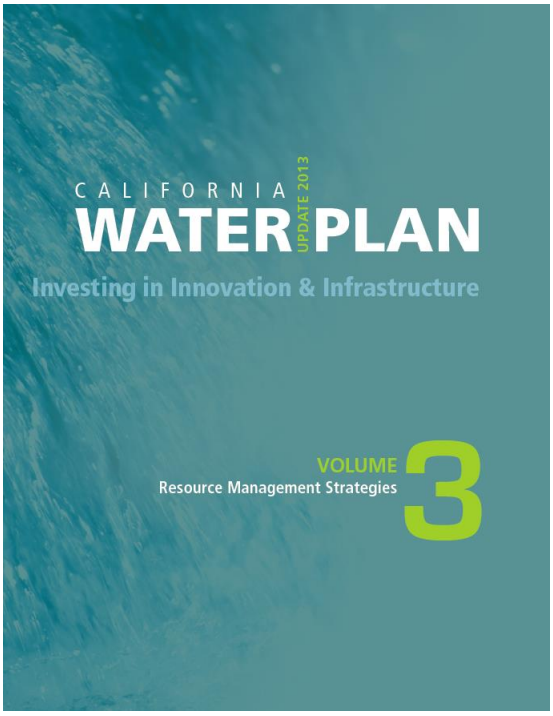
8 Resource Management Strategies

This chapter addresses requirements set forth in the Resource Management Strategies (RMS) Standard in the *2016 IRWM Program Guidelines* (DWR, 2016). As such, this chapter considers each RMS listed in the *California Water Plan (CWP) Update 2013* (DWR, 2013), documents which RMS will help achieve the 2019 IRWM Plan 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.

8.1 Overview

The *2016 IRWM Program Guidelines* require that an IRWM Plan consider each RMS listed in the *CWP Update 2013.* As part of the stakeholder outreach and involvement process conducted for the 2019 IRWM Plan (refer to *Chapter 6, Governance and Stakeholder Involvement*), stakeholders were asked to provide input on other potentially applicable RMS that could be considered in the 2013 IRWM Plan. Those additional RMS are described in *Sections 8.2* and *8.4* below.



California Water Plan Update 2013 contains a wide range of water management strategies.

8.1.1 Resource Management Strategies in *California Water Plan Update 2013*

Division 26.7, Chapter 7, Section 79740 of the California Water Code authorizes funding for long-term water needs of the state, and requires that eligible projects implement IRWM Plans that address the water management strategies identified within the *CWP Update 2013.*

Table 8-1 below lists RMS included within the *CWP Update 2013*, listed by the categories generated by the California Department of Water Resources (DWR).

Table 8-1: Resource Management Strategies Addressed in *California Water Plan Update 2013*

No.	RMS within CWP Update 2013[1]	Strategy Overview	Included in 2019 IRWM Plan
Reduce Water Demand			
1	Agricultural Water Use Efficiency	Increasing water use efficiency and achieving reductions in the amount of water used for agricultural irrigation. Includes incentives, public education, and other efficiency-enhancing programs.	Yes
2	Urban Water Use Efficiency	Increasing water use efficiency by achieving reductions in the amount of water used for municipal, commercial, industrial, irrigation, and aesthetic purposes. Includes incentives, public education, and other efficiency-enhancing programs.	Yes
Improve Operational Efficiency and Transfers			
3	Conveyance - Delta	Maintaining, optimizing use of, and increasing the reliability of conveyance facilities associated with the Bay-Delta. Included within this strategy is Bay-Delta restoration efforts.	Yes
4	Conveyance – Regional/Local	Strategies include improvement conveyance systems, upgrading aging distribution systems, promoting development of more extensive interconnections among water resources systems, establishing performance metrics for quantitative and qualitative indicators (e.g., quantity of deliveries, miles of rehabilitated conveyance facilities, and resiliency of conveyance to earthquakes and fewer regulatory conflicts), and assuring adequate resources to maintain the condition and capacity of existing constructed and natural conveyance facilities.	Yes
5	System Reoperation	Managing surface storage facilities to optimize the availability and quality of stored water supplies and to protect/enhance beneficial uses. Includes balancing supply and delivery forecasts, coordinating and interconnecting reservoir storage, and optimizing depth and timing of withdrawals.	Yes
6	Water Transfers	Contracting to provide additional outside sources of imported water to the Region over and above contracted State Water Project and Colorado River supplies	Yes
Increase Water Supply			
7	Conjunctive Management and Groundwater	Using and managing groundwater supplies to ensure sustainable groundwater yields while maintaining groundwater-dependent beneficial uses, including coordinating management of groundwater and surface water supplies (conjunctive use)	Yes
8	Desalination – Brackish and Seawater	Developing potable water supplies through desalination of seawater and brackish groundwater. Includes disposal of waste brine.	Yes
9	Precipitation Enhancement	Strategy involves increasing precipitation yields through cloud seeding or other precipitation enhancing measures.	No
10	Recycled Municipal Water	Developing usable water supplies from treated municipal wastewater. Includes recycled water treatment, distribution, storage, and retrofitting of existing uses.	Yes
11	Surface Storage – CALFED	Strategy involves developing additional CALFED storage capacity or more efficiently using existing CALFED storage capacity.	Yes
12	Surface Storage – Regional/Local	Developing additional yield through construction or modification (enlargement) of local or regional surface reservoirs or developing surface storage capabilities in out-of-region reservoirs.	Yes
Improve Water Quality			
13	Drinking Water Treatment and Distribution	Includes improving the quality of the potable supply delivered to potable water customers by increasing the degree of potable water treatment. Strategy also may include conveyance system improvements that improve the quality of supply delivered to treatment facilities.	Yes

No.	RMS within CWP Update 2013[1]	Strategy Overview	Included in 2019 IRWM Plan
14	Groundwater / Aquifer Remediation	Includes strategies that remove pollutants from contaminated groundwater aquifers through pumping and treatment, in situ treatment, or other means.	Yes
15	Matching Quality to Use	Optimizing existing resources by matching the quality of water supplies to the required quality associated with use.	Yes
16	Pollution Prevention	Strategies that prevent pollution, including public education, efforts to identify and control pollutant contributing activities, and regulation of pollution-causing activities. Includes identifying, reducing, controlling, and managing pollutant loads from non-point sources.	Yes
17	Salt and Salinity Management	Recommendations that encourage stakeholders to proactively seek to identify sources, quantify the threat, prioritize necessary mitigation action and work collaboratively with entities with the authority to take appropriate actions.	Yes
18	Urban Stormwater Runoff Management	Includes strategies for managing or controlling urban runoff, including intercepting, diverting, controlling, or managing stormwater runoff or dry season runoff.	Yes
Practice Resources Stewardship			
19	Agricultural Lands Stewardship	Includes strategies for promoting continued agricultural use of lands (e.g. agricultural preserves), strategies to reduce pollutants from agricultural lands, and strategies to maintain and create wetlands and wildlife habitat within agricultural lands. Stewardship strategies for agricultural lands include wetlands creation, land preserves, erosion reduction measures, invasive species removal, conservation tillage, riparian buffers, and tailwater management.	Yes
20	Ecosystem Restoration	Strategies that restore impacted or impaired ecosystems, and may include invasive species removal, land acquisition, water quality protection, re-vegetation, wetlands creation and enhancement, and habitat protection and improvement, habitat management and species monitoring.	Yes
21	Forest Management	Strategies that promote forest management include long-term monitoring, multi-party coordination, improvement in communications between downstream water users and communities and upstream forest managers, residents, and workers, and revisions of water-quality management plans between the State Water Board and forest management agencies to address concerns with impaired water bodies.	No
22	Land Use Planning and Management	Includes land use controls to manage, minimize, or control activities that may negatively affect the quality and availability of groundwater and surface waters, natural resources, or endangered or threatened species.	Yes
23	Recharge Areas Protection	Includes land use planning, land conservation, and physical strategies to protect areas that are important sources of groundwater recharge.	Yes
24	Sediment Management	Strategies that utilize sediment for habitat restoration, beach nourishment, riparian and wetland health, as well as reduce its impact on water quality.	Yes
25	Watershed Management	Comprehensive management, protection, and enhancement of groundwater and surface waters, natural resources, and habitat	Yes
Improve Flood Management			
26	Flood Management	Strategies that decrease the potential for flood-related damage to property or life including control or management of floodplain lands or physical projects to control runoff.	Yes

No.	RMS within CWP Update 2013[1]	Strategy Overview	Included in 2019 IRWM Plan
Other			
27	Other Strategies	Other RMS include: • Crop Idling for Water Transfers • Dewvaporation/Atmospheric Pressure Desalination • Fog Collection • Irrigated Land Retirement • Rainfed Agriculture • Waterbag Transport	No
People and Water			
28	Economic Incentives (Loans, Grants, and Water Pricing)	Includes economic incentives (e.g. loans, grants, water pricing) to promote resource preservation or enhancement.	Yes
29	Outreach and Engagement	Tools and practices used by water agencies to facilitate contributions by public individuals and groups towards good water management outcomes.	Yes
30	Water and Culture	Increasing the awareness of how cultural values, uses, and practices are affected by water management, and how they affect water management.	Yes
31	Water-Dependent Recreation	Enhancing and protecting water-dependent recreational opportunities and public access to recreational lands.	Yes
San Diego IRWM Region RMS (not included in the *CWP Update 2013*)			
N/A	N/A	San Diego IRWM Region-Specific RMS include: • Water Resources Data Collection, Management, and Assessment • Scientific and Technical Water Quality Management and Enhancement • Wastewater Management	Yes

Source: DWR, 2013

8.2 Resource Management Strategies Considered and Selected for the 2013 IRWM Plan

8.2.1 California Water Plan Update 2013

As required by DWR in the 2016 IRWM Program Guidelines, this IRWM Plan Update considered each RMS included in the *CWP Update 2013.* Each of these RMS is included in Table 8-1 above and are analogous to those RMS included within the 2016 IRWM Program Guidelines (DWR, 2016). For purposes of presenting and discussing RMS, the 2019 IRWM Plan utilizes the RMS organizational structure and convention set forth in the *CWP Update 2013*.

8.2.2 Resource Management Strategies Specific to the 2013 IRWM Plan

In addition to the RMS listed within the *CWP Update 2013,* RMS specific to the San Diego IRWM Region were considered for inclusion within the 2019 IRWM Plan. The 2013 IRWM Plan included four Region-specific RMS, which were re-evaluated by stakeholders as part of the 2019 IRWM Plan. Those additional RMS include:

1. *Stakeholder and Community Involvement* – Strategies to involve stakeholders in water resources planning or management activities, including public outreach and education.

2. *Water Resources Data Collection, Management, and Assessment* – Includes collection, analysis, and management of water resources data to support regional water management activities.
3. *Scientific and Technical Water Quality Management Knowledge Enhancement* – Includes technical and scientific analysis to support regulatory compliance issues and options, regional coordination, and compliance.
4. *Wastewater Management* – Includes addressing management of wastewater flows as a water resource, for public and environmental health, and for improved efficiency.

Of the four Region-specific RMS included in the 2013 IRWM Plan, one (Stakeholder and Community Involvement) was incorporated into the "Outreach and Engagement" RMS that was added during the *CWP Update 2013*.

8.3 Documenting the Process

One of the priorities of the IRWM Program is to maximize stakeholder involvement and input into the IRWM planning process. As such, members of the Regional Water Management Group (RWMG), Regional Advisory Committee (RAC), and the public were asked to discuss and vet RMS during a public workshop held on August 1, 2012. The RAC reviewed updates to this chapter during a joint RAC Meeting-IRWM Plan Update Workshop on April 4, 2018.

IRWM stakeholders were asked to consider all RMS listed within the *CWP Update 2013,* the additional RMS included within the 2013 IRWM Plan, and any additional RMS that may be relevant to the Region. Stakeholders were also asked to consider whether each RMS is being implemented within the Region and if so, to provide an example. Further, as described in detail in *Section 7.9* in Chapter 7, *Regional Coordination*, the Climate Change Workgroup also evaluated each RMS in terms of how they could help the Region to address climate change vulnerabilities or mitigate greenhouse gas emissions.

Section 8.4 includes a compilation of RMS examples that are currently implemented in the Region, the majority of which were provided by IRWM stakeholders.

8.3.1 Selected IRWM Plan Resource Management Strategies

Stakeholder review and consideration of RMS for inclusion within the 2019 IRWM Plan involved considering the potential applicability of each strategy to the Region. Specifically, stakeholders were asked to consider how each RMS could potentially help the Region to meet the San Diego IRWM Objectives in Chapter 2, *Vision and Objectives*. Upon reviewing all RMS listed within the *CWP Update 2013,* as well as the three Region-specific RMS, stakeholders determined that two RMS are only partially relevant to the San Diego IRWM Region. Although these two RMS are critical for supply reliability for the Region, they will not be implemented within the Region itself. Because of the importance of these RMS for

RMS exercise conducted at joint Public Workshop/RAC Meeting in August 2012

Photo Credit: Rosalyn Prickett, RMC Water and Environment

the Region's imported water supply, they are included in this 2019 IRWM Plan:

1. Conveyance – Delta (#3)
2. Surface Storage – CALFED (#11)

IRWM stakeholders also noted that the following RMS are not applicable to the Region due to the fact that they cannot be realistically implemented or are not directly applicable to the Region. These eight RMS were not selected by the Region's stakeholders for inclusion within the 2013 IRWM Plan:

1. Precipitation Enhancement (#9)
2. Forest Management (#21)
3. Crop Idling for Water Transfers (#27, Other Strategies)
4. Dewvaporation /Atmospheric Pressure Desalination (#27, Other Strategies)
5. Fog Collection (#27, Other Strategies)
6. Irrigated Land Retirement (#27, Other Strategies)
7. Rainfed Agriculture (#27, Other Strategies)
8. Waterbag Transport (#27, Other Strategies)

As such, 29 strategies were selected for inclusion within the 2019 IRWM Plan, including the three Region-specific RMS.

8.4 Current Application of Water Management Strategies in Region

Determining the applicability of RMS to the San Diego IRWM Region was done, in part, by assessing how the Region may already implement those RMS listed within the *CWP Update 2013.* The following sections include a description of each RMS and examples of current efforts in the San Diego IRWM Region that involve implementation of the RMS included in Table 8-1.

8.4.1 Agricultural Water Use Efficiency

Agricultural water use efficiency is practiced both by private agricultural businesses and by local water agencies. The San Diego County Water Authority (Water Authority) and local agencies maintain programs to encourage agricultural water conservation and increase efficiency of use. Water costs represent a significant portion of the overall operating costs for many growers within the Region and economic factors have led to significant improvements in agricultural water use efficiency within the Region during the past 30 years. The Water Authority's Agricultural Water Management Program provides free irrigation system evaluations for agricultural operations of one acre or more (Winzler and Kelly et al., 2011). Additional irrigation efficiency expertise, technology, and advice are available to the Region's agricultural businesses through the University of California Agricultural Extension, U.S. Natural Resource Conservation Service, and local growers' organizations.

8.4.2 Urban Water Use Efficiency

Urban water use efficiency programs focus on conversion to water wise landscaping.

Photo Credit: Toby Roy, San Diego County Water Authority

The Water Authority and local water agencies currently implement programs to enhance urban water use efficiency within the Region. The Water Authority offers numerous programs to assist customers in using water more efficiently, including residential surveys, retrofits, a landscape efficiency program, voucher programs to encourage flow-efficient toilets and washing machines, and a commercial/industrial/ institutional water efficiency program. Local water agencies assist the Water Authority in implementing urban water use efficiency programs, resulting in additional water conservation savings of an estimated 128,000 AFY of savings by 2040 (see *Chapter 3, Region Description*) (Water Authority, 2016). Local municipalities encourage conservation through land use regulations, building codes, and incentives.

Three Water Conservation Summits (2006, 2007, and 2009) were held to bring regional water and land use agencies and urban landscape stakeholders together to shape the future of water conservation in the Region, outline the actions needed to change the conservation ethic, and demonstrate how to implement water conservation programs.

***Urban Water Use Efficiency* RMS in the San Diego IRWM Region**

San Diego County Water Authority - Sustainable Landscapes Program

The Sustainable Landscapes Program is designed to reduce water waste and pollutant infiltration into local waterways through the development and implementation of landscape standards and specifications generally consistent with the California Model Water Efficient Landscape Ordinance and the San Diego Regional Water Quality Control Board Municipal Stormwater Permit. This project is sponsored by the Water Authority and was developed in partnership with City of San Diego, County of San Diego, California American Water, and non-profit partners such as California Center for Sustainable Energy, Surfrider Foundation, and Association of Compost Producers. The Sustainable Landscapes Program relies on the integration of landscape standards and specifications development, education and training, materials, incentives, outreach, and technical assistance to achieve project goals (water waste and pollution reduction). The project is targeted towards the residential sector, but also includes commercial participants. Due to continued drought conditions, project benefits expected to accrue beyond 2022 include:

- water use reduction
- green waste reduction
- labor reductions associated with maintenance
- carbon dioxide emissions reduction
- water quality improvements

The Water Authority has developed education and training curricula that are geared towards the residential sector and include long- and short-format workshops, online video series, ad hoc training events, and Qualified Water Efficient Landscaper (QWEL) training. The average size of turf replacement projects planned by participants is more than 1,000 square feet.

Source: San Diego County Water Authority, 2016

***Urban Water Use Efficiency* RMS in the San Diego IRWM Region**
Biogen Idec – Use of Recycled Water in Cooling Towers Biogen Idec is a biotechnology firm that specializes in the development of therapeutic products for the medical field. Biogen Idec was one of the first companies to use recycled water from the North City Water Reclamation Plant. The company has used recycled water for irrigation of its 42-acre campus in San Diego since 2004 and in its cooling towers since November 2006. The cooling towers at Biogen Idec are the largest users of water in the facility. Conversion to recycled water has allowed Biogen Idec to realize significant cost savings through discounted rates and has provided Biogen Idec with a drought-proof source of water. *Sources: San Diego County Water Authority, NDc; San Diego County Water Authority, 2009a*

8.4.3 Conveyance – Delta

As described in *Chapter 3, Region Description*, the Region receives imported water supply from the State Water Project; therefore, the Region relies upon conveyance facilities associated with the Sacramento-San Joaquin River Delta (Bay-Delta) for water supply.

Although implementation activities that directly improve or enhance the Delta would not be located within the Region, such activities could be financially and politically supported by the Region. For example, the Water Authority's *2015 Urban Water Management Plan* identified advocating for near-term actions and permanent fixes to the Delta as a potential strategy for managing future water uncertainties (Water Authority, 2016). As of this writing, the Water Authority has not endorsed any specific proposal under consideration to restore the Bay-Delta ecosystem and create a more reliable water supply for California.

8.4.4 Conveyance – Regional/Local

The Water Authority aqueduct system delivers both treated and untreated water to the Region. Conveyance facilities for flood flows include lined or armored flood channels, culverts, natural stream courses, and storm drains. Member agency operations for conveying local reservoir supplies include:

- Pipelines (e.g. Hodges, Olivenhain, San Vicente, El Capitan, Sweetwater, and Otay Reservoirs)
- Releases to natural stream channels (e.g. Sutherland, Loveland, Morena, and Cuyamaca Reservoirs)
- Canals, surface channels, and flumes (e.g. Wohlford, Barrett, and Henshaw)

Alternative pipeline transmission facilities are located between reservoirs within the Region to provide system flexibility in an earthquake emergency. Provision of such pipelines enhances reliability without augmenting supplies by increasing flexibility to move water between storage locations and points of use.

8.4.5 System Reoperation

All local reservoir-operating agencies (see *Chapter 3, Region Description*) employ some form of system operation and reservoir management. Key reservoir reoperation/management programs within the Region include the following reservoirs that capture local runoff, serve large water treatment facilities, are connected to the imported water system, and are interconnected with other local reservoirs:

- San Vicente Reservoir (City of San Diego),
- Sweetwater Reservoir (Sweetwater Authority),
- Otay Reservoir (City of San Diego),
- El Capitan Reservoir (City of San Diego), and
- Hodges Reservoir (City of San Diego).

The San Vicente Dam Raise (completed in 2014) will contribute to long-term water supply reliability for the region.

Photo Credit: Toby Roy, San Diego County Water Authority

The Water Authority works with its member agencies through storage agreements and aqueduct operating plans to optimize the use of local storage (Water Authority, 2016). The storage agreements allow for carryover storage in member agency reservoirs and provide increased local storage, which can be used during peak demands on the aqueduct system. The aqueduct operating plans coordinate imported water deliveries and optimize reservoir fill opportunities. A series of regional systems operations projects build upon each other to optimize functionality of Hodges Reservoir. The Water Authority coordinated with its member agencies to model and evaluate whether other opportunities for storage optimization exist as part of preparing its *2013 Regional Water Facilities Optimization and Master Plan Update* (Water Authority, 2014).

***System Reoperation* RMS in the San Diego IRWM Region**

The City of San Diego is undertaking a multi-pronged approach to improving water quality in Lake Hodges. Lake Hodges is part of the region's Emergency Storage Project and is connected with the Water Authority's regional distribution system. Water quality in the reservoir, however, make it undesirable as a supply. Improving water quality in the reservoir will allow water stored in Lake Hodges to be distributed through the Regional system, where it currently cannot. The four projects described here were funded by IRWM Implementation Grants and each contributes to improved water quality in the reservoir, ultimately expected to result in the ability to operate the reservoir as designed.

San Diego County Water Authority, Lake Hodges Water Quality and Quagga Mitigation

The project addresses two issues centered within the San Dieguito Hydrologic Unit. The first is improving low water quality within Lake Hodges. The second is mitigating against the potential long- term effects of quagga mussels on Lake Hodges, San Dieguito Reservoir, Olivenhain Reservoir, and attached facilities. This project is sponsored by the San Diego County Water Authority, but is complementary to the ongoing effort by the San Dieguito Water District, Santa Fe Irrigation District, City of San Diego, San Dieguito River Valley Conservancy, and the San Dieguito Watershed Council to address long term water quality and environmental issues within the Lake Hodges watershed.

Regional Emergency Storage and Conveyance System Intertie Optimization

This project will install a Speece Cone at Hodges Reservoir to oxygenate the deep portions of the reservoir and improve water quality, increasing the volume of useable water in the reservoir, enabling movement of water from Hodges to other storage reservoirs and reducing the need to import additional water. Over its 20-year life, this project is anticipated to result in 102,163 AF of additional local supplies that are not now available to the Region.

Hodges Reservoir Natural Treatment System

The City of San Diego is creating a biofiltration wetland at the Hodges Reservoir to treat seasonally degraded water quality in the reservoir. This project addresses the water quality issues facing the reservoir that prevent full implementation of the Pumped Storage Project, which is a major element of Water Authority's Emergency Storage Project. The wetland will provide habitat, and as water quality in the reservoir improves, additional recreational opportunities are likely to become available. Project partners include the Santa Fe Irrigation District, San Dieguito Water District, San Dieguito Valley Conservancy, and SDCWA. This project supports the Region's goals of water supply reliability, improved water quality, and sustainable integrated water resources management.

8.4.6 Water Transfers

As discussed in *Chapter 3, Region Description,* the Water Authority has implemented water transfer agreements to take delivery of conserved agricultural water from the Imperial Irrigation District and water conserved through lining the All-American and Coachella Canals in Imperial County. Local water agencies have implemented agreements and facilities to allow for transfer of supplies among agencies.

***Water Transfer* RMS in the San Diego IRWM Region**

San Diego County Water Authority – Water Transfer

On April 29, 1998, the Water Authority signed an agreement with the Imperial Irrigation District for the long-term transfer of conserved Colorado River water to San Diego County. The Water Authority–Imperial Irrigation District Water Conservation and Transfer Agreement is the largest agriculture-to-urban water transfer in United States history. Colorado River water is being conserved by Imperial Valley farmers who voluntarily participate in the program, and then transferred to the Water Authority for use in San Diego County.

Deliveries into San Diego County from the transfer began in 2003 with an initial transfer of 10,000 AF. The Water Authority has received increasing amounts of transfer water each year, according to a water delivery schedule contained in the transfer agreement. In 2015, the Water Authority received approximately 100,000 AF. The quantities will increase annually to 200,000 AF by 2021 then remain fixed for the duration of the transfer agreement. The initial term of the Transfer Agreement is 45 years, with a provision that either agency may extend the agreement for an additional 30-year term. During dry years, when water availability is low, the conserved water will be transferred under the Imperial Irrigation District's 's Colorado River rights, which are among the most senior in the Lower Colorado River Basin. Without the protection of these rights, the Water Authority could suffer imported water delivery cutbacks.

Source: San Diego County Water Authority, 2016

8.4.7 Conjunctive Management and Groundwater

As shown in *Chapter 3, Region Description*, approximately ten of the region's major water agencies incorporate groundwater as part of their water supply portfolio. Groundwater supplies are projected to comprise 32,670 AFY of supply for Water Authority member agencies by 2040 (see *Section 3.10* in *Chapter 3, Region Description*). The Region's water agencies have prepared groundwater resources development and management plans for many of the Region's groundwater basins.

Groundwater represents the sole source of supply throughout much of the less developed eastern portion of the Region outside the Water Authority's service area. Groundwater that can be extracted and used as a potable water supply with minimal treatment generally occurs within the upper reaches of the east–west trending watersheds and outside the influence of human activities. Because no backup supply exists in areas outside the Water Authority's service area, management of groundwater is critical to ensuring continued water availability to this portion of the Region's population.

Groundwater that is high in salts and total dissolved solids (TDS) and other contaminants, and requires advanced treatment prior to potable use, is typically found in shallow basins in the downstream portions of watersheds. Brackish groundwater recovery projects use membrane technology, principally reverse osmosis, to treat extracted groundwater to potable water standards. The City of Oceanside's 6.37-million-gallon per day (mgd) capacity Mission Basin Desalter and the Sweetwater Authority's existing 4.0-mgd Richard A. Reynolds Groundwater Desalination Facility are currently the only operating brackish groundwater recovery and treatment facilities within the Water Authority's service area (Water Authority, 2016). The Richard A. Reynolds Groundwater Desalination Facility recently completed an expansion that increased its capacity to 8,800 AFY. Olivenhain Municipal Water District is exploring groundwater extraction options and recently completed its *San Dieguito Valley Brackish Groundwater Desalination Study* (OMWD, 2017).

Unit costs for brackish groundwater recovery projects are considerably higher than those for simple groundwater extraction and disinfection projects due to the additional treatment requirements and the cost of concentrate (brine) disposal. However, where economical options exist for disposal of brine, this type of groundwater project has proven to be an economically sound water supply option (Water Authority, 2016). Because most of the higher-quality groundwater within the Water Authority's service area is already being fully utilized, the focus for future local groundwater development is brackish groundwater recovery and treatment.

Artificial recharge and recovery projects, also referred to as conjunctive-use projects, can increase groundwater basin yields by supplementing the natural recharge process. Conjunctive use represents an important form of groundwater management, which could be implemented in the Region to ensure the sustainability of the Region's groundwater supplies. FPUD, Camp Pendleton, Padre Dam MWD, and Helix WD are currently exploring the feasibility of such projects (Water Authority, 2016).

8.4.8 Desalination Brackish and Seawater

The Water Authority's *2015 Urban Water Management Plan* establishes a target of 56,000 AFY of seawater desalination within the Region by 2040 based on the production capacity of the Claude "Bud" Lewis Carlsbad Desalination Plant (Carlsbad Desalination Plant) (see *Chapter 3, Region Description*). Under terms of a water purchase agreement, the Water Authority buys between 48,000 and 56,000 acre-feet per year (AFY) of desalinated seawater from the Carlsbad Desalination Plant enough water to meet about 8 percent of the San Diego region's projected water demand in 2020.

The Carlsbad Desalination Plant includes a seawater desalination plant and conveyance pipelines that were developed by a private, investor-owned company (Poseidon Resources). The Water Authority modified its aqueduct system to incorporate this water supply. The Carlsbad Desalination Plant is located on industrially zoned land adjacent to the Encina Power Station and Agua Hedionda Lagoon, in Carlsbad (Water Authority, 2016). At the end of the water purchase agreement's 30-year term, the Water Authority may purchase the plant for $1. The Water Authority also is evaluating a potential Camp Pendleton Desalination Project in collaboration with the U.S. Marine Corps Base Camp Pendleton.

The Region also participates in several efforts to desalinate brackish groundwater. There are two projects within the Region being implemented that desalinate brackish groundwater. As described above, the City of Oceanside's 6.37-mgd capacity Mission Basin Desalter and the Sweetwater Authority's existing 4.0-mgd Richard A. Reynolds Groundwater Desalination Facility are the only brackish groundwater recovery and treatment facilities operating within the Water Authority's service area (Water Authority, 2016).

***Desalination* RMS in the San Diego IRWM Region**
San Diego County Water Authority – Carlsbad Desalination Project and Camp Pendleton Desalination Project The Water Authority currently imports approximately 70 percent of its water supply from Metropolitan Water District of Southern California (Metropolitan). Metropolitan's ability to provide reliable water supplies, particularly in dry years, is constrained by the preferential right of each of its member agencies, as well as by uncertainties regarding the continued reliability of the State Water Project and the Colorado River. For these reasons, developing new, local water supplies for the region, such as seawater desalination, is a key component in the Water Authority's water supply diversification efforts. The Claude "Bud" Lewis Carlsbad Desalination Plant has been producing water since 2015 and another project that would be located at U.S. Marine Corps Base Camp Pendleton is under study. The Carlsbad Desalination Plant is located at the Encina Power Station in Carlsbad in northern San Diego County. It was developed by Poseidon Resources. In addition to the treatment facility, the plant includes a pipeline connection to the Water Authority's regional aqueduct system. The Water Authority participates in the Carlsbad Desalination Plant as a purchaser of product water from the facility under the terms of a 30-year water purchase agreement. The Carlsbad Desalination Project is fully operational and provides a highly reliable local supply of 48,000 to 56,000 AFY for the Region. The Water Authority has the option to purchase the plant for $1 at the end of the agreement term. The Water Authority, with participation from U.S. Marine Corps Base Camp Pendleton, continues to evaluate the cost and feasibility of a desalination plant located at Camp Pendleton. The Camp Pendleton desalination plant would provide between 50 and 150 million gallons per day of desalinated water. Following the completion of a feasibility study in 2009, the Water Authority completed further technical studies at the proposed facility site in 2013. The studies included detailed facility siting and pipeline alignment studies, as well as onshore and offshore field investigations near the proposed project sites to determine the viability, costs, and impacts to marine life of seawater intake and discharge systems. In 2015, the Water Authority's Board of Directors authorized a contract for building, operating, and reporting on a pilot-scale seawater intake testing program. *Source: San Diego Water Authority, 2017 and San Diego County Water Authority, 2016*

8.4.9 Precipitation Enhancement

Regional efforts do not currently focus on precipitation enhancement as an important water management strategy in the Region as a result of (1) the highly seasonal nature of precipitation in the region, (2) the potential for flash flooding, and (3) the virtually nonexistent role of snow pack in storing water within the Region. Upon review, stakeholders determined the precipitation enhancement strategy is not an appropriate RMS for the San Diego IRWM Region.

8.4.10 Recycled Municipal Wastewater

Recycled water is currently produced and distributed by many of the Region's water and recycled water agencies. Tertiary treatment capacity within the Region is currently approximately 68 mgd, and the Region's water supply plans propose to increase recycled water use within the Region from 29,000 AFY in year 2015 to 47,000 AFY by year 2040 (see *Section 3.5.5* in *Chapter 3, Region Description*) (Water Authority, 2016). Attaining this recycled water use target will involve expanding existing recycled water distribution systems, increasing the number of users, and increasing the variety of recycled water uses.

Recycled water can be used for landscape irrigation, cooling towers, and ornamental ponds.

Photo Credit: Jeff Pasek, City of San Diego

Currently, recycled water (tertiary-treated wastewater) is used exclusively for non-

potable purposes, such as irrigation and industrial use. The Region is exploring potable reuse, purifying tertiary treated wastewater with advance treatment technology, as a potential future water supply. The City of San Diego has been conducting a demonstration project for indirect potable reuse, which involves blending purified water with raw water sources in an environmental buffer (in this case, a reservoir) prior to re-treating the water at a drinking water treatment plant. The City of San Diego is also working with the WateReuse Foundation to study various treatment trains for direct potable reuse which would involve the same process as indirect potable reuse without an environmental buffer.

Several agencies are completing studies pertaining to potable reuse in San Diego County through groundwater recharge or reservoir augmentation. The City of Oceanside completed the investigative phase of their Indirect Potable Reuse Project, which involves recharging of the Mission Groundwater Basin using water treated at the San Luis Rey Water Reclamation Facility (SLRWRF). The project will be implemented in two phases, with a final capacity of 4.5 mgd, which will provide an ultimate yield of 3,300 AFY of groundwater recharge. This project will be operational in 2020. Pure Water San Diego, the City of San Diego's phased, multi-year program to produce purified water is scheduled to be operational by 2021. The project's long-term goal is to produce 83 mgd, or one-third of San Diego's future drinking water supply, by 2035.

***Recycled Municipal Wastewater* RMS in the San Diego IRWM Region**
City of San Diego - Pure Water The City of San Diego is developing a large-scale potable reuse project called Pure Water San Diego. This project will provide up to one-third of the City's projected supplies by 2035 by advance treating wastewater for potable reuse with an environmental buffer. Previously, the City had undertaken the 1 mgd Water Purification Demonstration Project to evaluate the feasibility of using advanced treatment technology on tertiary recycled water that can be sent to a local reservoir, blended with other raw water, and then treated and distributed as potable water (also known as indirect potable reuse/reservoir augmentation). The Pure Water San Diego project will produce reliable, drought-proof, local supply, and offset demands for imported water. It represents the next steps of recycled water, going beyond traditional non-potable water reuse (traditional recycled water).
North San Diego County Regional Recycled Water Project North San Diego County water and wastewater agencies are collaborating to connect the region's recycled water infrastructure – taking inventory of where there are available supplies of wastewater and where there are demands for recycled water for irrigation or industrial uses. The North San Diego Water Reuse Coalition consists of Carlsbad Municipal Water District, City of Escondido, City of Oceanside, Leucadia Wastewater District, Olivenhain Municipal Water District, Rincon del Diablo Municipal Water District, San Elijo Joint Powers Authority, Santa Fe Irrigation District, Vallecitos Water District, Vista Irrigation District, and U.S. Marine Corps Camp Pendleton. The Coalition's project will maximize recycled water use among the agencies, develop interconnections to more efficiently distribute recycled water, and construct new water reclamation facilities to increase the supply of recycled water available to each of these agencies' respective customers. Regional planning, design, environmental compliance, and construction is underway, all supported with San Diego IRWM funding. By working together, these agencies are demonstrating a commitment to provide a reliable, drought-proof source of water for the region and reduce discharge of wastewater to the ocean.
Padre Dam Municipal Water District, Padre Dam Advanced Water Treatment – Phase IA Expansion Padre Dam Municipal Water District's (MWD's) project is a key component of the East County Regional Water Reuse Program, a water reuse partnership with Helix Water District, County of San Diego, and City of El Cajon. The project will expand the Ray Stoyer Water Reclamation Facility by 4 mgd to deliver recycled water for irrigation, and to deliver tertiary effluent to the Advanced Water Purification Facility, to allow for future potable reuse. This project helps to move Padre Dam MWD and Helix Water District towards potable reuse, supporting the Region's goal of supply reliability and sustainability.

***Recycled Municipal Wastewater* RMS in the San Diego IRWM Region**
City of Escondido, Escondido Advanced Water Treatment for Agriculture
The City of Escondido's project will construct a new microfiltration/reverse osmosis (MFRO) advanced treatment facility with a total production capacity of 2.0 million gallons per day (mgd). Water treated at the MFRO facility will be blended with tertiary treated water from an existing recycled water plant and distributed to agricultural customers in the northern and eastern areas of the City of Escondido. The City of Escondido has partnered with Escondido Growers for Agricultural Preservation, Vista Irrigation District, City of San Diego, and Rincon Del Diablo Municipal Water District to implement this project. This project supports the Region's goals of supply reliability and sustainability, and protects water quality while supporting local agriculture and the economy.

8.4.11 Surface Storage - CALFED

CALFED water storage is critical to the reliability of the State Water Project, and in turn to the reliability of Metropolitan's supplies delivered to the Region. Regional efforts do not include constructing or optimizing additional CALFED storage as these storage facilities are not located within the Region. The plans and programs of state agencies and Metropolitan are more likely to incorporate this strategy. Instead, the Region focuses on water resources actions to improve conservation, increase water storage, and increase the diversity of the Region's supplies. For this reason, IRWM stakeholders indicated that this RMS was only applicable to the Region in a limited capacity.

8.4.12 Surface Storage - Regional/Local

Regional surface storage is critical in balancing seasonal and other temporal differences between water supply availability and demand. *Chapter 3, Region Description* summarizes existing regional surface water storage. The Emergency Storage Program (*Section 3.5.2* in *Chapter 3, Region Description*) represents an important part of the Region's effort to increase regional water storage.

***Surface Storage – Regional/Local* RMS in the San Diego IRWM Region**
San Diego County Water Authority - San Vicente Dam Raise
The San Vicente Dam Raise Project is a component of the Water Authority's Emergency & Carryover Storage Project, a system of reservoirs, interconnected pipelines and pumping stations designed to make water available to the San Diego Region in the event of an interruption in imported water deliveries. The San Vicente Dam Raise Project increased the height of the San Vicente Dam from 220 feet to 337 feet and increased storage capacity from 90,000 AF to 242,000 AF. This project serves two purposes: to use the additional water storage capacity to capture surplus water that is available during wet seasons for use in potential future dry years, and to store water for use in a regional water supply emergency. As such, the project helps to balance seasonal differences between water supply availability and demand, and provides additional storage that may be necessary in the event of a catastrophic emergency such as an earthquake that cuts off imported water supplies to the Region.
Source: San Diego County Water Authority, 2013b
City of San Diego – Watershed Sanitary Survey
All public water systems using surface water must conduct a comprehensive sanitary survey of its watersheds every five years. The purpose of the survey is to identify actual or potential sources of contamination, or any other watershed-related factor, which might adversely affect the quality of water used for domestic drinking water. The City of San Diego prepared an update to its Sanitary Survey in 2010. The update identified the potential contaminant sources as well as recommendations to protect the watershed and source water quality. The three categories of recommendations include watershed management and control practices, public education, and inter-jurisdictional coordination.
Source: City of San Diego, 2011

Surface Storage – Regional/Local RMS in the San Diego IRWM Region
City of San Diego - Source Water Protection Guidelines for New Development The City of San Diego owns and operates nine drinking water reservoirs. Seven of those reservoirs (Barrett, El Capitan, Hodges, Morena, Otay, San Vicente, and Sutherland), located mainly outside of the City, warrant protection because they are at risk of being polluted as runoff volumes and associated pollutant discharges increase from potential future development. Due to its concern for the water quality of its reservoirs, the City prepared the *Source Water Protection Guidelines for New Developments* (Guidelines). The Guidelines were prepared to assist municipal agencies, designers, land planners, developers, and laypersons in conducting site design planning and select best management practices (BMPs) that protect or improve the quality of runoff draining into the reservoirs. They are not focused on construction activities, but rather site design and source controls that occur over the life of a project. The Guidelines provide a stepwise, simplified BMP selection process to ensure that preferred source water protection BMPs are considered. Although the use of the Guidelines is voluntary, the guidance is consistent with state and local stormwater permit requirements, as well as local planning protocols. *Source: City of San Diego Water Department, 2004*

8.4.13 Drinking Water Treatment and Distribution

Water Authority-treated water supplies are derived from two sources: a Metropolitan-operated treatment facility at Lake Skinner in Riverside County, and the Twin Oaks Valley Water Treatment Plant, owned and operated by the Water Authority, which has the capacity to treat up to 100 mgd of untreated water delivered from Metropolitan. In addition, the Region includes additional (non-Water Authority) potable water treatment capacity of 752 mgd (*Section 3.5.2*, *Chapter 3, Region Description*) that allows for treatment of locally-derived supplies and untreated supplies delivered via the Water Authority's aqueducts. Each water agency maintains its own distribution network, and the agency systems are interconnected to create a potable water delivery system that extends throughout the Water Authority's service area.

Small water systems and community wells are an important source of supply in the portion of Region outside the Water Authority's service area. A lack of backup facilities and interconnections among these small community systems render them vulnerable to supply interruptions or water quality problems. Upgrades in treatment and conveyance to these small water systems would enhance both water quality and system reliability among the Region's rural populations.

8.4.14 Groundwater / Aquifer Remediation

Toxic organic contaminants have been documented in several of the Region's groundwater aquifers. The San Diego Water Board and San Diego County oversee investigation and remediation at more than 100 cleanup/remediation sites throughout the Region. The San Diego Water Board also maintains a program for investigating, monitoring, and enforcing cleanup/remediation of soil and groundwater pollution from (1) Department of Defense sites and (2) pollution sources other than underground storage tanks.

8.4.15 Matching Quality to Use

Many of the Region's water agencies have adopted regulations requiring the use of recycled water in place of potable supplies for certain non-potable irrigation uses. Additional instances where quality is matched to use within the Region include (1) using untreated water for dust control, (2) using poor quality groundwater for non-potable uses such as irrigation, and (3) the use of gray water for toilet flushing and non-potable uses.

***Matching Quality to Use* RMS in the San Diego IRWM Region**
University of California, San Diego The University of California, San Diego (UCSD) is the second-largest user of recycled water in the City. UCSD's recycled water efforts began with irrigation retrofits in 1998, and later recycled water features were designed into the new development within the campus. Currently, recycled water is about five percent of UCSD's total water usage, but UCSD intends to expand recycled water use in the future. *Source: San Diego County Water Authority, NDb*
Lomas Santa Fe Country Club, Solana Beach The Lomas Santa Fe Country Club, located in Solana Beach, receives recycled water from the San Elijo Water Reclamation Facility which is owned by the San Elijo Joint Powers Authority. A total of 100 acres of the country club is irrigated with recycled water; less than 5 acres are irrigated with potable water. The use of recycled water for irrigation decreases the amount of fertilizer needed (due to high nitrogen levels in recycled water) and reduces potable water use. *Source: San Diego County Water Authority et al., NDd*

8.4.16 Pollution Prevention

Approximately 48 inland surface waters and 65 coastal waters or beach segments are listed as 303(d)-impaired water bodies (*Section 3.7, Chapter 3, Region Description*). The San Diego Water Board is currently implementing TMDLs for several of the affected waters and has prioritized TMDLs for remaining impaired waters. The purpose of the TMDLs is to determine pollutant loads and implement activities that can reduce pollutant levels to those required by relevant water quality statutes.

In addition, the County and the Municipal Separate Storm Sewer Systems (MS4) copermittees implement a regional storm runoff program that includes activities to manage runoff discharge and implement programs to prevent, control, and treat sources of pollutants. Ongoing pollution prevention efforts associated with the MS4 program and also implemented by other agencies in the Region include:

- Conducting pollutant monitoring,
- Conducting MS4 discharge and receiving water monitoring,
- Planning and implementing stormwater capture and treatment,
- Developing and implementing non-point source controls including BMPs,
- Planning and implementing dry season diversion of surface flows and storm drain flows to the sewer system,
- Inspections of pollutant-generating activities such as commercial, industrial, residential, and construction,
- Implementing education programs for the general public, school children, and target audiences,
- Implementing wastewater collection system maintenance, rehabilitation, and sewer spill prevention programs, and
- Performing storm drain maintenance and community cleanup events.

8.4.17 Salt and Salinity Management

Several environmental uses can be impacted by excessive salinity. The most urgent need for salt management results from the loss or impending loss of beneficial uses caused by the following: nitrate contamination, seawater intrusion, soil and groundwater salinization, and reduced availability of fresh water flows. The Salt and Salinity Management strategy in the *CWP Update 2013*

identifies recommendations to address urgent needs for salt management. It recommends that stakeholders proactively identify sources, quantify the threat, prioritize necessary mitigation actions and work collaboratively with entities with the authority to take appropriate action to address salt loading.

***Salt and Salinity Management* RMS in the San Diego IRWM Region**
Proposed Guidelines for Salinity/Nutrient Management Planning in the San Diego Region, San Diego County Water Authority and Southern California Salinity Coalition In 2010, the Water Authority and Southern California Salinity Coalition worked together to develop guidelines for implementation of the State's 2009 Recycled Water Policy in the San Diego Region (San Diego Water Board). The guidelines are intended to assist agencies and stakeholders to develop salinity/nutrient management plans by establishing a standardized approach and framework that has been reviewed by the San Diego Water Board. The Guidelines assess San Diego Region aquifers and identify aquifers that are suitable for development of salinity/nutrient management plans, and present suggested tasks and procedures to be used in developing those plans. *Source: San Diego County Water Authority and Southern California Salinity Coalition, 2010*

8.4.18 Urban Stormwater Runoff Management

Urban runoff management within the Region is conducted by multiple entities in the Region, including both public and private parties. Urban runoff management in the form of stormwater runoff management generally occurs through activities related to flood management and runoff management actions implemented by the MS4 Copermittees and other relevant agencies, such as the California Department of Transportation and the U.S. Navy. Ongoing urban runoff management strategies implemented by applicable entities within the Region have been directed toward the following:

- Regulatory requirements to implement strategies such as BMPs and public education to effectively eliminate non-stormwater runoff,
- Physical means of control such as flow and pollutant reduction through minimizing impervious areas, capture and retention, diversion to the sewer, or treatment,
- Standards to manage the increase in runoff discharge rates and durations from all Priority Development Projects, to ultimately prevent erosion of channel beds and banks, and
- MS4 discharge and land use monitoring to characterize pollutant loading and BMP monitoring to evaluate effectiveness.

***Urban Runoff Management* RMS in the San Diego IRWM Region**
Integrated Water Resource Solutions for the Carlsbad Watershed, San Elijo Joint Powers Authority This project, implemented by San Elijo Joint Powers Authority (SEJPA), utilizes recycled water and low-impact development strategies to offset potable water demands, reduce urban runoff, and implement water quality monitoring at San Elijo Lagoon. Improvements provided by the project are anticipated to provide water quality benefits to San Elijo Lagoon and Cottonwood Creek/Moonlight Beach. In addition, SEJPA and its partners (City of Encinitas, City of Solana Beach, San Dieguito Water District, Santa Fe Irrigation District, Olivenhain Municipal Water District, and San Elijo Lagoon Conservancy) will conduct community outreach targeting DACs. This project supports the Region's supply reliability and sustainability goals and protects water quality and natural resources.

8.4.19 Agricultural Land Stewardship

While agricultural lands represent 3% of San Diego County (*Chapter 3, Region Description*), agricultural activities are an important element affecting the Region's water resources. Land preservation is a key agricultural land stewardship activity implemented within the Region. The County and several municipalities maintain agricultural land preserve programs in which owners

agree to set aside lands for agriculture or open space in return for reduced property taxes. Agricultural land stewardship practices implemented by private landowners include erosion control, habitat conservation, and pollution-reduction. Agencies that have programs that assist and advise in agricultural land stewardship practices within the Region include the U.S. Natural Resource Conservation Service, the County of San Diego Department of Agriculture Weights and Measures, and the University of California Agricultural Extension.

The San Diego Water Board is also involved in assisting in agricultural land stewardship through regulation (including issuance of discharge permits or conditional waivers) of animal confinement, agricultural and nursery operations, and silviculture operations.

8.4.20 Ecosystem Restoration

Habitat restoration can reduce creek pollution, flooding, and soil erosion.

Photo credit: Charles Davis, Jacob Center for Neighborhood Innovation

The ecosystem restoration strategy identified in the *CWP Update 2013* incorporates a broad range of strategies directed toward conserving, protecting, enhancing, and creating habitat, ecosystems, and wetlands. Ecosystem restoration, environmental and habitat protection and improvement, and wetlands enhancement and creation projects and programs have been implemented by government and non-government organizations within the Region. Ongoing efforts within the Region include multiple species conservation programs, land conservation, invasive species control, land contouring, rehabilitation and re-vegetation, addressing flow hydraulics and preserving natural flow hydrology, and wetlands preservation, conservation and creation. The California Department of Fish and Wildlife and the United States Fish and Wildlife Service are active in several of the Region's restoration programs. As detailed in *Chapter 3, Region Description*, three multiple species conservation and preservation plans are being implemented within the Region. In addition to government ecosystem restoration efforts, private foundations and conservancies have been established within the Region to preserve lands, restore ecosystems, and to provide environmental management of conserved lands.

***Ecosystem Restoration* RMS in the San Diego IRWM Region**
San Diego River Park Foundation, Sustaining Healthy Tributaries to the Upper San Diego River and Protection Local Water Supplies This project will protect Boulder Creek, within the San Diego River Watershed, from numerous threats such as sedimentation, temperature increase, and nutrient loading. Given the high quality of Boulder Creek, data collected along the creek will be used as a baseline for other streams in the San Diego River Watershed. Additionally, this project has a goal to purchase and restore up to 3,000 feet of stream currently damaged by private development and wildlife. Utilizing the partnerships formed in developing this project, increased monitoring of creeks draining into the El Capitan Reservoir will occur, and educational programs will be implemented to engage private land owners and reduce pollutant loading, erosion, and sedimentation. Further, outreach specifically geared to three tribes will enable them to survey and monitor water quality on tribal lands. This project is important for protecting the largest local water supply in the region, the El Capitan Reservoir. By protecting and improving water quality upstream of the reservoir, water treatment costs are reduced and the reservoir will better maintain its capacity, reducing the need for imported water. Organizations involved in this integrated effort include the San Diego River Park Foundation, Kumeyaay Diegueno Land Conservancy, San Diego River Conservancy, San Diego State University, Helix Water District, San Diego Stream Team, and San Diego Fly Fishers

8.4.21 Forest Management

Almost all forest management activities can affect water quantity and quality. The Forest Management strategy in the *CWP Update 2013* includes long-term monitoring to understand hydrologic changes resulting from climate change and management actions, multi-party coordination of forest management, improvement in communications between downstream water users and communities and upstream forest managers, residents, and workers, and revisions of water-quality management plans between the State Water Resources Control Board and forest management agencies to address concerns with impaired water bodies.

However, the Region has a Mediterranean climate and does not support extensive forestlands. For this reason, IRWM stakeholders indicated that this RMS was only applicable to the Region in a limited capacity.

8.4.22 (Urban) Land Use Planning and Management

The municipalities across the Region utilize urban land use management as a means of influencing water management through the Region's stormwater runoff program, zoning regulations, building codes, landscape ordinances, septic tanks, and agricultural preserve/land conservation programs. As part of its land use plans, the County limits development in areas dependent on groundwater supply so that water needs do not exceed available supplies. In addition, bills enacted by the State legislature (Senate Bills 610 and 221) require water agencies responsible for water resource planning to work with the local land use agencies to improve the coordination between land use planning and development and available long-term water supplies.

***Land Use Planning and Management* RMS in the San Diego IRWM Region**
San Diego County Water Authority and San Diego Association of Governments – Memorandum of Agreement The Water Authority entered into a Memorandum of Agreement (MOA) with the Region's regional transportation planning authority, the San Diego Association of Governments (SANDAG), in 1992. Per the MOA, the Water Authority agrees to use SANDAG's most recent regional growth forecasts for regional water supply planning purposes, provide updated information on changes in plans or programs, and implement relevant actions contained in the Water Element of the Regional Growth Management Strategy. The MOA ensures that the Water Authority will use land use management information (population projections) as the basis for conducting future water management. Further, the MOA ensures that water supply is considered as a component of the Region's overall growth management strategy. *Source: Appendix 7-C: Land Use Planning Study*

8.4.23 Recharge Areas Protection

Land use or land conservation measures to protect important groundwater recharge areas have been addressed in several of the Region's watershed management plans. Local water agencies using groundwater as a source of supply have identified key recharge area issues through sanitary surveys and within groundwater plans. Agencies that own and conserve significant land holdings to protect important groundwater recharge areas within the Region include:

- Camp Pendleton (lower portion of Santa Margarita River Watershed),
- Vista Irrigation District (upper portion of San Luis Rey Watershed), and
- City of San Diego (San Pasqual Valley in the San Dieguito River Watershed).

8.4.24 Sediment Management

Sediment management has been integrated into habitat and riparian restoration efforts across the Region. These multi-beneficial projects help to both restore local wetlands and coastal habitats, while

providing key flood mitigation assistance and improving water quality in both natural waterways and in reservoirs.

***Sediment Management* RMS in the San Diego IRWM Region**
San Diego Healthy Headwaters Restoration Project, Resource Conservation District of Greater San Diego County The San Diego Healthy Headwaters Restoration Project, sponsored by the Resource Conservation District of Greater San Diego County, will remove invasive species and restore open space impacted by unauthorized trails, routes, and recreation sites in the San Diego River Watershed. Restoring impacted sites, improving drainage on routes, and restoring the area will reduce sedimentation in the watershed. The combination of restoration activities will help to improve water quality and habitat, and contribute to a healthy watershed. The project supports the Region's goals of supply reliability, protection of natural resources, and sustainable integrated water resource management. Project partners include the U.S. Forest Service, City of San Diego, American Conservation Experience, Back Country Land Trust, San Diego River Park Foundation, San Diego River Conservancy, Animal and Plant Health Inspection Service, and the County of San Diego.

8.4.25 Watershed Management

Watershed management plans have been prepared for the Region's eleven hydrologic units by MS4 Copermittees and other required agencies. The management plans address watershed-specific water management issues outside the limitations of jurisdictional boundaries. The Region's watershed planning efforts also include non-government stakeholders in water management planning decisions. Watershed management includes monitoring, modeling, and assessments to improve understanding of the ambient condition of receiving water bodies, to characterize pollutant loading and management, and to support scientific basis for water quality regulations.

8.4.26 Flood Management

Flood management facilities within the Region include armored and lined channels, levees, natural channels and natural floodplain management, retention basins, culverts, and an extensive regional storm drain system. As described in Chapter 3, *Region Description*, the County of San Diego Flood Control Section coordinates region-wide flood control projects among the County's municipalities to: (1) engineer, maintain, and improve storm conveyance facilities, (2) perform stream restoration and maintenance, (3) update flood mapping, (4) provide for vegetation and debris removal, and (5) maintain stream flow and flood alert systems.

8.4.27 Other Strategies

The Other Strategies chapter of the *CWP Update 2013* discusses a variety of water management strategies that can potentially generate benefits but that are currently limited in their capacity to strategically address long-term regional water planning needs. As described above, all six Other Strategies were considered to be only partially applicable to the Region because they are either not realistic to implement, have already been fully satisfied, or are not directly implemented in the Region.

Rainfed Agriculture

Rainfed agriculture involves meeting all crop consumptive water use demands directly by rainfall on a real-time basis. Due to unpredictability of rainfall frequency, duration, and amount, there is significant uncertainty and risk in relying solely on rainfed agriculture. Currently, improvements in rainfed agricultural production offer limited opportunities to further increase water supply in California. Due to the limited precipitation in San Diego, this RMS can only be implemented in a limited fashion.

Waterbag Transport/Storage Technology

The use of waterbag transport/storage technology involves diverting water in areas that have unallocated freshwater supplies, storing the water in large inflatable bladders, and towing them to an alternate coastal region. This strategy is not currently being used in California, although a proposal was recently considered. The Alaska Water Exports Company proposed to divert up to 30,000 AF of water from the Albion and Gualala Rivers in Northern California and transport the water to the San Diego metropolitan area. The proposal received significant local opposition in Northern California. In 2003, the Albion and Gualala Rivers were added to the California Wild & Scenic Rivers system, and thus ended the plan. No other plans to implement this RMS are currently being considered in the Region.

Crop Idling for Water Transfers

Crop idling is a strategy that removes land from irrigation and makes water available for transfer to other uses. Crop idling could enhance water supply reliability by making water available for other uses, enhancing water quality, and protecting and restoring fish and wildlife. Agriculture in the Region is already limited, but constitutes an important part of the local economy. For these reasons, this RMS was considered to be unrealistic to implement in the Region.

Dewvaporation or Atmospheric Pressure Desalination

Dewvaporation is a specific process of humidification-dehumidification desalination. Brackish water is evaporated by heated air, which deposits fresh water as dew on the opposite side of a heat transfer wall. The energy needed for evaporation is supplied by the energy released from dew formation. Dewvaporation can provide small amounts of water in remote locations. The technology of dewvaporation is still being developed and therefore is not considered realistic to implement in the Region.

Fog Collection

Precipitation enhancement in the form of fog collection has not been used in California as a management technique, but experimental projects have been built or considered internationally. There has been some interest in fog collection for domestic water supply in some of the dry areas of the world near the ocean where fog is frequent. Because of its relatively small production, fog collection is limited to producing domestic water where few other viable water sources are available, and is not considered realistic to implement in the Region.

Irrigated Land Retirement

Irrigated land retirement is the removal of farmland from irrigated agriculture. Land retirement could enhance water supply reliability by making water available for redistribution, enhancing water quality, and protecting and restoring fish and wildlife resources, but it results in the loss of agricultural lands. Agriculture in the Region is already limited, but constitutes an important part of the local economy. For these reasons, this RMS was considered to be unrealistic to implement in the Region.

8.4.28 Economic Incentives

Many water agencies in the Region offer several economic incentive programs to encourage water conservation, including rebate programs for water-conserving washing machines, and outdoor irrigation systems (e.g., smarter controllers, rain barrels, turf replacement) (City of San Diego, NDb and Water Authority, NDd). As detailed in Table 11-5 in *Chapter 11, Implementation*, there are many additional regional financial incentive programs available.

8.4.29 Outreach and Engagement

Stakeholder/community involvement was added as a RMS by IRWM stakeholders during development of the 2013 IRWM Plan to address the previous Objective A (now Objective B): Maximize stakeholder/community involvement and stewardship. Stakeholder and community involvement continues to be an important component of IRWM planning in the Region. There are many examples of how this RMS is being implemented in the Region:

Stakeholder outreach and education builds a sense of creek stewardship in local residents.

Photo credit: Charles Davis, Jacob Center for Neighborhood Innovation

- In 2008, the San Diego IRWM Program launched a publicly accessible website, which continues to be updated and maintained to reflect current information (www.sdirwmp.org).
- Selection of IRWM projects continues to focus on stakeholder and community involvement; many of the IRWM projects funded to-date include outreach components. Inclusion of a stakeholder and community involvement program now is required for a project to be considered for inclusion in a San Diego Region IRWM grant application.
- IRWM stakeholders played an important role in providing input and information to update the IRWM Plan. This effort is discussed in detail in *Chapter 6, Governance and Stakeholder Involvement.*
- The Regional Advisory Committee (RAC) provide input on IRWM Program initiatives, as well as serves as a forum for information sharing about topics of interest to IRWM practitioners and stakeholders (see *Chapter 6, Governance and Stakeholder Involvement*).
- Solicitation and selection of local non-profit/academic partnerships to support the Water Needs Assessment, which is an evaluation of water management issued in DAC. EDA, URC, and EJ communities throughout the Region.

***Outreach and Engagement* RMS in the San Diego IRWM Region**

Water Needs Assessment, Tri-County Funding Area Coordination Committee

The Tri-County Funding Area Coordination Committee (Tri-County FACC) is working jointly to develop the Water Needs Assessment for the San Diego Funding Area. This Water Needs Assessment will be based on information gathered during extensive outreach to DACs, EDAs, URCs, EJ communities, and Tribes, with a focus on those not previously involved with IRWM. The Tri-County FACC is committed to providing up to 25 community meetings with organizations serving DACs, EDAs, URCs, EJs, and Tribes to increase engagement with IRWM and to better understand the challenges to participation by these communities. In partnership with the Rural Community Assistance Corporation and the Climate Science Alliance, the Tri-County FACC has contacted over 200 organizations in the San Diego Funding Area to solicit input on the Water Needs Assessment questionnaire. The questionnaire will be used to identify DACs, EDAs, URCs, and EJs, their water and wastewater resource management needs and priorities, and to inform the Water Needs Assessment, which will be critical for helping each of the three IRWM Regions in the Funding Area better understand these communities and identify opportunities to assist them with addressing their greatest water needs.

8.4.30 Water and Culture

The Region's emphasis on conservation ethics means that demand management, is particularly important, particularly through times of drought. The 2019 IRWM Plan's Objective E specifically focuses on promoting an ethic of "conserve, reuse, and recycle" as a means to encourage the efficient use and development of local water supplies. In addition, the Region has acknowledged the cultural connection between local Tribes and their water resources. A series of stories, myths, songs, and poems from Tribes in Southern California, called *Tribal Water Stories*, is meant to educate and inform readers, as well as honor the cultures and peoples from whom these stories come. The *Tribal Water Stories* are included in the 2019 IRWM Plan as Appendix 4-A.

8.4.31 Water-Dependent Recreation

Chapter 3, Region Description describes water-dependent recreational opportunities within the Region. Recreational uses (either non-contact or contact uses) are supported in virtually all of the Region's inland surface waters, reservoirs, lagoons, estuaries, bays, and coastal waters.

8.4.32 Water Resources Data Collection, Management, and Assessment

Water Resources Data Collection, Management, and Assessment was added as a RMS by IRWM stakeholders during development of the 2007 IRWM Plan to address previous Objective B (now Objective C): Effectively obtain, manage, and assess water resource data and information. This objective continues to be an important tenet of IRWM planning in the Region. There are many examples of how this RMS is being implemented in the Region:

- In 2010, the San Diego IRWM Program launched a publicly-accessible online project database (OPTI), which contains information regarding all IRWM projects submitted for inclusion in the IRWM Plan.
- The successful 2011 Proposition 84-Round 1 Implementation Grant included the *Regional Water Data Management Program,* which evaluated the feasibility of developing a comprehensive data management system for the IRWM Region.
- OPTI was updated in 2017 to allow project proponents to add stormwater projects, including their quantified benefits, consistent with the Regional Stormwater Resource Plan.
- In 2018, OPTI was updated to host project completion and project monitoring reports for IRWM-funded projects.
- The San Diego Basin Study, currently being developed by the City of San Diego and U.S. Bureau of Reclamation (Reclamation), will be leveraged as a resource for identifying priority projects in the Region.

8.4.33 Scientific and Technical Water Quality Management Knowledge Enhancement

Scientific and Technical Water Quality Management Knowledge Enhancement was added as a RMS by IRWM stakeholders during development of the 2007 IRWM Plan to address previous Objective C (now Objective D): Further scientific and technical foundation of water quality management. This objective continues to be an important tenet of IRWM planning in the Region. There are many examples of how this RMS is being implemented in the Region:

- The San Diego IRWM Program's RWMG participated in the San Diego Water Board's 2011 and 2014 Triennial Review Advisory Committee to provide feedback on amendments to the *Water Quality Control Plan for the San Diego Basin* from an IRWM perspective.
- The Regulatory Workgroup Report was completed in 2012 to evaluate potential opportunities for the IRWM Program to collaborate with regulatory agencies (specifically the San Diego Water Board) to achieve mutual water quality protection and management goals, particularly regarding enhancing the scientific and technical basis behind water quality regulations. Please refer to *Chapter 7, Regional Coordination* for more information.
- Representatives from the San Diego Region Water Quality Control Board provide regulatory and permitting updates pertaining to the San Diego region during RAC meetings.
- The San Diego IRWM Program has completed or is in the process of completing 27 of the 40 Implementation Actions described in the 2013 IRWM Plan

8.4.34 Wastewater Management

Wastewater Management was added as a RMS by IRWM stakeholders during the development of the 2013 IRWM Plan. Wastewater Management includes those activities that consider wastewater flows as a water resource, and therefore involves active and comprehensive management of wastewater as part of the Region's water supply. Specific actions that fall under this RMS include: improving wastewater treatment, maximizing wastewater reuse by managing wastewater as a regional resource, managing discharges, improving the collection system, improving efficiency, and any other aspect of wastewater management that would provide benefits or reduce costs to the Region. The Wastewater Management RMS can contribute to Objective A (integrated solutions), Objective E (diverse mix of water resources), Objective F (reliable water infrastructure), and Objective H (pollution reduction).

***Wastewater Management* RMS in the San Diego IRWM Region**
South Bay International Wastewater Treatment Plant (SBIWTP) The International Boundary and Water Commission, a partnership between the U.S. and Mexican governments, built the South Bay International Wastewater Treatment Plant in San Ysidro, CA to treat wastewater from the City of Tijuana in Mexico that would otherwise be discharged to the Tijuana River and impact the quality of this waterbody. Wastewater at the plant is treated to secondary standards prior to discharge through the South Bay Ocean Outfall. The facility treats an average of 25 mgd,but has the potential to expand to 100 mgd. The SBIWTP has reduced the amount of sewage entering the Tijuana River, and reduced the impacts to residents in the Region, and the City of Imperial Beach in particular. *Source: International Boundary & Water Commission (http://www.ibwc.state.gov/mission_operations/sbiwtp.html); RWQCB, Tijuana River Valley Recovery Strategy: Living with the Water.*

8.5 Objectives Assessment

Table 8-2 presents the RMS and how they contribute to meeting each of the IRWM Plan objectives, including the three additional San Diego IRWM Plan-specific RMS identified by the stakeholder group (listed in *Section 8.2.2*). The selected RMS for inclusion in the 2013 IRWM Plan indirectly or directly supports attainment of one or more IRWM Plan objectives. When selecting RMS, the effects of climate change on the Region and how each RMS will help address these effects was taken into consideration (*Section 3.14*, *Chapter 3, Region Description*).

8.6 Applicability to the Region's Watersheds

As described in *Chapter 5, Watershed Characterization*, the Region's eleven watersheds share many region-wide water quality management problems and needs. Key water management similarities among the Region's watersheds include:

- Water quality impairment associated with bacteriological, nutrient, and sediment loads,
- Ecosystem protection and restoration needs and the need for invasive species control,
- Water supply diversity and water infrastructure reliability needs,
- Hydromodification and flood control issues, and
- Climate change impacts and need for adaptive or mitigation water resource management.

While the Region's watersheds face many similar water management needs, not all of the water management strategies are applicable to each of them:

- Agricultural Water Use Efficiency and Agricultural Land Stewardship RMS are not applicable within the Pueblo HU, as that watershed does not support any significant commercial agriculture.
- The San Juan and Pueblo HUs do not feature any existing or planned surface storage reservoirs. System Reoperation and Surface Storage – Regional/Local are thus not applicable within these watersheds.
- While the Pueblo HU may possess significant manageable deep-aquifer groundwater resources (San Diego Formation), no usable near-surface groundwater exists within the hydrologic unit. As a result, Groundwater and Aquifer Remediation and Recharge Area Protection are not applicable within the watershed.
- Groundwater resources exist in the upper reaches of the Peñasquitos HU (private wells in the Poway area), but aquifer storage capacities and yields are not sufficient to warrant implementation of Groundwater and Aquifer Management and Recharge Area Protection within the Peñasquitos HU.
- Only one seawater desalination site (within the Carlsbad HU) has been identified within the Region's water plans. Seawater desalination may be feasible in other locations, but a lack of availability of facility sites and brine disposal issues may prevent this strategy from being implemented in all but a few select locations within the Region.

Table 8-2: IRWM Plan Objectives Supported by Resource Management Strategies

Resource Management Strategies	IRWM Plan Objectives Supported by Resource Management Strategies									
	A: Encourage the development of integrated solutions to address water management issues and conflicts.	B: Maximize stakeholder/community involvement and stewardship of water resources, emphasizing education	C: Effectively obtain, manage, and assess water resource data and information.	D: Further scientific and technical foundation of water management.	E: Develop and maintain a diverse mix of water resources, encouraging their efficient use and development of	F: Construct, operate, and maintain a reliable and resilient infrastructure system.	G: Enhance natural hydrologic processes to reduce the effects of hydromodification and encourage integrated flood management.	H: Effectively reduce sources of pollutants and environmental stressors to protect and enhance human health, safety, and the environment.	I: Protect, restore, and maintain habitat and open space.	J: Advance water-based enriching experiences.
Agricultural Water Use Efficiency	○	○		○	●	○		○		
Urban Water Use Efficiency	○	○		○	●	○		○		
Conveyance – Delta					○	○				
Conveyance – Regional/Local					○	●				
System Reoperation	○				○	○				
Water Transfers					●					
Conjunctive Management & Groundwater	○		○	○	●	○			●	
Desalination – Brackish and Seawater			○	○	●	○				
Precipitation Enhancement			○	○	○					
Recycled Municipal Water	●		○	○	●	○				
Surface Storage – CALFED		○	○	○	○	○			○	
Surface Storage – Regional/Local		○	○	○	○	○			○	
Drinking Water Treatment and Distribution		○	○	○	●	○				
Groundwater and Aquifer Remediation		○	○	○	●					
Matching Quality to Use			○	○	○					
Pollution Prevention		○	○	○				●	○	●
Salt and Salinity Management	○	○	○	○				●	○	○
Urban Stormwater Runoff Management		○					○	○	○	○
Agricultural Lands Stewardship				○				●	●	●
Ecosystem Restoration		○	○	○				○	●	○
Land Use Planning and Management	○	○		○					●	●
Recharge Areas Protection					○	○		○		
Sediment Management							●	●	●	○
Watershed Management	○	●	●	●	○		●	●	○	○
Flood Management	○	○	○	○			●		○	○
Economic Incentives (Loans, Grants, and Water Pricing)	○	○		○	○	○	○	○	●	○
Outreach and Engagement		●								●
Water and Culture	●	●			●					●
Water-dependent Recreation		○	○	○				○	○	●
Water Resources Data Collection, Management, and Assessment			●	○						
Scientific and Technical Water Quality Management Knowledge Enhancement			●	●	○	○	○			
Wastewater Management	●		○	○	●	●		●		

● Water management strategy primarily and directly supports attainment of the IRWM Plan objective | ○ Water management strategy helps achieve the IRWM Plan objective

8.7 Adapting Resource Management Strategies to Climate Change

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 change. These changes could present some uncertainty to the availability of future imported water delivery capabilities, cause changes to local water quality, cause sea level rise, increase flooding, and impact the frequency and intensity of wildfires. See *Section 7.9* in *Chapter 7*, *Regional Coordination*, and Appendix 7-D for a detailed assessment of the Region's potential climate change vulnerabilities.

RMS that are implemented to manage water resources can also address climate change adaptation and mitigation. Table 8-3 was extracted from the *CWP Update 2013*; it categorizes RMS and identifies greenhouse gas (GHG) reduction opportunities associated with each RMS. The GHG reduction opportunities were considered when determining which RMS to incorporate into the 2019 IRWM Plan.

Table 8-3: Resource Management Strategies and GHG Reduction Opportunities

Management Objectives	Resource Management Strategy	GHG Reduction Opportunities
Reduce Water Demand	Agricultural Water Use Efficiency Urban Water Use Efficiency	Reduce dependency on energy to transport water resources
Improve Operational Efficiency and Transfers	Conveyance – Delta Conveyance – Regional/local System Reoperation Water Transfers	Decrease emissions by reducing operational efficiency/ transfer vehicle use and energy required for operations/transfers
Increase Water Supply	Conjunctive Management & Groundwater Desalination Precipitation Enhancement Recycled Municipal Water Surface Storage – CALFED Surface Storage – Regional/local	Localize water use, reduce imported water use, which requires additional energy and increases GHG emissions.
Improve Water Quality	Drinking Water Treatment and Distribution Groundwater Remediation/Aquifer Remediation Matching Quality to Use Pollution Prevention Salt and Salinity Management Urban Runoff Management	Stabilize water cycles by restoring water systems to their natural state. Matching quality to use could also reduce the need for water treatment, which requires energy and results in greenhouse gas emissions.
Improve Flood Management	Flood Risk Management	Control flooding so recharge can be redirected efficiently. Redirecting to reservoirs and groundwater recharge can prevent droughts and reduce the Region's dependence on energy-intensive water importation, and improve water supply reliability in dry seasons.
Practice Resources Stewardship	Agricultural Lands Stewardship Ecosystem Restoration Forest Management Land Use Planning and Management Recharge Area Protection Sediment Management Watershed Management	Provide opportunities for carbon sequestration, reforestation, and restoration/maintenance of urban land surfaces.
People and Water	Economic Incentives (Loans, Grants and Water Pricing)	Design water projects that are tailored to grant programs with energy and water efficiency priorities.
	Outreach and Engagement	Provide educational opportunities to inform the public on the nexus between water and energy
	Water and Culture	Promoting a conservation ethic as a means to reduce water demand in the Region

Management Objectives	Resource Management Strategy	GHG Reduction Opportunities
	Water-Dependent Recreation	Provide outreach signage and materials about the relationship between water and GHG reduction in areas where water-dependent recreation occurs.
Other	Crop Idling for Water Transfers Dewvaporation or Atmospheric Pressure Fog Collection Irrigated Land Retirement Rainfed Agriculture Waterbag Transport/Storage Technology	Reduce energy requirements and GHG emissions through decreased demand on imported water.
Strategies Identified by Stakeholders	Stakeholder/Community Involvement Water Resources Data Collection, Management, and Assessment Scientific and Technical Water Quality Management Knowledge Enhancement Wastewater Management	Collaboration among stakeholders will help to strengthen water resources (including climate change-related) data, which will help to strengthen the scientific and technical basis of water management. Wastewater management includes increased efficiencies and comprehensive management of wastewater supplies. Collectively, these actions will help the Region reduce GHG emissions by increasing collaboration and efficiency in all realms of water planning, which will in turn enhance operational efficiency and reduce energy required in water planning and implementation processes.

Source: DWR, 2013

A crosswalk has been developed to help project proponents identify which RMS are likely to address the prioritized climate change vulnerabilities described in *Chapter 7, Regional Coordination*. This was developed so that project proponents can better understand if their Projects implement an RMS that addresses a specific climate change vulnerability. This crosswalk is provided in Table 8-4.

Table 8-4: RMS Anticipated to Address Climate Change Vulnerabilities

Key: ● = *directly reduces vulnerability* | ○ = *indirectly reduces vulnerability or possibly addresses vulnerability depending on project description*

IRWM Plan Prioritized Climate Change Vulnerability Issues	**Resource Management Strategies**																																
	Agricultural Water Use Efficiency	Urban Water Use Efficiency	Conveyance – Delta	Conveyance – Regional/Local	System Reoperation	Water Transfers	Conjunctive Management &	Desalination – Brackish and	Recycled Municipal Water	Surface Storage – CALFED	Surface Storage – Regional/Local	Drinking Water Treatment and	Groundwater and Aquifer	Matching Quality to Use	Pollution Prevention	Salt and Salinity Management	Urban Stormwater Runoff	Agricultural Lands Stewardship	Ecosystem Restoration	Forest Management	Land Use Planning and	Recharge Areas Protection	Sediment Management	Watershed Management	Flood Management	Economic Incentives	Outreach and Engagement	Water and Culture	Water-dependent Recreation	Water Resources Data Collection,	Scientific and Technical Water	Wastewater Management
Very High																																	
Water Supply: Decrease in imported supply	●	●	○	●	○	●	●	●	●	○	○	○	○	●		○	○	○		○	○	●	○	○		○							○
High																																	
Water Supply: Sensitivity due to higher drought potential	●	●	○	○	●	●	●	●	●	○	●	○	○	●		○	○	○	○	○	○	○	○	●		○		●		○			○
Water Quality: Increased constituent concentrations					●							●	●	●	●	●	○	●	●	○	●	○	●	●	○	○		●		●	●	●	
Flooding: Increases in flash flooding and inundation (extreme weather)				○	○						○						●	○	○	●	●	○	●	●	●	○				●			
Ecosystem/Habitat: Decrease in available necessary habitat			●	●	●		○		○		○				●	○	○	●	●	●	●	●	●	●	○	○		●	○	●	○		
Sea Level Rise: Inundation of storm drains and sewer systems																					●				●	○				●			
Ecosystem/Habitat: Decrease in ecosystem services		○	●	●	●		○						●		○	○	○	●	●	●	●	○	●	●	●	○		●	○	●	●		
Water Supply: Lack of groundwater and surface water storage* to buffer drought	○	●			●	○	●	○	○	○	○	○	●			○	○				●	●		●	○	○				●			
Ecosystem/habitat: Decrease in environmental flows	●	●	●	●		○	●	○	○		○			○			○	●	○	●	●		●	●	○	○				●			

IRWM Plan Prioritized Climate Change Vulnerability Issues	Resource Management Strategies																														
	Agricultural Water Use Efficiency	Urban Water Use Efficiency	Conveyance – Delta	Conveyance – Regional/Local	System Reoperation	Water Transfers	Conjunctive Management &	Desalination – Brackish and	Recycled Municipal Water	Surface Storage – CALFED	Surface Storage – Regional/Local	Drinking Water Treatment and	Groundwater and Aquifer	Matching Quality to Use	Pollution Prevention	Salt and Salinity Management	Urban Stormwater Runoff	Agricultural Lands Stewardship	Ecosystem Restoration	Forest Management	Land Use Planning and	Recharge Areas Protection	Sediment Management	Watershed Management	Flood Management	Economic Incentives	Outreach and Engagement	Water and Culture	Water-dependent Recreation	Water Resources Data Collection,	Scientific and Technical Water	Wastewater Management
Medium																															
Water Demand: Crop demand would increase	●					●	○	●	●		●		○	●				●								○	●	●		●		○
Water Demand: Industrial demand would increase		●				●	○	●	●		●		○	●												○	●	●		●		○
Water Supply: Decrease in groundwater supply	●	●	●		○	○	●	●	○		○	○	●	○		○	○	○	○	○	○	○	●		●	○	○				●		○
Water Quality: Increase in treatment cost		○			●		○				○	●	●	●	●	●	○	○	○	○	○	●	●	○	○		○				○	●	○
Sea Level Rise: Damage to coastal recreation / tourism due to inundation																			●		●		○	●		○		●	●			
Water Quality: Increased eutrophication	○				●							●		○	○	●	○	●	○	●	●		●	●		○				●	●	○
Low																															
Water Demand: Limited ability to conserve further	●	●				○		●	●		●		○	●												○	●	●				
Flooding: Increases in inland flooding			●	●	○						○				○		○	○	●	●	●		●	●	●	○				●		
Ecosystem/Habitat: Increased impacts to coastal species			○	○											○		○		●	○	●		○	●		○		●		●	○	
Sea Level Rise: Damage to ecosystem/habitat																			●		●		●	●		○		●				
Very Low																															
Water Demand: Limited ability to meet summer demand	●	●	●	●	●	●	●	●	●	●	●	○	○	●		○		○				○				○	●	●				○
Water Supply: Invasive species can reduce supply available					●			○	○		○				○			○	●	●	●	○	○	●		○				●	○	

IRWM Plan Prioritized Climate Change Vulnerability Issues	Resource Management Strategies																														
	Agricultural Water Use Efficiency	Urban Water Use Efficiency	Conveyance – Delta	Conveyance – Regional/Local	System Reoperation	Water Transfers	Conjunctive Management &	Desalination – Brackish and	Recycled Municipal Water	Surface Storage – CALFED	Surface Storage – Regional/Local	Drinking Water Treatment and	Groundwater and Aquifer	Matching Quality to Use	Pollution Prevention	Salt and Salinity Management	Urban Stormwater Runoff	Agricultural Lands Stewardship	Ecosystem Restoration	Forest Management	Land Use Planning and	Recharge Areas Protection	Sediment Management	Watershed Management	Flood Management	Economic Incentives	Outreach and Engagement	Water and Culture	Water-dependent Recreation	Water Resources Data Collection,	Scientific and Technical Water	Wastewater Management
Water Quality: Decrease in recreational opportunity		○			○						○				○		○		●	○	●	○	○	●	○	○	○	●	●		●	
Sea Level Rise: Decrease in land																			●		●		○	●		○		●				
Ecosystem/habitat: Decrease in environmental flows	●	●	●	●		○	●	○	○		○			○			○	●	○	●	●		●	●	○	○				●		
Hydropower: Decrease in hydropower potential		○			●	○																				○				●		

*The Region's current storage capacity is sufficient, however it lacks the ability to connect and convey water stored in some regional reservoirs.

8.8 References

California Department of Water Resources (DWR). 2013. *California Water Plan Update 2013*. Available: https://www.water.ca.gov/Programs/California-Water-Plan/Water-Plan-Updates

California Department of Water Resources (DWR). 2010. *Proposition 84 & Proposition 1E Integrated Regional Water Management Guidelines*. August 2010. Available: http://www.water.ca.gov/irwm/grants/docs/Archives/Prop84/Guidelines_PSPs/GL_Final_07_20_10.pdf

California Department of Water Resources (DWR). 2012. *Guidelines: Integrated Regional Water Management, Proposition 84 and 1E*. November 2012. Available: http://www.water.ca.gov/irwm/grants/docs/Guidelines/GL_2012_FINAL.pdf

California Department of Water Resources. December 2009. *California Water Plan Integrated Water Management*. Bulletin 160-09 Volume 2 – Resource Management Strategies.

California Regional Water Quality Control Board, San Diego Region. *Water Quality Control Plan for the San Diego Region (Basin Plan)*. 1994.

California Regional Water Quality Control Board, San Diego Region. 2012. *Tijuana River Valley Recovery Team, Recovery Strategy: Living with the Water*. January 2012.

City of San Diego. January 2004. *Source Water Protection Guidelines for New Development*. Available at: http://www.sandiego.gov/water/operations/pdf/swpguidelines.pdf

City of San Diego. March 1, 2011. *2010 Watershed Sanitary Survey* (CDPH System Number 37-10020). Available at: http://www.sandiego.gov/water/operations/environment/wssurvey.shtml

City of San Diego. NDa. Water Purification Demonstration Project. Available at: http://www.sandiego.gov/water/waterreuse/demo/ (Accessed June 4, 2013)

City of San Diego. NDb. Water Conservation. Accessed on January 21, 2013. Available: http://www.sandiego.gov/water/conservation/

Fallbrook Bonsall Village News (Issue 10, Volume 15). March 10, 2011. *CWA Approves Grant Application for Camp Pendleton Desalination Project*. Written by Joe Naiman. Available at: http://www.thevillagenews.com/story/54895/

HDR Engineering. February 2008. P*rotocol California Gnatcatcher Survey Report San Diego River Restoration Project: Edgemoor Property Santee, California.* Available at: http://www.mccollum.com/EdgemoorCAGNReportHDR_Feb-08.pdf

International Boundary and Water Commission. N.D. *South Bay International Wastewater Treatment Plant (SBIWTP)*. Accessed 16 August, 2013. Available: http://www.ibwc.state.gov/mission_operations/sbiwtp.html

Journal of Environmental Engineering (Volume 133, Issue 2). February 2007. *Abstract for "Evaluation of Hypolimnetic Oxygen Demand in a Large Eutrophic Raw Water Reservoir, San Vicente Reservoir, Calif."* Available: http://ascelibrary.org/action/showAbstract?page=130&volume=133&issue=2&journalCode=joeedu

National Water Research Institute. September 2009. *Final Report of the May 11-12, 2009, Meeting of the Independent Advisory Panel for the City of San Diego Indirect Potable Reuse/Reservoir*

Augmentation (IPR/RA) Demonstration Project. Available at: http://www.sandiego.gov/water/waterreuse/pdf/nwrireport.pdf

P&D Environmental. April 12, 2005. *Biological Technical Report within the Study Area of the San Diego River Restoration Project, Edgemoor Property, Santee, California*.

San Diego County Water Authority. *Updated 2005 Urban Water Management Plan*. Adopted 2007.

San Diego County Water Authority. July 2009a. *Technical Information for Cooling Towers Using Recycled Water*. Available at: http://www.sdcwa.org/sites/default/files/files/water-management/recycled/techinfo-cooling-towers.pdf

San Diego County Water Authority. December 2009b. *Camp Pendleton Seawater Desalination Project Feasibility Study Executive Summary*. http://www.sdcwa.org/desalination

San Diego County Water Authority (Water Authority). 2013a. *San Vicente Dam Raise – Factsheet.* Available: http://www.sdcwa.org/sites/default/files/files/publications/desal-carlsbad-fs-single.pdf

San Diego County Water Authority (Water Authority). 2013b. *Seawater Desalination: Carlsbad Desalination Project – Factsheet.* Available: http://www.sdcwa.org/sites/default/files/files/publications/svdamraise-fs.pdf

San Diego County Water Authority (Water Authority). 2014. *2013 Regional Water Facilities Optimization and Master Plan Update*. March. Available: https://www.sdcwa.org/master-plan-documents

San Diego County Water Authority (Water Authority). June 2016. *2015 Urban Water Management Plan*. Avaliable: https://www.sdcwa.org/sites/default/files/UWMP2015.pdf

San Diego County Water Authority. October 2017. *Camp Pendleton Seawater Desalination Project Feasibility Study – Fact Sheet*.

San Diego County Water Authority. NDa. *Recycled Water Case Study, Del Sur Master Planned Community Homeowner's Association*. Available at: http://www.sandiego.gov/water/pdf/recycled/casestudydelsur.pdf

San Diego County Water Authority. NDb. *Recycled Water Case Study, Biogen Idec, Use of Recycled Water in Cooling Water*. Available at: http://www.sandiego.gov/water/pdf/recycled/casestudybiogen.pdf

San Diego County Water Authority. NDc. *Recycled Water Case Study University of California – San Diego*. http://www.sandiego.gov/water/pdf/recycled/casestudyucsd.pdf

San Diego County Water Authority. NDd. Conservation. Accessed on January 21, 2013. Available: http://www.sdcwa.org/conservation

San Diego County Water Authority and Southern California Salinity Coalition. 2010. *Proposed Guidelines for Salinity/Nutrient Management Planning in the San Diego Region*. September.

San Diego County Water Authority and the City of San Diego. ND. *Recycled Water Case Study – Lomas Santa Fe Country Club.* Accessed on January 21, 2013. Available: http://www.sandiego.gov/water/pdf/recycled/casestudylomas.pdf

San Diego Integrated Regional Water Management. January 2011. Implementation Grant Proposal Work Plan.

U.S. Green Building Council. *Certified Project List for the Inland Empire Utilities Agency's administration headquarters*. 2008. Available at: http://leedcasestudies.usgbc.org/overview.cfm?ProjectID=278

Winzler & Kelly, Weber Analytical, and Maddaus Water Management (Winzler & Kelly et al). 2011. *San Diego County Water Authority – Agricultural Water Management Program Evaluation – Report*. June 2011. Available: http://www.sdcwa.org/sites/default/files/files/water-management/conservation/ag-watermanagment-report.pdf