



## **2019-2023 Business Plan**

**Pioneering.  
Visionary.  
Agile.  
Driven.**

*That's who we are.  
That's what we do.*





# **2019 - 2023 Business Plan**

**October 2018**

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## Message from the General Manager

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The San Diego County Water Authority was created by a legislative act in 1944 and tasked with the mission of providing a safe and reliable water supply to our member agencies serving the San Diego region. From inception, the Water Authority has faced and overcome significant economic, environmental, and regulatory challenges and a major key to our success has been the organization's ability to anticipate and adapt to these challenges. As a result, the Water Authority has achieved numerous important accomplishments, including the completion of the Claude "Bud" Lewis Carlsbad Desalination Plant, the 2015 Urban Water Management Plan, the San Vicente Dam Raise, and the updated Long-Range Financing Plan.

The Water Authority's Business Plan – presented originally to the Board of Directors in 2004 – is a key planning document that provides the roadmap for Water Authority staff to communicate, coordinate, and focus efforts towards meeting organizational goals. Throughout the years, the Business Plan has evolved, reflecting the addition of new challenges and changes to Water Authority policy and programs.

We have updated the 2017-2021 Business Plan to look forward for the next five years. The 2019-2023 Business Plan contains updates from the previous plan to include new objectives and tactics. The Business Plan highlights three key focus areas: Water Supply, Water Facilities, and Business Services. The plan contains updated programs and management strategies that reflect the organization's continued emphasis on water system management, system reliability, regulatory compliance, and financial stability. Objectives have also been updated to reflect the organization's emphasis on cybersecurity, energy

management, innovation, and workforce development. Near-term and long-term objectives and tactics, which are clearly linked to management strategies and key performance indicators to track continuous improvement, have been identified for each Business Plan program. As a leader on water issues statewide, the Water Authority continues to be a forward-looking agency, striving to anticipate future challenges, seek out opportunities, and respond quickly to our changing environment.



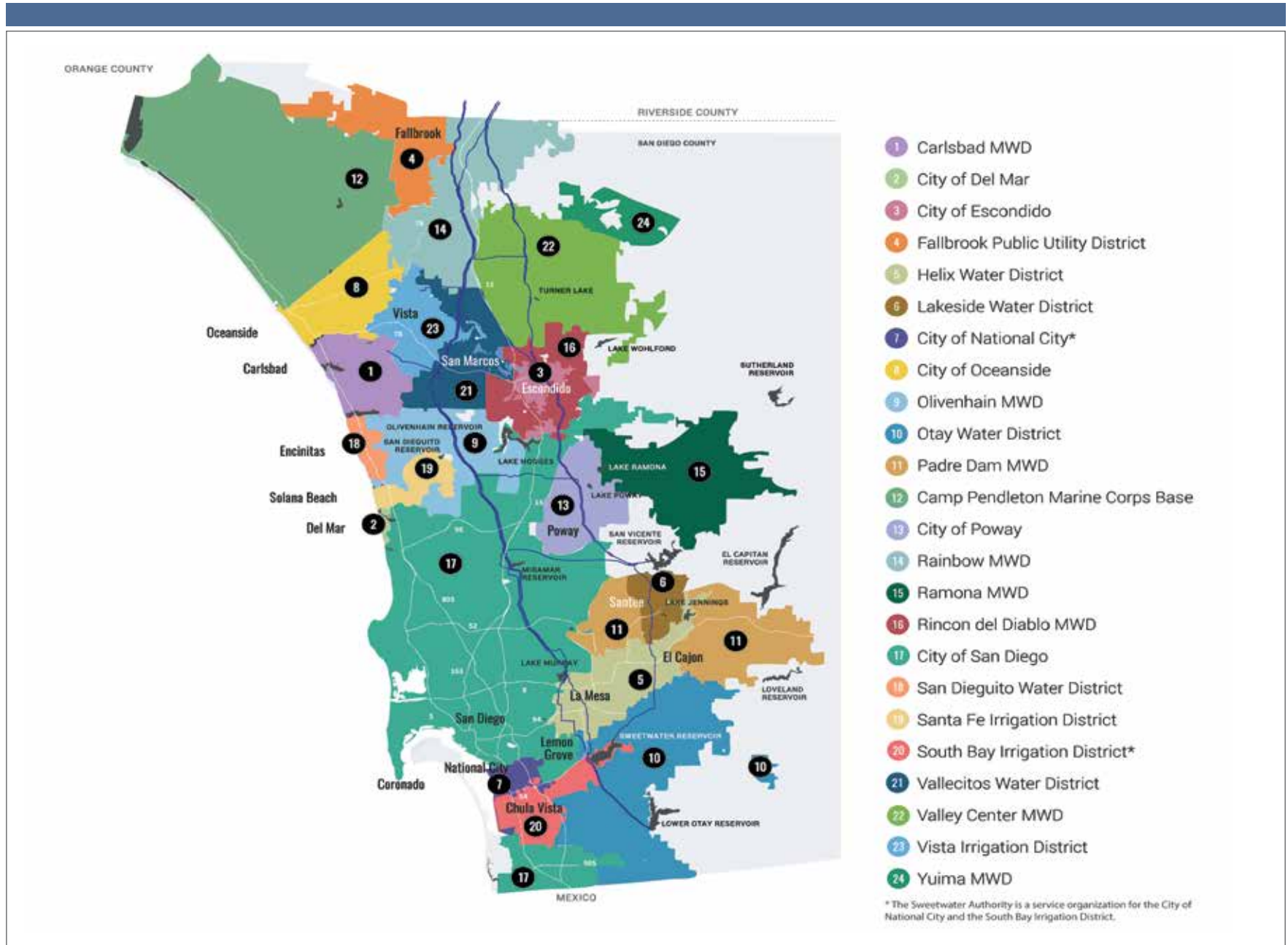
Maureen A. Stapleton  
General Manager

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FIGURE 1.1 The San Diego County Water Authority Member Agencies & Service Area



# Introduction

## Business Plan Overview

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The San Diego County Water Authority Business Plan describes the key focus areas, programs and program focus areas, management strategies, and objectives and tactics along with key performance indicators necessary to carry out the policies and strategic direction set forth by the Water Authority Board of Directors. Based on a five-year horizon, the plan is updated biennially in accordance with guiding principles and policies, related planning documents, and an analysis of current business trends.

The Water Authority's member agencies are represented through a 36-member Board of Directors. The Water Authority was formed by the California State Legislature under the County Water Authority Act, which established the Board of Directors as the agency's governing body. The County Water Authority Act authorizes the Water Authority to acquire water and water rights; construct, operate, and maintain facilities; tax; and incur bonded indebtedness.

The Board has adopted principles and policies that guide the Water Authority in its business practices. Among these are: the Debt Management and Disclosure Policy and Fiscal Sustainability Policy that ensure savings from refunded debt are maximized and financial stability for the agency, the Energy Management Policy that provides guidance on the development of energy related projects and programs, the Legislative Policy Guidelines that

provide a framework for evaluation of potential impacts to the Water Authority from state and federal legislation, and Bay-Delta and WaterFix Policy Principles that guide staff in evaluating the Bay-Delta initiatives. A complete list of the Water Authority's guiding principles and policies is provided in Appendix 1.



As the governing body of the Water Authority, the Board of Directors meet to ensure a safe and reliable water supply for the San Diego region..

**Business Plan Key Focus Areas & Programs**

Business Plan programs are divided into three key focus areas: Water Supply, Water Facilities, and Business Services. Each key focus area is divided into programs that contain the management strategies, objectives and tactics, and key performance indicators necessary to achieve the Water Authority’s mission.

**Water Supply**

The Water Supply key focus area consists of three programs that support the Board of Directors’ adopted level of water supply diversification.

**Water Facilities**

The Water Facilities key focus area consists of three programs that are designed to implement the Board of Directors’ cost-effective asset management strategy.

**Business Services**

The Business Services key focus area consists of four programs that are essential, in that they include the majority of the Water Authority’s business operations required to execute the activities of the previous two key focus areas.

**FIGURE 1.2 Business Plan – Key Focus Areas and Programs**

WATER SUPPLY			WATER FACILITIES			BUSINESS SERVICES		
	Imported Water			Infrastructure/ Capital Improvement Program			Business Support	
	Local Water			Sustainability			Communication and Messaging	
	Resource Planning			Water System Management			Financial Management	
							Workforce Management	

**FIGURE 1.3 Planning Documents by Business Plan Focus Areas/Programs**

KEY FOCUS AREA	WATER SUPPLY			WATER FACILITIES			BUSINESS SERVICES			
PROGRAM	IMPORTED WATER	LOCAL WATER	RESOURCE PLANNING	INFRASTRUCTURE / CIP	SUSTAINABILITY	WATER SYSTEM MANAGEMENT	BUSINESS SUPPORT	COMMUNICATION AND MESSAGING	FINANCIAL MANAGEMENT	WORKFORCE MANAGEMENT
AQUEDUCT OPERATING PLAN		■		■		■	■	■		■
ASSET MANAGEMENT PLAN				■		■	■	■	■	■
CLIMATE ACTION PLAN					■		■	■		
COMPREHENSIVE ANNUAL FINANCIAL REPORT	■	■	■	■	■	■	■	■	■	■
GENERAL MANAGER'S MULTI-YEAR BUDGET	■	■	■	■	■	■	■	■	■	■
INTEGRATED REGIONAL WATER MANAGEMENT PLAN		■	■		■		■	■		
LONG-RANGE FINANCING PLAN	■	■	■	■	■	■	■	■	■	
QUANTIFICATION SETTLEMENT AGREEMENT	■	■	■				■	■	■	
REGIONAL WATER FACILITIES OPTIMIZATION & MASTER PLAN		■		■	■	■	■	■	■	■
URBAN WATER MANAGEMENT PLAN	■	■	■	■				■	■	
WATER SHORTAGE CONTINGENCY PLAN	■	■	■	■				■	■	■

- Primary planning document
- Secondary planning document

## Related Planning Documents

The Business Plan serves as an overarching planning tool to assist the Water Authority in accomplishing its mission of providing a safe, reliable water supply to the region. To the left is a table of the supporting planning documents highlighting their impacts on the key focus areas of Water Supply, Water Facilities, and Business Services and their respective programs. A description of each plan is provided in Appendix 2.

## Current Business Trends

The water utility industry is similar to other factions of the American economy. The industry is subject to, and must be agile in adapting to changing economic conditions, societal perceptions, governmental regulations, environmental issues and sustainability, and technological security. The Water Authority faces an increasingly challenging future, and as a result must continue to develop pioneering strategies and execute a visionary approach to the management of water. Trends that are critical to the Water Authority's business operations are organized into the following categories: economic/business, societal/political, technological, and environmental.

### Economic/Business Trends

#### Fiscal Sustainability

The Water Authority has a long history of prudent financial management and financial planning. Identifying fiscal challenges well in advance, the Water Authority has successfully maintained its fiscal health through the financial crisis and subsequent recession of 2008, and the multi-year drought. One example of a proven success for crafting innovative solutions is the Supply Reliability Charge, which further diversifies the fixed/variable revenue mix and ensures equitable recovery of supply reliability investments. Looking forward, the Water Authority will be focused on addressing the challenges facing water supply availability, providing affordable and reliable water to the region, providing smooth and predictable rates and charges, and funding the asset management program.



Low unemployment levels in the County reflect an economy on the rise.

#### Economic Conditions

San Diego County's economic condition has improved significantly as unemployment levels are at their lowest level in 18 years and home construction and home prices continue to rise. The economic development will drive water demands up in the future for both residential and commercial users, and increase the property tax related revenues the Water Authority receives. Growth related revenue from capacity charges, a highly volatile revenue stream, is also expected to increase.

### **Workforce Planning**

The world of work is changing, and Workforce Management continues to be one of the greatest challenges facing the public sector today. Surrounded by a rapidly evolving world, volatile economies, environmental impacts, rapid changes in technology, and the changing needs of the workforce require the public sector to think differently about how to shape our organizations. The focus on five key areas: 1) Leadership, 2) Culture, 3) Talent, 4) Communication, and 5) Technology will help to shift our organization to a higher level of performance and to strategically position the Water Authority as a driver of change and innovation.

## **Societal/Political Trends**

### **Intergovernmental Relations**

The nexus between regional growth and water is an ongoing and important discussion. While the San Diego region's growth rate has slowed, the population is still increasing. Between 2000 and 2015, the region's population increased approximately 15 percent. This equates to roughly 414,000 more people in the region. The Water Authority continues to work closely with local and regional land-use agencies and continues to focus on state and federal level coordination. A significant portion of our water supply is integrated with large and complex water systems, such as the Colorado River and Bay-Delta. Taking an active role in the intergovernmental arena and advocating for our region will continue to be necessary to ensure supply reliability.

### **Integrated Public Policies**

The Water Authority's involvement with regional agencies is key for the integration of public policies affecting energy, housing, transportation, and water quality and supply. Advocating for the clarification of policies is in the public's best interest to ensure public agencies work in a consistent direction for the benefit of the region.

### **Transparent and Open Disclosure**

The Water Authority strives to make decisions that positively contribute to the well-being of citizens today and in the future. Organizations with transparent and open disclosure of performance information strengthen the water industry and communities. The Water Authority will continue to be transparent and demonstrate a willingness to be forthright with information. This willingness stresses accountability, supports continuous improvement, builds stakeholder trust, reinforces credibility, and educates and serves the public.



The Colorado River provides the San Diego region with a portion of its imported water supply.

### Public and Private Partnerships

The Water Authority has successfully engaged in partnerships with its member agencies, the private sector, community organizations, and ratepayers. These partnerships have resulted in the construction of the Twin Oaks Valley Water Treatment Plant, Helix Water Treatment Plant, San Vicente Dam Raise, Claude “Bud” Lewis Carlsbad Desalination Plant, and the creation of innovative water use efficiency programs. When cost-effective and feasible, the Water Authority and its member agencies will identify and evaluate opportunities for collaboration with each other and private enterprises to provide services and water supplies.

### Renewal and Replacement of Aging Infrastructure

Each year the American Water Works Association (AWWA) releases a State of the Water Industry Report based on responses to an annual survey of industry professionals. The survey provides an industry-wide self-assessment and gathers information to support the water community’s major challenges. The 2018 report identified renewal and replacement of aging water infrastructure as the number one issue for the fourth year in a row. The Water Authority has remained vigilant with managing our infrastructure starting with pipeline rehabilitation in the 1980’s and establishing a formal management program in 1992. Overall, we continue to invest in our critical water conveyance infrastructure through the Asset Management Program. The overall goal of the program is to manage infrastructure assets by analyzing a broad spectrum of risks and optimizing the timing of infrastructure rehabilitation spending. Over the past decades, the program has completed more than 45-miles of pipeline rehabilitation, the scanning and evaluation of more than 120-miles of a pipelines, and visually inspected all 310-miles of pipelines in the system.



Crews repair equipment at one of the Water Authority’s flow control facilities.

## Technological Trends

### Technology

The Water Authority has been very successful at fostering innovation and the use of new technologies to help meet the changing needs of the water industry. Moving forward, the Water Authority will continue to leverage new technologies to support the areas of communication, planning and design, daily operations, and business services. The water industry, like many others, has seen an increase in cybersecurity threats, and the Water Authority continues collaborate with other organizations to promote coordinated security responses and adopt mitigation methods to protect and secure its technical infrastructure. The Water Authority is also optimizing its maintenance activities by using new technology and in-house developed

inspection technologies. The innovation program, a relatively advanced idea for a public agency, will help the Water Authority continue to be a technology pioneer that pursues cost efficient solutions to help safeguard critical water assets and increase the value to customers.

### **Potable Reuse Water**

Reuse water is part of a natural cycle. The Earth's water supply is a closed loop system, with all the water on our planet being used over and over again. Water can be reused safely, efficiently, and in a sustainable manner. For these reasons, it is a viable part of the Water Authority's supply portfolio. To achieve the Water Authority's mission to secure a safe and reliable water supply for the region, it is important to beneficially reuse our water supply in the region.



The Water Authority and its member agency staff are actively pursuing potable reuse initiatives. Photo of the Advanced Purification Demonstration Facility courtesy of Padre Dam MWD.

## **Environmental Trends**

### **Climate Change**

The climate is becoming increasingly warmer and drier, and ocean levels are on the rise. Snowfall in the Sierras, a major source of water for California, is occurring later and melting earlier, therefore, reducing the supply of water. In addition, the State of California now mandates that government agencies address climate change impacts and reduce their carbon footprint.

### **Energy Demand**

The Water Authority recognizes that energy is a significant cost in treating and delivering water to its member agencies. The Water Authority is pursuing opportunities to reduce these costs and energy demands through a variety of energy initiatives that include agency-wide planning, regulatory and legislative engagement, operations of existing energy facilities, and diversification of its energy supply portfolio. These initiatives will ensure the Water Authority's success in helping to stabilize water rates, reduce greenhouse gas emissions, and address economic and electrical system reliability risks.

### **Environmental Sustainability**

A commitment to support cost-effective sustainability programs that will benefit the environment and promote thoughtful stewardship of natural resources is essential to decreasing the impact to ratepayers, reducing the environmental impacts of Water Authority operations, conserving energy and water, and helping the Water Authority better anticipate and adapt to the impacts of climate change. The Water Authority is engaged in a variety of sustainability initiatives, such as the development of renewable energy sources, the reduction in fleet emissions, and a decrease in waste production. These initiatives help to ensure the Water Authority is reducing its impact on the environment and making a positive contribution to a more sustainable future for the region.

### **Natural Disasters**

The Water Authority recognizes its responsibility to be prepared and to respond quickly, safely, and effectively to emergency situations that arise within our jurisdiction. Building partnerships with other utilities and businesses for mutual aid, establishing clear public communication procedures, and having resources in place to effectively meet the needs at hand are evidence of our commitment to the well-being of the communities we serve.

### **Limited Local Water Supplies**

Traditional sources of water supplies, such as local surface water and groundwater, are limited and becoming less reliable. While historically these supplies represent the least-costly source of water, climate change may negatively impact these already scarce water resources. As a result, they will continue to comprise a smaller percentage of our water supply portfolio and make the development of additional supply sources and increased water use efficiency essential.



The regional surface water yield is supported by 24 surface reservoirs. The Olivenhain Reservoir, completed in 2003, is the region's newest reservoir.

## **Business Plan Performance Assessment**

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Water Authority Management will conduct periodic performance assessments of the Business Plan objectives and tactics, and key performance indicators. These assessments will be presented to the Board of Directors and the public annually. The performance report, as well as an electronic version of the Business Plan document, are available online at [www.sdcwa.org/mission-vision-values-strategies](http://www.sdcwa.org/mission-vision-values-strategies).

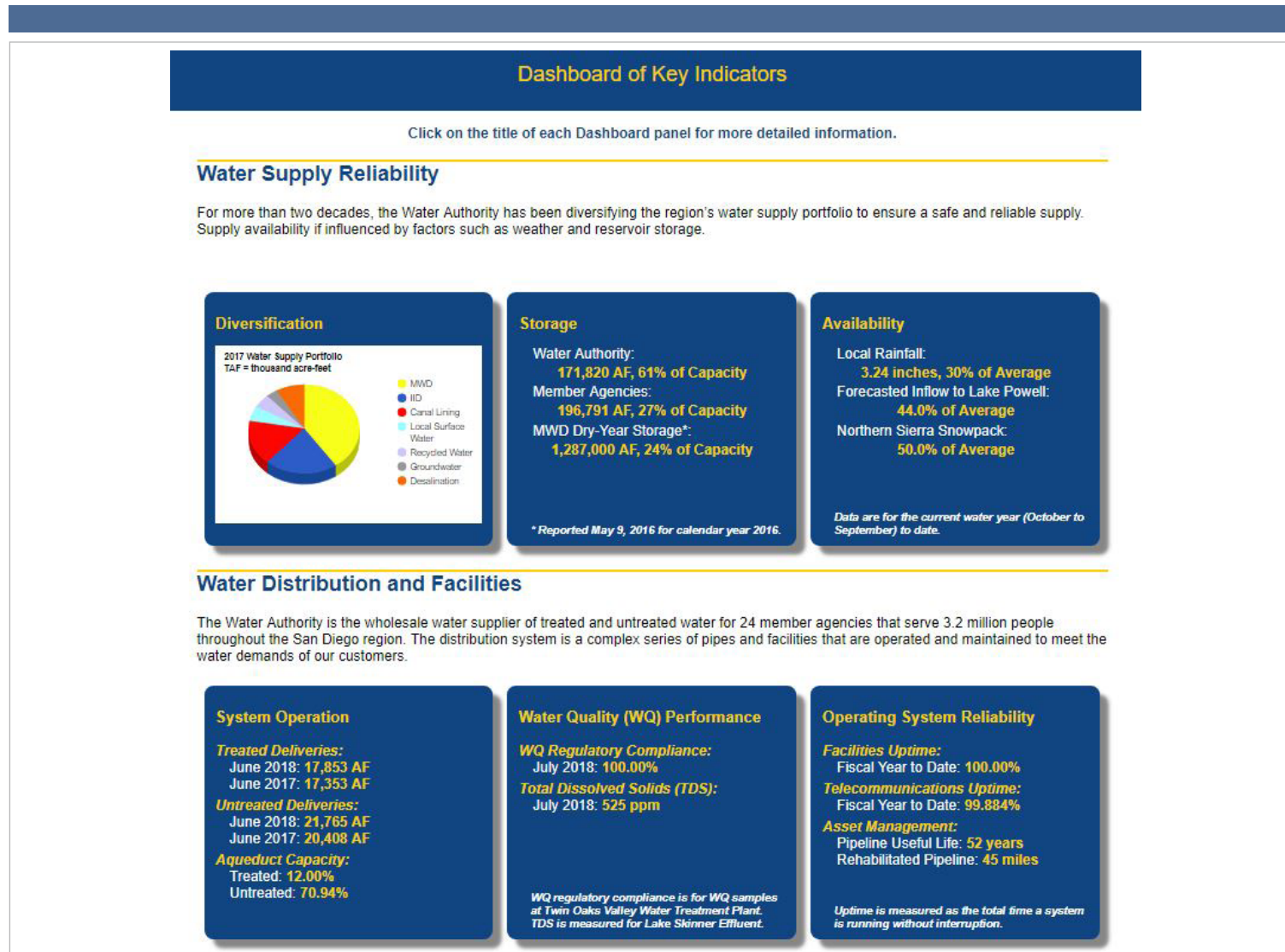
## **Agency Dashboard of Key Performance Indicators**

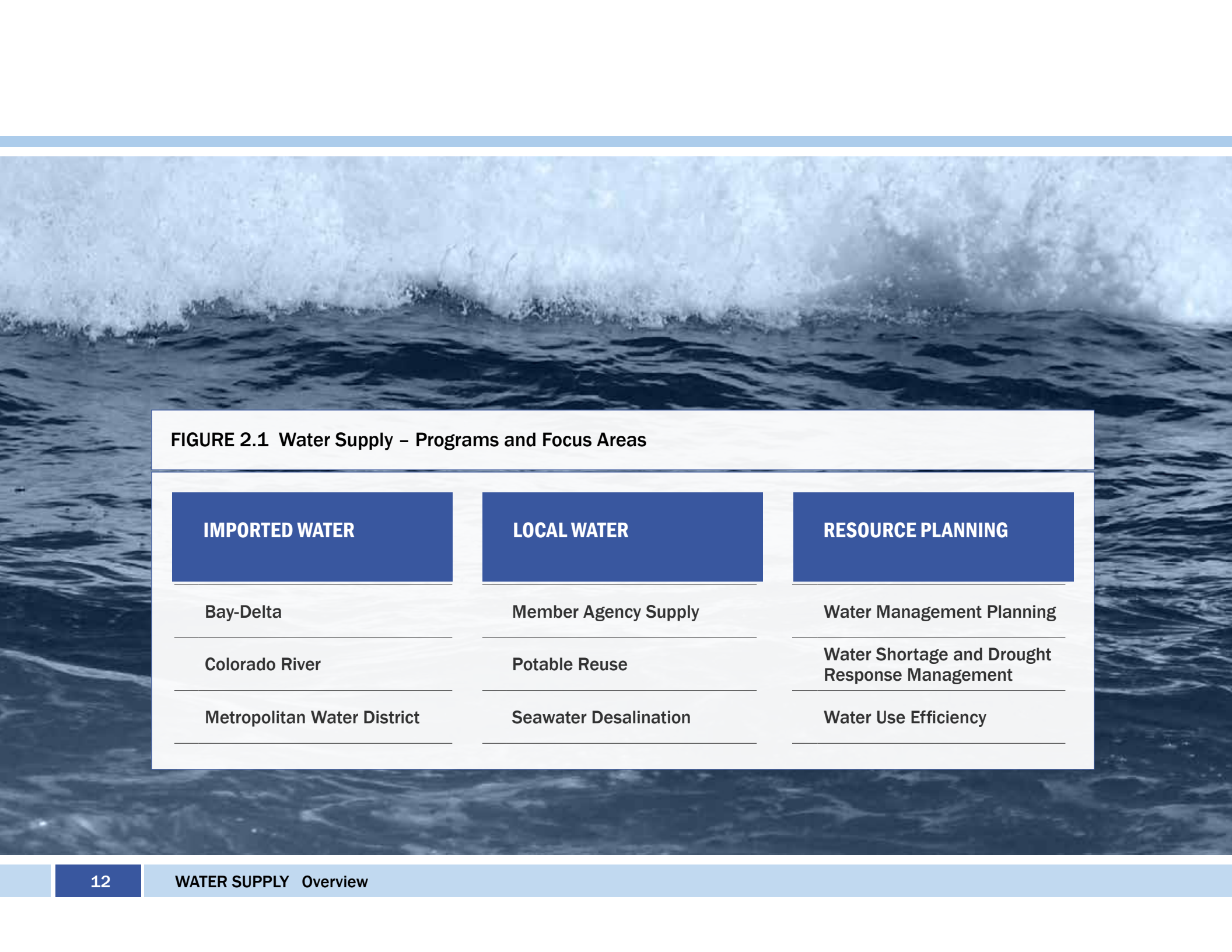
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The online Water Authority Agency Dashboard displays agency-wide key performance indicators in the focus areas of water supply reliability, water distribution and facilities, and financial responsibility. Many of the key performance indicators are linked to Business Plan objectives and tactics, making it another useful tool for monitoring Water Authority activities towards achieving its mission of providing a safe, reliable water supply to the region. Detailed descriptions of the Water Authority Dashboard focus areas and key performance indicators are provided in Appendix 3.

The Water Authority Dashboard is available online at [www.sdcwa.org/dashboard](http://www.sdcwa.org/dashboard) and is continuously updated to ensure the most current status is available on each of the key performance indicators.

FIGURE 1.4 Agency Dashboard of Key Performance Indicators ([www.sdcwa.org/dashboard](http://www.sdcwa.org/dashboard))





**FIGURE 2.1 Water Supply – Programs and Focus Areas**

IMPORTED WATER	LOCAL WATER	RESOURCE PLANNING
Bay-Delta	Member Agency Supply	Water Management Planning
Colorado River	Potable Reuse	Water Shortage and Drought Response Management
Metropolitan Water District	Seawater Desalination	Water Use Efficiency

# Water Supply

## Water Supply Overview

The Water Supply focus area consists of three programs: **Imported Water**, **Local Water**, and **Resource Planning**.

Imported Water addresses the long-term viability, sustainability, and fiscal issues surrounding the Water Authority's imported water supplies. Local Water supports the on-going execution of the Water Authority's and member agencies' water supply diversification strategy. Resource Planning guides the Water Authority as it strives to carry on its visionary planning and implementation of pioneering water resource management and water efficiency programs and strategies.

Ensuring a diverse water supply portfolio supported by the long-term sustainability of local and imported water supplies depends on close coordination and collaboration with our member agencies and the public. Engaging stakeholders and influencing regulatory and legislative policy will help the Water Authority and the region plan for the future, obtain necessary funding, develop the necessary infrastructure, and attain our water reliability objectives.

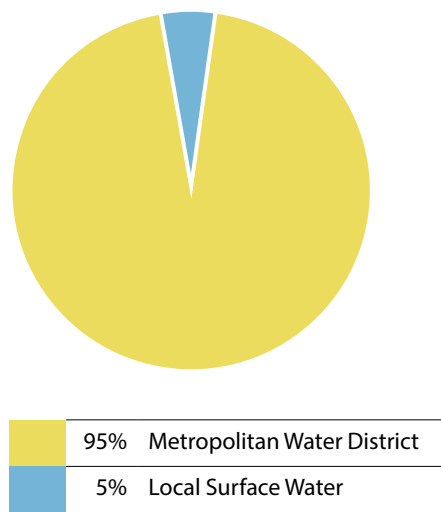
Key issues of the Water Supply focus area include:

- ▶ Ensuring appropriate cost allocation and long-term viability of imported water supplies
- ▶ Supporting regulatory efforts for potable reuse as the “next increment” of water supply for the region
- ▶ Advancing long-term water use efficiency practices in the region

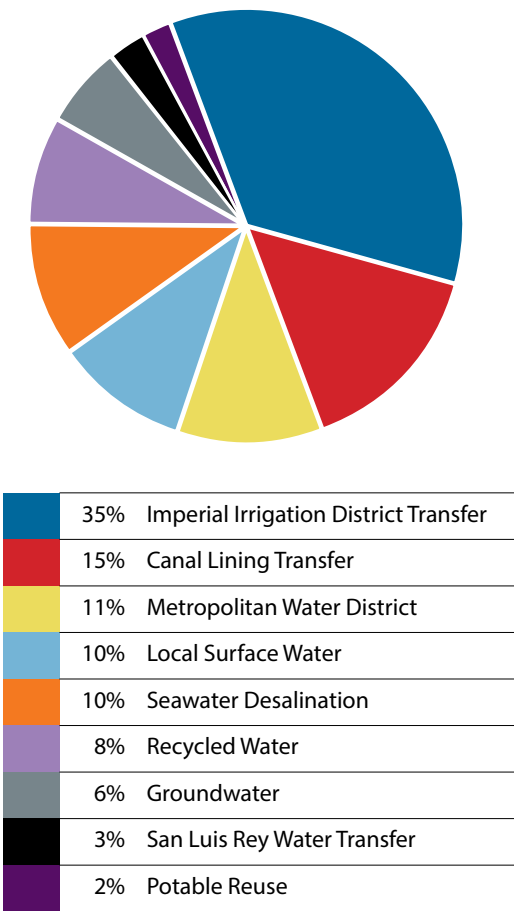


The Claude “Bud” Lewis Carlsbad Desalination Plant provides a highly reliable local water supply to the region.

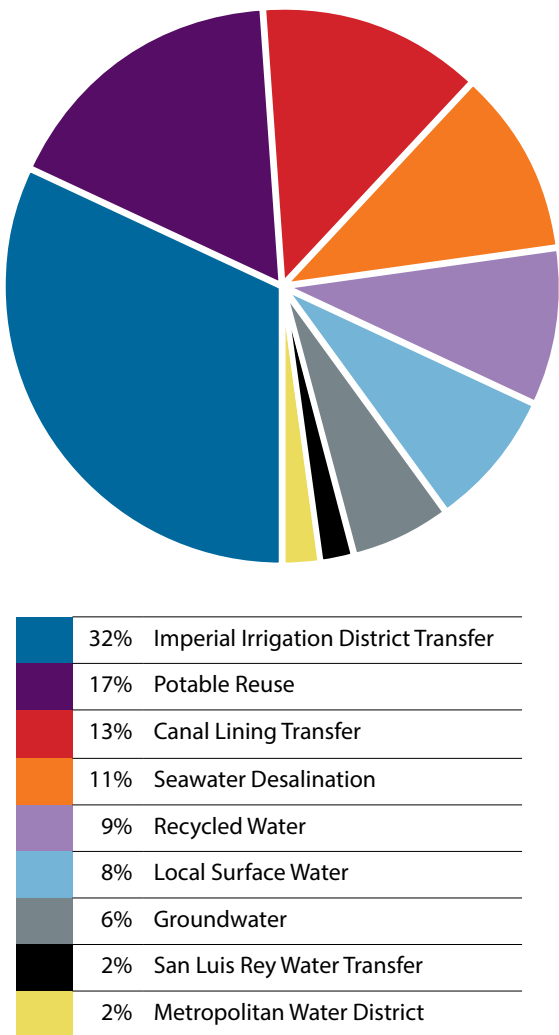
**Figure 2.2**  
1991 Water Supply Portfolio



**Figure 2.3**  
2020 Water Supply Portfolio\*



**Figure 2.4**  
2035 Water Supply Portfolio\*



*\*Based on interim demand forecast reset and includes verifiable and additional planned local supply projects from the 2015 Urban Water Management Plan.*

## Imported Water Overview

The Water Authority receives imported water as a member agency of the Metropolitan Water District of Southern California (MWD) and from our Quantification Settlement Agreement (QSA) water transfer with the Imperial Irrigation District (IID) and canal lining projects. These imported supplies from the Sacramento Bay-Delta and Colorado River are vital to providing a diversified and sustainable water supply to the San Diego region.

The Water Authority's government relations team pioneers our advocacy efforts through active engagement of various governmental decision-making levels on Bay-Delta issues to ensure the Water Authority is an integral part of the Bay-Delta solution and that San



As a result of the Quantification Settlement Agreement, the lining of the All-American Canal contributes to San Diego's imported water supply.

Diego ratepayers' interests are protected. The team also works closely with the Governor's office, state legislators, federal officials, state agencies, water agencies, and interested stakeholders to develop agile and visionary solutions that ensure California WaterFix is properly allocated as a supply cost.

The Colorado River Program advocates the Water Authority's position on developing state and federal issues associated with the seven Colorado River Basin States agreements and QSA, including environmental issues at the Salton Sea. The program continues to ensure the completion of QSA milestones for the timely creation and delivery of scheduled volumes of IID water transfer and canal lining supplies. Going forward, a vital component of the program will be to safeguard these supplies during negotiations related to continued drought in the Colorado River Basin and to look for new and flexible ways to store these supplies. Additionally, our satellite public outreach office in the Imperial Valley drives our advocacy efforts on QSA and Salton Sea issues and quickly responds to stakeholder concerns.

The Metropolitan Water District Program promotes creative and sustainable ideas at MWD to ensure its long-term viability as Southern California's imported water provider. Paramount to MWD's longevity and relevancy is the need for it to comply with the law and to be nimble and adaptive in reaction to changing conditions. The Metropolitan Water District Program team works closely with the Water Authority's Board Officers and Delegates to MWD to advocate for the Water Authority's policies and objectives with MWD, its member agencies, the state, and other interested stakeholders. Ensuring MWD's rate-setting practices are lawful is vital to the Water Authority's ratepayers. The

initiation, in 2010, of the Water Authority's rate litigation against MWD was a bold step towards that objective. As a result of one phase of the litigation, the Water Authority affirmed MWD member agencies' right to challenge MWD without threat of retaliation. In addition, the Water Authority regained eligibility to access MWD's Local Resources Program funding; was awarded a refund of illegally charged Water Stewardship Rate payments on the Water Authority's QSA supplies; and secured a higher preferential right to MWD water that is approximately equivalent to an additional 100,000 acre-feet annually. The Water Authority aims to sustain these successful outcomes in the pending cases and obtain the region's proportional share of Local Resources Program funding.

## Imported Water Focus Areas

The focus areas of the Imported Water Program are **Bay-Delta**, **Colorado River**, and **Metropolitan Water District**. Within each focus area are strategies to accomplish the major objectives and tactics over the next five fiscal years.

### Bay-Delta

The Water Authority is actively engaged in Bay-Delta activities as this is one of the important sources of San Diego's imported water supply. Environmental conditions in the Bay-Delta are not sustainable, and the resultant water supply reliability uncertainties associated with Bay-Delta conditions impact the predictability of State Water Project water supply available to the San Diego region. The state is implementing the California WaterFix project to mitigate the impact of future environmental regulations on water supply. On August 9, 2018, the Water Authority Board of Directors adopted policy principles that convey the Water Authority's support for the California WaterFix project on the condition that MWD properly allocates the project's costs as

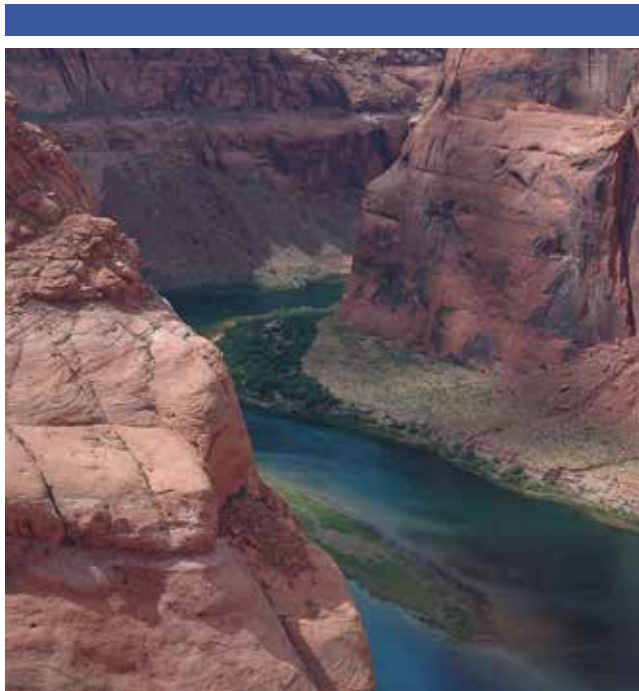
conservation or supply charges. The Water Authority will implement management strategies that ensure costs for fixing the Bay-Delta are equitably and fairly apportioned among MWD's member agencies, and commensurate with the water supply quantity and water quality benefits received. Main objectives and tactics driving these management strategies include bolstered outreach and advocacy of the Water Authority's support of the project conditioned on proper cost allocation, and ensuring that WaterFix's cost recovery does not disproportionately impact San Diego County ratepayers.

### Colorado River

The Water Authority's independent Colorado River supplies from our conserved water transfer with IID and canal lining projects are critical to our region's water



Environmental conditions in the Bay-Delta impact the availability of State Water Project water supply deliveries to the San Diego region.



Successful implementation of the Quantification Settlement Agreement milestones is one of the key strategies of the Colorado River program.

supply. The key management strategies and objectives of the Colorado River focus area include successfully implementing QSA milestones and environmental mitigation requirements, developing innovative options for flexibility in QSA deliveries as annual transfer volumes ramp up through 2021, and protecting our Colorado River supplies. In 2017, the Water Authority Board of Directors approved the extension of the Exchange Agreement with MWD to match the 45-year term of the IID Water Transfer Agreement. This action has generated renewed interest in considering alternative conveyance of the transfer water should the transfer be extended beyond the 45-year mark. Additionally, mitigation water delivered to the Salton Sea since 2003 ended in 2017, shifting the focus of mitigation efforts to cost-effective on-the-ground air quality projects at

the sea to ensure environmental impacts of the QSA are fully addressed. The Water Authority will continue to ensure all required environmental mitigation is implemented at the Salton Sea through the QSA Joint Powers Authority. Finally, in 2017 the Water Authority successfully coordinated with other agencies on drafting a Stipulated Order adopted by the State Water Resources Control Board. The Stipulated Order further establishes the state's obligation to meet a series of milestones in implementing its phased approach to restoration, through its Salton Sea Management Program (SSMP). The Water Authority will actively monitor the State's progress and work collaboratively with other stakeholders to advance implementation of the SSMP.

The Water Authority will continue to work with QSA partners, other stakeholders, and the government relations team to safeguard Water Authority Colorado River supplies through drought contingency planning negotiations, and work towards a storage solution in Lake Mead. These actions drive many of the objectives and tactics developed for this focus area.

### **Metropolitan Water District**

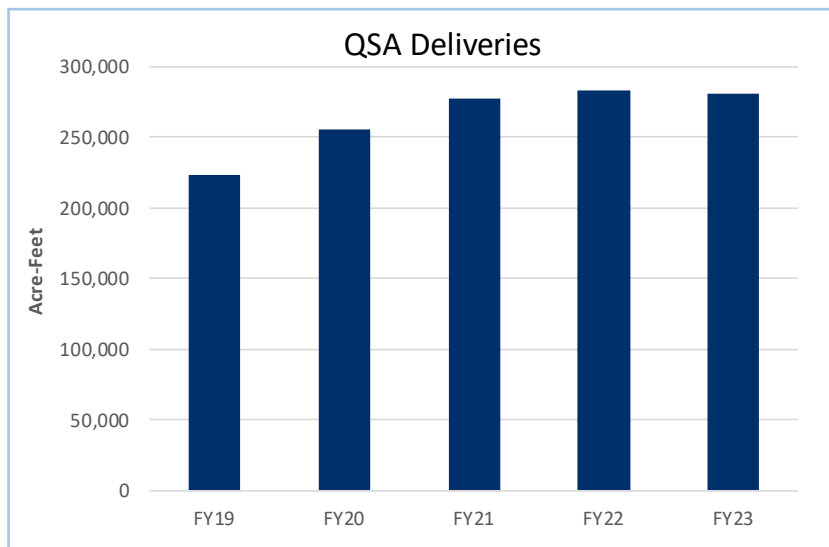
The Metropolitan Water District Program is responsible for developing and implementing strategies to achieve the Water Authority's long-term reliability and fiscal sustainability goals at MWD, in accordance with the Water Authority Board of Directors' strategic objectives. The Water Authority drives advancement of policies at MWD that: embrace transparent governance, legal rate setting, fiscal responsibility, and reliable supplies; create equity and fairness among MWD member agencies; and facilitate water transfers and effective resources management. The MWD management strategies aim to promote the Water Authority's positions on issues affecting MWD supply reliability, quality, cost and its long-term fiscal sustainability. Major tactics focus on gaining support and advocating for the Water Authority's position on key MWD policy concerns.

BAY-DELTA	COLORADO RIVER	METROPOLITAN WATER DISTRICT
A. Advocate Board policies regarding Bay-Delta issues, funding initiatives, and the California WaterFix to federal, state, local, and other stakeholders.	C. Develop flexibility in Quantification Settlement Agreement implementation.	H. Support MWD Delegates in identifying, maintaining, and advancing Water Authority strategic goals at MWD.
B. Protect ratepayers from paying an inequitable share of California WaterFix costs by ensuring project costs are properly assigned in MWD's rate and charges and are consistent with DWR's historic practice of assigning similar projects as "conservation", or supply charges.	D. Safeguard Water Authority investments from outside influences.	I. Influence policy decisions at MWD to ensure its long-term sustainability as a supplemental imported water supplier.
	E. Ensure completion of Quantification Settlement Agreement environmental mitigation milestones and Salton Sea activities.	J. Ensure the Water Authority receives its fair share of investments at MWD.
	F. Leverage opportunities to increase involvement in Colorado River Basin-wide programs, including storage opportunities in Lake Mead.	K. Advocate for equity and transparency in MWD's decision making processes.
	G. Advance Water Authority Quantification Settlement Agreement policy through continuing dialogue with governing bodies, elected officials, and the public.	L. Resolve through litigation or settlement all outstanding issues in rate litigation with MWD.

No.	Description	Target date
1.	Achieve final decision in 2010/2012 MWD rate litigation through final court action or settlement and secure award of damages. (H, I, J, K, L)	Dec-2019
2.	Develop new and flexible water storage solutions, including an Intentionally Created Surplus account in Lake Mead for Water Authority Colorado River supplies, in coordination with local, state and federal stakeholders. (C, D, F, G)	Dec-2019
3.	Develop and implement strategies for Water Authority participation in Basin States policy discussions on the Drought Contingency Plan, binational issues, and renegotiation of the 2007 Interim Guidelines. (C, D, F, G)	Dec-2019
4.	Support the Water Authority's MWD Delegates engagement in the review of MWD's Ethics Office to promote transparency and equity at MWD. (H, K)	Dec-2019
5.	Communicate the Board's conditional support of California WaterFix and updated Bay-Delta Policy Principles and WaterFix to secure the support of the San Diego legislative delegation, business community, civic leaders, opinion leaders, and media for the proper allocation of project costs on MWD's rates and charges. (A, B)	Jun-2020
6.	Continue to explore the viability of alternative conveyance of QSA supplies. (C, D, F)	Jun-2023
7.	Work with QSA JPA parties to ensure all required environmental mitigation is implemented at the Salton Sea. (C, E, G)	Jun-2023
8.	Engage with the state Salton Sea Management Program, Governor's Office, elected officials, and opinion leaders to ensure the state meets its obligations for restoration at the Salton Sea. (D, E, G)	Jun-2023
9.	Lead stakeholder briefings, annual tours, and additional outreach with Imperial Valley stakeholders to enhance relationships and exchange perspectives on efficiency-based water conservation, Salton Sea issues, and water diversification in the San Diego region. (D, E, F, G)	Dec-2023
10.	Actively engage in MWD's efforts to update and refine key programs and policies to support Water Authority's strategic goals, including but not limited to supply and facility reliability, demand management subsidies, and MWD fiscal sustainability. (H, I, K)	Dec-2023
11.	Communicate the status of MWD's fiscal condition with key stakeholders to ensure MWD's long-term financial sustainability and viability, and ultimately obtain support from stakeholders for MWD to adopt a long-term finance plan. (H, I, K)	Dec-2023

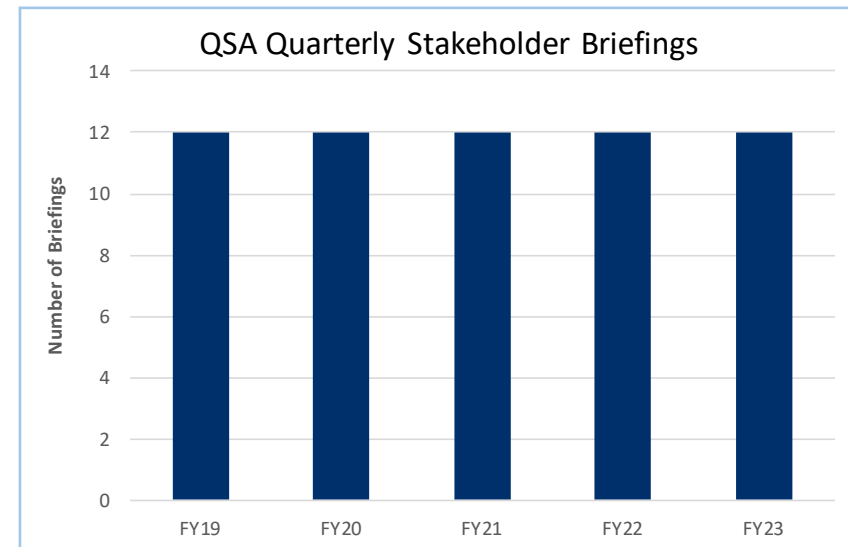
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Ensure full amount of scheduled Quantification Settlement Agreement water is delivered to the San Diego region each fiscal year.



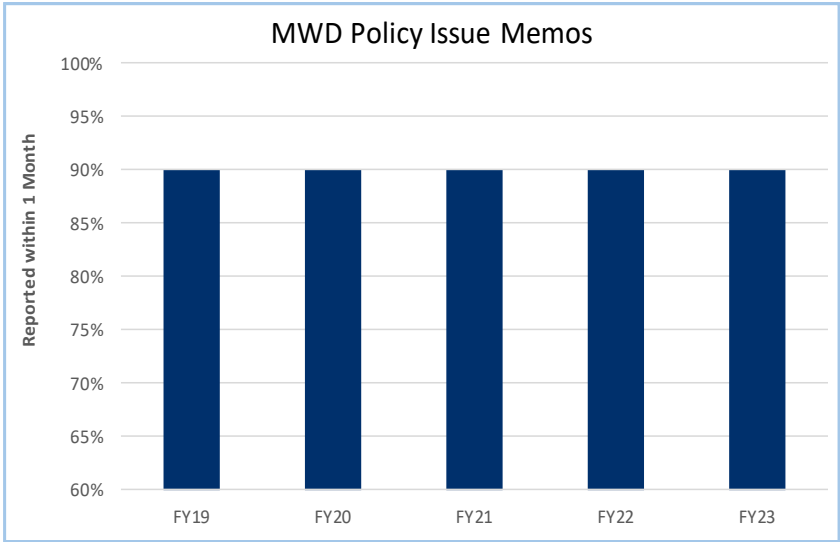
2

Perform three (3) stakeholder meetings per quarter (12 annually) on emerging QSA issues to enhance legislative and community support for protection of Water Authority's Colorado River supplies each fiscal year.



3

Present to the Water Authority Board of Directors, 90 percent of key MWD policy issues, major resource and financial plans within one month of MWD Board review through 2023 to increase awareness and understanding of key MWD policy issues.



## Local Water Overview

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Local water resources developed and managed by the Water Authority and its member agencies are critical to the success of the region's water supply diversification program. Local projects reduce the need for imported water and often provide agencies with a reliable, drought resilient supply. Local resources include recycled water, groundwater, surface water, potable reuse, and seawater desalination. The San Diego Region has a long history of capturing local stormwater in backcountry and urban reservoirs for use as a surface water supply. Potable reuse and seawater desalination are new water supplies that have been realized or initiated, and reflect ongoing pioneering efforts to diversify the region's water supply portfolio.

As part of this program, the Water Authority is driven to work closely with its member agencies to foster and support development and optimization of local water supplies. This is accomplished by identifying, promoting, and obtaining outside funding opportunities to assist agencies in offsetting project costs; serving as a visionary leader and facilitator on various regulatory issues that affect the region; and providing technical assistance.

Commercial operation of the Claude "Bud" Lewis Carlsbad Desalination Plant in December 2015 represents a significant local water supply accomplishment. It is the result of a twelve-year collaborative effort by the region to secure up to 56,000 acre-feet of local, drought-proof supply. Since the start of operations, it has produced over 36 billion gallons of high-quality drinking water and won numerous awards including Global Water Intelligence's Desalination Plant of the Year, San Diego County Tax Payers Association's Grand Golden Watchdog award, and the Association of California Water Agencies Clair A. Hill Water Agency Award. In addition to the progress

made in seawater desalination, the Water Authority has successfully supported member agencies on grant funding opportunities in the areas of potable reuse research and local supply development, the development of new regulations and regional planning efforts for potable reuse, recycled water and brackish water programs, and managed local project incentive programs.

## Local Water Focus Areas

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The focus areas within the Local Water Program support the development and management of **Member Agency Supply**, **Potable Reuse**, and **Seawater Desalination**. Each focus area identifies key management strategies to drive the execution of priority objectives and tactics over the next five fiscal years.

### Member Agency Supply

Member agencies take the lead in developing and managing local supplies such as recycled water, groundwater, and surface water. The Water Authority coordinates regional efforts with member agencies to promote a common vision across the region when engaging in statewide and regional forums. Strategies in this focus area include improving and maintaining regulatory flexibility and source water quality for the San Diego region's water supply and supporting member agency efforts to obtain outside funding. Supporting objectives and tactics include coordinating recommendations for the proposed Statewide Mercury Reservoir Program, advocating for reasonable monitoring requirements and standards for constituents of emerging concern in potable and recycled water, and developing

strategies for permitting treatment plant residual discharges; all in support of the various existing and proposed local supply facilities and projects.

### **Potable Reuse**

The Water Authority's member agencies are moving forward with research and planning for cutting edge and innovative projects that will set the standard for potable reuse in California. The Water Authority coordinates with member agencies on potable reuse to create a regional voice for reasonable and flexible regulations for approval of a new drinking water supply that will support the region in a time of climate change and unprecedented drought. For example, the Potable Reuse Coordinating Committee, comprised of Water Authority and member agency staff, provides a forum for regional collaboration on key potable reuse initiatives. Management strategies for this focus area over the next five fiscal years include regulatory and legislative support and educating the public on the benefits of potable reuse and associated water quality improvements.

### **Seawater Desalination**

The Water Authority has taken a leadership role in the state by developing local seawater desalination through a public-private partnership for the largest desalination facility in the nation. Management strategies linked to seawater desalination over the next five years include the ongoing oversight of the Claude "Bud" Lewis Carlsbad Desalination Plant to ensure compliance with the Water Purchase Agreement and the Ocean Plan Amendment, which was adopted by the State Water Resources Control Board in May 2015 and addresses seawater desalination plant intake and discharge facilities.



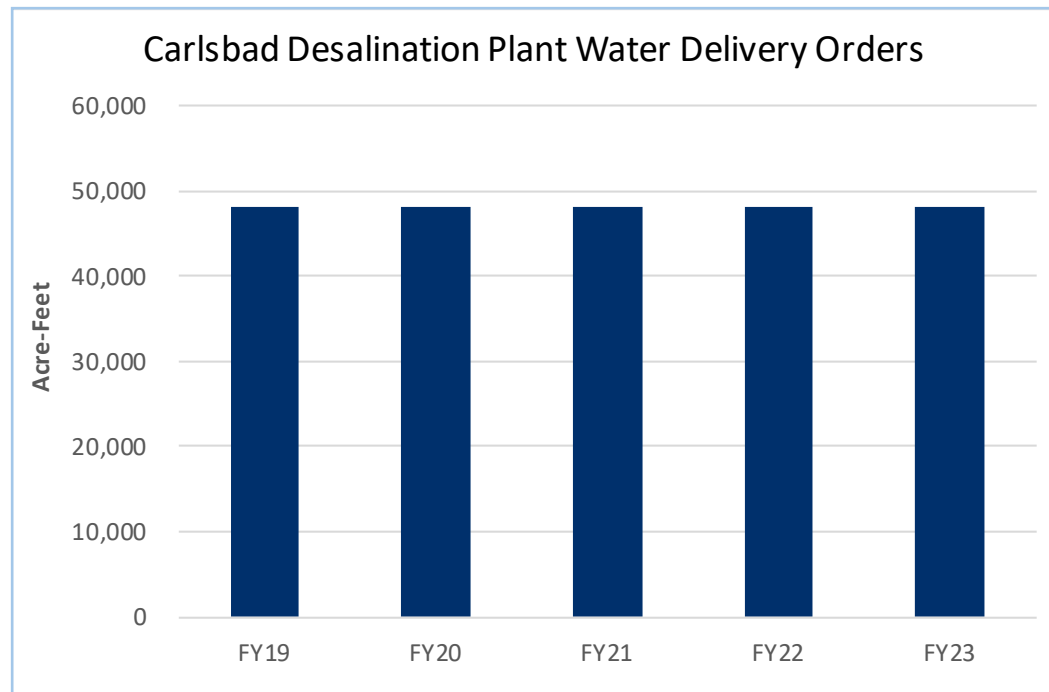
Desalinated water from the Lewis Carlsbad Desalination Plant provides a reliable, drought-proof water supply to San Diego County through a public-private partnership.

MEMBER AGENCY SUPPLY	POTABLE REUSE	SEAWATER DESALINATION
A. Improve regulatory flexibility and streamlining for local supplies.	D. Engage in regulatory and legislative processes to ensure regulatory pathways are available for approval of local potable reuse projects.	G. Ensure compliance with Lewis Carlsbad Desalination Plant Water Purchase Agreement.
B. Protect and improve source water quality for water supply in the San Diego region.	E. Assess and recognize the benefits of water quality improvements associated with new local supplies.	H. Ensure continued operation of Lewis Carlsbad Desalination Plant for stand-alone operation and compliance with Ocean Plan Amendment.
C. Support funding from outside the region for local water supply projects.	F. Encourage public support, implement public outreach, and offer technical assistance to support reuse and recycled water projects.	

No.	Description	Target date
1.	Lead a member agency workgroup to develop a strategy for permitting treatment plant residual discharges. (A, B)	Mar-2019
2.	Support Poseidon in obtaining National Pollutant Discharge Elimination System permit from the San Diego Regional Water Quality Control Board required to initiate the phased implementation of the Lewis Carlsbad Desalination Plant Intake Modifications Project. (G, H)	Jun-2019
3.	Support Poseidon with development and implementation of the intake screen demonstration project to optimize the proposed intake technology. (G, H)	Dec-2021
4.	In collaboration with member agencies, support the San Diego Regional Water Quality Control Board to develop a Basin Plan amendment or guidance that supports potable reuse and reservoir operations based on sound science. (A, B, C)	Dec-2021
5.	Advocate for state and federal funding opportunities applicable for the Lewis Carlsbad Desalination Plant Intake Modifications Project and apply as such programs are made available. (C, H)	Dec-2021
6.	Complete Contract Administration Memoranda and any necessary Water Purchase Agreement contract amendments for each phase of the new intake and discharge facilities at the Lewis Carlsbad Desalination Plant. (G, H)	Mar-2022
7.	Coordinate with member agencies and Water Research Foundation to evaluate the benefits of the Lewis Carlsbad Desalination Plant supply and new local supplies. (E)	Jun-2022
8.	Complete all submittal reviews within the Water Purchase Agreement required timeframe during oversight of the design, construction, and commissioning of the Lewis Carlsbad Desalination Plant's interim and permanent intake and discharge facilities in compliance with the Ocean Plan Amendment. (G, H)	Jun-2023
9.	Coordinate with member agencies to submit applications to MWD for LRP and other funding opportunities and advocate for criteria which is supportive of member agency projects. (C)	Jun-2023
10.	Facilitate a member agency workgroup to engage with the State Water Resources Control Board to provide coordinated regional comments on the proposed statewide Mercury Reservoir Plan. (D)	Jun-2023
11.	Coordinate with the member agencies to provide comments to the State Water Resources Control Board on development of monitoring requirements and standards for constituents of emerging concern in potable and recycled water. (A, B)	Jun-2023

1

Exceed the Claude “Bud” Lewis Carlsbad Desalination Plant Water Purchase Agreement Minimum Demand Commitment of 48,000 acre-feet annually.



## Resource Planning Overview

Resource planning is essential to ensuring a reliable water supply for the San Diego region and effectively managing potential supply shortages. Long-term supply planning at the Water Authority is accomplished with two major visionary plans – the San Diego Urban Water Management Plan (UWMP) and the San Diego Integrated Regional Water Management (IRWM) Plan. In collaboration with its 24 member agencies, the Water Authority completed the 2015 UWMP update, which was adopted by the Board in June 2016 and accepted by the State Department of Water Resources (DWR) in September of the same year. As part of the San Diego Regional Water Management Group (RWMG), the Water Authority Board adopted the 2013 IRWM Plan in September 2013. Both plans were prepared such that they comply with state requirements and maintain the region's eligibility for state funding. Going forward, implementation of the new laws created by the passage of SB 606 and AB 1668 will impact water suppliers throughout the state. For the Water Authority, the new laws require reporting on activities related to strengthening local drought resilience. As the implementation process begins, the Water Authority will continue to advocate on behalf of the San Diego region to ensure the region's interests are represented.

From 2008 to 2018, the Water Authority worked with its RWMG partners, City of San Diego and County of San Diego, to secure \$96 million in IRWM funding from three Department of Water Resources' grant programs to support 67 high-priority water projects that help achieve the goals of the San Diego IRWM Plan. The Water Authority continues to fulfill an ongoing obligation to both its RWMG partners and DWR to administer the IRWM grant funding obtained by the San Diego IRWM

Program. This is achieved through the IRWM Grant Administration Program, which administers the awarded grant funds for individual IRWM projects.

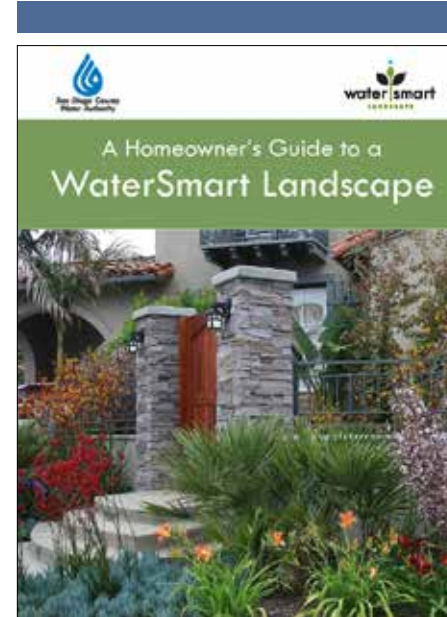
The Resource Planning Program also encompasses water shortage and drought response management. The Water Authority's primary planning document that addresses water supply shortages is the Water Shortage Contingency Plan (WSCP). The WSCP includes a series of orderly, progressive steps for the Water Authority and its member agencies to take during shortages to minimize impacts to the region's economy and quality of life. The WSCP was approved by the Board in August 2017.



Another important aspect of resource planning is water use efficiency, which supports the Water Authority's long-term strategy to improve the reliability of the region's water supplies by promoting and facilitating the efficient use of water. Examples of our award-winning water efficiency initiatives include the publication "A Homeowner's Guide to a WaterSmart Landscape" and the WaterSmart Landscape Makeover Series for homeowners. Other innovative programs include the Qualified Water Efficient Landscaper (QWEL) program, which provides basic training in water use-efficiency for landscape professionals and the Sustainable Landscapes Program, which pioneered issuing incentives for landscape transformation projects that achieve water efficiency and other environmental benefits. The Water Authority's water use efficiency activities support a number of ongoing efforts identified as core needs by member agencies to help them meet their long-term water management goals in a manner that aligns with the Water Authority's Water Use Efficiency Policy Principles. These activities are primarily focused on market transformation towards products and services that achieve outdoor water savings.

### Resource Planning Focus Areas

The focus areas of the Resource Planning Program are **Water Management Planning**, **Water Shortage and Drought Response Management**, and **Water Use Efficiency**. Each focus area includes management strategies designed to accomplish significant objectives over the next five fiscal years.



### Water Management Planning

The Water Management Planning focus area includes management strategies for maintaining an IRWM plan and a regional UWMP. The IRWM plan addresses resource management, water quality, and habitat in a region that includes the portion of San Diego County that is tributary to coastal waters. The plan builds on local and regional management plans within the San Diego region with input from an array of key stakeholders. It also provides the basis for acquiring grant funding from the state. The UWMP identifies a diverse mix of water resources projected for development over the next 25 years to ensure long-term water supply reliability for the region. It is prepared in accordance with the state

Urban Water Management Planning Act and includes conservation measures, programs, and policies. Together, these plans ensure a reliable regional water supply, and comply with evolving state requirements to maintain the region's eligibility to receive state funding and pursue other funding for projects that achieve San Diego IRWM Program goals. Strategies over the next five fiscal years include objectives and tactics to update the IRWM Plan to comply with state requirements, update the regional UWMP to identify supplies necessary to meet future demands, and secure the region's allocated share of IRWM grant funding from DWR's Proposition 1 grant program.

### **Water Shortage and Drought Response Management**

The Water Authority relies on its Water Shortage Contingency Plan to effectively manage and respond to water supply shortages during droughts to avoid or minimize impacts to the region. The plan identifies regional shortage response actions to be taken at specific shortage levels by the Water Authority and, where appropriate, its member agencies. A critically important element of the plan is the municipal and industrial supply allocation methodology, which provides the Water Authority a method by which to allocate supplies to its member agencies, if the region were to be cutback. The plan also includes a basic methodology to prepare an annual municipal and industrial water reliability assessment to ensure that the Board, member agencies, the public, and state and local agencies are informed as to the region's water supply conditions and the likelihood of water shortages. In order to comply with evolving state laws, objectives include an update of the WSCP, a revision of the 2008 Model Drought Response Conservation Ordinance, and preparation of an annual water supply and demand assessment for submittal to DWR.

### **Water Use Efficiency**

The Water Shortage Contingency Plan responds to specific conditions by reducing water use in the short term via policies and ordinances that enforce temporary water use restrictions. The plan and other related measures adopted by the Board of Directors may trigger the accelerated implementation of conservation programs administered by the Water Authority. For instance, in 2015 the Board deployed \$1 million in new extraordinary water conservation programs. These near-term measures were commissioned in addition to the region's ongoing long-term water-saving activities, which are driven by the Board's Water Use Efficiency Program Policy Principles. Water use efficiency programs are a core element of the Water Authority's strategy to make the region's water supply more reliable in the long term. The Water Use Efficiency focus area utilizes several management strategies, including continuing to pioneer the advancement of sustainable landscapes, increasing program administrative efficiencies, and enhancing customer service and support to member agencies and program participants. Other strategies involve providing leadership at the state and local level to advocate for long term water use efficiency policies that benefit the San Diego region, and obtaining external funding for Water Use Efficiency Program efforts. Objectives and tactics in this area include implementing and closing out four distinct Proposition 84 grant awards (Rounds 1, 2, 3, and 4); leveraging regional programs available through the Metropolitan Water District; and enhancing a long-standing Water-Energy Nexus partnership with SDG&E.

## WATER MANAGEMENT PLANNING

- A. Implement an Integrated Regional Water Management Plan that reflects stakeholder consensus and complies with evolving state requirements.
- B. Pursue funding for implementation of projects that achieve San Diego Integrated Regional Water Management Program goals.
- C. Develop a regional Urban Water Management Plan that complies with evolving state requirements and ensures a reliable water supply for the San Diego region.
- D. Update water management plans to maintain eligibility for state funding.

## WATER SHORTAGE AND DROUGHT RESPONSE MANAGEMENT

- E. Ensure planning documents are consistent and relevant to properly manage and respond to supply shortages.
- F. Ensure that proposed drought response actions are appropriate, progressive, and may be reasonably implemented by the Water Authority and its member agencies.
- G. Ensure the public, along with state agencies, are kept informed of regional supply conditions and likelihood of shortages through preparation of annual water supply and demand assessments.

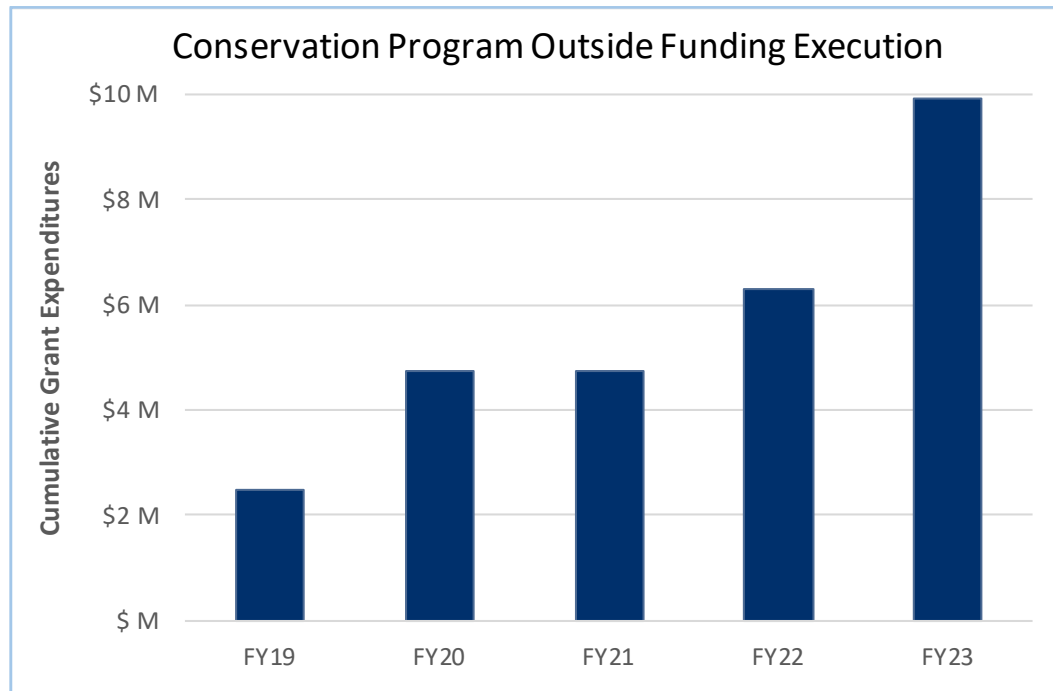
## WATER USE EFFICIENCY

- H. Implement best-practices to manage and deliver water-use efficiency programs and services in a timely, convenient, and courteous manner.
- I. Plan, develop, implement, or administer water efficiency programs and tools that meet the needs of member agencies and water users.
- J. Support policies and actions that advance long-term water-use efficiency best practices, behaviors, and market transformations.
- K. Leverage ratepayer investments by securing grants or other external funding sources and advocating for equitable benefits from MWD water-use efficiency programs.
- L. Advocate for long term water use efficiency policies that benefit the San Diego region.

No.	Description	Target date
1.	Prepare an annual water supply and demand assessment, in coordination with the member agencies, that complies with state requirements. (G)	Jun-2019
2.	Develop a centralized database covering five water-use efficiency programs to improve data management and performance reporting. (H, L)	Jul-2019
3.	Obtain Board approval for the updated Integrated Regional Water Management Plan (Phases 1 and 2) to comply with state requirements and enhance plan content. (A, D)	Jul-2019
4.	Secure \$2.5 million in external funding such as grant awards, utility funding, and in-kind contributions to support water-use efficiency programs. (H, I, J, K)	Jun-2021
5.	Secure the San Diego Region's allocated share of approximately \$38 million in Integrated Regional Water Management grant funding, from the Department of Water Resource's Proposition 1 program. (A, B, D)	Jun-2021
6.	Obtain Board approval for an updated Water Shortage Contingency Plan that complies with evolving state requirements. (E, F)	Jul-2021
7.	Obtain Board approval for a revised 2008 Model Drought Response Conservation Ordinance to achieve consistency with the Water Shortage Contingency Plan and evolving state requirements. (E, F)	Jul-2021
8.	Update the Urban Water Management Plan to identify supplies necessary to meet future demands and comply with the planned revision of the Urban Water Management Plan Act. (C, D)	Jul-2021

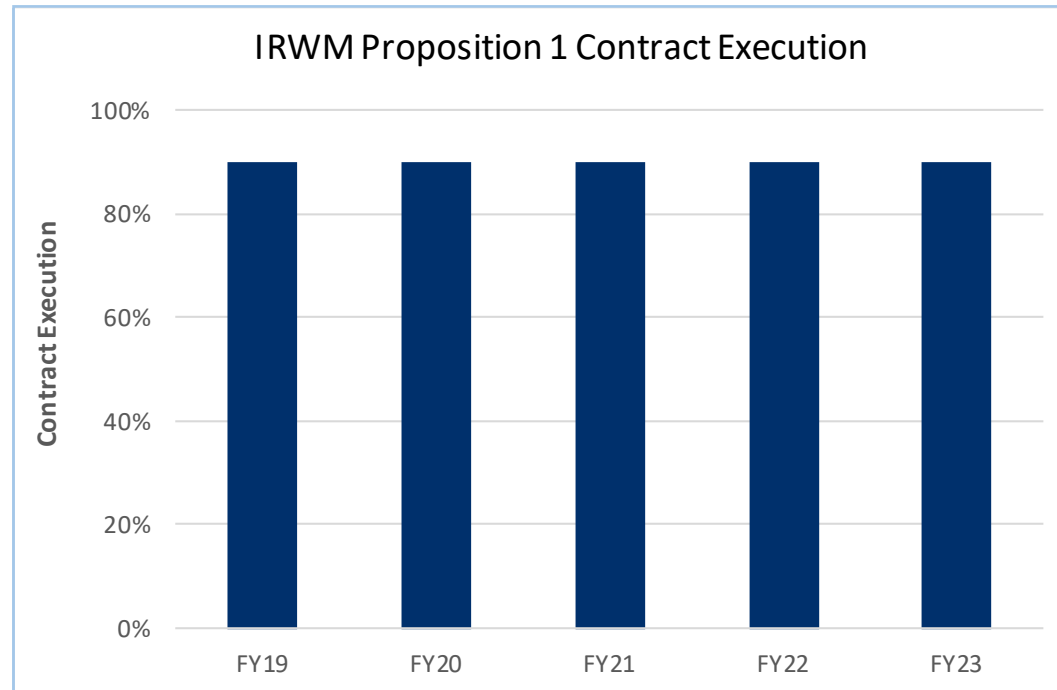
### 1

Implement regional conservation programs demonstrated by expending 95 percent of grants and external funding portfolio in accordance with the terms of each award.



2

Increase efficiency of awarding Proposition 1 IRWM grant funding by executing 90 percent of project sponsor contracts within 120 days of an agreement between the Water Authority and State Department of Water Resources.



**FIGURE 3.1 Water Facilities – Programs and Focus Areas**

**INFRASTRUCTURE/  
CAPITAL IMPROVEMENT  
PROGRAM**

Asset Management

Infrastructure Planning

New Facilities

**SUSTAINABILITY**

Climate Change

Environmental Management

**WATER SYSTEM  
MANAGEMENT**

Energy Initiatives

Facilities Security  
and Emergency Response

Operations and Maintenance

# Water Facilities

## Water Facilities Overview

The Water Facilities focus area consists of three programs: **Infrastructure/Capital Improvement Program**, **Sustainability**, and **Water System Management**.

Infrastructure/Capital Improvement Program addresses the execution of the Water Authority's large and complex capital projects.

Implementing cost-effective and productive sustainability strategies that reduce environmental impacts, promote thoughtful stewardship of nature resources and enhance facility and supply resiliency are the focus of the Sustainability Program.

Water Systems Management ensures the Water Authority's infrastructure is reliable, complies with water quality standards, and meets member agency demands through optimized operations and cost-effective maintenance.

The Water Facilities focus area ensures the Water Authority's complex network of water transportation, treatment, and storage facilities are efficiently and sustainably operated and maintained, resulting in a safe, reliable water supply to support the region's economy and a good quality of life for its residents.

Key issues within the Water Facilities focus area include the following.

- ▶ Controlling facility capital and operating costs
- ▶ Balancing facility growth with water demands
- ▶ Managing facility operations, maintenance, and security to consistently and efficiently deliver a reliable water supply and meet member agency water demands
- ▶ Implementing cost-effective sustainability strategies that reduce environmental impacts, and promote thoughtful stewardship of natural resources within the Water Authority's aqueduct system



Work crews install a section of 54-inch steel pipe connecting the Lewis Carlsbad Desalination Plant to the Water Authority's aqueduct system.

## Infrastructure/CIP Overview

The Water Authority has built a reputation of being both pioneering and visionary in its execution of large and complex capital projects. Over the past decade, the focus of the Capital Improvement Program (CIP) was to build new infrastructure to implement the award-winning Emergency and Carryover Storage Project and fulfill the Water Authority's mission to provide a safe and reliable water supply to the region.



Key facilities of the Emergency and Carryover Storage Projects.

The \$1.5 billion Emergency and Carryover Storage Project is a system of reservoirs, interconnected pipelines, and pumping stations designed to make water available to the San Diego Region if imported water deliveries are interrupted by an emergency event or periods of extended drought. Some of the key facilities of the Emergency and Carryover Storage Projects include the Olivenhain Dam, Reservoir, Pipeline, and Pump Station; Lake Hodges Pipeline and Pump Station; and the San Vicente Pipeline, Pump Station, and Dam Raise. With the completion of the San Vicente Dam Raise in 2014, the major components of the Emergency and Carryover Storage Project were completed.

The current 30-year CIP budget of \$2.5 billion, with an appropriation of \$137.6 million for Fiscal Years 2018 and 2019, reflects the shift from major construction projects to asset management and the optimization of the existing aqueduct system.

## Infrastructure/CIP Focus Areas

The focus areas for the Infrastructure/Capital Improvement Program are **Asset Management**, **Infrastructure Planning**, and **New Facilities**. Within each focus area are strategies that will drive the Water Authority to accomplish the major objectives and tactics set for the next five fiscal years.

### Asset Management

In 2009, the Water Authority adopted an Asset Management Program for its infrastructure assets worth \$3 billion. Effective management of these assets yields savings from improved system reliability, effective rehabilitation, and lower increases to water rates over time. Several industry groups identify the Water Authority's

Asset Management efforts as both visionary and pioneering, and recognize it as a leader in the field. Beyond established practices such as pipeline inspections, risk analysis, program monitoring, and long-term forecasting, the program continues to pioneer new technology to optimize maintenance, condition assessments, and prioritization of assets for rehabilitation or replacement.

Asset Management is comprised of two components: first, the Infrastructure Rehabilitation Project that consists of pipeline and facility assessments, repairs, and replacements; and second, the Relining and Pipe Replacement Program that includes rehabilitation efforts specifically related to pre-stressed concrete cylinder pipe. To date, 45 miles, or over 55 percent of the Water Authority's 82 miles of pre-stressed concrete cylinder pipe have been rehabilitated under this program.

### Infrastructure Planning

The Water Authority completed the 2013 Regional Water Facilities Optimization and Master Plan Update that focuses on optimizing the Water Authority's existing system while being agile enough to adapt to a range of future operating and member agency water demand scenarios. These projects include local supply development that has both direct and indirect impacts to the operation of the Water Authority's system. Future infrastructure planning will be focused on the projects specifically identified in the Master Plan Update in addition to other projects subsequently identified that ensure a safe and reliable water supply is maintained for the region.

### New Facilities

The focus for new facilities has shifted from major construction projects to asset management and the optimization of the existing aqueduct system. This new



In 2017, the Water Authority's Asset Management program was honored with a Technology Innovation award for its Pipeline Risk Visualization initiatives from the Special Districts West.

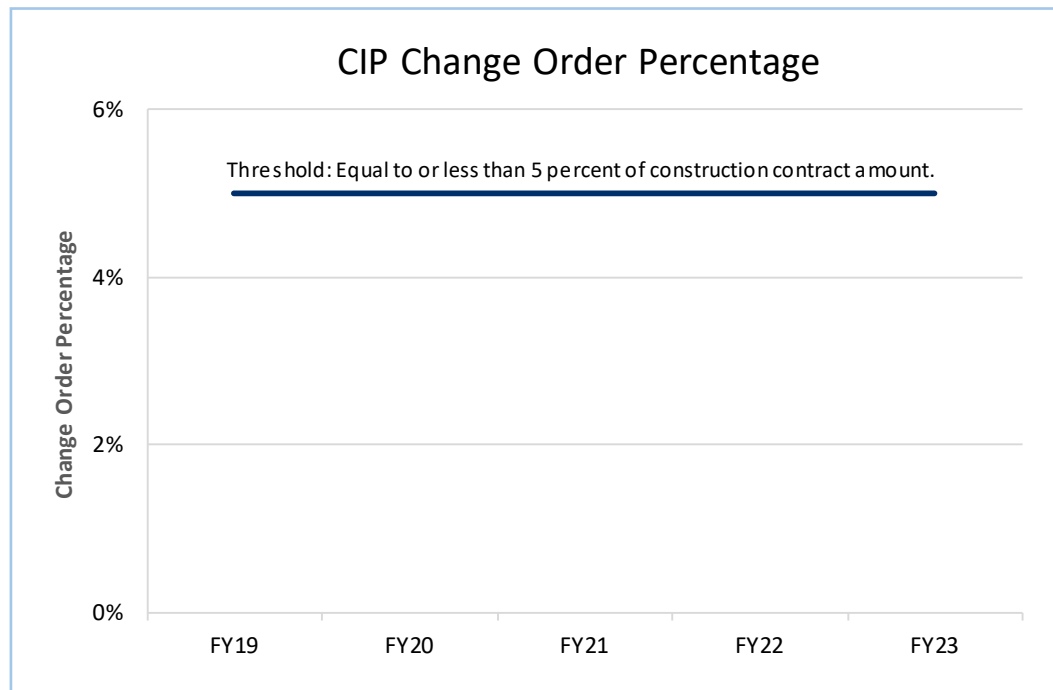
focus involves the implementation of small projects. As a result, the Water Authority must adapt by developing business policies, practices, and procedures that are conducive to the award and management of smaller contracts. Management strategies that employ pioneering technology, such as 3-D scanning, drones, and automated scheduling and controls can promote the most efficient and cost-effective delivery of projects. The Water Authority will continue to employ existing and new innovative best management practices such as performance metrics, quality control and quality assurance, value engineering, and comprehensive Gate reviews for all CIP projects, while continuing coordination efforts with both internal and external stakeholders and member agencies.

ASSET MANAGEMENT	INFRASTRUCTURE PLANNING	NEW FACILITIES
<p>A. Ensure prioritization, optimal maintenance, and rehabilitation of assets.</p> <p>B. Pioneer and utilize new and innovative technology to reduce risk and increase productivity and efficiency.</p>	<p>C. Coordinate and align project scope and schedules within the Master Plan Update and the Asset Management Program to achieve the optimal balance between regional water reliability and cost.</p> <p>D. Optimize use of existing treatment, storage, and conveyance facilities to meet projected member agency water demands.</p>	<p>E. Employ pioneering technology, innovation, and best management practices for all Capital Improvement Program projects.</p> <p>F. Develop innovative business policies, practices, and procedures that are aligned with smaller contracts.</p> <p>G. Collaborate with member agencies and other external stakeholders on the Capital Improvement Program.</p> <p>H. Coordinate with internal functional groups and stakeholders to promote the most efficient and cost-effective delivery of projects.</p>

No.	Description	Target date
1.	Complete the Kearny Mesa Headquarters Roof Rehabilitation project to provide an additional 20 to 30 years of waterproofing system service life. (A, E, F, H)	Apr-2019
2.	Evaluate and utilize tools and innovative technology which can be used for robotic pipeline inspections to reduce water discharge, labor costs, and risk of pipeline failures. (A, B)	Jun-2020
3.	Complete the Vallecitos Water District 11/Vista Irrigation District 12 Flow Control Facility project to improve operations and reliability for the delivery of treated water to the Vallecitos Water District and the Vista Irrigation District. (A, C, E, F, G, H)	Jun-2020
4.	Complete a pilot study for implementing the use of drone technology for assisting with Capital Improvement Program projects and management of the aqueduct right of way. (B, E, F)	Dec-2020
5.	Complete the San Diego 28 Flow Control Facility Rehabilitation project to improve operations and delivery reliability of untreated water to the city of San Diego's Alvarado Water Treatment Plant. (A, C, E, F, G, H)	Dec-2020
6.	Complete the Fallbrook Public Utility District 7/Rainbow Municipal Water District 14 Flow Control Facility project to improve operations and reliability for the delivery of treated water to the Fallbrook Public Utility District and the Rainbow Municipal Water District. (A, C, E, F, G, H)	Dec-2020
7.	Determine the number of Member Agencies who are interested in a Member Agency Asset Management Support Network. The network would offer a method for information sharing and guidance on asset management, condition assessment evaluation, procurement, and implementation. If interest is sufficient, draft a plan to develop the network and formalize the procedures. (A, B)	Dec-2020
8.	Complete the Carlsbad 5 Flow Control Facility project to allow desalination water delivery directly from the Lewis Carlsbad Desalination Plant to the Carlsbad Municipal Water District. (E, F, G, H)	Mar-2021
9.	Complete the Hauck Mesa Storage Reservoir and Pipeline Surge Protection project to provide operational flexibility on the First Aqueduct and long-term surge protection for the Valley Center Pipeline. (C, D, E, F, G, H)	Jun-2021
10.	Complete the Northern First Aqueduct Structures and Lining Rehabilitation project to improve operations and the reliability of First Aqueduct treated water deliveries. (A, C, E, F, G, H)	Jun-2021
11.	Complete the design for the Southern First Aqueduct Structures Rehabilitation project to improve operations and the reliability of First Aqueduct untreated water deliveries. (A, C, E, F, G, H)	Jun-2021
12.	Complete the Mission Trails Flow Regulatory Storage II and Flow Control Facility project to mitigate existing operational risks and meet future untreated water demands for the central and south county service areas. (C, D, E, G, H)	Jun-2021
13.	Complete a detailed study for the repair time estimates of the Water Authority's aqueduct and pipeline system based changes in seismic hazard evaluation and pipeline response to earthquakes. (A, C)	Dec -2021
14.	Complete the Emergency and Carryover Storage Project – North County Pump Station project to provide treated water deliveries to portions of the North County service area during an emergency event. (C, D, E, G, H)	Dec-2021
15.	Using the latest proven and innovative pipeline assessment technologies, perform 25-miles of comprehensive condition assessment of the treated water portion of the First Aqueduct. (A, B)	Jun-2022
16.	Complete a Master Plan Update that incorporates revised demand projects from the 2020 Urban Water Management Plan and evaluates system optimization strategies to address lower flows and water quality. (C, D, G)	Jun-2023
17.	Complete an additional 6 miles of priority pipeline relining, extending the service life of the identified segments of the aqueduct system. (A, E, G, H)	Dec-2023

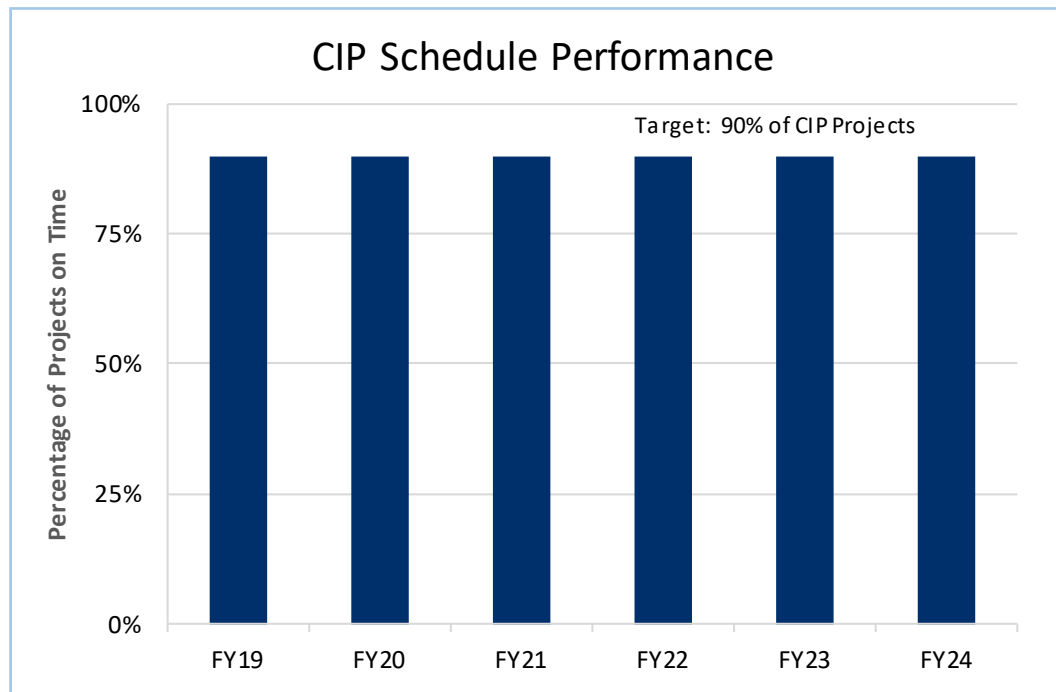
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Maintain an overall Construction Change Order Percentage equal to or less than 5 percent of the construction contract amount.



2

Maintain 90 percent of all Capital improvement Program projects within four months of their baseline schedule.



## Sustainability Overview

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The Water Authority is committed to being a model agency for sustainability. This is demonstrated through our continued support of cost-effective sustainability strategies that reduce environmental impacts, promote thoughtful stewardship of natural resources, and enhance facility and supply resiliency. These strategies save ratepayers money, reduce and manage the environmental footprint of Water Authority facilities and operations, conserve energy and water, and help the Water Authority better anticipate and adapt to the impacts of climate change.

The Water Authority's Environmental Management Program is designed to reduce short- and long-term environmental impacts and streamline the permitting process. The Water Authority's Natural Community Conservation Plan/Habitat Conservation Plan (NCCP/HCP), which became effective in 2012, provides a 55-year permit for future projects and includes goals, guidelines, and specifications that comprise the Water Authority's conservation strategy for biological resources. The NCCP/HCP also provides a description of the Water Authority's mitigation lands and preserve area management guidelines. In line with our innovative and visionary approach to environmental stewardship, in 2015 the Water Authority obtained a programmatic 50-year Clean Water Act Section 404 permit known as the Programmatic Master Plan Permit (PMPP).

The Water Authority recognizes the challenges that climate change poses to the San Diego region and is dedicated to proactively addressing these issues. Our regional climate change initiatives include both mitigation and adaptation strategies. The Water Authority voluntarily developed and adopted the agency's first Climate Action Plan (CAP). The CAP was initially adopted in March 2014 and revised

in December 2015, and serves as an interdisciplinary guide intended to promote, facilitate, and coordinate implementation of climate change mitigation strategies. The plan focuses on greenhouse-gas emission reduction measures to ensure our water supplies, infrastructure, and services will accommodate projected impacts of climate change. It contains a methodology to compute baseline greenhouse-gas emissions, an approach to track and report on emissions reduction progress, and establishes targets for voluntary compliance with Assembly Bill 32-California Global Warming Solutions Act of 2006. The Water Authority has already made great strides in reducing emissions, with 2017 levels falling well below our 2020 emissions goal.

Additionally, the Water Authority has pursued partnerships with researchers and other climate change practitioners to advance actionable climate science focused on adaptation strategies. Through partnering with agencies like the Scripps Institution of Oceanography, the Water Authority has collaborated on work products including California's Fourth Climate Change Assessment - San Diego Region Report. As a pioneering leader in the climate change arena, the Water Authority is also a founding member of the Water Utility Climate Alliance (WUCA). Formed in 2007, WUCA is comprised of 12 of the nation's largest water providers that supply drinking water to more than 50 million people throughout the United States. WUCA provides leadership in assessing and adapting to the potential effects of climate change. Projects funded through WUCA, such as the Best Practices in Climate Adaptation project intended to define climate adaptation for a water utility context and identify, document, and synthesize lessons and practices associated with adapting to climate change.

The Water Authority continues to make a positive contribution to a more sustainable future for the region by implementing cost-effective adaptation and mitigation strategies that support efficient resource management, decrease greenhouse-gas emissions, and promote actionable climate change research.

## Sustainability Focus Areas

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The focus areas of the Sustainability Program are **Climate Change** and **Environmental Management**. Within each focus area are specific management strategies that establish the Water Authority's sustainability vision of maintaining a leadership role in advancing climate science research and collaborating on approaches to mainstream adaptation strategies into business practices.

### Climate Change

The climate of the San Diego region is increasingly warmer and drier, with recent prolonged record-breaking temperatures – as demonstrated by 54 out of 57 months (between November 2014 and July 2018) having hotter than normal temperatures at Lindbergh Field. Heat wave frequency, intensity, and duration are anticipated to increase. Precipitation patterns are also anticipated to experience changes with more frequent and severe droughts punctuated by more intense individual precipitation events. The Water Authority's agile strategies and associated tactics for the Climate Change focus area include implementing cost-effective measures to reduce greenhouse-gas emissions, updating the Climate Action Plan, and collaborating on leading-edge climate science research to evaluate potential impacts of climate change on the quantity and quality of local water supplies and its effect on water demands.

### Environmental Management

The Environmental Management focus area is central to the sustainability of long-term facility planning and operations. It is driven by regulatory compliance with the California Environmental Quality and National Environmental Policy Acts, State and Federal endangered species acts, clean water act, and other natural resources regulations. Other environmental management activities include mitigation planning and implementation, land management, permitting support for Capital Improvement Program projects, and legislative review.

Key management strategies and objectives of the Environmental Management Program include advanced planning, projecting mitigation needs, and proactively obtaining mitigation lands and/or credits at a mitigation bank. These strategies will give the Water Authority the ability to move projects forward as mitigation acreage (credits) are debited from already established mitigation properties. This includes utilizing proactive methods to ensure sustainable mitigation in advance of capital and operational project needs; developing a plan to manage mitigation land credit inventory; evaluating the potential to market excess mitigation land credits; reassessing NCCP/HCP covered species list to consider additions or reductions to the list, proactively participating in regulatory agency's five-year review of PMPP, and creating an environmental awareness training program.

### CLIMATE CHANGE

- A. Implement cost-effective measures that reduce greenhouse-gas emissions in compliance with emission targets contained in the Climate Action Plan.
- B. Advance climate science research and mainstream adaptation strategies into business practices.
- C. Ensure resiliency of infrastructure and supplies in response to climate change impacts.

### ENVIRONMENTAL MANAGEMENT

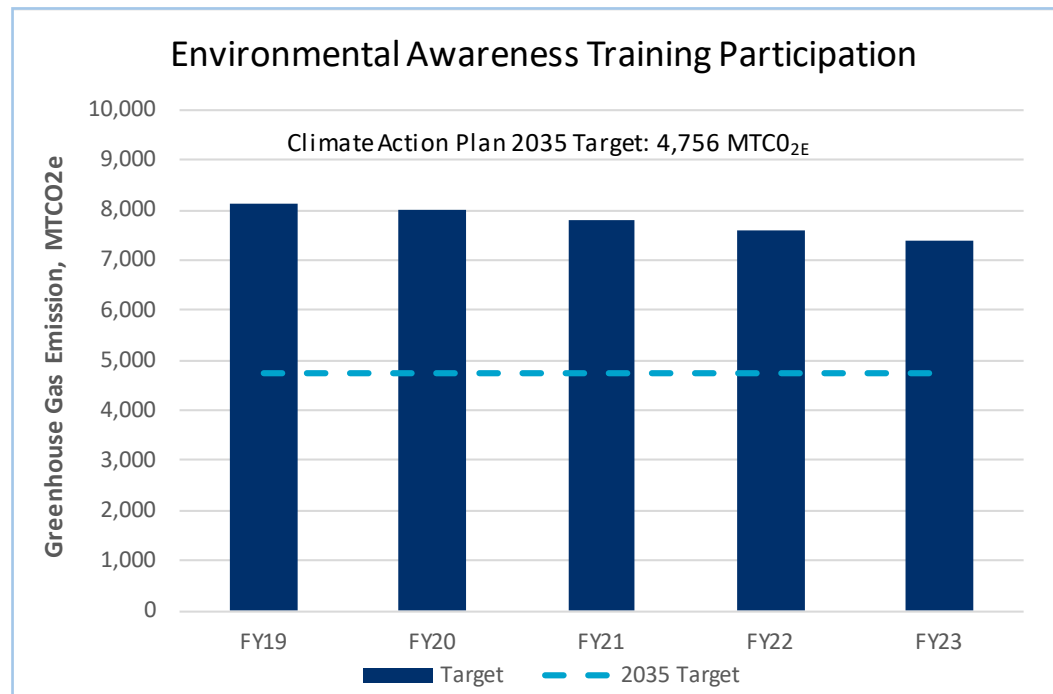
- D. Incorporate advanced planning to ensure Water Authority compliance with environmental regulations.
- E. Strengthen inter-departmental coordination of environmental compliance.
- F. Ensure sustainable mitigation is obtained in advance of project needs.

No.	Description	Target date
1.	Meet 2020 Climate Action Plan emission targets by using adaptive management strategies developed for further reduction of carbon emissions. (A, B, C)	Dec-2019
2.	Develop an environmental awareness training video on the California Environmental Quality Act and current environmental permitting requirements to be used for new hires and as a refresher course tailored for Engineering and Operations & Maintenance staff. (E)	Dec-2019
3.	Obtain Board approval for the updated Climate Action Plan to ensure conformity of greenhouse-gas inventory calculation with the Climate Registry's current General Reporting Protocol. (B, C)	Jun-2020
4.	Obtain partnerships on leading-edge climate science projects on adaptation, sustainability, and resiliency strategies, and evaluate opportunities to incorporate research findings into facility and supply planning processes. (B, C)	Jun-2021
5.	Evaluate NCCP/HCP covered species list to determine if desirable to seek a major amendment to the NCCP/HCP, its' implementing agreement, and State and Federal incidental take permits to revise the Covered Species list. (D, F)	Jun-2021
6.	Develop a minimum of three acres of wetland mitigation at the San Luis Rey Kendall site to mitigate impacts of near-term Capital Improvement Program projects. (D, F)	Jun-2022

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## 1

Ensure compliance with 2020 and 2035 greenhouse gas emission targets identified in the Water Authority's Climate Action Plan.



## Water System Management Overview

The Water Authority operates and maintains a complex water system including large diameter pipelines, flow control facilities, flow regulatory structures, pump stations, a large dam, and hydroelectric facilities. The Water System Management Program ensures this complex infrastructure is reliable, complies with water quality standards, and meets member agency demands through optimized operations and cost-effective maintenance.

The program is engaged in several ongoing initiatives, including developing and maintaining a skilled workforce, monitoring hydroelectric performance, resolving right of way encroachments, enhancing physical security and the operations communication network, and improving the work management system.

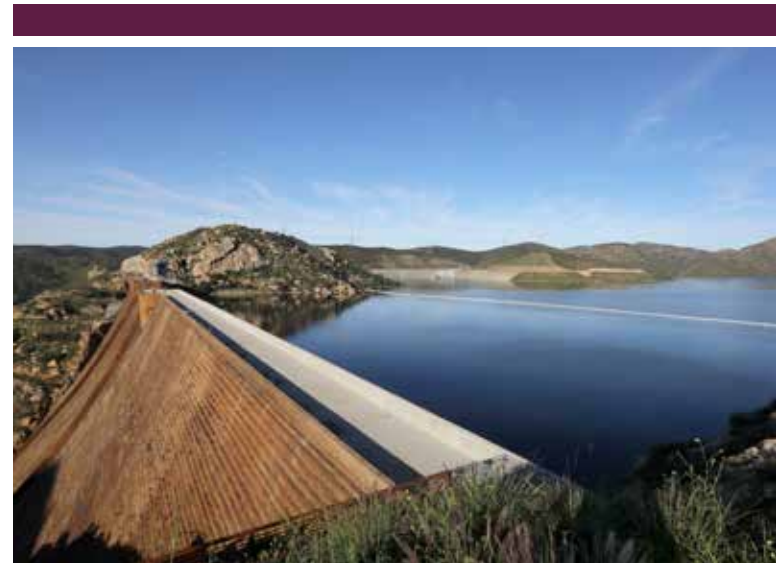
Past accomplishments of this focus area include securing a business arrangement for the Rancho Penasquitos Hydroelectric Facility to maximize the value of energy generated at the facility and successfully implementing a cost-effective option for in-house operation and maintenance of the Lake Hodges Hydroelectric Pumped Storage facility. Also, physical security assessments were conducted resulting in the development of improvement plans for critical facilities for continued water system protection against potential threats and battery systems were installed at both the Kearny Mesa Headquarters and the Twin Oaks Valley Water Treatment Plant to reduce energy demand charges.

## Water System Management Focus Areas

The focus areas of the Water System Management Program are **Energy Initiatives**, **Facilities Security and Emergency Response**, and **Operations and Maintenance**. Within each focus area are management strategies that will drive staff to accomplish major objectives and tactics over the next five fiscal years.

### Energy Initiatives

The Water Authority's energy initiatives support efforts to maximize existing power generation facilities, advance new energy initiatives, foster strategic partnerships, and participate in the setting of legislation and regulations. Over the past several decades, the Water Authority has successfully pursued diversification of its water supply portfolio to reduce potential supply shortages. Similarly, this focus area strives to diversify the Water Authority's



A proposed energy storage facility at the San Vicente Reservoir Site is one energy initiative under consideration by the Water Authority Board of Directors.

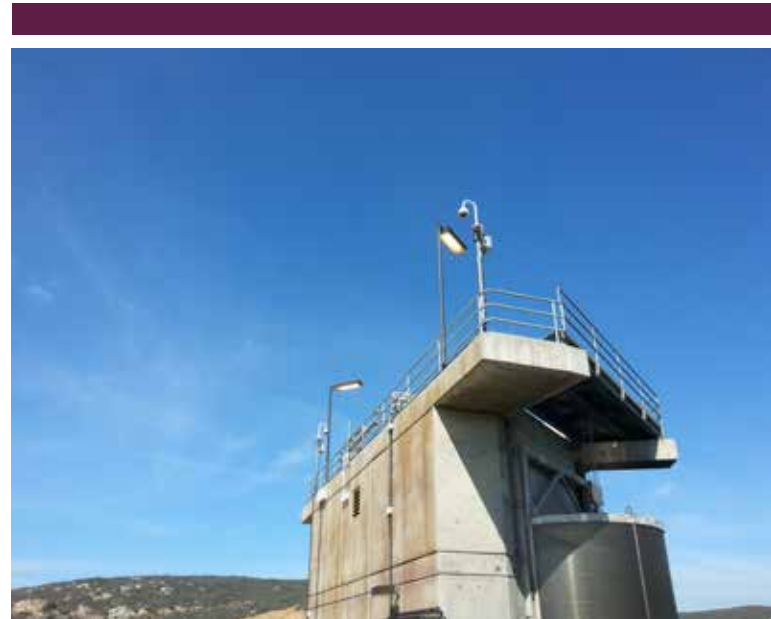
energy supply portfolio to address economic and electrical system reliability risks. The Water Authority's Energy Management policy, adopted by the Board in 2013, provides direction for the implementation and administration of energy efficiency projects and programs.

### **Facilities Security and Emergency Response**

The Water Authority operates critical infrastructure to ensure a safe and reliable water supply for the region. Security and emergency response efforts support the need for physical and cybersecurity, business continuity, and emergency preparedness. This focus area emphasizes the protection of critical facilities and the operations control system against risks and vulnerabilities from all potential threats, such as terrorism and cyber-threats. The Water Authority plays a critical dual role during emergencies, as a provider of water to the region and as a first responder. The ability to respond quickly during a security or emergency incident is crucial to ensure water supply availability to our member agencies and to minimize potential injury, loss of life and property damage.

### **Operations and Maintenance**

The Operations and Maintenance area focuses on efficiently maintaining system reliability and continuing to develop staff that are driven to excellence in their fields of expertise. The Water Authority's complex water system requires staff to continuously develop their knowledge, skills and abilities. In addition, efficient operations and enhanced proactive maintenance sustains a reliable water system and increases the Water Authority's ability to efficiently support and supply its member agencies.



Water Authority facilities are monitored to ensure the safety of the water supply.

## ENERGY INITIATIVES

- A. Leverage power market opportunities that maximize the value of existing energy facilities.
- B. Pursue new energy initiatives that reduce energy costs.
- C. Develop updates to the 2013 Board adopted Energy Management Policy.
- D. Coordinate with local, regional, state and federal agencies to best position Water Authority energy purchases.
- E. Influence energy rule-making by engaging in legislative and regulatory processes.

## FACILITIES SECURITY AND EMERGENCY RESPONSE

- F. Provide necessary facilities, staffing, and funding to support security and emergency response requirements.
- G. Comply with applicable state and federal regulations regarding security.
- H. Engage in water related security and emergency response issues at the local and national levels.

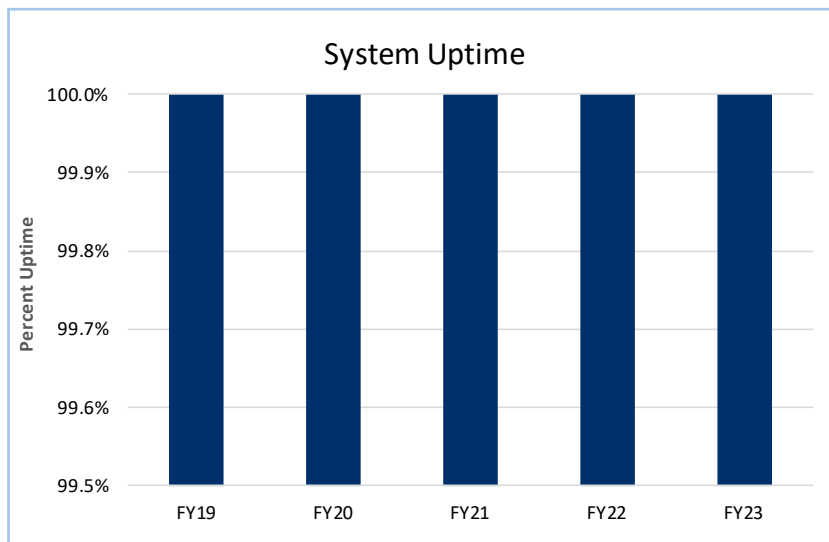
## OPERATIONS AND MAINTENANCE

- I. Maintain water system reliability and efficient operations through staff development and facility improvements.
- J. Enhance proactive maintenance practices.

No.	Description	Target date
1.	Secure a bill crediting arrangement at the Lewis Carlsbad Desalination Plant for energy generated from the Rancho Peñasquitos Hydroelectric Facility to the desalination plant to offset the plant's energy costs. (A, B, E)	Jun-2019
2.	Complete update and obtain Board approval of updates to the 2013 Energy Management Policy. (C)	Jun-2019
3.	Develop a major maintenance and replacement plan for the Lake Hodges Hydroelectric Pumped Storage Facility. (I, J)	Dec-2019
4.	Negotiate a draft project development agreement with a developer for Board consideration for the proposed San Vicente Energy Storage Facility project. (A,B)	Dec-2019
5.	Complete an Escondido Facility Space Needs Assessment Study and utilize the Study results to develop a master plan for an efficient and secure operating facility. (I)	Dec-2019
6.	Construct and place into operation the Mission Trails Chlorination facility to mitigate nitrification on the 2nd Aqueduct. (I)	Mar-2020
7.	Implement identified physical security assessment recommendations for critical facilities. (F, G, H)	Jun-2020
8.	Complete replacement of the instrumentation communication network at San Vicente Pump Station to increase operational reliability of these facilities. (I)	Jun-2020
9.	Develop a communication system master plan for the Water Authority's Aqueduct Control System. (I)	Jun-2020
10.	Evaluate alternatives for centralizing energy generation and usage data. (B)	Dec-2020
11.	Identify innovative opportunities for energy procurement to reduce energy costs and identify schedules for economically viable alternatives. (D, E)	Dec-2020
12.	Participate in Federal and State regulatory proceedings to move bulk energy storage forward in California. (E)	Jun-2023

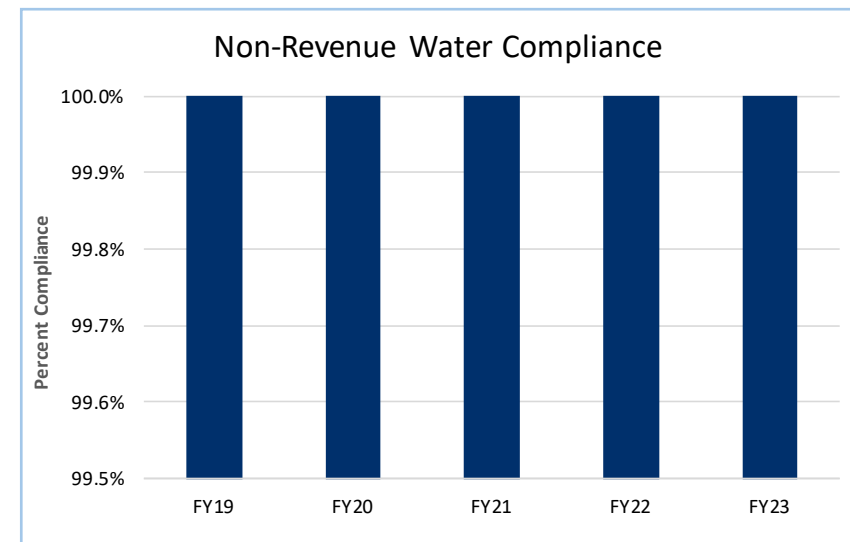
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Eliminate unplanned service interruptions to member agencies by maintaining 100 percent system uptime each fiscal year.



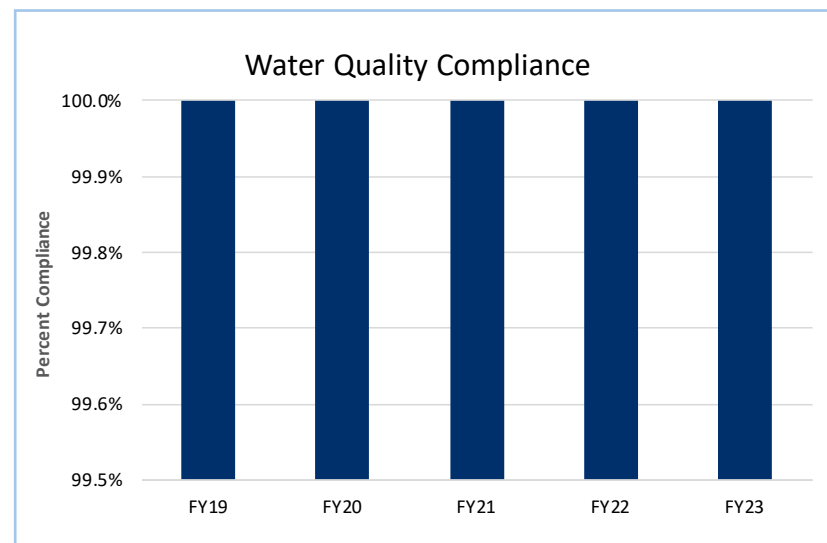
2

Minimize non-revenue water by managing system water loss within established standards 100 percent each fiscal year.



### 3

Meet all federal and state drinking water regulations by maintaining 100 percent compliance each fiscal year.





**FIGURE 4.1 Business Services – Programs and Focus Areas**

<b>BUSINESS SUPPORT</b>	<b>COMMUNICATION AND MESSAGING</b>	<b>FINANCIAL MANAGEMENT</b>	<b>WORKFORCE MANAGEMENT</b>
Cybersecurity	Governmental Relations Outreach	Accounting	Leadership
IT Services and Operations	Public Outreach	Debt and Investment Management	Culture
Facilities	Regulatory Policy Support	Financial Planning	Talent Management
Administrative Support			Communication
			Technology

# Business Services

## Business Services Overview

The Business Services focus area consists of four programs: **Business Support**, **Communication and Messaging**, **Financial Management**, and **Workforce Management**.

The Business Support Program encompasses the areas of cybersecurity, technology, records management, and facilities, and supports efficient and productive agency operations.

Communication and Messaging supports and maintains strong relations with regulators, elected officials, and other stakeholders through effective communication.

Financial Management focuses on near- and long-term financial planning, management and reporting.

Workforce Management bridges the workforce of today with the workforce of the future.

Collectively, the programs within the Business Services focus area serve as the foundation for all aspects of the Water Authority's business operations and is an essential component of the Business Plan.

Key issues within the Business Services focus area include the following.

- ▶ Adopting pioneering technology and protecting against cybersecurity threats
- ▶ Continuing effective communications with external stakeholders
- ▶ Implementing long-term financial plans to provide rate and charges guidance
- ▶ Attracting, retaining, and developing a high-performing workforce



The Business Services focus area serves as the foundation for all aspects of the Water Authority's business operations.

## Business Support Overview

The Water Authority's day-to-day operations, long-term planning, engineering, design, communication, and public engagement all depend on high-quality business support services. The Business Support Program helps the organization meet its ongoing and rapidly changing needs by providing excellent information technology systems, tools and services, implementing cybersecurity best practices and performing a range of critical administrative functions to support daily business operations, such as records management, facility management, risk management, and purchasing and contract support.

Recent accomplishments for the Business Support Program include transitioning email, Microsoft Office and other key systems to cloud-based platforms, completing the first in-house major upgrade to PeopleSoft enterprise software, and developing new web-based applications and dashboards to facilitate program reporting and transparency. Others include implementing a number of critical cyber and information security measures in accordance with the Center for Internet Security's CIS-20 framework, completing several facilities projects designed to reduce water and energy use at the Kearny Mesa headquarters (including installation of electric vehicle chargers, switching to LED light fixtures and a Sustainable Landscape demonstration garden), updating the organization's Record Retention Schedule, and finding cost-effective insurance coverage to mitigate risk from new facilities or initiatives such as drone use.

The Business Support Program must remain driven to act nimbly and provide solutions to new and evolving circumstances. Critical technologies such as website, phone communications and enterprise software will need to be upgraded, while staff continue to bolster cybersecurity defenses and stay on top of ongoing needs such as helpdesk requests, developing new web/GIS apps for customer departments, and managing network hardware and software. Meanwhile, staff will implement cost-effective measures to make the Water Authority's headquarters facility more efficient, resilient and secure, and they will continue to pursue administrative initiatives, such as expanding the use of electronic document signatures, designed to improve staff efficiency and productivity.



The Sustainable Landscape demonstration garden at the Water Authority's headquarters is one facilities project designed to reduce water use.

## Business Support Focus Areas

The focus areas of the Business Support Program are **Cybersecurity, IT Services and Operations, Facilities,** and **Administrative Support**. The focus areas support the vision of the program to protect, enable and improve the ability of the organization and its employees to perform their duties effectively and efficiently.

### Cybersecurity

Comprehensive network security remains a high priority for the agency and is critical to providing stable business operations. Best practice technical and administrative controls were enhanced as part of an overarching program to ensure the organization is well protected against cyber threats. The multi-layered security model is consistently updated to reflect current trends and respond to emerging threats. In Fiscal Year 2019, the Water Authority repurposed several staff positions to ensure effective coordination and implementation of information security measures for the business and Aqueduct Control System. Over the next five fiscal years, staff will continue to follow the implementation and maintenance of internationally recognized best practices for securing our systems and data.

### IT Services and Operations

The Water Authority continually updates its technology infrastructure and tools to support enhanced business operations, such as providing specialized software and robust databases that deliver essential financial reporting and budgeting tools. It also maintains a specific suite of software applications to help meet agency-wide business needs and manages critical network infrastructure, allowing Water Authority employees to operate effectively and to deliver high-quality service to its member agencies and stakeholders. This focus area will continue to support customer departments with improved databases, dashboards, websites and other applications, by making



A Water Authority Information Systems developer programming a specialized database for use by the Operations and Maintenance department.

timely upgrades and enhancements to financial management, human resource and asset management enterprise software, and by ensuring equipment and technical tools are available to employees when and where needed. The Water Authority's IT Policy Committee provides oversight of new investments in IT services and applications to ensure accountability and to align with business needs.



Solar panels installed on the roof of the Kearny Mesa headquarters have improved energy efficiency. Initiatives are planned to continue to improve energy efficiency by 7 percent over the next five fiscal years.

## Facilities

The Facilities focus area covers the operation and maintenance of the Kearny Mesa headquarters building and associated facilities. It works to enhance the efficiency of these facilities and ensure employees, Board members and visitors have a safe, secure and comfortable environment for their official business. In recent years, the Water Authority has implemented many physical improvements, such as solar panels, waterless urinals, dual-flush toilets, bathroom hand dryers, a hydration station, LED lighting, hallway lighting controls, and sustainable landscaping to immediately reduce energy and water use and save on their long-term costs. The Water Authority will continue to improve energy efficiency over the next five fiscal years through more efficient lighting, window tinting, roof improvements, and other projects. Many public agencies and institutions are re-evaluating and strengthening their building security measures to protect employees and visitors at their facilities from a variety of threats. The Water Authority recently conducted a security review and as a result of that review will be making physical and technological improvements, updating policies and conducting workforce training.

## Administrative Support

The Administrative Support focus area provides a variety of services crucial for carrying out the agency's business affairs, from records management to risk management to purchasing and other processes that support employee productivity and agency objectives.

The Water Authority maintains a comprehensive records management program that effectively manages agency records from creation to ultimate disposition so the Water Authority can reliably access documents when necessary to meet its legal, operational or other obligations as a public agency. Over the next five fiscal years, staff aims to pilot enhancements to its records management software platform to further automate records classification and disposition to make successful records management easier and more efficient.

Historically, the Water Authority has employed innovative and cost-effective solutions to manage risk and reduce exposure to liability. An example is implementing an owner-controlled insurance program during the height of the Capital Improvement Program. More recently, new lines of insurance have needed to be secured to cover areas such as drone use and cybersecurity. Given constantly changing laws and regulations, new facilities and technologies, as well as the need to control costs where possible, staff will need to remain agile and ready to adapt the Water Authority's insurance portfolio over the next five fiscal years.



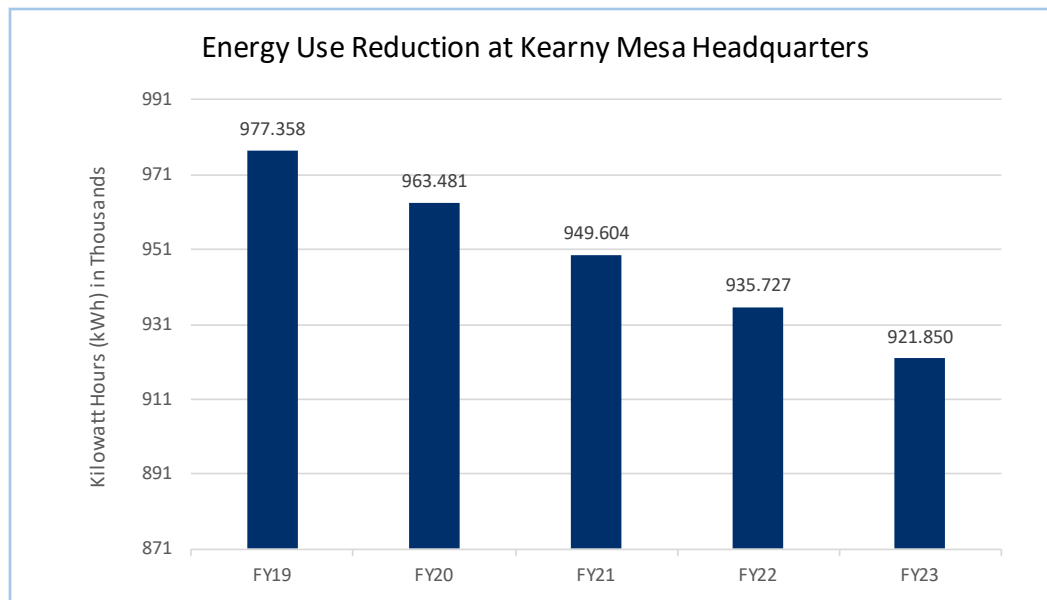
With the advancement of technology within the agency, new lines of insurance are needed, such as for drone use.

CYBERSECURITY		IT SERVICES AND OPERATIONS		FACILITIES		ADMINISTRATIVE SUPPORT	
A.	Provide back-up and recovery capability to protect data and critical information systems for business continuity.	D.	Maintain and upgrade critical software and business applications and hardware to meet business needs.	G.	Implement measures that maintain or enhance a safe, secure and productive working environment.	I.	Obtain cost-effective business insurance policies that appropriately manage risk and support evolving business needs.
B.	Implement cybersecurity measures to provide a safe and secure computing environment.	E.	Continually improve business processes by increasing automation, flexibility, ease of use, and mobility.	H.	Improve the efficiency of water and energy use at the Kearny Mesa Headquarters to reduce long-term costs and conserve resources.	J.	Maintain and upgrade records management practices and electronic document management systems.
C.	Educate employees to be technically skilled, well informed, alert, and vigilant.	F.	Upgrade, enhance, and support critical software applications to leverage new functionality, maintain compliance and compatibility, improve productivity and promote timely and informed decision making.			K.	Support and improve tools and processes that enhance business efficiency and productivity.

No.	Description	Target date
1.	Pilot implementation of enhancements to records management application that increase functionality, such as auto-classification of new records upon creation. (D, E, J, K)	Jun-2019
2.	Complete development of the Maximo computer maintenance management system for use in the field by Operations and Maintenance staff. (D, E, F)	Sep-2020
3.	Implement all physical and policy improvements to enhance the security of the Kearny Mesa Headquarters that were identified in the 2018 Security Review. (G)	Dec-2020
4.	Migrate three primary shared drives to cloud-based platforms to maximize resilience against loss of service while reducing on-premise physical server hardware needs. (A, B)	Dec-2021
5.	Upgrade existing phone technology to complete the “unified communication” system (combined messaging, presence, phone, video conferencing, voicemail, and email) to expand organization-wide communication capabilities. (D, E, F)	Dec-2021
6.	Reduce energy use of the Kearny Mesa Headquarters from Fiscal Year 2018 baseline by 7 percent by the end of Fiscal Year 2023. (H, K)	Sep-2023
7.	Implement at least 50 additional information security measures based on Center for Internet Security’s CIS-20 security framework. (A, B, C)	Sep-2023
8.	Adapt business insurance policies to cost-effectively meet the evolving needs of the Water Authority. (I)	Sep-2023
9.	Migrate electronic document management system to the cloud to improve systems resilience. (A, B, D, E, J, K)	Sep-2023

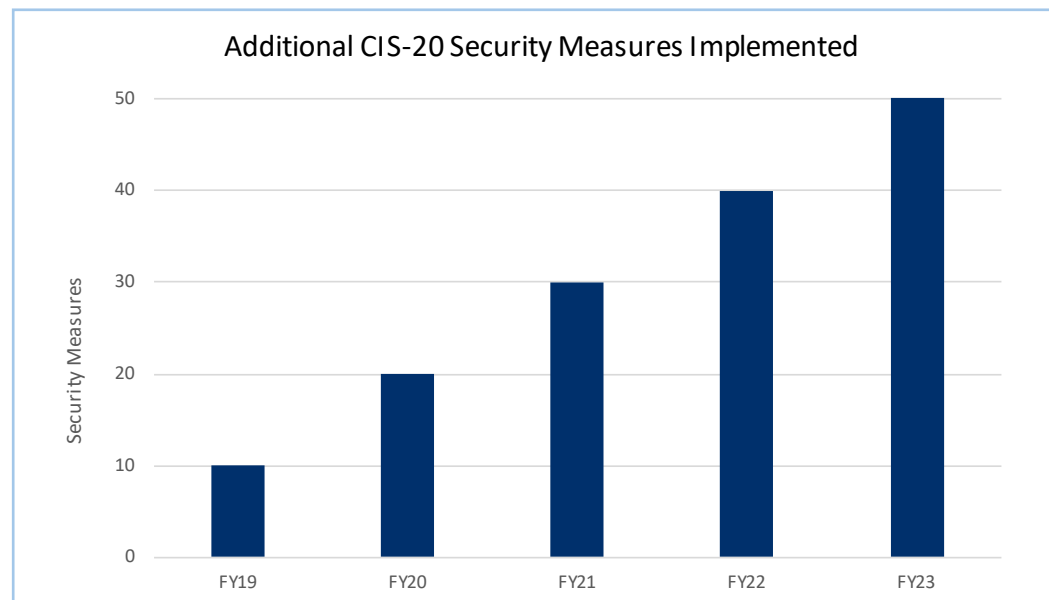
1

Reduce energy use of the Kearny Mesa Headquarters from the Fiscal Year 2018 baseline of 991,235 Kilowatt hours (kWh) by 7 percent by the end of the Fiscal Year 2023.



2

Implement at least 50 additional information security measures based on Center for Internet Security's CIS-20 security framework by the end of Fiscal Year 2023.



## Communication and Messaging Overview

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The Communication and Messaging Program supports the organization's vision in multiple ways. Effective communication with regulators, elected officials, media, community leaders, and the general public is imperative for meeting critical Water Authority goals. Regulatory or legislative requirements can have a significant impact on the Water Authority's and its member agencies' ability to maintain flexibility and cost sustainability of their systems. Meanwhile, public trust and support are also necessary to ensure the successful implementation of endeavors ranging from short-term maintenance projects to long-term supply reliability strategies. Engaging in these areas has become increasingly challenging in recent years as statewide drought and other complex water issues have dominated headlines and heightened public and regulatory interest in how water is secured, used, and funded.

Recent accomplishments in the Communication and Messaging Program include the State Water Resources Control Board's adoption of drought response requirements that take into consideration local supply development; engagement with the member agencies, WaterReuse California, and the State Water Resources Control Board to obtain flexible statewide standards for permitting reservoir potable reuse projects; and collaborating with WaterReuse to support passage of Assembly Bill 574 that lays out a strategy to advance direct potable reuse in California and develop statewide standards by 2023.

Government relations outreach efforts have resulted in the successful passage of Water Authority-sponsored bills that significantly advance the San Diego region's strong water conservation ethic into statewide policy and practice, and improved opportunities for small non-profit and disadvantaged community organizations to meaningfully

participate in Integrated Regional Water Management activities and projects. Additionally, the Water Authority has played an instrumental role in legislative efforts to secure robust funding for implementation of the Salton Sea Management Program.

Public outreach efforts have helped the San Diego region maintain a strong water conservation ethic. Water Authority branded communications, including the WaterSmart campaign, help to remind the public of the on-going need to practice efficient and sustainable water use. Outreach efforts have also helped maintain high levels of public support for the Water Authority's supply diversification strategy, water-use efficiency, and the value of public water services. Outreach has also bolstered engagement of community leaders on important water issues through initiatives such as the Citizens Water Academy and the new Brought to You by Water outreach and education program.

## Communication and Messaging Focus Areas

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The focus areas of the Communications and Messaging Program are **Government Relations Outreach**, **Public Outreach**, and **Regulatory Policy Support**. The focus areas support the vision of the program to maintain the Water Authority's leadership position in these areas into the future. Staff will remain driven to build and maintain strong relations with regulators, elected officials, and other stakeholders.

### **Government Relations Outreach**

The Government Relations Outreach focus area increases the Water Authority's political influence with Washington, D.C., Sacramento, and local entities to secure favorable legislation, funding, or other outcomes that will help ensure continued safe and reliable water supplies for the region. Objectives include being driven to support legislative outcomes that protect the interests of the San Diego region's water agencies and their rate payers.

### **Public Outreach**

The Public Outreach focus area builds community understanding and support for the Water Authority's strategies, programs, and projects through building and maintaining relationships with key audiences such as business, community, labor, education, environmental, industry leaders and organizations, the media, school-age children, and the general public. Outreach activities include media relations, online and social media communications, developing publications and other printed materials, hosting tours and events, offering school education programs, community presentations, and more. The focus area also oversees efforts to help small businesses participate in Water Authority procurements. Objectives include increasing our social media followers and engagement, along with redesigning [sdewa.org](http://sdewa.org) and "microsites" on an updated, integrated operating system.

### **Regulatory Policy Support**

The Regulatory Policy Support focus area enables the Water Authority to engage and collaborate with state and national organizations, groups, and other agencies to maximize its impact on various regulatory policies related to water supply and quality, energy, and the environment. The Water Authority actively partners

with various entities, such as WaterReuse, Association of California Water Agencies, American Water Works Association, Water Utility Climate Alliance, Western Urban Water Coalition, Cal Desal, Southern California Salinity Coalition and California Urban Water Agencies, to gain support on regulatory policy issues. In addition, it fosters relationships with state and federal agencies, such as the regional and state Water Boards, Division of Drinking Water, California Public Utilities Commission, California Department of Water Resources, and the U.S. Environmental Protection Agency. Other objectives include working with supporters to develop a visionary, long-term strategy to support potable reuse in California.



Advocating for the interests of San Diego County's ratepayers at the state and national level is a key objective of the Government Relations Outreach program.

### GOVERNMENT RELATIONS OUTREACH

- |    |   |
|----|---|
| A. | Strengthen relationships with the San Diego local, state, and federal legislative delegations, other key legislators, legislative staff, and the state and federal administrations. |
| B. | Engage and influence relevant legislation, regulatory matters, and funding requests in the Legislature, Congress, and state and federal administrations.                            |
| C. | Sponsor and promote legislation that positively impacts the region and conveys San Diego's role as a statewide water community leader.  |

### PUBLIC OUTREACH

- |    |  |
|----|--|
| D. | Enhance public understanding and support for Water Authority and member agency strategies, policies, and programs.   |
| E. | Implement innovative and effective public outreach programs and tools that deliver Water Authority messages to key stakeholders.                                     |
| F. | Promote greater public awareness of local water issues and wise water use by building relationships and partnerships with compatible organizations and institutions. |

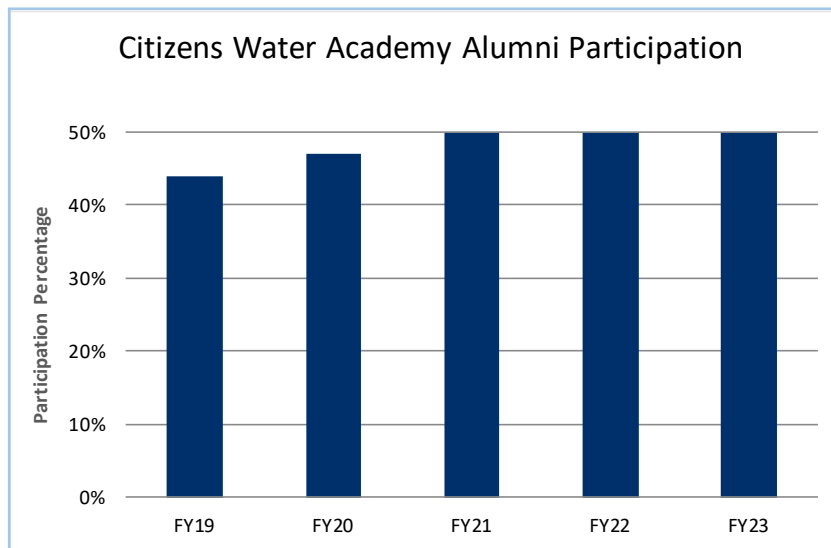
### REGULATORY POLICY SUPPORT

- |    |   |
|----|---|
| G. | Maximize flexibility and sustainability in water supply development and management, water-use efficiency, and water quality protection. |
| H. | Foster collaborative relationships with regulatory agencies.  |
| I. | Engage in policy and regulatory development under local, state and federal water, energy, and environmental laws.                       |
| J. | Inform and obtain feedback from Water Authority departments and member agencies on regulatory and permitting issues.                    |

No.	Description	Target date
1.	Conduct communications and outreach activities that result in at least 70 percent of stakeholders viewing municipal water service as a “good” or “excellent” value through the public opinion poll. (D, E, F)	Jun-2019
2.	Execute a minimum of three significant programs or events to commemorate the Water Authority’s 75th Anniversary. (A, D, E, F)	Jun-2019
3.	Execute effective advocacy strategies to defeat all legislation that the Water Authority Board opposes each year. (B)	Dec-2019
4.	Redesign sdcwa.org and microsites on an integrated, up-to-date operating system. (E, F)	Jun-2020
5.	Grow total social media audience and engagement by 15 percent. (F)	Sep-2020
6.	Achieve passage of one or more Water Authority sponsored bills annually. (A, B)	Dec-2020
7.	Provide at least one briefing annually to each member of the San Diego state legislative delegation to enhance support for advancing and protecting the Water Authority’s legislative interests. (A, B)	Jun-2021
8.	Increase awareness and understanding of the Water Authority’s interests by providing at least one briefing annually to each member of the San Diego congressional delegation in Washington, D.C. and the San Diego district office. (A, B)	Jun-2021
9.	Strengthen relationships with state and federal legislators by conducting at least two legislative roundtable events at the Water Authority headquarters during each calendar year. (A, B)	Jun-2021
10.	Engage in outreach efforts that result in at least 50 percent of Citizens Water Academy alumni engaging in at least one alumni activity through Fiscal Year 2021. (E, F)	Jun-2021
11.	Convene the Potable Reuse Coordinating Committee to advocate for direct potable reuse criteria that supports potable reuse in the San Diego region. (H, I, J)	Jun-2023
12.	Participate with water supply stakeholders to support water supply development and operations in EPA’s rulemaking for Waters of the United States. (H, J)	Jun-2023

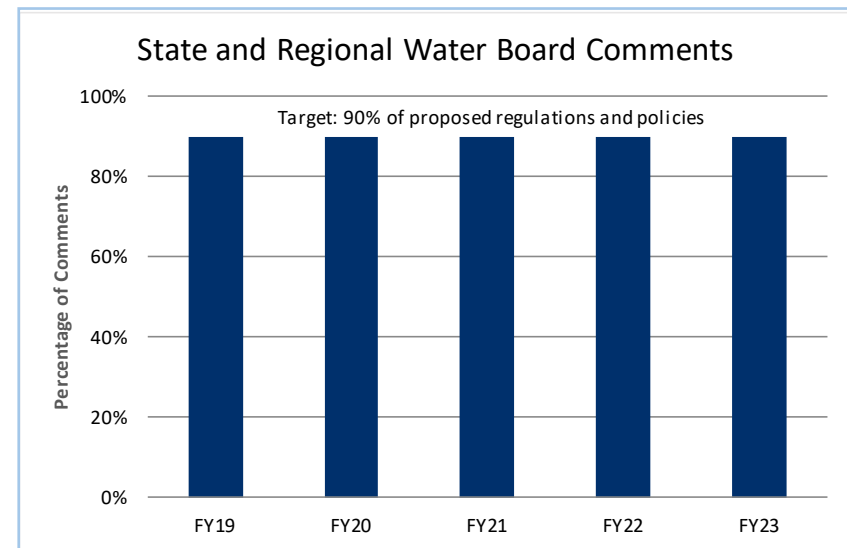
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Engage in outreach efforts that result in at least 50 percent of Citizens Water Academy alumni participating in a least one alumni activity through June 2021.



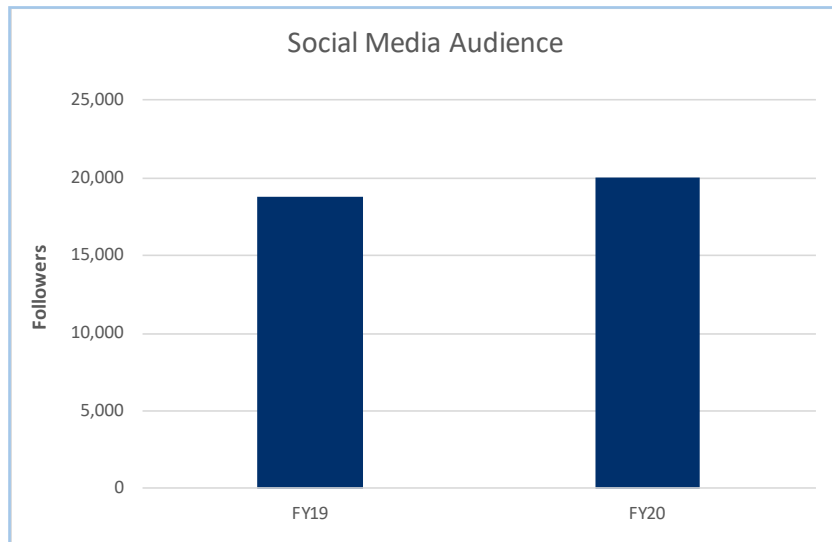
2

Provide comments on a least 90 percent of the proposed State or Regional Water Board regulations and policies that directly impact the Water Authority or its member agencies.



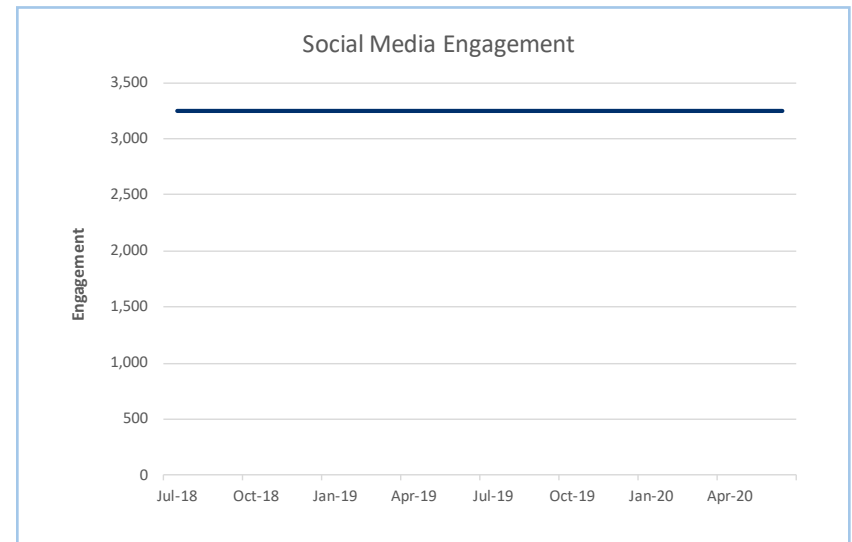
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Grow total social media audience (followers) from 17,500 to 20,000 across core platforms (Twitter, Facebook, Instagram and LinkedIn) by the end of Fiscal Year 2020.



4

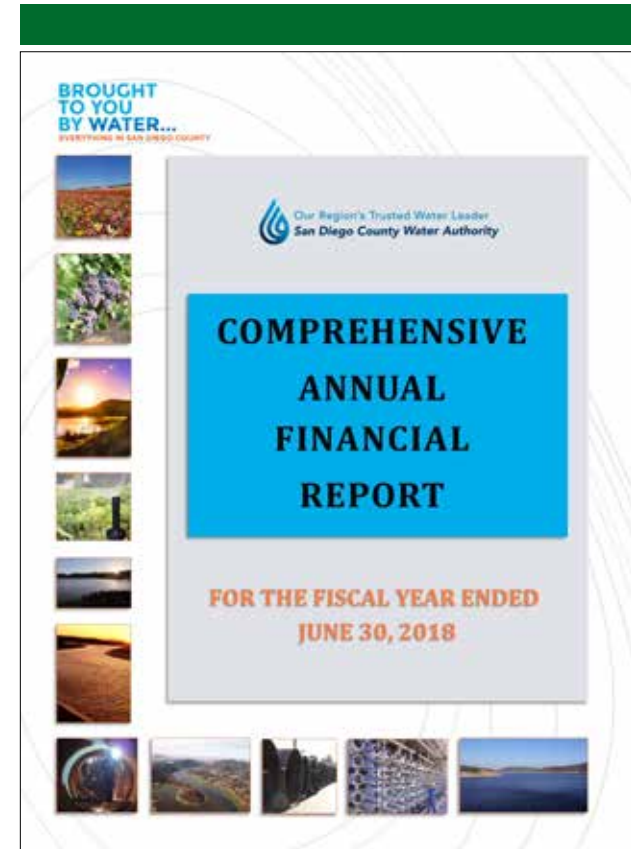
Increase monthly social media engagement (shares, likes, comments, clicks) from 2,750 per month to 3,250 per month by the end of Fiscal Year 2020.



## Financial Management Overview

The Water Authority maintains a comprehensive financial management plan that focuses on both near-term and long-term planning to provide smooth and predictable rates and charges. A key ongoing component of near-term planning and reporting is the Water Authority's Multi-Year Budget. The last Multi-Year Budget, adopted in June 2017, successfully executed the financial policies and objectives as determined by the Board of Directors. The Multi-Year Budget document conforms to the highest standards and has received awards for Distinguished Budget Presentation from the Government Finance Officers Association (GFOA) every year since 1995. The Multi-Year Budget will be presented for adoption every other June during the five year planning period of the 2019-2023 Business Plan. An additional and equally key component of our near-term planning and reporting is the preparation of the Comprehensive Annual Financial Report (CAFR). The CAFR is produced to report the results of the financial operations each fiscal year. The report for the prior fiscal year, ending on June 30, is presented to the Audit Committee and Board of Directors during the last meeting of each calendar year. The CAFR preparation has received the prestigious GFOA Certificate of Achievement award for the past fourteen years.

Central to long-term planning is the development of the Long-Range Financing Plan, which was most recently updated and adopted by the Board of Directors in January 2016. The Long-Range Financing Plan is a 10-year guiding document that incorporates the Water Authority's financial policies and goals. It includes an optimized funding and Capital Improvement Program strategy, water sales and rate projections, and sensitivity analyses of selected variables.



Comprehensive Annual Financial Report 2018

## Financial Management Focus Areas

The key focus areas of the Financial Management Program are **Accounting**, **Debt and Investment Management**, and **Financial Planning**. Within each focus area, management strategies are identified to determine the vision for accomplishment of significant objectives and tactics over the next five fiscal years.

### Accounting

The Accounting focus area centers on delivering accurate, meaningful, and timely information to all of its customers. This group has the important responsibility of recording the financial activities of the Water Authority using various accounting platforms and summarizing the financial activities into levels of information important to our internal and external users. Management strategies for Accounting includes providing financial data and other key information, monitoring revenue and expense trends, and assessing industry best practices to apply to Water Authority financial operations.

### Debt and Investment Management

Effective debt and investment management help to minimize costs. By optimizing the debt portfolio, the Water Authority's cost of funds can be reduced. Effective management of the investment portfolio maximizes the revenues generated from the Water Authority's cash balances and offsets other costs. Management strategies under Debt and Investment Management include maintaining solid credit fundamentals and optimizing the capital financing mix.

## Financial Planning

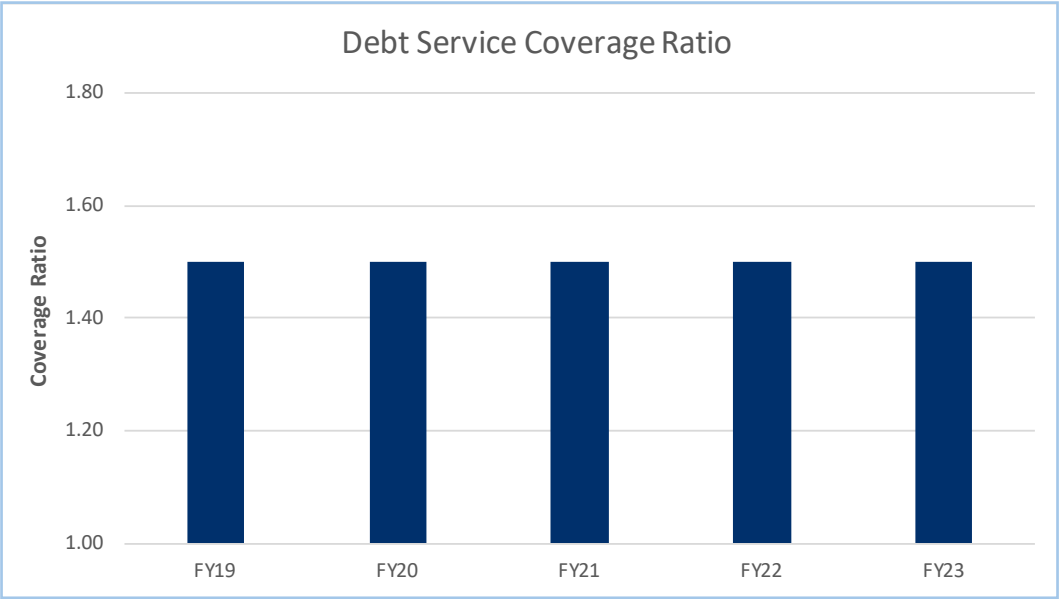
The Water Authority's prudent financial planning and sound financial policies are aligned to achieve long-term fiscal sustainability. Financial planning involves accurately projecting both near- and long-term operating and capital costs so rates and charges can be set to achieve the financial policy goals (i.e. the Board of Directors' Senior Lien Coverage Ratio target of 1.5 times). Financial planning strategies include ensuring financial policies are aligned with the long-term fiscal sustainability of the Water Authority.

ACCOUNTING	DEBT AND INVESTMENT MANAGEMENT	FINANCIAL PLANNING
A. Provide relevant, accessible, and usable financial data and other key information.	D. Ensure Water Authority credit ratings through sound financial management.	H. Develop detailed cost projections for Capital Improvement Program projects and operations to develop long-term rate projections.
B. Analyze revenue and expense trends proactively to anticipate early budget variances and formulate actions to ensure fiscal sustainability.	E. Ensure strong financial industry presence for the Water Authority.	I. Analyze and recommend an updated rates and charges model resulting in the goals of cost efficiency, predictable rates, and intergenerational equity.
C. Assess and recommend as appropriate industry best practices and new accounting standards for applicability to Water Authority financial operations for enhanced financial reporting.	F. Strategically optimize the resources of the debt and investment portfolio to execute future bond and investment transactions successfully.	J. Provide high level of service to member agencies while ensuring equitable rates and charges.
	G. Optimize the capital financing mix to achieve the lowest cost of funds and minimize interest rate risk.	K. Ensure financial policies are aligned with the long-term fiscal sustainability of the Water Authority.

No.	Description	Target date
1.	Upgrade the Financial Rate Model Program for rate and charge reliability. (A, B, I)	Mar-2019
2.	Develop and obtain approval for a long-term pension funding strategy for future pension savings. (C, G, K)	Jun-2019
3.	Complete the full implementation of both short-term and long-term investment strategies to realize future investment earnings. (E, F, K)	Jun-2019
4.	Complete pipeline refunding transactions resulting in debt policy driven savings. (D, F, K)	Jun-2019
5.	Restructure the Chart of Accounts for better measurement of the organization's performance and increase effectiveness of reporting. (A, C)	Jul-2019
6.	Develop the Water Billing and Information Management System project (subsequently renamed the Data Archival and Invoicing System - DAIS) to replace the existing PRIMA and WBIS systems. (A, C)	Mar-2020
7.	Update budgeting processes to ensure efficiency and continued best practices in accordance with Government Finance Officers Association standards. (A, C, H)	Jun-2020
8.	Advocate Water Authority position through participation in two industry conferences per year via speaking engagements and achieve membership in industry committees and boards, such as California Society of Municipal Finance Officers, Government Finance Officers Association, Bond Buyer, and the California Municipal Treasurer's Association. (E, K)	Jun 2023

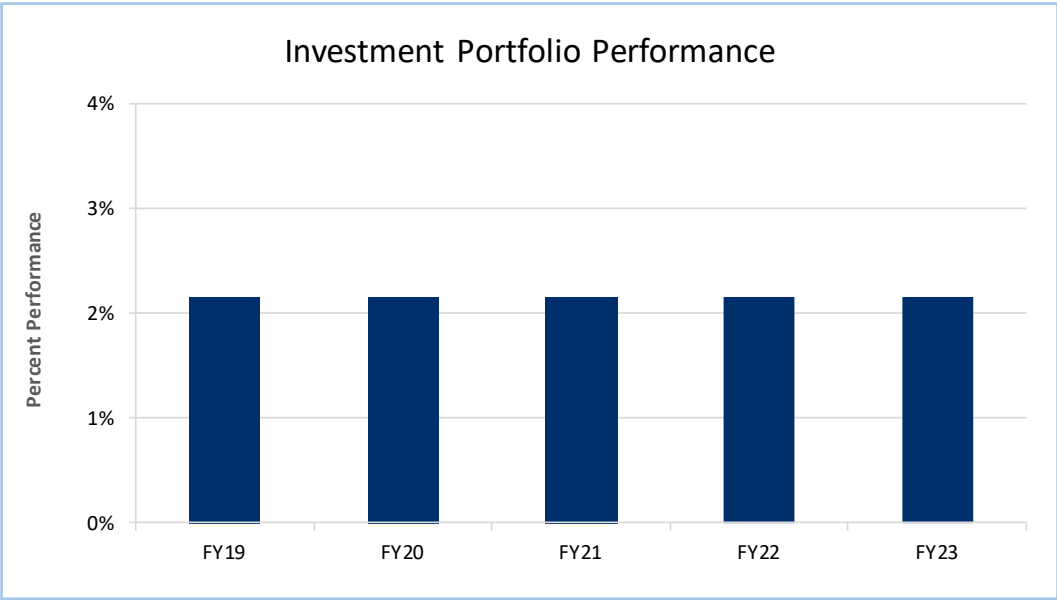
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Maintain debt service coverage ratio of 1.5 times on senior lien debt in accordance with the Water Authority’s Board policy target. (Source: Water Authority Board and Long-Range Financing Plan.)



2

Monitor the Water Authority’s short-term investment portfolio performance using the Bank of America Merrill Lynch 0-3 Year US Treasury & Agency Index as a performance benchmark.



## Workforce Management Overview

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Workforce Management continues to be one of the greatest challenges facing the public sector today. Surrounded by a rapidly evolving world, volatile economies, environmental impacts, rapid changes in technology, and the changing needs of the workforce require the public sector to think differently about how to shape our organizations. Workforce Management focuses on key areas to shift the organization to a higher level of performance and to strategically position the organization as a driver of change and innovation.

### Workforce Management Focus Areas

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The focus areas of the Workforce Management Program include **Leadership**, **Culture**, **Talent**, **Communication**, and **Technology**. Within each focus area are strategies to accomplish the objectives and tactics planned for the next five fiscal years.

#### Leadership

The Water Authority emphasizes organization-wide knowledge of its mission, vision, values, and priorities of its leadership to manage the ‘workforce of tomorrow’. The Workforce Management Program is responsible for the development of targeted leadership and skill-based training programs to ensure the workforce fulfills the competency and leadership skills necessary for the success of the agency. Leadership training, combined with succession planning, enables the Water Authority to create a long-term, flexible system focused on the development of visionary leaders that will cultivate an innovative spirit across the entire workforce.

#### Culture

Organizational culture captures the ‘personality’ of an organization and how it functions and expresses itself. Culture is the key factor in determining how effectively the Water Authority’s goals and objectives will be achieved. Objectives of a positive organizational culture focus on developing policies, programs, and practices that support the physical, social, and mental well-being of the workforce, allowing each individual to bring their best selves to their roles in the organization. A healthy organizational culture can also facilitate improved professional development, career agility, and knowledge transfer to ensure the Water Authority’s succession planning needs are met through acknowledging the value of creativity, continuous process improvement, and an agile organizational structure. As we address the Water Authority culture, it is also paramount to ensure inclusive leadership methods are employed, such as openness and consideration of innovative solutions and diverse points of view.

#### Talent Management

Ensuring there is a high performing workforce in place to execute and meet desired results is paramount to workforce management. Assuring the Water Authority has the right people, in the right place, at the right time, with the right set of skills, will allow the organization to continue to move forward. Creating an integrated systems approach to talent management improves the agency’s ability to fulfill evolving needs of the agency and its workforce.

The nature of the workforce is increasingly changing. Traditionalists are all but gone from full time employment and baby boomers are quickly exiting the workforce. Millennials are the fastest growing demographic in applicant pools. Because of the rapid and multiple changes taking place across the spectrum of society in general,

organizations will have to evolve to be able to fulfill missions, successfully achieve goals and objectives and retain this valuable workforce demographic.

To address this new workforce, the Water Authority will adopt and promote innovative practices for attracting, selecting and promoting employees who possess the desired personality characteristics (e.g. agility and curiosity) for the future state of the needed workforce. The Water Authority will not discount technical competencies for job success, but will begin to shift to more strongly encourage hiring managers to hire for desired attributes and train for technical skills when possible.



Regional Water/Wastewater program interns visit Helix Water District for an informative tour.

To address the hiring gaps of entry level water/wastewater positions among member agencies, the Water Authority has facilitated the Regional Water/Wastewater program for over ten years and will revamp the program over the next two years to better include the stakeholders, including the local community colleges and member agency contacts.

### Communication

Communication touches every area of our business operation and every employee. Communication is rapidly changing in messaging, frequency and the manner in which the message is transmitted in order to be effective. The proliferation of communication channels, along with the changing dynamic of the workforce, requires the Water Authority to be innovative in developing communication strategies that reach all employees in all locations. Workforce management plays a key role in how effective communication channels operate and connect the workforce with one another internally across departments as well as externally with the public. Included in the objectives is the development of a Water Authority introductory video to provide a framework for prospective applicants unaware of the water industry.

### Technology

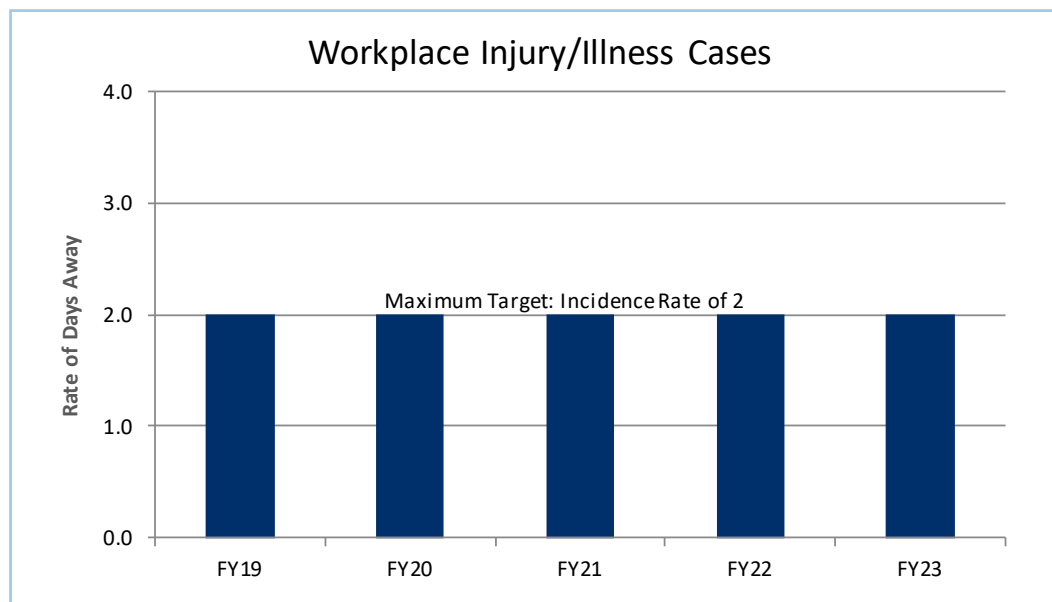
Technology plays a critical and foundational role in providing workforce management, not only for the automated processes but also for the analytics that can be derived from such tools. Evaluating and developing tools for employee performance will ensure more effective feedback at more regular intervals to address any issues or highlight any successes. Additional technology tools will streamline human resources practices that will improve accuracy, speed, transparency and relevance to the overall workforce management strategies.

LEADERSHIP	CULTURE	COMMUNICATION
A. Strengthen leadership capabilities and capacity to encourage performance excellence and productivity.	B. Foster a positive culture by developing policies, programs and practices that support the employees' physical, social, and mental well-being; and facilitating learning through professional development, career agility, and knowledge transfer.	C. Maintain open and effective communication that addresses the changing dynamic of the workforce.
TALENT	TECHNOLOGY	
D. Creating an integrated systems approach to Talent Management better enables the organization to meet the evolving needs of the agency and the workforce of the future.	E. Evaluate and facilitate tools that will streamline processes and provide more relevant and effective information.	

No.	Description	Target date
1.	Develop communication plan and implement additional communication channels to address changing demographics of the workforce. (C)	Jun-2019
2.	Evaluate and implement a competency-based hiring model. (D, E)	Mar-2019
3.	Evaluate a new performance review tool to address consistent, relevant feedback for leadership staff. (E)	Jun-2019
4.	Develop and produce job preview videos, showcasing our industry and what a hard to recruit for job looks like. (C)	Jun-2019
5.	Develop a workforce management strategic plan that addresses diversity and inclusion. (B)	Jun-2020
6.	Reassess the San Diego Regional Water/Wastewater Internship Program to address needs of the stakeholders and increase number of qualified applicants. (D)	Mar-2021
7.	Develop a Water Authority Alumni Network and hold annual meetings with the Alumni group. (D)	Jun-2021
8.	Develop targeted quarterly leadership and ongoing skills-based training programs for employees to address any competency gaps in the workforce. (A)	Jun-2023
9.	Develop organization-wide mentoring program designed to empower early and mid-career professionals, increase diversity, attract high performing employees, and foster a culture of continuous learning and knowledge transfer. (A, B, D)	Jun-2023
10.	Achieve and maintain an employee turnover rate of six percent or less, factoring out retirements, for employees meeting or exceeding overall performance standards each fiscal year. (D)	Jun-2023
11.	Develop and implement Wellness Initiatives to improve health and wellness of employees; develop employee satisfaction survey regarding wellness; and achieve 20 percent increase in satisfaction from baseline results. (B)	Jun-2023
12.	Enroll 150 Water Authority employees over a two-year fiscal period in the supervisory training provided by the Liebert Cassidy Whitmore Employee Relations Consortium. (B)	Jun-2023

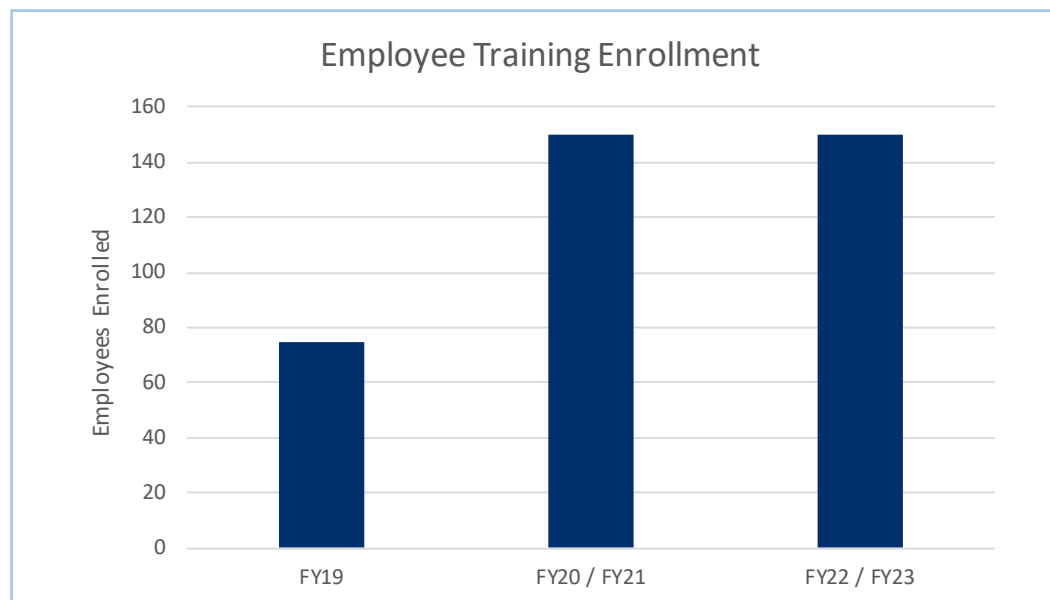
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Reduce the number of workplace injury/illness incidents by achieving 100 percent hazard identification and remediation each calendar year.



2

Enroll 150 Water Authority employees over a two-year fiscal period in the supervisory training provided by Liebert Cassidy Whitmore Employee Relations Consortium.



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## Appendix 1

### Guiding Policies and Principles

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The Water Authority's member agencies are represented through a 36-member Board of Directors. The Water Authority was formed by an Act of the California state legislature establishing the Board of Directors as the agency's governing body. Below are highlights of the Board's adopted principles and policies that guide the Water Authority in its business practices.

**County Water Authority Act** – Sets forth the organization, incorporation, and government of the Water Authority, including authorizing the agency to acquire and own water rights, to construct and maintain facilities, and to tax and incur bonded indebtedness.

**Debt Management and Disclosure Policy** – Ensures the Water Authority's debt portfolio is optimized to minimize cost of funds and ensure savings from refunded debt are maximized.

**Delta Policy Principles** – Guides staff in evaluating Bay-Delta initiatives and the Water Authority's advocacy to ensure a successful implementation of a Delta solution.

**Energy Management Policy** – Provides guidance to the Board when it is considering energy related issues, and provides guidance to staff in the development of projects and programs. Areas of focus include inter-agency cooperation; the design, construction, maintenance, and operation of facilities; and public education.

**Fiscal Sustainability Guiding Principles** – Provides guidance to the Board when it is considering changes or additions to the Water Authority's rates and charges structure or financial policies with the objective of ensuring long-term fiscal sustainability.

**Legislative Policy Guidelines** – Leads staff and the legislative advocates on issues of critical importance to the Water Authority and its service area. Provides a framework for evaluation of potential impacts to the Water Authority from state and federal legislation.

**Water Shortage and Drought Response Plan Allocation Methodology** – Establishes policies and procedures for administering the Municipal and Industrial (M&I) water supply allocation methodology to member agencies during times of water shortage or drought.

**Water Supply Diversification Strategy** – Guides Water Authority staff to enhance regional water supply reliability through a diversified water supply portfolio.

**Water Use Efficiency Policy Principles** – Provides Water Authority staff with long-term strategic direction for planning and implementing regional water use efficiency initiatives and programs.

## Appendix 2

### Related Planning Documents

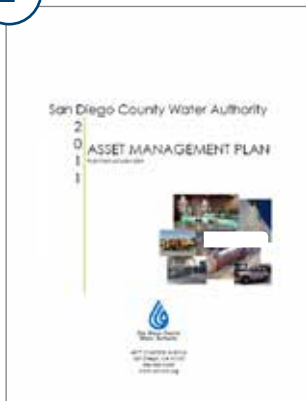
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1. **Aqueduct Operating Plan** – Reflects on-going efforts to optimize the delivery, treatment, and storage of water in the San Diego region through coordination between the Water Authority, its member agencies, and the Metropolitan Water District of Southern California. Prepared by the Operations and Maintenance Department.
2. **Asset Management Plan** – Documents the actions necessary to derive the most value from each Water Authority asset through its life cycle. Prepared by the Operations and Maintenance Department.
3. **Climate Action Plan** – An inter-disciplinary effort that promotes, facilitates, and coordinates implementation of climate change strategies and related activities within the Water Authority. Prepared by the Water Resources Department.
4. **Comprehensive Annual Financial Report** – Details the results of operations each fiscal year and includes the Continuing Disclosure, which is a required communication to investors. Prepared by the Finance Department.
5. **General Manager’s Adopted Multi-Year Budget** – Based on the Board of Directors’ financial and operational policies, and provides the resources necessary to achieve the Water Authority’s Business Plan management strategies, objectives, and tactics. Prepared by the Finance Department.
6. **Integrated Regional Water Management Plan** – Addresses resource management, water quality, and habitat in a region that includes the portion of San Diego County that is tributary to coastal waters. Prepared under the direction of the Regional Water Management Group.
7. **Long-Range Financing Plan** – Calculates the cost of service and projects the Water Authority’s financial position. It provides a solid financial foundation on which to build and operate the Water Authority’s infrastructure. Prepared by the Finance Department.
8. **Quantification Settlement Agreement** – Provides California the means to implement water transfers and supply programs to the state’s 4.4 million acre-foot basic annual apportionment of Colorado River Water. Prepared by various parties.
9. **Regional Water Facilities Optimization and Master Plan** – Provides a comprehensive evaluation of the infrastructure required for meeting the Water Authority’s mission to provide a safe and reliable water supply to its member agencies. Prepared by the Water Resources Department.
10. **Urban Water Management Plan** – Identifies a diverse mix of water resources projected for development over the next 25 years to ensure long-term water supply reliability for the region. Prepared by the Water Resources Department.
11. **Water Shortage Contingency Plan** – Provides the Water Authority and its member agencies with a series of potential actions to take when faced with a shortage of imported water supplies from Metropolitan Water District of California due to drought conditions. Prepared by the Water Resources Department.

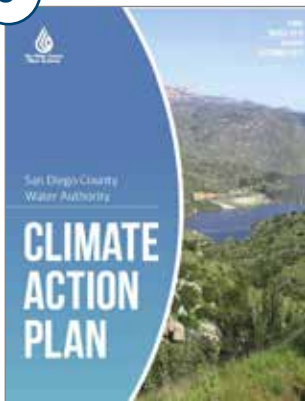
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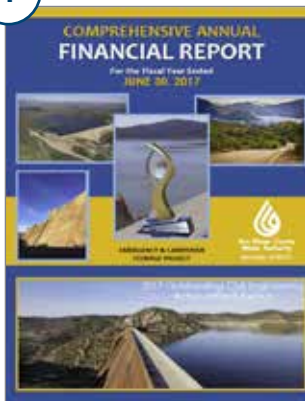
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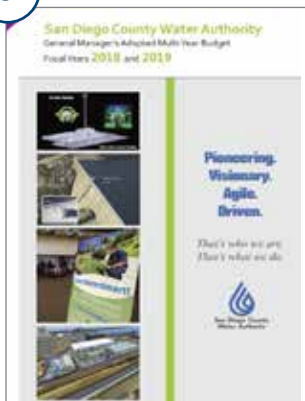
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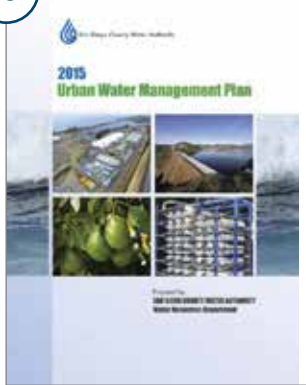
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## Appendix 3

### Agency Dashboard of Key Performance Indicators

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The Water Authority Agency Dashboard displays 12 key performance indicators, divided into 4 agency-wide focus categories: **Water Supply Reliability**, **Water Distribution and Facilities**, **Environmental Stewardship**, and **Financial Responsibility**.

#### Water Supply Reliability

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Key Performance Indicators

- ▶ **Diversification**  
Water supply diversification pie charts are used to track the Water Authority's progress towards our supply portfolio goals.
- ▶ **Storage**  
Reservoir storage is an important indicator of current supply reliability. The Storage indicator tracks member agency, Water Authority, and Metropolitan Water District water storage volumes and reservoir levels with comparisons to previous time periods.
- ▶ **Availability**  
Hydrologic conditions and storage levels for the State Water Project and Colorado River provide implications for water availability for the Water Authority and throughout California. The Availability indicator tracks precipitation, snowpack, major reservoir levels, and other indicators for the State Water Project and Colorado River systems.

#### Water Distribution and Facilities

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Key Performance Indicators

- ▶ **System Operation Water Deliveries**  
The System Operation indicator tracks untreated and treated water deliveries and aqueduct flows. Monthly and annual water deliveries reveal trends in water demand.
- ▶ **Water Quality Performance**  
Maintaining water quality standards is a vital component of the Water Authority distribution system. The Water Quality Performance indicator tracks compliance with water quality regulations and guidelines.
- ▶ **Operating System Reliability**  
The Water Authority's operating system consists of the communications network, aqueduct and facilities, and hundreds of miles of pipeline. The Operating System Reliability indicator tracks the communications and facilities systems uptime and outages compared to goals. Pipeline asset management is expressed through length of pipeline rehabilitated (relined, replaced, or repaired) and the impact of system improvements on the long-term reliability of the pipeline network.

## Environmental Stewardship

### Key Performance Indicators

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#### ► **Habitat Conservation**

The Water Authority's Habitat Conservation Plan and Natural Communities Conservation Plan describe the types of habitat, target species, and conservation areas within San Diego County preserved to offset environmental impacts from water supply and delivery projects. The Habitat Conservation indicator tracks preserved habitat associated with environmental programs related to the Quantification Settlement Agreement.

#### ► **Energy Budget**

Transporting and delivering water throughout the Water Authority service area can be an energy-intensive process. The Water Authority has developed alternative energy sources through solar and hydroelectric projects to help offset energy use. The Energy Budget indicator monitors energy production and use, and associated financial information.

#### ► **Per Capita Water Use**

Per capita water use relates directly to progress towards reaching the California Senate Bill X7-7 requirement to reduce urban water use 20 percent statewide by 2020. The Per Capita Water Use indicator tracks progress toward achieving the 2020 mandate.

## Financial Responsibility

### Key Performance Indicators

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#### ► **Revenue**

The Water Authority's two-year budget contains the expected revenue sources and amounts necessary to achieve the Water Authority's programs and initiatives. The Revenue indicator tracks actual revenues compared to budgeted amounts for the Water Authority on a quarterly basis.

#### ► **Expenditures**

Expenditure projections and source categories are shown in the Water Authority's two-year budget. The Expenditures indicator tracks the Water Authority's actual expenditures compared to budgeted amounts on a quarterly basis.

#### ► **Credit Rating**

The Water Authority's credit rating is an indicator of our ability to repay debt and the likelihood of default. The Credit Rating indicator includes annual updates to financial metrics, bond ratings, and debt service coverage ratios, which track the Water Authority's financial responsibility.

## Appendix 4

### Glossary

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#### A

**Acre-foot** – The measurement by which large amounts of water are measured. One acre-foot is about 326,000 gallons, or enough water to cover one acre to a depth of one foot. An acre-foot can supply the needs of 2.5 single-family households of four for one year.

**Adaptive Management** – A management approach whereby strategies are adapted to changing circumstances.

**Agricultural Water** – Water used mostly for irrigating groves and crops.

**Aqueduct** – An artificial man-made pipeline constructed to convey water from one location to another.

**Asset Management** – The combination of management, financial, economic, engineering, and other practices applied to physical assets with the objective of providing the required level of service in the most cost-effective manner. It includes the management of the entire lifecycle including design, construction, commissioning, operating, maintaining, repairing, modifying, replacing, and decommissioning/disposal of infrastructure assets.

#### B

**Basin Plan** – Water Quality Control Plan for the San Diego Region - A planning document prepared and managed by the California Regional Water Quality Control Board, San Diego Region that recognizes and reflects the regional differences in existing water quality, beneficial uses of ground and surface waters, and local water conditions.

**Battery Systems** – One or more batteries that store energy during off-peak periods where energy costs are lower, and discharge energy for use during peak demand periods when energy costs are higher.

**Bay-Delta** – The Bay-Delta is formed by the confluence of California's two largest rivers: the Sacramento and San Joaquin. Joined by the Mokelumne and Cosumnes rivers, they comprise the Bay-Delta's watershed, which drains nearly 50 percent of the state's water runoff. Pumping stations move a portion of Bay-Delta water throughout the state, while the remainder flows to farms and communities within the Bay-Delta itself and then out to sea through a series of bays.

**Best Management Practices** – Practices, methods, or techniques agreed upon by industry professionals found to be the most effective and practical means in achieving an objective while making the optimum use of resources.

**Brackish Groundwater** – Somewhat salty water, often found in groundwater aquifers. The water has a mineral content between freshwater and seawater.

#### C

**California WaterFix** – WaterFix is a science-driven upgrade to the aging water system. It will provide clean, reliable water while protecting the environment. WaterFix covers five main areas: water security; environmental protection; reduced risk from earthquakes and climate change; system upgrades and new technology; and increased efficiency.

**Capital Improvement Program (CIP)** – A major building program initiated in 1989 to plan and implement projects required to meet the region’s current and future water demands. Projects in the CIP include: constructing new facilities to improve operational flexibility and capacity to deliver water, particularly during times of peak usage; rehabilitating existing facilities; and replacing or relining aging pipelines.

**Carryover Storage** – A volume of storage dedicated to water storage during a wet year for future use in a dry year.

**Claude “Bud” Lewis Carlsbad Desalination Plant (CDP)** – This seawater desalination plant meets approximately 10 percent of the region’s water demand by producing an average of 50 million gallons per day of locally controlled water for the region as part of a Water Purchase Agreement (WPA) between Poseidon, the owner/operator of the plant, and the Water Authority.

**Colorado Lower Basin States** – The three states that are fed from the lower basin of the Colorado River: California, Arizona, and Nevada.

**Conservation** – The preservation of a physical quantity of water, or the deferral of use of that same amount of water.

**Conveyance** – The movement of bulk commodities such as water.

## D

**DDW** – The Division of Drinking Water of the State Water Resources Control Board.

**Direct Potable Reuse Water** – Water that is distributed directly into a potable water supply distribution system downstream of a water treatment plant or in the source water supply immediately upstream of the water treatment plant.

**Distribution Tariff** – The rate charged by an electrical utility to customers wishing to use the infrastructure owned by the electrical utility to deliver wholesale power to itself or others.

**Drought** – A prolonged period of below-average precipitation.

**Dry-year** – A year in which rainfall is less than the long-term average.

## E

**Emergency Storage** – Additional water that is stored during a water year, for emergency use, should an emergency occur.

**Emergency Storage Project (ESP)** – A set of Water Authority Capital Improvement Program projects. The ESP is a system of reservoirs, interconnected pipelines, and pumping stations designed to make water available to all communities in the San Diego region in the event of a disaster that interrupts imported water deliveries.

**Energy Facilities** – As it pertains to the Water Authority, any systems or facilities that generate or store energy.

**Environmental Impact** – The direct and indirect physical changes to the environment that are caused by a project. Impacts can be classified in four general categories: 1) beneficial impact; 2) less than significant impact; 3) less than significant impact with incorporation of mitigation measures; or 4) significant and unavoidable impact.

## F

**Facilities** – As it pertains to the Water Authority, any pipelines, pump stations, flow control facilities, reservoirs, or dams that enable the transport of water throughout San Diego County.

**First Aqueduct** – The eastern-most of two San Diego County Water Authority pipeline aqueducts which conveys water from Metropolitan Water District's system throughout San Diego County. The First Aqueduct contains Pipeline 1 and 2.

## G

**Gate** – A hold point in a project schedule where the project team certifies to a select committee of senior managers that predetermined work deliverables have been completed for specific project milestones.

**Groundwater** – Water that is found below the Earth's surface within aquifers and extracted for potable use, either for demineralization treatment or directly through residential wells.

## H

**Hydraulic Transient** – A pressure surge that is created when sudden changes in flow rate occurs in pumping and pipeline systems. The pressures created may be high enough to damage or even cause catastrophic failure of pipelines. Specialized hydraulic transient analysis provides the basis for designing surge control measures to protect important infrastructure.

**Hydroelectric Facilities** – A power plant that produces electricity from the power of rushing water turning turbine-generators.

## I

**Imported Water Supply** – A water supply that lies outside the region of San Diego County and requires transport into San Diego County.

**Indirect Potable Reuse (IRR)** – Water that is blended with other environmental systems such as a river, reservoir, or groundwater basin, before the water is reused.

**Irrigation** – A water supply used for agriculture by artificial means, such as pumping water onto crops, in an area where rainfall is insufficient.

## L

**Local Water Supply** – A water supply that is not imported from outside of San Diego County. Local resources for the San Diego region are recycled water, groundwater, local surface water, and conservation.

## M

**Member Agency** – An agency that is a direct purchaser of water from the Water Authority. The Water Authority has 24 member agencies. The Water Authority's member agencies are comprised of 6 cities, 5 water districts, 3 irrigation districts, 8 municipal water districts, 1 public utility, and 1 federal agency (military base).

**MGD** – Million gallons per day

**Mitigation** – A way in which an agency may offset negative environmental impacts from a project, or make the impacts less serious.

**Mitigation Monitoring Plan** – A written document, adopted when the lead agency approves a project, to ensure that mitigation measures, or other project revisions identified in the certified final environmental impact report, to reduce or avoid impacts are implemented. Inspectors/monitors may be placed on-site during construction to record proper implementation of mitigation measures. The plan remains active until all mitigation measures have been satisfactorily completed.

**Municipal and Industrial (M&I) Water** – Water for residential and commercial uses, accounting for approximately 80 to 85 percent of Water Authority demand. Does not include agricultural water, which makes up the remaining 15 to 20 percent.

## N

**Non-potable Water** – Water not treated to a level for drinking water purposes.

## O

**Ocean Plan Amendment** – The May 6, 2015 amendment to the State Water Resources Control Board's Water Quality Control Plan for Ocean Waters of California regarding construction and operation of seawater desalination facilities.

## P

**Potable Reuse Water** – Recycled water that has been purified to meet or exceed federal and state drinking water standards and is safe for human consumption.

**Potable Water** – Water suitable for drinking.

**Pre-stressed Concrete Cylinder Pipe** – A type of pipe that consists of a concrete core, a thin steel cylinder, high tensile pre-stressing wires, and a mortar coating. The pre-stressing wires are prone to early failure, which can cause a pipe segment to break. There are 82 miles of this type of pipe within the Water Authority's aqueduct system.

**Preferential Rights** – An antiquated formula used by Metropolitan Water District of Southern California to calculate the amount of water to which each of its member agencies is legally entitled.

**Pump Storage** – A hydroelectric technology that stores and generates energy by moving water between two reservoirs at different elevations.

## Q

**Quantification Settlement Agreement (QSA)** – An agreement between the San Diego County Water Authority, Coachella Valley Water District, Imperial Irrigation District, and the Metropolitan Water District of Southern California signed in 2003. The QSA provides California a transition period to implement water transfers and supply programs that will reduce California's over-dependence on the Colorado River, and reduces the state's draw to its 4.4 million acre-foot annual apportionment.

## R

**Recycled Water** – Municipal wastewater that is treated and disinfected to a level suitable for non-drinking purposes. The beneficial reuse of recycled water reduces the need to import or develop other water supplies.

**Reservoir** – A pond or lake where water is collected and stored until it is needed.

**Runoff** – Water that travels over the surface of the earth, moving downward due to the law of gravity. Runoff is one way in which water that falls as precipitation returns to the ocean.

## S

**Seawater Desalination** – A reverse osmosis membrane technology employed to separate fresh water from seawater.

**Second Aqueduct** – The western-most of two San Diego County Water Authority pipelines which convey water from Metropolitan Water District's system throughout San Diego County. The Second Aqueduct contains Pipelines 3, 4, and 5.

**State Water Project** – A water supply and delivery system of reservoirs, aqueducts, power plants, and pumping plants which extends over two-thirds of California.

**Surface Water** – All water, fresh and salty, on the earth's surface.

**Surge Protection** - A facility designed and constructed for the purpose of controlling hydraulic transient pressures created by a sudden change in flow rate within a pipeline.

## T

**Treated/Filtered Water** – Water that meets the Department of Health Services standards for potable drinking water use.

## U

**Untreated/Raw Water** – Water that has not yet been treated to meet the Department of Health Services standards for potable drinking water use.

**Urban Water Use** – Same as Municipal and Industrial (M&I) Water. Water for residential and commercial uses, accounting for approximately 80 to 85 percent of Water Authority demand. Does not include agricultural water, which makes up the remaining 15 to 20 percent.

## V

**Value Engineering** – A systematic and structured approach used to analyze and improve design and construction of projects. It helps to achieve an optimum balance between function, performance, quality, safety, and costs. The proper balance results in the maximum value for the project and the reliable performance of functions to meet customer needs at the lowest overall cost.

## W

**Wastewater** – Water containing waste material.

**Water Demand** – The amount of water, at present, that is required to meet the needs of a specified group.

**Water Facilities** – As it pertains to the Water Authority, any pipelines, pump stations, flow control facilities, reservoirs, or dams that enable the transport of water throughout San Diego County.

**Water Purchase Agreement (WPA)** – Agreement that governs the purchase of between 48,000 and 56,000 acre-feet of desalinated seawater per year from the Claude "Bud" Lewis Carlsbad Desalination Plant (CDP).

**Water Recycling** – The treatment and disinfection of municipal wastewater to provide a water supply suitable for non-potable reuse.

**Water Supply Diversification** – A strategy to meet regional water demands with a diverse range of water supplies and tactics including imported water, local supply development, and water use efficiency.

**Waters of the United States** – A document that defines the waters that fall within the jurisdiction of the Environmental Protection Agency and the Army Corp of Engineers.

**Watershed** – A region or area of land bounded peripherally by a water parting and draining ultimately to a specific watercourse or body of water.



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## Appendix 7-D: San Diego IRWM Climate Change Study

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# **Climate Change Planning Study**

## **Final**

**Prepared by:**



**May 2013**

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## **List of Abbreviations**

AB	Assembly Bill
AF	Acre-foot
CalEPA	California Environmental Protection Agency
CARB	California Air Resources Board
CAT	Climate Action Team
CCAR	California Climate Action Registry
CCAS	California Climate Action Strategy
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CH <sub>4</sub>	Methane
CNRA	California Natural Resources Agency
CO <sub>2</sub>	Carbon Dioxide
DWR	Department of Water Resources
EO	Executive Order
EPA	Environmental Protection Agency
GHG	Greenhouse Gas
HFCs	Hydrofluorocarbons
IRWM	Integrated Regional Water Management
kWh	kilowatt hours
MMTCO <sub>2</sub> E	Million metric tons carbon dioxide equivalent
MSHCP	Multiple Species Habitat Conservation Plan
N <sub>2</sub> O	Nitrous Oxide
NF <sub>3</sub>	Nitrogen Trifluoride
OPC	Ocean Protection Council
OPR	Office of Planning and Research
PFCs	Perfluorocarbons
RMS	Resource Management Strategy
SB	Senate Bill
SDCWA	San Diego County Water Authority

SDG&E	San Diego Gas & Electric
SDRIP	San Diego River Improvement Project
SF <sub>6</sub>	Sulfur Hexafluoride
SLR	Sea Level Rise
SWP	State Water Project
SWRCB	State Water Resources Control Board
TCR	The California Registry
TMDL	Total Maximum Daily Load
TDS	Total Dissolved Solids
USEPA	United States Environmental Protection Agency
WET-CAT	Water Energy Team of the Climate Action Team

# 1 Climate Change in Water Resources

This chapter addresses requirements set forth in the Resource Management Strategies (RMS) Standard in the *2012 IRWM Program Guidelines* (DWR 2012). As such, this chapter considers each RMS listed in the *California Water Plan (CWP) Update 2009* (DWR 2009), documents which RMS will help achieve the IRWM Plan Update objectives, presents all RMS considered for the IRWM Plan Update, and includes an evaluation of the adaptability of water management systems in the San Diego IRWM Region to climate change.

## 1.1 Introduction

Climate change projections have shown that California can expect to be impacted by changes to temperature and precipitation in the future, and even now California is beginning to experience the effects of these impacts. Water resource planners already face challenges interpreting new climate change information and discerning which response methods and approaches will be most appropriate for their planning needs. This Climate Change Planning Study (Study) examines current climate change science, policies, and regulations in terms of how they affect the San Diego Integrated Regional Water Management Region (Region). This Study serves as an initial guide for the Region to begin incorporating climate change adaptation and mitigation measures into its Integrated Regional Water Management (IRWM) Plan, where adaptation is how the Region can respond to climate change effects and mitigation is how the Region can reduce future climate change effects, and includes the following sections:

- Chapter 1: Climate Change in Water Resources
- Chapter 2: Climate Change in IRWM Planning
- Chapter 3: Effects of Climate Change on the Region
- Chapter 4: Vulnerability Analysis
- Chapter 5: Climate Change Management Strategies
- Chapter 6: Recommendations

## 1.2 Adaptation Relationship

Climate change is expected to directly impact a number of areas related to water resources, in particular temperature, precipitation, and sea level rise. As global temperature increases, seasonal precipitation patterns including the timing, intensity and form of precipitation, are projected to continue to change. Sea level rise, which has risen about seven inches over the last century due to warming, is expected to rise further in the future. In order for the Region to adapt to, or protect against, climate change, it must first identify the impacts climate change is expected to have on the Region.

These impacts are expected to further impact local water resources as follows (DWR, 2011):

- Temperature increases:
  - More winter precipitation falling as rain rather than snow, leading to reduced snowpack water storage, reduced long term soil humidity, reduced groundwater and downstream flows, and reduced imported water deliveries

- Higher irrigation demands as temperatures alter evapotranspiration rates, and growing seasons become longer
- Exacerbated water quality issues associated with dissolved oxygen levels, increased algal blooms and increased concentrations of salinity and other constituents
- Impacted habitats for temperature-sensitive fish and other life forms, and increased susceptibility of aquatic habitats to eutrophication
- Precipitation pattern changes:
  - Increased flooding (both coastal and inland) caused by more intense storms
  - Changes to growth and life cycle patterns caused by shifting weather patterns
  - Threats to soil permeability, adding to increased flood threat and decreased water availability
  - Reduced water supply caused by the inability to capture precipitation from more intense storms, and a projected progressive reduction in average annual runoff (though some models suggest that there may be some offset from tropical moisture patterns increasingly moving northward)
  - Increased turbidity caused by more extreme storm events, leading to increased water treatment needs and impacts to habitat
  - Increased wildfires with less frequent, but more intense rainfall, and possibly differently timed rainfall through the year, potentially resulting in vegetation cover changes
  - Reduction in hydropower generation potential
- Sea level rise:
  - Inundation and erosion of coastal areas (coastal bluffs in particular), including coastal infrastructure
  - Saline intrusion of coastal aquifers
  - Increased risk of storm surges and coastal flooding and erosion during and after storms
  - Changes in near-shore protective biogeography such as loss of sand, tide pools and kelp beds

Although the extent of these changes is uncertain, scientists agree that some level of change is inevitable; therefore, it will be necessary to implement flexible adaptation measures that will allow natural and human systems to respond to these climate change impacts in timely and effective ways. Adaptation measures may be implemented in response to climate change impacts that have already occurred, or expected impacts that are projected to occur. It is important to take note that water resources decisions made in the future will impact the rate of climate change.

In addition to adapting to climate change, the Region has the opportunity to mitigate against climate change by minimizing greenhouse gas emissions emitted by water supply and wastewater activities. The relationship between water resources and greenhouse gas emissions is discussed further in the next section.

## 1.3 Water-Energy Nexus

To understand how water is related to climate change, it's helpful to understand the connection between water resources planning and energy, which is known as the water-energy nexus. Energy production accounts for between 30% and 40% of total GHG production in California, and can emit a number of different types of GHGs. California's Air Resources Board recognizes and inventories the following GHGs: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), sulfur hexafluoride (SF<sub>6</sub>), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and nitrogen trifluoride (NF<sub>3</sub>). These GHGs vary in magnitude in terms of their GHG strength, and therefore are converted to be equivalent to CO<sub>2</sub> for the purposes of measuring GHG emissions across the state. CO<sub>2</sub> emissions (or the equivalent for other GHGs) are the common measurement for GHG emissions. (CARB, 2013). Currently, statewide water use accounts for nearly 20% of electricity use, and 30% of non-power plant related natural gas consumption (CEC, 2006). Water use and energy are linked in at least three critical ways (CEC, 2011):

1. **Water pumping and purification:** The amount of energy used to pump water will depend upon the source (e.g., surface versus groundwater), the distance and height the water must be moved, and the treatment requirements. For example, pumping water to San Diego County through the State Water Project, which accounts for nearly 80% of the County's water supply, uses about 4,600 kilowatt hours (kWh) per acre-foot of electricity (DWR, 2012a), while groundwater pumping typically uses 300 kWh/AF (Cohen, 2007).
2. **Wastewater treatment:** The amount of energy used in wastewater treatment plant typically ranges from 1,100 to 4,600 kWh per million gallons of wastewater treated (CEC, 2006).
3. **Water heating:** In an average California home, 41 percent of the water is used for dishwashing, faucets, laundry, and bathing water that is often heated.

These amounts, in total, are so significant that we must also count the amount of GHGs from the fossil fuels that are burned to produce the oil, gas, coal and other combustibles which are then burned to produce the electricity. Understanding the water-energy nexus in California provides opportunities to attain significant energy benefits through two primary strategies (CEC, 2006):

1. Conserving water saves the energy that would have been used to convey, treat, and distribute the water, and energy that may have been needed to collect, treat and dispose of the wastewater.
2. Reducing the energy intensity of water operations reduces the total amount of energy consumed in the water sector and ultimately reduces the value of energy embedded in saved water.

By reducing the energy used through the above strategies, GHG production can be reduced.

It should be noted that, at times, the above processes may also be used to generate energy, such as through cogeneration at wastewater treatment plants, or capturing energy as water flows downhill. Concurrently, energy production processes require water for steam production for thermoelectric power and to cool equipment by absorbing waste heat. Energy conservation in the Region can reduce this need.

These strategies are reflected in California's legislation and policy regarding climate change mitigation and greenhouse (GHG) emissions reduction discussed in the remainder of Chapter 1.

## 1.4 Legislative and Policy Context

In order to address currently-projected climate change impacts to California's water resources, the Department of Water Resources' (DWR's) 2012 IRWM Grant Program Guidelines require that IRWM Plans describe and consider climate change adaptation and mitigation. Below is a summary of State legislation and policy that were considered as part of this IRWM Plan.

### **Executive Order S-3-05**

Executive Order (EO) S-3-05, signed on June 1, 2005 by Governor Arnold Schwarzenegger, is one of the key pieces of legislation that has laid the foundation for California's climate change policy. This piece of legislation recognizes California's vulnerabilities to the impacts of climate change, which include its water-related natural resources. EO S-3-05 established three GHG reduction targets for California:

- By 2010, reduce GHG emissions to 2000 California levels
- By 2020, reduce GHG emissions to 1990 California levels
- By 2050, reduce GHG emissions to 80 percent below 1990 California levels

In addition to establishing GHG reduction targets for California, EO S-3-05 dictates that the Secretary of the California Environmental Protection Agency (CalEPA) establish the Climate Action Team (CAT) for State agencies to coordinate oversight of efforts to meet these targets. As laid out in EO S-3-05, the CAT submits biannual reports to the governor and State legislature describing progress made toward reaching the targets.

There are currently 12 sub-groups within the CAT, one of which is the Water-Energy group (also known as WET-CAT). WET-CAT was tasked with coordinating the study of GHG effects on California's water supply system, including the development of GHG mitigation strategies for energy consumption related to water use. Since the adoption of the Assembly Bill 32 Scoping Plan (see the following section), WET-CAT has been working on the implementation and analyses of six water-related measures identified in the Scoping Plan:

- Water Use Efficiency
- Water Recycling
- Water System Energy Efficiency
- Reuse Urban Runoff
- Increase Renewable Energy Production
- Public Goods Charge for Water

### **Assembly Bill 32: The California Global Warming Solutions Act of 2006**

Assembly Bill (AB) 32, the California Global Warming Solutions Act of 2006 was signed by Governor Schwarzenegger to codify the mid-term GHG reduction target established in EO S-3-05 (reduce GHG emissions to 1990 levels by 2020) through, among other mechanisms, imposing an enforceable cap on GHG emissions. AB 32 directed the California Air Resources Board (CARB) to develop discrete early actions to reduce GHG emissions by 2007, and to adopt regulations to implement early action measures by January 1, 2010.

### **Climate Change Scoping Plan**

AB 32 also required CARB to prepare a Scoping Plan to identify and achieve reductions in GHG emissions in California. The approved Climate Change Scoping Plan, adopted by CARB in December 2008, recommends specific strategies for different business sectors, including water management, to achieve the 2020 GHG emissions limit. The Scoping Plan as it relates to water resources is discussed further in Section 0 below.

### **Senate Bill 97**

Senate Bill 97 (SB 97) directed the Governor's Office of Planning and Research (OPR) to develop amendments to the California Environmental Quality Act (CEQA) Guidelines to determine how climate change is analyzed in documents required by CEQA. On December 31, 2009, the California Natural Resources Agency adopted amendments to the CEQA Guidelines and sent them to the California Office of Administrative Law for approval and filing with the Secretary of State. These CEQA Guideline amendments became effective on March 18, 2010. The CEQA Guidelines are not prescriptive; rather they encourage lead agencies to consider many factors in performing a CEQA analysis, and maintain discretion with lead agencies to make their own determinations based on substantial evidence.

### **Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water**

DWR, in collaboration with the State Water Resources Control Board, other state agencies, and numerous stakeholders, has initiated a number of projects to begin climate change adaptation planning for the water sector. In October 2009, DWR released the first state-level climate change adaptation strategy for water resources in the U.S., and the first adaptation strategy for any sector in California. Entitled *Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water*, the report details how climate change is currently affecting the state's water supplies, and sets forth ten adaptation strategies to help avoid or reduce climate change impacts to water resources.

Central to these adaptation efforts will be the full implementation of IRWM plans, which address regionally-appropriate management practices that incorporate climate change adaptation. These plans will evaluate and provide a comprehensive, economical, and sustainable water use strategy at the watershed level for California.

### **Executive Order S-13-08**

Given the potentially serious threat of sea level rise to California's water supply and coastal resources, and the subsequent impact it would have on our state's economy, population, and natural resources, Governor Schwarzenegger issued EO S-13-08 to enhance the state's management of climate impacts from sea level rise, increased temperatures, shifting precipitation, and extreme weather events. It requested a California Sea Level Rise Assessment Report to be conducted by the National Academy of Sciences, which was released in June 2012.

### **California Climate Adaptation Strategy**

In response to the passage of EO S-13-08, the California Natural Resources Agency released the report entitled *2009 California Climate Adaptation Strategy* that summarizes the best known science on climate change impacts in the state, assesses vulnerabilities, and outlines possible solutions that can be implemented within and across the state agencies to promote resilience to climate change.

### **GHG Reporting Rule**

While California has taken the lead in climate change policy and legislation, there have been several recent important developments at the federal level. On September 22, 2009, the United States Environmental Protection Agency (USEPA) released its final GHG Reporting Rule (Reporting Rule). Starting in 2010, facility owners that emit 25,000 metric tons of CO<sub>2</sub> emissions or more per year are required to submit an annual GHG emissions report with detailed calculations of facility GHG emissions. These activities will dovetail with the AB 32 reporting requirements in California.

### **Water Code Section 10541**

California has included climate change in its water code to ensure that it is considered as part of water management. California Water Code Section 10541 contains requirements for considering climate change in IRWM Plans. Specifically, it states that the guidelines for IRWM Plans are required to include:

- Consideration of GHG emissions of identified programs and projects
- Evaluation of the adaptability to climate change of water management systems in the region

## **1.5 AB 32 Scoping Plan and CARB Strategies**

As stated previously, AB 32 required CARB to prepare a Scoping Plan to identify and achieve reductions in GHG emissions in California, and recommended specific strategies for different business sectors to achieve the 2020 GHG emissions limit. This Scoping Plan was introduced in 2005, and adopted in 2008. Water use is identified in the AB 32 Scoping Plan as a sector requiring significant amounts of energy, and sets a goal to “continue efficiency programs and use cleaner energy sources to move and treat water.” This goal recognizes that California has a history of advancing water efficiency and conservation programs.

The Scoping Plan identifies six greenhouse gas emissions reduction (mitigation) measures for the water sector that could reduce GHGs if implemented statewide (please note that not all of these measures may be applicable to the San Diego IRWM Region):

1. Water Use Efficiency: Through increases in water use efficiency measures, reduce total statewide emissions
2. Water Recycling: Through increases in water recycling, reduce total statewide emissions
3. Water system energy efficiency: Through increases in water system energy efficiency, reduce total statewide emissions
4. Reuse of urban runoff: Through reuse of urban runoff, reduce total statewide emissions
5. Increase renewable energy production: Through the increase in renewable energy production, reduce statewide emissions
6. Public goods charge: To be determined

The first three of the measures will reduce energy requirements associated with providing reliable water supplies. The next two measures will reduce the amount of non-renewable electricity associated with conveying and treating water. The final measure (public goods charge) focuses on providing sustainable funding for implementing these actions. Other sectors identified in the Scoping Plan, such as Agriculture and Green Building, recognize that water use efficiency measures

will help to decrease GHG emissions as well, but do not calculate water use efficiency savings separately. The Scoping Plan states that to implement these GHG reduction measures, CARB and other State agencies will work with stakeholders and the public to develop regulatory measures and other programs.

## 1.6 California Climate Action Registry/The Climate Registry

The California Climate Action Registry (CCAR) was a program of the Climate Action Reserve which closed in December 2010. It served as a voluntary GHG registry to promote early actions to reduce GHG emissions by organizations. CCAR members voluntarily measured, verified, and publicly reported their GHG emissions. Members of the CCAR have been transitioned over to The Climate Registry (TCR), which is a nonprofit GHG emissions registry for North America that provides organizations with the tools to help them calculate, verify, report and manage their GHG emissions within a single registry. A number of agencies and organizations in the IRWM Region are voluntary members of TCR, including:

- San Diego County Water Authority
- City of San Diego
- County of San Diego
- Metropolitan Water District of Southern California

TCR's tools and database are particularly useful to those entities required to report their GHG emissions according to the EPA's Greenhouse Gas Reporting Rule (74 FR 56260) which requires reporting of GHG data and other relevant information from large sources and suppliers in the United States, and went into effect in January 2010. Though primarily affecting facilities that supply fossil fuels or industrial GHGs, manufacturers of vehicles and engines, this rule also applies to facilities that are responsible for the emission of 25,000 metric tons or more of GHG emissions per year, and therefore may apply to water and wastewater utilities, and large water purchasers. In addition to meeting USEPA requirements, by becoming a member of TCR, a utility, agency or company may better be able to respond to California's requirements for reporting and reducing GHG emissions.

## 1.7 Climate Action Plans and Climate Initiatives

Climate action plans are becoming more common among California's cities and counties. A climate action plan, which may also be referred to as a climate mitigation and adaptation plan, is a set of strategies intended to guide efforts for reducing GHG emissions, and typically covers a range of sectors such as energy, transportation, water, wastewater, solid waste, infrastructure, urban forestry and agriculture, and public health. Plans may also include strategies to guide efforts for reducing the impact of climate change effects on the area. Within the Region, the County and a number of cities and agencies have developed or are developing climate action plans and adaptation plans:

- County of San Diego Climate Action Plan
- San Diego County Water Authority Climate Action Plan and Climate Mitigation Plan
- City of San Diego Climate Mitigation and Adaptation Plan

- City of San Diego Long Range Water Resources Plan
- City of Chula Vista Adaptation and Mitigation Plan
- City of Encinitas Climate Action Plan
- City of Escondido Climate Action Plan
- City of San Marcos Climate Action Plan
- Port of San Diego Climate Mitigation and Adaptation Plan
- San Diego Association of Governments (SANDAG) Regional Energy Strategy and Climate Action Strategy
- San Diego Bay Sea Level Rise Adaptation Study
- San Diego Foundation Focus 2050 Study

In addition to the Climate Action Plans developed in the Region, the San Diego Foundation has developed a Climate Initiative to support community awareness about the local impacts of climate change. This initiative aims to educate the community about climate change, support climate change research, partner with local governments to address climate change, and provide technical assistance for climate action planning. As part of this initiative, every jurisdiction in the County has completed a GHG emissions inventory.

## 2 Climate Change in IRWM Planning

### 2.1 DWR Requirements

As previously discussed, the California Water Code contain language stating that IRWM Plan guidelines require climate change be considered as part of IRWM Plans. In line with this, DWR has included a Climate Change Standard in the IRWM Guidelines that requires IRWM plans to include a “cursory analysis of the effects on the region due to climate change, with the intent that a more refined analysis be required as additional guidance is made available.” To meet these guidelines, DWR has suggested that climate change be included in IRWM Plans as shown in Table 1.

**Table 1: IRWM Plan Standards in Relation to Climate Change**

Plan Section According to IRWM Plan Standards	Climate Change Information to Include <sup>1</sup>
Region Description	Language that describes likely climate change impacts on the Region as determined from a vulnerability assessment
Plan Objectives	<p>Adaptation to climate change:</p> <ul style="list-style-type: none"> <li>• Address adapting to changes in the amount, intensity, timing, quality and variability precipitation, runoff and recharge.</li> <li>• Consider sea level rise effects on water supply and other water resource conditions (e.g., recreation, habitat) and identify suitable adaptation measures. Consider OPC's Sea Level Rise Policy</li> </ul> <p>Reducing emissions (mitigation of greenhouse gasses)</p> <ul style="list-style-type: none"> <li>• Reduce carbon consumption, especially the energy embedded in water use, and ultimately reduce GHG emissions</li> <li>• Consider the strategies adopted by CARB in its AB 32 Scoping Plan, including innovative applications</li> <li>• Consider options for carbon sequestration where such options are integrally (directly or indirectly) tied to supporting IRWM Plan objectives</li> </ul>
Resource Management Strategies	Identify and implement adaptation strategies that address region-specific or local climate change contributions or impacts
Project Review Process	<p>Include the following factors:</p> <ul style="list-style-type: none"> <li>• Contribution of the project to adapting to climate change</li> <li>• Contribution of the project in reducing GHG emissions as compared to project alternatives</li> </ul>
Relation to Local Water Planning	Consider and incorporate water management issues and climate change adaptation and mitigation strategies from local plans into the IRWM Plan.
Relation to Local Land Use Planning	Demonstrate information sharing and collaboration with regional land use planning in order to management multiple water demands through the state (as described in CWP Update 2009), adapt water management systems to climate change, and potentially offset climate change impacts to water supply.
Plan Performance and Monitoring	Contain policies and procedures that promote adaptive management.
Coordination	<p>Consider the following:</p> <ul style="list-style-type: none"> <li>• Stay involved in CNRA's California Adaptation Strategy process</li> <li>• Consider joining The California Registry (<a href="http://www.theclimateregistry.org">www.theclimateregistry.org</a>)</li> </ul>

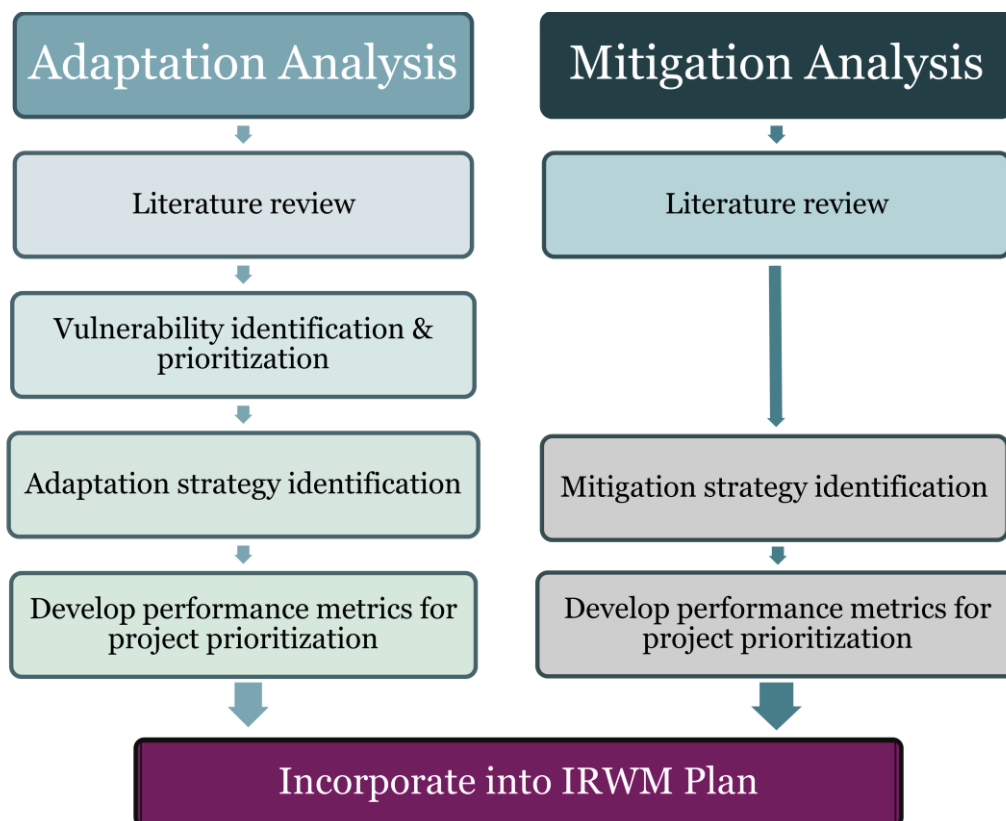
1. Based on information in DWR's 2012 Prop 84 and Prop 1E IRWM Guidelines, Appendix C, Table 7

## 2.2 Adaptation and Mitigation Analysis

In order to meet the IRWM Plan standards discussed in the previous section, the climate change analysis process shown in Figure 1 was followed. As previously discussed in this Study, climate change includes both adaptation (responding to climate change) and mitigation (reducing GHGs), and therefore is reflected in the analysis process below. While both the adaptation analysis and mitigation analysis include a literature review, strategy identification and performance metrics

development, the adaptation analysis includes an extra step to identify and prioritize climate change vulnerabilities. The information gathered through this climate change analysis will be incorporated into the Region's IRWM Plan update. By working through each of these steps, the Region can meet the requirements contained in DWR's IRWM Plan Guidelines.

**Figure 1: Climate Change Analysis Process**



## 2.3 San Diego IRWM Region Climate Change Study

To fulfill DWR's requirements and work through the climate change analysis discussed above, the Region established a Climate Change Workgroup (Workgroup) comprised of various water resources and planning representatives that have experience in climate change planning within the Region to work with a consultant to develop this Climate Change Planning Study (Study). In addition, local climate change efforts, in particular the San Diego Foundation Regional Focus 2050 Study which defines Region-specific climate change impacts, were used in the climate change assessment.

## 3 Effects of Climate Change on Region

### 3.1 Impacts and Effects on Region

Estimating the impacts of climate change at a regional level is challenging due to the coarse spatial scale of models that project climate change impacts of temperature and rainfall, and due to the long time scale evaluated in many models (to the year 2100). Recently, state and local entities have been working to downscale climate models to allow for climate change planning at a level that can be useful for planning efforts. The timescale used for these models has also been downscaled to provide outputs for the year 2050, and though this is still a longer timescale than is used in IRWM planning, is still useful for assessing climate change.

To incorporate climate change into water resources management, downscaled temperature and precipitation projections are input into other models, such as hydrologic models, to project impacts to water supply, water demand, snow pack, sea level rise, and wildfires. The results of these models have been summarized in a variety of studies and planning documents at the state, regional, and local levels. As part of this Study, a number of these documents were reviewed to determine which best represented the impacts for the Region. These documents include:

- *Regional Focus 2050 Study* (San Diego Foundation, 2008a & 2008b)
- *2010 Urban Water Management Plan* (San Diego County Water Authority, 2011)
- *Using Future Climate Projections to Support Water Resources Decision Making in California*, (California Climate Change Center, 2009)
- *Reconciling Projections of Colorado River Streamflow, Southwest Hydrology* (Hoerling et al., 2009)

Climate change impacts and effects are based on very different climate change assumptions and analysis approaches. Table 2 summarizes the impacts and effects of climate change on the San Diego Region by 2050 (unless otherwise indicated), which are typically based on an average of various climate change analyses. Generally, climate change is expected to increase temperature in the region. Rainfall projections vary with some projections showing that the Region will receive as much as 35% less rainfall and some showing up to 17% more rainfall (San Diego Foundation, 2008a). It's generally accepted that storms will be less frequent, but more intense (San Diego Foundation, 2008a). With higher temperatures and changes in rainfall volume and frequency, additional impacts will be felt in the Region.

Imported water supply from the State Water Project is projected to decrease by up to 25% (California Climate Change Center, 2009), while Colorado River Aqueduct supply may decrease by up to 20% (Hoerling et al, 2009). An overall shortfall of 164,000 acre-feet per year (AFY) in imported water is expected by 2050 (San Diego Foundation, 2008b).

Preliminary analysis of regional water demand trends in the San Diego County Water Authority service area indicate that climate change impacts may result in a slight demand increase, between 0.6 and 1.8%, by the year 2035. (SDCWA, 2011).

In currently accepted models, sea level rise is projected to be at least 12 to 18 inches by 2050, which would both inundate the coast due to the average rise, and impact coastal flood control during storms (San Diego Foundation, 2008a).

The changes to climate are also expected to increase the frequency of wildfires. Studies suggest that there will be a 40% increase in Coastal Sage Scrub acreage burned (San Diego Foundation, 2008a), and that 54% more acreage in the Western U.S. will burn compared to present (San Diego Foundation, 2008a). Increases in wildfires have the potential to increase sedimentation and turbidity of surface waters, and increase flash flooding.

Knowing what climate change impacts and effects are projected to have on the Region, it's possible to determine what water resources in the Region are most vulnerable to climate change. The next sections identify and prioritize the vulnerabilities to determine how to best apply management practices. These effects were presented to and vetted by the Workgroup at a meeting held on June 12, 2012.

**Table 2: Impacts and Effects of Climate Change on Region by 2050**

Impact	Effect
Temperature	<ul style="list-style-type: none"><li>• 1.5°F to 4.5°F average temperature increase</li></ul>
Rainfall	<ul style="list-style-type: none"><li>• Variable projections predict between 35% drier and 17% wetter</li><li>• Increase in variability between years</li></ul>
Supply	<ul style="list-style-type: none"><li>• Up to 25% decrease in SWP supply</li><li>• Up to 20% decrease in Colorado River supply</li><li>• 164,000 afy average shortfall in imported supply</li></ul>
Demand	<ul style="list-style-type: none"><li>• Potential 0.6% to 1.8% increase in demand by 2035</li></ul>
Sea level rise	<ul style="list-style-type: none"><li>• 12 to 18 inch rise in mean sea level rise</li></ul>
Wildfires	<ul style="list-style-type: none"><li>• 40% increase in California Coastal Shrub acreage burned in Southwestern U.S.</li><li>• 54% increase in overall acreage burned in Western U.S.</li></ul>

### 3.2 Identification of Vulnerabilities

Understanding the potential impacts and effects that climate change is projected to have on the Region allows an informed vulnerability assessment to be conducted for the Region's water resources. A climate change vulnerability assessment helps a Region to assess its water resource sensitivity to climate change, prioritize climate change vulnerabilities, and ultimately guides decisions as to what strategies and projects would most effectively adapt to and mitigate against climate change. DWR has identified a series of questions to help regions identify key indicators of potential vulnerability, including (DWR, 2011):

- Currently observable climate change impacts (climate sensitivity)
- Presence of particularly climate sensitive features, such as specific habitats and flood control infrastructure (internal exposure)
- Resiliency of a region's resources (adaptive capacity)

The Workgroup developed an analysis of the Region's vulnerabilities to climate change at the June 12, 2012 climate change workshop by asking a series of questions suggested by DWR in its 2011 *Climate Change Handbook for Regional Water Planning*. Table 3 summarizes the analysis, which includes:

- Vulnerability Question: Taken from Box 4-1 of DWR's *Climate Change Handbook*

- Answer: Provided at June 12, 2012 workshop
- Justification: Why Y (yes) or N (no) was selected
- Vulnerability Issue: What is the climate change vulnerability issue that is identified by asking the question?

Following this analysis, the vulnerability issues were prioritized by the Workgroup. This activity and results are described in Chapter 4.

Table 3: Climate Change Vulnerability Indicator Questions

Vulnerability Question	Answer	Justification	Vulnerability Issue
<b>Water Demand</b>			
Are there major industries that require cooling/process water in your planning region?	Y	Electronics and aerospace manufacturing, energy generation, research development, pharmaceutical. Biotech and energy growing. Room for efficiency improvements	Increase in industrial demand
Are crops grown in your region climate-sensitive? Would shifts in daily heat patterns, such as how long heat lingers before night-time cooling, be prohibitive for some crops?	Y	Primary crops include avocados, nurseries and citrus which can be climate sensitive, but agricultural land use is expected to decrease. Rise in smaller agricultural/urban farms/residential gardens, and increased crop diversity. Decrease in larger agricultural users.	Increase in agricultural crop water demand per acre; small food production use of permaculture could decrease per acre use
Do groundwater supplies in your region lack resiliency after drought events?	Y	The small groundwater basins in the Region tend to decrease resiliency. Increasing impermeability reduces recharge. Sweetwater, Oceanside, Escondido/Vista. Salt water intrusion as water tables drop.	Lack of groundwater storage to buffer drought
Are water use curtailment measures effective in your region?	Y	Shortage management activities currently in place were effective in meeting demands during the last major drought which began in 2007. Management measures not previously considered, such as soil conditions, may provide additional opportunities.	Perceived limited ability to conserve further
Does water use vary by more than 50% seasonally in parts of your region?	Y	Water agencies have peaking factors ranging from 2:1 to 6:1. Some of the higher peaking agencies dependent on imported water will have reduced peaking as agricultural use declines and more development occurs.	Limited ability to meet summer demand
Are some in-stream flow requirements in your region either currently insufficient to support aquatic life, or occasionally unmet?	N	Most streams are intermittent; however, some agencies that move water between reservoirs via streams have in-stream requirements to protect species during certain times of the year which impacts when water can be moved.	Habitat demand would be impacted
<b>Water Supply</b>			
Does a portion of the water supply in your region come from snowmelt?	Y	Imported supplies (SWP, Colorado River) come from snowmelt.	Decrease in imported supply
Does part of your region rely on water diverted from the Delta, imported from the Colorado River, or imported from other climate-sensitive systems outside your region?	Y	Approximately 80% of the Region's supplies are imported.	Decrease in imported supply

<b>Vulnerability Question</b>	<b>Answer</b>	<b>Justification</b>	<b>Vulnerability Issue</b>
Would your region have difficulty in storing carryover supply surpluses from year to year?	N	No, the County has sufficient storage capacity, and is currently completing an emergency storage carryover project. It should be noted that there is little transfer market available in California, with a focus of storage in northern California.	Decrease in reliability
Does part of your region rely on coastal aquifers? Has salt intrusion been a problem in the past?	Y	Some brackish groundwater exists near the coast which limits the use of coastal aquifers.	Decrease in groundwater supply
Has your region faced a drought in the past during which it failed to meet local water demands?	Y	Drought management plans had to be put into effect. It should be noted that the Region has never failed to meet its customers' demands once drought measures were put into place. Development of additional supplies may reduce the Region's vulnerability to this issue.	Sensitivity due to higher drought potential
Does your region have invasive species management issues at your facilities, along conveyance structures, or in habitat areas?	Y	Quagga, Arundo, Tamarisk	Invasives can reduce supply available
<b>Water Quality</b>			
Are increased wildfires a threat in your region? If so, does your region include reservoirs with fire-susceptible vegetation nearby which could pose a water quality concern from increased erosion?	Y	Wildfires are a common occurrence in the area, and often cause increased erosion in the Region's watersheds.	Increased erosion and sedimentation
Does part of your region rely on surface water bodies with current or recurrent water quality issues related to eutrophication, such as low dissolved oxygen or algal blooms? Are there other water quality constituents potentially exacerbated by climate change?	Y	Several water bodies are 303(d) listed for water quality issues related to eutrophication including the Lake Hodges, Famosa Slough, Guajome Lake, Loma Alta Slough, Mission Bay at the mouths of Rose Creek and Tecolote Creek, lower San Diego River, Sal Elijo Lagoon, Santa Margarita Lagoon, Tijuana River, and the Tijuana River Estuary.	Increased eutrophication
Are seasonal low flows decreasing for some water bodies in your region? If so, are the reduced low flows limiting the water bodies' assimilative capacity?	Y	At times during the year, the only flow in some streams is irrigation overflow, which in turn increase the concentration of constituents.	Increased constituent concentration
Are there beneficial uses designated for some water bodies in your region that cannot always be met due to water quality issues?	Y	At times recreation use in some reservoirs is impacted, and beach closures occur. Wildlife habitat and freshwater habitat issues as well.	Decrease in recreational opportunity

Vulnerability Question		Answer	Justification	Vulnerability Issue
Does part of your region currently observe water quality shifts during rain events that impact treatment facility operation?	Y		Total dissolved solids (TDS), turbidity and nutrient levels in reservoirs may increase during storm events, impacting water treatment, particularly after fires. Oils and feces show up in reservoirs as well.	Increase in treatment needs and cost
<b>Sea Level Rise</b>				
Has coastal erosion already been observed in your region?	Y		Coastal erosion occurs at unstable bluffs along the coast, for example: Sunset cliff, bluffs along City of San Diego, Encinitas, military infrastructure at Coronado Island and Camp Pendleton..	Decrease in land due to erosion
Do tidal gauges along the coastal parts of your region show an increase over the past several decades?	Y		San Diego Bay Adaptation shows increasing levels	Damage to coastal recreation/tourism due to inundation
Is there land subsidence in the coastal areas of your region?	N		None noted	
Are there coastal structures, such as levees or breakwaters, in your region?	Y		Examples include Mission Bay, San Diego Harbor	
Is there significant coastal infrastructure, such as residences, recreation, water and wastewater treatment, tourism, and transportation) at less than six feet above mean sea level in your region?	Y		Beach community - wide-spread	Damage to ecosystems/habitats
Are there climate-sensitive low-lying coastal habitats in your region?	Y		Habitat type - salt marsh	
Are there areas in your region that currently flood during extreme high tides or storm surges?	Y		Mission Valley flooded from San Diego river during high tidal events	Storm drains and sewer systems will be inundated
<b>Flooding</b>				
Does critical infrastructure in your region lie within the 200-year floodplain?	Y		There is low-lying water and wastewater infrastructure. Pump stations.	Increases in inland flooding
Does aging critical flood protection infrastructure exist in your region?	Y		San Diego River Flood Improvement project. San Diego River Improvement Project (SDRIP) at Mission Valley.	

Vulnerability Question	Answer	Justification	Vulnerability Issue
Have flood control facilities (such as impoundment structures) been insufficient in the past?	Y	Flooding (and flash flooding in particular) has been a danger in certain areas of the Region due to overflowing drainage channels, low lying areas with poor drainage, and debris build-up in basins. Some areas identified by the County include localized areas in Mission Valley, Moreno Valley, Ocotillo Wells, Lemon Crest, below San Vicente Reservoir, Ramona, etc.	
Are wildfires a concern in parts of your region?	Y	Wildfires are a common occurrence in the Region.	Increases in flash flooding
Does part of your region lie within the Sacramento-San Joaquin Drainage District?	N	Not applicable	Not applicable
<b>Ecosystem and Habitat</b>			
Does your region include inland or coastal aquatic habitats vulnerable to erosion and sedimentation issues?	Y	Erosion and sedimentation issues in Penasquitos Canyon, San Onofre, Crest Canyon, San Dieguito lagoon, Del Mar area, Encinitas area,	Increased impacts to coastal species
Does your region include estuarine habitats which rely on seasonal freshwater flow patterns?	Y	A number of brackish lagoons exist along the coast including Baticuitos Lagoon, Buena Vista Lagoon, Agua Hedionda Lagoon, and San Elijo Lagoon.	
Do estuaries, coastal dunes, wetlands, marshes, or exposed beaches exist in your region? If so, are coastal storms possible/frequent in your region?	Y	Estuaries, coastal dunes, wetlands, marshes and exposed beaches exist along the entire coast of the region. Historically, coastal storms have caused erosion.	
Do climate-sensitive fauna or flora populations live in your region?	Y	Numerous species dependent upon the Mediterranean climate live in the Region	Decreases in ecosystem services
Do endangered or threatened species exist in your region? Are changes in species distribution already being observed in parts of your region?	Y	A number of endangered and threatened species exist in the Region.	Decrease in available, necessary habitat
Does the region rely on aquatic or water-dependent habitats for recreation or other economic activities?	Y	Beach tourism, reservoir recreation, river trails	
Are there areas of fragmented estuarine, aquatic, or wetland wildlife habitat within your region? Are there movement corridors for species to naturally migrate? Are there infrastructure projects planned that might preclude species movement?	Y	Multiple Species Habitat Conservation Plans (MSHCPs) working on ensuring corridors but some need to be created	

Vulnerability Question	Answer	Justification	Vulnerability Issue
Does your region include one or more of the habitats described in the Endangered Species Coalition's Top 10 habitats vulnerable to climate change?	N	No, the Region is not within any of the ten listed habitats.	
Are there rivers in your region with quantified environmental flow requirements or known water quality/quantity stressors to aquatic life?	Y	Some rivers and streams have quantified flow requirements but are primarily related to water rights. There is a bacteria Total Maximum Daily Load (TMDL) covers almost every water body in region. Nutrient TMDLs on lots of water bodies	Decrease in environmental flows
<b>Hydropower</b>			
Is hydropower a source of electricity in your region?	Y	Approximately 10% of electricity provided by SDG&E is hydropower. The Water Authority also produces hydroelectric power which is sold to San Diego Gas & Electric (SDG&E).	Decrease in hydropower potential
Are energy needs in your region expected to increase in the future? If so, are there future plans for hydropower generation facilities or conditions for hydropower generation in your region?	Y	Energy demand is expected to increase in the future with population increase and development. Additional hydropower was recently created at Lake Hodges/Olivenhain Reservoir, and an additional project is possible at the San Vicente Dam.	

## 4 Vulnerability Analysis

Once the Workgroup identified the Region's areas of concern in terms of climate change issues, it was able to begin examining the adaptability of its water resources to climate change by prioritizing the vulnerability issues. In prioritizing the vulnerability issues, the Workgroup identified those water resources that are of highest concern to the Region in terms of the significance of the impact of climate change and therefore the level of adaptation that will be needed.

### 4.1 Vulnerability Prioritization Process

The vulnerabilities identified were then prioritized during an exercise conducted with the Working group. Each member selected five vulnerability issues they determined should have the highest priority in being addressed. In total, the nine members of the Workgroup resulted in 45 votes. Votes were spread across nearly all of the categories, indicating the Workgroup perceived there to be a wide range of climate change vulnerabilities. The vulnerability issues were then grouped into five priority levels ranging from very high to very low according to the number of votes: very high (nine votes), high (three to four votes), medium (two to three votes), low (one to two votes), very low (no votes).

At a subsequent meeting held on July 26, 2012, the Workgroup reviewed the results and made suggestions for refinements that could be made to better align the prioritization with the vulnerabilities identified in planning documents. These suggestions were incorporated into the prioritized vulnerability issues which are shown in the next section.

### 4.2 Vulnerability Prioritization Results

The Region's list of prioritized vulnerabilities developed by the Workgroup is shown in Table 4, and discussed further below.

**Table 4: Prioritized Climate Change Vulnerability Issues**

Priority Level	Category and Vulnerability Issue
Very High	<ul style="list-style-type: none"> <li>Water Supply: Decrease in imported supply</li> </ul>
High	<ul style="list-style-type: none"> <li>Water Supply: Sensitivity due to higher drought potential</li> <li>Water Quality: Increased constituent concentrations</li> <li>Flooding: Increases in flash flooding and inundation (extreme weather)</li> <li>Sea Level Rise: Inundation of storm drains and sewer systems</li> <li>Ecosystem/Habitat: Decrease in available necessary habitatEcosystem/Habitat: Decrease in ecosystem services</li> </ul>
Medium	<ul style="list-style-type: none"> <li>Water Demand: Crop demand would increase</li> <li>Water Demand: Industrial demand would increase</li> <li>Water Supply: Decrease in groundwater supply</li> <li>Water Quality: Increase in treatment cost</li> <li>Sea Level Rise: Damage to coastal recreation / tourism due to inundation</li> </ul>
Low	<ul style="list-style-type: none"> <li>Water Demand: Limited ability to conserve further</li> <li>Water Supply: Lack of groundwater storage to buffer drought</li> <li>Water Quality: Increased eutrophication</li> <li>Flooding: Increases in inland flooding</li> <li>Ecosystem/Habitat: Increased impacts to coastal species</li> </ul>

Priority Level	Category and Vulnerability Issue
Very Low	<ul style="list-style-type: none"> <li>• Water Demand: Limited ability to meet summer demand</li> <li>• Water Supply: Invasives can reduce supply available</li> <li>• Water Quality: Decrease in recreational opportunity</li> <li>• Sea Level Rise: Decrease in land</li> <li>• Sea Level Rise: Damage to ecosystem/habitat</li> <li>• Ecosystem/habitat: Decrease in environmental flows</li> <li>• Hydropower: Decrease in hydropower potential</li> </ul>

### **Very High Prioritization**

#### ***Water supply: Decrease in imported supply***

The water supply vulnerability issue of “decrease in imported supply” was identified by the Workgroup as the highest priority issue. The Region is highly dependent on imported water with nearly 80% of its supplies currently coming from the State Water Project and the Colorado River aqueduct. Given the Region’s limited local water supplies and the projected 20% to 25% decrease in imported water supply, a decrease in imported supply with climate change could have a significant impact on the Region and is an issue that needs to be addressed.

### **High Prioritization**

#### ***Water Supply: Sensitivity due to higher drought potential***

Climate change is expected to increase drought potential in the Region. In past years, water suppliers in the Region have successfully implemented drought management measures in order to lower demand. However, there are limits on the effectiveness of drought management measures. For example, tourists visiting the area are not likely to take part in drought management measures. Taking these issues into account, the Region is expected to be more susceptible to drought conditions. As drought is expected to increase in frequency and severity, more direct/long-term measures may be warranted as well as evaluation of revenue impacts to local water districts.

#### ***Water Quality: Increased constituent concentrations***

The water quality vulnerability issue of increased constituent concentrations with climate change was ranked highly as water bodies in the area already require treatment to meet water quality standards, such as pathogens and nutrients. Climate change is expected to decrease local water resources in the future, which will increase constituent concentrations leading to difficulty in meeting water quality standards and increases to treatment cost.

#### ***Flooding: Increases in flash flooding and inundation (extreme weather)***

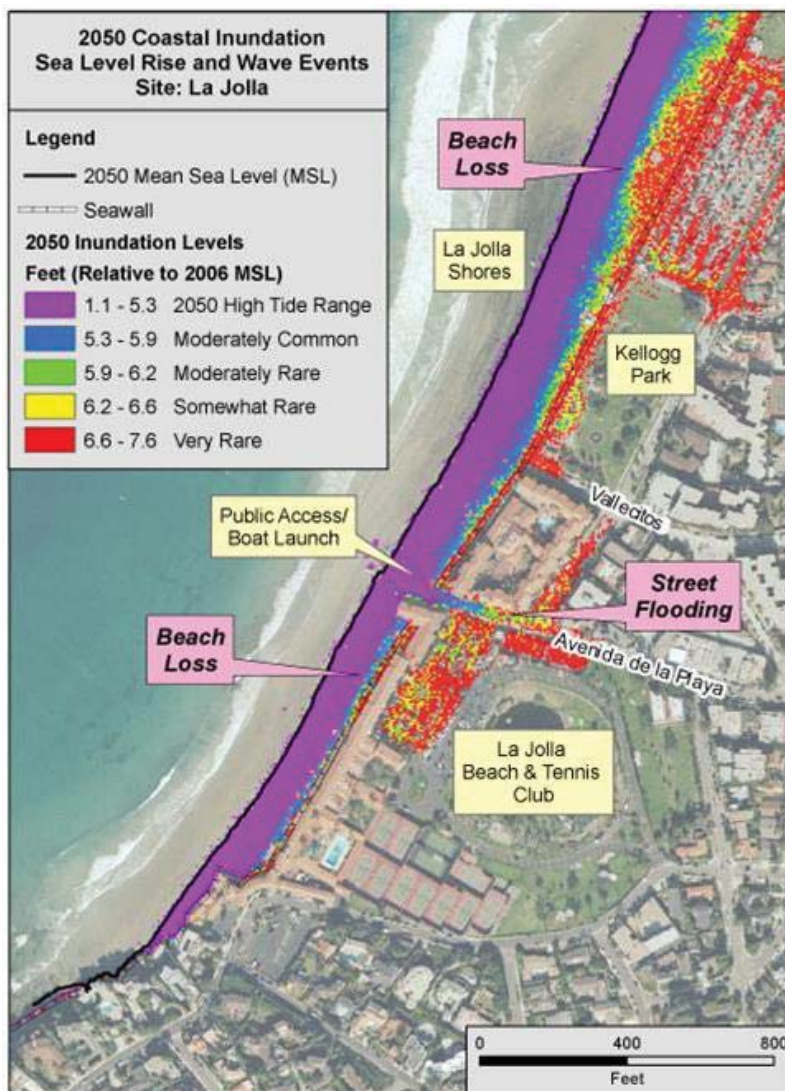
Flash flooding has been an issue for the Region in the past. Foothill areas are especially in danger from flash floods from large seasonal storms, which become a greater concern as the Region is prone to wildfires. Given that more frequent and intense storms are predicted as a consequence of climate change, in addition to increased wildfire risk, increases in flash flooding and inundation are of high concern.

#### ***Sea Level Rise: Inundation of storm drains and sewer systems***

Regional studies have found that sea level rise is already occurring, and is expected to continue to rise an additional 12 and 18 inches by 2050. This new sea level will inundate a number of low-lying areas along the Region’s coast such as Oceanside, La Jolla, Del Mar, Mission Beach, Coronado Island

and Camp Pendleton (Coastal Data Information Program, 2008), and impact their storm drains, wastewater systems, and other facilities and infrastructure. Coastal stormwater infrastructure and wastewater infrastructure that discharge to the ocean will be inundated with increased sea level rise, in particular during coastal storms, causing increased coastal flooding and sewer system overflows. An example of the extent of sea level rise on La Jolla is shown in Figure 2. Concern over aging systems and systems not designed for the increased capacity that will be needed with sea level rise led the group to give this issue a high-priority ranking

**Figure 2: Projected 2050 Coastal Inundation with Sea Level Rise in La Jolla**



(CDIP, 2008)

***Ecosystem/Habitat: Decrease in available necessary habitat***

The Region has numerous unique habitat areas extending from the mountains to the oceans which sensitive and endangered species are dependent upon. Anticipated higher temperatures, longer more frequent droughts, and more extreme precipitation events are projected to cause shifts and

loss of habitat necessary for these species. Of particular concern to IRWM planning is the shift and loss of riparian and wetland habitat. Riparian habitat will be altered due to decreased flows, increased water temperatures and increased constituent concentrations. These reductions in habitat and associated loss of sensitive and endangered species will, in turn, create biodiversity shifts and increase invasive species.

***Ecosystem/Habitat: Decrease in ecosystem services***

Ecosystem services provide important functions, such as material cycling and treatment of stormwater runoff that, if decreased, may result in the need for additional water treatment. As discussed above, climate change is expected to decrease available necessary habitat. This reduction in habitat and associated biodiversity shift and increase in invasive species is expected to decrease ecosystem services in the Region, and could result in additional cost.

**Medium Prioritization**

***Water Demand: Increase in agricultural crop water demand per acre***

Crop water demands are expected to increase with the increased temperatures caused by climate change. Though the number of acres of agricultural land is expected to decrease slightly in the future, the net demand for irrigation supply on the remaining acres may exceed current demand under climate change conditions. Through current jurisdictional plans, notably the County of San Diego General Plan, it is apparent that agriculture is an important industry to the Region, particularly smaller agricultural productions and urban farms that provide an economic base and community character to the Region. Given that agricultural land is decreasing, the Workgroup has given this climate change vulnerability issue a medium prioritization.

***Water Demand: Increase in industrial demand***

Industrial demand is expected to increase with temperature increases due to the need for cooling and process water. This vulnerability issue is particularly of concern for industries such as electronics and aerospace manufacturing, energy generation, research development and the pharmaceutical industry. Industrial demand increases are of concern in particular as increased demand in the Region could impact companies' decision to locate their plants within the Region, which would impact economic development.

***Water Supply: Decrease in groundwater supply***

Groundwater supply is projected to decline by seven inches per year with climate change. In addition, sea water intrusion caused by rising sea levels also has the potential to impact groundwater supply quality, which will reduce the amount of groundwater available for pumping. Despite these impacts, this vulnerability issue was prioritized as medium since the Region only obtains a small portion of its supplies through groundwater due to the limited size of the groundwater basins. This issue may be of a higher priority in localized areas such as the community of Lakeside, the Marine Corps Base at Camp Pendleton, Pauma Valley, the San Luis Rey River area, and National City where groundwater is a greater portion of supply.

***Water Quality: Increase in treatment cost***

Total dissolved solids (TDS) levels in reservoirs may increase due to increases in precipitation intensity, particularly after fires, which would in turn increase the cost of water treatment. The Region has a number of reservoirs which are downstream of forested watersheds, and are

susceptible to increased turbidity due to runoff from the surrounding area. However, this is not currently a large issues and therefore, the Workgroup rated this vulnerability issue as medium.

***Sea Level Rise: Damage to coastal recreation / tourism due to inundation***

As discussed previously, sea level rise is already documented as occurring, and is expected to continue to rise to between 12 and 18 inches by 2050. This rise in sea level is expected to cause damage to coastal recreation and tourism areas (such as beaches), though planning efforts such as the *Sea Level Rise Adaptation Strategy for San Diego Bay*, are ongoing. As the Region's economy relies partially on recreation and tourism, this vulnerability issue has been given a medium prioritization.

**Low Prioritization**

***Water Demand: Limited ability to conserve further***

The Region has already succeeded in implementing a large amount of water use efficiency measures. These measures have proven to be successful in mitigating against droughts such as in the severe drought that occurred in 2007. With this in mind, the Region may have difficulty in conserving further to meet greater drought frequency and intensity. However, additional savings measures are available and are being incorporated into Urban Water Management Plans and local climate action plans, which allow the Region to classify this issue as low.

***Water Supply: Lack of groundwater storage to buffer drought***

As mentioned under the water supply issue of decrease in groundwater supply, the Region's groundwater basins are limited in size, meaning there is very limited storage availability in the groundwater basins for use in buffering drought. Despite this, the Region's low reliability on groundwater makes this issue relatively less of a priority.

***Water Quality: Increased eutrophication***

Several water bodies in the Region are 303(d) listed for water quality issues related to eutrophication, including a number of lagoons, Tecolote Creek, lower San Diego River, and the Tijuana River Estuary. Consequently, it's probable that temperature increases caused by climate change could increase eutrophication of the Region's water bodies. This climate change vulnerability was ranked low, however, relative to other water quality vulnerability issues.

***Flooding: Increases in inland flooding***

Inland flooding was listed as a low priority for the Region, though there has been localized flooding in low-lying areas caused by insufficient and/or aging flood infrastructure. More extreme storms due to climate change could cause an increase in inland flooding, but as this is not a Region-wide issue, it has been prioritized as low as the Workgroup felt that this issue could best be addressed through local planning efforts.

***Ecosystem/Habitat: Increased impacts to coastal species***

Coastal dunes, wetlands, marshes and beaches provide unique habitats for the Region's species. Changes to temperature and precipitation have the potential to impact sensitive species. In addition, brackish lagoons provide estuarine habitat that depends on seasonal freshwater flow patterns. Habitat shifts and loss caused by climate change induced sea level rise, coastal erosion, and changes to freshwater flow patterns could also impact coastal species. Because coastal species

are already protected and because this is a localized issue, the Workgroup decided to classify it as low priority.

### **Very Low Prioritization**

#### ***Water Demand: Limited ability to meet summer demand***

Increased seasonal temperatures associated with climate change may create a challenge for the Region in meeting summer demands. However, as this is an issue mainly caused by agricultural and urban irrigation, it is ranked low compared to other vulnerability issues.

#### ***Water Supply: Invasives can reduce supply available***

Invasive species in the Region such as Arundo, Tamarisk and Quagga mussels have the potential to damage water conveyance facilities. Climate change is expected to increase invasive species in the region, which has the potential to impact water supplies in the future. However, this is not currently an issues affecting the Region's water supply infrastructure, and therefore is ranked very low.

#### ***Water Quality: Decrease in recreational opportunity***

As previously discussed, climate change is expected to increase constituent concentrations in the Region's reservoirs and beaches, a number of which are frequently used for recreation. The Regional already experiences beach closures due to poor stormwater quality which deposits contaminants in near shore areas. A decrease in water quality could impact this beneficial use of these water resources. However, because this is a localized issue, it is ranked very low.

#### ***Sea Level Rise: Decrease in land***

Coastal erosion is already occurring in the Region along bluffs and cliffs. The continued rise of sea level with climate change is expected to continue to erode land along the Region's coast, and could eventually begin to impact water and wastewater facilities near to the coast, but is a localized issue.

#### ***Sea Level Rise: Damage to ecosystem/habitat***

As discussed under the vulnerability issue of *increased impacts to coastal species*, sea level rise can be expected to damage coastal ecosystems and habitats. This may occur both through loss of land and through alterations to freshwater flow patterns. Again though, this is a localized issue.

#### ***Ecosystem/habitat: Decrease in environmental flows***

Aquatic and wetland species often depend upon a minimum flow to survive, and could be impacted with a decrease in minimum flow caused by climate change. In addition, a reduction in flows may increase constituent concentrations in the Region's waters that could stress aquatic life. There are a number of known water quality issues that have the potential to impact species should they worsen in the future, however, there are currently no minimum environmental flows in the Region's rivers and streams,

#### ***Hydropower: Decrease in hydropower potential***

The Region currently generates 40 megawatts of peak hydropower at the Olivenhain Reservoir and additional hydropower at the Rancho Peñasquitos Pressure Control Hydroelectric Facility, and is examining potential for construction of hydropower facilities elsewhere. Alterations to the Region's hydrology could decrease hydropower generation potential, however, hydropower generation within the Region is not currently a major electricity source.

### **Vulnerabilities Summary**

As can be seen in the above discussion, the Region is faced with a wide range of climate change vulnerability issues. Should the Region not implement strategies to adapt to these, it would face a number of risks, such as:

- Insufficient water supply if current dependence on imported supply is maintained
- Inability to meet demand during droughts given increased overall seasonal demands without increases in long-term operational storage
- Poorer water quality that further impacts beneficial uses and increases treatment needs
- Damage from increased flash flooding and inland flooding
- Coastal flooding and inundation of storm drains and sewer systems due to sea level rise
- Damage to coastal ecosystems and habitats, and associated impacts to sensitive species due to reduced terrestrial flows and sea level rise

## **5 Climate Change Management Strategies**

The next step in conducting the Region's climate change analysis is to identify appropriate strategies for adapting to the climate change vulnerability issues identified and prioritized in Chapter 4. The strategies selected will help the region to respond to or prevent future impacts of climate change on water resources. These strategies also have the potential to mitigate against further climate change by reducing the energy used to treat or convey water supplies and reducing GHG emissions, and some have the potential to provide carbon sequestration. This chapter details how the Workgroup identified, evaluated and prioritized adaptation and mitigation strategies relevant to the Region.

### **5.1 Identification of Strategies**

Strategies were identified through the review of relevant climate change related documents. These documents include:

- California Water Plan (DWR, 2009)
- Managing an Uncertain Future (DWR, 2008)
- Climate Change Scoping Plan (CARB, 2006)
- Climate Action Team Biennial Report (CalEPA, 2010)
- Resolution on Sea Level Rise (OPC, 2010)
- California Climate Extremes Workshop Report (Scripps, 2011)

The California Water Plan contains Resource Management Strategies (RMS) that provide the primary list of strategies used for this Study. The remaining documents in the above list were reviewed for additional and/or more detailed versions of the strategies. The Workgroup reviewed the strategies from the above documents, and discussed them relative to each strategy's potential for addressing the vulnerability issues prioritized above and mitigating GHG emissions.

## 5.2 Strategy Prioritization

A series of criteria were used by the Workgroup to refine and prioritize the list of strategies. The Workgroup first determined which strategies may be infeasible or not currently relevant to the Region at this time, or were determined not to be desired by the Region, and were not considered further in the strategy identification process.

Following the acceptance screening process, the strategies were analyzed further by evaluating each strategy according to the following questions:

- Is the strategy a “no regret” strategy?
- Does the strategy help to adapt to the vulnerability issues identified and evaluated in Chapters 3 and 4 of this Study?
- Does the strategy help the Region to mitigate GHGs?

By definition, “no regret” strategies are those strategies that would provide benefits today while also reducing vulnerability to climate change impacts. “No regret” strategies are desirable for immediate implementation as they will provide some benefit even under the uncertainty of climate change projections. The strategies were cross referenced with the vulnerability issues discussed in Chapters 2 and 3 to determine the number and type of climate change vulnerabilities that can be addressed. In addition, a strategy received a higher priority if it addresses vulnerability issues vulnerable determined to be high priority. Finally, the strategies were evaluated to determine whether they would mitigate GHG emissions through energy efficiency, emissions reduction, and/or carbon sequestration. Appendix A shows the results of this evaluation.

Using this evaluation, an initial prioritization was completed based on the criteria shown in Table 5.

**Table 5: Initial Strategy Prioritization Criteria**

Tier	Criteria
Tier 1	<ul style="list-style-type: none"> <li>• Considered “no regret”</li> <li>• Mitigates GHGs/is GHG neutral</li> <li>• Addresses the imported water (very high) vulnerability</li> </ul>
Tier 2	<ul style="list-style-type: none"> <li>• Included in other local climate change documents</li> <li>• Mitigates GHGs/is GHG neutral</li> <li>• Addresses at least 3 vulnerability areas</li> </ul>
Tier 3	<ul style="list-style-type: none"> <li>• Addresses at least 1 vulnerability or mitigates GHGs</li> </ul>

This initial prioritization was then presented to the Workgroup at the August 23, 2012 meeting where the listing of strategies and prioritization were further refined to best represent the needs of the Region. The final list of prioritized climate change management strategies and definitions is shown in Table 6, Table 7 and

Table 8 as Tier 1, 2, and 3 strategies. Strategies that were not prioritized as they were determined to be infeasible or irrelevant for the Region, or would have opposition, are shown Table 9. By

prioritizing these strategies, the Region can better define the types of projects and targets that will help respond to climate change.

**Table 6: Tier 1 Climate Change Management Strategies**

Strategy	Description
<b>Reduce Water Demand</b>	
Urban water use efficiency	Technological and behavioral improvements that decrease indoor and outdoor residential, commercial, industrial and institutional water use.
Crop idling for water transfers	Remove lands from irrigation (with the aim of returning the lands to irrigation at a later time) in order to make water available for transfer.
Education	Implement outreach program to educate urban and agricultural water users in water demand reduction practices.
Gray water use	Implement gray water use systems to reduce water supply demand.
Rainfed agriculture	Transfer crop consumptive use to be supplied directly by rainfall.
<b>Improve Operational Efficiency/Transfers</b>	
Conveyance - Regional/local	Improvements to regional and local conveyance facilities that improve conveyance capacity, including locating and widening narrow points that constrict the movement of water to increase the water transmission capacity of the entire system, and improve operational flexibility.
System Reoperation	Change existing operation and management procedures for existing reservoirs and conveyance facilities to increase water related benefits from these facilities. May improve the efficiency of existing water uses or may increase the emphasis of one use over another.
<b>Increase Water Supply</b>	
Conjunctive Management & Groundwater Storage	Coordinate and plan use and management of both surface and groundwater resources to maximize the available and reliability of supplies.
Recycled Municipal Water	Increase supply of recycled water through additional wastewater treatment, and/or expand conveyance of recycled water to end users.
<b>Improve Water Quality</b>	
Drinking Water Treatment and Distribution	Develop and maintain adequate water treatment and distribution facilities, and protect the quality and safety of the raw water supply.
Groundwater/Aquifer Remediation	Remove contaminants that affect the beneficial use of groundwater. Can include passive or active methods.
Pollution Prevention	Prevent pollution of local surface waters and groundwater using tools that prevent point and non-point sources of pollution. Examples include water management actions and projects such as the increase of local flows, recharge area protection, etc.
Salt and Salinity Management	Manage salt and salinity in surface and/or groundwater. Examples of methods include dilution and displacement, desalination, and salt collection and storage. The Region is currently working to meet State Salinity/Nutrient Management Planning Guidelines, and will help to implement this strategy.
Urban Runoff Management	Prevent pollution of local surface waters by implementing best management practices (BMPs) designed to reduce the pollutant loading and reduce the volumes and velocities of urban runoff discharged to surface waters.
<b>Improve Flood Management</b>	
Flood Risk Management	Enhance flood protection through projects and programs that assist in the management of flood flows and to prepare for, respond to, and recover from a flood.
<b>Practice Resource Stewardship</b>	

Strategy	Description
Agricultural Lands Stewardship	Conserve natural resources and protect the environment by conserving and improving land for food, fiber and biofuels production, watershed functions, soil, air, energy, plant and other conservation purposes. Can also protect open space and the traditional characteristics of rural communities.
Economic Incentives (Loans, Grants, Water Pricing)	Provide incentives such as financial assistance, water pricing, and water market policies intended to influence water management in order to influence amount of use, time of use, wastewater volume, and source of supply.
Ecosystem Restoration	Improve the condition of modified natural landscapes and biological communities to provide for their sustainability and for their use and enjoyment by current and future generations.
Land Use Planning and Management	Integrate land use and water management for the planning of housing and economic development needs of a growing population while providing for the efficient use of water, water quality, energy and other resources.
Recharge area protection	Protect recharge areas to ensure that areas suitable for recharge continue to be capable of adequate recharge rather than covered by urban infrastructure, and prevent pollutants from entering groundwater.
Water-dependent recreation protection	Incorporate planning for water-dependent recreation activities in water project, and implement project that protect/create water-dependent recreation opportunities.
Watershed/Soils/Forest management	Create and implement plans, programs, projects and activities to restore, sustain, and enhance watershed functions, soil functions, and forests.
Water-dependent cultural resources and practices preservation	Create and implement plans, programs, projects and activities to preserve water-dependent cultural resources and practices
Increase urban forest management	Encourage the planting of trees in urban areas to improve urban water quality and local supplies.
<b>Sea Level Rise</b>	
Building water facilities in coordination with land use/sea level rise (SLR) planning	Integrate water/wastewater resources planning with land use/sea level rise planning.

**Table 7: Tier 2 Climate Change Management Strategies**

Strategy	Description
<b>Improve Operational Efficiency/Transfers</b>	
Conduct emissions inventory and target	Create inventory of all emission coming from water/wastewater operations, and develop a target for reduction of emissions.
Increase use of renewable energy sources	Use renewable energy sources for the treatment and conveyance of water and wastewater.
<b>Increase Water Supply</b>	
Surface Storage - Regional/local	Add or increase the storage capacity of surface storage reservoirs to increase carryover storage and optimize supplies in drought situations.
<b>Improve Flood Management</b>	
Protective Infrastructure	Construct flood management facilities to reduce the impact of climate change enhanced flooding.
Sediment Management	Implement sediment management practices to reduce the impact of climate change enhanced flash flooding.
<b>Sea Level Rise</b>	
Protect water facilities through the relocation or removal of vulnerable structures	Relocate or remove water/wastewater facilities that may be impacted by sea level rise.
Protect resources and facilities by constructing seawalls or levees	Construct seawalls or levees to protect from sea level rise caused by climate change.
Protect/restore/create coastal wetlands	Protect, restore or create coastal wetlands to prevent the loss of wetland due to sea level rise.

**Table 8: Tier 3 Climate Change Management Strategies**

Strategy	Description
<b>Reduce Water Demand</b>	
Water Meters Installation	Installation of water meters in order to bill customers volumetrically.
<b>Improve Operational Efficiency/Transfers</b>	
Treatment and Distribution Efficiency	Improve treatment and distribution efficiency or water/wastewater systems in order to reduce energy usage.
Water Transfers	Transfer or exchange of water or water rights that result in temporary or long-term change in the point of diversion, place of use, or purpose of use.
Localized Treatment	Implement localized (or decentralized) treatment of water/wastewater to reduce the energy required for conveyance.
Shift water use to off-peak hours	Implement policies that will shift water use (e.g. irrigation) to off-peak hours to reduce evaporative loss.
Optimize Sewer Systems	Optimize sewer systems (wastewater or stormwater) to adapt to increased precipitation caused by climate change.
<b>Increase Water Supply</b>	
Desalination (Seawater or Brackish Groundwater)	Construct desalination plant to treat seawater or brackish groundwater.
Indirect Potable Reuse/ Potable Reuse	Implement program that will use recycled water to recharge groundwater, or use advanced treated recycled water to augment drinking water supplies.

**Table 9: Additionally Reviewed Climate Change Management Strategies**

Strategy
<b>Reduce Water Demand</b>
Irrigated Land Retirement
<b>Improve Operational Efficiency/Transfers</b>
Conveyance - Delta
<b>Increase Water Supply</b>
Waterbag Transport/Storage Technology
Precipitation Enhancement
Surface Storage – CALFED
Dewvaporation or Atmospheric Pressure Desalination
Fog Collection
Matching Quality to Use
<b>Sea Level Rise</b>
Rolling Easements
Expendable/Movable Structures in Risk Areas

## 5.3 Performance Measures/Metrics for Adaptation and Mitigation Strategies

The set of strategies evaluated in the previous section were determined to be those that will best help the Region in responding to and reducing climate change impacts. When implementing these strategies, it will be necessary to develop performance measures or metrics to assess the effectiveness of a project in meeting the Region's goals. Though specific measures and metrics will be defined according to a specific project or portfolio of projects, Table 10 provides examples of how these measures or metrics might be defined according to general water resource perspective. It should be noted that several of the strategies (the no regret strategies) may apply to additional objectives in the Region's IRWM Plan, and not solely to adapting to and/or mitigating climate change. Without specific metrics, it would be difficult to assess the effectiveness of strategies in responding to climate change. Moreover, some of the strategies implemented to adapt to climate change are "good planning" for future vulnerabilities and may not be immediately measurable. Many of the effects of climate change are anticipated past the planning horizon of the IRWM Plan. To respond to this uncertainty, the Region should update this climate change analysis during each IRWM Plan update, and implement adaptive management measures which will be discussed in the next chapter.

**Table 10: Sample Performance Measures/Metrics**

Strategy Category	Sample Performance Measures/Metrics
Reduce Water Demand	<ul style="list-style-type: none"> <li>• Average (annual) water demand reduction</li> <li>• Peak (seasonal, monthly) water demand reduction</li> </ul>
Improve Operational Efficiency	<ul style="list-style-type: none"> <li>• Additional supply</li> <li>• Supply reliability</li> </ul>
Increase Water Supply	<ul style="list-style-type: none"> <li>• Additional supply</li> <li>• Potable demand offset</li> <li>• Supply reliability</li> </ul>
Improve Water Quality	<ul style="list-style-type: none"> <li>• Salt line migration</li> <li>• Stream temperature</li> <li>• Dissolved oxygen</li> <li>• Turbidity</li> <li>• Pollutant concentrations</li> </ul>
Improve Flood Management	<ul style="list-style-type: none"> <li>• Acres of a certain habitat or floodplain function restored/protected</li> <li>• Volume of natural flood storage provided</li> <li>• Storm return period used for planning</li> <li>• Expected damage resulting for a certain return period storm</li> </ul>
Practice Resource Stewardship	<ul style="list-style-type: none"> <li>• Presence/absence of key indicator species</li> <li>• Acres of a certain habitat or floodplain function restored/protected</li> <li>• Volume of natural flood storage provided</li> <li>• Acres of recharge area protected</li> </ul>
Sea Level Rise	<ul style="list-style-type: none"> <li>• Acres of coastal wetlands created/restored/protected</li> <li>• Miles of pipeline or number of facilities relocated away from coastlines</li> <li>• Length of coastline protected by seawalls or levees</li> </ul>

## 6 Recommendations

The Region has taken the first steps in planning for climate change by examining current climate change projections to determine potential impacts, assessing water resource vulnerabilities, and developing a series of strategies that can be used in projects to adapt to climate change and mitigate GHGs. Chapter 6 discussed recommendations that may be used to successfully implement these strategies, including: use of adaptive management, objectives and targets for inclusion in the IRWM Plan, and project selection considerations for including climate change.

### 6.1 Adaptive Management

There is a level of uncertainty in projecting the effects and impacts of climate change. To respond to this, DWR recommends the use of adaptive management in implementing climate change strategies (DWR, 2011). Adaptive management consists of identifying and monitoring the most important uncertainties and translating them into risk triggers or early warning indicators. This allows for a flexible path of actions to take as triggers occur. DWR's *Climate Change Handbook* recommends the following steps in developing an adaptive management plan:

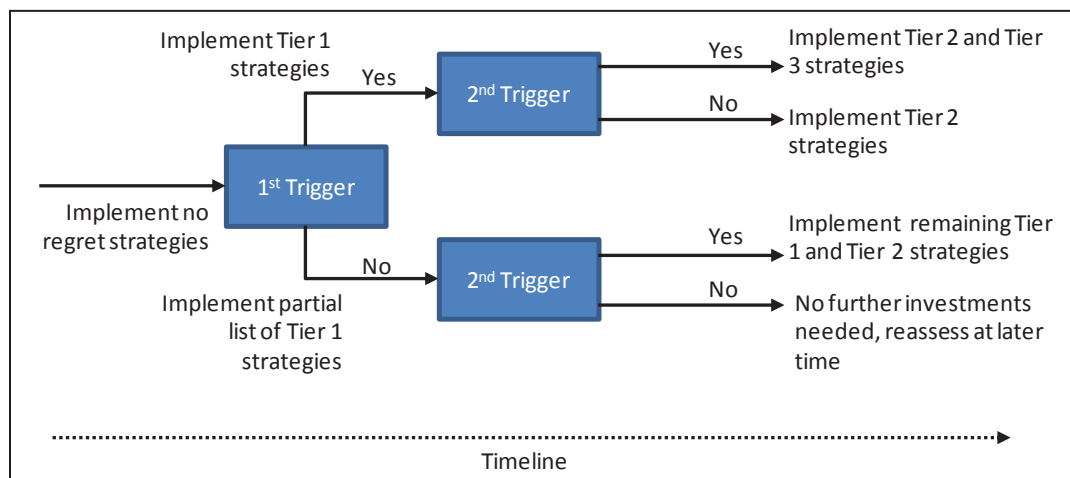
1. Identify risk triggers associated with important vulnerabilities or uncertainties
2. Quantify impacts and uncertainties
3. Evaluate strategies and define flexible implementation paths of action that allows for multiple options at specific triggers
4. Monitor performance and critical variables in the system
5. Implement or reevaluate strategies when triggers are reached

Under Step 1, the Region identifies risk triggers in order to monitor the Region's response to climate change. Risk triggers can be established deterministically (e.g., a threshold) or probabilistically (e.g. frequency of exceedance). The quantification of risk triggers are developed in Step 2, and serve as the basis for the definition of a path for plan implementation under Step 3.

Step 3 involves the definition of an implementation path for the evaluated strategies, and is central to the adaptive management process. The implementation path incorporates risk triggers over the course of time to allow the Region to determine what level of climate change adaptation/mitigation strategy should be implemented. Step 4 of the process, performance monitoring, incorporates performance measures and metrics used to evaluate water resources projects, and will help to define whether a risk trigger has been reached. Step 4 leads into the final step of implementing or reevaluating strategies, Step 5. The general structure of an adaptive management plan can be seen in Figure 3.

The key to successfully implementing the adaptive management process over time is continued active participation by stakeholders, and a clear understanding of project objectives. This should involve ongoing identification, monitoring, and updating of the most important impacts and uncertainties, and re-evaluation of the Region's vulnerabilities (DWR, 2011).

**Figure 3: General Adaptive Management Plan**



## 6.2 Climate Change Related Objectives and Targets

DWR requires that climate change be incorporated in the development of IRWM Plan objectives in terms of both climate change adaptation and GHG mitigation (DWR, 2012b). The strategies developed in Chapter 4 include both adaptation and mitigation, and therefore can be incorporated into climate change related objectives and targets that will meet DWR's requirement. The following objective and targets are recommended for inclusion in the IRWM Plan:

**Objective: Effectively address climate change through adaptation and mitigation in water resource management.**

Target 1: Encourage development of cost-effective carbon-efficient strategies for water management projects.

Target 2: Incorporate adaptation strategies to respond to sea-level rise, rainfall variability, and temperature variability in planning for water and wastewater management.

Target 3: Reduce or neutralize GHG emissions in all areas of water resource management.

## 6.3 Climate Change in Project Selection Considerations

In order for the Region to adapt to and mitigate against climate change, it will be necessary to ensure that projects utilize strategies identified in this study as helping the Region to adapt to and mitigate against climate change. It is recommended that the Region consider using the strategy priority levels discussed in Chapter 5 to assess the adaptation capacity of the project, and also consider whether the project helps the Region to mitigate GHGs. Oftentimes, a project that implements multiple strategies has the potential to increase the level of benefits provided while reducing the unit cost.

A recommended prioritization approach is presented in Table 11. In these prioritization criteria, projects are given higher priority for utilizing Tier 1 strategies and lower priority for Tier 3 strategies. Additionally, projects that contribute to two or more GHG measures, including energy efficiency, emissions reduction and carbon sequestration, are prioritized more highly. Projects that

contribute to one of these mitigation measures receive higher prioritization, and projects that would increase GHGs receive reduce prioritization. In the future, it is recommended that the Region define a threshold for GHG production or remediation to be used in the prioritization of projects. A worksheet to assist the Region in scoring projects according to the number of strategies utilized can be found in Appendix B. In this way, the Region can ensure that projects will help it to both adapt to climate change vulnerabilities of high concern, and will mitigate against climate change.

**Table 11: Climate Change Project Prioritization Criteria**

Adaptation	Mitigation <sup>1</sup>	Priority
Tier 1 Strategy	Contributes to 2 out of 3 mitigation measures	High
	Contributes to 1 out of 3 mitigation measures	High
	Increases greenhouse gasses	Medium or Low
Tier 2 Strategy	Contributes to 2 out of 3 mitigation measures	High
	Contributes to 1 out of 3 mitigation measures	Medium
	Increases greenhouse gasses	Low
Tier 3 Strategy	Contributes to 2 out of 3 mitigation measures	Medium
	Contributes to 1 out of 3 mitigation measures	Low
	Increases greenhouse gasses	Low

1. Mitigation measures referred to are: energy efficiency, emissions reduction, and carbon sequestration

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# Appendix 7-D: San Diego IRWM Climate Change Study

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# **Climate Change Planning Study**

## **Final**

**Prepared by:**



**May 2013**

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## **Appendices**

<b>Appendix A -</b>	<b>Detailed Strategy Prioritization Table</b>
<b>Appendix B -</b>	<b>Sample Climate Change Scoring Sheet for Projects</b>

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## **List of Abbreviations**

AB	Assembly Bill
AF	Acre-foot
CalEPA	California Environmental Protection Agency
CARB	California Air Resources Board
CAT	Climate Action Team
CCAR	California Climate Action Registry
CCAS	California Climate Action Strategy
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CH <sub>4</sub>	Methane
CNRA	California Natural Resources Agency
CO <sub>2</sub>	Carbon Dioxide
DWR	Department of Water Resources
EO	Executive Order
EPA	Environmental Protection Agency
GHG	Greenhouse Gas
HFCs	Hydrofluorocarbons
IRWM	Integrated Regional Water Management
kWh	kilowatt hours
MMTCO <sub>2</sub> E	Million metric tons carbon dioxide equivalent
MSHCP	Multiple Species Habitat Conservation Plan
N <sub>2</sub> O	Nitrous Oxide
NF <sub>3</sub>	Nitrogen Trifluoride
OPC	Ocean Protection Council
OPR	Office of Planning and Research
PFCs	Perfluorocarbons
RMS	Resource Management Strategy
SB	Senate Bill
SDCWA	San Diego County Water Authority

SDG&E	San Diego Gas & Electric
SDRIP	San Diego River Improvement Project
SF <sub>6</sub>	Sulfur Hexafluoride
SLR	Sea Level Rise
SWP	State Water Project
SWRCB	State Water Resources Control Board
TCR	The California Registry
TMDL	Total Maximum Daily Load
TDS	Total Dissolved Solids
USEPA	United States Environmental Protection Agency
WET-CAT	Water Energy Team of the Climate Action Team

# 1 Climate Change in Water Resources

This chapter addresses requirements set forth in the Resource Management Strategies (RMS) Standard in the *2012 IRWM Program Guidelines* (DWR 2012). As such, this chapter considers each RMS listed in the *California Water Plan (CWP) Update 2009* (DWR 2009), documents which RMS will help achieve the IRWM Plan Update objectives, presents all RMS considered for the IRWM Plan Update, and includes an evaluation of the adaptability of water management systems in the San Diego IRWM Region to climate change.

## 1.1 Introduction

Climate change projections have shown that California can expect to be impacted by changes to temperature and precipitation in the future, and even now California is beginning to experience the effects of these impacts. Water resource planners already face challenges interpreting new climate change information and discerning which response methods and approaches will be most appropriate for their planning needs. This Climate Change Planning Study (Study) examines current climate change science, policies, and regulations in terms of how they affect the San Diego Integrated Regional Water Management Region (Region). This Study serves as an initial guide for the Region to begin incorporating climate change adaptation and mitigation measures into its Integrated Regional Water Management (IRWM) Plan, where adaptation is how the Region can respond to climate change effects and mitigation is how the Region can reduce future climate change effects, and includes the following sections:

- Chapter 1: Climate Change in Water Resources
- Chapter 2: Climate Change in IRWM Planning
- Chapter 3: Effects of Climate Change on the Region
- Chapter 4: Vulnerability Analysis
- Chapter 5: Climate Change Management Strategies
- Chapter 6: Recommendations

## 1.2 Adaptation Relationship

Climate change is expected to directly impact a number of areas related to water resources, in particular temperature, precipitation, and sea level rise. As global temperature increases, seasonal precipitation patterns including the timing, intensity and form of precipitation, are projected to continue to change. Sea level rise, which has risen about seven inches over the last century due to warming, is expected to rise further in the future. In order for the Region to adapt to, or protect against, climate change, it must first identify the impacts climate change is expected to have on the Region.

These impacts are expected to further impact local water resources as follows (DWR, 2011):

- Temperature increases:
  - More winter precipitation falling as rain rather than snow, leading to reduced snowpack water storage, reduced long term soil humidity, reduced groundwater and downstream flows, and reduced imported water deliveries

- Higher irrigation demands as temperatures alter evapotranspiration rates, and growing seasons become longer
- Exacerbated water quality issues associated with dissolved oxygen levels, increased algal blooms and increased concentrations of salinity and other constituents
- Impacted habitats for temperature-sensitive fish and other life forms, and increased susceptibility of aquatic habitats to eutrophication
- Precipitation pattern changes:
  - Increased flooding (both coastal and inland) caused by more intense storms
  - Changes to growth and life cycle patterns caused by shifting weather patterns
  - Threats to soil permeability, adding to increased flood threat and decreased water availability
  - Reduced water supply caused by the inability to capture precipitation from more intense storms, and a projected progressive reduction in average annual runoff (though some models suggest that there may be some offset from tropical moisture patterns increasingly moving northward)
  - Increased turbidity caused by more extreme storm events, leading to increased water treatment needs and impacts to habitat
  - Increased wildfires with less frequent, but more intense rainfall, and possibly differently timed rainfall through the year, potentially resulting in vegetation cover changes
  - Reduction in hydropower generation potential
- Sea level rise:
  - Inundation and erosion of coastal areas (coastal bluffs in particular), including coastal infrastructure
  - Saline intrusion of coastal aquifers
  - Increased risk of storm surges and coastal flooding and erosion during and after storms
  - Changes in near-shore protective biogeography such as loss of sand, tide pools and kelp beds

Although the extent of these changes is uncertain, scientists agree that some level of change is inevitable; therefore, it will be necessary to implement flexible adaptation measures that will allow natural and human systems to respond to these climate change impacts in timely and effective ways. Adaptation measures may be implemented in response to climate change impacts that have already occurred, or expected impacts that are projected to occur. It is important to take note that water resources decisions made in the future will impact the rate of climate change.

In addition to adapting to climate change, the Region has the opportunity to mitigate against climate change by minimizing greenhouse gas emissions emitted by water supply and wastewater activities. The relationship between water resources and greenhouse gas emissions is discussed further in the next section.

## 1.3 Water-Energy Nexus

To understand how water is related to climate change, it's helpful to understand the connection between water resources planning and energy, which is known as the water-energy nexus. Energy production accounts for between 30% and 40% of total GHG production in California, and can emit a number of different types of GHGs. California's Air Resources Board recognizes and inventories the following GHGs: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), sulfur hexafluoride (SF<sub>6</sub>), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and nitrogen trifluoride (NF<sub>3</sub>). These GHGs vary in magnitude in terms of their GHG strength, and therefore are converted to be equivalent to CO<sub>2</sub> for the purposes of measuring GHG emissions across the state. CO<sub>2</sub> emissions (or the equivalent for other GHGs) are the common measurement for GHG emissions. (CARB, 2013). Currently, statewide water use accounts for nearly 20% of electricity use, and 30% of non-power plant related natural gas consumption (CEC, 2006). Water use and energy are linked in at least three critical ways (CEC, 2011):

1. **Water pumping and purification:** The amount of energy used to pump water will depend upon the source (e.g., surface versus groundwater), the distance and height the water must be moved, and the treatment requirements. For example, pumping water to San Diego County through the State Water Project, which accounts for nearly 80% of the County's water supply, uses about 4,600 kilowatt hours (kWh) per acre-foot of electricity (DWR, 2012a), while groundwater pumping typically uses 300 kWh/AF (Cohen, 2007).
2. **Wastewater treatment:** The amount of energy used in wastewater treatment plant typically ranges from 1,100 to 4,600 kWh per million gallons of wastewater treated (CEC, 2006).
3. **Water heating:** In an average California home, 41 percent of the water is used for dishwashing, faucets, laundry, and bathing water that is often heated.

These amounts, in total, are so significant that we must also count the amount of GHGs from the fossil fuels that are burned to produce the oil, gas, coal and other combustibles which are then burned to produce the electricity. Understanding the water-energy nexus in California provides opportunities to attain significant energy benefits through two primary strategies (CEC, 2006):

1. Conserving water saves the energy that would have been used to convey, treat, and distribute the water, and energy that may have been needed to collect, treat and dispose of the wastewater.
2. Reducing the energy intensity of water operations reduces the total amount of energy consumed in the water sector and ultimately reduces the value of energy embedded in saved water.

By reducing the energy used through the above strategies, GHG production can be reduced.

It should be noted that, at times, the above processes may also be used to generate energy, such as through cogeneration at wastewater treatment plants, or capturing energy as water flows downhill. Concurrently, energy production processes require water for steam production for thermoelectric power and to cool equipment by absorbing waste heat. Energy conservation in the Region can reduce this need.

These strategies are reflected in California's legislation and policy regarding climate change mitigation and greenhouse (GHG) emissions reduction discussed in the remainder of Chapter 1.

## 1.4 Legislative and Policy Context

In order to address currently-projected climate change impacts to California's water resources, the Department of Water Resources' (DWR's) 2012 IRWM Grant Program Guidelines require that IRWM Plans describe and consider climate change adaptation and mitigation. Below is a summary of State legislation and policy that were considered as part of this IRWM Plan.

### **Executive Order S-3-05**

Executive Order (EO) S-3-05, signed on June 1, 2005 by Governor Arnold Schwarzenegger, is one of the key pieces of legislation that has laid the foundation for California's climate change policy. This piece of legislation recognizes California's vulnerabilities to the impacts of climate change, which include its water-related natural resources. EO S-3-05 established three GHG reduction targets for California:

- By 2010, reduce GHG emissions to 2000 California levels
- By 2020, reduce GHG emissions to 1990 California levels
- By 2050, reduce GHG emissions to 80 percent below 1990 California levels

In addition to establishing GHG reduction targets for California, EO S-3-05 dictates that the Secretary of the California Environmental Protection Agency (CalEPA) establish the Climate Action Team (CAT) for State agencies to coordinate oversight of efforts to meet these targets. As laid out in EO S-3-05, the CAT submits biannual reports to the governor and State legislature describing progress made toward reaching the targets.

There are currently 12 sub-groups within the CAT, one of which is the Water-Energy group (also known as WET-CAT). WET-CAT was tasked with coordinating the study of GHG effects on California's water supply system, including the development of GHG mitigation strategies for energy consumption related to water use. Since the adoption of the Assembly Bill 32 Scoping Plan (see the following section), WET-CAT has been working on the implementation and analyses of six water-related measures identified in the Scoping Plan:

- Water Use Efficiency
- Water Recycling
- Water System Energy Efficiency
- Reuse Urban Runoff
- Increase Renewable Energy Production
- Public Goods Charge for Water

### **Assembly Bill 32: The California Global Warming Solutions Act of 2006**

Assembly Bill (AB) 32, the California Global Warming Solutions Act of 2006 was signed by Governor Schwarzenegger to codify the mid-term GHG reduction target established in EO S-3-05 (reduce GHG emissions to 1990 levels by 2020) through, among other mechanisms, imposing an enforceable cap on GHG emissions. AB 32 directed the California Air Resources Board (CARB) to develop discrete early actions to reduce GHG emissions by 2007, and to adopt regulations to implement early action measures by January 1, 2010.

### **Climate Change Scoping Plan**

AB 32 also required CARB to prepare a Scoping Plan to identify and achieve reductions in GHG emissions in California. The approved Climate Change Scoping Plan, adopted by CARB in December 2008, recommends specific strategies for different business sectors, including water management, to achieve the 2020 GHG emissions limit. The Scoping Plan as it relates to water resources is discussed further in Section 0 below.

### **Senate Bill 97**

Senate Bill 97 (SB 97) directed the Governor's Office of Planning and Research (OPR) to develop amendments to the California Environmental Quality Act (CEQA) Guidelines to determine how climate change is analyzed in documents required by CEQA. On December 31, 2009, the California Natural Resources Agency adopted amendments to the CEQA Guidelines and sent them to the California Office of Administrative Law for approval and filing with the Secretary of State. These CEQA Guideline amendments became effective on March 18, 2010. The CEQA Guidelines are not prescriptive; rather they encourage lead agencies to consider many factors in performing a CEQA analysis, and maintain discretion with lead agencies to make their own determinations based on substantial evidence.

### **Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water**

DWR, in collaboration with the State Water Resources Control Board, other state agencies, and numerous stakeholders, has initiated a number of projects to begin climate change adaptation planning for the water sector. In October 2009, DWR released the first state-level climate change adaptation strategy for water resources in the U.S., and the first adaptation strategy for any sector in California. Entitled *Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water*, the report details how climate change is currently affecting the state's water supplies, and sets forth ten adaptation strategies to help avoid or reduce climate change impacts to water resources.

Central to these adaptation efforts will be the full implementation of IRWM plans, which address regionally-appropriate management practices that incorporate climate change adaptation. These plans will evaluate and provide a comprehensive, economical, and sustainable water use strategy at the watershed level for California.

### **Executive Order S-13-08**

Given the potentially serious threat of sea level rise to California's water supply and coastal resources, and the subsequent impact it would have on our state's economy, population, and natural resources, Governor Schwarzenegger issued EO S-13-08 to enhance the state's management of climate impacts from sea level rise, increased temperatures, shifting precipitation, and extreme weather events. It requested a California Sea Level Rise Assessment Report to be conducted by the National Academy of Sciences, which was released in June 2012.

### **California Climate Adaptation Strategy**

In response to the passage of EO S-13-08, the California Natural Resources Agency released the report entitled *2009 California Climate Adaptation Strategy* that summarizes the best known science on climate change impacts in the state, assesses vulnerabilities, and outlines possible solutions that can be implemented within and across the state agencies to promote resilience to climate change.

### **GHG Reporting Rule**

While California has taken the lead in climate change policy and legislation, there have been several recent important developments at the federal level. On September 22, 2009, the United States Environmental Protection Agency (USEPA) released its final GHG Reporting Rule (Reporting Rule). Starting in 2010, facility owners that emit 25,000 metric tons of CO<sub>2</sub> emissions or more per year are required to submit an annual GHG emissions report with detailed calculations of facility GHG emissions. These activities will dovetail with the AB 32 reporting requirements in California.

### **Water Code Section 10541**

California has included climate change in its water code to ensure that it is considered as part of water management. California Water Code Section 10541 contains requirements for considering climate change in IRWM Plans. Specifically, it states that the guidelines for IRWM Plans are required to include:

- Consideration of GHG emissions of identified programs and projects
- Evaluation of the adaptability to climate change of water management systems in the region

## **1.5 AB 32 Scoping Plan and CARB Strategies**

As stated previously, AB 32 required CARB to prepare a Scoping Plan to identify and achieve reductions in GHG emissions in California, and recommended specific strategies for different business sectors to achieve the 2020 GHG emissions limit. This Scoping Plan was introduced in 2005, and adopted in 2008. Water use is identified in the AB 32 Scoping Plan as a sector requiring significant amounts of energy, and sets a goal to “continue efficiency programs and use cleaner energy sources to move and treat water.” This goal recognizes that California has a history of advancing water efficiency and conservation programs.

The Scoping Plan identifies six greenhouse gas emissions reduction (mitigation) measures for the water sector that could reduce GHGs if implemented statewide (please note that not all of these measures may be applicable to the San Diego IRWM Region):

1. Water Use Efficiency: Through increases in water use efficiency measures, reduce total statewide emissions
2. Water Recycling: Through increases in water recycling, reduce total statewide emissions
3. Water system energy efficiency: Through increases in water system energy efficiency, reduce total statewide emissions
4. Reuse of urban runoff: Through reuse of urban runoff, reduce total statewide emissions
5. Increase renewable energy production: Through the increase in renewable energy production, reduce statewide emissions
6. Public goods charge: To be determined

The first three of the measures will reduce energy requirements associated with providing reliable water supplies. The next two measures will reduce the amount of non-renewable electricity associated with conveying and treating water. The final measure (public goods charge) focuses on providing sustainable funding for implementing these actions. Other sectors identified in the Scoping Plan, such as Agriculture and Green Building, recognize that water use efficiency measures

will help to decrease GHG emissions as well, but do not calculate water use efficiency savings separately. The Scoping Plan states that to implement these GHG reduction measures, CARB and other State agencies will work with stakeholders and the public to develop regulatory measures and other programs.

## 1.6 California Climate Action Registry/The Climate Registry

The California Climate Action Registry (CCAR) was a program of the Climate Action Reserve which closed in December 2010. It served as a voluntary GHG registry to promote early actions to reduce GHG emissions by organizations. CCAR members voluntarily measured, verified, and publicly reported their GHG emissions. Members of the CCAR have been transitioned over to The Climate Registry (TCR), which is a nonprofit GHG emissions registry for North America that provides organizations with the tools to help them calculate, verify, report and manage their GHG emissions within a single registry. A number of agencies and organizations in the IRWM Region are voluntary members of TCR, including:

- San Diego County Water Authority
- City of San Diego
- County of San Diego
- Metropolitan Water District of Southern California

TCR's tools and database are particularly useful to those entities required to report their GHG emissions according to the EPA's Greenhouse Gas Reporting Rule (74 FR 56260) which requires reporting of GHG data and other relevant information from large sources and suppliers in the United States, and went into effect in January 2010. Though primarily affecting facilities that supply fossil fuels or industrial GHGs, manufacturers of vehicles and engines, this rule also applies to facilities that are responsible for the emission of 25,000 metric tons or more of GHG emissions per year, and therefore may apply to water and wastewater utilities, and large water purchasers. In addition to meeting USEPA requirements, by becoming a member of TCR, a utility, agency or company may better be able to respond to California's requirements for reporting and reducing GHG emissions.

## 1.7 Climate Action Plans and Climate Initiatives

Climate action plans are becoming more common among California's cities and counties. A climate action plan, which may also be referred to as a climate mitigation and adaptation plan, is a set of strategies intended to guide efforts for reducing GHG emissions, and typically covers a range of sectors such as energy, transportation, water, wastewater, solid waste, infrastructure, urban forestry and agriculture, and public health. Plans may also include strategies to guide efforts for reducing the impact of climate change effects on the area. Within the Region, the County and a number of cities and agencies have developed or are developing climate action plans and adaptation plans:

- County of San Diego Climate Action Plan
- San Diego County Water Authority Climate Action Plan and Climate Mitigation Plan
- City of San Diego Climate Mitigation and Adaptation Plan

- City of San Diego Long Range Water Resources Plan
- City of Chula Vista Adaptation and Mitigation Plan
- City of Encinitas Climate Action Plan
- City of Escondido Climate Action Plan
- City of San Marcos Climate Action Plan
- Port of San Diego Climate Mitigation and Adaptation Plan
- San Diego Association of Governments (SANDAG) Regional Energy Strategy and Climate Action Strategy
- San Diego Bay Sea Level Rise Adaptation Study
- San Diego Foundation Focus 2050 Study

In addition to the Climate Action Plans developed in the Region, the San Diego Foundation has developed a Climate Initiative to support community awareness about the local impacts of climate change. This initiative aims to educate the community about climate change, support climate change research, partner with local governments to address climate change, and provide technical assistance for climate action planning. As part of this initiative, every jurisdiction in the County has completed a GHG emissions inventory.

## 2 Climate Change in IRWM Planning

### 2.1 DWR Requirements

As previously discussed, the California Water Code contain language stating that IRWM Plan guidelines require climate change be considered as part of IRWM Plans. In line with this, DWR has included a Climate Change Standard in the IRWM Guidelines that requires IRWM plans to include a “cursory analysis of the effects on the region due to climate change, with the intent that a more refined analysis be required as additional guidance is made available.” To meet these guidelines, DWR has suggested that climate change be included in IRWM Plans as shown in Table 1.

**Table 1: IRWM Plan Standards in Relation to Climate Change**

Plan Section According to IRWM Plan Standards	Climate Change Information to Include <sup>1</sup>
Region Description	Language that describes likely climate change impacts on the Region as determined from a vulnerability assessment
Plan Objectives	<p>Adaptation to climate change:</p> <ul style="list-style-type: none"> <li>• Address adapting to changes in the amount, intensity, timing, quality and variability precipitation, runoff and recharge.</li> <li>• Consider sea level rise effects on water supply and other water resource conditions (e.g., recreation, habitat) and identify suitable adaptation measures. Consider OPC's Sea Level Rise Policy</li> </ul> <p>Reducing emissions (mitigation of greenhouse gasses)</p> <ul style="list-style-type: none"> <li>• Reduce carbon consumption, especially the energy embedded in water use, and ultimately reduce GHG emissions</li> <li>• Consider the strategies adopted by CARB in its AB 32 Scoping Plan, including innovative applications</li> <li>• Consider options for carbon sequestration where such options are integrally(directly or indirectly) tied to supporting IRWM Plan objectives</li> </ul>
Resource Management Strategies	Identify and implement adaptation strategies that address region-specific or local climate change contributions or impacts
Project Review Process	<p>Include the following factors:</p> <ul style="list-style-type: none"> <li>• Contribution of the project to adapting to climate change</li> <li>• Contribution of the project in reducing GHG emissions as compared to project alternatives</li> </ul>
Relation to Local Water Planning	Consider and incorporate water management issues and climate change adaptation and mitigation strategies from local plans into the IRWM Plan.
Relation to Local Land Use Planning	Demonstrate information sharing and collaboration with regional land use planning in order to management multiple water demands through the state (as described in CWP Update 2009), adapt water management systems to climate change, and potentially offset climate change impacts to water supply.
Plan Performance and Monitoring	Contain policies and procedures that promote adaptive management.
Coordination	<p>Consider the following:</p> <ul style="list-style-type: none"> <li>• Stay involved in CNRA's California Adaptation Strategy process</li> <li>• Consider joining The California Registry (<a href="http://www.theclimateregistry.org">www.theclimateregistry.org</a>)</li> </ul>

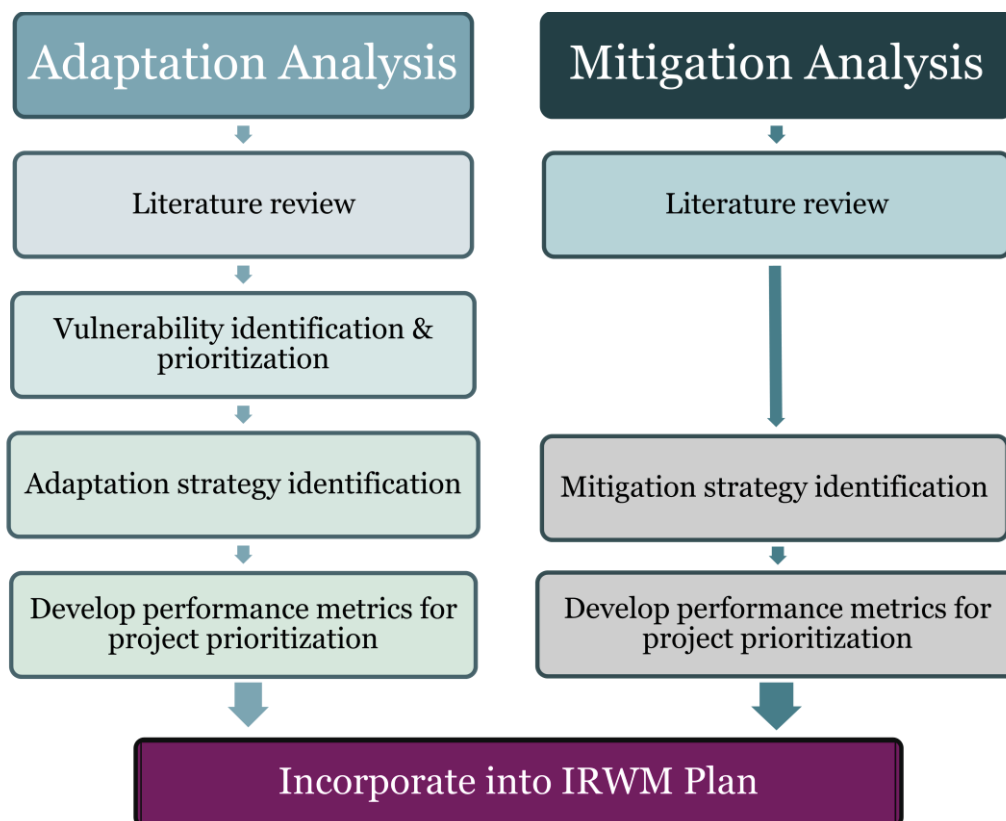
1. Based on information in DWR's 2012 Prop 84 and Prop 1E IRWM Guidelines, Appendix C, Table 7

## 2.2 Adaptation and Mitigation Analysis

In order to meet the IRWM Plan standards discussed in the previous section, the climate change analysis process shown in Figure 1 was followed. As previously discussed in this Study, climate change includes both adaptation (responding to climate change) and mitigation (reducing GHGs), and therefore is reflected in the analysis process below. While both the adaptation analysis and mitigation analysis include a literature review, strategy identification and performance metrics

development, the adaptation analysis includes an extra step to identify and prioritize climate change vulnerabilities. The information gathered through this climate change analysis will be incorporated into the Region's IRWM Plan update. By working through each of these steps, the Region can meet the requirements contained in DWR's IRWM Plan Guidelines.

**Figure 1: Climate Change Analysis Process**



## 2.3 San Diego IRWM Region Climate Change Study

To fulfill DWR's requirements and work through the climate change analysis discussed above, the Region established a Climate Change Workgroup (Workgroup) comprised of various water resources and planning representatives that have experience in climate change planning within the Region to work with a consultant to develop this Climate Change Planning Study (Study). In addition, local climate change efforts, in particular the San Diego Foundation Regional Focus 2050 Study which defines Region-specific climate change impacts, were used in the climate change assessment.

## 3 Effects of Climate Change on Region

### 3.1 Impacts and Effects on Region

Estimating the impacts of climate change at a regional level is challenging due to the coarse spatial scale of models that project climate change impacts of temperature and rainfall, and due to the long time scale evaluated in many models (to the year 2100). Recently, state and local entities have been working to downscale climate models to allow for climate change planning at a level that can be useful for planning efforts. The timescale used for these models has also been downscaled to provide outputs for the year 2050, and though this is still a longer timescale than is used in IRWM planning, is still useful for assessing climate change.

To incorporate climate change into water resources management, downscaled temperature and precipitation projections are input into other models, such as hydrologic models, to project impacts to water supply, water demand, snow pack, sea level rise, and wildfires. The results of these models have been summarized in a variety of studies and planning documents at the state, regional, and local levels. As part of this Study, a number of these documents were reviewed to determine which best represented the impacts for the Region. These documents include:

- *Regional Focus 2050 Study* (San Diego Foundation, 2008a & 2008b)
- *2010 Urban Water Management Plan* (San Diego County Water Authority, 2011)
- *Using Future Climate Projections to Support Water Resources Decision Making in California*, (California Climate Change Center, 2009)
- *Reconciling Projections of Colorado River Streamflow, Southwest Hydrology* (Hoerling et al., 2009)

Climate change impacts and effects are based on very different climate change assumptions and analysis approaches. Table 2 summarizes the impacts and effects of climate change on the San Diego Region by 2050 (unless otherwise indicated), which are typically based on an average of various climate change analyses. Generally, climate change is expected to increase temperature in the region. Rainfall projections vary with some projections showing that the Region will receive as much as 35% less rainfall and some showing up to 17% more rainfall (San Diego Foundation, 2008a). It's generally accepted that storms will be less frequent, but more intense (San Diego Foundation, 2008a). With higher temperatures and changes in rainfall volume and frequency, additional impacts will be felt in the Region.

Imported water supply from the State Water Project is projected to decrease by up to 25% (California Climate Change Center, 2009), while Colorado River Aqueduct supply may decrease by up to 20% (Hoerling et al, 2009). An overall shortfall of 164,000 acre-feet per year (AFY) in imported water is expected by 2050 (San Diego Foundation, 2008b).

Preliminary analysis of regional water demand trends in the San Diego County Water Authority service area indicate that climate change impacts may result in a slight demand increase, between 0.6 and 1.8%, by the year 2035. (SDCWA, 2011).

In currently accepted models, sea level rise is projected to be at least 12 to 18 inches by 2050, which would both inundate the coast due to the average rise, and impact coastal flood control during storms (San Diego Foundation, 2008a).

The changes to climate are also expected to increase the frequency of wildfires. Studies suggest that there will be a 40% increase in Coastal Sage Scrub acreage burned (San Diego Foundation, 2008a), and that 54% more acreage in the Western U.S. will burn compared to present (San Diego Foundation, 2008a). Increases in wildfires have the potential to increase sedimentation and turbidity of surface waters, and increase flash flooding.

Knowing what climate change impacts and effects are projected to have on the Region, it's possible to determine what water resources in the Region are most vulnerable to climate change. The next sections identify and prioritize the vulnerabilities to determine how to best apply management practices. These effects were presented to and vetted by the Workgroup at a meeting held on June 12, 2012.

**Table 2: Impacts and Effects of Climate Change on Region by 2050**

Impact	Effect
Temperature	<ul style="list-style-type: none"><li>• 1.5°F to 4.5°F average temperature increase</li></ul>
Rainfall	<ul style="list-style-type: none"><li>• Variable projections predict between 35% drier and 17% wetter</li><li>• Increase in variability between years</li></ul>
Supply	<ul style="list-style-type: none"><li>• Up to 25% decrease in SWP supply</li><li>• Up to 20% decrease in Colorado River supply</li><li>• 164,000 afy average shortfall in imported supply</li></ul>
Demand	<ul style="list-style-type: none"><li>• Potential 0.6% to 1.8% increase in demand by 2035</li></ul>
Sea level rise	<ul style="list-style-type: none"><li>• 12 to 18 inch rise in mean sea level rise</li></ul>
Wildfires	<ul style="list-style-type: none"><li>• 40% increase in California Coastal Shrub acreage burned in Southwestern U.S.</li><li>• 54% increase in overall acreage burned in Western U.S.</li></ul>

### 3.2 Identification of Vulnerabilities

Understanding the potential impacts and effects that climate change is projected to have on the Region allows an informed vulnerability assessment to be conducted for the Region's water resources. A climate change vulnerability assessment helps a Region to assess its water resource sensitivity to climate change, prioritize climate change vulnerabilities, and ultimately guides decisions as to what strategies and projects would most effectively adapt to and mitigate against climate change. DWR has identified a series of questions to help regions identify key indicators of potential vulnerability, including (DWR, 2011):

- Currently observable climate change impacts (climate sensitivity)
- Presence of particularly climate sensitive features, such as specific habitats and flood control infrastructure (internal exposure)
- Resiliency of a region's resources (adaptive capacity)

The Workgroup developed an analysis of the Region's vulnerabilities to climate change at the June 12, 2012 climate change workshop by asking a series of questions suggested by DWR in its 2011 *Climate Change Handbook for Regional Water Planning*. Table 3 summarizes the analysis, which includes:

- Vulnerability Question: Taken from Box 4-1 of DWR's *Climate Change Handbook*

- Answer: Provided at June 12, 2012 workshop
- Justification: Why Y (yes) or N (no) was selected
- Vulnerability Issue: What is the climate change vulnerability issue that is identified by asking the question?

Following this analysis, the vulnerability issues were prioritized by the Workgroup. This activity and results are described in Chapter 4.

Table 3: Climate Change Vulnerability Indicator Questions

Vulnerability Question	Answer	Justification	Vulnerability Issue
<b>Water Demand</b>			
Are there major industries that require cooling/process water in your planning region?	Y	Electronics and aerospace manufacturing, energy generation, research development, pharmaceutical. Biotech and energy growing. Room for efficiency improvements	Increase in industrial demand
Are crops grown in your region climate-sensitive? Would shifts in daily heat patterns, such as how long heat lingers before night-time cooling, be prohibitive for some crops?	Y	Primary crops include avocados, nurseries and citrus which can be climate sensitive, but agricultural land use is expected to decrease. Rise in smaller agricultural/urban farms/residential gardens, and increased crop diversity. Decrease in larger agricultural users.	Increase in agricultural crop water demand per acre; small food production use of permaculture could decrease per acre use
Do groundwater supplies in your region lack resiliency after drought events?	Y	The small groundwater basins in the Region tend to decrease resiliency. Increasing impermeability reduces recharge. Sweetwater, Oceanside, Escondido/Vista. Salt water intrusion as water tables drop.	Lack of groundwater storage to buffer drought
Are water use curtailment measures effective in your region?	Y	Shortage management activities currently in place were effective in meeting demands during the last major drought which began in 2007. Management measures not previously considered, such as soil conditions, may provide additional opportunities.	Perceived limited ability to conserve further
Does water use vary by more than 50% seasonally in parts of your region?	Y	Water agencies have peaking factors ranging from 2:1 to 6:1. Some of the higher peaking agencies dependent on imported water will have reduced peaking as agricultural use declines and more development occurs.	Limited ability to meet summer demand
Are some in-stream flow requirements in your region either currently insufficient to support aquatic life, or occasionally unmet?	N	Most streams are intermittent; however, some agencies that move water between reservoirs via streams have in-stream requirements to protect species during certain times of the year which impacts when water can be moved.	Habitat demand would be impacted
<b>Water Supply</b>			
Does a portion of the water supply in your region come from snowmelt?	Y	Imported supplies (SWP, Colorado River) come from snowmelt.	Decrease in imported supply
Does part of your region rely on water diverted from the Delta, imported from the Colorado River, or imported from other climate-sensitive systems outside your region?	Y	Approximately 80% of the Region's supplies are imported.	Decrease in imported supply

Vulnerability Question	Answer	Justification	Vulnerability Issue
Would your region have difficulty in storing carryover supply surpluses from year to year?	N	No, the County has sufficient storage capacity, and is currently completing an emergency storage carryover project. It should be noted that there is little transfer market available in California, with a focus of storage in northern California.	Decrease in reliability
Does part of your region rely on coastal aquifers? Has salt intrusion been a problem in the past?	Y	Some brackish groundwater exists near the coast which limits the use of coastal aquifers.	Decrease in groundwater supply
Has your region faced a drought in the past during which it failed to meet local water demands?	Y	Drought management plans had to be put into effect. It should be noted that the Region has never failed to meet its customers' demands once drought measures were put into place. Development of additional supplies may reduce the Region's vulnerability to this issue.	Sensitivity due to higher drought potential
Does your region have invasive species management issues at your facilities, along conveyance structures, or in habitat areas?	Y	Quagga, Arundo, Tamarisk	Invasives can reduce supply available
<b>Water Quality</b>			
Are increased wildfires a threat in your region? If so, does your region include reservoirs with fire-susceptible vegetation nearby which could pose a water quality concern from increased erosion?	Y	Wildfires are a common occurrence in the area, and often cause increased erosion in the Region's watersheds.	Increased erosion and sedimentation
Does part of your region rely on surface water bodies with current or recurrent water quality issues related to eutrophication, such as low dissolved oxygen or algal blooms? Are there other water quality constituents potentially exacerbated by climate change?	Y	Several water bodies are 303(d) listed for water quality issues related to eutrophication including the Lake Hodges, Famosa Slough, Guajome Lake, Loma Alta Slough, Mission Bay at the mouths of Rose Creek and Tecolote Creek, lower San Diego River, Sal Ejijo Lagoon, Santa Margarita Lagoon, Tijuana River, and the Tijuana River Estuary.	Increased eutrophication
Are seasonal low flows decreasing for some water bodies in your region? If so, are the reduced low flows limiting the water bodies' assimilative capacity?	Y	At times during the year, the only flow in some streams is irrigation overflow, which in turn increase the concentration of constituents.	Increased constituent concentration
Are there beneficial uses designated for some water bodies in your region that cannot always be met due to water quality issues?	Y	At times recreation use in some reservoirs is impacted, and beach closures occur. Wildlife habitat and freshwater habitat issues as well.	Decrease in recreational opportunity

Vulnerability Question		Answer	Justification	Vulnerability Issue
Does part of your region currently observe water quality shifts during rain events that impact treatment facility operation?	Y		Total dissolved solids (TDS), turbidity and nutrient levels in reservoirs may increase during storm events, impacting water treatment, particularly after fires. Oils and feces show up in reservoirs as well.	Increase in treatment needs and cost
<b>Sea Level Rise</b>				
Has coastal erosion already been observed in your region?	Y		Coastal erosion occurs at unstable bluffs along the coast, for example: Sunset cliff, bluffs along City of San Diego, Encinitas, military infrastructure at Coronado Island and Camp Pendleton..	Decrease in land due to erosion
Do tidal gauges along the coastal parts of your region show an increase over the past several decades?	Y		San Diego Bay Adaptation shows increasing levels	Damage to coastal recreation/tourism due to inundation
Is there land subsidence in the coastal areas of your region?	N		None noted	
Are there coastal structures, such as levees or breakwaters, in your region?	Y		Examples include Mission Bay, San Diego Harbor	
Is there significant coastal infrastructure, such as residences, recreation, water and wastewater treatment, tourism, and transportation) at less than six feet above mean sea level in your region?	Y		Beach community - wide-spread	Damage to ecosystems/habitats
Are there climate-sensitive low-lying coastal habitats in your region?	Y		Habitat type - salt marsh	
Are there areas in your region that currently flood during extreme high tides or storm surges?	Y		Mission Valley flooded from San Diego river during high tidal events	Storm drains and sewer systems will be inundated
<b>Flooding</b>				
Does critical infrastructure in your region lie within the 200-year floodplain?	Y		There is low-lying water and wastewater infrastructure. Pump stations.	Increases in inland flooding
Does aging critical flood protection infrastructure exist in your region?	Y		San Diego River Flood Improvement project. San Diego River Improvement Project (SDRIP) at Mission Valley.	

<b>Vulnerability Question</b>	<b>Answer</b>	<b>Justification</b>	<b>Vulnerability Issue</b>
Have flood control facilities (such as impoundment structures) been insufficient in the past?	Y	Flooding (and flash flooding in particular) has been a danger in certain areas of the Region due to overflowing drainage channels, low lying areas with poor drainage, and debris build-up in basins. Some areas identified by the County include localized areas in Mission Valley, Moreno Valley, Ocotillo Wells, Lemon Crest, below San Vicente Reservoir, Ramona, etc.	
Are wildfires a concern in parts of your region?	Y	Wildfires are a common occurrence in the Region.	Increases in flash flooding
Does part of your region lie within the Sacramento-San Joaquin Drainage District?	N	Not applicable	Not applicable
<b>Ecosystem and Habitat</b>			
Does your region include inland or coastal aquatic habitats vulnerable to erosion and sedimentation issues?	Y	Erosion and sedimentation issues in Penasquitos Canyon, San Onofre, Crest Canyon, San Dieguito lagoon, Del Mar area, Encinitas area,	Increased impacts to coastal species
Does your region include estuarine habitats which rely on seasonal freshwater flow patterns?	Y	A number of brackish lagoons exist along the coast including Baticuitos Lagoon, Buena Vista Lagoon, Agua Hedionda Lagoon, and San Elijo Lagoon.	
Do estuaries, coastal dunes, wetlands, marshes, or exposed beaches exist in your region? If so, are coastal storms possible/frequent in your region?	Y	Estuaries, coastal dunes, wetlands, marshes and exposed beaches exist along the entire coast of the region. Historically, coastal storms have caused erosion.	
Do climate-sensitive fauna or flora populations live in your region?	Y	Numerous species dependent upon the Mediterranean climate live in the Region	Decreases in ecosystem services
Do endangered or threatened species exist in your region? Are changes in species distribution already being observed in parts of your region?	Y	A number of endangered and threatened species exist in the Region.	Decrease in available, necessary habitat
Does the region rely on aquatic or water-dependent habitats for recreation or other economic activities?	Y	Beach tourism, reservoir recreation, river trails	
Are there areas of fragmented estuarine, aquatic, or wetland wildlife habitat within your region? Are there movement corridors for species to naturally migrate? Are there infrastructure projects planned that might preclude species movement?	Y	Multiple Species Habitat Conservation Plans (MSHCPs) working on ensuring corridors but some need to be created	

Vulnerability Question	Answer	Justification	Vulnerability Issue
Does your region include one or more of the habitats described in the Endangered Species Coalition's Top 10 habitats vulnerable to climate change?	N	No, the Region is not within any of the ten listed habitats.	
Are there rivers in your region with quantified environmental flow requirements or known water quality/quantity stressors to aquatic life?	Y	Some rivers and streams have quantified flow requirements but are primarily related to water rights. There is a bacteria Total Maximum Daily Load (TMDL) covers almost every water body in region. Nutrient TMDLs on lots of water bodies	Decrease in environmental flows
<b>Hydropower</b>			
Is hydropower a source of electricity in your region?	Y	Approximately 10% of electricity provided by SDG&E is hydropower. The Water Authority also produces hydroelectric power which is sold to San Diego Gas & Electric (SDG&E).	Decrease in hydropower potential
Are energy needs in your region expected to increase in the future? If so, are there future plans for hydropower generation facilities or conditions for hydropower generation in your region?	Y	Energy demand is expected to increase in the future with population increase and development. Additional hydropower was recently created at Lake Hodges/Olivenhain Reservoir, and an additional project is possible at the San Vicente Dam.	

## 4 Vulnerability Analysis

Once the Workgroup identified the Region's areas of concern in terms of climate change issues, it was able to begin examining the adaptability of its water resources to climate change by prioritizing the vulnerability issues. In prioritizing the vulnerability issues, the Workgroup identified those water resources that are of highest concern to the Region in terms of the significance of the impact of climate change and therefore the level of adaptation that will be needed.

### 4.1 Vulnerability Prioritization Process

The vulnerabilities identified were then prioritized during an exercise conducted with the Working group. Each member selected five vulnerability issues they determined should have the highest priority in being addressed. In total, the nine members of the Workgroup resulted in 45 votes. Votes were spread across nearly all of the categories, indicating the Workgroup perceived there to be a wide range of climate change vulnerabilities. The vulnerability issues were then grouped into five priority levels ranging from very high to very low according to the number of votes: very high (nine votes), high (three to four votes), medium (two to three votes), low (one to two votes), very low (no votes).

At a subsequent meeting held on July 26, 2012, the Workgroup reviewed the results and made suggestions for refinements that could be made to better align the prioritization with the vulnerabilities identified in planning documents. These suggestions were incorporated into the prioritized vulnerability issues which are shown in the next section.

### 4.2 Vulnerability Prioritization Results

The Region's list of prioritized vulnerabilities developed by the Workgroup is shown in Table 4, and discussed further below.

**Table 4: Prioritized Climate Change Vulnerability Issues**

Priority Level	Category and Vulnerability Issue
Very High	<ul style="list-style-type: none"> <li>Water Supply: Decrease in imported supply</li> </ul>
High	<ul style="list-style-type: none"> <li>Water Supply: Sensitivity due to higher drought potential</li> <li>Water Quality: Increased constituent concentrations</li> <li>Flooding: Increases in flash flooding and inundation (extreme weather)</li> <li>Sea Level Rise: Inundation of storm drains and sewer systems</li> <li>Ecosystem/Habitat: Decrease in available necessary habitatEcosystem/Habitat: Decrease in ecosystem services</li> </ul>
Medium	<ul style="list-style-type: none"> <li>Water Demand: Crop demand would increase</li> <li>Water Demand: Industrial demand would increase</li> <li>Water Supply: Decrease in groundwater supply</li> <li>Water Quality: Increase in treatment cost</li> <li>Sea Level Rise: Damage to coastal recreation / tourism due to inundation</li> </ul>
Low	<ul style="list-style-type: none"> <li>Water Demand: Limited ability to conserve further</li> <li>Water Supply: Lack of groundwater storage to buffer drought</li> <li>Water Quality: Increased eutrophication</li> <li>Flooding: Increases in inland flooding</li> <li>Ecosystem/Habitat: Increased impacts to coastal species</li> </ul>

Priority Level	Category and Vulnerability Issue
Very Low	<ul style="list-style-type: none"> <li>• Water Demand: Limited ability to meet summer demand</li> <li>• Water Supply: Invasives can reduce supply available</li> <li>• Water Quality: Decrease in recreational opportunity</li> <li>• Sea Level Rise: Decrease in land</li> <li>• Sea Level Rise: Damage to ecosystem/habitat</li> <li>• Ecosystem/habitat: Decrease in environmental flows</li> <li>• Hydropower: Decrease in hydropower potential</li> </ul>

### **Very High Prioritization**

#### ***Water supply: Decrease in imported supply***

The water supply vulnerability issue of “decrease in imported supply” was identified by the Workgroup as the highest priority issue. The Region is highly dependent on imported water with nearly 80% of its supplies currently coming from the State Water Project and the Colorado River aqueduct. Given the Region’s limited local water supplies and the projected 20% to 25% decrease in imported water supply, a decrease in imported supply with climate change could have a significant impact on the Region and is an issue that needs to be addressed.

### **High Prioritization**

#### ***Water Supply: Sensitivity due to higher drought potential***

Climate change is expected to increase drought potential in the Region. In past years, water suppliers in the Region have successfully implemented drought management measures in order to lower demand. However, there are limits on the effectiveness of drought management measures. For example, tourists visiting the area are not likely to take part in drought management measures. Taking these issues into account, the Region is expected to be more susceptible to drought conditions. As drought is expected to increase in frequency and severity, more direct/long-term measures may be warranted as well as evaluation of revenue impacts to local water districts.

#### ***Water Quality: Increased constituent concentrations***

The water quality vulnerability issue of increased constituent concentrations with climate change was ranked highly as water bodies in the area already require treatment to meet water quality standards, such as pathogens and nutrients. Climate change is expected to decrease local water resources in the future, which will increase constituent concentrations leading to difficulty in meeting water quality standards and increases to treatment cost.

#### ***Flooding: Increases in flash flooding and inundation (extreme weather)***

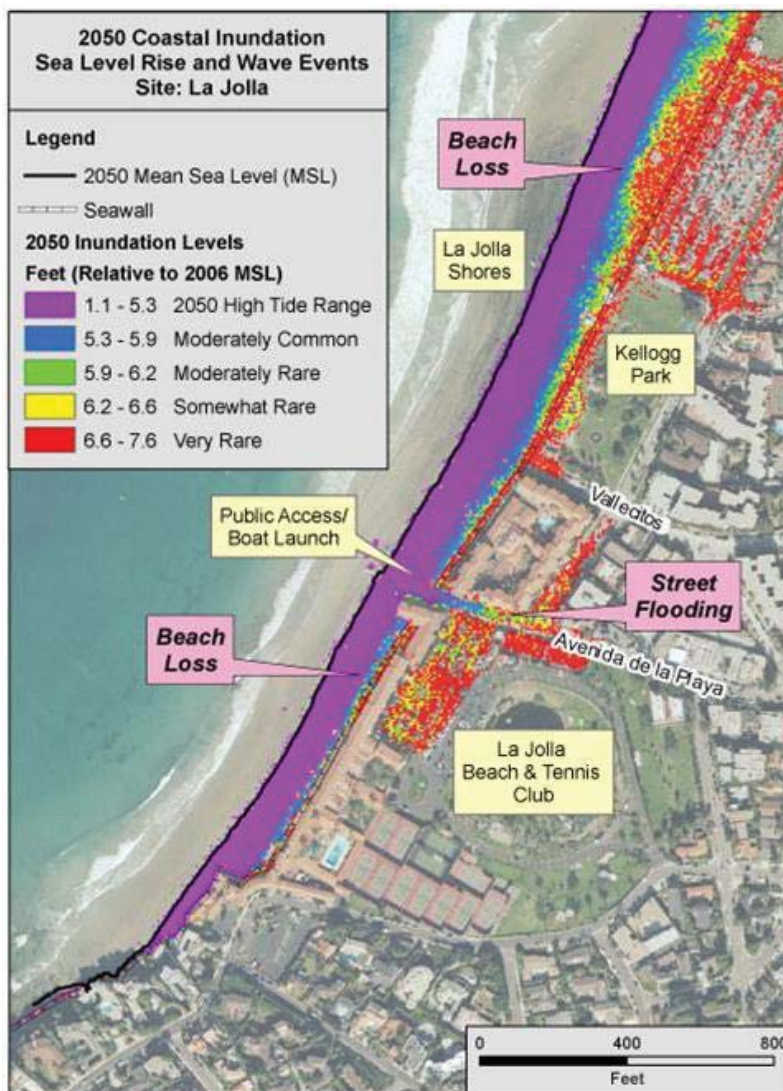
Flash flooding has been an issue for the Region in the past. Foothill areas are especially in danger from flash floods from large seasonal storms, which become a greater concern as the Region is prone to wildfires. Given that more frequent and intense storms are predicted as a consequence of climate change, in addition to increased wildfire risk, increases in flash flooding and inundation are of high concern.

#### ***Sea Level Rise: Inundation of storm drains and sewer systems***

Regional studies have found that sea level rise is already occurring, and is expected to continue to rise an additional 12 and 18 inches by 2050. This new sea level will inundate a number of low-lying areas along the Region’s coast such as Oceanside, La Jolla, Del Mar, Mission Beach, Coronado Island

and Camp Pendleton (Coastal Data Information Program, 2008), and impact their storm drains, wastewater systems, and other facilities and infrastructure. Coastal stormwater infrastructure and wastewater infrastructure that discharge to the ocean will be inundated with increased sea level rise, in particular during coastal storms, causing increased coastal flooding and sewer system overflows. An example of the extent of sea level rise on La Jolla is shown in Figure 2. Concern over aging systems and systems not designed for the increased capacity that will be needed with sea level rise led the group to give this issue a high-priority ranking

**Figure 2: Projected 2050 Coastal Inundation with Sea Level Rise in La Jolla**



(CDIP, 2008)

***Ecosystem/Habitat: Decrease in available necessary habitat***

The Region has numerous unique habitat areas extending from the mountains to the oceans which sensitive and endangered species are dependent upon. Anticipated higher temperatures, longer more frequent droughts, and more extreme precipitation events are projected to cause shifts and

loss of habitat necessary for these species. Of particular concern to IRWM planning is the shift and loss of riparian and wetland habitat. Riparian habitat will be altered due to decreased flows, increased water temperatures and increased constituent concentrations. These reductions in habitat and associated loss of sensitive and endangered species will, in turn, create biodiversity shifts and increase invasive species.

***Ecosystem/Habitat: Decrease in ecosystem services***

Ecosystem services provide important functions, such as material cycling and treatment of stormwater runoff that, if decreased, may result in the need for additional water treatment. As discussed above, climate change is expected to decrease available necessary habitat. This reduction in habitat and associated biodiversity shift and increase in invasive species is expected to decrease ecosystem services in the Region, and could result in additional cost.

**Medium Prioritization**

***Water Demand: Increase in agricultural crop water demand per acre***

Crop water demands are expected to increase with the increased temperatures caused by climate change. Though the number of acres of agricultural land is expected to decrease slightly in the future, the net demand for irrigation supply on the remaining acres may exceed current demand under climate change conditions. Through current jurisdictional plans, notably the County of San Diego General Plan, it is apparent that agriculture is an important industry to the Region, particularly smaller agricultural productions and urban farms that provide an economic base and community character to the Region. Given that agricultural land is decreasing, the Workgroup has given this climate change vulnerability issue a medium prioritization.

***Water Demand: Increase in industrial demand***

Industrial demand is expected to increase with temperature increases due to the need for cooling and process water. This vulnerability issue is particularly of concern for industries such as electronics and aerospace manufacturing, energy generation, research development and the pharmaceutical industry. Industrial demand increases are of concern in particular as increased demand in the Region could impact companies' decision to locate their plants within the Region, which would impact economic development.

***Water Supply: Decrease in groundwater supply***

Groundwater supply is projected to decline by seven inches per year with climate change. In addition, sea water intrusion caused by rising sea levels also has the potential to impact groundwater supply quality, which will reduce the amount of groundwater available for pumping. Despite these impacts, this vulnerability issue was prioritized as medium since the Region only obtains a small portion of its supplies through groundwater due to the limited size of the groundwater basins. This issue may be of a higher priority in localized areas such as the community of Lakeside, the Marine Corps Base at Camp Pendleton, Pauma Valley, the San Luis Rey River area, and National City where groundwater is a greater portion of supply.

***Water Quality: Increase in treatment cost***

Total dissolved solids (TDS) levels in reservoirs may increase due to increases in precipitation intensity, particularly after fires, which would in turn increase the cost of water treatment. The Region has a number of reservoirs which are downstream of forested watersheds, and are

susceptible to increased turbidity due to runoff from the surrounding area. However, this is not currently a large issues and therefore, the Workgroup rated this vulnerability issue as medium.

***Sea Level Rise: Damage to coastal recreation / tourism due to inundation***

As discussed previously, sea level rise is already documented as occurring, and is expected to continue to rise to between 12 and 18 inches by 2050. This rise in sea level is expected to cause damage to coastal recreation and tourism areas (such as beaches), though planning efforts such as the *Sea Level Rise Adaptation Strategy for San Diego Bay*, are ongoing. As the Region's economy relies partially on recreation and tourism, this vulnerability issue has been given a medium prioritization.

**Low Prioritization**

***Water Demand: Limited ability to conserve further***

The Region has already succeeded in implementing a large amount of water use efficiency measures. These measures have proven to be successful in mitigating against droughts such as in the severe drought that occurred in 2007. With this in mind, the Region may have difficulty in conserving further to meet greater drought frequency and intensity. However, additional savings measures are available and are being incorporated into Urban Water Management Plans and local climate action plans, which allow the Region to classify this issue as low.

***Water Supply: Lack of groundwater storage to buffer drought***

As mentioned under the water supply issue of decrease in groundwater supply, the Region's groundwater basins are limited in size, meaning there is very limited storage availability in the groundwater basins for use in buffering drought. Despite this, the Region's low reliability on groundwater makes this issue relatively less of a priority.

***Water Quality: Increased eutrophication***

Several water bodies in the Region are 303(d) listed for water quality issues related to eutrophication, including a number of lagoons, Tecolote Creek, lower San Diego River, and the Tijuana River Estuary. Consequently, it's probable that temperature increases caused by climate change could increase eutrophication of the Region's water bodies. This climate change vulnerability was ranked low, however, relative to other water quality vulnerability issues.

***Flooding: Increases in inland flooding***

Inland flooding was listed as a low priority for the Region, though there has been localized flooding in low-lying areas caused by insufficient and/or aging flood infrastructure. More extreme storms due to climate change could cause an increase in inland flooding, but as this is not a Region-wide issue, it has been prioritized as low as the Workgroup felt that this issue could best be addressed through local planning efforts.

***Ecosystem/Habitat: Increased impacts to coastal species***

Coastal dunes, wetlands, marshes and beaches provide unique habitats for the Region's species. Changes to temperature and precipitation have the potential to impact sensitive species. In addition, brackish lagoons provide estuarine habitat that depends on seasonal freshwater flow patterns. Habitat shifts and loss caused by climate change induced sea level rise, coastal erosion, and changes to freshwater flow patterns could also impact coastal species. Because coastal species

are already protected and because this is a localized issue, the Workgroup decided to classify it as low priority.

### **Very Low Prioritization**

#### ***Water Demand: Limited ability to meet summer demand***

Increased seasonal temperatures associated with climate change may create a challenge for the Region in meeting summer demands. However, as this is an issue mainly caused by agricultural and urban irrigation, it is ranked low compared to other vulnerability issues.

#### ***Water Supply: Invasives can reduce supply available***

Invasive species in the Region such as Arundo, Tamarisk and Quagga mussels have the potential to damage water conveyance facilities. Climate change is expected to increase invasive species in the region, which has the potential to impact water supplies in the future. However, this is not currently an issues affecting the Region's water supply infrastructure, and therefore is ranked very low.

#### ***Water Quality: Decrease in recreational opportunity***

As previously discussed, climate change is expected to increase constituent concentrations in the Region's reservoirs and beaches, a number of which are frequently used for recreation. The Regional already experiences beach closures due to poor stormwater quality which deposits contaminants in near shore areas. A decrease in water quality could impact this beneficial use of these water resources. However, because this is a localized issue, it is ranked very low.

#### ***Sea Level Rise: Decrease in land***

Coastal erosion is already occurring in the Region along bluffs and cliffs. The continued rise of sea level with climate change is expected to continue to erode land along the Region's coast, and could eventually begin to impact water and wastewater facilities near to the coast, but is a localized issue.

#### ***Sea Level Rise: Damage to ecosystem/habitat***

As discussed under the vulnerability issue of *increased impacts to coastal species*, sea level rise can be expected to damage coastal ecosystems and habitats. This may occur both through loss of land and through alterations to freshwater flow patterns. Again though, this is a localized issue.

#### ***Ecosystem/habitat: Decrease in environmental flows***

Aquatic and wetland species often depend upon a minimum flow to survive, and could be impacted with a decrease in minimum flow caused by climate change. In addition, a reduction in flows may increase constituent concentrations in the Region's waters that could stress aquatic life. There are a number of known water quality issues that have the potential to impact species should they worsen in the future, however, there are currently no minimum environmental flows in the Region's rivers and streams,

#### ***Hydropower: Decrease in hydropower potential***

The Region currently generates 40 megawatts of peak hydropower at the Olivenhain Reservoir and additional hydropower at the Rancho Peñasquitos Pressure Control Hydroelectric Facility, and is examining potential for construction of hydropower facilities elsewhere. Alterations to the Region's hydrology could decrease hydropower generation potential, however, hydropower generation within the Region is not currently a major electricity source.

### **Vulnerabilities Summary**

As can be seen in the above discussion, the Region is faced with a wide range of climate change vulnerability issues. Should the Region not implement strategies to adapt to these, it would face a number of risks, such as:

- Insufficient water supply if current dependence on imported supply is maintained
- Inability to meet demand during droughts given increased overall seasonal demands without increases in long-term operational storage
- Poorer water quality that further impacts beneficial uses and increases treatment needs
- Damage from increased flash flooding and inland flooding
- Coastal flooding and inundation of storm drains and sewer systems due to sea level rise
- Damage to coastal ecosystems and habitats, and associated impacts to sensitive species due to reduced terrestrial flows and sea level rise

## **5 Climate Change Management Strategies**

The next step in conducting the Region's climate change analysis is to identify appropriate strategies for adapting to the climate change vulnerability issues identified and prioritized in Chapter 4. The strategies selected will help the region to respond to or prevent future impacts of climate change on water resources. These strategies also have the potential to mitigate against further climate change by reducing the energy used to treat or convey water supplies and reducing GHG emissions, and some have the potential to provide carbon sequestration. This chapter details how the Workgroup identified, evaluated and prioritized adaptation and mitigation strategies relevant to the Region.

### **5.1 Identification of Strategies**

Strategies were identified through the review of relevant climate change related documents. These documents include:

- California Water Plan (DWR, 2009)
- Managing an Uncertain Future (DWR, 2008)
- Climate Change Scoping Plan (CARB, 2006)
- Climate Action Team Biennial Report (CalEPA, 2010)
- Resolution on Sea Level Rise (OPC, 2010)
- California Climate Extremes Workshop Report (Scripps, 2011)

The California Water Plan contains Resource Management Strategies (RMS) that provide the primary list of strategies used for this Study. The remaining documents in the above list were reviewed for additional and/or more detailed versions of the strategies. The Workgroup reviewed the strategies from the above documents, and discussed them relative to each strategy's potential for addressing the vulnerability issues prioritized above and mitigating GHG emissions.

## 5.2 Strategy Prioritization

A series of criteria were used by the Workgroup to refine and prioritize the list of strategies. The Workgroup first determined which strategies may be infeasible or not currently relevant to the Region at this time, or were determined not to be desired by the Region, and were not considered further in the strategy identification process.

Following the acceptance screening process, the strategies were analyzed further by evaluating each strategy according to the following questions:

- Is the strategy a “no regret” strategy?
- Does the strategy help to adapt to the vulnerability issues identified and evaluated in Chapters 3 and 4 of this Study?
- Does the strategy help the Region to mitigate GHGs?

By definition, “no regret” strategies are those strategies that would provide benefits today while also reducing vulnerability to climate change impacts. “No regret” strategies are desirable for immediate implementation as they will provide some benefit even under the uncertainty of climate change projections. The strategies were cross referenced with the vulnerability issues discussed in Chapters 2 and 3 to determine the number and type of climate change vulnerabilities that can be addressed. In addition, a strategy received a higher priority if it addresses vulnerability issues vulnerable determined to be high priority. Finally, the strategies were evaluated to determine whether they would mitigate GHG emissions through energy efficiency, emissions reduction, and/or carbon sequestration. Appendix A shows the results of this evaluation.

Using this evaluation, an initial prioritization was completed based on the criteria shown in Table 5.

**Table 5: Initial Strategy Prioritization Criteria**

Tier	Criteria
Tier 1	<ul style="list-style-type: none"> <li>• Considered “no regret”</li> <li>• Mitigates GHGs/is GHG neutral</li> <li>• Addresses the imported water (very high) vulnerability</li> </ul>
Tier 2	<ul style="list-style-type: none"> <li>• Included in other local climate change documents</li> <li>• Mitigates GHGs/is GHG neutral</li> <li>• Addresses at least 3 vulnerability areas</li> </ul>
Tier 3	<ul style="list-style-type: none"> <li>• Addresses at least 1 vulnerability or mitigates GHGs</li> </ul>

This initial prioritization was then presented to the Workgroup at the August 23, 2012 meeting where the listing of strategies and prioritization were further refined to best represent the needs of the Region. The final list of prioritized climate change management strategies and definitions is shown in Table 6, Table 7 and

Table 8 as Tier 1, 2, and 3 strategies. Strategies that were not prioritized as they were determined to be infeasible or irrelevant for the Region, or would have opposition, are shown Table 9. By

prioritizing these strategies, the Region can better define the types of projects and targets that will help respond to climate change.

**Table 6: Tier 1 Climate Change Management Strategies**

Strategy	Description
<b>Reduce Water Demand</b>	
Urban water use efficiency	Technological and behavioral improvements that decrease indoor and outdoor residential, commercial, industrial and institutional water use.
Crop idling for water transfers	Remove lands from irrigation (with the aim of returning the lands to irrigation at a later time) in order to make water available for transfer.
Education	Implement outreach program to educate urban and agricultural water users in water demand reduction practices.
Gray water use	Implement gray water use systems to reduce water supply demand.
Rainfed agriculture	Transfer crop consumptive use to be supplied directly by rainfall.
<b>Improve Operational Efficiency/Transfers</b>	
Conveyance - Regional/local	Improvements to regional and local conveyance facilities that improve conveyance capacity, including locating and widening narrow points that constrict the movement of water to increase the water transmission capacity of the entire system, and improve operational flexibility.
System Reoperation	Change existing operation and management procedures for existing reservoirs and conveyance facilities to increase water related benefits from these facilities. May improve the efficiency of existing water uses or may increase the emphasis of one use over another.
<b>Increase Water Supply</b>	
Conjunctive Management & Groundwater Storage	Coordinate and plan use and management of both surface and groundwater resources to maximize the available and reliability of supplies.
Recycled Municipal Water	Increase supply of recycled water through additional wastewater treatment, and/or expand conveyance of recycled water to end users.
<b>Improve Water Quality</b>	
Drinking Water Treatment and Distribution	Develop and maintain adequate water treatment and distribution facilities, and protect the quality and safety of the raw water supply.
Groundwater/Aquifer Remediation	Remove contaminants that affect the beneficial use of groundwater. Can include passive or active methods.
Pollution Prevention	Prevent pollution of local surface waters and groundwater using tools that prevent point and non-point sources of pollution. Examples include water management actions and projects such as the increase of local flows, recharge area protection, etc.
Salt and Salinity Management	Manage salt and salinity in surface and/or groundwater. Examples of methods include dilution and displacement, desalination, and salt collection and storage. The Region is currently working to meet State Salinity/Nutrient Management Planning Guidelines, and will help to implement this strategy.
Urban Runoff Management	Prevent pollution of local surface waters by implementing best management practices (BMPs) designed to reduce the pollutant loading and reduce the volumes and velocities of urban runoff discharged to surface waters.
<b>Improve Flood Management</b>	
Flood Risk Management	Enhance flood protection through projects and programs that assist in the management of flood flows and to prepare for, respond to, and recover from a flood.
<b>Practice Resource Stewardship</b>	

Strategy	Description
Agricultural Lands Stewardship	Conserve natural resources and protect the environment by conserving and improving land for food, fiber and biofuels production, watershed functions, soil, air, energy, plant and other conservation purposes. Can also protect open space and the traditional characteristics of rural communities.
Economic Incentives (Loans, Grants, Water Pricing)	Provide incentives such as financial assistance, water pricing, and water market policies intended to influence water management in order to influence amount of use, time of use, wastewater volume, and source of supply.
Ecosystem Restoration	Improve the condition of modified natural landscapes and biological communities to provide for their sustainability and for their use and enjoyment by current and future generations.
Land Use Planning and Management	Integrate land use and water management for the planning of housing and economic development needs of a growing population while providing for the efficient use of water, water quality, energy and other resources.
Recharge area protection	Protect recharge areas to ensure that areas suitable for recharge continue to be capable of adequate recharge rather than covered by urban infrastructure, and prevent pollutants from entering groundwater.
Water-dependent recreation protection	Incorporate planning for water-dependent recreation activities in water project, and implement project that protect/create water-dependent recreation opportunities.
Watershed/Soils/Forest management	Create and implement plans, programs, projects and activities to restore, sustain, and enhance watershed functions, soil functions, and forests.
Water-dependent cultural resources and practices preservation	Create and implement plans, programs, projects and activities to preserve water-dependent cultural resources and practices
Increase urban forest management	Encourage the planting of trees in urban areas to improve urban water quality and local supplies.
<b>Sea Level Rise</b>	
Building water facilities in coordination with land use/sea level rise (SLR) planning	Integrate water/wastewater resources planning with land use/sea level rise planning.

**Table 7: Tier 2 Climate Change Management Strategies**

Strategy	Description
<b>Improve Operational Efficiency/Transfers</b>	
Conduct emissions inventory and target	Create inventory of all emission coming from water/wastewater operations, and develop a target for reduction of emissions.
Increase use of renewable energy sources	Use renewable energy sources for the treatment and conveyance of water and wastewater.
<b>Increase Water Supply</b>	
Surface Storage - Regional/local	Add or increase the storage capacity of surface storage reservoirs to increase carryover storage and optimize supplies in drought situations.
<b>Improve Flood Management</b>	
Protective Infrastructure	Construct flood management facilities to reduce the impact of climate change enhanced flooding.
Sediment Management	Implement sediment management practices to reduce the impact of climate change enhanced flash flooding.
<b>Sea Level Rise</b>	
Protect water facilities through the relocation or removal of vulnerable structures	Relocate or remove water/wastewater facilities that may be impacted by sea level rise.
Protect resources and facilities by constructing seawalls or levees	Construct seawalls or levees to protect from sea level rise caused by climate change.
Protect/restore/create coastal wetlands	Protect, restore or create coastal wetlands to prevent the loss of wetland due to sea level rise.

**Table 8: Tier 3 Climate Change Management Strategies**

Strategy	Description
<b>Reduce Water Demand</b>	
Water Meters Installation	Installation of water meters in order to bill customers volumetrically.
<b>Improve Operational Efficiency/Transfers</b>	
Treatment and Distribution Efficiency	Improve treatment and distribution efficiency or water/wastewater systems in order to reduce energy usage.
Water Transfers	Transfer or exchange of water or water rights that result in temporary or long-term change in the point of diversion, place of use, or purpose of use.
Localized Treatment	Implement localized (or decentralized) treatment of water/wastewater to reduce the energy required for conveyance.
Shift water use to off-peak hours	Implement policies that will shift water use (e.g. irrigation) to off-peak hours to reduce evaporative loss.
Optimize Sewer Systems	Optimize sewer systems (wastewater or stormwater) to adapt to increased precipitation caused by climate change.
<b>Increase Water Supply</b>	
Desalination (Seawater or Brackish Groundwater)	Construct desalination plant to treat seawater or brackish groundwater.
Indirect Potable Reuse/ Potable Reuse	Implement program that will use recycled water to recharge groundwater, or use advanced treated recycled water to augment drinking water supplies.

**Table 9: Additionally Reviewed Climate Change Management Strategies**

Strategy
<b>Reduce Water Demand</b>
Irrigated Land Retirement
<b>Improve Operational Efficiency/Transfers</b>
Conveyance - Delta
<b>Increase Water Supply</b>
Waterbag Transport/Storage Technology
Precipitation Enhancement
Surface Storage – CALFED
Dewvaporation or Atmospheric Pressure Desalination
Fog Collection
Matching Quality to Use
<b>Sea Level Rise</b>
Rolling Easements
Expendable/Movable Structures in Risk Areas

## 5.3 Performance Measures/Metrics for Adaptation and Mitigation Strategies

The set of strategies evaluated in the previous section were determined to be those that will best help the Region in responding to and reducing climate change impacts. When implementing these strategies, it will be necessary to develop performance measures or metrics to assess the effectiveness of a project in meeting the Region's goals. Though specific measures and metrics will be defined according to a specific project or portfolio of projects, Table 10 provides examples of how these measures or metrics might be defined according to general water resource perspective. It should be noted that several of the strategies (the no regret strategies) may apply to additional objectives in the Region's IRWM Plan, and not solely to adapting to and/or mitigating climate change. Without specific metrics, it would be difficult to assess the effectiveness of strategies in responding to climate change. Moreover, some of the strategies implemented to adapt to climate change are "good planning" for future vulnerabilities and may not be immediately measurable. Many of the effects of climate change are anticipated past the planning horizon of the IRWM Plan. To respond to this uncertainty, the Region should update this climate change analysis during each IRWM Plan update, and implement adaptive management measures which will be discussed in the next chapter.

**Table 10: Sample Performance Measures/Metrics**

Strategy Category	Sample Performance Measures/Metrics
Reduce Water Demand	<ul style="list-style-type: none"> <li>• Average (annual) water demand reduction</li> <li>• Peak (seasonal, monthly) water demand reduction</li> </ul>
Improve Operational Efficiency	<ul style="list-style-type: none"> <li>• Additional supply</li> <li>• Supply reliability</li> </ul>
Increase Water Supply	<ul style="list-style-type: none"> <li>• Additional supply</li> <li>• Potable demand offset</li> <li>• Supply reliability</li> </ul>
Improve Water Quality	<ul style="list-style-type: none"> <li>• Salt line migration</li> <li>• Stream temperature</li> <li>• Dissolved oxygen</li> <li>• Turbidity</li> <li>• Pollutant concentrations</li> </ul>
Improve Flood Management	<ul style="list-style-type: none"> <li>• Acres of a certain habitat or floodplain function restored/protected</li> <li>• Volume of natural flood storage provided</li> <li>• Storm return period used for planning</li> <li>• Expected damage resulting for a certain return period storm</li> </ul>
Practice Resource Stewardship	<ul style="list-style-type: none"> <li>• Presence/absence of key indicator species</li> <li>• Acres of a certain habitat or floodplain function restored/protected</li> <li>• Volume of natural flood storage provided</li> <li>• Acres of recharge area protected</li> </ul>
Sea Level Rise	<ul style="list-style-type: none"> <li>• Acres of coastal wetlands created/restored/protected</li> <li>• Miles of pipeline or number of facilities relocated away from coastlines</li> <li>• Length of coastline protected by seawalls or levees</li> </ul>

## 6 Recommendations

The Region has taken the first steps in planning for climate change by examining current climate change projections to determine potential impacts, assessing water resource vulnerabilities, and developing a series of strategies that can be used in projects to adapt to climate change and mitigate GHGs. Chapter 6 discussed recommendations that may be used to successfully implement these strategies, including: use of adaptive management, objectives and targets for inclusion in the IRWM Plan, and project selection considerations for including climate change.

### 6.1 Adaptive Management

There is a level of uncertainty in projecting the effects and impacts of climate change. To respond to this, DWR recommends the use of adaptive management in implementing climate change strategies (DWR, 2011). Adaptive management consists of identifying and monitoring the most important uncertainties and translating them into risk triggers or early warning indicators. This allows for a flexible path of actions to take as triggers occur. DWR's *Climate Change Handbook* recommends the following steps in developing an adaptive management plan:

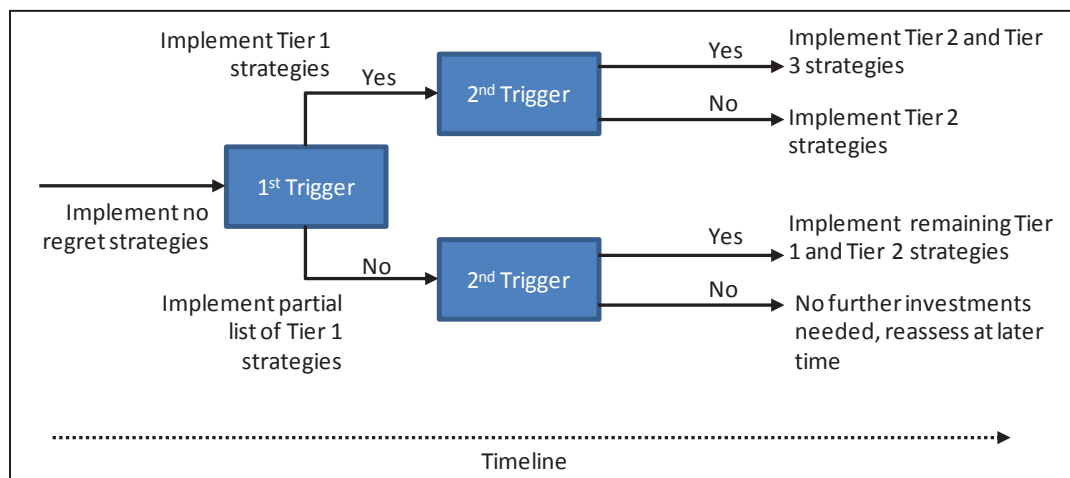
1. Identify risk triggers associated with important vulnerabilities or uncertainties
2. Quantify impacts and uncertainties
3. Evaluate strategies and define flexible implementation paths of action that allows for multiple options at specific triggers
4. Monitor performance and critical variables in the system
5. Implement or reevaluate strategies when triggers are reached

Under Step 1, the Region identifies risk triggers in order to monitor the Region's response to climate change. Risk triggers can be established deterministically (e.g., a threshold) or probabilistically (e.g. frequency of exceedance). The quantification of risk triggers are developed in Step 2, and serve as the basis for the definition of a path for plan implementation under Step 3.

Step 3 involves the definition of an implementation path for the evaluated strategies, and is central to the adaptive management process. The implementation path incorporates risk triggers over the course of time to allow the Region to determine what level of climate change adaptation/mitigation strategy should be implemented. Step 4 of the process, performance monitoring, incorporates performance measures and metrics used to evaluate water resources projects, and will help to define whether a risk trigger has been reached. Step 4 leads into the final step of implementing or reevaluating strategies, Step 5. The general structure of an adaptive management plan can be seen in Figure 3.

The key to successfully implementing the adaptive management process over time is continued active participation by stakeholders, and a clear understanding of project objectives. This should involve ongoing identification, monitoring, and updating of the most important impacts and uncertainties, and re-evaluation of the Region's vulnerabilities (DWR, 2011).

**Figure 3: General Adaptive Management Plan**



## 6.2 Climate Change Related Objectives and Targets

DWR requires that climate change be incorporated in the development of IRWM Plan objectives in terms of both climate change adaptation and GHG mitigation (DWR, 2012b). The strategies developed in Chapter 4 include both adaptation and mitigation, and therefore can be incorporated into climate change related objectives and targets that will meet DWR's requirement. The following objective and targets are recommended for inclusion in the IRWM Plan:

**Objective: Effectively address climate change through adaptation and mitigation in water resource management.**

Target 1: Encourage development of cost-effective carbon-efficient strategies for water management projects.

Target 2: Incorporate adaptation strategies to respond to sea-level rise, rainfall variability, and temperature variability in planning for water and wastewater management.

Target 3: Reduce or neutralize GHG emissions in all areas of water resource management.

## 6.3 Climate Change in Project Selection Considerations

In order for the Region to adapt to and mitigate against climate change, it will be necessary to ensure that projects utilize strategies identified in this study as helping the Region to adapt to and mitigate against climate change. It is recommended that the Region consider using the strategy priority levels discussed in Chapter 5 to assess the adaptation capacity of the project, and also consider whether the project helps the Region to mitigate GHGs. Oftentimes, a project that implements multiple strategies has the potential to increase the level of benefits provided while reducing the unit cost.

A recommended prioritization approach is presented in Table 11. In these prioritization criteria, projects are given higher priority for utilizing Tier 1 strategies and lower priority for Tier 3 strategies. Additionally, projects that contribute to two or more GHG measures, including energy efficiency, emissions reduction and carbon sequestration, are prioritized more highly. Projects that

contribute to one of these mitigation measures receive higher prioritization, and projects that would increase GHGs receive reduce prioritization. In the future, it is recommended that the Region define a threshold for GHG production or remediation to be used in the prioritization of projects. A worksheet to assist the Region in scoring projects according to the number of strategies utilized can be found in Appendix B. In this way, the Region can ensure that projects will help it to both adapt to climate change vulnerabilities of high concern, and will mitigate against climate change.

**Table 11: Climate Change Project Prioritization Criteria**

Adaptation	Mitigation <sup>1</sup>	Priority
Tier 1 Strategy	Contributes to 2 out of 3 mitigation measures	High
	Contributes to 1 out of 3 mitigation measures	High
	Increases greenhouse gasses	Medium or Low
Tier 2 Strategy	Contributes to 2 out of 3 mitigation measures	High
	Contributes to 1 out of 3 mitigation measures	Medium
	Increases greenhouse gasses	Low
Tier 3 Strategy	Contributes to 2 out of 3 mitigation measures	Medium
	Contributes to 1 out of 3 mitigation measures	Low
	Increases greenhouse gasses	Low

1. Mitigation measures referred to are: energy efficiency, emissions reduction, and carbon sequestration

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