%	96.9%	98.1%	99.3%
Wet_5Yr	YR2030	101.6%	100.9%	99.7%	100.3%	91.7%	99.7%	99.1%	101.1%	102.9%	93.8%	96.3%	98.5%
Wet_5Yr	YR2035	100.0%	98.4%	98.2%	93.8%	84.8%	99.2%	99.6%	100.1%	106.2%	91.5%	87.9%	102.0%
Wet_5Yr	YR2040	98.3%	95.9%	96.7%	87.4%	77.8%	98.7%	100.1%	99.2%	109.4%	89.4%	79.6%	105.5%
Wet_5Yr	YR2045	96.6%	93.5%	95.2%	80.9%	70.9%	98.2%	100.7%	98.2%	112.6%	87.2%	71.2%	109.0%

**Table A2: Projected Changes in Rainfall under Median Scenario**

YearType	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	YR2025	100.4%	99.6%	100.0%	100.4%	96.1%	99.6%	99.3%	100.8%	100.6%	96.5%	98.0%	99.1%
Normal	YR2030	100.9%	99.1%	100.0%	100.9%	92.1%	99.1%	98.5%	101.6%	101.1%	92.9%	95.9%	98.2%
Normal	YR2035	101.7%	99.4%	99.1%	97.5%	90.3%	98.5%	100.7%	102.6%	103.8%	91.8%	93.3%	97.4%
Normal	YR2040	102.6%	99.6%	98.3%	94.2%	88.5%	97.8%	102.9%	103.6%	106.5%	90.6%	90.7%	96.6%
Normal	YR2045	103.4%	99.9%	97.4%	90.9%	86.8%	97.2%	105.1%	104.5%	109.1%	89.4%	88.1%	95.9%
Dry_1Yr	YR2025	101.8%	99.6%	100.7%	103.7%	94.3%	100.0%	100.0%	100.0%	100.6%	93.8%	96.7%	99.9%
Dry_1Yr	YR2030	103.6%	99.1%	101.4%	107.4%	88.6%	100.0%	100.0%	100.0%	101.1%	87.7%	93.3%	99.7%
Dry_1Yr	YR2035	103.9%	99.1%	100.5%	102.6%	86.2%	100.0%	100.0%	100.0%	106.1%	84.9%	88.8%	100.0%
Dry_1Yr	YR2040	104.1%	99.1%	99.7%	97.7%	83.8%	100.0%	100.0%	100.0%	111.1%	82.1%	84.3%	100.2%
Dry_1Yr	YR2045	104.3%	99.1%	98.8%	92.8%	81.4%	100.0%	100.0%	100.0%	116.1%	79.3%	79.8%	100.5%
Dry_5Yr	YR2025	100.0%	97.8%	99.6%	100.4%	94.8%	99.7%	100.0%	101.2%	100.1%	95.2%	97.8%	98.1%
Dry_5Yr	YR2030	100.0%	95.6%	99.1%	100.9%	89.5%	99.4%	100.0%	102.4%	100.3%	90.5%	95.6%	96.3%
Dry_5Yr	YR2035	100.9%	96.9%	98.2%	97.2%	87.3%	98.9%	100.0%	104.6%	101.0%	88.4%	92.6%	95.7%
Dry_5Yr	YR2040	101.8%	98.3%	97.3%	93.5%	85.1%	98.4%	100.0%	106.9%	101.8%	86.4%	89.7%	95.2%
Dry_5Yr	YR2045	102.6%	99.7%	96.4%	89.8%	82.9%	97.9%	100.0%	109.1%	102.5%	84.4%	86.8%	94.6%
Wet_1Yr	YR2025	100.6%	100.4%	98.8%	98.9%	95.4%	100.0%	100.0%	100.0%	98.6%	97.2%	98.6%	101.0%
Wet_1Yr	YR2030	101.1%	100.9%	97.6%	97.9%	90.9%	100.0%	100.0%	100.0%	97.2%	94.4%	97.2%	101.9%
Wet_1Yr	YR2035	101.8%	101.3%	98.0%	97.0%	87.8%	100.0%	100.0%	98.8%	103.1%	94.3%	97.8%	99.9%
Wet_1Yr	YR2040	102.6%	101.8%	98.4%	96.1%	84.7%	100.0%	100.0%	97.5%	109.0%	94.2%	98.3%	97.9%
Wet_1Yr	YR2045	103.3%	102.3%	98.8%	95.1%	81.7%	100.0%	100.0%	96.3%	114.9%	94.0%	98.9%	95.8%
Wet_5Yr	YR2025	100.8%	100.4%	99.9%	100.1%	95.9%	99.9%	99.6%	100.6%	101.5%	96.9%	98.1%	99.3%
Wet_5Yr	YR2030	101.6%	100.9%	99.7%	100.3%	91.7%	99.7%	99.1%	101.1%	102.9%	93.8%	96.3%	98.5%
Wet_5Yr	YR2035	102.7%	101.1%	99.2%	97.9%	89.3%	99.5%	100.7%	101.1%	105.0%	92.4%	92.1%	97.9%
Wet_5Yr	YR2040	103.8%	101.3%	98.7%	95.6%	86.9%	99.2%	102.2%	101.1%	107.1%	91.1%	88.0%	97.2%
Wet_5Yr	YR2045	104.9%	101.6%	98.2%	93.2%	84.5%	99.0%	103.7%	101.1%	109.2%	89.8%	83.9%	96.6%

**Table A3: Projected Changes in Rainfall under Wetter with Moderate Warming Scenario**

YearType	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	YR2025	100.4%	99.6%	100.0%	100.4%	96.1%	99.6%	99.3%	100.8%	100.6%	96.5%	98.0%	99.1%
Normal	YR2030	100.9%	99.1%	100.0%	100.9%	92.1%	99.1%	98.5%	101.6%	101.1%	92.9%	95.9%	98.2%
Normal	YR2035	102.7%	106.5%	107.5%	97.4%	92.9%	97.7%	98.8%	100.3%	122.9%	90.0%	95.4%	96.1%
Normal	YR2040	104.5%	113.9%	115.0%	94.0%	93.6%	96.3%	99.0%	99.0%	144.6%	87.1%	94.8%	94.0%
Normal	YR2045	106.3%	121.4%	122.5%	90.6%	94.4%	94.9%	99.3%	97.7%	166.4%	84.1%	94.3%	91.9%
Dry_1Yr	YR2025	101.8%	99.6%	100.7%	103.7%	94.3%	100.0%	100.0%	100.0%	100.6%	93.8%	96.7%	99.9%
Dry_1Yr	YR2030	103.6%	99.1%	101.4%	107.4%	88.6%	100.0%	100.0%	100.0%	101.1%	87.7%	93.3%	99.7%
Dry_1Yr	YR2035	106.5%	105.6%	112.5%	101.7%	89.6%	100.0%	100.0%	100.0%	162.5%	86.8%	93.3%	91.7%
Dry_1Yr	YR2040	109.3%	112.2%	123.6%	96.0%	90.6%	100.0%	100.0%	100.0%	223.9%	86.0%	93.3%	83.6%
Dry_1Yr	YR2045	112.2%	118.7%	134.7%	90.3%	91.5%	100.0%	100.0%	100.0%	285.2%	85.2%	93.3%	75.5%
Dry_5Yr	YR2025	100.0%	97.8%	99.6%	100.4%	94.8%	99.7%	100.0%	101.2%	100.1%	95.2%	97.8%	98.1%
Dry_5Yr	YR2030	100.0%	95.6%	99.1%	100.9%	89.5%	99.4%	100.0%	102.4%	100.3%	90.5%	95.6%	96.3%
Dry_5Yr	YR2035	99.4%	111.4%	105.3%	97.0%	90.3%	98.2%	100.0%	100.5%	107.1%	86.9%	94.7%	93.4%
Dry_5Yr	YR2040	98.8%	127.2%	111.4%	93.3%	91.1%	96.9%	100.0%	98.7%	113.9%	83.3%	93.9%	90.5%
Dry_5Yr	YR2045	98.1%	143.1%	117.5%	89.5%	91.9%	95.6%	100.0%	96.8%	120.8%	79.8%	93.1%	87.6%
Wet_1Yr	YR2025	100.6%	100.4%	98.8%	98.9%	95.4%	100.0%	100.0%	100.0%	98.6%	97.2%	98.6%	101.0%
Wet_1Yr	YR2030	101.1%	100.9%	97.6%	97.9%	90.9%	100.0%	100.0%	100.0%	97.2%	94.4%	97.2%	101.9%
Wet_1Yr	YR2035	104.5%	106.0%	101.4%	95.5%	90.7%	100.0%	100.0%	92.7%	173.9%	86.2%	93.4%	98.6%
Wet_1Yr	YR2040	107.9%	111.1%	105.3%	93.2%	90.6%	100.0%	100.0%	85.5%	250.6%	78.0%	89.5%	95.2%
Wet_1Yr	YR2045	111.3%	116.3%	109.1%	90.8%	90.4%	100.0%	100.0%	78.2%	327.3%	69.7%	85.6%	91.9%
Wet_5Yr	YR2025	100.8%	100.4%	99.9%	100.1%	95.9%	99.9%	99.6%	100.6%	101.5%	96.9%	98.1%	99.3%
Wet_5Yr	YR2030	101.6%	100.9%	99.7%	100.3%	91.7%	99.7%	99.1%	101.1%	102.9%	93.8%	96.3%	98.5%
Wet_5Yr	YR2035	106.0%	106.8%	104.6%	97.7%	91.6%	98.7%	98.7%	100.5%	117.5%	89.8%	96.9%	97.0%
Wet_5Yr	YR2040	110.3%	112.8%	109.5%	95.1%	91.4%	97.7%	98.4%	99.9%	132.1%	85.9%	97.6%	95.4%
Wet_5Yr	YR2045	114.6%	118.8%	114.4%	92.5%	91.3%	96.7%	98.0%	99.3%	146.7%	82.0%	98.3%	93.9%

**Table A4: Projected Changes in Santa Ana River Flow under Drier with Extreme Warming Scenario**

YearType	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	YR2025	100.6%	100.1%	99.3%	97.6%	96.1%	98.0%	99.4%	100.1%	100.4%	99.4%	98.9%	99.7%
Normal	YR2030	101.1%	100.3%	98.5%	95.2%	92.1%	95.9%	98.9%	100.3%	100.9%	98.9%	97.9%	99.4%
Normal	YR2035	100.3%	96.4%	94.5%	89.3%	87.5%	93.6%	97.7%	99.9%	104.4%	98.8%	95.1%	101.3%
Normal	YR2040	99.4%	92.6%	90.5%	83.4%	82.9%	91.2%	96.5%	99.5%	107.9%	98.8%	92.4%	103.2%
Normal	YR2045	98.6%	88.7%	86.5%	77.6%	78.2%	88.9%	95.3%	99.2%	111.5%	98.8%	89.6%	105.1%
Dry_1Yr	YR2025	101.0%	100.4%	97.8%	97.8%	98.6%	99.7%	99.9%	100.0%	100.0%	98.9%	99.1%	99.9%
Dry_1Yr	YR2030	101.9%	100.9%	95.6%	95.6%	97.2%	99.4%	99.7%	100.0%	100.0%	97.9%	98.2%	99.7%
Dry_1Yr	YR2035	96.5%	96.3%	88.2%	90.0%	94.7%	98.2%	99.0%	99.6%	107.8%	98.2%	97.2%	99.7%
Dry_1Yr	YR2040	91.2%	91.8%	80.8%	84.4%	92.2%	96.9%	98.2%	99.2%	115.5%	98.4%	96.1%	99.7%
Dry_1Yr	YR2045	85.8%	87.3%	73.5%	78.9%	89.6%	95.6%	97.4%	98.9%	123.2%	98.7%	95.1%	99.7%
Dry_5Yr	YR2025	100.3%	98.6%	98.5%	97.2%	95.4%	97.6%	99.7%	100.0%	100.0%	99.4%	98.8%	98.9%
Dry_5Yr	YR2030	100.6%	97.2%	96.9%	94.4%	90.9%	95.2%	99.4%	100.0%	100.0%	98.9%	97.6%	97.9%
Dry_5Yr	YR2035	98.7%	93.2%	92.7%	89.2%	87.0%	93.5%	98.5%	99.6%	100.6%	97.8%	94.3%	98.8%
Dry_5Yr	YR2040	96.9%	89.2%	88.6%	83.9%	83.2%	91.8%	97.6%	99.2%	101.2%	96.8%	90.9%	99.7%
Dry_5Yr	YR2045	95.0%	85.2%	84.4%	78.7%	79.4%	90.2%	96.8%	98.9%	101.9%	95.7%	87.6%	100.7%
Wet_1Yr	YR2025	100.3%	101.3%	98.8%	97.4%	94.1%	92.5%	96.7%	100.7%	99.6%	96.5%	98.5%	99.4%
Wet_1Yr	YR2030	100.6%	102.7%	97.6%	94.8%	88.2%	85.0%	93.3%	101.4%	99.1%	92.9%	96.9%	98.9%
Wet_1Yr	YR2035	96.0%	97.2%	98.2%	89.9%	80.9%	81.5%	91.7%	99.6%	106.0%	104.7%	90.6%	101.7%
Wet_1Yr	YR2040	91.4%	91.7%	98.9%	85.0%	73.6%	77.9%	90.1%	97.8%	112.9%	116.5%	84.3%	104.5%
Wet_1Yr	YR2045	86.9%	86.2%	99.6%	80.0%	66.3%	74.3%	88.5%	95.9%	119.8%	128.2%	77.9%	107.3%
Wet_5Yr	YR2025	101.0%	101.1%	99.6%	97.2%	95.0%	96.9%	98.9%	100.4%	102.2%	100.1%	99.3%	99.9%
Wet_5Yr	YR2030	101.9%	102.2%	99.1%	94.4%	90.0%	93.8%	97.9%	100.9%	104.4%	100.3%	98.5%	99.7%
Wet_5Yr	YR2035	100.7%	99.1%	97.0%	88.2%	83.9%	91.3%	97.0%	100.5%	108.6%	100.5%	97.0%	105.9%
Wet_5Yr	YR2040	99.5%	96.0%	94.8%	82.0%	77.8%	88.8%	96.1%	100.1%	112.8%	100.8%	95.4%	112.1%
Wet_5Yr	YR2045	98.3%	92.9%	92.6%	75.7%	71.7%	86.3%	95.1%	99.7%	117.0%	101.0%	93.9%	118.2%

**Table A5: Projected Changes in Santa Ana River Flow under Median Scenario**

YearType	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	YR2025	100.6%	100.1%	99.3%	97.6%	96.1%	98.0%	99.4%	100.1%	100.4%	99.4%	98.9%	99.7%
Normal	YR2030	101.1%	100.3%	98.5%	95.2%	92.1%	95.9%	98.9%	100.3%	100.9%	98.9%	97.9%	99.4%
Normal	YR2035	101.1%	100.3%	97.4%	92.5%	89.7%	94.9%	98.4%	100.2%	101.7%	98.4%	97.0%	98.0%
Normal	YR2040	101.1%	100.3%	96.2%	89.9%	87.4%	94.0%	98.1%	100.0%	102.6%	98.1%	96.1%	96.6%
Normal	YR2045	101.1%	100.3%	95.0%	87.2%	85.0%	93.0%	97.7%	99.9%	103.4%	97.7%	95.1%	95.2%
Dry_1Yr	YR2025	101.0%	100.4%	97.8%	97.8%	98.6%	99.7%	99.9%	100.0%	100.0%	98.9%	99.1%	99.9%
Dry_1Yr	YR2030	101.9%	100.9%	95.6%	95.6%	97.2%	99.4%	99.7%	100.0%	100.0%	97.9%	98.2%	99.7%
Dry_1Yr	YR2035	99.2%	99.4%	91.8%	92.4%	96.0%	98.9%	99.5%	99.9%	101.0%	97.4%	97.3%	99.6%
Dry_1Yr	YR2040	96.4%	97.9%	88.1%	89.2%	94.8%	98.4%	99.2%	99.8%	102.0%	96.8%	96.4%	99.5%
Dry_1Yr	YR2045	93.7%	96.4%	84.3%	86.0%	93.6%	97.9%	99.0%	99.6%	103.0%	96.3%	95.5%	99.3%
Dry_5Yr	YR2025	100.3%	98.6%	98.5%	97.2%	95.4%	97.6%	99.7%	100.0%	100.0%	99.4%	98.8%	98.9%
Dry_5Yr	YR2030	100.6%	97.2%	96.9%	94.4%	90.9%	95.2%	99.4%	100.0%	100.0%	98.9%	97.6%	97.9%
Dry_5Yr	YR2035	100.1%	96.0%	95.4%	91.8%	88.3%	94.2%	99.0%	99.9%	100.1%	98.2%	96.4%	96.2%
Dry_5Yr	YR2040	99.6%	94.8%	94.0%	89.1%	85.7%	93.2%	98.7%	99.8%	100.2%	97.5%	95.2%	94.5%
Dry_5Yr	YR2045	99.1%	93.6%	92.5%	86.4%	83.0%	92.3%	98.3%	99.6%	100.4%	96.9%	94.0%	92.8%
Wet_1Yr	YR2025	100.3%	101.3%	98.8%	97.4%	94.1%	92.5%	96.7%	100.7%	99.6%	96.5%	98.5%	99.4%
Wet_1Yr	YR2030	100.6%	102.7%	97.6%	94.8%	88.2%	85.0%	93.3%	101.4%	99.1%	92.9%	96.9%	98.9%
Wet_1Yr	YR2035	100.7%	102.7%	98.6%	93.9%	85.2%	83.0%	92.9%	100.8%	100.7%	92.4%	97.9%	95.7%
Wet_1Yr	YR2040	100.8%	102.7%	99.7%	92.9%	82.3%	81.0%	92.5%	100.2%	102.2%	91.8%	98.8%	92.6%
Wet_1Yr	YR2045	100.9%	102.7%	100.8%	91.9%	79.4%	78.9%	92.0%	99.6%	103.7%	91.2%	99.7%	89.6%
Wet_5Yr	YR2025	101.0%	101.1%	99.6%	97.2%	95.0%	96.9%	98.9%	100.4%	102.2%	100.1%	99.3%	99.9%
Wet_5Yr	YR2030	101.9%	102.2%	99.1%	94.4%	90.0%	93.8%	97.9%	100.9%	104.4%	100.3%	98.5%	99.7%
Wet_5Yr	YR2035	102.7%	103.1%	98.6%	91.5%	86.4%	92.4%	97.6%	100.8%	106.8%	100.5%	97.7%	98.2%
Wet_5Yr	YR2040	103.6%	104.1%	98.1%	88.5%	82.8%	91.1%	97.4%	100.8%	109.2%	100.8%	97.0%	96.7%
Wet_5Yr	YR2045	104.4%	105.0%	97.6%	85.5%	79.2%	89.8%	97.1%	100.8%	111.7%	101.0%	96.2%	95.2%

**Table A6: Projected Changes in Santa Ana River Flow under Wetter with Moderate Warming Scenario**

YearType	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	YR2025	100.6%	100.1%	99.3%	97.6%	96.1%	98.0%	99.4%	100.1%	100.4%	99.4%	98.9%	99.7%
Normal	YR2030	101.1%	100.3%	98.5%	95.2%	92.1%	95.9%	98.9%	100.3%	100.9%	98.9%	97.9%	99.4%
Normal	YR2035	104.8%	112.7%	111.4%	99.7%	93.5%	97.0%	99.6%	100.2%	131.8%	100.5%	96.8%	97.6%
Normal	YR2040	108.4%	125.1%	124.2%	104.2%	94.8%	98.1%	100.4%	100.0%	162.8%	102.2%	95.8%	95.9%
Normal	YR2045	112.0%	137.5%	137.0%	108.6%	96.2%	99.2%	101.1%	99.9%	193.7%	103.8%	94.7%	94.1%
Dry_1Yr	YR2025	101.0%	100.4%	97.8%	97.8%	98.6%	99.7%	99.9%	100.0%	100.0%	98.9%	99.1%	99.9%
Dry_1Yr	YR2030	101.9%	100.9%	95.6%	95.6%	97.2%	99.4%	99.7%	100.0%	100.0%	97.9%	98.2%	99.7%
Dry_1Yr	YR2035	103.7%	116.0%	102.6%	101.7%	99.5%	101.2%	100.7%	100.4%	159.8%	107.9%	103.2%	103.1%
Dry_1Yr	YR2040	105.5%	131.2%	109.7%	107.8%	101.8%	103.0%	101.7%	100.8%	219.5%	117.9%	108.1%	106.5%
Dry_1Yr	YR2045	107.3%	146.4%	116.8%	113.9%	104.1%	104.7%	102.7%	101.1%	279.2%	127.9%	113.1%	109.9%
Dry_5Yr	YR2025	100.3%	98.6%	98.5%	97.2%	95.4%	97.6%	99.7%	100.0%	100.0%	99.4%	98.8%	98.9%
Dry_5Yr	YR2030	100.6%	97.2%	96.9%	94.4%	90.9%	95.2%	99.4%	100.0%	100.0%	98.9%	97.6%	97.9%
Dry_5Yr	YR2035	101.8%	104.1%	107.8%	97.9%	92.6%	96.5%	100.1%	100.2%	114.8%	97.4%	96.1%	95.8%
Dry_5Yr	YR2040	103.0%	110.9%	118.7%	101.3%	94.3%	97.7%	100.7%	100.5%	129.5%	96.0%	94.7%	93.7%
Dry_5Yr	YR2045	104.3%	117.7%	129.6%	104.7%	95.9%	99.0%	101.3%	100.8%	144.3%	94.6%	93.2%	91.6%
Wet_1Yr	YR2025	100.3%	101.3%	98.8%	97.4%	94.1%	92.5%	96.7%	100.7%	99.6%	96.5%	98.5%	99.4%
Wet_1Yr	YR2030	100.6%	102.7%	97.6%	94.8%	88.2%	85.0%	93.3%	101.4%	99.1%	92.9%	96.9%	98.9%
Wet_1Yr	YR2035	105.6%	111.5%	107.3%	99.2%	86.2%	85.3%	93.2%	97.8%	161.8%	108.2%	94.9%	94.4%
Wet_1Yr	YR2040	110.7%	120.4%	116.9%	103.6%	84.3%	85.4%	93.0%	94.1%	224.6%	123.5%	92.9%	90.1%
Wet_1Yr	YR2045	115.7%	129.3%	126.6%	108.0%	82.3%	85.6%	92.9%	90.5%	287.3%	138.8%	90.9%	85.7%
Wet_5Yr	YR2025	101.0%	101.1%	99.6%	97.2%	95.0%	96.9%	98.9%	100.4%	102.2%	100.1%	99.3%	99.9%
Wet_5Yr	YR2030	101.9%	102.2%	99.1%	94.4%	90.0%	93.8%	97.9%	100.9%	104.4%	100.3%	98.5%	99.7%
Wet_5Yr	YR2035	106.8%	117.2%	109.7%	98.0%	90.3%	94.6%	98.4%	100.6%	138.3%	104.8%	98.6%	97.1%
Wet_5Yr	YR2040	111.7%	132.2%	120.3%	101.6%	90.6%	95.5%	98.9%	100.3%	172.3%	109.2%	98.8%	94.4%
Wet_5Yr	YR2045	116.5%	147.2%	130.9%	105.1%	90.9%	96.3%	99.5%	100.1%	206.3%	113.7%	98.9%	91.8%

**Table A7: Projected Changes in Santa Margarita River Flow under Drier with Extreme Warming Scenario**

YearType	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	YR2025	100.3%	99.9%	99.6%	99.1%	98.8%	99.4%	99.6%	100.3%	100.3%	99.4%	98.9%	99.6%
Normal	YR2030	100.6%	99.7%	99.1%	98.2%	97.6%	98.9%	99.1%	100.6%	100.6%	98.9%	97.9%	99.1%
Normal	YR2035	99.6%	95.7%	96.3%	93.5%	94.5%	97.2%	98.0%	99.9%	102.9%	98.6%	95.1%	98.6%
Normal	YR2040	98.6%	91.7%	93.5%	88.8%	91.5%	95.5%	96.8%	99.3%	105.2%	98.3%	92.4%	98.1%
Normal	YR2045	97.6%	87.6%	90.7%	84.1%	88.4%	93.8%	95.7%	98.7%	107.6%	98.1%	89.6%	97.6%
Dry_1Yr	YR2025	100.7%	99.4%	100.1%	100.0%	99.6%	99.9%	100.0%	100.0%	100.0%	99.6%	99.9%	99.9%
Dry_1Yr	YR2030	101.4%	98.9%	100.3%	100.0%	99.1%	99.7%	100.0%	100.0%	100.0%	99.1%	99.7%	99.7%
Dry_1Yr	YR2035	96.9%	94.2%	96.1%	97.5%	97.1%	98.7%	99.2%	99.2%	100.4%	98.4%	98.7%	99.0%
Dry_1Yr	YR2040	92.4%	89.6%	91.8%	95.0%	95.0%	97.7%	98.5%	98.5%	100.8%	97.6%	97.7%	98.2%
Dry_1Yr	YR2045	88.0%	84.9%	87.6%	92.5%	93.0%	96.7%	97.8%	97.8%	101.1%	96.8%	96.7%	97.4%
Dry_5Yr	YR2025	100.0%	99.6%	99.1%	98.8%	98.9%	99.4%	99.7%	100.0%	99.9%	99.4%	98.9%	99.3%
Dry_5Yr	YR2030	100.0%	99.1%	98.2%	97.6%	97.9%	98.9%	99.4%	100.0%	99.7%	98.9%	97.9%	98.5%
Dry_5Yr	YR2035	97.6%	95.9%	95.3%	93.3%	95.0%	97.3%	98.5%	99.5%	100.5%	98.7%	95.1%	96.7%
Dry_5Yr	YR2040	95.3%	92.7%	92.5%	89.1%	92.1%	95.7%	97.6%	99.0%	101.2%	98.6%	92.4%	94.9%
Dry_5Yr	YR2045	92.9%	89.5%	89.6%	84.8%	89.2%	94.2%	96.8%	98.5%	102.0%	98.4%	89.6%	93.1%
Wet_1Yr	YR2025	99.9%	99.3%	96.3%	95.9%	92.8%	99.1%	99.4%	102.6%	100.3%	98.3%	97.0%	100.1%
Wet_1Yr	YR2030	99.7%	98.5%	92.5%	91.7%	85.6%	98.2%	98.9%	105.2%	100.6%	96.6%	94.1%	100.3%
Wet_1Yr	YR2035	97.1%	93.7%	94.0%	87.2%	78.8%	96.4%	97.5%	100.9%	100.8%	96.5%	87.5%	99.5%
Wet_1Yr	YR2040	94.4%	88.9%	95.5%	82.7%	72.0%	94.6%	96.2%	96.5%	101.1%	96.3%	80.9%	98.8%
Wet_1Yr	YR2045	91.8%	84.1%	97.0%	78.1%	65.2%	92.7%	95.0%	92.2%	101.3%	96.2%	74.3%	98.0%
Wet_5Yr	YR2025	100.3%	100.1%	98.5%	98.3%	98.3%	99.4%	99.7%	100.1%	101.2%	99.1%	99.1%	99.4%
Wet_5Yr	YR2030	100.6%	100.3%	96.9%	96.6%	96.6%	98.9%	99.4%	100.3%	102.4%	98.2%	98.2%	98.9%
Wet_5Yr	YR2035	97.7%	96.1%	96.1%	91.7%	93.3%	97.3%	98.4%	99.8%	107.0%	98.2%	96.8%	100.4%
Wet_5Yr	YR2040	94.9%	91.8%	95.3%	86.8%	90.1%	95.7%	97.4%	99.3%	111.6%	98.2%	95.3%	101.9%
Wet_5Yr	YR2045	92.1%	87.6%	94.5%	81.9%	86.8%	94.2%	96.4%	98.8%	116.2%	98.2%	93.9%	103.5%

**Table A8: Projected Changes in Santa Margarita River Flow under Median Scenario**

YearType	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	YR2025	100.3%	99.9%	99.6%	99.1%	98.8%	99.4%	99.6%	100.3%	100.3%	99.4%	98.9%	99.6%
Normal	YR2030	100.6%	99.7%	99.1%	98.2%	97.6%	98.9%	99.1%	100.6%	100.6%	98.9%	97.9%	99.1%
Normal	YR2035	100.3%	99.1%	97.6%	96.1%	96.3%	98.2%	99.0%	100.3%	101.3%	98.4%	96.8%	97.5%
Normal	YR2040	100.1%	98.5%	96.1%	94.0%	94.9%	97.5%	98.9%	100.1%	102.0%	98.1%	95.8%	95.8%
Normal	YR2045	99.8%	97.8%	94.5%	91.9%	93.6%	96.9%	98.7%	99.8%	102.8%	97.7%	94.7%	94.1%
Dry_1Yr	YR2025	100.7%	99.4%	100.1%	100.0%	99.6%	99.9%	100.0%	100.0%	100.0%	99.6%	99.9%	99.9%
Dry_1Yr	YR2030	101.4%	98.9%	100.3%	100.0%	99.1%	99.7%	100.0%	100.0%	100.0%	99.1%	99.7%	99.7%
Dry_1Yr	YR2035	99.6%	97.3%	98.2%	98.6%	98.1%	99.2%	99.8%	100.0%	100.2%	98.7%	99.5%	99.5%
Dry_1Yr	YR2040	97.8%	95.7%	96.1%	97.3%	97.1%	98.7%	99.5%	100.0%	100.5%	98.4%	99.2%	99.2%
Dry_1Yr	YR2045	95.9%	94.2%	94.0%	95.9%	96.1%	98.2%	99.2%	100.0%	100.8%	98.0%	99.0%	99.0%
Dry_5Yr	YR2025	100.0%	99.6%	99.1%	98.8%	98.9%	99.4%	99.7%	100.0%	99.9%	99.4%	98.9%	99.3%
Dry_5Yr	YR2030	100.0%	99.1%	98.2%	97.6%	97.9%	98.9%	99.4%	100.0%	99.7%	98.9%	97.9%	98.5%
Dry_5Yr	YR2035	99.5%	98.2%	96.5%	95.6%	96.6%	98.1%	99.2%	99.9%	100.0%	98.4%	97.0%	97.0%
Dry_5Yr	YR2040	99.0%	97.3%	94.8%	93.6%	95.3%	97.3%	98.9%	99.8%	100.2%	98.1%	96.1%	95.4%
Dry_5Yr	YR2045	98.5%	96.4%	93.1%	91.6%	93.9%	96.5%	98.7%	99.6%	100.5%	97.7%	95.1%	93.9%
Wet_1Yr	YR2025	99.9%	99.3%	96.3%	95.9%	92.8%	99.1%	99.4%	102.6%	100.3%	98.3%	97.0%	100.1%
Wet_1Yr	YR2030	99.7%	98.5%	92.5%	91.7%	85.6%	98.2%	98.9%	105.2%	100.6%	96.6%	94.1%	100.3%
Wet_1Yr	YR2035	100.5%	98.1%	91.9%	90.4%	82.4%	97.6%	98.4%	102.0%	101.1%	95.6%	93.5%	97.2%
Wet_1Yr	YR2040	101.2%	97.7%	91.4%	89.0%	79.2%	96.9%	98.1%	98.7%	101.5%	94.7%	93.0%	94.1%
Wet_1Yr	YR2045	102.0%	97.4%	90.8%	87.7%	75.9%	96.3%	97.7%	95.4%	102.0%	93.7%	92.4%	91.0%
Wet_5Yr	YR2025	100.3%	100.1%	98.5%	98.3%	98.3%	99.4%	99.7%	100.1%	101.2%	99.1%	99.1%	99.4%
Wet_5Yr	YR2030	100.6%	100.3%	96.9%	96.6%	96.6%	98.9%	99.4%	100.3%	102.4%	98.2%	98.2%	98.9%
Wet_5Yr	YR2035	101.1%	100.4%	95.8%	94.6%	95.1%	98.3%	99.3%	100.5%	104.5%	98.1%	97.4%	96.9%
Wet_5Yr	YR2040	101.5%	100.5%	94.8%	92.5%	93.6%	97.8%	99.2%	100.8%	106.6%	97.9%	96.6%	95.0%
Wet_5Yr	YR2045	102.0%	100.7%	93.7%	90.5%	92.1%	97.3%	99.0%	101.0%	108.8%	97.8%	95.9%	93.0%

**Table A9: Projected Changes in Santa Margarita River Flow under Wetter with Moderate Warming Scenario**

YearType	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	YR2025	100.3%	99.9%	99.6%	99.1%	98.8%	99.4%	99.6%	100.3%	100.3%	99.4%	98.9%	99.6%
Normal	YR2030	100.6%	99.7%	99.1%	98.2%	97.6%	98.9%	99.1%	100.6%	100.6%	98.9%	97.9%	99.1%
Normal	YR2035	103.5%	108.3%	110.5%	103.4%	99.4%	100.4%	100.0%	100.7%	122.4%	98.7%	97.0%	97.3%
Normal	YR2040	106.5%	116.8%	121.9%	108.7%	101.3%	101.9%	100.9%	100.8%	144.2%	98.6%	96.1%	95.5%
Normal	YR2045	109.4%	125.4%	133.2%	113.9%	103.1%	103.5%	101.8%	100.9%	166.0%	98.4%	95.1%	93.8%
Dry_1Yr	YR2025	100.7%	99.4%	100.1%	100.0%	99.6%	99.9%	100.0%	100.0%	100.0%	99.6%	99.9%	99.9%
Dry_1Yr	YR2030	101.4%	98.9%	100.3%	100.0%	99.1%	99.7%	100.0%	100.0%	100.0%	99.1%	99.7%	99.7%
Dry_1Yr	YR2035	103.2%	109.1%	105.9%	101.2%	99.9%	100.3%	100.2%	100.4%	121.2%	99.0%	99.8%	100.6%
Dry_1Yr	YR2040	105.0%	119.4%	111.5%	102.5%	100.7%	101.0%	100.5%	100.8%	142.5%	98.9%	100.0%	101.5%
Dry_1Yr	YR2045	106.8%	129.7%	117.0%	103.8%	101.4%	101.6%	100.8%	101.1%	163.8%	98.7%	100.1%	102.4%
Dry_5Yr	YR2025	100.0%	99.6%	99.1%	98.8%	98.9%	99.4%	99.7%	100.0%	99.9%	99.4%	98.9%	99.3%
Dry_5Yr	YR2030	100.0%	99.1%	98.2%	97.6%	97.9%	98.9%	99.4%	100.0%	99.7%	98.9%	97.9%	98.5%
Dry_5Yr	YR2035	101.8%	104.1%	106.2%	101.3%	99.3%	100.0%	100.2%	100.9%	108.7%	97.9%	96.8%	96.8%
Dry_5Yr	YR2040	103.5%	109.1%	114.1%	105.0%	100.8%	101.1%	100.9%	101.8%	117.6%	97.0%	95.8%	95.1%
Dry_5Yr	YR2045	105.2%	114.1%	122.1%	108.7%	102.2%	102.3%	101.7%	102.6%	126.5%	96.1%	94.7%	93.5%
Wet_1Yr	YR2025	99.9%	99.3%	96.3%	95.9%	92.8%	99.1%	99.4%	102.6%	100.3%	98.3%	97.0%	100.1%
Wet_1Yr	YR2030	99.7%	98.5%	92.5%	91.7%	85.6%	98.2%	98.9%	105.2%	100.6%	96.6%	94.1%	100.3%
Wet_1Yr	YR2035	104.4%	109.4%	114.0%	102.0%	87.7%	98.7%	99.2%	100.4%	116.0%	93.6%	91.8%	95.8%
Wet_1Yr	YR2040	109.0%	120.3%	135.6%	112.2%	89.7%	99.3%	99.6%	95.7%	131.4%	90.6%	89.5%	91.3%
Wet_1Yr	YR2045	113.7%	131.2%	157.1%	122.5%	91.7%	99.8%	100.0%	90.9%	146.8%	87.6%	87.2%	86.9%
Wet_5Yr	YR2025	100.3%	100.1%	98.5%	98.3%	98.3%	99.4%	99.7%	100.1%	101.2%	99.1%	99.1%	99.4%
Wet_5Yr	YR2030	100.6%	100.3%	96.9%	96.6%	96.6%	98.9%	99.4%	100.3%	102.4%	98.2%	98.2%	98.9%
Wet_5Yr	YR2035	104.8%	114.8%	126.4%	106.2%	100.7%	101.0%	101.2%	101.4%	157.6%	104.1%	99.1%	97.4%
Wet_5Yr	YR2040	108.9%	129.3%	155.9%	115.9%	104.7%	103.2%	103.0%	102.5%	212.8%	110.0%	100.0%	96.0%
Wet_5Yr	YR2045	113.1%	143.8%	185.4%	125.5%	108.8%	105.4%	104.7%	103.6%	268.0%	115.8%	101.0%	94.6%

**Table A10: Projected Changes in Outdoor Demand under Drier with Extreme Warming Scenario**

YearType	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	YR2025	101.1%	100.7%	100.4%	100.6%	100.8%	100.6%	100.4%	100.6%	100.6%	100.7%	101.0%	101.1%
Normal	YR2030	102.2%	101.4%	100.9%	101.1%	101.6%	101.1%	100.9%	101.1%	101.1%	101.4%	101.9%	102.2%
Normal	YR2035	103.9%	103.3%	102.3%	102.9%	103.7%	102.6%	101.2%	101.6%	101.6%	102.5%	104.2%	104.4%
Normal	YR2040	105.7%	105.2%	103.8%	104.8%	105.7%	104.0%	101.6%	102.1%	102.1%	103.6%	106.4%	106.7%
Normal	YR2045	107.5%	107.2%	105.2%	106.6%	107.8%	105.5%	101.9%	102.6%	102.6%	104.6%	108.7%	108.9%
Dry_1Yr	YR2025	100.8%	100.6%	100.4%	100.4%	100.8%	100.6%	100.4%	100.6%	100.7%	100.8%	100.7%	100.8%
Dry_1Yr	YR2030	101.6%	101.1%	100.9%	100.9%	101.6%	101.1%	100.9%	101.1%	101.4%	101.6%	101.4%	101.6%
Dry_1Yr	YR2035	103.8%	103.7%	102.4%	102.2%	103.4%	102.1%	101.2%	101.8%	101.7%	103.0%	103.1%	102.6%
Dry_1Yr	YR2040	106.0%	106.2%	104.0%	103.5%	105.2%	103.1%	101.6%	102.6%	102.1%	104.3%	104.8%	103.6%
Dry_1Yr	YR2045	108.1%	108.8%	105.6%	104.9%	107.0%	104.0%	101.9%	103.3%	102.5%	105.6%	106.4%	104.5%
Dry_5Yr	YR2025	101.0%	100.7%	100.6%	100.6%	100.8%	100.6%	100.4%	100.6%	100.6%	100.7%	101.0%	101.1%
Dry_5Yr	YR2030	101.9%	101.4%	101.1%	101.1%	101.6%	101.1%	100.9%	101.1%	101.1%	101.4%	101.9%	102.2%
Dry_5Yr	YR2035	104.0%	103.4%	102.6%	103.1%	103.6%	102.3%	101.1%	101.6%	101.6%	102.5%	104.5%	104.5%
Dry_5Yr	YR2040	106.2%	105.5%	104.0%	105.0%	105.5%	103.5%	101.3%	102.1%	102.1%	103.6%	107.1%	106.9%
Dry_5Yr	YR2045	108.3%	107.5%	105.5%	106.9%	107.4%	104.8%	101.6%	102.6%	102.6%	104.6%	109.8%	109.3%
Wet_1Yr	YR2025	101.2%	100.6%	100.3%	100.6%	101.0%	100.7%	100.6%	100.6%	100.7%	101.2%	101.2%	101.1%
Wet_1Yr	YR2030	102.4%	101.1%	100.6%	101.1%	101.9%	101.4%	101.1%	101.1%	101.4%	102.4%	102.4%	102.2%
Wet_1Yr	YR2035	105.0%	103.5%	101.8%	103.3%	103.5%	103.3%	101.7%	101.5%	102.0%	103.2%	105.0%	105.1%
Wet_1Yr	YR2040	107.6%	106.0%	103.0%	105.5%	105.0%	105.2%	102.3%	101.8%	102.6%	104.1%	107.6%	108.1%
Wet_1Yr	YR2045	110.2%	108.4%	104.3%	107.7%	106.5%	107.2%	102.9%	102.2%	103.2%	104.9%	110.2%	111.0%
Wet_5Yr	YR2025	101.0%	100.6%	100.4%	100.6%	100.8%	100.6%	100.4%	100.6%	100.6%	100.7%	100.8%	101.0%
Wet_5Yr	YR2030	101.9%	101.1%	100.9%	101.1%	101.6%	101.1%	100.9%	101.1%	101.1%	101.4%	101.6%	101.9%
Wet_5Yr	YR2035	103.0%	103.1%	102.2%	102.9%	103.6%	102.7%	101.2%	101.6%	101.5%	102.2%	103.7%	103.3%
Wet_5Yr	YR2040	104.0%	105.0%	103.5%	104.8%	105.5%	104.3%	101.6%	102.1%	101.8%	103.1%	105.7%	104.8%
Wet_5Yr	YR2045	105.1%	106.9%	104.9%	106.6%	107.4%	105.9%	101.9%	102.6%	102.2%	103.9%	107.8%	106.2%

**Table A11: Projected Changes in Outdoor Demand under Median Scenario**

YearType	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	YR2025	101.1%	100.7%	100.4%	100.6%	100.8%	100.6%	100.4%	100.6%	100.6%	100.7%	101.0%	101.1%
Normal	YR2030	102.2%	101.4%	100.9%	101.1%	101.6%	101.1%	100.9%	101.1%	101.1%	101.4%	101.9%	102.2%
Normal	YR2035	102.9%	102.1%	101.6%	101.8%	102.4%	101.7%	101.2%	101.5%	101.5%	102.0%	102.7%	103.2%
Normal	YR2040	103.6%	102.8%	102.3%	102.6%	103.1%	102.3%	101.6%	101.8%	101.8%	102.6%	103.6%	104.3%
Normal	YR2045	104.3%	103.6%	103.0%	103.3%	103.8%	102.9%	101.9%	102.2%	102.2%	103.2%	104.4%	105.4%
Dry_1Yr	YR2025	100.8%	100.6%	100.4%	100.4%	100.8%	100.6%	100.4%	100.6%	100.7%	100.8%	100.7%	100.8%
Dry_1Yr	YR2030	101.6%	101.1%	100.9%	100.9%	101.6%	101.1%	100.9%	101.1%	101.4%	101.6%	101.4%	101.6%
Dry_1Yr	YR2035	102.6%	102.2%	101.6%	101.7%	102.2%	101.6%	101.2%	101.6%	101.7%	102.2%	102.2%	102.4%
Dry_1Yr	YR2040	103.6%	103.3%	102.3%	102.6%	102.8%	102.1%	101.6%	102.1%	102.1%	102.8%	103.1%	103.1%
Dry_1Yr	YR2045	104.5%	104.4%	103.0%	103.4%	103.4%	102.6%	101.9%	102.6%	102.5%	103.4%	103.9%	103.8%
Dry_5Yr	YR2025	101.0%	100.7%	100.6%	100.6%	100.8%	100.6%	100.4%	100.6%	100.6%	100.7%	101.0%	101.1%
Dry_5Yr	YR2030	101.9%	101.4%	101.1%	101.1%	101.6%	101.1%	100.9%	101.1%	101.1%	101.4%	101.9%	102.2%
Dry_5Yr	YR2035	102.7%	102.2%	101.8%	102.0%	102.4%	101.6%	101.2%	101.5%	101.6%	102.1%	102.7%	103.3%
Dry_5Yr	YR2040	103.6%	103.1%	102.6%	102.8%	103.1%	102.1%	101.6%	101.8%	102.1%	102.8%	103.6%	104.5%
Dry_5Yr	YR2045	104.4%	103.9%	103.3%	103.7%	103.8%	102.6%	101.9%	102.2%	102.6%	103.6%	104.4%	105.7%
Wet_1Yr	YR2025	101.2%	100.6%	100.3%	100.6%	101.0%	100.7%	100.6%	100.6%	100.7%	101.2%	101.2%	101.1%
Wet_1Yr	YR2030	102.4%	101.1%	100.6%	101.1%	101.9%	101.4%	101.1%	101.1%	101.4%	102.4%	102.4%	102.2%
Wet_1Yr	YR2035	103.2%	102.1%	101.3%	101.7%	102.4%	102.0%	101.6%	101.5%	101.7%	103.0%	103.1%	103.1%
Wet_1Yr	YR2040	104.1%	103.1%	102.0%	102.3%	102.9%	102.6%	102.1%	101.8%	102.1%	103.6%	103.8%	104.1%
Wet_1Yr	YR2045	104.9%	104.0%	102.8%	102.9%	103.3%	103.2%	102.6%	102.2%	102.5%	104.2%	104.5%	105.0%
Wet_5Yr	YR2025	101.0%	100.6%	100.4%	100.6%	100.8%	100.6%	100.4%	100.6%	100.6%	100.7%	100.8%	101.0%
Wet_5Yr	YR2030	101.9%	101.1%	100.9%	101.1%	101.6%	101.1%	100.9%	101.1%	101.1%	101.4%	101.6%	101.9%
Wet_5Yr	YR2035	102.7%	102.0%	101.6%	101.8%	102.2%	101.8%	101.2%	101.5%	101.5%	101.9%	102.6%	102.9%
Wet_5Yr	YR2040	103.6%	102.8%	102.3%	102.6%	102.8%	102.6%	101.6%	101.8%	101.8%	102.3%	103.6%	103.8%
Wet_5Yr	YR2045	104.4%	103.7%	103.0%	103.3%	103.4%	103.3%	101.9%	102.2%	102.2%	102.8%	104.5%	104.8%

**Table A12: Projected Changes in Outdoor Demand under Wetter with Moderate Warming Scenario**

YearType	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	YR2025	101.1%	100.7%	100.4%	100.6%	100.8%	100.6%	100.4%	100.6%	100.6%	100.7%	101.0%	101.1%
Normal	YR2030	102.2%	101.4%	100.9%	101.1%	101.6%	101.1%	100.9%	101.1%	101.1%	101.4%	101.9%	102.2%
Normal	YR2035	103.1%	100.9%	100.5%	100.5%	101.3%	101.2%	101.0%	101.2%	101.1%	101.1%	101.8%	102.8%
Normal	YR2040	104.1%	100.4%	100.1%	99.9%	100.9%	101.4%	101.1%	101.4%	101.1%	100.9%	101.7%	103.3%
Normal	YR2045	105.0%	99.9%	99.7%	99.3%	100.6%	101.5%	101.2%	101.5%	101.1%	100.7%	101.5%	103.9%
Dry_1Yr	YR2025	100.8%	100.6%	100.4%	100.4%	100.8%	100.6%	100.4%	100.6%	100.7%	100.8%	100.7%	100.8%
Dry_1Yr	YR2030	101.6%	101.1%	100.9%	100.9%	101.6%	101.1%	100.9%	101.1%	101.4%	101.6%	101.4%	101.6%
Dry_1Yr	YR2035	102.2%	101.1%	100.2%	101.0%	100.8%	101.2%	101.0%	101.2%	101.0%	100.2%	99.7%	100.7%
Dry_1Yr	YR2040	102.8%	101.1%	99.6%	101.1%	100.0%	101.4%	101.1%	101.4%	100.7%	98.8%	98.0%	99.7%
Dry_1Yr	YR2045	103.4%	101.1%	99.0%	101.2%	99.1%	101.5%	101.2%	101.5%	100.3%	97.3%	96.3%	98.8%
Dry_5Yr	YR2025	101.0%	100.7%	100.6%	100.6%	100.8%	100.6%	100.4%	100.6%	100.6%	100.7%	101.0%	101.1%
Dry_5Yr	YR2030	101.9%	101.4%	101.1%	101.1%	101.6%	101.1%	100.9%	101.1%	101.1%	101.4%	101.9%	102.2%
Dry_5Yr	YR2035	103.1%	101.4%	100.9%	100.4%	101.4%	101.2%	101.0%	101.2%	101.2%	101.5%	101.8%	103.2%
Dry_5Yr	YR2040	104.3%	101.4%	100.6%	99.7%	101.2%	101.4%	101.1%	101.4%	101.4%	101.6%	101.7%	104.3%
Dry_5Yr	YR2045	105.5%	101.4%	100.4%	98.9%	100.9%	101.5%	101.2%	101.5%	101.5%	101.7%	101.5%	105.4%
Wet_1Yr	YR2025	101.2%	100.6%	100.3%	100.6%	101.0%	100.7%	100.6%	100.6%	100.7%	101.2%	101.2%	101.1%
Wet_1Yr	YR2030	102.4%	101.1%	100.6%	101.1%	101.9%	101.4%	101.1%	101.1%	101.4%	102.4%	102.4%	102.2%
Wet_1Yr	YR2035	104.3%	100.5%	100.8%	100.3%	101.5%	101.7%	101.5%	101.2%	101.6%	102.9%	102.3%	103.0%
Wet_1Yr	YR2040	106.2%	99.9%	101.1%	99.4%	101.2%	102.1%	101.8%	101.4%	101.9%	103.4%	102.2%	103.8%
Wet_1Yr	YR2045	108.1%	99.3%	101.3%	98.6%	100.8%	102.5%	102.2%	101.5%	102.1%	103.8%	102.1%	104.6%
Wet_5Yr	YR2025	101.0%	100.6%	100.4%	100.6%	100.8%	100.6%	100.4%	100.6%	100.6%	100.7%	100.8%	101.0%
Wet_5Yr	YR2030	101.9%	101.1%	100.9%	101.1%	101.6%	101.1%	100.9%	101.1%	101.1%	101.4%	101.6%	101.9%
Wet_5Yr	YR2035	103.2%	100.6%	100.6%	100.5%	101.3%	101.4%	101.0%	101.2%	100.9%	101.1%	102.2%	102.7%
Wet_5Yr	YR2040	104.5%	100.1%	100.3%	99.9%	100.9%	101.6%	101.1%	101.4%	100.6%	100.9%	102.8%	103.6%
Wet_5Yr	YR2045	105.8%	99.7%	100.1%	99.3%	100.6%	101.8%	101.2%	101.5%	100.4%	100.7%	103.4%	104.4%

## Appendix G – Mitigation Actions TM

# Technical Memorandum

**To:** Drought Contingency Plan Task Force  
**From:** Drought Contingency Plan Development Team  
**CC:** Melissa Matlock, Western Municipal Water District  
**Date:** 9/27/2022  
**Re:** Western Municipal Water District – Mitigation Actions

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Water Systems Consulting, Inc. (WSC) and GEI Consultants, Inc. (GEI) were contracted by Western Municipal Water District (Western) for the preparation of its 2020 Urban Water Management Plan (UWMP) for submittal to the California Department of Water Resources (DWR) and a Drought Contingency Plan (DCP) for submittal to the United States Bureau of Reclamation (USBR). Pursuant to the development of the DCP and in collaboration with the Drought Task Force (Task Force), Western developed a suite of mitigation actions, which are a key component of the DCP. This Technical Memorandum (TM) provides:

- The overall purpose and benefits of including mitigation actions in the DCP
- Identification and a preliminary evaluation of the mitigation actions that were developed by the region in collaboration with the Task Force
- Other proposed mitigation actions that are not yet in development

## 1 Introduction

Mitigation actions are projects, programs, and strategies that are implemented prior to the occurrence of a drought to address potential risks and impacts and reduce the need for response actions. These actions are generally beneficial in increasing regional flexibility and resiliency during times of drought.

Within the framework of a DCP, these actions are generally developed in response to vulnerabilities identified through a Climate Change Vulnerability Assessment (CCVA). As part of this regional DCP, Western performed a CCVA, which is detailed in Western's CCVA TM dated 02/01/2022. In short, the analysis and findings from the CCVA projected:

- **Decreases** in supplies under normal and drought (single year and multi-year) conditions from two basins that provide surface water supplies to portions of the service area (Santa Ana and Santa Margarita Rivers)
- **Decreases** in precipitation and natural recharge under normal and multi-year drought years
- **Increases** in outdoor water uses under normal, single dry, and multi-year drought conditions

- An **increase** in dependence on imported water if mitigation actions are not implemented

In response to these findings, Western and the Task Force compiled a suite of mitigations for inclusion into the DCP. The full suite of mitigation actions is identified in Section 2, Figure 2-1, and summarized in Table A-1 in Appendix A.

This suite of mitigation actions that was developed in concert with the Task Force includes projects that are in various stages of implementation, from pre-planning, planning, design, to construction, and the timelines projected for these projects are estimations. Many of these actions are consistent with existing planning programs and processes of the various regional stakeholders, such as Western's Capital Improvement and Facilities Plan. However, numerous factors have the potential to impact implementation of these actions, such as funding availability, regulatory requirements, implementation complexities, and strategic planning priorities that are unique to each regional stakeholder. As such, inclusion of these actions into this regional DCP does not imply any commitment or obligation for future implementation. Furthermore, the mitigation actions presented are not intended to be exhaustive; thus, this TM also provides guidance for establishing consistency with this DCP for projects that may be implemented in the future but are not included in the potential suite of mitigation actions. This guidance is provided in Section 4 of this TM.

There are numerous regional benefits that could be realized through the implementation of these potential mitigation actions. These benefits include increasing local supplies, promoting water conservation, enhancing water supply reliability, enhancing operational flexibility, and decreasing imported water supplies. Benefiting disadvantaged communities and promoting environmental justice are other benefits that could be realized by the region through the implementation of these potential mitigation actions. Several criteria were developed with consideration of these benefits to perform a preliminary evaluation of the potential mitigation actions, which is described further in Section 3. The results of the preliminary evaluation are provided in Table A-1 in Appendix A. Note that many of the potential mitigation actions included in this regional DCP would likely require compliance with the California Environmental Quality Act (CEQA). This regional DCP does not include a CEQA analysis, and any potential action that requires compliance with CEQA would need to be evaluated by the project proponent prior to implementation.

The region also developed a suite of other mitigation actions that are not yet in development, but could be helpful for the region in mitigating the impacts of drought in the future. These potential mitigation actions are identified in Section 4 and are summarized in Table A-2 in Appendix A.

## **2 Identification of Potential Mitigation Actions**

In November 2021, the Task Force was sent a survey that asked each organization to respond to the following question:

***What projects or programs does your organization have in development that would potentially mitigate drought impacts in the future?***

For the purposes of this regional DCP, the respondents were asked to categorize their responses into one of the following four categories:

- **Supply/treatment:** Creation of access to additional water supplies that leverages existing water supply sources, creates new sources of supply, and/or improves treatment capacity in existing plants to treat new, more challenging local water supplies
- **Interties:** Construction of new physical connections between agencies that would allow transfer of water supply between and among Task Force members
- **Storage:** Expansion of water storage capacity
- **Operations and Management:** Changes in water management practices that do not require new or modified infrastructure
- **Other:** Other projects or programs

The survey also asked each organization to include as many key identifiers as possible for each mitigation action, including, but not limited to, the following:

- Project stage (planning, design, construction)
- Identification of regional partners
- Implementation timeline/schedule (short-, mid-, and long-term action)
- Estimated costs (capital and operation and maintenance [O&M])
- Estimated annual water savings or estimation of the supplemental supplies created as a result of implementation

The survey also asked each organization to assess whether the mitigation action has the potential to provide any of the following regional benefits:

- 1. Enhancing Regional Water Supply Reliability and Resiliency**
  - 1.1 – Increasing local supplies
  - 1.2 – Promoting water conservation
  - 1.3 – Enhancing water supply reliability
  - 1.4 – Enhancing operational flexibility
  - 1.5 – Decreasing reliance on imported water supplies
- 2. Prioritizing Social Equity**
  - 2.1 – Benefiting disadvantaged communities (DAC)
  - 2.1 – Promoting environmental justice

The survey responses were discussed with the Task Force during Workshop 4 on December 16, 2021, which also provided the opportunity to solicit input from other organizations that were unable to respond by survey. Additional mitigation actions were identified from agency responses to a Metropolitan Water District of Southern California (MWD) climate change survey conducted in early 2022. Though unrelated to the scope of this DCP, the survey served a similar purpose of identifying

regional projects to address water supply reliability and resiliency. From the survey responses, workshop input, and information from the MWD climate change survey, a total of 65 projects, programs, and strategies were identified for the DCP (Figure 2-1). A summary of these mitigation actions and their key identifiers are provided in Table A-1 in Appendix A.

As previously discussed, implementation of the mitigation actions could be impacted by numerous factors including funding availability, regulatory requirements, implementation complexities, and planning priorities. The Drought Task Force meetings together with Western's Regional Drought Portal mitigation action will be used to support implementation of the mitigation actions described in the DCP.

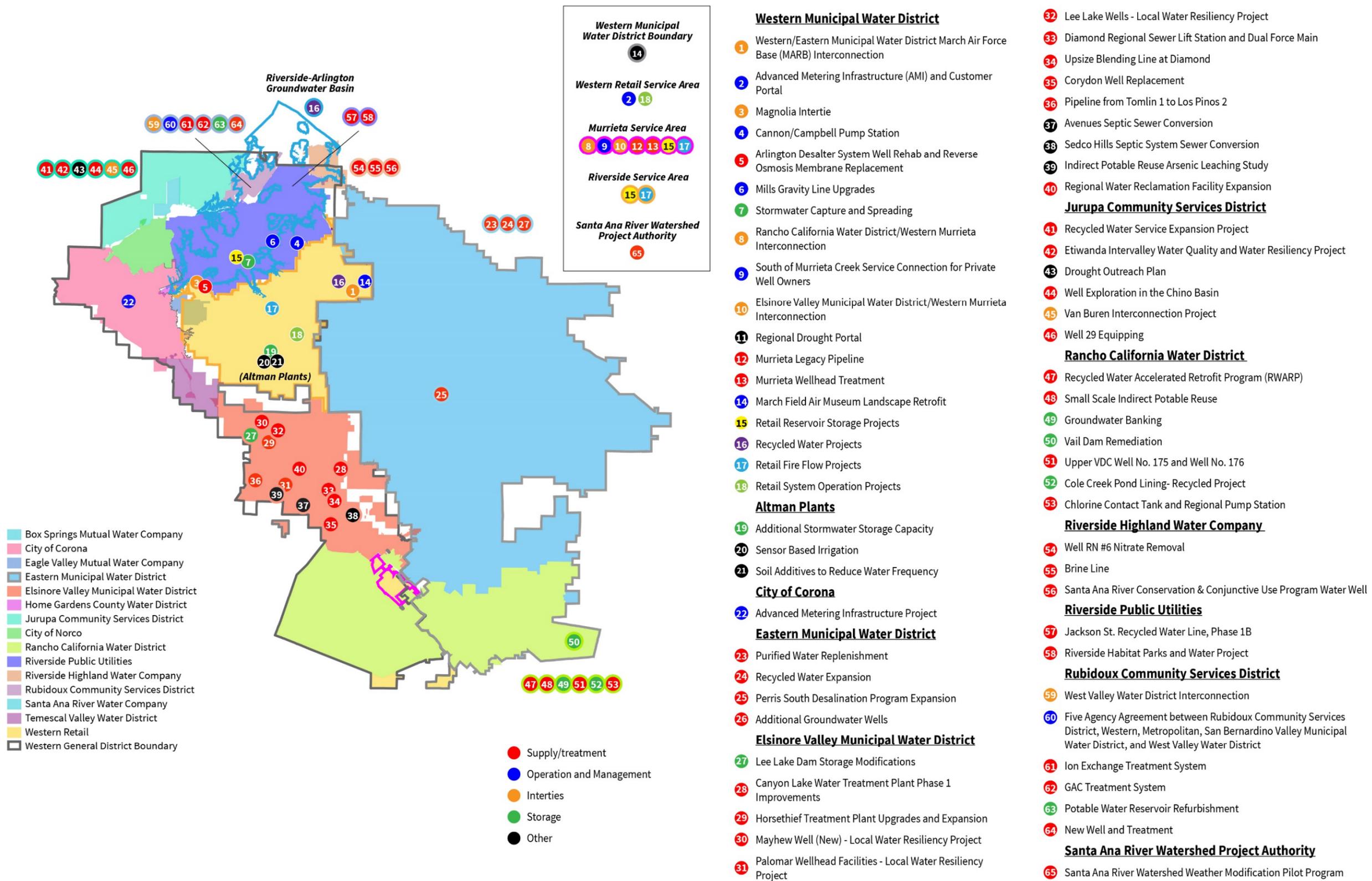


Figure 2-1: Potential Suite of Mitigation Actions for the Regional DCP

### 3 Preliminary Evaluation of Potential Mitigation Actions

Each potential project was classified using the categorization for each criterion provided in Table 3-1. As a wholesaler, Western is not involved in the prioritization of agency projects. Prioritization of mitigation actions is agency driven and as part of the development of the DCP, Western provided each member of the Drought Task Force the opportunity to provide and prioritize their own projects. As such, this categorization does not represent a prioritization or ranking of the projects identified, nor are the provided criteria intended to be exhaustive. Rather, these criteria were developed to assist in the identification of the key aspects of each project for the purposes of this DCP. This preliminary evaluation could be used in future planning efforts to further inform regional priorities. Long term, Western will continue to meet with retail agencies on a regular basis to support them in prioritizing resiliency projects to address agency-specific concerns and needs.

**Table 3-1: Evaluation Criteria and Ranking**

<b>Criteria</b>	<b>Categorization</b>		
Enhance Regional Water Supply Reliability and Resiliency	Meets 3 or more of the regional benefits	Meets 2 of the regional benefits	Meets 1 of the regional benefits
Prioritize Social Equity	Benefits DAC and promotes environmental justice	Benefits DAC or promotes environmental justice	Does not benefit DAC or promote environmental justice
Regional Benefits	Regional action	Action involves multiple adjacent agencies	Single agency action
Timing/Schedule	Short-term action (1-3 years)	Mid-term action (3-5 years)	Long-term action (> 5 years)

The preliminary evaluation of the potential suite of mitigation actions with respect to the criteria and categorization identified above is provided in full in Table A-1 in Appendix A. Details with respect to timing/schedule and the potential benefits associated with these mitigation actions are described below.

The 65 potential projects were grouped into short-, mid-, and long-term actions (Figure 3-1). Note that the potential timelines for the projects that are included in the DCP are estimates and as noted previously, depend upon many factors, such as the ability to secure funding, procurement, implementation complexities and permitting challenges, regional priorities, and other factors. However, with the estimates provided, 38 of the potential projects (or 58 percent) identified are projected for implementation in the short-term (by the end of 2024), with many of these projects already in the design or construction phase. Implementation for 12 of the potential projects (or 18 percent) is projected in the mid-term (by the end of 2026), and four of the potential projects are projected for implementation in the long-term (2027 and beyond). The remaining projects' timelines are currently uncertain.

	Short-Term	Mid-Term	Long-Term
Supply/ Treatment	5, 13, 24, 28, 29, 31, 32, 34, 36, 41, 46, 47, 51, 53-58, 61, 62, 64, 65	12, 23, 30, 33, 35, 40, 44	25, 26, 42
Interties	1, 3, 45, 59		
Storage	19, 52, 63	50	27
Operations and Management	2, 4, 14, 60	6, 22	
Other	20, 21, 39, 43	37, 38	
<b>TOTAL</b>	<b>38</b>	<b>12</b>	<b>4</b>

*Projects with unknown timeline: 7-11, 15-18, 48, 49 (11 total)*

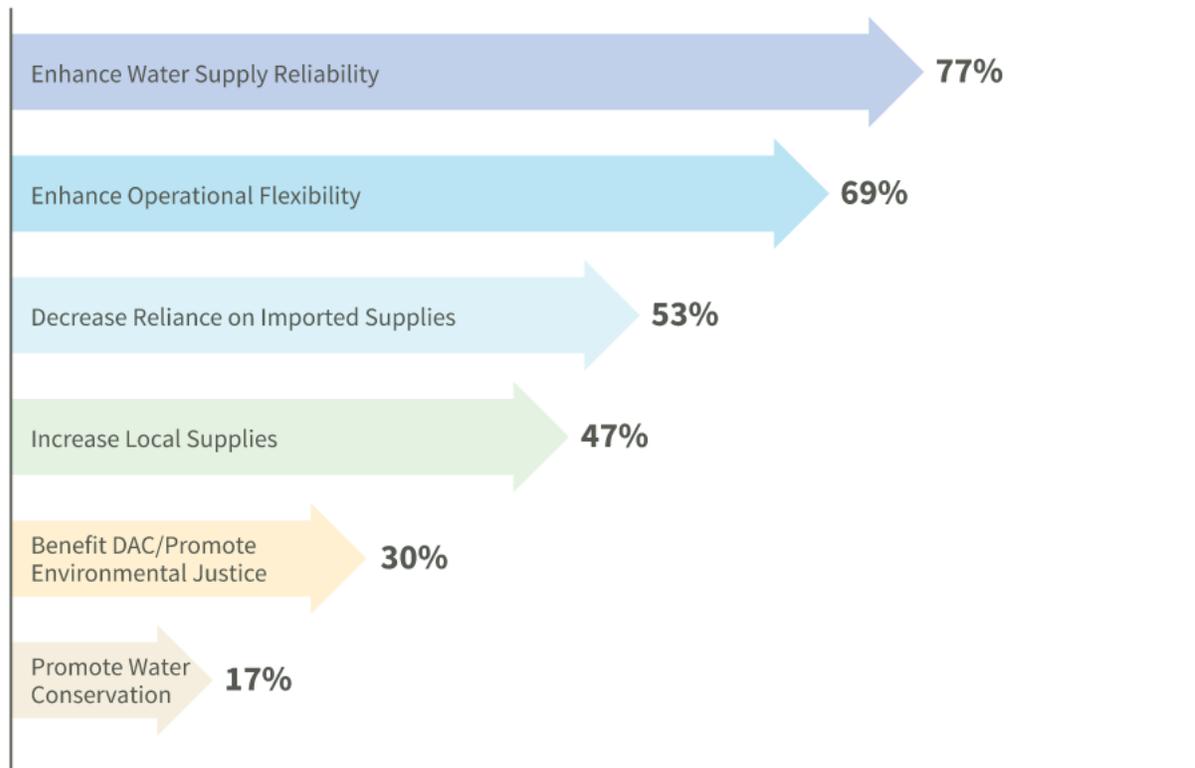
**Figure 3-1: Potential Timeline for Mitigation Actions**

For the purposes of this analysis, of the 65 projects, programs, and strategies identified, four represent a bundling of 16 unique projects that were further grouped into additional categories based on common characteristics. These four projects are shown as #15-#18 on Figure 2-1 and include:

- Retail reservoir storage projects
- Recycled water projects
- Retail fire flow projects
- Retail system operation projects

Each of the 16 projects that are included in these four categories is summarized in Appendix A, Table A-1.

Of the 65 projects, programs, and strategies identified, 77 percent have the potential to enhance water supply reliability. Additionally, 69 percent of the projects have the potential to enhance operational flexibility, and 53 percent have the potential to decrease reliance on imported supplies. Forty-seven percent of the projects have the potential to increase local supplies. A subset of these projects also has the potential to either benefit DACs/promote environmental justice or promote water conservation (Figure 3-2). Many of the projects identified have multiple benefits and thus the percentages identified in Figure 3-2 do not sum to 100 percent.



**Figure 3-2: Potential Benefits of the Regional DCP Mitigation Actions**

As mentioned above, the implementation timelines for the projects that are included in the regional DCP are estimates and thus so is the timeline for when the benefits associated with these projects will be realized by the region. Some of the 65 projects identified above are also in the pre-planning phase, and their timelines are currently being evaluated. Including only those projects that currently have a projected implementation timeline, Figure 3-3 shows the estimated timing for when the benefits associated with these projects could start to be realized. In 2022, a total of 25 projects are projected for implementation. These projects have shared benefits of enhancing water supply reliability (20 projects), decreasing reliance on imported supplies (17 projects), and increasing local supply (13 projects). By 2023, another 16 projects are projected for implementation, increasing the total project count to 41 projects, which similarly increases the cumulative number of projects in each benefit category.

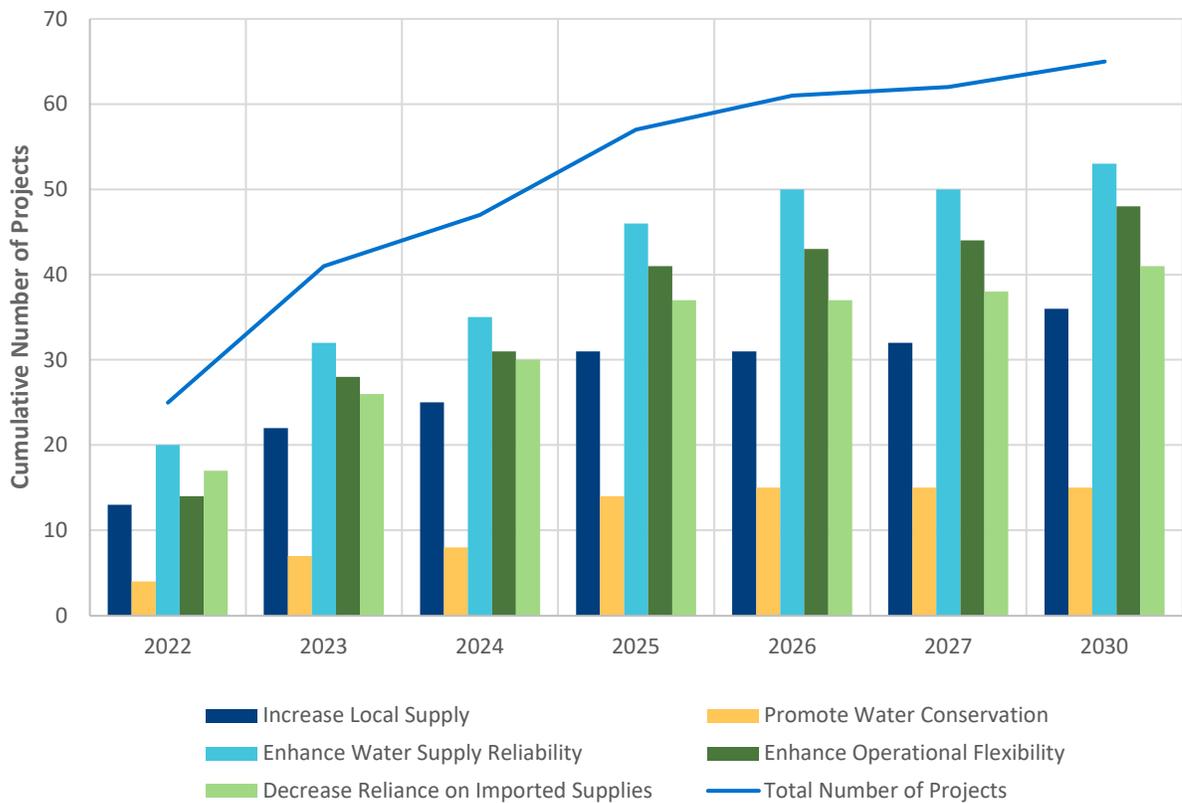


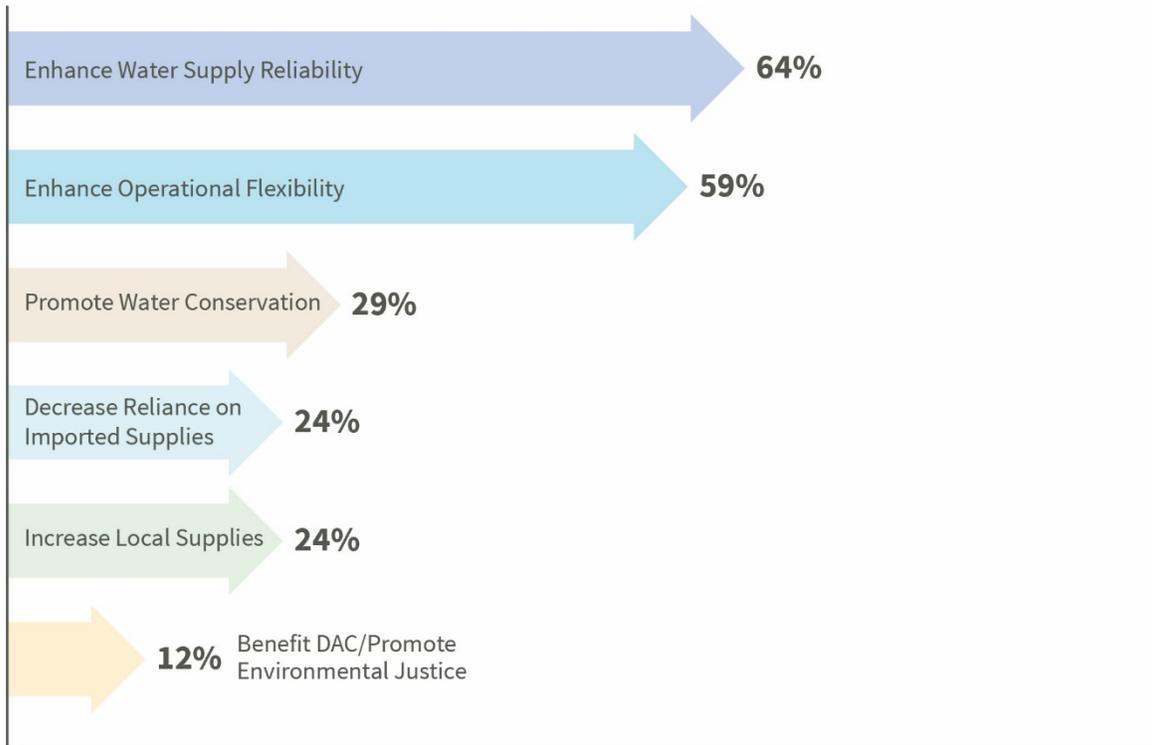
Figure 3-3: Potential Timeline for Mitigation Actions and Realization of Benefits within the Region

#### 4 Other Proposed Mitigation Actions for Future Exploration

The November 2021 survey sent to the Task Force also asked each organization to respond to the following question:

***What other project or programs do you think would be helpful for the region in mitigating the impacts of drought in the future?***

The responses received are depicted on Figure 4-2 and summarized in Table A-2 in Appendix A. Similar to those potential projects previously defined, these potential projects were also grouped into the categories of supply/treatment, interties, storage, operation and management, and other. These projects, programs, and strategies also have similar shared benefits of enhancing regional water supply reliability and resiliency and prioritizing social equity. Of the 17 total projects, programs, and strategies identified, 64 percent have the potential to enhance water supply reliability. Additionally, nearly 60 percent of the projects have the potential to enhance operational flexibility, and nearly 30 percent have the potential to promote water conservation. Twenty-four percent of the projects identified have the potential to decrease reliance on imported supplies or to increase local supplies, and a subset of these projects also has the potential to benefit DACs and promote environmental justice (Figure 4-1).



**Figure 4-1: Potential Benefits of the Other Mitigation Actions Proposed by the Task Force**

These projects, along with a summary of their potential benefits, are summarized in Table A-2 of Appendix A.

The suite of actions included in the regional DCP is not exhaustive, as members of the Task Force and other regional stakeholders may have other projects, programs, or strategies under development or consideration. In an effort to be inclusive of these potential future efforts, any future projects that provide any of the following benefits as previously described in Section 2 are considered to be consistent with the goals and objectives of this DCP:

- 1.1 – Increases local supplies
- 1.2 – Promotes water conservation
- 1.3 – Enhances water supply reliability
- 1.4 – Enhances operational flexibility
- 1.5 – Decreases imported water supplies

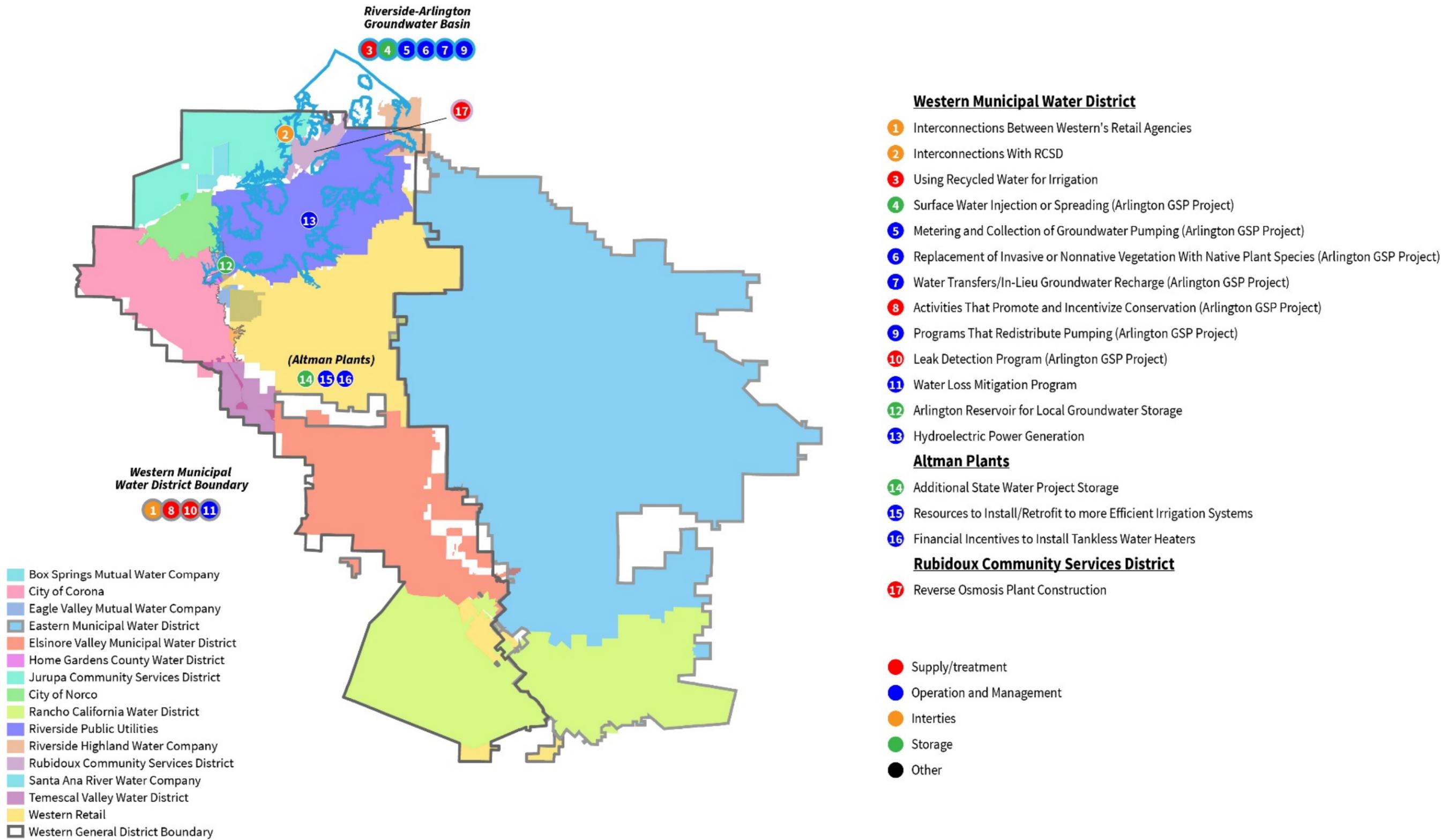


Figure 4-2: Additional Proposed Mitigation Actions for Future Exploration

## Appendix A

Table A-1: Identification of Potential Mitigation Actions and Their Key Identifiers

Project Number	Agency	Type of Mitigation Action	Project/Program Name	Location	Stage	Regional Partners	Timing/Schedule	Estimated Capital Costs (\$ M)	Potential Benefits							Evaluation			
									Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DACs	Environmental Justice	Regional Water Supply Reliability and Resiliency	Prioritizing Social Equity	Regional Benefits	Timing/Schedule
1	WMWD	Interties	WMWD/ EMWD MARB inter-connection	MARB	Construction	EMWD, MARB, March JPA	2022	\$12.3	X		X	X	X	X	X	Meets 3 or more of the regional benefits	Benefits DAC and promotes environmental justice	Action involves multiple adjacent agencies	Short-term action
2	WMWD	Operation and Management	AMI and Customer Portal	Retail Service Area	Construction		2022	\$3.6		X			X			Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
3	WMWD	Interties	Magnolia Intertie	Along Magnolia Ave near the Arlington Desalters	Design	Riverside Public Utilities, SAWPA	2023	\$1.3	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Regional action	Short-term action
4	WMWD	Operation and Management	Cannon/Campbell Pump Station	Near intersection of Cannon Road and Alessandro Blvd, Riverside	Design	Riverside Public Utilities, SAWPA	2023	\$12.5	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Regional action	Short-term action
5	WMWD	Supply/Treatment	ADS Well Rehab and Reverse Osmosis Membrane Replacement	Arlington Desalter	Design		2023	\$2.2	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
6	WMWD	Operation and Management	MGL Upgrades	MGL	Design		2025	\$3.0		X	X	X				Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Mid-term action
7	WMWD	Storage	Stormwater Capture and Spreading	Victoria Recharge Basin	Other		Unknown	Unknown	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown
8	WMWD	Interties	RCWD/ WMWD Murrieta inter-connection	Murrieta	Planning	RCWD	Unknown	\$2.2								Meets less than 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Action involves multiple adjacent agencies	Unknown
9	WMWD	Operation and Management	South of Murrieta Creek Service Connection for Private Well Owners	Murrieta	Planning		Unknown	\$20.3			X	X		X	X	Meets 2 of the regional benefits	Benefits DAC and promotes environmental justice	Single agency action	Unknown
10	WMWD	Interties	EVMWD/ WMWD Murrieta interconnection	Murrieta	Planning	EVMWD	Unknown	\$9.0			X	X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Action involves multiple adjacent agencies	Unknown
11	WMWD	Other	Regional drought portal	WMWD	Planning		Unknown	Unknown								Meets less than 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown
12	WMWD	Supply/Treatment	Murrieta Legacy Pipeline	Murrieta	Design		2026	\$5.0		X	X	X		X		Meets 3 or more of the regional benefits	Benefits DAC or promotes environmental justice	Single agency action	Mid-term action

Project Number	Agency	Type of Mitigation Action	Project/Program Name	Location	Stage	Regional Partners	Timing/ Schedule	Estimated Capital Costs (\$ M)	Potential Benefits							Evaluation			
									Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DACs	Environmental Justice	Regional Water Supply Reliability and Resiliency	Prioritizing Social Equity	Regional Benefits	Timing/ Schedule
13	WMWD	Supply/ Treatment	Murrieta Wellhead Treatment	Murrieta	Design		2024	\$8.0	X	X	X	X	X	X		Meets 3 or more of the regional benefits	Benefits DAC or promotes environmental justice	Single agency action	Short-term action
14	WMWD	Operation and Management	March Field Air Museum Landscape Retrofit	March Field Air Museum	Design	March Field Air Museum	2024	\$0.23		X	X	X	X	X		Meets 3 or more of the regional benefits	Benefits DAC or promotes environmental justice	Action involves multiple adjacent agencies	Short-term action
15 – Retail Reservoir Storage Projects	WMWD	Storage	Murrieta 1280 Zone Storage	Murrieta	Planning		Unknown	\$7.3			X	X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown
	WMWD	Storage	2.7 MG Hidden Valley # 2 Tank	Riverside	Planning		Unknown	\$10.7			X	X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown
	WMWD	Storage	3 MG 2320 PZ Tank	Riverside	Planning		Unknown	\$11.9			X	X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown
	WMWD	Storage	5 MG Orangecrest #3 tank	Riverside	Planning		Unknown	\$19.9			X	X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown
	WMWD	Storage	1 MG El Nido # 2 Tank	Riverside	Planning		Unknown	\$4.0			X	X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown
16 – Recycled Water Projects	WMWD	Supply/ Treatment	Recycled Water System Expansion	WWRF	Planning		Unknown	\$34.4	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown
	WMWD	Storage	Artificial Recharge Using Recycled Water	Victoria Recharge Basin	Planning		Unknown	Unknown	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown

Project Number	Agency	Type of Mitigation Action	Project/Program Name	Location	Stage	Regional Partners	Timing/ Schedule	Estimated Capital Costs (\$ M)	Potential Benefits							Evaluation				
									Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DACs	Environmental Justice	Regional Water Supply Reliability and Resiliency	Prioritizing Social Equity	Regional Benefits	Timing/ Schedule	
	WMWD	Supply/ Treatment	PFAS Treatment on WWRF	Western Water Recycling Facility	Design	March Air Reserve Base; March JPA	2023	\$7.0	X		X	X	X	X	X		Meets 3 or more of the regional benefits	Benefits DAC and promotes environmental justice	Single agency action	Short-term action
	WMWD	Supply/ Treatment	Well 7	Riverside Basin	Design	SAWPA	2023	\$5.0	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Regional action	Short-term action	
17 – Retail Fire Flow Projects	WMWD	Operation and Management	Flow-Based Pump Station at Lockwood Tank for fireflow	WMWD	Design		2023	\$0.7			X	X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action	
	WMWD	Other	Expanded pipelines for fireflow service	Riverside	Planning		Unknown	\$7.0			X	X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown	
	WMWD	Other	Expanded pipelines for fireflow service	Murrieta	Planning		Unknown	\$4.9				X		X	X	Meets less than 2 of the regional benefits	Benefits DAC and promotes environmental justice	Single agency action	Unknown	
18 – Retail System Operation Projects	WMWD	Operation and Management	Operations Control Room	WMWD	Design		2023	\$0.2		X		X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action	
	WMWD	Operation and Management	Water Filling Stations	One at Western's Operations facility and one in the rural area of Gavilan Hills	Feasibility		2023	\$0.5			X	X		X	X	Meets 2 of the regional benefits	Benefits DAC and promotes environmental justice	Single agency action	Short-term action	
	WMWD	Operation and Management	SCADA Master Plan Implementation	WMWD	Construction		2025	\$2.0		X	X	X				Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Mid-term action	
	WMWD	Operation and Management	District Metered Areas	Retail Service Area	Planning		Unknown	Unknown		X		X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown	
19	Altman Plants	Storage	Additional stormwater storage capacity	Perris, CA	Construction		2022	\$1.1	X		X		X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action	

Project Number	Agency	Type of Mitigation Action	Project/Program Name	Location	Stage	Regional Partners	Timing/Schedule	Estimated Capital Costs (\$ M)	Potential Benefits							Evaluation				
									Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DACs	Environmental Justice	Regional Water Supply Reliability and Resiliency	Prioritizing Social Equity	Regional Benefits	Timing/Schedule	
20	Altman Plants	Other	Sensor-based irrigation	Perris, CA	Planning		2022	\$0.5		X							Meets less than 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
21	Altman Plants	Other	Soil additives	Perris, CA	Design		2022	\$0.5		X							Meets less than 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
22	City of Corona	Operation and Management	Advanced Metering Infrastructure Project	City of Corona	Planning		2025	\$22.7		X			X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Mid-term action
23	EMWD	Supply/Treatment	Purified Water Replenishment	EMWD	Planning		2025	Unknown	X		X	X	X				Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Mid-term action
24	EMWD	Supply/Treatment	Recycled Water Expansion	EMWD	Planning		2022	Unknown	X		X	X	X				Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
25	EMWD	Supply/Treatment	Perris South Desalination Program Expansion	EMWD	Design		2030	\$50.0	X		X	X	X				Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Long-term action
26	EMWD	Supply/Treatment	Additional groundwater wells	EMWD	Design		2030	Unknown	X		X	X	X				Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Long-term action
27	EVMWD	Storage	Lee Lake Dam Storage Modifications	Lee Lake Dam			2027	\$70.0	X			X	X				Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Long-term action
28	EVMWD	Supply/Treatment	Canyon Lake Water Treatment Plant Phase 1 Improvements	Canyon Lake Water Treatment Plant			2024	\$40.0	X		X	X	X				Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action

Project Number	Agency	Type of Mitigation Action	Project/Program Name	Location	Stage	Regional Partners	Timing/Schedule	Estimated Capital Costs (\$ M)	Potential Benefits							Evaluation				
									Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DACs	Environmental Justice	Regional Water Supply Reliability and Resiliency	Prioritizing Social Equity	Regional Benefits	Timing/Schedule	
29	EVMWD	Supply/Treatment	Horsethief Treatment Plant Upgrades and Expansion	Horsethief Canyon Water Reclamation Facility			2023	\$15.8	X					X			Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
30	EVMWD	Supply/Treatment	Mayhew Well (New) - Local Water Resiliency Project	EVMWD			2026	\$8.0			X	X					Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Mid-term action
31	EVMWD	Supply/Treatment	Palomar Wellhead Facilities - Local Water Resiliency Project	EVMWD			2022	\$5.0			X	X					Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
32	EVMWD	Supply/Treatment	Lee Lake Wells - Local Water Resiliency Project	Lee Lake Basin			2022	\$5.5	X		X	X	X				Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action

Project Number	Agency	Type of Mitigation Action	Project/Program Name	Location	Stage	Regional Partners	Timing/Schedule	Estimated Capital Costs (\$ M)	Potential Benefits							Evaluation				
									Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DACs	Environmental Justice	Regional Water Supply Reliability and Resiliency	Prioritizing Social Equity	Regional Benefits	Timing/Schedule	
33	EVMWD	Supply/Treatment	Diamond Regional Sewer Lift Station and Dual Force Main	Diamond Regional Sewer Lift Station			2025	\$60.0			X						Meets less than 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Mid-term action
34	EVMWD	Supply/Treatment	Upsize Blending Line at Diamond	EVMWD			2024	\$3.0				X	X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
35	EVMWD	Supply/Treatment	Corydon Well Replacement	EVMWD			2025	\$4.5			X	X					Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Mid-term action
36	EVMWD	Supply/Treatment	Pipeline from Tomlin 1 To Los Pinos 2	EVMWD			2023	\$4.3		X					X		Meets less than 2 of the regional benefits	Benefits DAC or promotes environmental justice	Single agency action	Short-term action

Project Number	Agency	Type of Mitigation Action	Project/Program Name	Location	Stage	Regional Partners	Timing/Schedule	Estimated Capital Costs (\$ M)	Potential Benefits							Evaluation			
									Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DACs	Environmental Justice	Regional Water Supply Reliability and Resiliency	Prioritizing Social Equity	Regional Benefits	Timing/Schedule
37	EVMWD	Other	Avenues Septic to Sewer Conversion	EVMWD			2026	\$16.0			X					Meets less than 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Mid-term action
38	EVMWD	Other	SEDCO Hills Septic System Sewer Conversion	SEDCO Hills			2026	\$25.0			X					Meets less than 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Mid-term action
39	EVMWD	Other	Arsenic Leaching Study - IPR	EVMWD			2024	\$1.5	X		X		X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action

Project Number	Agency	Type of Mitigation Action	Project/Program Name	Location	Stage	Regional Partners	Timing/Schedule	Estimated Capital Costs (\$ M)	Potential Benefits							Evaluation			
									Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DACs	Environmental Justice	Regional Water Supply Reliability and Resiliency	Prioritizing Social Equity	Regional Benefits	Timing/Schedule
40	EVMWD	Supply/Treatment	Regional Water Reclamation Facility Expansion	EVMWD RWRF			2025	\$150.0	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Mid-term action
41	JCSD	Supply/Treatment	Recycled Water Service Expansion Project	The City of Eastvale and some areas within the City of Jurupa Valley	Design	IEUA, WRCRWA, City of Corona, City of Norco	2021	\$37.0	X		X	X	X	X		Meets 3 or more of the regional benefits	Benefits DAC or promotes environmental justice	Regional action	Short-term action
42	JCSD	Supply/Treatment	Etiwanda Intervalley Water Quality and Water Resiliency Project (Phase 1-4)	Jurupa Valley, Fontana, Ontario, and Rancho Cucamonga	Design	CVWD	2030	\$241.0	X		X	X		X		Meets 3 or more of the regional benefits	Benefits DAC or promotes environmental justice	Action involves multiple adjacent agencies	Long-term action
43	JCSD	Other	Drought Outreach Plan	All of JCSD's service area.	Other	Agency specific	2021	Unknown		X					X	Meets less than 2 of the regional benefits	Benefits DAC or promotes environmental justice	Single agency action	Short-term action

Project Number	Agency	Type of Mitigation Action	Project/Program Name	Location	Stage	Regional Partners	Timing/Schedule	Estimated Capital Costs (\$ M)	Potential Benefits							Evaluation				
									Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DACs	Environmental Justice	Regional Water Supply Reliability and Resiliency	Prioritizing Social Equity	Regional Benefits	Timing/Schedule	
44	JCSD	Supply/Treatment	Well Exploration in the Chino Basin	Jurupa Valley	Feasibility	Agency specific	2025	\$5.2	X		X	X	X	X			Meets 3 or more of the regional benefits	Benefits DAC or promotes environmental justice	Single agency action	Mid-term action
45	JCSD	Interties	Van Buren Interconnection Project			City of Riverside	2022	\$6.0	X		X	X	X				Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Action involves multiple adjacent agencies	Short-term action
46	JCSD	Supply/Treatment	Well 29 Equipping				2022	\$5.3	X		X	X	X				Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
47	RCWD	Supply/Treatment	Recycled Water Accelerated Retrofit Program	Entire Recycled Water System (City of Temecula and City of Murrieta)	Construction		2022	\$6.0			X		X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
48	RCWD	Supply/Treatment	Small Scale IPR	Entire District	Planning		Unknown	\$20.0	X		X		X				Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown
49	RCWD	Storage	Groundwater Banking	Entire District	Conceptual		Unknown	Unknown	X		X	X					Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Unknown
50	RCWD	Storage	Vail Dam Remediation	Vail Dam			2025	\$65.0	X		X	X	X				Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Mid-term action
51	RCWD	Supply/Treatment	Upper VDC Well No. 175 and Well No. 176				2023	\$6.4	X		X	X	X				Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action

Project Number	Agency	Type of Mitigation Action	Project/Program Name	Location	Stage	Regional Partners	Timing/Schedule	Estimated Capital Costs (\$ M)	Potential Benefits							Evaluation			
									Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DACs	Environmental Justice	Regional Water Supply Reliability and Resiliency	Prioritizing Social Equity	Regional Benefits	Timing/Schedule
52	RCWD	Storage	Cole Creek Pond Lining-Recycled Project				2021	\$2.2			X					Meets less than 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
53	RCWD	Supply/Treatment	Chlorine Contact Tank and Regional Pump Station				2022	\$16.1	X		X		X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
54	RHWC	Supply/Treatment	Well RN #6 Nitrate Removal	12374 Michigan Street Grand Terrace, CA 92313	Design		2022	Unknown	X		X	X	X	X		Meets 3 or more of the regional benefits	Benefits DAC or promotes environmental justice	Single agency action	Short-term action
55	RHWC	Supply/Treatment	Brine Line	Pipeline commences at the Ion Exchange System in Grand Terrace and terminates at the Inland Empire Brine Line	Design		2022	Unknown	X		X	X	X	X		Meets 3 or more of the regional benefits	Benefits DAC or promotes environmental justice	Single agency action	Short-term action
56	RHWC	Supply/Treatment	Santa Ana River Conservation and Conjunctive Use Program Water Well	1450 East Washington, Colton Ca, 92324	Design	WMWD	2022	Unknown	X		X	X	X	X		Meets 3 or more of the regional benefits	Benefits DAC or promotes environmental justice	Regional action	Short-term action
57	RPU	Supply/Treatment	Jackson St. Recycled Water Line, Phase 1B				2022	\$1.5			X	X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
58	RPU	Supply/Treatment	Riverside Habitat Parks and Water Project			SBVMWD	2023	\$25.0	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Action involves multiple adjacent agencies	Short-term action

Project Number	Agency	Type of Mitigation Action	Project/Program Name	Location	Stage	Regional Partners	Timing/Schedule	Estimated Capital Costs (\$ M)	Potential Benefits							Evaluation			
									Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DACs	Environmental Justice	Regional Water Supply Reliability and Resiliency	Prioritizing Social Equity	Regional Benefits	Timing/Schedule
59	RCSD	Interties	West Valley Water District Interconnection				2022	\$0.6	X		X	X	X			Meets 3 or more of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
60	RCSD	Operation and Management	Five Agency Agreement between RCSD, Western, MWD, SBVMWD, and WVWD			MWD, WMWD, SBVMWD, WVMWD	2022	< \$0.1								Meets less than 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Regional action	Unknown
61	RCSD	Supply/Treatment	Ion Exchange Treatment System				2021	\$4.0			X		X			Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
62	RCSD	Supply/Treatment	GAC Treatment System				2021	\$1.3			X		X			Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action
63	RCSD	Storage	RCSD Potable Water Reservoir Refurbishment				2022	\$2.7			X	X				Meets 2 of the regional benefits	Does not benefit DAC or promote environmental justice	Single agency action	Short-term action

Project Number	Agency	Type of Mitigation Action	Project/Program Name	Location	Stage	Regional Partners	Timing/Schedule	Estimated Capital Costs (\$ M)	Potential Benefits							Evaluation			
									Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DACs	Environmental Justice	Regional Water Supply Reliability and Resiliency	Prioritizing Social Equity	Regional Benefits	Timing/Schedule
64	RCSD	Supply/Treatment	RCSD New Well and Treatment		Design		2024	\$3.0	X	X	X	X	X	X	X	Meets 3 or more of the regional benefits	Benefits DAC and promotes environmental justice	Action involves multiple adjacent agencies	Short-term action
65	SAWPA	Supply/Treatment	Santa Ana River Watershed Weather Modification Pilot Program		Design	SAWPA member agencies	2022	\$1.4	X		X	X	X	X		Meets 3 or more of the regional benefits	Benefits DAC or promotes environmental justice	Action involves multiple adjacent agencies	Short-term action

**Notes:**

CVWD: Cucamonga Valley Water District  
EMWD: Eastern Municipal Water District  
EVMWD: Elsinore Valley Municipal Water District  
GAC: granulated activated carbon  
IEUA: Inland Empire Utilities Agency  
IPR: indirect potable reuse  
JCSD: Jurupa Community Services District  
MARB: March Air Reserve Base  
MG: million gallon

MGL: Mills Gravity Line  
PFAS: per-and polyfluoroalkyl substances  
PZ: pressure zone  
RCSD: Rubidoux Community Services District  
RCWD: Rancho California Water District  
RHWC: Riverside Highland Water Company  
RPU: Riverside Public Utilities  
RWRF: Regional Water Reclamation Facility  
SAWPA: Santa Ana Watershed Project Authority

SBVMWD: San Bernardino Valley Municipal Water District  
SCADA: supervisory control and data acquisition  
VDC: Valle De Los Caballos  
WMWD: Western Municipal Water District  
WRCRWA: Western Riverside County Regional Wastewater Authority  
WVMWD: West Valley Water District  
WWRF: Western Water Recycling Facility

**Table A-2: Identification of Other Proposed Mitigation Actions and their Key Identifiers**

Project Number	Agency	Type of Mitigation Action	Project/Program Description	Location	Potential Benefits						Other Notes/Comments	
					Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DAC		Environmental Justice
1	WMWD	Interties	Interconnections between WMWD's retail agencies		X		X	X	X			
2	WMWD	Interties	Interconnections with RCSD	Interconnections with RCSD			X	X		X	X	
3	WMWD	Supply/ Treatment	Irrigation with recycled water can offset groundwater pumping by utilizing treated wastewater for irrigation. Currently recycled water is not used as a source of irrigation in the basin.	Arlington Basin	X		X	X	X			Riverside-Arlington Groundwater Sustainability Plan (GSP) Project
4	WMWD	Storage	This project injects or spreads surface water, treated to drinking water standards, into basin aquifers to be used as underground storage reservoirs.	Arlington Basin	X		X	X	X			Riverside-Arlington GSP Project
5	WMWD	Operation and Management	Projects for the metering and collection of groundwater pumping in the Arlington Basin	Arlington Basin				X				Riverside-Arlington GSP Project
6	WMWD	Operation and Management	Replacement of invasive or nonnative vegetation with native plant species will not only have a positive impact on the health of an ecosystem but can also provide indirect aquifer recharge by decreasing evapotranspiration.	Arlington Basin		X						Riverside-Arlington GSP Project
7	WMWD	Operation and Management	Water Transfers/In-Lieu Groundwater Recharge would replace groundwater pumping, provide passive recharge, and could potentially allow an increase in groundwater in storage with the delivery of excess, treated to drinking water standards surface water to the Arlington Basin.	Arlington Basin			X	X				Riverside-Arlington GSP Project
8	WMWD	Supply/ Treatment	Activities that promote and incentivize conservation	WMWD		X						Riverside-Arlington GSP Project

Project Number	Agency	Type of Mitigation Action	Project/Program Description	Location	Potential Benefits						Other Notes/Comments	
					Increase Local Supply	Water Conservation	Water Supply Reliability	Operational Flexibility	Decrease Reliance on Imported Supplies	Benefit DAC		Environmental Justice
9	WMWD	Operation and Management	Programs that redistribute pumping can alter the timing of when groundwater extraction occurs or the location of groundwater is pumped, potentially from existing groundwater wells to new groundwater wells.	Arlington Basin			X	X				Riverside-Arlington GSP Project
10	WMWD	Supply/ Treatment	A leak detection program traces the flow of water from its source, through a water distribution system, to customers and for other uses with the review of records and data collected. Creation of a leak detection program would help ensure supplied water reaches its destination, supporting water conservation.	WMWD		X						Riverside-Arlington GSP Project
11	WMWD	Operation and Management	Water Loss Mitigation Program: Pipeline Repair; Repairing Aging infrastructure will help decrease water loss and help create more resilience in current water supplies during a drought.	WMWD			X	X				
12	WMWD	Storage	Arlington Reservoir for local groundwater storage	Arlington Desalter			X	X				
13	WMWD	Operation and Management	Hydroelectric Power Generation	MGL and Sterling			X	X				
14	Altman Plants	Storage	Additional storage for the State Water Project (Sites Reservoir)		X		X					
15	Altman Plants	Operation and Management	Additional resources for homeowners to install/retrofit to more efficient irrigation systems. Both educational outreach and financial incentives.			X						
16	Altman Plants	Operation and Management	Financial incentives for homeowners to install tankless water heaters.			X						
17	RCSD	Supply/ Treatment	Reverse Osmosis Plant Construction				X		X			

Appendix H – Drought Task Force Workshop Summaries

**DROUGHT TASK FORCE — WORKSHOP NO. 1-2 SUMMARY**

# ***Drought Goals and Drought Response Actions***

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Western Municipal Water District (Western)

*Summary of workshops held January 22 and February 10, 2021*

The January 22 and February 10, 2021 virtual workshops were attended by members of the Western Drought Task Force. The group participated in two small group exercises to inform a set of **Guiding Principles for the Task Force**, and to inform best-fit **Drought Response Actions** for the region.

Following are key themes that permeated the Task Force discussions.



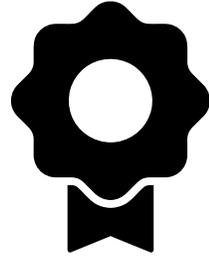
# Key Themes from Task Force Input

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## Coordinated communication

Use coordinated, ongoing communication that consistently reaches and educates diverse audiences with specific calls to action.



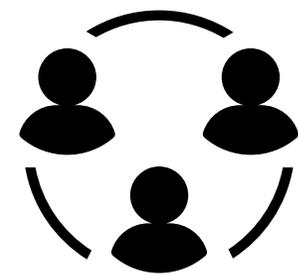
## Incentives and Rewards

Use carrots over sticks to incentivize smart water use and reward it with appropriate benefits.



## There's no one size fits all policy

Regional solutions require flexibility and adaptability to different community needs.



## Interagency collaboration

Collaboration across water agencies and stakeholders will benefit all water customers.



In the **Regional Drought Goals activity**, Task Force members worked in small groups to answer prompt questions spanning six goal categories; each group surfaced diverse insights that informed a draft set of Guiding Principles.

Following are the draft **Guiding Principles for the Task Force** which will inform the group's remaining work together, as well as a summary of each group's responses.



# Guiding Principles for the Task Force

DRAFT FOR TASK FORCE REVIEW

**1**

Prioritize equitable water policies region wide.

**2**

Employ drought and shortage triggers that empower a coordinated, flexible, regional response.

**3**

To support climate resilience, diversify regional supply and encourage conservation as a way of life.

**4**

Foster continuous, coordinated, and accessible stakeholder education to empower smart water use.

**5**

Prioritize water investments that sustainably support environmental health, quality of life, and regulatory compliance.

**6**

Foster regional water planning collaboration, knowledge-sharing, and alignment.



# 1 Prioritize equitable water policies region wide.

## ENCLOSED ARE ALL RESPONSES FROM GROUP NO. 1 THAT INFORMED DROUGHT GOAL NO. 1

- Box Springs Mutual wanted to ensure they are not lost in the noise and are considered fairly.
- (IERCD) Ensure people are invited to participate in an inclusive and meaningful way
- Getting all parties to the table takes professional expertise. More vulnerable groups are more challenging to connect with.
- From an affordability side, how the cutbacks are made needs to be considered: Normalize water use to identify reasonable reductions (by agency, sector, customer).
- Each group will be impacted differently. There should be understanding of all needs.
- Consider creating a platform for education of other stakeholders to understand what their partners are dealing with and navigating, and what resources are available to them.
- Facilitate awareness.
- Price as a sole driver for rationing does not always consider equity. Services need to remain affordable.
- Environmental needs often come first, especially in adjudicated areas
- Consider how cuts and rates are determined across sectors (agriculture, residential, small business, industrial). What are the priorities for the agencies?

# 1 Prioritize equitable water policies region wide.

ENCLOSED ARE ALL RESPONSES FROM GROUP NO. 2 & 3 THAT INFORMED DROUGHT GOAL NO. 1

## GROUP NO. 2

- Participation can be gained by incentivizing it with giveaways or door prizes at events, especially events that involve the whole family.
- How do we reach out to stakeholders that may not usually participate in the process? Providing translators and translated materials for non-English speaking stakeholders.
- Don't want to punish stakeholders/organizations that have been proactive in drought planning and response.
- Senior citizens have more time available to attend but are more apt to attend if it's coupled with another event.
- When setting goals, we aren't trying to pick winners and losers.

## GROUP NO. 3

- Defining drought with objective criteria to be equitable in response and triggers
- When development projects come forward, traffic and water are usually issues
- Regular communication

# 1 Prioritize equitable water policies region wide.

## ENCLOSED ARE ALL RESPONSES FROM GROUP NO. 4 THAT INFORMED DROUGHT GOAL NO. 1

- Consider the variability of local weather conditions (affecting ET and urban demand), consider using CIMAX data for accuracy in local drought actions and standard available precipitation data from NOAA's Climate Prediction Center (i.e., to set representative or fair percent reduction, action plan by agencies.).\*Also availability of resources, previous and ongoing investments and collaboration by local water agencies in water resources management, conservation, use of recycled water program should be credited. (Farid, RPU)
- As wholesaler, our allocations are determined based on an equitable formula based on historical baseline needs, population growth, relative dependence on MWD's supplies, and groundwater replenishment/seawater barrier needs, with an appeals process for special circumstances
- Provide communication messaging and program implementation in multiple languages
- Invest in a variety of supply options in different places
- Provide targeted outreach to disadvantaged communities and non-English speakers
- Provide lifeline rates for low income (might be difficult to implement quickly and effectively)
- Baseline health and safety allocations not subject to penalty allocation rates
- Considerations for agencies that have already invested in demand management and local supplies (i.e., demand hardening credits)
- MWD has Allocation Plans to enforce when needed, it's a choice of the MAs on how much water to use. Try to make it equitable by looking at past use. Each MA chooses whether or not to reduce but incentivized by cost structure. (Demetri, MWD)
- Concerned about whether the voice of Tribes are being included (Suzie Earp)
- Need a diverse set of actions (not just cost based/penalties) that everyone has an opportunity to achieve.
- Challenge: During drought response, there is no way in the process to cut back water, can't sacrifice quality. (Todd, Kroger)
- Maintain consistent curtailments between all users for potable uses

# 1 Prioritize equitable water policies region wide.

## ENCLOSED ARE ALL RESPONSES FROM GROUP NO. 5 THAT INFORMED DROUGHT GOAL NO. 1

- Data shows trends of challenges paying utility bills across certain socioeconomic sectors
- Start by identifying the communities now inequitably affected by drought and provide them with more accessible education so they know they are a stakeholder in these decisions
- What is the process for understanding the impact of regional drought decisions on various stakeholders?
- What does Western mean by "ensure equity"? What region are we talking about, which decisions are we talking about?
- Some regional decisions may affect some customers and agencies very differently from others. How can we create a process that helps us understand the impact of decisions?
- A great first step, let's make this a permanent task force outside of drought conditions to ensure regional voices are heard
- How do we "ensure" this goal until we have a way to measure it?
- Rather than create a plan "in a box," we want to hear and reflect voices in the community into our plan
- As climate change impacts continue, ensuring equity is going to become harder. The best approach as a water resources community is this type of ongoing, continuous discussion (w/Task Force); so we can find regional solutions to overcome these obstacles.
- We want to hear from stakeholders.
- We want to make sure as we go through this process that we give overall credit for overall water delivered; that all water sources are "treated" equality (not just imported drinking water).
- In past efforts, we mirrored Met's approach. Is there a desire to change our approach moving forward?
- Given the relevance of water supply and drought planning in So. Cal, a lot of what we do depends on the regulations from Met., are they represented in this process?
- We've all been investing heavily in other water resources; let's keep in mind that all water should be considered within the plan itself
- Often drought contingencies focus on potable drinking water only; lets look at all water resources; every local retail agency that has invested in water resources, they "get credit for that"

# 2

## Employ drought and shortage triggers that empower a coordinated, flexible, regional response.

### ENCLOSED ARE ALL RESPONSES FROM GROUP NO. 1, 2 & 3 THAT INFORMED DROUGHT GOAL NO. 2

#### GROUP NO. 1

- Need to account for various indices and data points (precipitation, northern snowpack)
- Needs to consider the western U.S.; broad considerations.
- Have a good understanding of the conditions for region relevant to the DCP
- Must include statewide order and/or regional (MWD) as a consideration.
- The state is often in the same situation (hydrologic drought as opposed to a meteorological drought).
- Metric to account for five-year projections

#### GROUP NO. 2

- For technical consideration in DCP development: A lot of disadvantaged stakeholders are located within rural/unincorporated areas have relatively shallow wells. Consider using this as a trigger for drought response actions.
- Base definitions on historical data and trends. Factor in projections of population growth and land use.
- Changes in groundwater quality that are driven by groundwater depletion.
- Drought vs. shortage — Drought could be regional, but a shortage can be local due to more concentrated impacts. How does Western support retail agencies that are experiencing a local impacts to groundwater access?

#### GROUP NO. 3

- Are there objective criteria in defining what is in a drought? SCE has allegations regarding power shutoffs in DAC communities
- Regional approach/regional consistency
- RPU - cumulative departure from long-term mean from precipitation - downward trending is drought period definition for; Valley defines it similarly
- Consider local conditions of the agency; definitions for different stakeholders

# 2

Employ drought and shortage triggers that empower a coordinated, flexible, regional response.

ENCLOSED ARE ALL RESPONSES FROM GROUP NO. 4 THAT INFORMED DROUGHT GOAL NO. 2

## GROUP NO. 4

- Yes, different definitions could affect some stakeholder differently, and there are drought indices (Palmer index family) which is based on the departure from the mean normal conditions of a set of these items mentioned, precipitation, temperature, soil moisture, groundwater level) (Farid, RPU)
- Should consider the big picture and all available assets. Not just hydrologic conditions.
- Yes, need to be careful when defining drought
- One-size-fits-all definition may not work well to reflect the preparedness of agencies
- For Metropolitan, we consider several things in total: our imported supply sources, hydrologic conditions, reservoir levels, our storage balances, wholesale demand. We can have criteria for each of these.
- Maybe not think only in terms of drought. Should always be using water efficiently.
- May adversely affect constituents by undervaluing long-term investments and proactive planning in reliability (such as storage and transfers) and putting overemphasis on short term measures and reactions.
- Because of the diverse water supplies in this area, there are different criteria to be aware of.
- Drought can also trigger water quality challenges; sources and impacts are another thing to monitor

# 2

Employ drought and shortage triggers that empower a coordinated, flexible, regional response.

ENCLOSED ARE ALL RESPONSES FROM GROUP NO. 5 THAT INFORMED DROUGHT GOAL NO. 2

## GROUP NO. 5

- This is a Met question, a state question in terms of how we define a "shortage"
- Tribes can declare a drought at any time
- Most of the region's supply is imported, individual utilities have their own supply portfolio
- How do we take regional conditions into account?
- What do we mean by "regional shortage conditions" if 97% of water goes to agriculture?

# 3

To support climate resilience, diversify regional supply and encourage conservation as a way of life.

**ENCLOSED ARE ALL RESPONSES FROM GROUP NO. 1 & 2 THAT INFORMED DROUGHT GOAL NO. 3**

## **GROUP NO. 1**

- Bank water in the ground is a long-term solution, if there is a groundwater bank available.
- Consider using reclaimed water more; Indirect Potable Reuse or whatever is appropriate.
- Requires partners: ex: Regional Potable Re-use Agreements.
- Start from scarcity. Partnerships can be helpful as not all agencies will experience shortage in the same way.
- Consider institutional exchange agreements.
- Consider education and information campaigns.
- Consider pricing.
- Reduce least-value uses first.
- Agriculture demands in some areas may not be high value crops and trading water for a fallowed fields.

## **GROUP NO. 2**

- Consider conjunctive use projects, sponsored by multiple agencies.
- Consider incentive programs for private industry to develop their own projects to leverage water supplies, when available.
- Consider incentive programs to implement water conservation and demand reduction measures.

# 3

To support climate resilience, diversify regional supply and encourage conservation as a way of life.

## ENCLOSED ARE ALL RESPONSES FROM GROUP NO. 3 & 4 THAT INFORMED DROUGHT GOAL NO. 3

### GROUP NO. 3

- Diversify supply portfolio: local, regional, imported supplies
- Consumption issue: encourage conservation all the time, not just in the drought
- Talk about it all the time — demand management — emphasis with the state, continued emphasis on Water Use Efficiency as a way of life
- Tie consumption with local supply (SCE with flex alert), we don't refer to that often. Tie consumption with local supply (SCE with flex alert), we don't refer to that often
- Yes, continue using recycled water, improving our recycled water systems, switching potable users to recycled water users if possible
- Identify leaks in systems and in households

### GROUP NO. 4

- Partner with local agencies to produce more local supply to reduce reliance on MWD. Incentivize and fund conservation efforts, R&D, pilot programs. Also support GW recharge via replenishment water. - Demetri, MWD
- Need a plan in place to address how to make use of supplies when available, taking advantage when things are wet. Invest in capture, storage, conveyance, conjunctive use. Can have wet periods even in a dry year
- Resiliency: Use of use metrics for efficiency, conservation, loss reduction. Also consider, water availability (quantity, quality), reliability of source water (Farid, RPU)
- Diversification in type (groundwater, surface, recycled, conservation) and location (in-region, other side of fault line)
- Promote interagency water connections.
- There is no over-communicating or over-educating on water; messages need to be consistent and can be more broad reaching than even intended when all agencies are communicating the same thing.
- When the message is on-point it helps with equity; everyone knows there is a drought and can respond. Keep talking about it even we aren't "in" a drought. Keep the drumbeat going!

# 3

To support climate resilience, diversify regional supply and encourage conservation as a way of life.

ENCLOSED ARE ALL RESPONSES FROM GROUP NO. 5 THAT INFORMED DROUGHT GOAL NO. 3

## GROUP NO. 5

- Recognize we're in a semi-arid environment and need to change our habits indoor and outdoor to be more water efficient
- Other incentive programs could encourage drought friendly landscaping
- Water rate structure that incentivizes conservation is an important part of the solution
- Are their regional efforts for household or school district education in droughts to help them conserve? Are these accessible?
- Pricing incentives vs. water budgets

# 4 Foster continuous, coordinated, and accessible stakeholder education to empower smart water use.

## ENCLOSED ARE ALL RESPONSES FROM GROUP NO. 1, 2 & 3 THAT INFORMED DROUGHT GOAL NO. 4

### GROUP NO. 1

- Planning documents can sometimes get lost due to a lack of communication and update processes

### GROUP NO. 2

- DCP Team follow up via phone call and direct emails may be more effective in getting response/feedback.
- Making sure that we engage with the appropriate parties (staying informed of personnel changes, regular updates to contact lists).
- Requesting alternate contacts to ensure that communications don't slip between the cracks.

### GROUP NO. 3

- Emails, social media, updates during council meetings
- Workshops like this one
- What is efficient use? But in a drought, now we ask them to squeeze out more; more relatable since there is a budget-based system; targeted messaging for over budget usage; Use existing system in place

# 4 Foster continuous, coordinated, and accessible stakeholder education to empower smart water use.

ENCLOSED ARE ALL RESPONSES FROM GROUP NO. 4 & 5 THAT INFORMED DROUGHT GOAL NO. 4

## GROUP NO. 4

- Consider local weather conditions variability (Affecting ET and Urban demand), consider using CIMAX data for accuracy in local drought actions and standard available precipitation data/ from NOAA's Climate Prediction Center (i.e., to set representative or fair % reduction, action plan by agencies).
- \*Also availability of resources, previous and ongoing investments and collaboration by local water agencies in water resources management, conservation, use of recycled water program should be credited. —Farid, RPU
- Region needs to agree to plan, protocols, and message
- Keep coordinating and talking (example: MWD's monthly member agency PIO meetings)
- Coordinating at all levels and consistent messaging up and down

## GROUP NO. 5

- Ensuring all outreach material is in multi languages, using the tools and channels that meet stakeholders where they are

# 5

Prioritize water investments that sustainably support environmental health, quality of life, and regulatory compliance.

## ENCLOSED ARE ALL RESPONSES FROM GROUP NO. 1, 2 & 3 THAT INFORMED DROUGHT GOAL NO. 5

### GROUP NO. 1

- None

### GROUP NO. 2

- None

### GROUP NO. 3

- Making sure our water quality does not get worse
- Investments to deal with climate change consequences in the future like OCWD
- Ensure if we were in a drought, everyone could still live comfortably and shouldn't need to threaten businesses with reduction in water user
- Access for all agencies/ stakeholders/ customers
- Conserving potable water use/ conserve resources
- Still keep green spaces/importance of open spaces and clean environment (in light of COVID -19)
- Collaboration among water agencies and beyond like city and county

# 5

Prioritize water investments that sustainably support environmental health, quality of life, and regulatory compliance.

**ENCLOSED ARE ALL RESPONSES FROM GROUP NO. 4 & 5 THAT INFORMED DROUGHT GOAL NO. 5**

## **GROUP NO. 4**

- We prioritize science to set guidance on environmental needs
- Achieving a reliable water supply through all conditions both quantity and quality

## **GROUP NO. 5**

- None

# 6

## Foster regional water planning collaboration, knowledge-sharing, and alignment.

### ENCLOSED ARE ALL RESPONSES FROM GROUP NO. 1, 2 & 3 THAT INFORMED DROUGHT GOAL NO. 6

#### GROUP NO. 1

- Ensure long-term effectiveness

#### GROUP NO. 2

- We should partner with SAWPA, which deals with similar concerns as Western.

#### GROUP NO. 3

- Integrate with Groundwater Sustainability Plans
- Encourage consistency/collaboration in region with neighboring water agencies and their planning documents
- Encourage data sharing, there's a lot out there and communicate with other agencies
- Treated wastewater in region
- Integrate with conservation program, consistent in goals

# 6

Foster regional water planning collaboration, knowledge-sharing, and alignment.

**ENCLOSED ARE ALL RESPONSES FROM GROUP NO. 4 & 5 THAT INFORMED DROUGHT GOAL NO. 6**

## GROUP NO. 4

- Integrate with long-term planning documents and implementation planning documents in region (IRP, WSDM Plan/WSAP)
- Coordinate—Have regular meetings where agencies take turns presenting and educating each other on plans.

## GROUP NO. 5

- None

In the **Drought Response Actions Activity**, the stakeholders worked in small groups to answer three prompt questions designed to surface insights, opportunities, and potential barriers to an effective regional response to drought.

Following is a summary of each group's responses as well as **Key Takeaways** that will be used by the project team to inform the Drought Response Actions identified in the **Drought Contingency Plan**. We also encourage regional agencies to consider the key takeaways as they develop their own Water Shortage Contingency Plans.



# Key Takeaways to inform the Drought Response Actions

DRAFT FOR TASK  
FORCE REVIEW

- Communicate consistently, in simple and accessible ways to incentivize smart water use
- Educate continuously, not just in a drought
- Water restrictions alone don't work; especially for those who can't cut use further
- Use technology (like smart meters) to reveal leaks and opportunities to conserve
- Tiered pricing that incentivizes conservation works well to encourage conservation
- Peer pressure, social influencers, and coordinated communication across agencies can encourage smart water use
- Work in advance to communicate and educate about supplies so when there is a shortage the community understands why
- Balance water reduction mandates with commitment to quality of life and connection to customer needs



**1** When we are in a drought, how should we respond?

- There is not a "one-size fits all" drought does not usually work. Even neighboring agencies can be facing different conditions. Messaging to customers needs to be targeted and direct.
- Transparent and simple expected message. A message that customers can understand. Education in advance of a drought is extremely important. Awareness of supplies. People need to understand where their water is coming from.
- Brought drought indices can cause confusion.
- Messaging at different levels can vary. But making it consistent where possible and appropriate is helpful.
- Messaging on various platforms. More messages the better: radio, state, newspaper

**2** What types of actions have been most effective during previous droughts?

- Volumetric Penalties. Not adjusting tiers. This has typically been the response. These have been quickly effective. They generate revenue when there can often be lost revenue from reduced water use.
- Take away the choices: update building codes and appliances.

**3** What types of actions would be most difficult to implement or comply with, and why?

- Setting tiers can be challenging. Challenges with budgets and fiscal pressures.

**1** When we are in a drought, how should we respond?

- Incentivize more efficient water use practices (physical changes and behavioral changes).
- Increase magnitude of response based on the severity of the drought.
- Show baseline usage vs. current billing cycle on water bill (same billing period the previous year, average for neighborhood) Similar to PG&E and SoCal Edison. (Isabel really likes this!)
- Implement wider use of smart water meters so that leaks can be detected sooner.

**2** What types of actions have been most effective during previous droughts?

- Tiered pricing seems to be the most effective with encouraging end-user participation in response actions.
- Continuous communications/reminders to the public and end-users so they can make informed decisions about their water usage.

**3** What types of actions would be most difficult to implement or comply with, and why?

- Voluntary restrictions are difficult to implement so that they are effective, particularly indoor water use.
- From the agency standpoint, implementing allocation reductions is difficult from a political standpoint.
- From an end-user standpoint, implementing allocation reductions that are a percent reduction of usage can be punitive to users who have already implemented their own efficiency measures. (The preferred option is the budget-based allocation).
- On a regional basis, mandating reductions at the retailer/service area level may be unfairly applied to agencies that have already developed their projects to augment supply (if they are held to the same reduction percentage.)

### 1 When we are in a drought, how should we respond?

- Make sure we communicate with the users regarding drought conditions, actions agency is taking (price increase)
- Communication and education to end-users on what conditions are suggestions on how we can together reduce the usage together (ex checking for toilet leaks) — simple yet effective; doesn't need to be in a drought; identify more and success
- Use portfolio of methods to reduce use such as (prices, education)
- Public outreach; expanding public education regarding the water
- Not necessarily price increase, but a drought surcharge for those who are consuming over a threshold
- Start with cutting back lower value use (leaks, outdoor)
- Agency tells me what I need to do; bill helps grab the attention

### 2 What types of actions have been most effective during previous droughts?

- Identifying and fixing leaks
- targeting high end users, neighborhood than general messaging with same message
- Public outreach and education have worked in the past; people do understand
- Once drought severity became more obvious and everyone chipped in and planned their usage more (breakroom piling of dishes to be done at one time); severity and dire of situation helps
- Specific action items for different customer types, understanding customer's water usage (energy building, landscaping vs SFR) - could prove challenging; level of understanding from water companies, pool of ideas to be distributed to get ideas flowing

### 3 What types of actions would be most difficult to implement or comply with, and why?

- Command and control actions such as irrigation restriction, state mandate hard to implement and enforce
- Difficult for people to come up with they need to do to conserve
- Behavioral side - there is still a lot of people not comfortable with using dishwashers - smart controllers running after raining days; finding ways to help people overcome their challenges and misconceptions
- Last drought - saying everyone reduce by 10% doesn't work, especially if it doesn't work. If you are inefficient, you could reduce by 40% and still be fine
- Severity of drought and how much we want to reduce, hits businesses hard and their operating procedures may not allow it
- Increases prices/ changing price of structure, hard to implement but can be effective
- Technology is available, but costly; upgrading system, if no money available for them
- Are there programs that companies can tap into to increase the efficiency of their facilities - like toilets- provide access (ex commercial buildings don't have dishwashers in breakrooms, no resources for that) - What will be used vs not used?

## 1 When we are in a drought, how should we respond?

- Should respond based on the plans that have been put into place
- — Changing programs too often may send a message to customers that planning is faulty or inadequate
- Effective outreach and messaging programs should educate residents about emerging drought conditions, offer tips about how to reduce demand in the short-term, and guide residents toward resources that can help them lower demand in a more direct and hopefully permanent way (2020 AWE Use and Effectiveness of Municipal Irrigation Restrictions During Drought, Executive Summary)
- Drought responses are temporary measures. The criteria that determine when surcharges and other restrictions will be lifted should ideally be specified when they are imposed. This will reinforce the temporary nature of the emergency measure in the minds of customers and help with compliance. (2019 AWWA Drought Preparedness and Response Handbook)
- Publicly announce and clearly communicate to the public the end of the drought or shortage event and the lifting of restrictions. Lift any surcharges imposed promptly. This is to retain credibility and goodwill for future emergencies. (2019 AWWA Drought Preparedness and Response Handbook)
- Communicate! Including the consequences of drought
- Capture wash water for outdoor water needs - requires education
- Lawns should be abnormal / can be hard socially
- Look at the big picture and the individual; different areas use water differently
- We live in a dry area - message that behavioral changes should be permanent, not just triggered during droughts

## 2 What types of actions have been most effective during previous droughts?

- Customer water use messaging is part of the larger field of behavior-based programs which includes using social comparisons to change people's water use behavior. Informing customers about how their water use compares to similar households has become an accepted way to influence water conservation. Fiscal year 2017/18 saw a significant increase in customer water use messaging by Metropolitan's member agencies, and they were able to get their customers to reduce water usage by about 4,320 acre-feet.
- Increase conservation device rebate amounts
- Work with rebate vendor to create in store marketing and work with various businesses to let them know what water saving opportunities are available.
- Develop onsite leak prevention programs.
- Develop a specific online class or video that promotes simple water saving techniques.
- AWE 2020 Drought Restrictions study recommends: messaging, enforcement, irrigation day-of-week and/or time-of-day restrictions, drought surcharges, and implementation strategies.
- Effective outreach and messaging programs should educate residents about emerging drought conditions, offer tips about how to reduce demand in the short-term, and guide residents toward resources that can help them lower demand in a more direct and hopefully permanent way
  - — Water waste ordinances
  - — Landscape irrigation ordinances
  - — Exemptions that are well-publicized and easy to understand (i.e. nonpotable water or alternative irrigation methods used for landscaping, dust control at construction sites, etc.)
- Customer hotlines, phone apps, and online reporting websites useful for identifying repeat violators. Reported violations must be quickly followed up by enforcement in order to retain credibility. (2019 AWWA Drought Preparedness and Response Handbook)
- Turf removal programs
- Consistent messaging - this worked well in the last drought
- Make examples of people who did turf removal last time there was a drought
- Water police/ reporting hotlines also work, but reduces harmony
- Newer concept but - Peer pressure works well, helps show what is possible/ reasonable

## 3 What types of actions would be most difficult to implement or comply with, and why?

- As a wholesale-only supplier, Metropolitan does not impose restrictions on consumer end-uses.
- Difficult and unpleasant to monitor customers for compliance with mandatory measures that are not strictly related to metered consumption. (2019 AWWA Drought Preparedness and Response Handbook)
  - —Water suppliers rely on peer pressure and observations by the public and by the water-supplier field employees during their regular work schedule.
  - —Other municipal employees whose daily work routine requires them to move about the community can be empowered to issue citations, although these employees are often reluctant to fulfill this role.
- Simple percentage reduction allocations are widely perceived as unfair because they in effect penalize former water conservers while rewarding above-average users. Neighbors in identical houses could receive vastly different water allotments. (2019 AWWA Drought Preparedness and Response Handbook)
- Across the board reduction in baseline water use was very unpopular because of perceptions of unfairness for those already conserving
- MWD allocation approach is an example that addresses this and tries to maintain equity
- If rate structures don't support low volume deliveries, retailers can be significantly impacted. But increasing fixed charges to stabilize revenue reduces incentives to conserve

### 1 When we are in a drought, how should we respond?

- We're following the stages set out in our WSCP, stages are defined by Western or Met — follow the plan we've established to focus on a reduction in water consumption (so we know what the target is). We use specific activities to get to the target (Jesus)
- Customers play a big role because they will decrease demand; communicate to customers
- Communicate with adjoining water agencies to encourage knowledge sharing and collaboration
- We can sometimes hear different messages across different agencies; move to consistent messages
- (Jeff) What does "in a drought" mean for our region? It has to be a drought declared by others

### 2 What types of actions have been most effective during previous droughts?

- (Jesus) We've come up with comprehensive package to encourage conservation; most effective is drought pricing; both water rates and penalties
- (Jeff) Asking people to conserve doesn't get us there, the tools that works is pricing and penalties
- (Mark) RE: impacts on equity, how do the rates and penalties impact disadvantaged communities; can we also consider rate reductions for certain customers who can't afford their water bill
- (Jeff) when we're encourage our customers to lower their water use; in drought planning stages there can be huge inequities
- How does supply/price hardening play out here?
- One policy doesn't fit all; range of needs and challenges across customers

### 3 What types of actions would be most difficult to implement or comply with, and why?

- (Jeff) We have a community of custom homes, etc. with large grass areas, some with little, some with none; if it's a policy that will kill their landscaping that's really tough. Question comes up: who pays for that?
- (Jesus) at the point where we're shifting to a new stage of reduction and we're asking customers to sacrifice something; this is a tough message to convey
- It's the "extreme conservation" behavior change actions; how do you enforce it? who's paying for it?
- Between regulators and retailers (who work directly with customers); those on the front line selling the water need a backstop
- Is there an opportunity for more collaboration; are we asking the tough questions of "why" when it comes to specific mandates?
- We have to comply with Prop 218 (protest hearings for water rate changes)

# ***Western Municipal Water District Drought Monitoring Framework***

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Proposed Outline

*Created September 27, 2021*

The following Drought Monitoring Framework was created based on the feedback received at the August 23<sup>rd</sup> virtual Drought Task Force workshop:

### **Process and Data**

- Which indicators should the region use?
- How often should they be compiled/updated and shared with the group?
- What information should be shared with the public?

### **Triggers**

- How should regional drought stages be defined?
- What conditions should trigger a regional response? (i.e., 2 or more local water agencies are in a WSCP stage)

### **Communication**

- What level of regional collaboration and communication tools should always be in place?
- What more should we do some agencies in the region are experiencing a supply shortage?
- What is in our communication toolbox now? What else do we need?

### **Other Regional Water Shortage Responses**

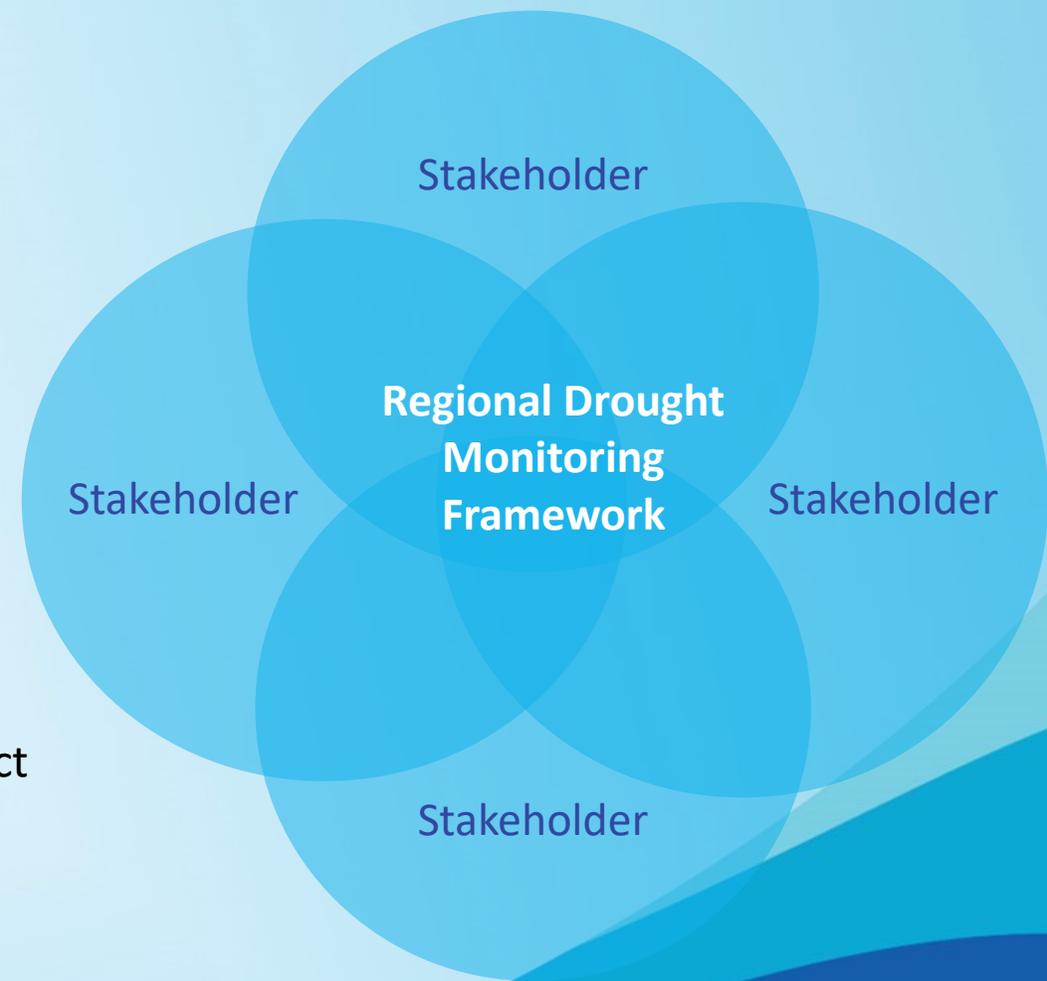
- Besides consistent communication, what other actions could be taken regionally?
- How could we support one another during a drought?



# Summary

## DROUGHT MONITORING FRAMEWORK (DMF)

- **Goals**
  - *Support existing activities and programs*
  - *Improve regional coordination and information sharing regarding droughts and shortages*
- The DMF will be included in the Western Municipal Water District (WMWD) Drought Contingency Plan (DCP), which is expected to be completed in early 2022.
- Provide additional mechanisms for engagement and coordination among regional stakeholders as well as a tools and resources for communication and collaboration.



# DMF TM (Proposed) Outline

## 1. Introduction

- Purpose of the TM
- Drought Monitoring Framework defined

## 2. Current Drought Monitoring Efforts

- Review the various drought monitoring and related activities of the regional stakeholders

## 3. Regional Coordination and Framework

- Outline coordination and information sharing frameworks

# Current Drought Monitoring Efforts

- Summarize drought monitoring and related activities of regional stakeholders within the WMWD
  - Each stakeholder has a different approach to monitoring conditions in their respective areas
  - Summaries will focus on how droughts and water shortages are predicted and defined.
    - Metropolitan WSAP
    - Arlington Groundwater Subbasin GSP
    - Annual Water Supply and Demand Assessments
    - WSCPs /DCPs/General drought monitoring
- A crosswalk evaluation across the stakeholder drought monitoring efforts will highlight similarities and differences among efforts

# Draft Summary of Agency WSCP Contents

## Regional Drought Stages

Agency	Stage 1 Supply Reduction (%)	Stage 2 Supply Reduction (%)	Stage 3 Supply Reduction (%)	Stage 4 Supply Reduction (%)	Stage 5 Supply Reduction (%)
City of Corona	10%	20%	30%	40%	50%
City of Norco	0%	< 15%	15 - 20 %	20 - 50 %	> 50 %
City of Riverside	0 - 5 %	20%	30%	40%	50%
Elsinore Valley MWD	5%	10%	25%	40%	50%
Jurupa CSD	10%	10% – 20%	20% – 30%	30% – 40%	40% +
Rancho California WD	0 - 10%	10% – 20%	20% – 30%	30% – 40%	40 - 50 %
Riverside Highland Water Company	10%	25%	35%	50%	-
Rubidoux CSD	10%	20%	30%	40%	50%

# Regional Coordination and Framework

The two key elements of the proposed regional coordination will be the development of a *Regional Drought Portal* and the establishment of a Regional Drought Task Force with an agreed upon meeting frequency.

## Regional Drought Portal

Provide a platform to post, collect, and disseminate key datasets



## Stakeholders/Task Force Meetings

Provide a forum for the members to review data, share updates, and coordinate responses and messaging



# Regional Coordination and Framework

## Regional Drought Portal

Provide a platform to post, collect, and disseminate key datasets



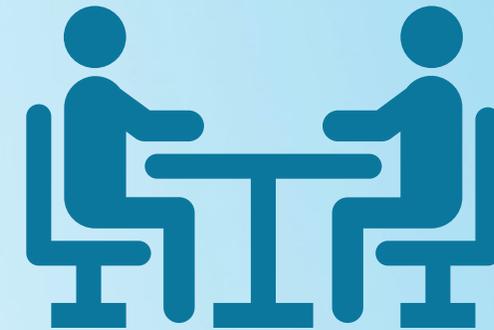
Data Updated Quarterly (where applicable)

- Local Conditions (groundwater levels, precipitation, storage, Met WSAP, etc.)
- Statewide Conditions:(reservoir levels, regional drought indices, statewide declarations, etc.)

# Regional Coordination and Framework

- Criteria and triggers for convening based on conditions in the region and within the supply catchment areas.
  - U.S. Drought monitor, WSAP, County Emergency Proclamations, Agency Shortages
- If one or more trigger is met, the meeting frequency will be increased to the corresponding interval.

## Stakeholders/Task Force Meetings



Regional Drought Stage	Meeting Frequency	Triggers			
		Drought Monitor	WSAP	Agencies in Declared Shortage	Riverside County Drought Proclamation
Normal	Annual	None-Abnormally Dry	Levels 1 and 2	None	--
Watch	Quarterly	Moderate-Extreme Drought	Levels 3 thru 5	3 or more	Drought
Alert	Monthly	Exceptional Drought	Levels 6 thru 8	6 or more	Drought
Emergency	Weekly	Exceptional Drought	Levels 9 and 10	10 or more	Drought

# County Drought Emergency Proclamation

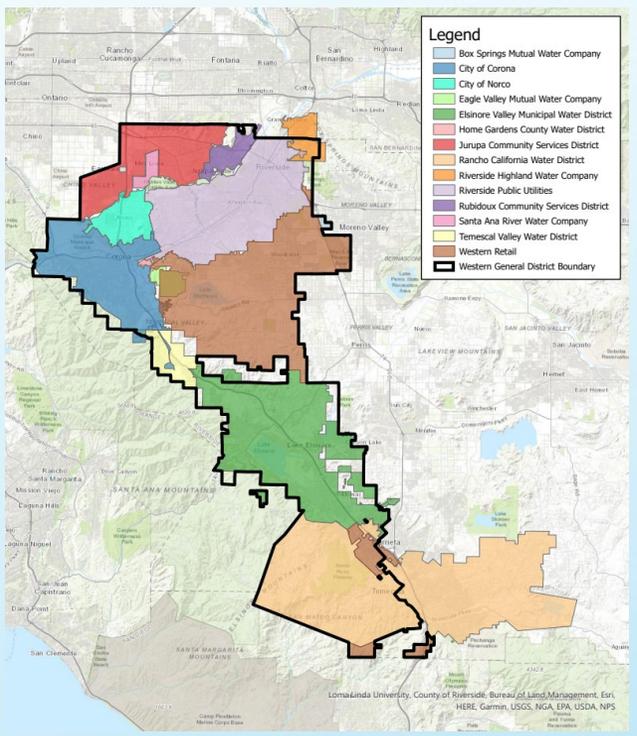
# Regional Coordination

## Task Force Meetings Criteria Detail

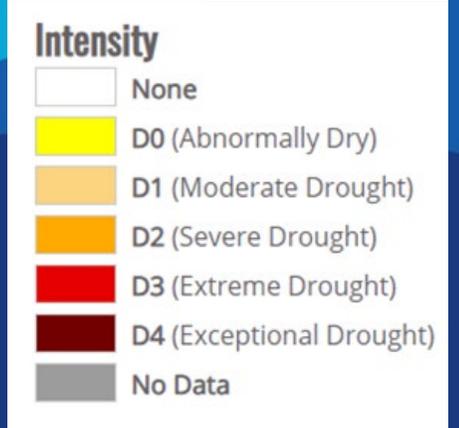
### Metropolitan WSAP

Regional Shortage Level	Wholesale Minimum %	Max Retail Impact Adjustment %
1	92.5%	2.5%
2	85.0%	5.0%
3	77.5%	7.5%
4	70.0%	10%
5	62.5%	12.5%
6	55.0%	15.0%
7	47.5%	17.5%
8	40.0%	20.0%
9	32.5%	22.5%
10	25.0%	25%

### Agencies in Declared Shortage



### U.S. Drought Monitor



# ***Drought Task Force Workshop No. 3: Regional Drought Monitoring Framework Summary***

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Western Municipal Water District  
*August 23, 2021 • 2:00 p.m. – 4:00 p.m.*

The August 23, 2021 virtual workshop was attended by members of the Western Drought Task Force. The group participated in a small group exercises to inform a **Drought Monitoring Framework** for the region.

Following is the input from the Task Force discussions.



## Process and Data

- Which indicators should the region use?
- How often should they be compiled/updated and shared with the group?
- What information should be shared with the public?

### **ENCLOSED ARE ALL RESPONSES TO PROCESS AND DATA QUESTIONS**

- Groundwater levels, feel comfortable sharing with watermasters and outside. Collected on outside basis.
- Dependent on local vs. imported supply. Statewide percentages
- Track precipitation and levels of reservoirs that are more connected with water supplies. Paying a lot of attention to CO River and Lake Meade. Track precipitation in No. CA and Co. River Basin
- Region select existing rain gauges to all work from same numbers.
- MET storage to manage drought condition, which defines how MET will manage drought.
- Share out quarterly. Initial numbers come out in December, again in March, then assess.
- If there is a sharing process/report in place, we can latch onto that.
- Quarterly give glimpse into seasonality of numbers.
- If there is a concise set of metrics that is quickly digestible, maybe send more often. Comprehensive data sent quarterly.
- A lot of information is already getting to the public through the media, especially during a drought.
- More education and communication about groundwater levels to the public.
- What is the relevance of the numbers (groundwater, lake levels, precipitation etc.)
- Information to be shared: more the better; info for today but also what the future is saying/scenarios ex: 2021 looks good, but if 2021 conditions continue what would that look like in 2022; don't hold back

## Process and Data

- Which indicators should the region use?
- How often should they be compiled/updated and shared with the group?
- What information should be shared with the public?

### ENCLOSED ARE ALL RESPONSES TO PROCESS AND DATA QUESTIONS

- Recognizing water supply portfolio; track state indicators and projections on imported water supplies from SWP
- MWD sharing data and impacts on allocations
- SWP deliveries on regional use
- MWD has storages and supply tracking (improve/get worse over time)
- Indicators are spanning wet season (Oct-April) in Northern California Area to help us know how to respond locally
- Interagency agreements coming into play (emergency situations)
- How often - at least monthly to get best sense of where we are going
- Wholesale agencies share with retail agencies within their service areas
- Broad messaging to general public- very open and informed of impacts to encourages WUE and conservation
- Helping people motivate to change behavior
- Echoing similar statements for public information; individual city having a different message then neighboring city can create inconsistencies in public; what is wholesaler saying; 1 message regionally or for multiple cities
- Needs to be a comprehensive indicator - supply available, projected use, % of the demand that is efficient (i.e. 15%)
- Percentage of water use that is considered efficient (calc based on population, GPCD may not be the best indicator)
- Regional consumption based on aggregate GPCD - compare across all agencies in the region - Valley District has been doing this
- Specific drought indices - Palmer drought index - temp, precipitation, soil moisture. Quantitative measure of drought. Updated monthly, accounts for previous conditions.
- Objective drought index - maybe an interactive platform to dig in to get more info.
- Complimentary to human activities represented in overall supply and demand.
- Rain gauge - cumulative departure from long-term mean precipitation - shows periods of drought over time. Helps correlate to when GW levels are dropping.

## Process and Data

- Which indicators should the region use?
- How often should they be compiled/updated and shared with the group?
- What information should be shared with the public?

### **ENCLOSED ARE ALL RESPONSES TO PROCESS AND DATA QUESTIONS**

- Drought indices are public anyway, updated maybe daily
- Need to consider HOW to present this info to the public and what the message is.
- monthly for drought indices
- monthly for GPCD info (based on state reporting requirements), supply is annual
- Take advantage of as many existing monitoring programs. Consolidate efforts where you can.
- Met, as a supplier, looks at delivered volumes as a good indicator.
- Tracking imported volumes of water used for groundwater banking/recharge and delivered directly to end users.
- For agencies with groundwater banking, keeping track of and reporting banked water supplies.
- Met acknowledges groundwater recharge activities as part of their demand projections.
- Local and regional messages would and should be crafted differently. But also include information on the broader conditions for context
- Sharing and reporting requirements should be flexible to allow for adjustment when things change.
- The projections are based on Met's customers' projections for usage and banking activities.
- There are regional indicators, but there are other factors at play. Even just the last 6 months there have been big changes in messages about level of preparedness.
- Indicators need to include more factors than the region and take a broader view. (i.e. hydrologic conditions in N. CA).
- Counties in the state with shortage
- Water Storage in the region, prediction of native water.
- Data is released in February. Includes 5-year predictions. Annually produced.
- Information would be shared annually, bi-annually, and/or as there are major changes.
- Drought declarations would be public.
- There are numerous regional indicators available which should be used, but they also need to include the broader statewide conditions (i.e. conditions in northern CA).
- Some Examples: Agencies have regional projecting that the do, Number of Counties in shortage, Statewide declarations

## Triggers

- How should regional drought stages be defined?
- What conditions should trigger a regional response? (i.e., 2 or more local water agencies are in a WSCP stage)

### ENCLOSED ARE ALL RESPONSES TO THE TRIGGERS QUESTIONS

- Qualitative triggers are easier in some ways to implement, but qualitative triggers are important to consider as well.
- Quantitatively defining drought would be helpful
- There are annual and 5-year type planning that goes on.
- MET and or State proclamations being more qualitative ways to define stages
- Rate tiers are very effective ways to reduce demand
- A more qualitative approach would be appropriate for Western, given the diversity the region's supply portfolio.
- It's the fairest approach to account for existing banking projects, rather than making an assessment based on only the annual supply and demand assessment.
- In terms of defining a trigger based on the number of retail agencies at a drought stage, it can be difficult if they have different definitions.
- Don't want to be too prescriptive.
- In terms of defining a trigger based on the number of retail agencies at a drought stage, it can be difficult if they have different definitions.
- Quantitative definitions can be too proscriptive.
- A more qualitative approach would be appropriate for Western, given the diversity the region's supply portfolio.
- It's the fairest approach to account for existing banking projects, rather than making an assessment based on only the annual supply and demand assessment.
- Drought stages have been defined in the Palmer Drought Index, don't need to redefine them
- The DCP could be part of the assessment that triggers the actions in a WSCP so that may not be a good input
- Regional response is subjective, needs to be based on group consensus. Stages could mean something different to each agency.
- Also need consider mandates the state could impose.
- What are the indicators that people will see that will drive them to move to regional communication vs. individual responses?
- Locally, still in a long-term drought. Distinguish between the local drought and northern California drought.
- Focusing on local conditions is more fruitful, imported water is supplemental to support long-term reliability.

## Triggers

- How should regional drought stages be defined?
- What conditions should trigger a regional response? (i.e., 2 or more local water agencies are in a WSCP stage)

### ENCLOSED ARE ALL RESPONSES TO THE TRIGGERS QUESTIONS

- Need to be able to separate a 1-year drought from a long-term drought (severity/amplitude + duration are both important) - has different impacts and requires a different kind of action. i.e. a 2 on the Palmer index maps to a Stage 2 in the WSCP
- Challenges with regional response - number of agencies are interconnected
- Regional response can have an impact
- Some agencies are not as interconnected that have a unique situation
- Take that into account (sensitivity of the triggers)
- Water shortage
- What the state might propose might not be the best for our region
- Brown 25% mandates - WUE conservation were given undue burden since they had already done so much proactively
- Regional approach catered to region (state is helpful), but tie it more to portfolio and storage and supply
- So many individual agencies and each one has greater resources than another- universal switch would be problematic (many agency problem vs 1-2 agencies bringing the level down)
- Encourage awareness of unique assets and local agencies have in times of drought and what was done in the past (demand hardening?)
- Tribal agency can define drought any time of the year. Still trying to define it for themselves, are currently following the state's lead.
- Reactive, depends on another declaration before they adopt.
- Regional drought map already exists. Color-coded. May mirror those stages. Drought Monitor.
- Why are we defining drought as a region? Different agencies have varied ways of measuring that they use for different purposes.
- They normally wait for MET or DWR to define/declare. These will be the most impactful to water shortages.
- Find ways to proactive and to educate/inform around drought. Constantly messaging the unique challenges of living in Southern CA and water supply/conservation
- Depends on the agency, needs flexibility based on local differences regional follow what the state puts out - voluntary 18% reduction

## Communication

- What level of regional collaboration and communication tools should always be in place?
- What more should we do some agencies in the region are experiencing a supply shortage?
- What is in our communication toolbox now? What else do we need?

### ENCLOSED ARE ALL RESPONSES TO THE COMMUNICATION QUESTIONS

- Set up quick, formal stakeholder meeting/quarterly gathering for updates.
- Message board or webpage for agencies to share their information and collaborate.
- Utilize technology to collaborate - Teams, One Drive, GIS, etc.
- Fact sheets for when an agency is experiencing a shortage.
- Level of regional collaboration - always readily available on websites
- Resources and tools, data assistance, funding agencies can use and access to implement WUE and conservation measures
- Keep that strong and readily available for all water agencies to use
- Track agencies in shortage and continue to make a dialog within regional and local agencies for issues
- Proactive planning
- Toolbox - awareness of state demands and legislation, Water budgets tools, water blog and website talks about quality of water supply, impacts due to drought, public informed (yoursocaltapwater website)
- Link agency websites to one main hub for general public access
- Where agency boundaries back up to each other, increase communication/collaboration so others can be aware before neighbors start talking.
- Western used to water conservation workshops; more opportunity to collaborate with Lowes, workshops to swap out toilet, check for leaks
- Video/education series (hurdles: scary, new to it)
- Communication to each of the target audiences in the language they are comfortable (native language and industry language)
- Consistent messaging - water conservation a way of life
- Year-round resources
- Corona discussing internally to get the word out
- Easy to follow posts on what the differences are and why conserve 24/7 and difference between current situation and the past fatigue in messaging
- How do we express where we are now
- Communicate to the public

## Communication

- What level of regional collaboration and communication tools should always be in place?
- What more should we do some agencies in the region are experiencing a supply shortage?
- What is in our communication toolbox now? What else do we need?

### ENCLOSED ARE ALL RESPONSES TO THE COMMUNICATION QUESTIONS

- Get informed when an agency has a shortage to see how agencies can help and to pass information on to their customers as a caution.
- share success stories (monthly/ quarterly), find customer that have gone above and beyond and what they saved; how they saved, and dollar savings
- In April/May of every year, Met reviews its supply and makes recommendations on which water supply stage the agency is at. Effective from July 1st to June 30th.
- If water supply allocation is necessary, Met would communicate this in April/May.
- Regional coordination and communication is very important.
- As much advanced warning as they can give.
- When are private end users affected?
- Public outreach teams with each agency.
- Establish a working group amongst that group to establish the messages and strategies.
- While regional messages are helpful, there is also a need for flexibility for areas to adjust the messages for their customer base.
- Social media is a powerful tool in use now
- Last year it was save water vs now we REALLY want them to save water re-educate and continue to educate the public on what is being done, what has been done, and what can be done in the future
- Agencies have already done a lot
- Tap into resources; constantly evolving
- Regional collaboration around messaging would be helpful.

## Other Regional Water Shortage Responses

- Besides consistent communication, what other actions could be taken regionally?
- How could we support one another during a drought?

### **ENCLOSED ARE ALL RESPONSES TO THE REGIONAL RESPONSES QUESTIONS**

- Continue to let legislators know of the need for their support as state funding becomes available
- Areas of need for improvements in the region (small mutuals), failing infrastructure, assistance in grant applications
- Interagency agreements to help each other (connectiveness) to ensure safe, reliable water being delivered
- Larger regional entities to help assist in diversified portfolios and drought scenarios
- always a concern is making sure drought response aren't picking winners or losers, determining who can go forward or not
- All types of water usage (outdoor is first to be looked at because its easy to monitor or manage)
- Harder to see a 30-minute shower
- Both can be wasteful- water budget approach addresses all water uses and incentivizes people to conserve everywhere;
- grants or more knowledge to upgrade system to use more recycled water
- Helping us have money to convert businesses to reclaimed water

# ***Drought Task Force Workshop No. 4: Climate Change Vulnerability Assessment Update and Drought Mitigation Actions***

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Western Municipal Water District  
*December 16, 2021 • 2:00 p.m. – 4:00 p.m.*

# *Workshop Goals*

- Review expanded CCVA analysis and what this means for local drought planning and mitigation

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- Review the results of the projects submitted through the survey and add missing projects during the breakout session

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# Presenters

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**Ryan Shaw**  
Director of Water Resources,  
Western Municipal Water District



**Kwabena Asante**  
Senior Climate Specialist, GEI



**Larry Rodriguez**  
Vice President Water Resources Planning,  
GEI



**Katie Laird**  
Project Manager, GEI



**Amy Stevens**  
Facilitator,  
Water Systems Consulting (WSC)



**Laine Carlson**  
Civil Engineer, Water Systems Consulting (WSC)



# Workshop Agenda

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5 min	<b>WELCOME:</b> Project and Task Force Overview
5 min	DCP and Task Force Overview
35 min	<b>PRESENTATION:</b> Climate Change Vulnerability Analysis
10 min	Mitigation Action Surveys
30 min	<b>SMALL GROUP BREAKOUT:</b> Mitigation Action Survey
30 min	Small Group Report Out and Large Group Discussion
5 min	Next Steps



# ***DCP and Task Force Overview***

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Ryan Shaw, *Western Municipal Water District*

# Guiding Principles for the DCP Task Force

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**1**

Prioritize equitable water policies region wide.

**2**

Employ drought and shortage triggers that empower a coordinated, flexible, regional response.

**3**

To support climate resilience, diversify regional supply and encourage conservation as a way of life.

**4**

Foster continuous, coordinated, and accessible stakeholder education to empower smart water use.

**5**

Prioritize water investments that sustainably support environmental health, quality of life, and regulatory compliance.

**6**

Foster regional water planning collaboration, knowledge-sharing, and alignment.



# 5 Steps to the Drought Contingency Plan

**Step 1.**  
Determine Future Demands



DCP uses UWMP demand projections.

**Step 2.**  
Evaluate Existing Supply Reliability



DCP develops robust Climate Change Vulnerability Assessment and informs UWMP Drought Risk Assessment and Supply Reliability Analysis.

**Step 3.**  
Develop Future Supply & Response / Mitigation Options



DCP builds on drought response actions from UWMPs and WSCP; develops a drought monitoring framework, defines mitigation activities and projects to build drought resilience.

**Step 4.**  
Develop Implementation Plan



DCP identifies process for implementing drought monitoring, initiating actions during drought conditions and communicating with the public.

**Step 5.**  
Document the Plan



DCP will establish a process for future updates to keep the plan dynamic and undergo public review and adoption process.

Completed in UWMPs

Completed in UWMPs



**WE ARE HERE**



# Task Force Overview



## Drought Task Force

Represent and share regional stakeholder interests, needs in plan development.



## General Public

Public comment periods



## EOWR Committee

Advises Board of Directors on water policy decisions.



## Western Board of Directors

Makes regional water policy decisions.

Share Perceptions / Opinions

Recommend

Decide



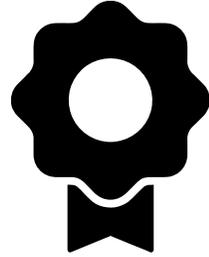
# Key Themes from Task Force Input

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## Coordinated communication

Use coordinated, ongoing communication that consistently reaches and educates diverse audiences with specific calls to action.



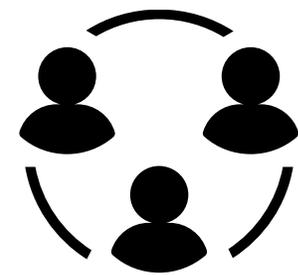
## Incentives and Rewards

Use carrots over sticks to incentivize smart water use and reward it with appropriate benefits.



## There's no one size fits all policy

Regional solutions require flexibility and adaptability to different community needs.



## Interagency collaboration

Collaboration across water agencies and stakeholders will benefit all water customers.



# *Climate Change Vulnerability Analysis (CCVA)*

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Kwabena Asante and Larry Rodriguez, GEI

# *Climate Change Vulnerability Assessment (CCVA): Purpose*

## RESOURCES

- Imported Water
- Groundwater
- Surface Water
- Critical Infrastructure

## RISK FACTORS

- Drought
- Climate Variability
- Population Growth
- Other



# Local Climate Change Factors



# Climate Change Factors for Local Water Sources

**Future Supply Change Factors** =  $\frac{\text{Climate Model Rainfall Under Future Conditions}}{\text{Climate Model Rainfall Under Past Conditions}}$



Total Projected  
Local Supplies

=

**Future Supply Change Factors**

\*

Natural Recharge  
Stormwater Recharge  
Surface Water Supplies

+

Growth-Adjusted  
Recycled Water

# Climate Change Factors for Local Water Demands

**Future Demand Change Factors** =  $\frac{\text{Climate Model Evapotranspiration Under Future Conditions}}{\text{Climate Model Evapotranspiration Under Past Conditions}}$



Total Projected  
Local Demand

=

**Future Demand  
Change Factors**

\*

Growth-Adjusted  
Outdoor Water Use

+

Growth-Adjusted  
Indoor Water Use

# Planning Year Types for Local and Imported Supplies

- Planning required for normal, single dry and 5-year dry periods under UWMP
- Drought years for vary for each water source
- Data availability also limits the choice of planning year types
- Western is electing to use different years for regional and imported water

Year Type	Imported Supplies	Riverside FS3 Gauge	CIMIS #44 Gauge
Normal	1922 - 2004	1922 - 2004	1986 - 2020
Single Dry-Year	1977	1989	2007
Five-Year Drought	1988 - 1992	1971 - 1975	2005 - 2009



# Local Climate Change Factors – Extreme Scenarios



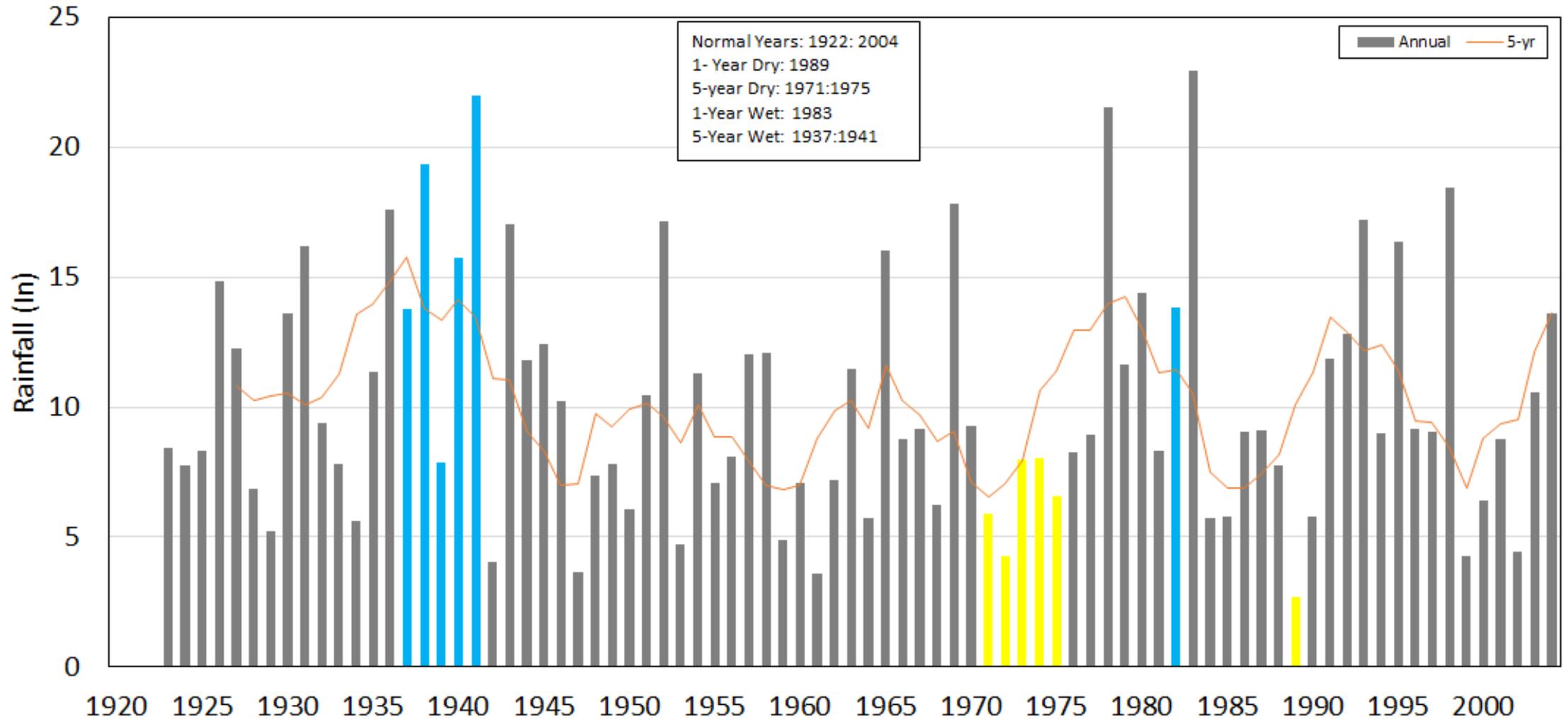
# Extreme Scenarios

- Updated analysis of climate change impacts to rainfall & recharge, streamflow, and evaporative demand (ET) based on two extreme scenarios
  - Drier future conditions with Extreme Warming (Dry-Hot)
  - Median future conditions (Median)
  - Wetter future conditions with Moderate Warming (Wet-Warm)
- Updated analysis of climate impacts using local year types
  - Normal Years: 1922:2004
  - 1-Year Dry: 1989
  - 5-Year Dry: 1971:1975
  - 1-Year Wet: 1983
  - 5-Year Wet: 1937:1941



# Local Extreme Wet and Dry Periods

Annual Rainfall at RiverSide Fire Station 3



# 12 Results Tables (3 Scenarios, 4 Sets of Factors)

## Sample Output for Projected Changes in Rainfall & Recharge

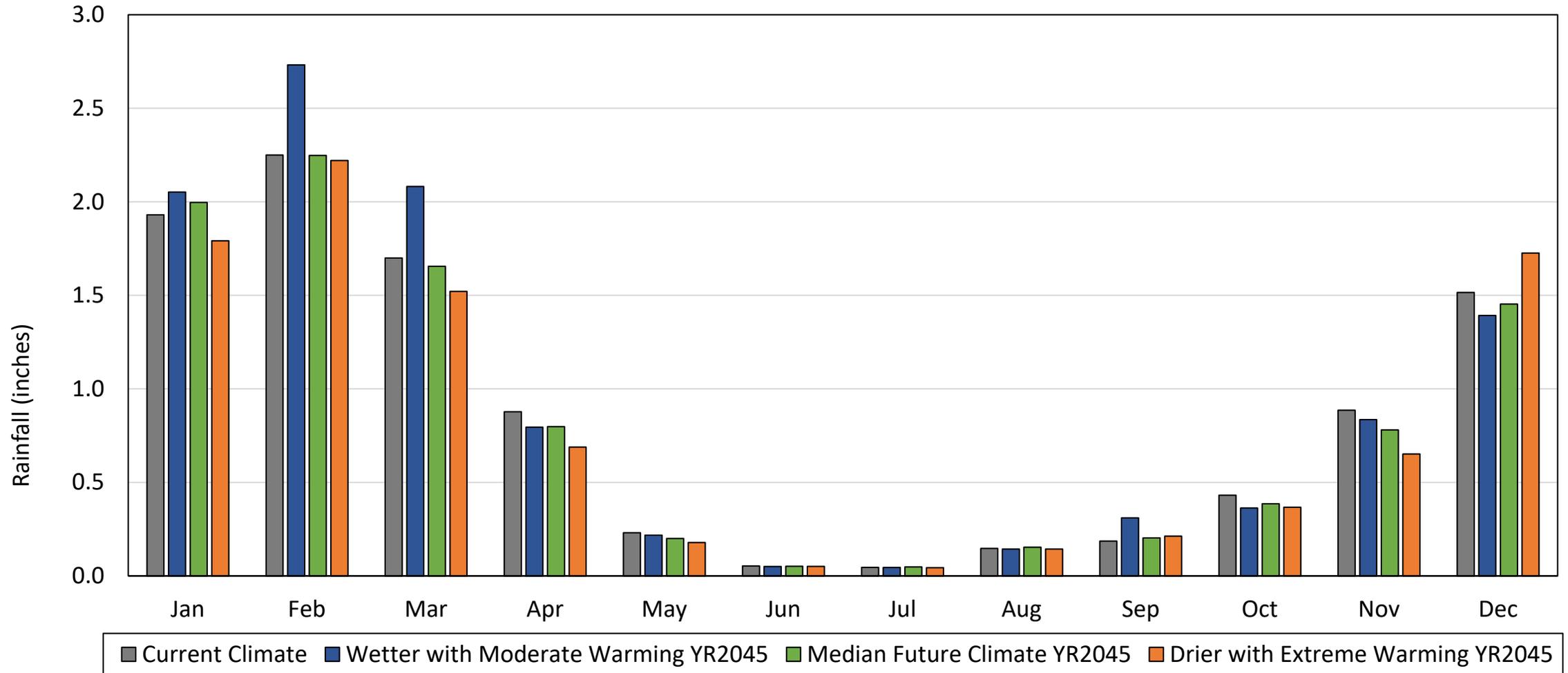
- Scenarios include
- Wet with Moderate Warming
  - Median
  - Dry with Extreme Warming

- Sets of factors include
- Rainfall & Recharge
  - Outdoor Demand
  - Santa Margarita Flows
  - Santa Ana Flows

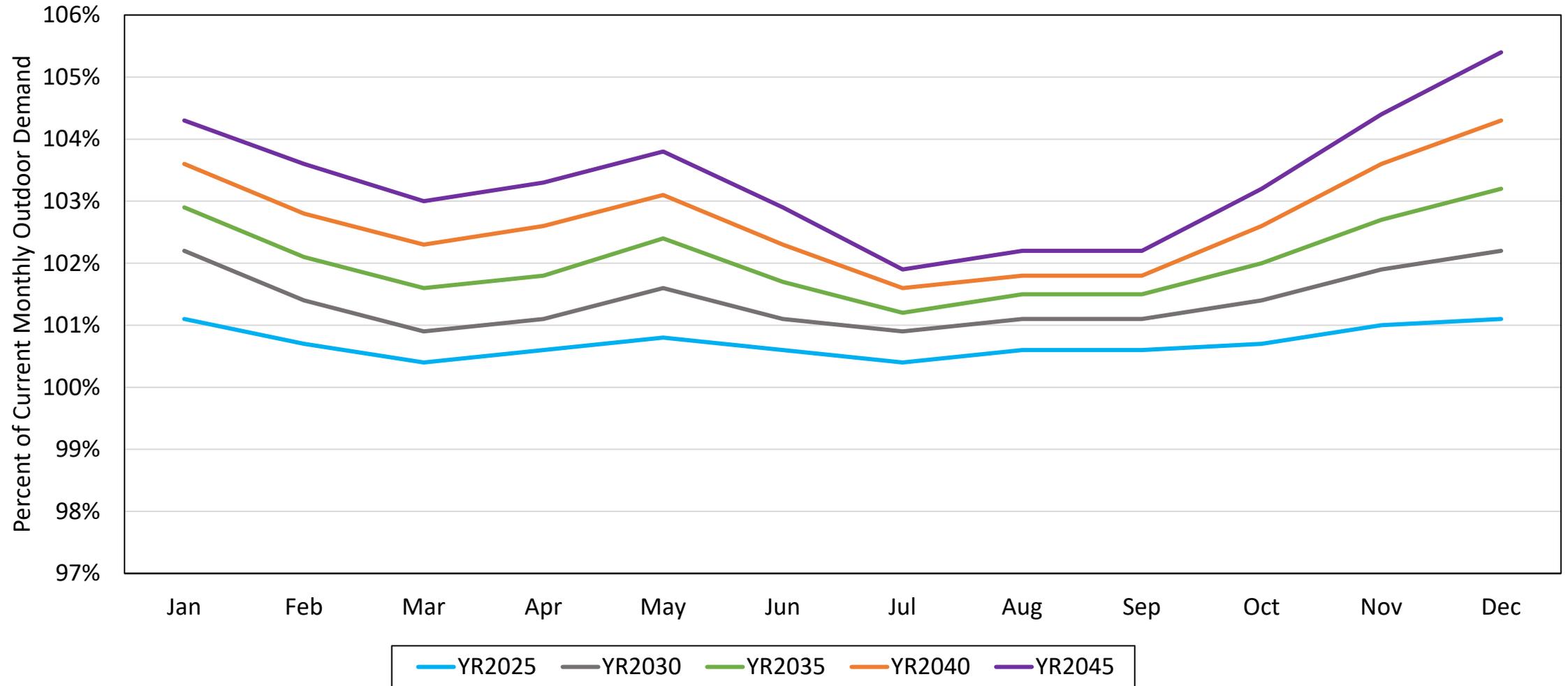
YearType	Scenario	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Normal	Median Future Climate	YR2025	100.4%	99.6%	100.0%	100.4%	96.1%	99.6%	99.3%	100.8%	100.6%	96.5%	98.0%	99.1%
Normal	Median Future Climate	YR2030	100.9%	99.1%	100.0%	100.9%	92.1%	99.1%	98.5%	101.6%	101.1%	92.9%	95.9%	98.2%
Normal	Median Future Climate	YR2035	101.7%	99.4%	99.1%	97.5%	90.3%	98.5%	100.7%	102.6%	103.8%	91.8%	93.3%	97.4%
Normal	Median Future Climate	YR2040	102.6%	99.6%	98.3%	94.2%	88.5%	97.8%	102.9%	103.6%	106.5%	90.6%	90.7%	96.6%
Normal	Median Future Climate	YR2045	103.4%	99.9%	97.4%	90.9%	86.8%	97.2%	105.1%	104.5%	109.1%	89.4%	88.1%	95.9%
Dry_1Yr	Median Future Climate	YR2025	101.8%	99.6%	100.7%	103.7%	94.3%	100.0%	100.0%	100.0%	100.6%	93.8%	96.7%	99.9%
Dry_1Yr	Median Future Climate	YR2030	103.6%	99.1%	101.4%	107.4%	88.6%	100.0%	100.0%	100.0%	101.1%	87.7%	93.3%	99.7%
Dry_1Yr	Median Future Climate	YR2035	103.9%	99.1%	100.5%	102.6%	86.2%	100.0%	100.0%	100.0%	106.1%	84.9%	88.8%	100.0%
Dry_1Yr	Median Future Climate	YR2040	104.1%	99.1%	99.7%	97.7%	83.8%	100.0%	100.0%	100.0%	111.1%	82.1%	84.3%	100.2%
Dry_1Yr	Median Future Climate	YR2045	104.3%	99.1%	98.8%	92.8%	81.4%	100.0%	100.0%	100.0%	116.1%	79.3%	79.8%	100.5%
Dry_5Yr	Median Future Climate	YR2025	100.0%	97.8%	99.6%	100.4%	94.8%	99.7%	100.0%	101.2%	100.1%	95.2%	97.8%	98.1%
Dry_5Yr	Median Future Climate	YR2030	100.0%	95.6%	99.1%	100.9%	89.5%	99.4%	100.0%	102.4%	100.3%	90.5%	95.6%	96.3%
Dry_5Yr	Median Future Climate	YR2035	100.9%	96.9%	98.2%	97.2%	87.3%	98.9%	100.0%	104.6%	101.0%	88.4%	92.6%	95.7%
Dry_5Yr	Median Future Climate	YR2040	101.8%	98.3%	97.3%	93.5%	85.1%	98.4%	100.0%	106.9%	101.8%	86.4%	89.7%	95.2%
Dry_5Yr	Median Future Climate	YR2045	102.6%	99.7%	96.4%	89.8%	82.9%	97.9%	100.0%	109.1%	102.5%	84.4%	86.8%	94.6%
Wet_1Yr	Median Future Climate	YR2025	100.6%	100.4%	98.8%	98.9%	95.4%	100.0%	100.0%	100.0%	98.6%	97.2%	98.6%	101.0%
Wet_1Yr	Median Future Climate	YR2030	101.1%	100.9%	97.6%	97.9%	90.9%	100.0%	100.0%	100.0%	97.2%	94.4%	97.2%	101.9%
Wet_1Yr	Median Future Climate	YR2035	101.8%	101.3%	98.0%	97.0%	87.8%	100.0%	100.0%	98.8%	103.1%	94.3%	97.8%	99.9%
Wet_1Yr	Median Future Climate	YR2040	102.6%	101.8%	98.4%	96.1%	84.7%	100.0%	100.0%	97.5%	109.0%	94.2%	98.3%	97.9%
Wet_1Yr	Median Future Climate	YR2045	103.3%	102.3%	98.8%	95.1%	81.7%	100.0%	100.0%	96.3%	114.9%	94.0%	98.9%	95.8%
Wet_5Yr	Median Future Climate	YR2025	100.8%	100.4%	99.9%	100.1%	95.9%	99.9%	99.6%	100.6%	101.5%	96.9%	98.1%	99.3%
Wet_5Yr	Median Future Climate	YR2030	101.6%	100.9%	99.7%	100.3%	91.7%	99.7%	99.1%	101.1%	102.9%	93.8%	96.3%	98.5%
Wet_5Yr	Median Future Climate	YR2035	102.7%	101.1%	99.2%	97.9%	89.3%	99.5%	100.7%	101.1%	105.0%	92.4%	92.1%	97.9%
Wet_5Yr	Median Future Climate	YR2040	103.8%	101.3%	98.7%	95.6%	86.9%	99.2%	102.2%	101.1%	107.1%	91.1%	88.0%	97.2%
Wet_5Yr	Median Future Climate	YR2045	104.9%	101.6%	98.2%	93.2%	84.5%	99.0%	103.7%	101.1%	109.2%	89.8%	83.9%	96.6%



# Projected Changes in Normal Year Rainfall - 2045



# Normal Year Outdoor Demand under Median Future Climate

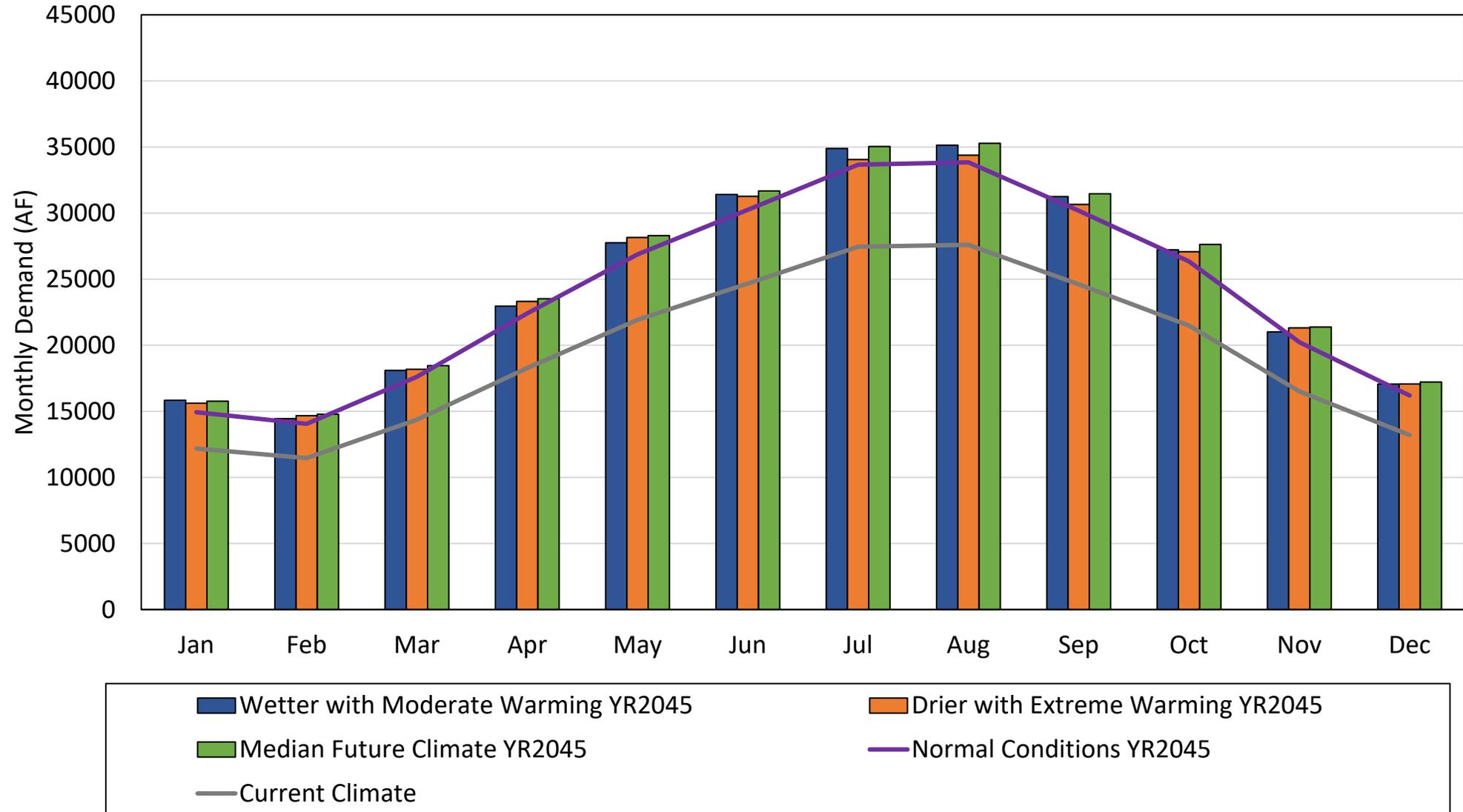


# Key Assumptions for Quantifying Water Supply Impacts

- Monthly distributions of recharge is proportional to monthly rainfall
- Outdoor water use is sensitive to both climate and population growth
- Indoor water use is only sensitive to population growth
- Water use is split between indoor (39%) and outdoor (61%)
- Population growth rate for the Western wholesale service area from Western's 2020 UWMP (approximately 1%)

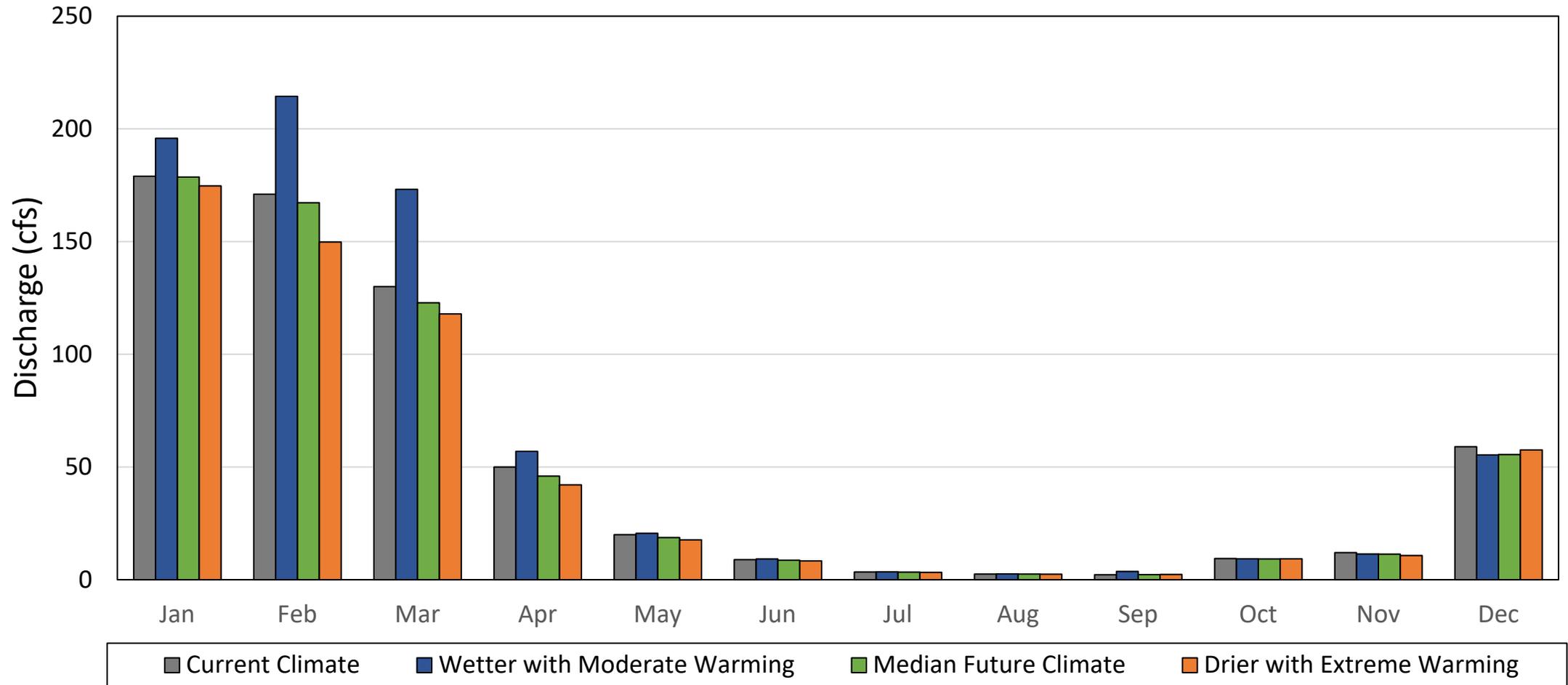


# Projected Changes in Normal Year Demand 2045



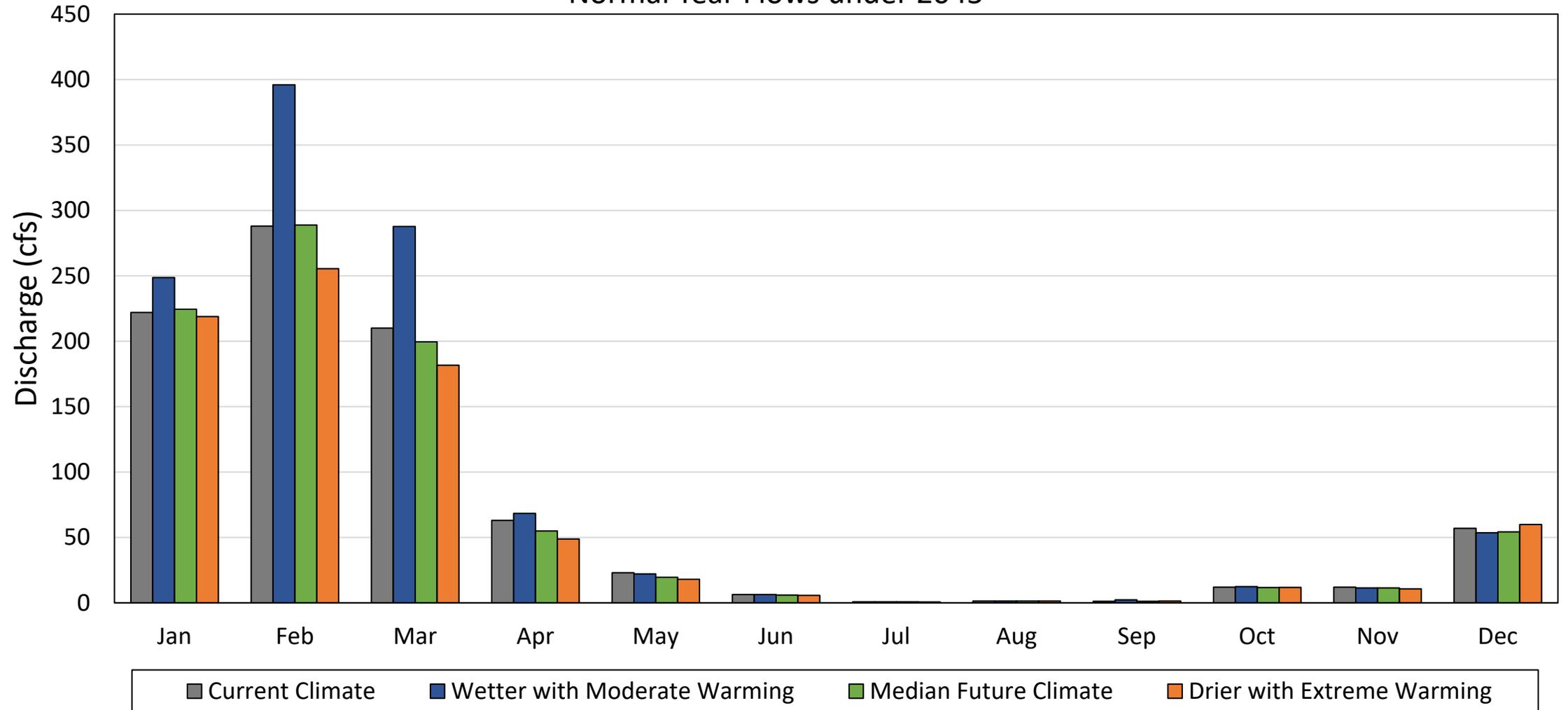
# Projected Changes in Normal Year Flow 2045: Santa Margarita

USGS 11046000 Santa Margarita River at Ysidora  
Normal Year Flows under 2045

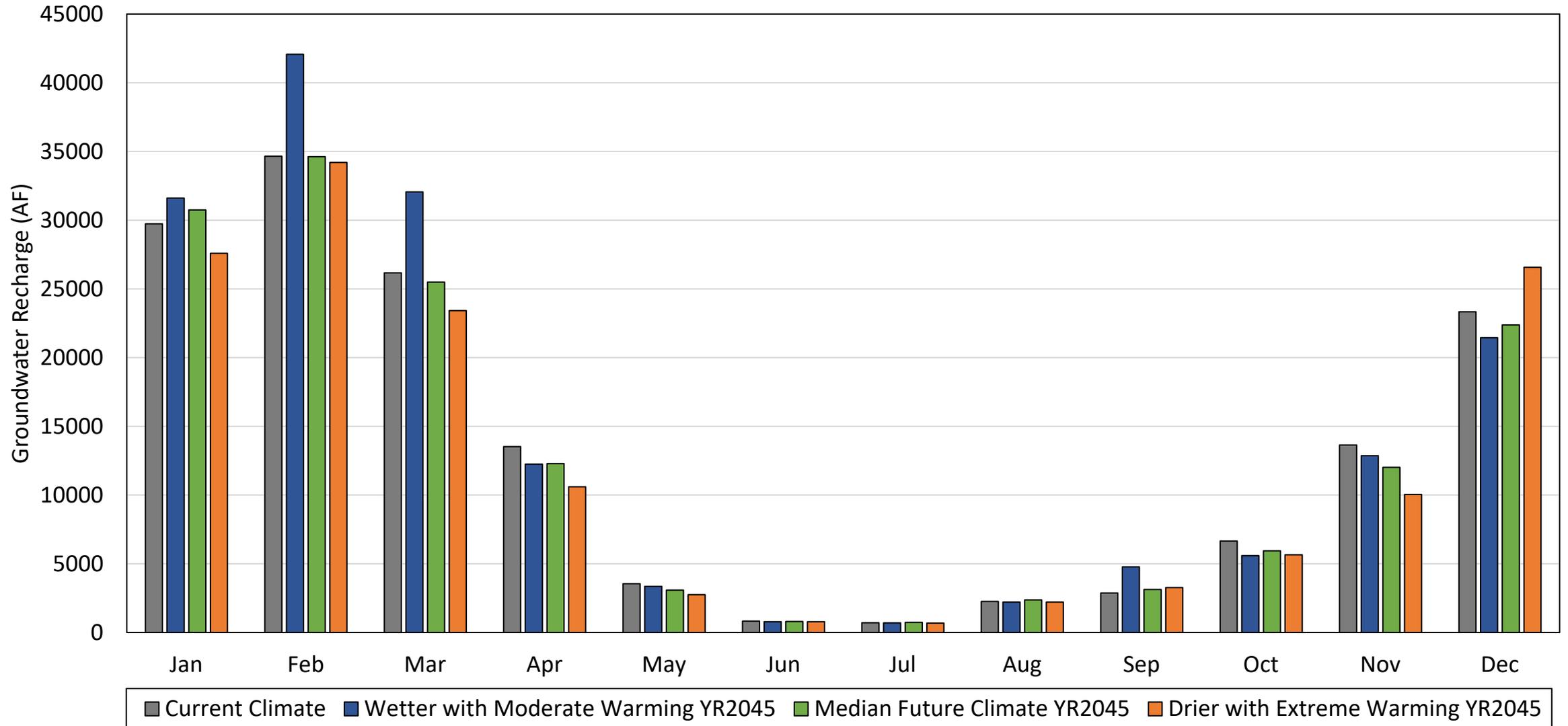


# Projected Changes in Normal Year Flow 2045: Santa Ana

USGS 11046000 Santa Ana River at Santa Ana  
Normal Year Flows under 2045



# Projected Changes in Normal Year Groundwater Supply 2045



# Key Takeaways: Changes by 2045

Rainfall could decrease or increase depending on scenario:

-7.2 % (Dry Hot) to +5% (Wet Warm) with Median of -2.7%

Large increase in Feb and Mar under the Wet Warm scenario

Demand Increases under all future scenarios:

+1.3% (Wet Warm) to +6% (Dry Hot) with Median of +3.4 %

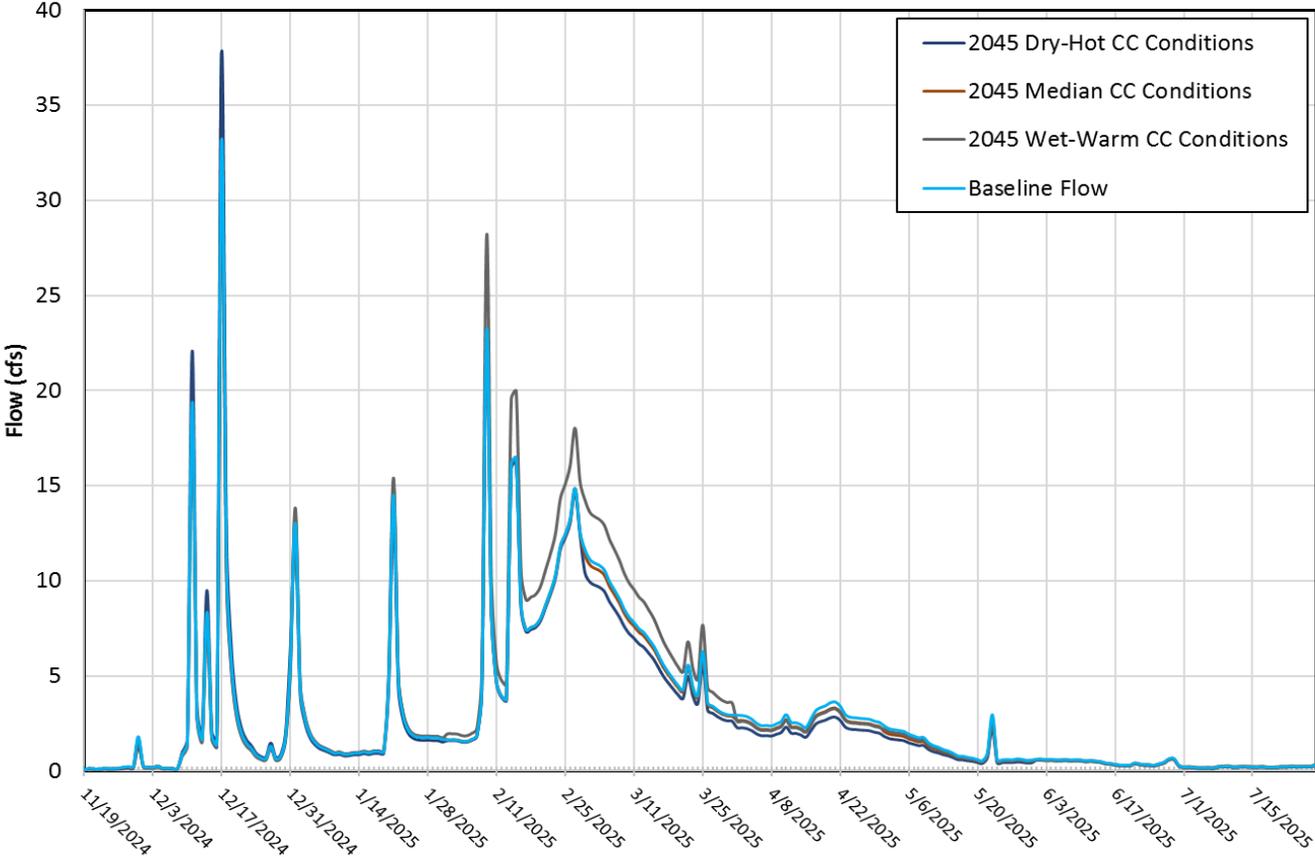
Santa Margarita : -5.9% (Dry Hot) to +12 % (Wet Warm) with Median of -3.1%

Santa Ana : -6.8% (Dry Hot) to +14.8 % (Wet Warm) with Median of -4.1%



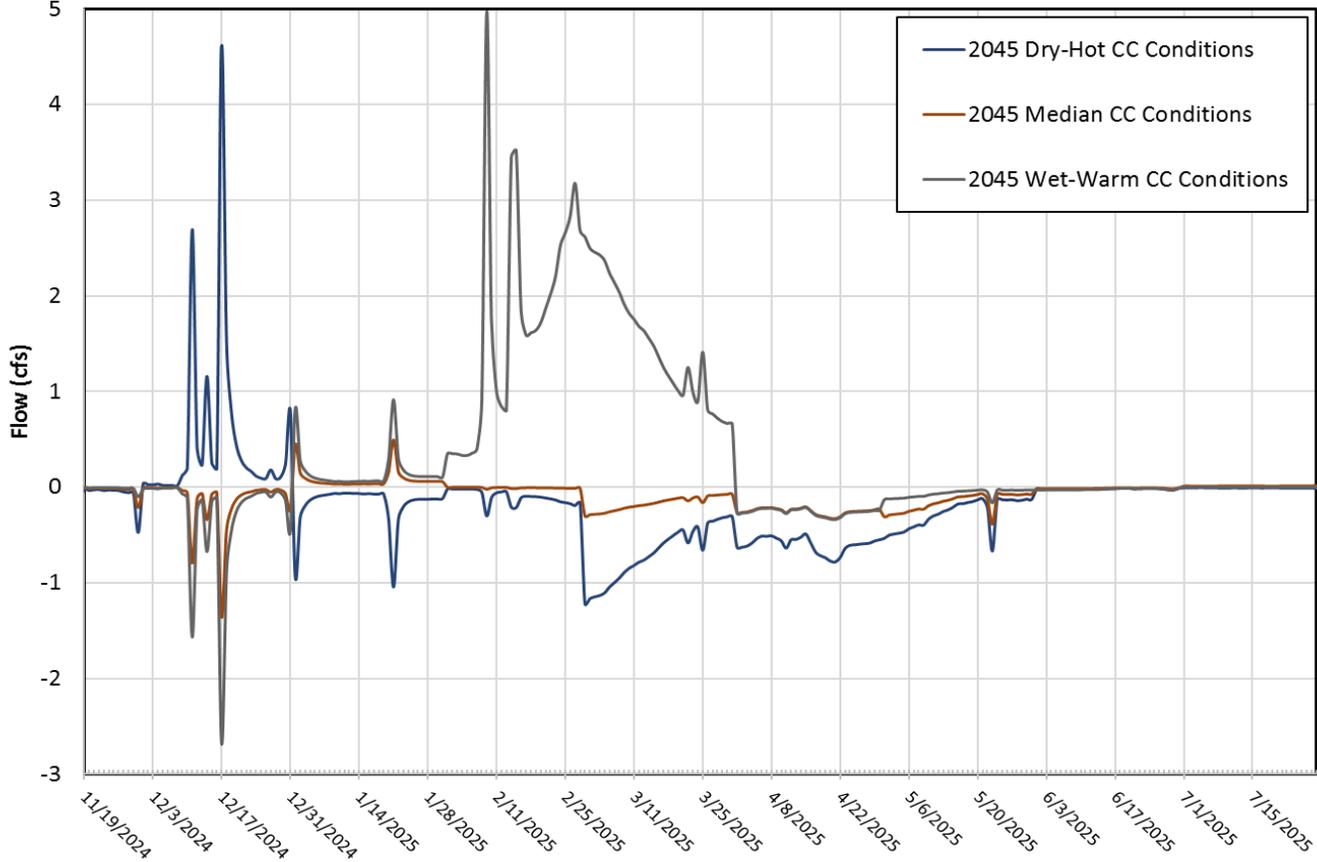
# Example of Stormflow Changes – Victoria Recharge Basin:

Western Municipal Water District - Victoria Recharge Basin  
Projected Daily Average Flow - Moderate Wet Storm



# Example of Stormflow Changes – Victoria Recharge Basin:

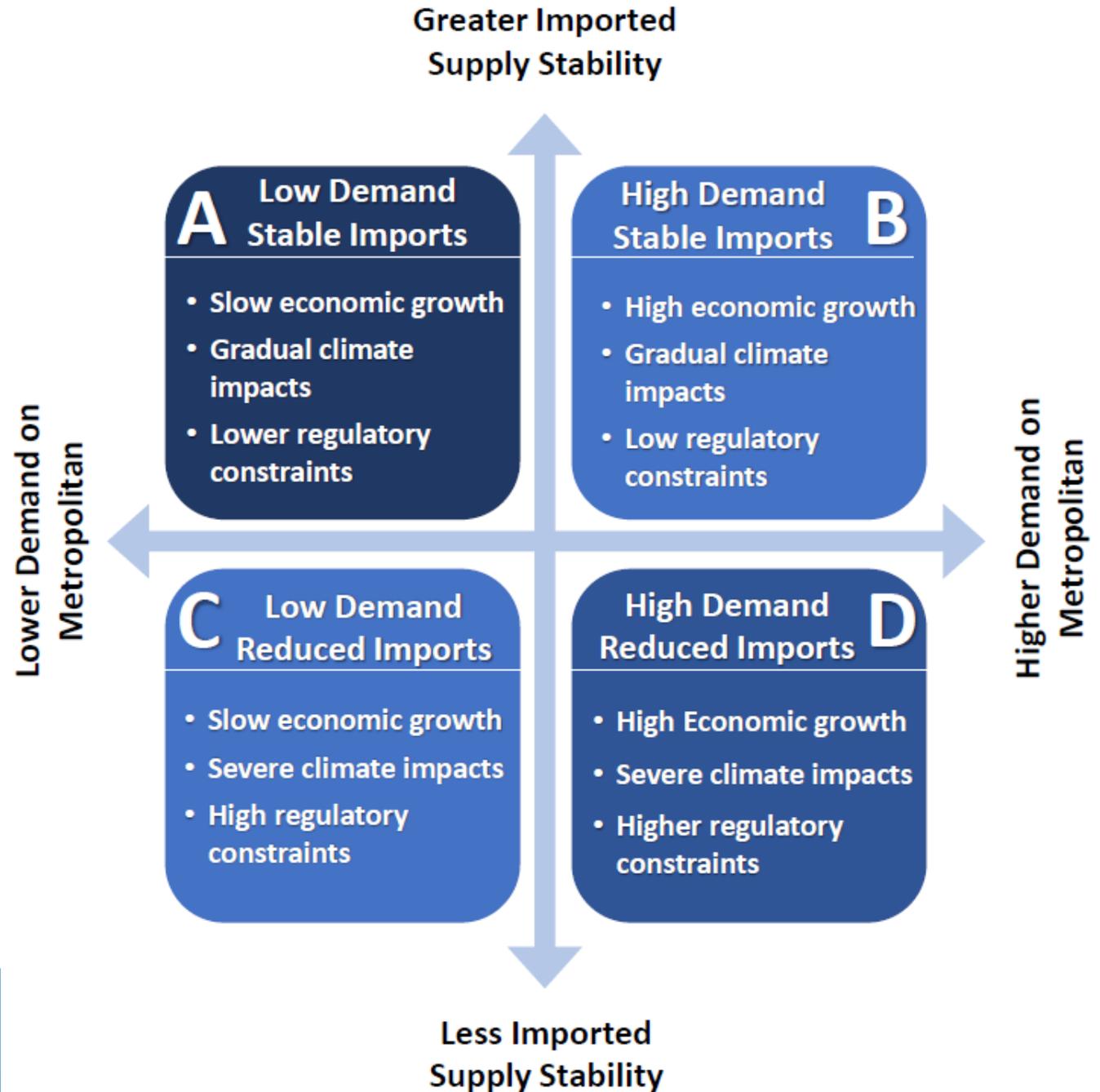
Western Municipal Water District - Victoria Recharge Basin  
Projected Flow Change - Moderate Wet Storm



# Projections from Metropolitan's Integrated Resource Plan (IRP)



# Metropolitan's Planning Scenarios



# Metropolitan's Planning Scenarios: Projections for Western Municipal

Scenario A: NORMAL YEAR	2020	2025	2030	2035	2040	2045
Retail M&I	196,393	201,263	202,912	203,759	203,859	204,441
Retail Agricultural	20,450	26,473	26,116	25,911	25,543	25,555
Replenishment Demand	330	410	410	410	410	410
<b>Total Demand</b>	<b>217,173</b>	<b>228,147</b>	<b>229,438</b>	<b>230,080</b>	<b>229,812</b>	<b>230,406</b>
Groundwater Production	154,750	163,130	171,243	177,279	177,882	178,116
Surface Production	8,000	8,000	8,000	8,000	8,000	8,000
Groundwater Recovery	33,730	36,092	36,797	37,502	38,208	38,400
Recycling	4,463	4,705	4,909	5,102	5,292	5,480
<b>Total Local Supplies</b>	<b>200,943</b>	<b>211,927</b>	<b>220,949</b>	<b>227,883</b>	<b>229,382</b>	<b>229,996</b>
<b>Total Imports</b>	<b>16,230</b>	<b>16,220</b>	<b>8,488</b>	<b>2,197</b>	<b>430</b>	<b>410</b>

Scenario B: NORMAL YEAR	2020	2025	2030	2035	2040	2045
Retail M&I	197,358	254,442	311,622	326,483	338,282	349,890
Retail Agricultural	20,450	26,473	26,116	25,911	25,543	25,555
Replenishment Demand	264	2,032	5,194	7,730	10,348	10,348
<b>Total Demand</b>	<b>218,072</b>	<b>282,947</b>	<b>342,932</b>	<b>360,124</b>	<b>374,173</b>	<b>385,793</b>
Groundwater Production	154,750	163,130	171,510	179,890	188,270	196,650
Surface Production	8,000	8,000	8,000	8,000	8,000	8,000
Groundwater Recovery	33,730	36,092	36,797	37,502	38,208	38,400
Recycling	4,876	7,101	8,651	9,426	9,923	10,328
<b>Total Local Supplies</b>	<b>201,356</b>	<b>214,323</b>	<b>224,958</b>	<b>234,818</b>	<b>244,401</b>	<b>253,378</b>
<b>Total Imports</b>	<b>16,716</b>	<b>68,624</b>	<b>117,974</b>	<b>125,306</b>	<b>129,772</b>	<b>132,415</b>

Scenario C: NORMAL YEAR	2020	2025	2030	2035	2040	2045
Retail M&I	196,393	201,263	202,912	203,759	203,859	204,441
Retail Agricultural	20,450	26,473	26,116	25,911	25,543	25,555
Replenishment Demand	330	410	410	410	410	410
<b>Total Demand</b>	<b>217,173</b>	<b>228,147</b>	<b>229,438</b>	<b>230,080</b>	<b>229,812</b>	<b>230,406</b>
Groundwater Production	154,700	153,580	152,460	151,340	150,220	148,550
Surface Production	1,600	1,600	1,600	1,600	1,600	1,600
Groundwater Recovery	33,730	36,092	36,797	37,502	38,208	38,400
Recycling	4,463	4,705	4,909	5,102	5,292	5,480
<b>Total Local Supplies</b>	<b>194,493</b>	<b>195,977</b>	<b>195,766</b>	<b>195,544</b>	<b>195,320</b>	<b>194,030</b>
<b>Total Imports</b>	<b>22,680</b>	<b>32,170</b>	<b>33,672</b>	<b>34,536</b>	<b>34,492</b>	<b>36,376</b>

Scenario D: NORMAL YEAR	2020	2025	2030	2035	2040	2045
Retail M&I	197,358	254,442	311,622	326,483	338,282	349,890
Retail Agricultural	20,450	26,473	26,116	25,911	25,543	25,555
Replenishment Demand	211	1,625	4,155	6,184	8,278	8,278
<b>Total Demand</b>	<b>218,019</b>	<b>282,540</b>	<b>341,893</b>	<b>358,578</b>	<b>372,103</b>	<b>383,723</b>
Groundwater Production	154,700	153,580	152,460	151,340	150,220	148,550
Surface Production	1,600	1,600	1,600	1,600	1,600	1,600
Groundwater Recovery	29,707	30,412	30,720	30,720	30,720	30,720
Recycling	4,601	6,801	8,346	9,121	9,592	9,927
<b>Total Local Supplies</b>	<b>190,608</b>	<b>192,393</b>	<b>193,126</b>	<b>192,781</b>	<b>192,132</b>	<b>190,797</b>
<b>Total Imports</b>	<b>27,411</b>	<b>90,147</b>	<b>148,767</b>	<b>165,797</b>	<b>179,971</b>	<b>192,926</b>



# Western DCP Drought Planning Scenarios:

Assumes no new local supplies

*Drier with Extreme Warming Future Climate  
Condition Projections*

	2025	2030	2035	2040	2045
Retail M&I	245,910	260,841	275,618	281,921	295,777
<b>Total Demand</b>	<b>245,910</b>	<b>260,841</b>	<b>275,618</b>	<b>281,921</b>	<b>295,777</b>
Groundwater Production	157,111	156,298	153,439	150,638	147,771
Surface Production	2,414	2,414	2,414	2,414	2,414
Recycling	6,908	6,908	6,908	6,908	6,908
Recycling - M&I and Agricultural	6,908	6,908	6,908	6,908	6,908
<b>Total Local Supplies</b>	<b>166,433</b>	<b>165,620</b>	<b>162,761</b>	<b>159,960</b>	<b>157,093</b>
Consumptive Use	79,477	95,220	112,856	121,961	138,685
<b>Total Net Demand on Metropolitan</b>	<b>79,477</b>	<b>95,220</b>	<b>112,856</b>	<b>121,961</b>	<b>138,685</b>



# WMWD Drought Planning Scenarios:

## *Median Future Climate Condition Projections*

	2025	2030	2035	2040	2045
Retail M&I	245,910	258,614	271,889	285,842	300,509
<b>Total Demand</b>	<b>245,910</b>	<b>258,614</b>	<b>271,889</b>	<b>285,842</b>	<b>300,509</b>
Groundwater Production	157,111	156,298	155,377	154,484	153,591
Surface Production	2,414	2,414	2,414	2,414	2,414
Recycling	6,908	6,908	6,908	6,908	6,908
Recycling - M&I and Agricultural	6,908	6,908	6,908	6,908	6,908
<b>Total Local Supplies</b>	<b>166,433</b>	<b>165,620</b>	<b>164,699</b>	<b>163,806</b>	<b>162,913</b>
Consumptive Use	79,477	92,994	107,190	122,037	137,596
<b>Total Net Demand on Metropolitan</b>	<b>79,477</b>	<b>92,994</b>	<b>107,190</b>	<b>122,037</b>	<b>137,596</b>

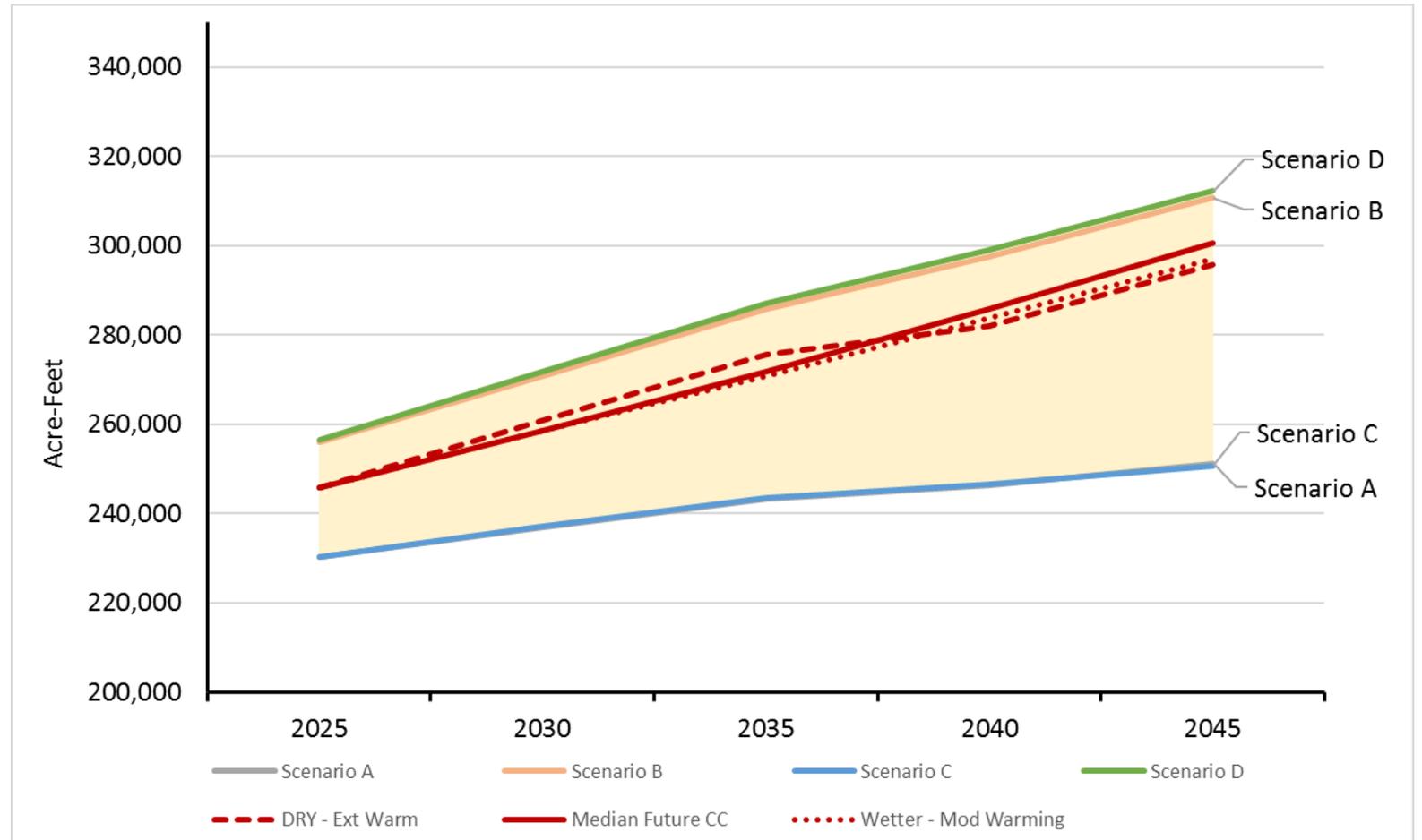
## *Wetter with Moderate Warming Future Climate Condition Projections*

	2025	2030	2035	2040	2045
Retail M&I	245,910	258,614	270,834	283,668	297,076
<b>Total Demand</b>	<b>245,910</b>	<b>258,614</b>	<b>270,834</b>	<b>283,668</b>	<b>297,076</b>
Groundwater Production	157,111	156,298	160,752	165,199	169,694
Surface Production	2,414	2,414	2,414	2,414	2,414
Recycling	6,908	6,908	6,908	6,908	6,908
Recycling - M&I and Agricultural	6,908	6,908	6,908	6,908	6,908
<b>Total Local Supplies</b>	<b>166,433</b>	<b>165,620</b>	<b>170,074</b>	<b>174,521</b>	<b>179,016</b>
Consumptive Use	79,477	92,994	100,760	109,148	118,060
<b>Total Net Demand on Metropolitan</b>	<b>79,477</b>	<b>92,994</b>	<b>100,760</b>	<b>109,148</b>	<b>118,060</b>



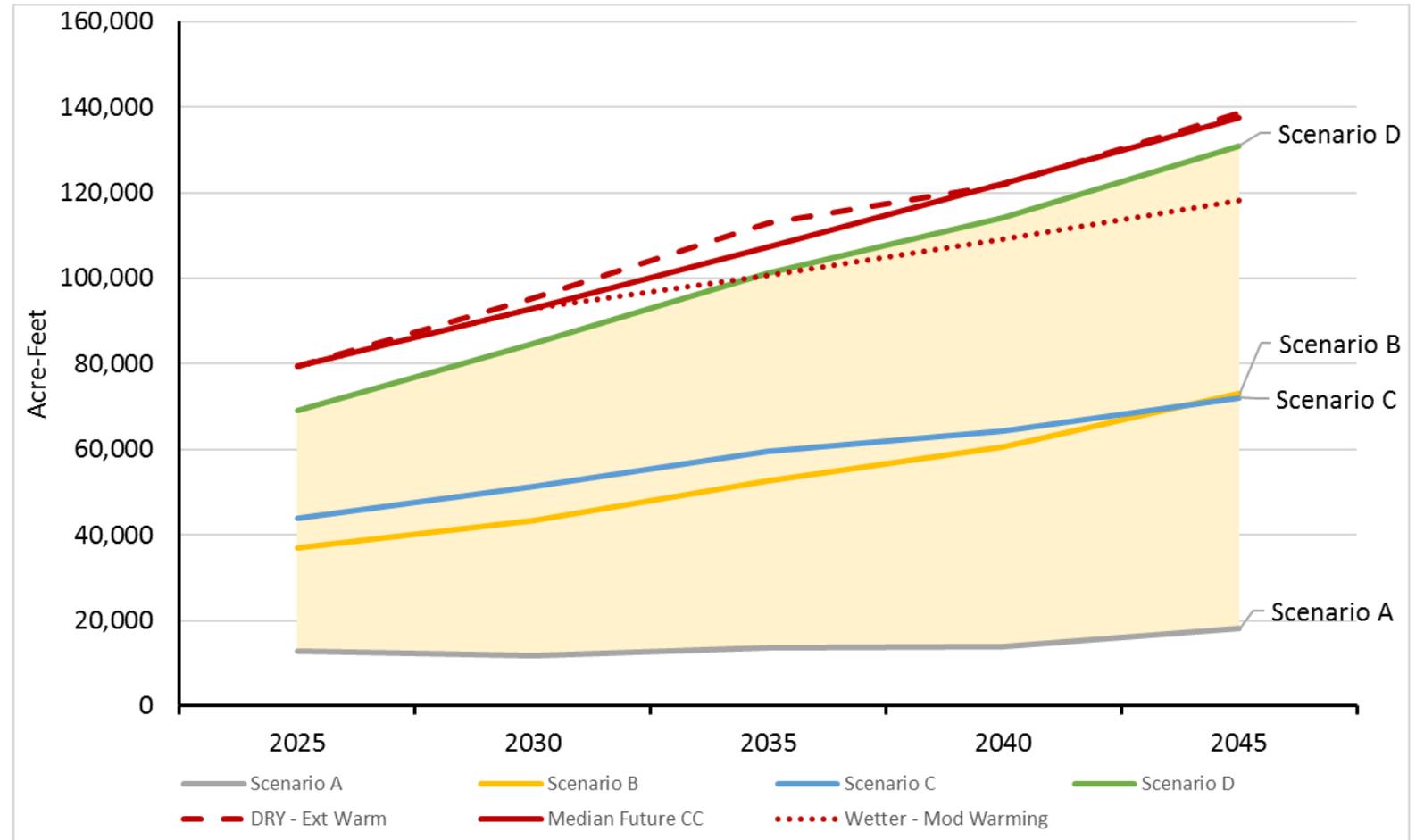
# MWD-IRP versus WMWD Scenarios:

TOTAL DEMANDS



# MWD-IRP versus WMWD Scenarios:

DEMAND ON MWD



# Key Takeaways

- Assuming no additional local supplies are developed, there will be a greater demand on Metropolitan in the future than projected for the region in the IRP process
- For those agencies who rely on Metropolitan, future supply gaps will need to be met by Metropolitan or by developing other local supplies (i.e., mitigation actions)
- For those agencies who rely on local supplies, future supply gaps will need to be met by developing additional local supplies (i.e., mitigation actions)



# ***Drought Task Force Survey: Mitigation Actions for the Drought Contingency Plan***

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Katie Laird, GEI

# What are “Mitigation Actions”?

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*Mitigation Actions are projects or programs that work to alleviate the impacts of droughts in the future. These actions are implemented ahead of a drought in anticipation of potential future shortages.*

## Categories of Types of Actions:

- Supply/Treatment
- Interties
- Storage
- Operations and Management



# *Why are mitigation actions important to you?*

## *Why should they be included in the DCP?*

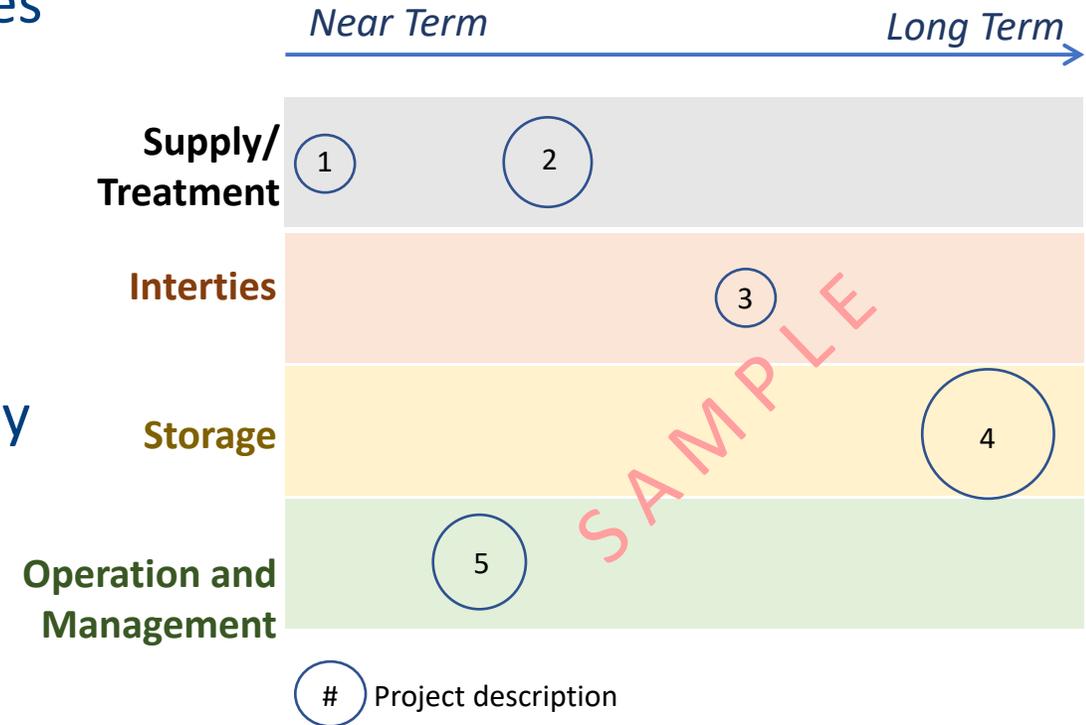
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- Mitigation Actions are water management improvements which **increase flexibility** in times of drought and increase **the region's resiliency**.
- The actions described in the DCP will help to facilitate **proactive planning** for the region's water supply reliability and help to **identify opportunities for alignment and engagement**.
- By including projects and programs in the DCP, the projects have increased opportunities for **grant funding**
  - USBR- WaterSMART Drought Program
  - DWR -Urban Community and Multi-benefit Drought Relief Program
  - Others



# How will projects/programs be included in the DCP?

- Inclusion of project descriptions in the DCP will be done in alignment with existing planning processes and programs.
- Project proponents maintain authority of project elements.
- DCP is a high-level planning document and recognizes that plans, budgets, and schedules may change.
- The intention of the DCP is to facilitate regional coordination and inclusion in the DCP does not imply any commitment or obligation for implementation.



# Supply and Treatment Projects/Programs

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*Includes the creation of access to additional water supplies that leverages existing water supply sources, creates new sources of supply, and/or improves treatment capacity in existing plants to treat new, more challenging local water supplies*

## Examples:

- New or deeper wells
- Facilities to treat saline groundwater
- New or expanded recycled water treatment and distribution facilities
- Groundwater recharge
- Stormwater capture



# Interties

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*Includes the construction of new physical connections between agencies that would allow transfer of water supply between and among Task Force members.*



# Storage

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*Includes the expansion of water storage capacity.*

## Examples:

- Groundwater banking projects
- Surface water storage
- Groundwater recharge



# Operations and Management

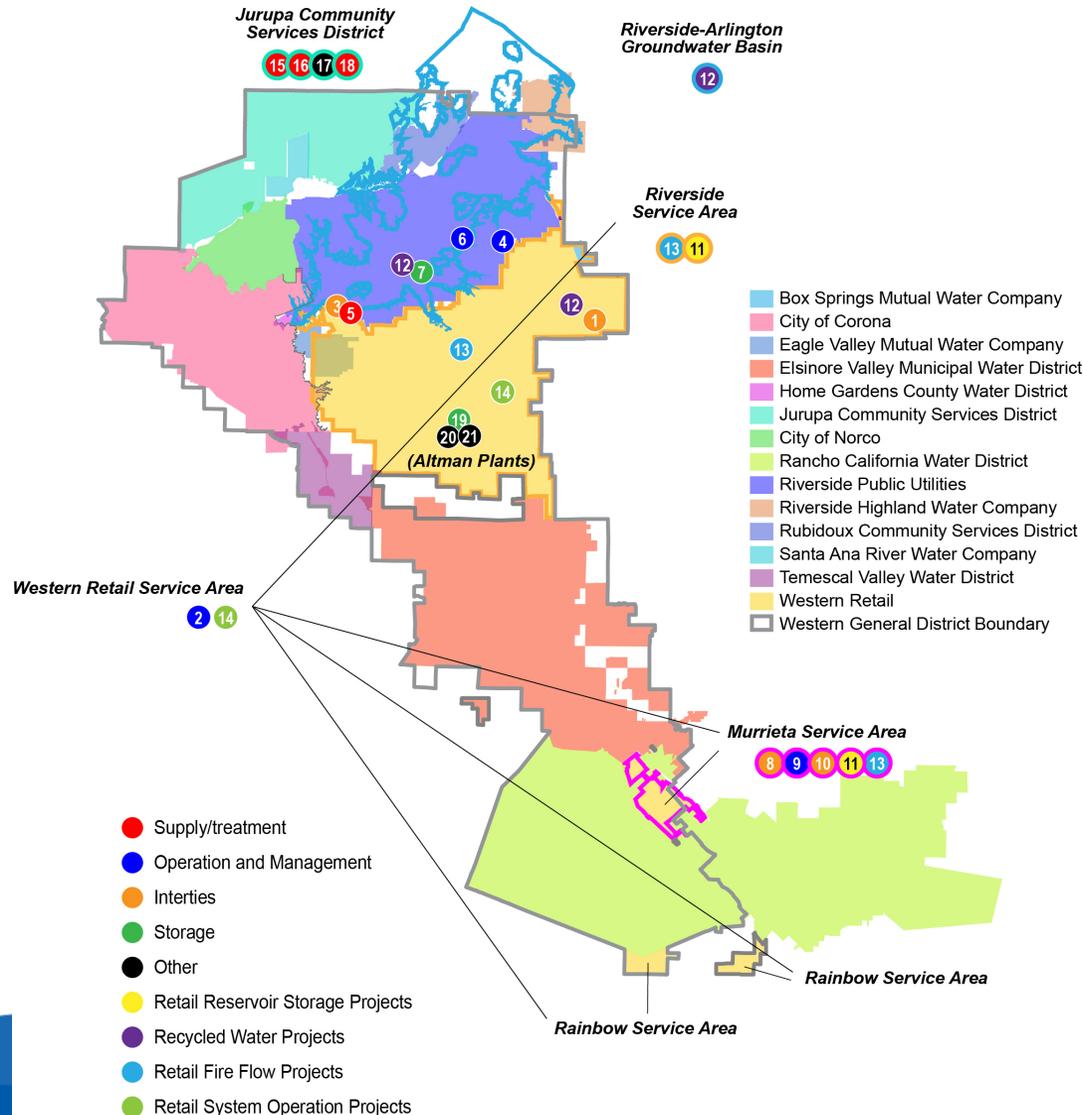
*Includes changes in water management practices that do not require new or modified infrastructure.*

## Examples:

- Ordinances aimed at long-term conservation (i.e., xeriscaping)
- Conservation Programs (i.e., rebates, education programs, leak detection)
- Metering
- Transfer and Exchange Programs or Agreements



# What projects or programs does your organization have in development that would potentially mitigate drought impacts in the future?



## Western Municipal Water District

- 1 Western/Eastern Municipal Water District March Air Force Base (MARB) Interconnection
- 2 Advanced Metering Infrastructure (AMI) and Customer Portal
- 3 Magnolia Intertie
- 4 Cannon/Campbell Pump Station
- 5 Arlington Desalter System Well Rehab and Reverse Osmosis Membrane Replacement
- 6 Mills Gravity Line Upgrades
- 7 Stormwater Capture and Spreading
- 8 Rancho California Water District/Western Murrieta Interconnection
- 9 South of Murrieta Creek Service Connection for Private Well Owners
- 10 Elsinore Valley Municipal Water District/Western Murrieta Interconnection
- 11 Retail Reservoir Storage Projects
- 12 Recycled Water Projects
- 13 Retail Fire Flow Projects
- 14 Retail System Operation Projects

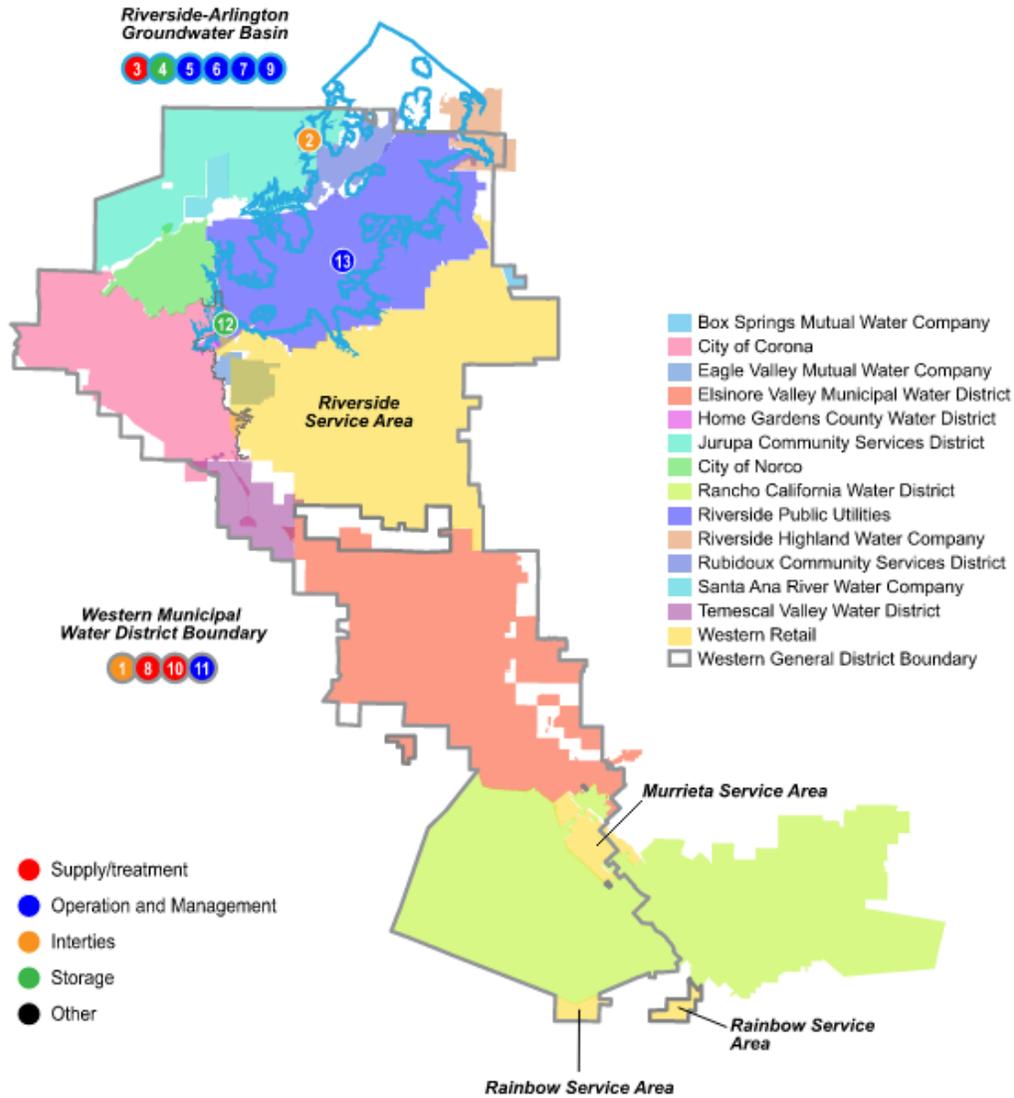
## Jurupa Community Services District

- 15 Recycled Water Service Expansion Project
- 16 Etiwanda Intervalley Water Quality and Water Resiliency Project
- 17 Drought Outreach Plan
- 18 Well Exploration in the Chino Basin

## Altman Plants

- 19 Additional Stormwater Storage Capacity
- 20 Sensor Based Irrigation
- 21 Soil Additives to Reduce Water Frequency

# What other project or programs do you think would be helpful for the region in mitigating the impacts of drought in the future?



## Western Municipal Water District

- 1 Interconnections Between Western's Retail Agencies
- 2 Interconnections With RCSD
- 3 Using Recycled Water for Irrigation
- 4 Surface Water Injection or Spreading (Arlington GSP Project)
- 5 Metering and Collection of Groundwater Pumping (Arlington GSP Project)
- 6 Replacement of Invasive or Nonnative Vegetation With Native Plant Species (Arlington GSP Project)
- 7 Water Transfers/In-Lieu Groundwater Recharge (Arlington GSP Project)
- 8 Activities That Promote and Incentivize Conservation (Arlington GSP Project)
- 9 Programs That Redistribute Pumping (Arlington GSP Project)
- 10 Leak Detection Program (Arlington GSP Project)
- 11 Water Loss Mitigation Program
- 12 Arlington Reservoir for Local Groundwater Storage
- 13 Hydroelectric Power Generation



# *Small Group Breakout*

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Amy Stevens, WSC

# Questions

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- 1. What projects or programs does your organization have in development that would potentially mitigate drought impacts in the future?**
  - Self-Complete
  - List project by type
  - Include the project name, agency name, and timeframe
- 2. What other project or programs do you think would be helpful for the region in mitigating the impacts of drought in the future?**
  - Discussion led by group facilitator
  - Large group will discuss this more after breakouts



# Responses

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## 1. What projects or programs does your organization have in development that would potentially mitigate drought impacts in the future?

### Ted Beckwith

1. RCSD is working on an inter tie with WVMWD right now. Expected completion in 2022.
2. Five agency agreement with WMWD, MWD, SBVMWD, WVMWD and RCSD..
3. Completed PFOS Treatment this year. New wells (Few years out) to serve future needs in the District but we'll have excess water that will need treatment for a plethora of constituents and TDS Mitigation. We don't have funding for RO plant construction.
4. Riverside groundwater basin - if stable - can produce more water that buildout, but has wq probs

### EMWD

1. Supply /Treatment: Purified Water Replenishment, 2025
2. Recycled Water Expansion - ongoing.
3. Perris South Desalination Program Expansion - 2030.
4. Additional Groundwater Wells - 2030. Enhanced Recharge and Recovery, Phase II - 2030



# Responses

---

## 2. What other project or programs do you think would be helpful for the region in mitigating the impacts of drought in the future?

### Ted Beckwith

Reverse osmosis plant to put more water into local area, strip TES (potentially partner with JCSD and others)

### Jim Hessler

- Water recycling collects water runoff for irrigation. Not capturing the influx of water from stronger storms. Added 50 acre feet but need more
- Sensor based irrigation – has wiring and computers set up, working on the data collection, challenge with variety of types and sizes of growth so determining irrigation cycles is tough,
- Has some good case studies for water savings for sensor based irrigation and stormwater capture at commercial facilities
- Additional storage for the State Water Project (Sites Reservoir)
- Additional resources for homeowners to install/retrofit to more efficient irrigation systems. Both educational outreach and financial incentives.
- Financial incentives for homeowners to install tankless water heaters

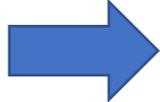


# *What's next?*

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Laine Carlson, WSC

# Drought Contingency Plan Next Steps



Activity	Timeframe
Workshop #4 will be held to present the results of GEI’s expanded Climate Change Vulnerability Analysis (CCVA), review the results of the drought mitigation activities survey and refine the drought mitigation activities to be included in the DCP. The updated CCVA TM will also be provided to the Task Force for review and comment.	December 16 <sup>th</sup> , 2021 from 2-4pm
Updated CCVA TM and Drought Monitoring Framework TM provided to Task Force for review and comment	January 2022
Drought Mitigation Actions TM to Task Force for review	February 2022
Task Force members will receive the Draft DCP for review and comment	Draft DCP comment period will be from Mid-March 2022 to mid-May 2022
Workshop #5 will be held mid-way through the Draft DCP comment period to review the contents of the plan and discuss any questions or comments	Mid-April 2022
Task Force feedback will be incorporated into a Public Draft DCP that will be released for public review	June 2022
The DCP will be presented to the Western Board of Directors for adoption	July 2022

*Attend workshop No. 5*

DCP Review and Discussion

**April**

**ALL TASK FORCE MEMBERS ARE REGISTERED**

Watch for Zoom details by email from WSC

[wmwd.com/UWMP](http://wmwd.com/UWMP)



# ***Thank you!***

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*Email Amy Stevens with any questions or additional comments.*

**astevens@wsc-inc.com**



# ***Drought Task Force Workshop No. 5: Draft DCP and Task Force Planning***

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Western Municipal Water District  
*April 21, 2022 • 1:30 – 3:30 p.m.*

# *Workshop Goals*

Review the draft DCP and provide feedback

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Conduct a Mock Drought Task Force meeting

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# Presenters/Facilitators

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**Katie Laird**  
Project Manager, GEI



**Roger Putty**  
Water Resources  
Engineer, GEI



**Melissa Matlock**  
Water Resources  
Specialist II,  
Western Municipal  
Water District



**Ryan Shaw**  
Director of Water  
Resources,  
Western Municipal  
Water District



**Laine Carlson**  
Civil Engineer, Water  
Systems Consulting  
(WSC)



**Amy Stevens**  
Facilitator,  
Water Systems  
Consulting (WSC)



# Workshop Agenda

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- Welcome
- Drought Contingency Planning (20 min)

## Mock Task Force Meeting

- Regional Drought Conditions and Potential Impacts - Metropolitan Water District (10 min)
- WSCP Updates (20 min)
- Drought Communication Toolkits (20 min)
- Open Forum Poll /Discussion (15 min)

## Reflection

- Task Force Planning (25 min)
- Close



# ***Drought Contingency Planning***

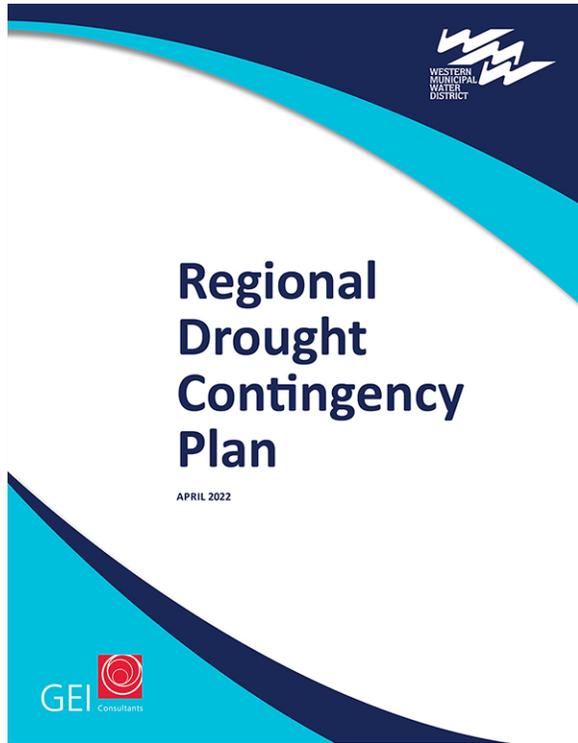
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Katie Laird, *GEI*



Workshops 1 - 4





Look here for help to answer those questions

How will we recognize drought in its early stages?

How will drought affect us?

How can we protect ourselves from the next drought and increase opportunities for grant funding?



# Workshop 5: April 21, 2022



# *How will we recognize the next drought in its early stages?*

---

- Regional Drought Portal
- Drought Task Force Meetings

## Benefits:

- Early alerts of troubling drought indicators
- Information and knowledge exchange
- Opportunity to promote consistent messaging
- Address regional challenges and identify collaborative opportunities
- Grant and other funding opportunities



# How will we recognize the next drought in its early stages?

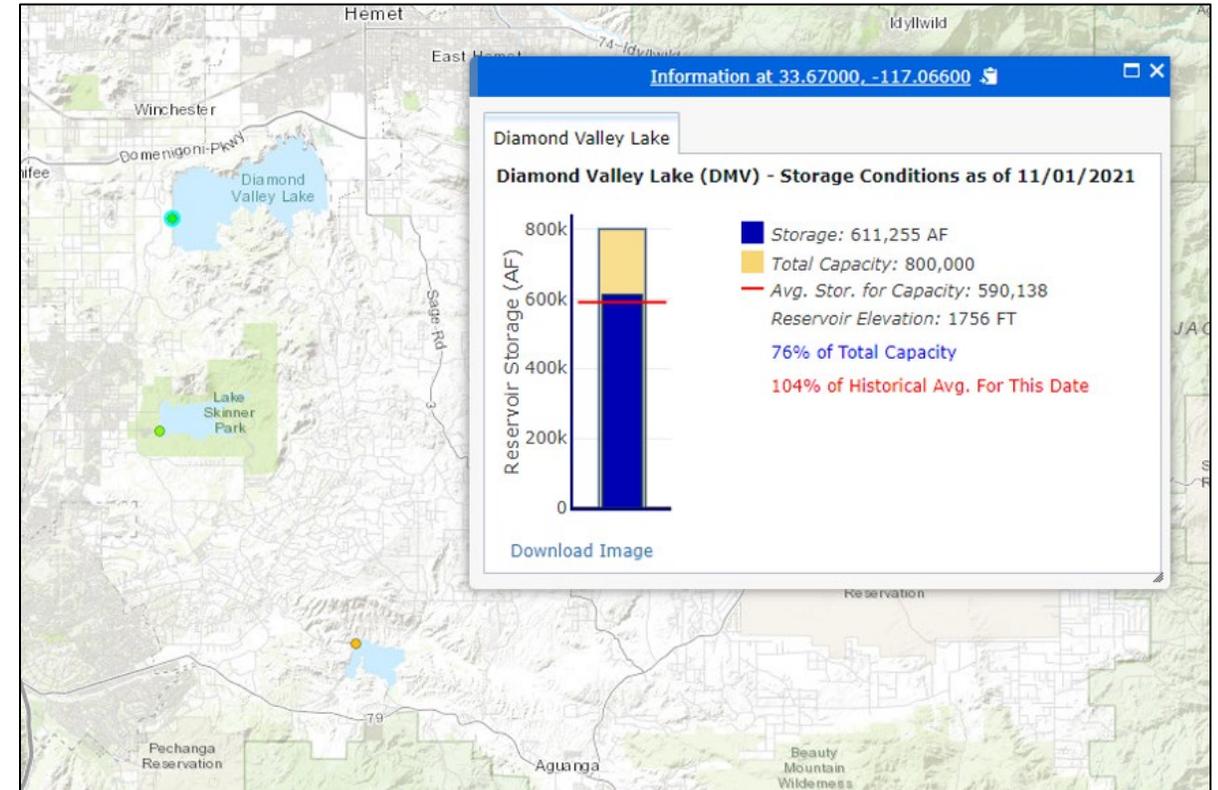
The **Regional Drought Portal** will provide a platform to post, collect, and disseminate key datasets for regional drought planning and response:

*To assess local conditions:*

- Groundwater levels
- Annual assessment results

*To assess imported supplies:*

- MWD storage levels



# How will we recognize the next drought in its early stages?

## Drought Task Force Meetings

Provide a forum for members to review data, share updates, and coordinate drought response

Convened based on regional conditions

Regional Drought Stage	Meeting Frequency	Triggers				
		Drought Monitor (DCP Region)	MWD WSAP/Similar Action	Agencies in Declared Shortage*	Statewide Drought Proclamation	Riverside County Drought Proclamation
Normal	Annual	None-Abnormally Dry	--	None	--	--
Watch	Quarterly	Moderate-Extreme Drought	Levels 1 and 2	3 or more	Drought	Drought
Alert	Monthly	Exceptional Drought	Levels 3 thru 5	6 or more	Drought	Drought
Emergency	Weekly	Exceptional Drought	Levels 6 and 10	10 or more	Drought	Drought

\*Not including state mandated shortage



## *How will drought affect us?*

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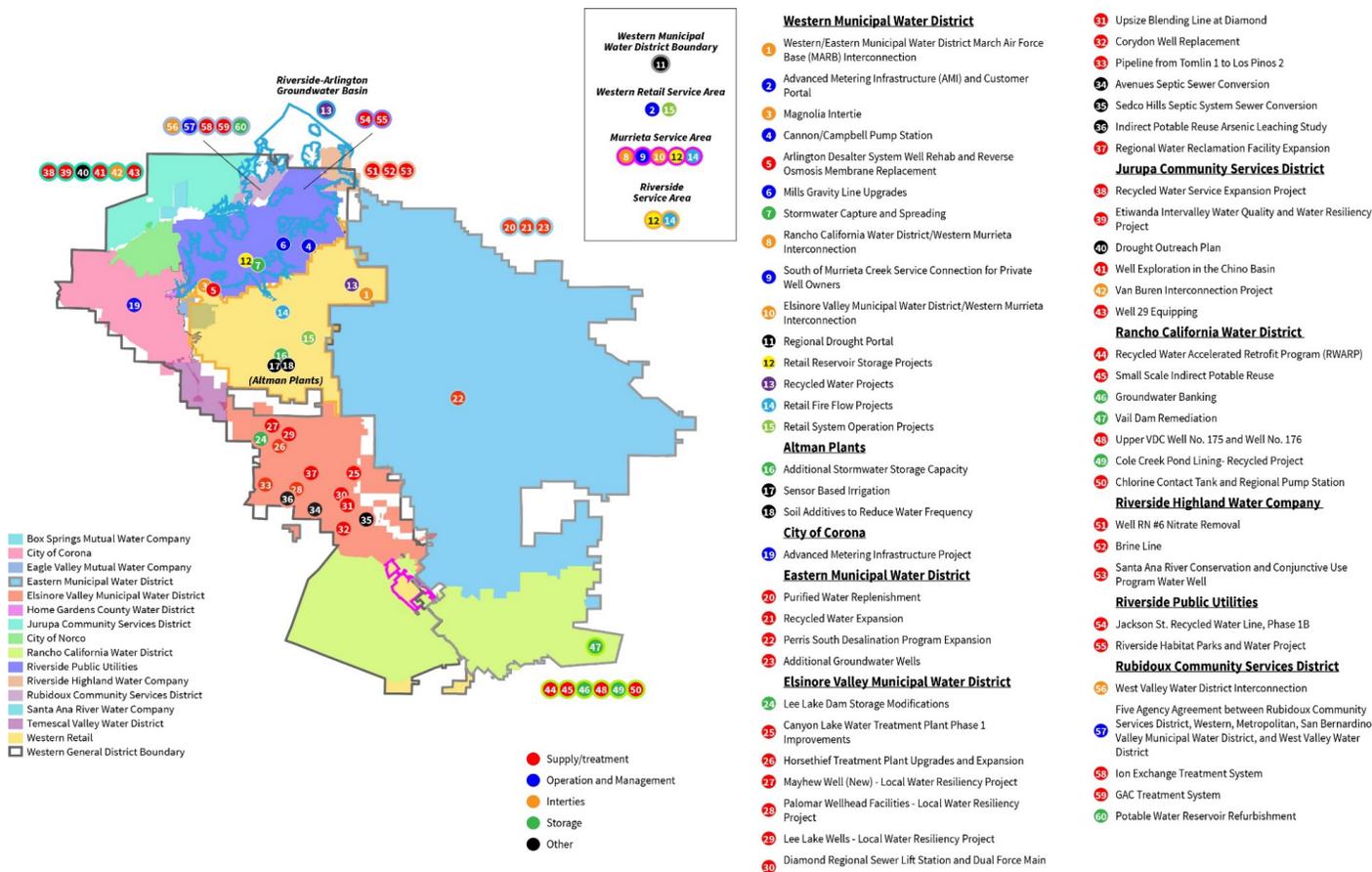
A **climate change vulnerability assessment** performed as part of the DCP indicated that the **region's dependence on imported water will increase** if the region does not implement mitigation strategies ahead of drought

A tool which evaluates **future estimates of supplies and demands** considering the effects of climate change is available upon request from Western



# How can we protect ourselves from the next drought?

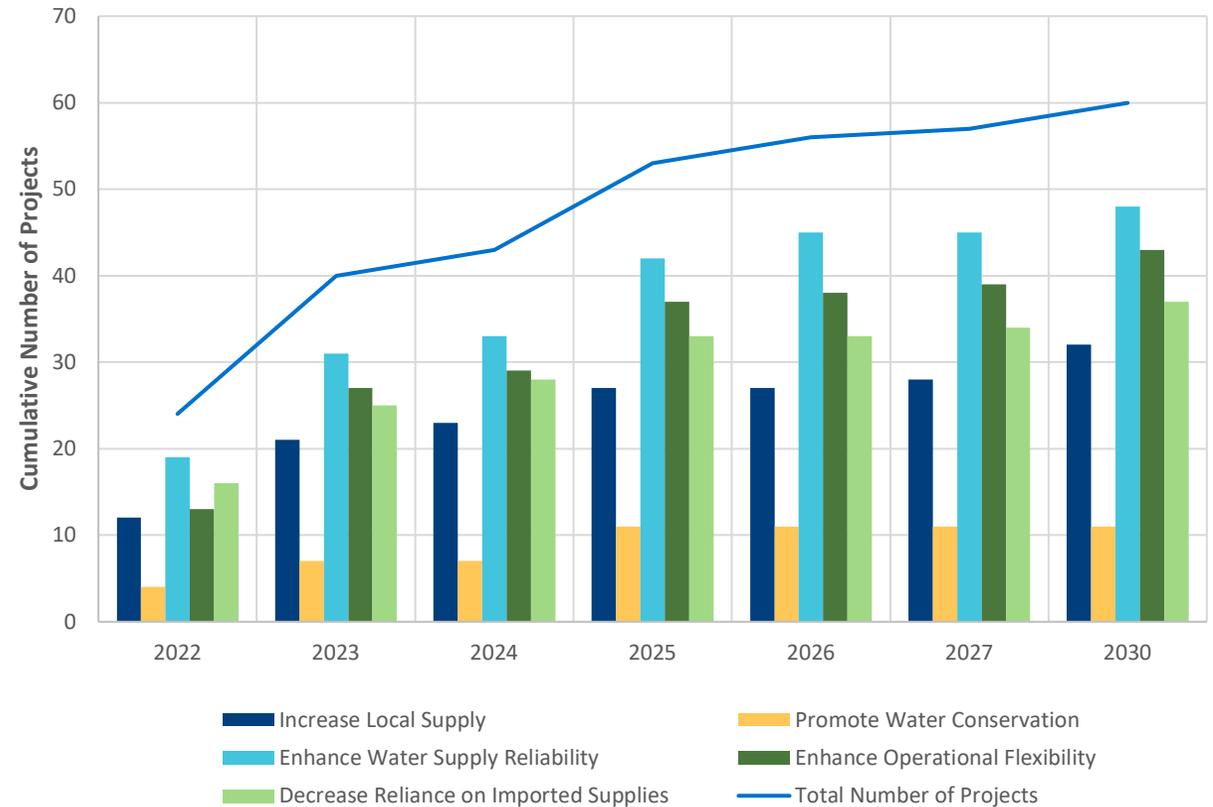
Identifying projects that align with yours to demonstrate a regional benefit can make your grant applications more competitive



# How can we protect ourselves from the next drought?

A total of 60 projects, programs, and/or strategies were included in the DCP

By including projects in the DCP, the projects have increased opportunities for **grant funding** – **review the DCP to ensure your projects are included!**



# Opportunity for Regional Collaboration for Mitigation Funding

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- Regional Water Quality Project
  - Partner agencies: WMWD, RHWC, RCSD
- Applying to USBR's WaterSMART Drought Resiliency Project
  - Applying for funding group 3
  - Up to \$5M in grant funds

Earn up to 15 extra points for projects included in the DCP!

**Partnership arose through review of the DCP** mitigation projects submitted. We found a common project theme that would be eligible under this funding opportunity and instead of competing against each other, **we are working together to make our grant submission as strong as possible.**



# *Mock Task Force Meeting*

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Amy Stevens, WSC

# *Meeting Agenda*

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## **Mock Task Force Meeting**

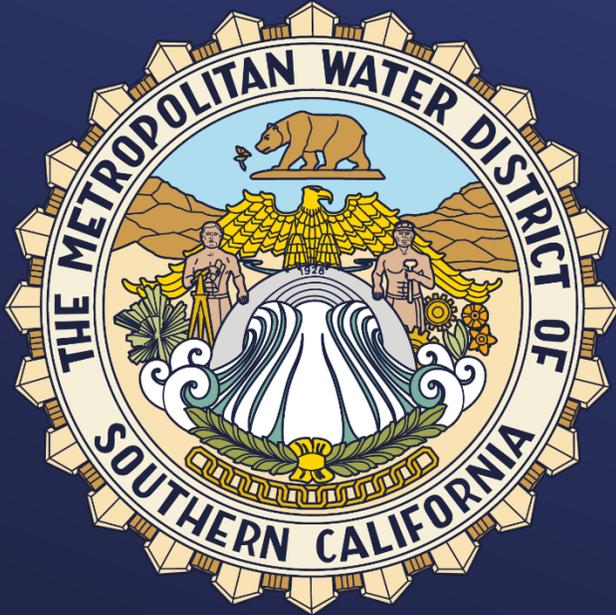
- Drought Conditions and Potential Impacts (10 min)
- WSCP Updates (20 min)
- Communication Toolkit (20 min)
- Open Forum Poll (15 min)



# *Regional Drought Conditions and Potential Impacts*

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Demetri Polyzos, Metropolitan Water District



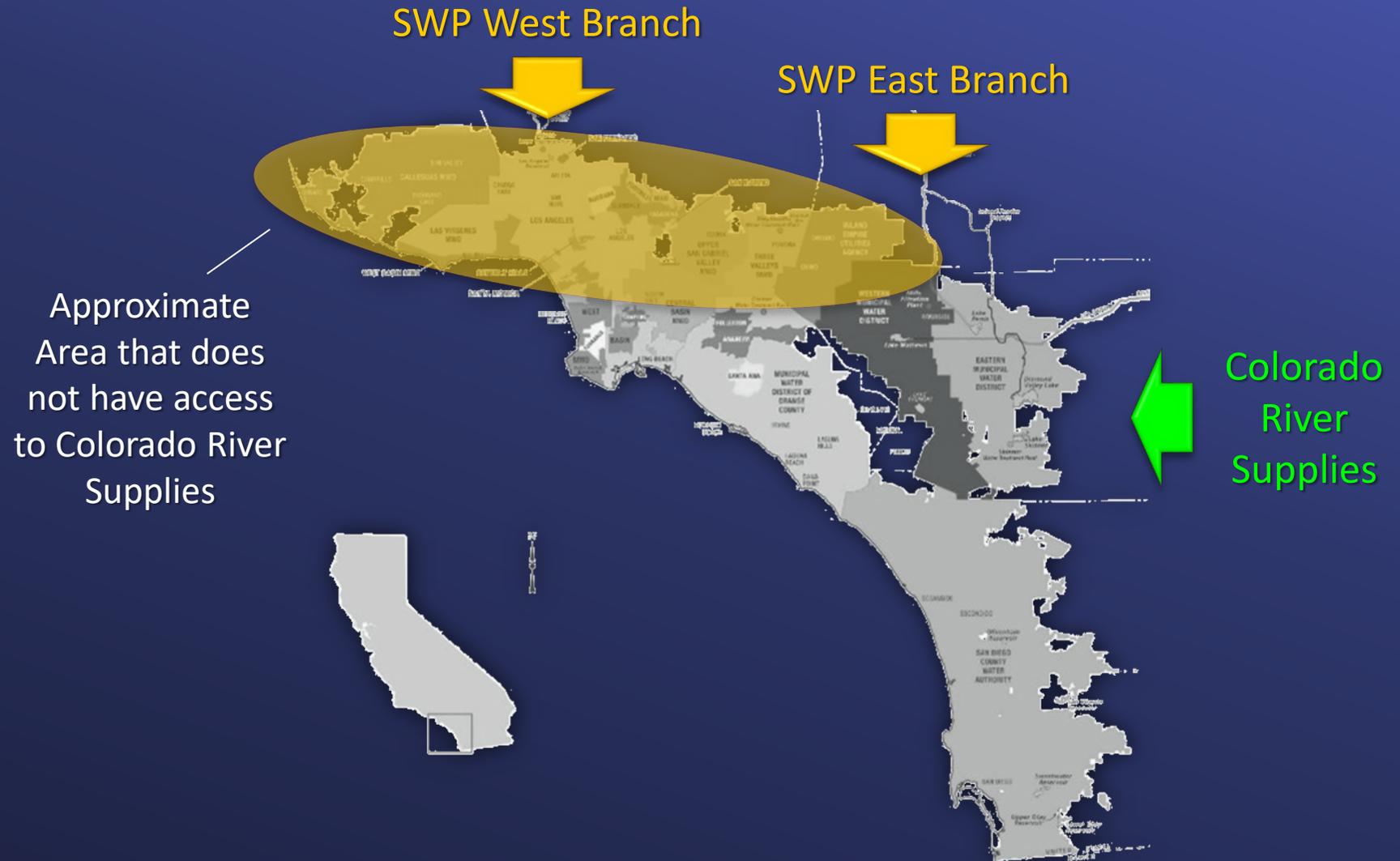
Western Drought Task Force Meeting

# Metropolitan's Supply and Response Action Update

April 21, 2022

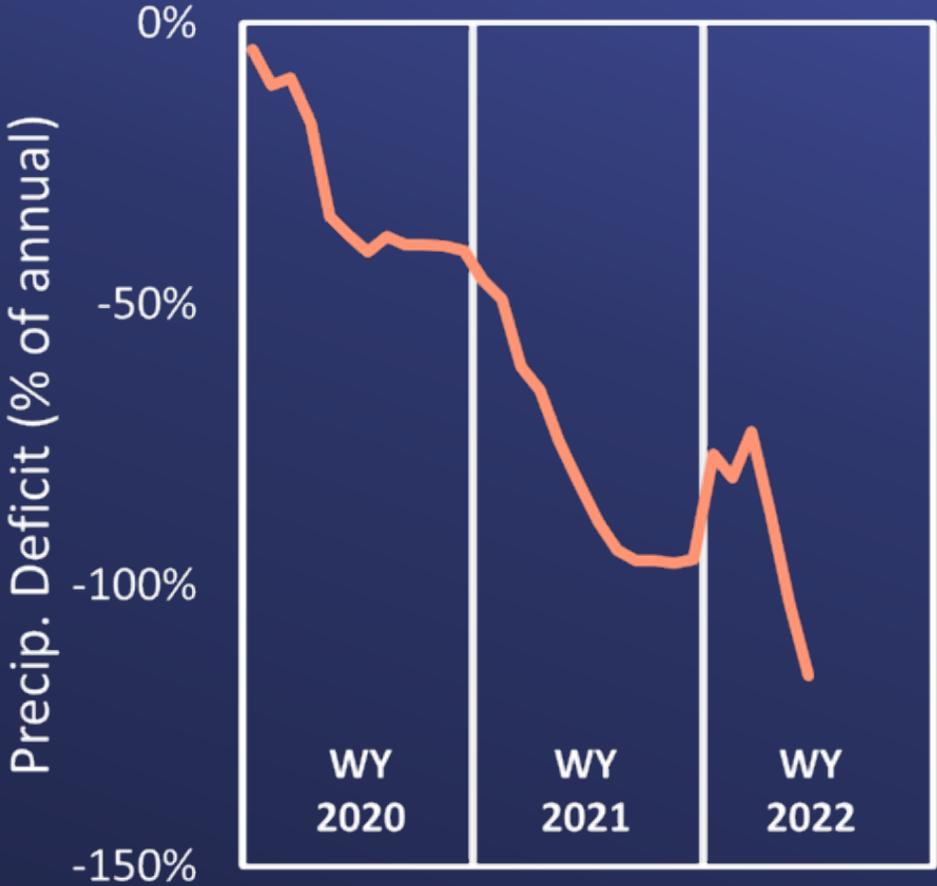
# Metropolitan Water District Imported Supply

Colorado River  
Supplies do  
Not Reach **All**  
Portions of the  
Service Area



# Third Year of Drought

How did we get here?



8-Station Index Precipitation

How did we get here?



8-Station Index Precipitation

## Third Year of Drought

- Driest 3 years
- Driest 3 months (Jan. – Mar.)
- Lowest 3-year total deliveries from State Water Project

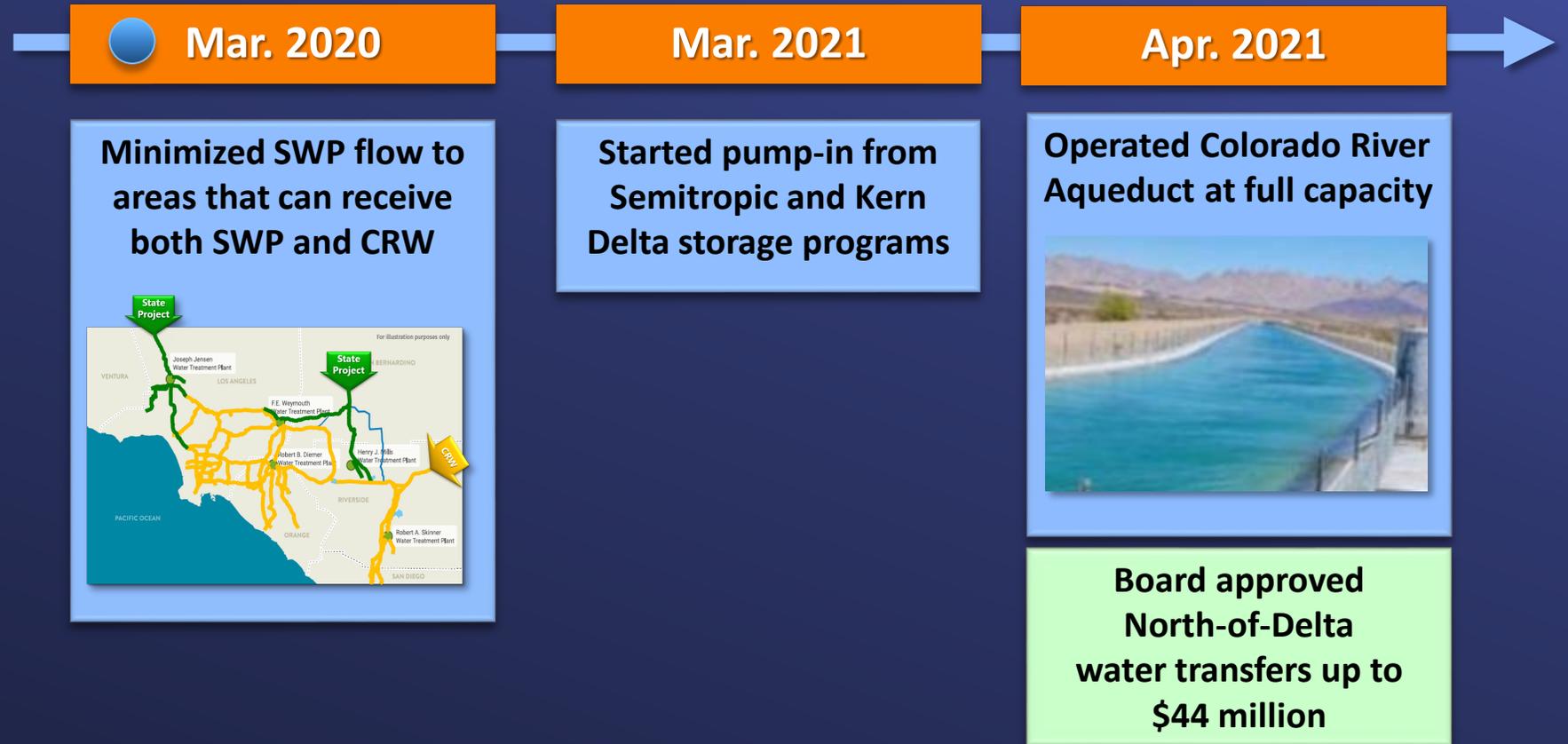
Average Expectation for SWP	3.2 million AF
DWR's Lowest Forecast	1.0 million AF
Today	0.6 million AF

# What did we do as the drought intensified?

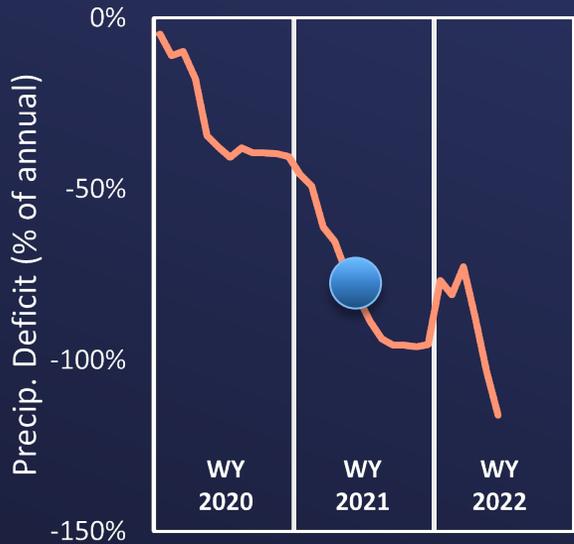


8-Station Index Precipitation

## Proportionate Response Since Mar. 2020



# What did we do as the drought intensified?



8-Station Index Precipitation

## Proportionate Response Since Mar. 2020

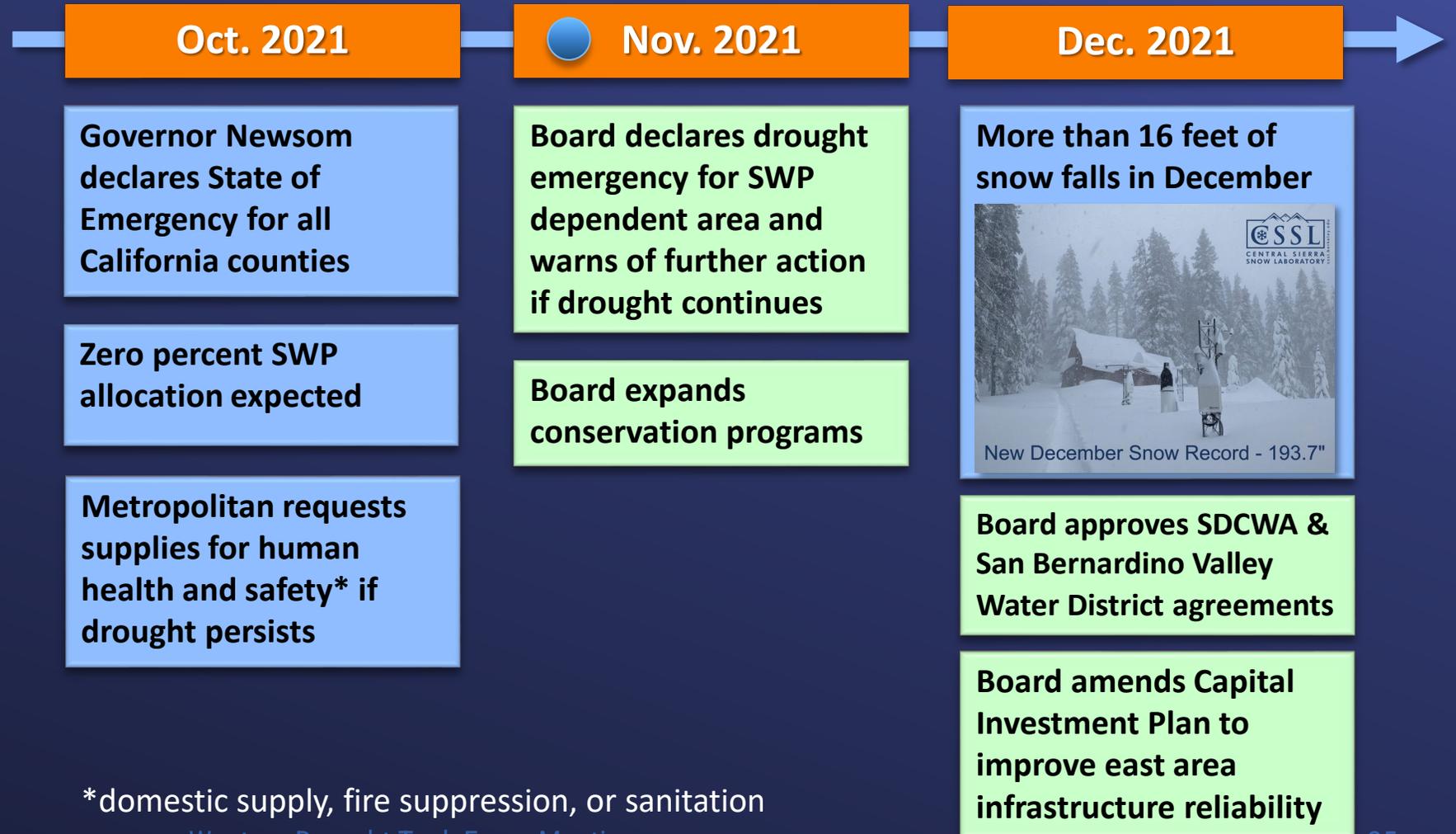


# What did we do as the drought intensified?



8-Station Index Precipitation

## Proportionate Response Since Mar. 2020



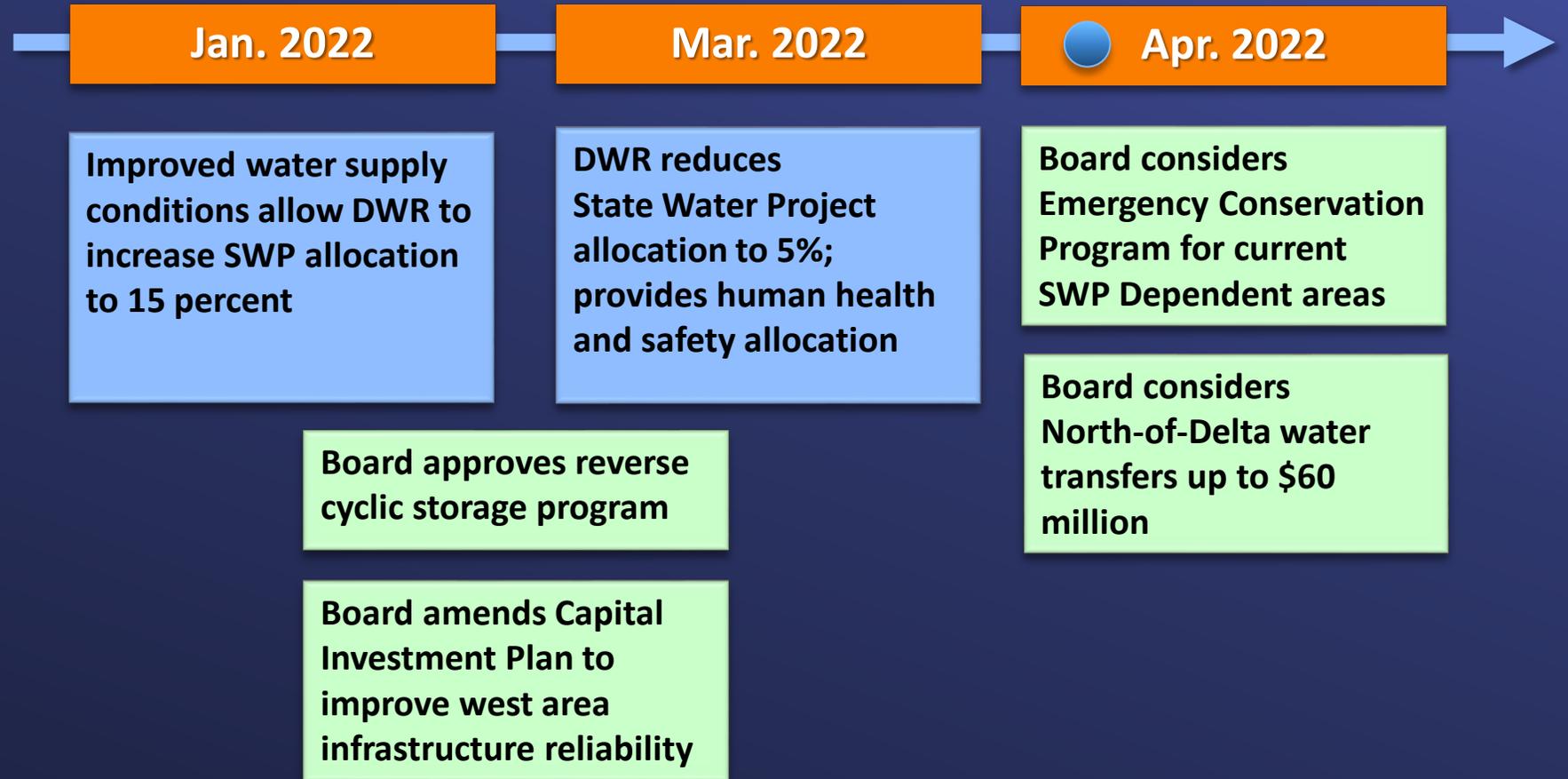
\*domestic supply, fire suppression, or sanitation

# What did we do as the drought intensified?

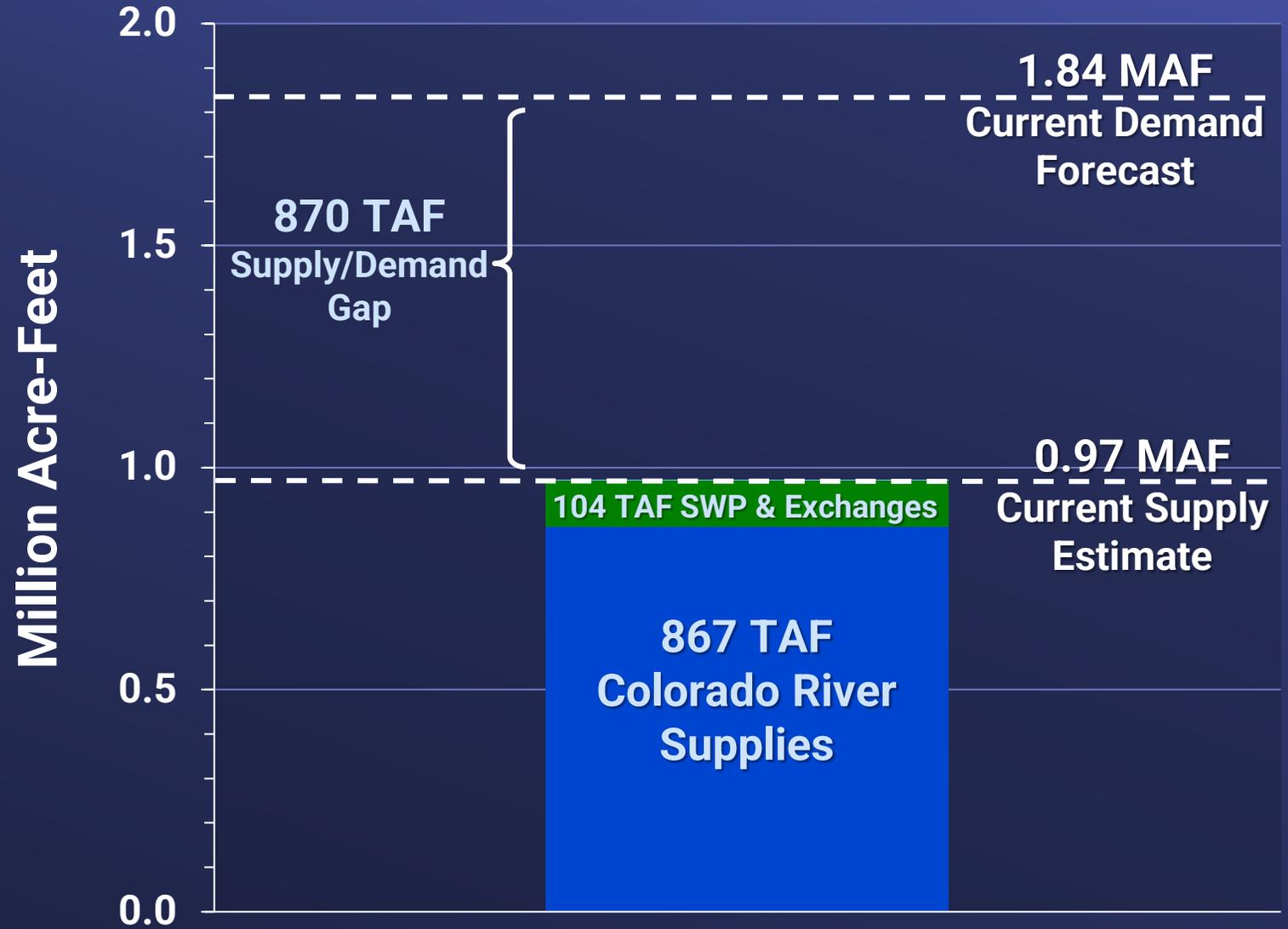


8-Station Index Precipitation

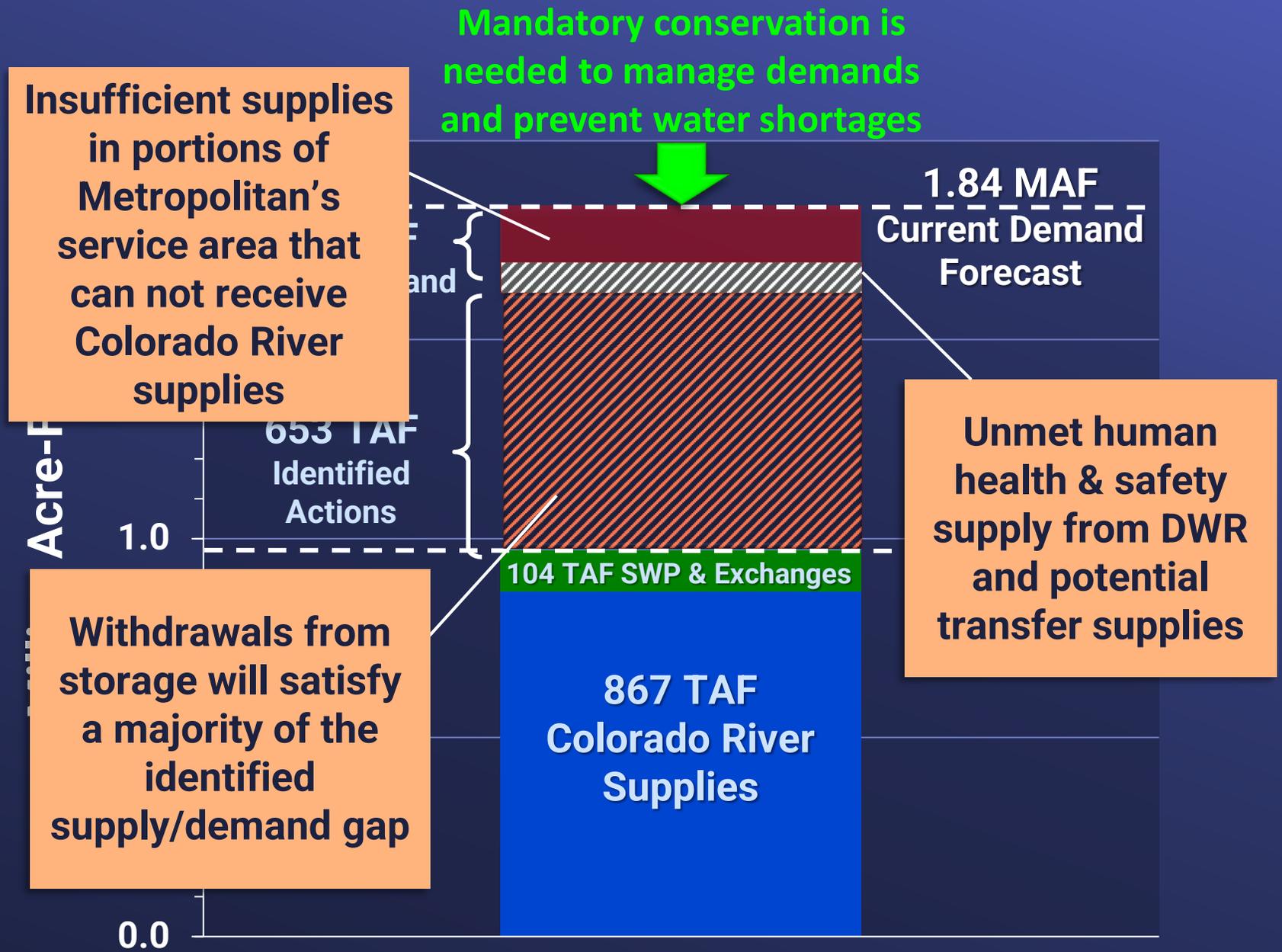
## Proportionate Response Since Mar. 2020



# Regional Supply Demand Balance



# Regional Supply Demand Balance



Proposed  
framework for  
Emergency  
Conservation  
Program

## Three main elements of the Emergency Conservation Program

- Mandate and enforce conservation actions
  - Such as single day per week outdoor watering
  - Potentially no outdoor watering (if warranted)
- Volumetric penalty \$ X per acre-ft
  - Assessed on all SWP delivered to non-compliant water provider (e.g., only part wholesale Member Agency delivery )
- Incentivize local production and conservation
  - Outdoor watering restrictions and penalties do not apply if agency eliminates need for delivery of water from SWP

Goals of  
the  
Emergency  
Conservation  
Program

## Seeking three objectives

- Preserve scarce supplies this year
- Minimize take of human health and safety water
- Prepare for a potential fourth year of drought



# *WSCP Updates*

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Amy Stevens, WSC

slido

What WSCP stage are you in now?

 Start presenting to display the poll results on this slide.

slido

Do you plan on moving to a different stage?  
Do you have a date in mind?

 Start presenting to display the poll results on this slide.

slido

Which types of water shortage response actions are you focusing on?

 Start presenting to display the poll results on this slide.

slido

What other types of water shortage response actions are you focusing on?

 Start presenting to display the poll results on this slide.

slido

What information is helpful from water agencies and the media?  
What is missing?

 Start presenting to display the poll results on this slide.

# *Drought Communication Toolkits*

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Melissa Matlock, WMWD

# Inland Empire Clean Water Partnership

## Drought-O-Meter



### KEEP IT UP!

Your water-wise practices are paying off and we, as a region, are better prepared for drought that we've ever been. You know what to do—so **KEEP IT UP!**

## DROUGHT

It's back, but you know what to do.

#KeepItUpIE

A message from your community water providers.

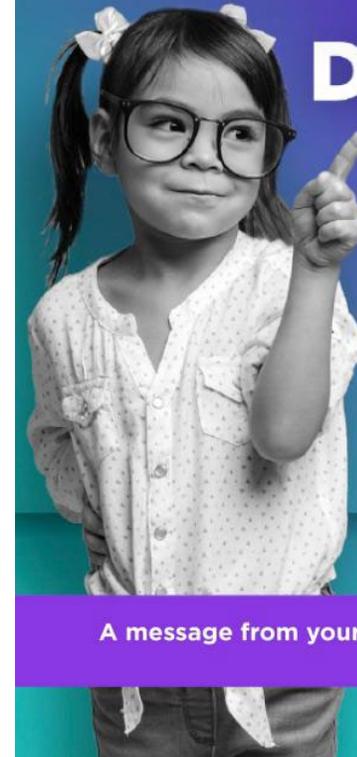


## DROUGHT

It's back, but you know what to do.

#KeepItUpIE

A message from your community water providers.



[www.emwd.org](http://www.emwd.org)



# Western Municipal Water District

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- Continuing “Step it up” call-to-action with increased urgency.
- Regional effort launched via the Inland Empire Clean Water Partnership; uses the same images and call to action.
- Focus on water saving tips that customers can easily incorporate into their everyday routines.  
Remind customers about our enhanced rebates and encourage them to apply.

## Future Efforts

- Blanket our region with drought messaging.
- Targeted messaging to out of budget customers.
- CII outreach for non-functional turf
- Increase the urgency/seriousness of messaging

**You’ve heard it all your life, but saving water during a drought is more important than ever.**

**JUST  
USE  
LESS**

**#StepItUp**



**A message from your community water provider**



# Metropolitan Water District

Metropolitan's Board of Directors approved \$10.5 million to expand advertising and outreach efforts to increase public awareness of the drought and the need for conservation

The multilingual campaign will be featured in a variety of ways:

- Radio
- Digital
- Social media
- Outdoor advertising platforms



# Metropolitan Water District

## Full campaign set to launch May/June 2022

- Photography based campaign showcasing real and diverse people from southern California.
- Saving tips are presented in a friendly and personal way
- Utilizes a combination of media platforms to blanket the southland with positive, helpful tips on how to save water
- Messages develop a greater sense of urgency, but not emergency
- Anticipating a long-term relevancy of a sustained high-level conservation effort



# *Open Forum Poll*

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Amy Stevens, WSC

slido

Which additional topic would you like to discuss today?

 Start presenting to display the poll results on this slide.

# *Open Forum Discussion Topic Options*

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- [Funding Opportunities](#)
- [Annual Water Supply and Demand Assessment](#)
- [CA Water Watch web portal overview](#)

# *Drought Funding Opportunities*

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Spring 2022 Update

# *WaterSMART Drought Resiliency - Federal*

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- Funds projects that build resiliency to drought by increasing reliability of water supplies, improving water management, and providing benefits for fish and wildlife
- Needs to be supported by a drought planning effort
- Group 1: Up to \$500K completed in 2 years; Group 2: Up to \$2M completed in 3 years; Group 3: Up to \$5M completed in 3 years
- Cost match = 50%
- Due June 15, 2022



# *WaterSMART Small-Scale- Federal*

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- Funds small on-the-ground projects that conserve, better manage, or use water more efficiently
- Up to \$100K grant available per project; total budget less than \$225K
- Cost match = 50%
- Due April 28, 2022



# *WaterSMART WEEG - Federal*

---

- Water and Energy Efficiency Funding Opportunity
- Projects that result in quantifiable water savings, renewable energy components, broader sustainability benefits
- Up to \$2M to be completed in 3 years
- Cost match = 50%
- Anticipated Spring 2022

Funding announcement not released: Details subject to change



# *Environmental Water Resources - Federal*

---

- Projects focused on environmental benefits that developed as part of a collaborative process to carry out increases in water reliability
  - Quantifiable water savings
  - Increase water supply reliability for ecological values
  - Developed in a collaborative process
  - Component of an established water reliability strategy
- Up to \$2M to be completed in 3 years
- Cost match = 25%
- Anticipated Fall 2022

Funding announcement not released: Details subject to change



# *US EDA Public Works and Economic Adjustment Assistance*

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- Provide strategic investments to support economic development, foster job creation, and attract private investment in economically distressed areas
- Pre-application call with regional representative is recommended
- Public Works: \$600K-\$3M; Economic Adjustment Assistance: \$150K-\$1M
- Cost match = 20%
- Implementation of construction 12-48 months
- No submission dates; ongoing basis



# *Annual Water Supply and Demand Assessment*

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# *Annual Water Supply and Demand Assessment (AWSDA)*

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- New report defined in each agency's adopted Water Shortage Contingency Report (prior to July 2021)
- Due to Executive Order N-7-22, preliminary assessment is due June 1, 2022



# ***AWSDA Reporting Tables***

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- Demands (Table 2)– DWR’s suggestion procedure is to use the past fiscal year’s actual demands (split by treated and untreated). They ask for monthly, but if you do not wish to provide monthly, put your annual data into the June column
- Supplies (Table 3) – DWR’s suggestion procedure is to use the single dry year supply estimate provided in your UWMPs, unless you have more accurate supply reductions available for the next fiscal year. They ask for monthly, but if you do not wish to provide monthly, put your annual data into the June column
- If you have planned supply augmentation or demand reduction actions, place the estimated values into the Tables 4P & 4NP and then provide more details in the Actions area (Table 5)

# *CA Water Watch Web Portal Overview*

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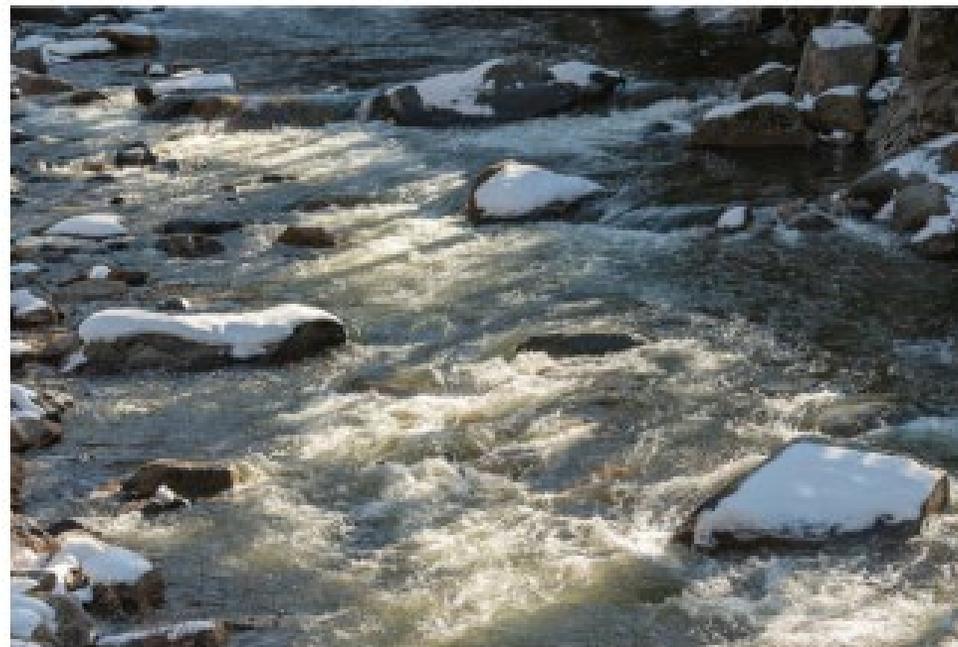
# California Water Watch – Landing Page

## Track Latest Water Conditions

Welcome to California Water Watch! This site offers the most current local and statewide water conditions down to your region and even your neighborhood. This information is updated dynamically from a [variety of data sources](#). Everyone is welcome to research, learn, and stay informed about California's most precious resource -- water.

[Understanding Our Current Drought](#)

[Read Latest State Hydrology Update](#)



## Snapshot of California Hydroclimate and Water Supply Conditions

California has a Mediterranean climate characterized by warm, dry summers and mild, wet winters. The climate can vary depending on the geographical region where you live, and climate change is increasing this variability.

The maps below show current statewide hydroclimate and water supply conditions, including precipitation, temperature, reservoir storage, groundwater conditions, snowpack, streamflow, soil moisture and vegetation conditions.

To view the conditions in your local area, enter your address or zip code in the location finder.

## View Watershed Conditions

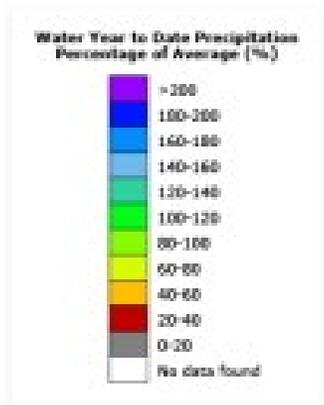
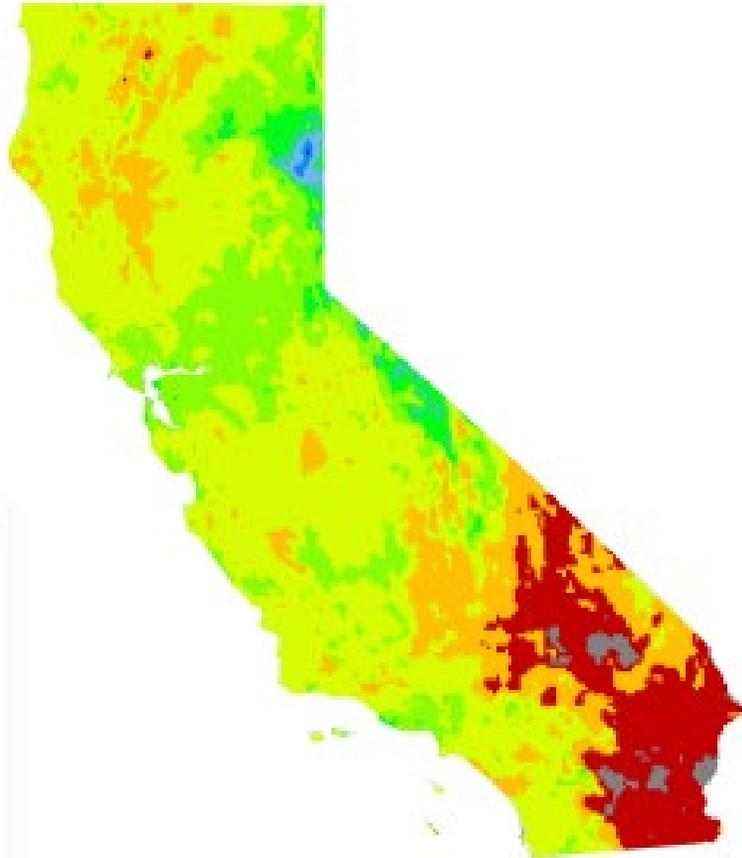
### Search by Address or Zip Code

### Search on Map

[View](#)



# California Water Watch – Landing Page



## Precipitation as of 04/18/2022

California's annual precipitation can vary greatly from year to year and region to region. The map of California shows how this water year's precipitation compares to what has been observed historically. The chart below breaks down this same data into discrete ranges to illustrate the levels of precipitation different portions of the state are seeing relative to historical averages.

PERCENT OF AVERAGE PRECIPITATION (%)	PERCENT OF STATE (%)
0-19	1.32
20-39	12.19
40-59	15.84
60-79	49.78
80-99	17.17
100-119	2.49
120-139	0.74
140-159	0.35
160-179	0.10
180-199	0.00
>= 200	0.00



# California Water Watch – Understanding Our Current Drought

Drought conditions are not experienced uniformly across California. Water users experience drought differently, depending on the type of water supply being accessed and the user's ability to manage drought impacts.

Dry conditions can quickly lead to impacts for ranchers grazing livestock on non-irrigated rangeland or for rural residents relying on private wells for groundwater. In contrast, large urban water agencies with multiple water sources have the potential to weather multiple dry years. As drought conditions persist, eventually all water users experience impacts.

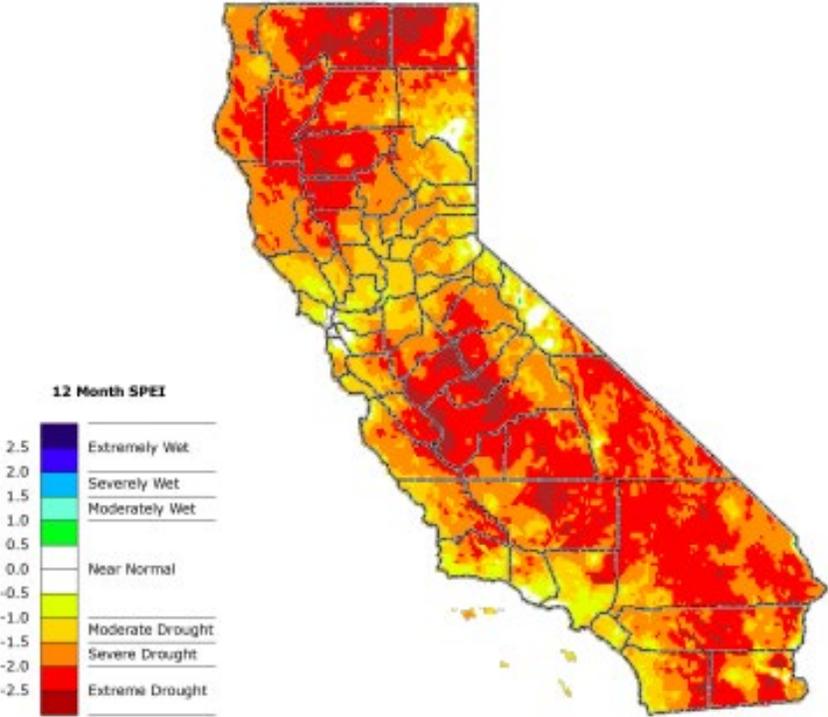
Risk of drought impacts occur when precipitation is below normal levels. Risk also increases when dry conditions combine with above-average temperatures, as has been observed in California's recent droughts.

Maps on this page show three different indicators that provide a measure of the severity of the current drought in California. The use of multiple drought indicators is preferred given the diversity of California's water users. The three indicators displayed here include:

-  "Weather drought indicator" – Indicator represents a measure of atmospheric moisture supply and demand over time by integrating the effects of precipitation, temperature, and evapotranspiration.
-  "Runoff drought indicators" – Indicators represent the effects of changes in atmospheric conditions on a watershed's snowpack and runoff.
-  "Water supply drought indicators" – Indicators represent the amount of surface and groundwater storage available.



# California Water Watch - Understanding Our Current Drought



## Weather Drought Indicator

California is experiencing extreme dryness. Low precipitation combined with higher temperature is resulting in dry conditions throughout the state. This map integrates measures of precipitation, air temperature, and evapotranspiration, key factors in California's water cycle.



**Note:** Map shows the Standard Precipitation-Evapotranspiration Index (SPEI).  
Source: Western Regional Climate Center  
(<https://wrcc.dri.edu/wwdt/index.php?folder=spei12>)



# California Hydrology Update – April 14, 2022

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The California Hydrology Update is a regular summary of current weather conditions in the State of California and serves as a supplement to the data on the California Water Watch website. It is produced by the California State Climatologist, Mike Anderson, and the hydrology and forecasting team at the California Department of Water Resources. For the latest on drought conditions, visit [drought.ca.gov](https://drought.ca.gov). For tips and resources for conserving water, please visit [saveourwater.com](https://saveourwater.com).

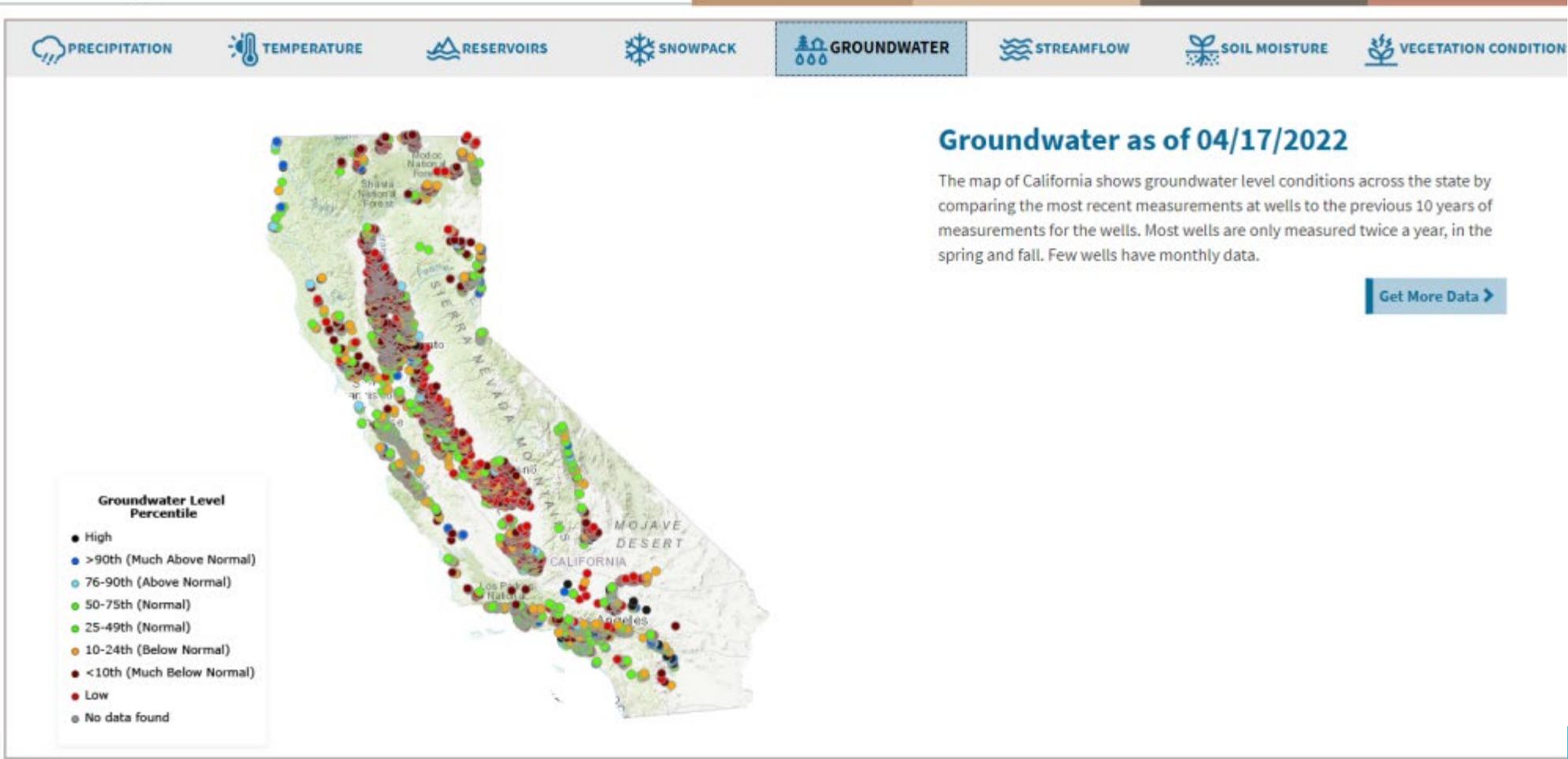
- **Precipitation** To date statewide precipitation for the current water year (October 1, 2021- April 15, 2022), is 70% of average. A series of storms the second week of April brought much needed moisture to Northern California, augmenting the below-average snowmelt and keeping the landscape from drying out as quickly as spring moves toward summer. However, the precipitation was not statewide, and this amount of moisture will not offset the record dry conditions experienced the first three months of 2022.
- **Temperature** A couple of early-season heat waves led to many new high-temperature records across California. Fortunately, the transition month of April also includes the passing weather systems that bring cooler temperatures. In some places like Redding new low-temperature records have been set with clear skies overnight. The cooler days between the heat really help to slow down the drying out of the landscape and offer some respite to urban communities. This pattern is expected to continue through the rest of April.



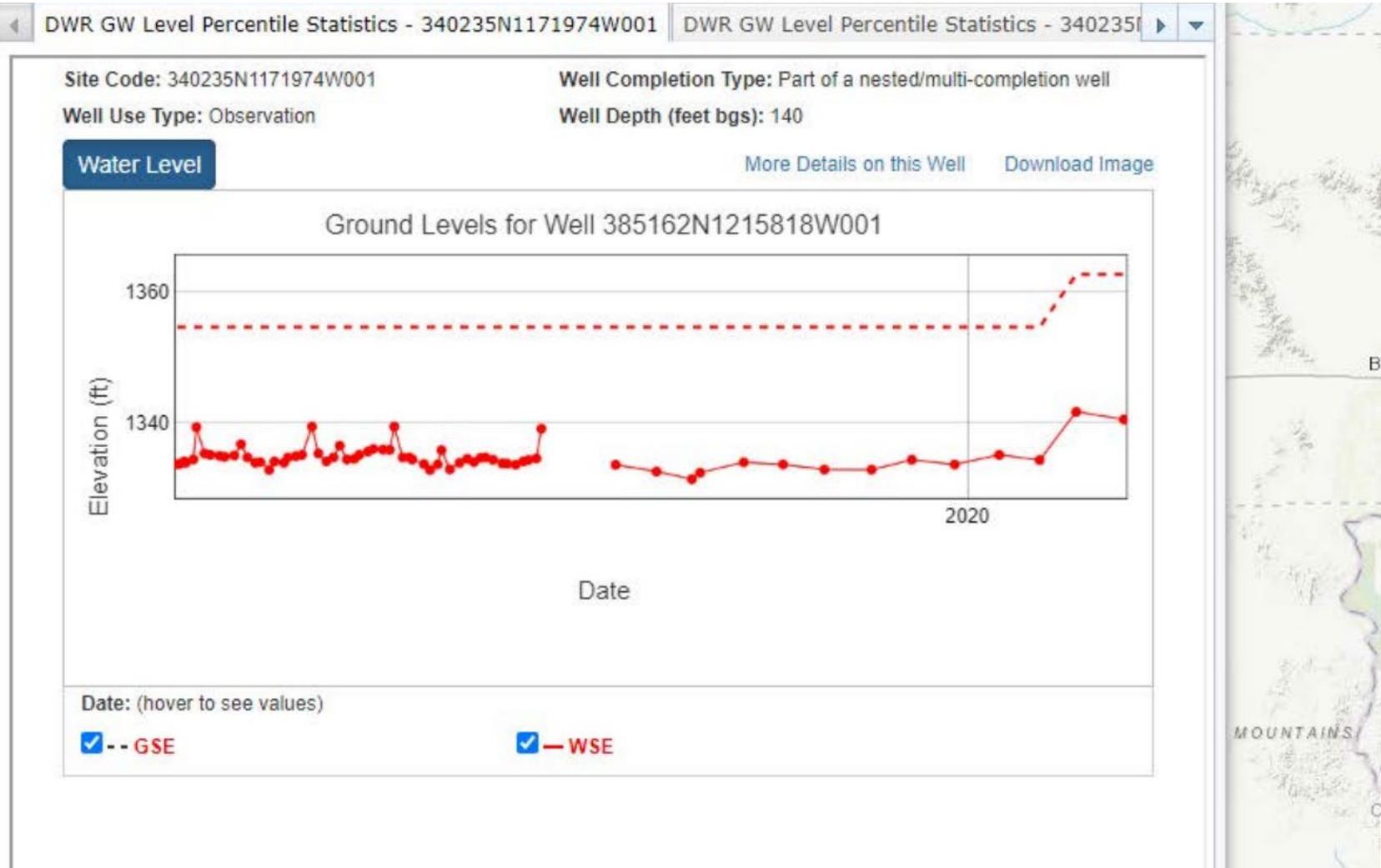
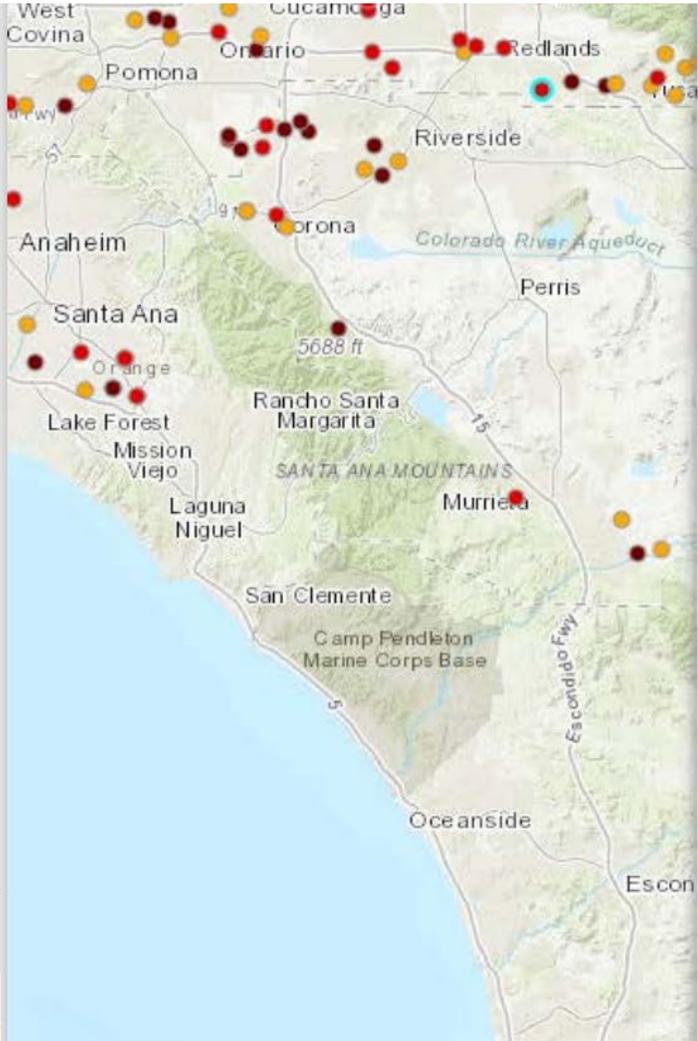
- **Reservoirs** Statewide reservoir storage has increased at a slower pace than normal but has been helped by the recent storms and associated runoff. While it will augment the snowmelt, it will not make up for the below average snowpack and dry conditions from earlier in the year. At the end of March, the statewide storage is at 69% of average storage for this time of year which is consistent with other year 3 droughts at this point in the water year.
- **Snowpack** The peak of the statewide snowpack as measured by the automated sensors appear to have happened on March 8 with about 57% of a seasonal snowpack which equates to 16.1 inches of snow water equivalent or SWE. The April 1 snowpack ended up being in the bottom 10 in the period of record due to the amount of snow melting in March with the lack of storms, clear skies and warmer than average temperatures. The current storms will slow the pace of melt and may add an inch or two which will help the spring runoff but will still be well below average. It is better than the record dry and warm conditions of last year.
- **Streamflow and Groundwater** are also both well below average across much of the state. The start of the calendar year has been much drier than average which intensified drought conditions. Early snowmelt is pushing some Sierra Nevada rivers above values normally seen this time of year, but many areas have already peaked and are now beginning to recede. The recent storms will help sustain flows where precipitation fell. As we head into May and the start of the dry season, the flows will drop off rapidly given the third year of drought and the heat of summer beginning. Groundwater levels will hit their spring peak and then begin to drop as water use picks up and surface supplies are unable to meet demands. Additional heat events and any further spring precipitation will determine how quickly the landscape dries out. The landscape will then continue to dry until the first rains of water year 2023 fall.



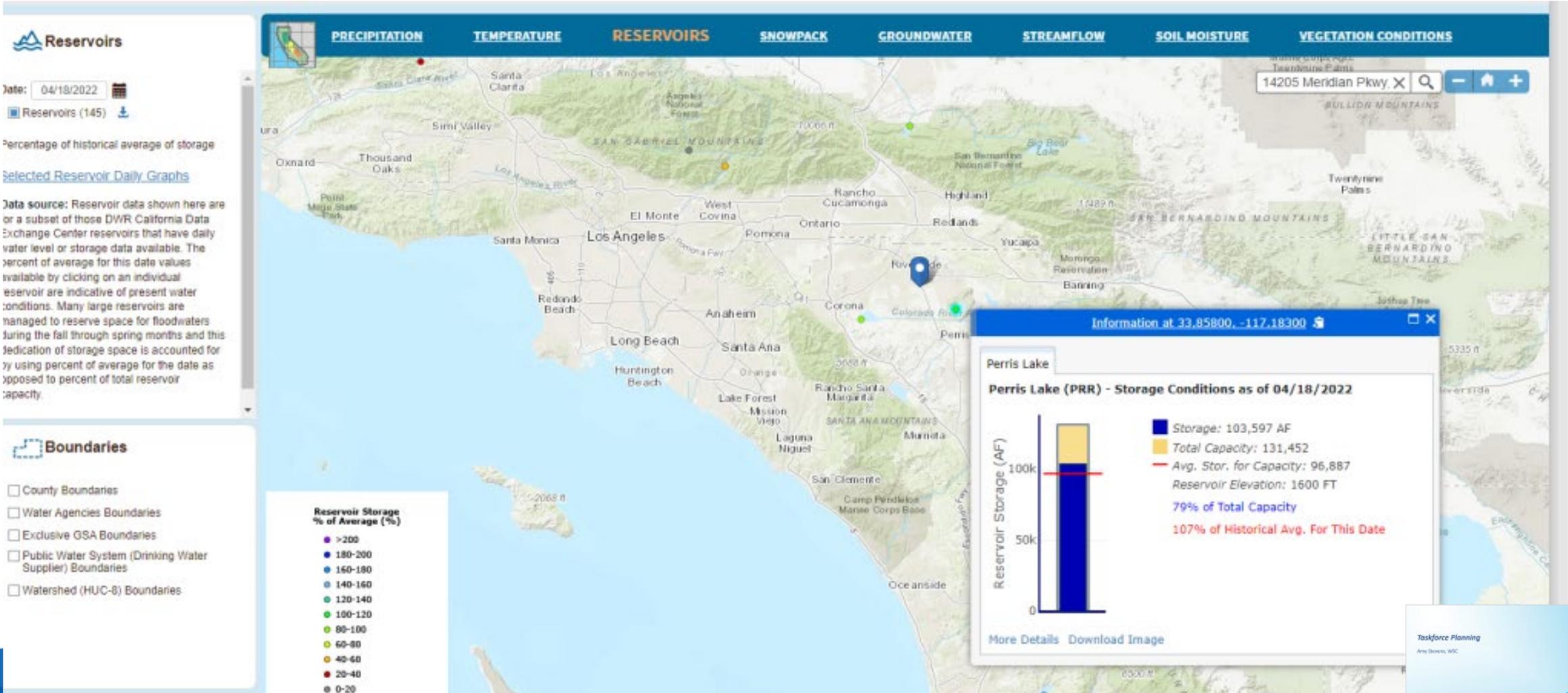
# California Water Watch - Groundwater



# California Water Watch – Groundwater Zoom In



# California Water Watch - Reservoirs



# *Taskforce Planning*

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Amy Stevens, WSC

slido

Rank how beneficial you found each section of the mock task force meeting. (Most beneficial to least)

 Start presenting to display the poll results on this slide.

# *Draft Future Meeting Agenda Outline*

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- Guest Presentation/Update
- Grant/Funding Opportunities and Current Applications
- WSCP Updates
- Communication Update
- Open Forum
- Close



## *Questions to Consider*

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1. What would make this beneficial to you and your agency?
2. Is there anything else we should be striving for to accomplish our goals?
3. What discussions should this group be having?
4. What information would be helpful?
5. Are there any guests that you would like to hear from on a regular basis?
6. How often do we want to meet? Does it align with the drought triggers?



# How will we recognize the next drought in its early stages?

## Drought Task Force Meetings

Provide a forum for members to review data, share updates, and coordinate drought response

Convened based on regional conditions

Regional Drought Stage	Meeting Frequency	Triggers				
		Drought Monitor (DCP Region)	MWD WSAP/Similar Action	Agencies in Declared Shortage*	Statewide Drought Proclamation	Riverside County Drought Proclamation
Normal	Annual	None-Abnormally Dry	--	None	--	--
Watch	Quarterly	Moderate-Extreme Drought	Levels 1 and 2	3 or more	Drought	Drought
Alert	Monthly	Exceptional Drought	Levels 3 thru 5	6 or more	Drought	Drought
Emergency	Weekly	Exceptional Drought	Levels 6 and 10	10 or more	Drought	Drought

\*Not including state mandated shortage



# *Next Steps*

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Amy Stevens, WSC

# Next Steps

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## DCP

- 5/11 – Comments due on the Draft DCP from the Task Force
- Mid-June – incorporate Task Force comments into the Final DCP for adoption by Western's Board

## Task Force Meetings

- Planning Committee Volunteers? Contact Melissa: [mmatlock@wmwd.com](mailto:mmatlock@wmwd.com)
- Watch your emails for upcoming calendar invite and agenda





Appendix I – DCP Adoption Resolution