8 Resource Management Strategies

This chapter addresses requirements set forth in the Resource Management Strategies (RMS) Standard in the *2012 IRWM Program Guidelines* (DWR, 2012). As such, this chapter considers each RMS listed in the *California Water Plan (CWP) Update 2009* (DWR, 2009), documents which RMS will help achieve the 2013 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

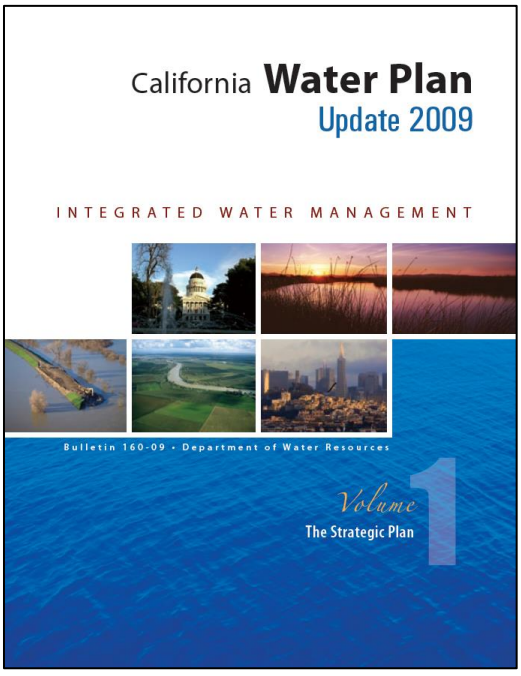
The *2012 IRWM Program Guidelines* require that an IRWM Plan consider each RMS listed in the *CWP Update 2009.* As part of the stakeholder outreach and involvement process conducted for the 2013 IRWM Plan (refer to *Chapter 6, Governance and Stakeholder Involvement*), stakeholders were asked to provide 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.

8.1.1 Resource Management Strategies in *California Water Plan Update 2009*

Division 43, Chapter 2, Section 75206(a) of the California Water Code authorizes funding (pursuant to Proposition 84) 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 2009*:

> *Eligible projects must implement regional water management plans that meet the requirements of this section. Integrated regional water management plans shall identify and address the major water related objectives and conflicts within the region, consider all of the resource management strategies identified in the California Water Plan, and shall use an integrated, multi-benefit approach to project selection and design.*

Table 8-1 below lists RMS included within the *CWP Update 2009*, listed by the categories generated by the California Department of Water Resources (DWR).



California Water Plan Update 2009 contains a wide range of water management strategies.

Table 8-1: Resource Management Strategies Addressed in *California Water Plan Update 2009*

No.	RMS within CWP Update 2009[1]	Strategy Overview	Included in 2013 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 Storage	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	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 2009[1]	Strategy Overview	Included in 2013 IRWM Plan
14	Groundwater and Aquifer Remediation	Includes strategies that remove pollutants from contaminated groundwater aquifers through pumping and treatment, in situ treatment, or other means.	Yes
15	Matching Water 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 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	Economic Incentives	Includes economic incentives (e.g. loans, grants, water pricing) to promote resource preservation or enhancement.	Yes
21	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
22	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
23	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
24	Recharge Area Protection	Includes land use planning, land conservation, and physical strategies to protect areas that are important sources of groundwater recharge.	Yes
25	Water-Dependent Recreation	Enhancing and protecting water-dependent recreational opportunities and public access to recreational lands.	Yes
26	Watershed Management	Comprehensive management, protection, and enhancement of groundwater and surface waters, natural resources, and habitat	Yes
Improve Flood Management			
27	Flood Risk Management	Strategies that decreasing 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 2009[1]	Strategy Overview	Included in 2013 IRWM Plan
Other			
28	Other Strategies	Other RMS include: • Crop Idling for Water Transfers • Dewvaporation/Atmospheric Pressure Desalination • Fog Collection • Irrigated Land Retirement • Rainfed Agriculture • Waterbag Transport/Storage Technology	No
San Diego IRWM Region RMS (not included in the *CWP Update 2009*)			
N/A	N/A	San Diego IRWM Region-Specific RMS include: • Stakeholder and Community Involvement • Water Resources Data Collection, Management, and Assessment • Scientific and Technical Water Quality Management and Enhancement • Wastewater Management	Yes

Source: DWR, 2009

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

8.2.1 California Water Plan Update 2009

As required by DWR in the 2012 IRWM Program Guidelines, this IRWM Plan Update considered each RMS included in the *CWP Update 2009.* Each of these RMS is included in Table 8-1 above, and are analogous to those RMS included within the 2012 IRWM Program Guidelines (DWR, 2012). For purposes of presenting and discussing RMS, the 2013 IRWM Plan utilizes the RMS organizational structure and convention set forth in the *CWP Update 2009*.

8.2.2 Resource Management Strategies Specific to the 2013 IRWM Plan

In addition to the RMS listed within the *CWP Update 2009,* RMS specific to the San Diego IRWM Region were considered for inclusion within the 2013 IRWM Plan. The 2007 IRWM Plan included three Region-specific RMS, which were re-evaluated by stakeholders as part of the 2013 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.

During the August 1, 2012 workshop in which stakeholders were asked to discuss and vet RMS, San Diego IRWM stakeholders determined that the additional RMS included within the 2007 IRWM Plan were appropriate for the 2013 IRWM Plan. During the public comment period that was held for the Public Draft 2013 IRWM Plan, several comments were received that recommended the addition of another RMS beyond those included in the 2007 IRWM Plan and the *CWP Update 2009*. The additional RMS, *Wastewater Management*, addresses management of wastewater flows as a water resource, for public and environmental health, and for improved efficiency.

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

Photo Credit: Rosalyn Prickett, RMC Water and Environment

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 resource management strategies during a public workshop held on August 1, 2012.

IRWM stakeholders were asked to consider all RMS listed within the *CWP Update 2009,* the additional RMS included within the 2007 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 7.8 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. The public comment period for the Public Draft 2013 IRWM Plan provided another opportunity for stakeholders to consider the RMS included in the 2013 IRWM Plan.

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 2013 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 2009,* as well as the three additional RMS included within the 2007 IRWM Plan, 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 the Region's imported water supply, they are included in this 2013 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 (#22)
3. Crop Idling for Water Transfers (#28, Other Strategies)
4. Dewvaporation /Atmospheric Pressure Desalination (#28, Other Strategies)
5. Fog Collection (#28, Other Strategies)
6. Irrigated Land Retirement (#28, Other Strategies)
7. Rainfed Agriculture (#28, Other Strategies)
8. Waterbag Transport/Storage (#28, Other Strategies)

As such, 28 strategies were selected for inclusion within the 2013 IRWM Plan, including the four additional RMS identified locally.

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 2009.* 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

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 water conservation savings that are projected to increase by approximately 118,000 AFY to an estimated 174,000 AFY of savings by 2035 (see *Chapter 3, Region Description*) (Water Authority, 2011). Local municipalities encourage conservation through land use regulations, building codes, and incentives.

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

Photo Credit: Toby Roy, San Diego County Water Authority

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 is being 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. Project benefits expected to accrue through 2022 include:

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

Landscape standards and specifications are underway. Education and training curriculums have been developed by the Water Authority and will be geared towards the residential sector. Technical assistance has been initiated; the Water Authority is in the process of hiring a consultant on a limited basis to provide technical assistance to three pilot sites.

Source: San Diego Integrated Regional Water Management, January 2011

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 *2010 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, 2010). 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), and
- El Capitan Reservoir (City of San Diego).

The Water Authority works with its member agencies through storage agreements and aqueduct operating plans to optimize the use of local storage (Water Authority, 2011). 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. The Water Authority will also coordinate with its member agencies to model and evaluate whether other opportunities for storage optimization exist as part of preparing its *2012 Regional Water Facilities Optimization and Master Plan Update*.

The San Vicente Dam Raise will contribute to long-term water supply reliability for the region.

Photo Credit: Toby Roy, San Diego County Water Authority

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

City of San Diego, Hypolimnetic Oxygen Demand Investigation - San Vicente Reservoir

The City installed hypolimnetic oxygenation systems in several of its reservoirs to study the ability to manage anoxia and sediment nutrient release. These reservoirs include San Vicente, Otay, and El Capitan Reservoirs. Results of the study showed that hypolimnetic oxygenation can improve water quality by decreasing hypolimnetic accumulation of compounds that complicate potable water treatment. Historically, aeration systems have been undersized because designers have not accounted for increases in sediment oxygen demand resulting from the operation of aeration systems. A comprehensive study was performed to estimate the hypolimnetic oxygen demand in San Vicente Reservoir, a eutrophic raw water reservoir in San Diego. Experiments confirmed that maintenance of a well-oxygenated sediment-water interface inhibited the release of certain compounds from sediments. In addition, modeling showed that operation of an oxygenation system would not significantly affect thermal stratification.

The results of this investigation will help the City to improve management of its reservoirs by taking actions to increase oxygen within lower layers of the reservoirs to improve water quality and potentially reduce water treatment needs.

Source: Journal of Environmental Engineering (Volume 133, Issue 2), 2007

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 received increasing amounts of transfer water each year, according to a water delivery schedule contained in the transfer agreement. In 2012, the Water Authority received approximately 90,000 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, 2011*

8.4.7 Conjunctive Management and Groundwater Storage

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 28,360 AFY of supply for Water Authority member agencies by 2035 (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, 2011). 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, 2011). 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, 2011).

8.4.8 Desalination

The Water Authority's *2010 Urban Water Management Plan* establishes a target of 56,000 AFY of seawater desalination within the Region by 2035 based on the proposed regional seawater desalination project (see *Chapter 3, Region Description*). This desalination capacity would be provided by the Carlsbad Desalination Project, through which the Water Authority would purchase between 48,000 and 56,000 acre-feet per year (AFY) of desalinated seawater. The Carlsbad Desalination Project, which is currently under construction, includes a seawater desalination plant and conveyance pipelines that are being developed by a private, investor-owned company (Poseidon Resources). The Water Authority also is modifying its aqueduct system to incorporate this new water supply. The seawater desalination plant would be located on industrially zoned land adjacent to the Encina Power Station and Agua Hedionda Lagoon, in Carlsbad (Water Authority 2013a). The Water Authority is also engaged in other desalination efforts in the Region, including the Camp Pendleton Seawater Desalination Project and the Rosarito Beach Bi-national Desalination Plant Feasibility Evaluation and Preliminary Design Project.

The Region also participates in several efforts to desalinate brackish groundwater. Currently, 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 currently operating brackish groundwater recovery and treatment facilities within the Water Authority's service area (Water Authority, 2011).

***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 desalination, is a key component in the Water Authority's water supply diversification efforts. The two projects currently under development within San Diego County are the Carlsbad Desalination Project and the Camp Pendleton Seawater Desalination Project.

The Carlsbad Desalination Project is located at the Encina Power Station in Carlsbad, California. It is being developed by Poseidon Resources. In addition to the treatment facility, the project would involve a new pipeline connection to the Water Authority's existing regional aqueduct system. The Water Authority is participating in the Carlsbad Desalination Project as a potential purchaser of product water from the facility. The Carlsbad Desalination Project has obtained all required permits and environmental clearances and when completed will provide a highly reliable local supply of 48,000 to 56,000 AFY for the Region.

The Water Authority, with participation from U.S. Marine Corps Base Camp Pendleton, is evaluating 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. Following the completion of a feasibility study in 2009, the Water Authority will conduct further technical studies at the proposed facility site. The studies include hydrogeological, geophysical, and ocean and marine life investigations and will also review new power supply facility needs, conveyance, and integration into the existing Water Authority infrastructure.

Source: San Diego Water Authority, 2009b and San Diego County Water Authority, 2013a

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. While precipitation enhancement is not an important strategy for the Region, the City of San Diego has periodically experimented with precipitation enhancement as a means of increasing runoff to local reservoirs. 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 40 MGD, and the Region's water supply plans propose to increase recycled water use within the Region from 28,000 AFY in year 2010 to 50,000 AFY by year 2035 (see Section 3.5.5 in *Chapter 3, Region Description*) (Water Authority, 2011). 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 – including the City of San Diego, City of Escondido, City of Oceanside, Padre Dam Municipal Water District, and San Elijo Joint Powers Authority – are exploring different technologies that would allow for future potable reuse. While potable reuse is currently in planning and pilot study stages in the Region, full implementation would provide many benefits allowing the Region to expand the use of recycled water supplies, which are currently underutilized.

Recycled Municipal Wastewater RMS in the San Diego IRWM Region
City of San Diego - Water Purification Demonstration Project The City of San Diego has undertaken the 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 Water Purification Demonstration involves: • Designing, constructing, and operating a 1-MGD Advanced Water Purification Facility at the North City Water Reclamation Plant; • Conducting a study to establish residence time, dilution and water quality parameters of purified water in San Vicente Reservoir; • Defining the State of California State regulatory requirements for a full-scale indirect potable reuse/reservoir augmentation project; • Performing a pipeline alignment study; and • Conducting a public education and outreach program, including tours of the Advanced Water Purification Facility. The Water Purification Demonstration Project puts the City on a path to (1) achieve a more reliable and local source of water and (2) minimize wastewater discharges into the ocean. Although the initial testing phase is complete, operation of the Advanced Water Purification Facility is ongoing. The Public Utilities Department has successfully obtained grant funding for research to help define regulatory criteria for direct potable reuse (a process in which purified water is a raw water supply immediately upstream of a water treatment plant). San Diego's Advanced Water Purification Facility is ideal for these studies because it uses full-scale components already in place. In the case of direct potable reuse, the absence of an environmental barrier (i.e local reservoir) could be compensated through the following: • Additional treatment process or other engineered barriers that increase overall system redundancy and reliability. • Infallible or best available water quality monitoring strategies for each treatment process to achieve real-time control. Real-time monitoring serves to identify treatment breakthroughs and alert the need for immediate system shutdowns to prevent sub-standard water from reaching potable water supplies San Diego IRWM funding has supported research focused on identifying strategies and evaluating their effectiveness pertaining to the above via the Advanced Water Purification Facility Extended Testing Project and the Failsafe Potable Reuse Project. *Source: City of San Diego. 2013. Water Purification Demonstration Project, Project Report, July 2013. 129 pp, plus appendices.*
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. *Source: RMC Water and Environment. 2012. North San Diego County Regional Recycled Water Project Facilities Plan.*

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 Storage Project, which is a regional project that focuses on water supply reliability. The San Vicente Dam Raise Project will increase the height of the San Vicente Dam from 220 feet to 337 feet and increase storage capacity from 90,000 AF to 242,000 AF. This project will serve 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 will help to balance seasonal differences between water supply availability and demand, and provide 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 - 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 storm water permit requirements, as well as local planning protocols. *Source: City of San Diego Water Department, 2004*
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*

8.4.13 Drinking Water Treatment and Distribution

Recycled water is used for dust control at construction sites because drinking water quality is unnecessary.

Photo credit: Jeff Pasek, City of San Diego

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 treats untreated water delivered from Metropolitan. In addition, the Region includes additional (non-Water Authority) potable water treatment capacity of 790 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 and Aquifer Remediation

Toxic organic contaminants have been documented in several of the Region's groundwater aquifers. The Regional Board and San Diego County oversee investigation and remediation at more than 100 cleanup/remediation sites throughout the Region. The Regional 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 Regional 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*

2009 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 (Regional Board 9). 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 Regional 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 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 limit runoff flows,
- 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.

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 Regional 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 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.

8.4.21 Ecosystem Restoration

The ecosystem restoration strategy identified in the *CWP Update 2009* 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.

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

Photo credit: Charles Davis, Jacob Center for Neighborhood Innovation

***Ecosystem Restoration* RMS in the San Diego IRWM Region**

County of San Diego - San Diego River Restoration Project, Edgemoor Property, City of Santee

The County of San Diego is undertaking the San Diego River Restoration Project, a restoration project on the Edgemoor Property in the City of Santee. The San Diego River Restoration Project will enhance riparian habitat which may be used to provide future off-site mitigation for development projects. The project will involve both habitat enhancement and creation. Habitat enhancement will improve riparian scrub/woodland and freshwater marsh by removing invasive species, cleaning up trash, and, if needed, replanting select areas with native plants. In addition, habitat creation will convert nonnative grassland, tamarisk scrub, and disturbed habitat into open water, riparian scrub/woodland, and freshwater marsh.

Sources: HDR Engineering, 2008; P&D Environmental, 2005

8.4.22 Forest Management

Almost all forest management activities can affect water quantity and quality. The Forest Management strategy in the *CWP Update 2009* 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.

8.4.23 (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*

8.4.24 Recharge Area 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).

8.4.25 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.

8.4.26 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.

8.4.27 Flood Risk 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.

8.4.28 Other Strategies

The Other Strategies chapter of the *CWP Update 2009* 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.

8.4.29 Stakeholder/Community Involvement

Stakeholder/community involvement was added as a RMS by IRWM stakeholders during development of the 2007 IRWM Plan to address 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 publically-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.
- 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.*

8.4.30 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 publically-accessible online project database, 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 will provide the first step in creating a comprehensive data management system for the IRWM Region.

8.4.31 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 Regional Board's 2011 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 Regional 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.

8.4.32 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 contributes 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.

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	C. Effectively Obtain, Manage and Assess Water Resources Data	D. Further Technical and Scientific Foundation for Water Management	E. Develop, Operate, and Maintain a Diverse Mix of Water Resources	F. Construct, Operate, and Maintain Reliable Infrastructure System	G. Enhance Natural Hydrologic Processes to Reduce the Effects of Hydromodification and Encourage Integrated Flood Management	H. Reduce Pollutant Sources and Environmental Stressors	I. Protect, Restore and Maintain Habitat and Open Space	J. Optimize Recreational Opportunities	K. Effectively Address Climate Change through Adaptation or Mitigation in water Resource Management
Agricultural Water Use Efficiency	○	○		○	●	○		○			○
Urban Water Use Efficiency	○	○		○	●	○		○			○
Conveyance – Delta					○	○					○
Conveyance – Regional/Local					○	●					○
System Reoperation	○				○	○					○
Water Transfers					●						●
Conjunctive Management & Groundwater	○		○	○	●	○			●		○
Desalination			○	○	●	○					●
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 Runoff Management		○					○	○	○	○	
Agricultural Lands Stewardship				○				●	●	●	
Economic Incentives (Loans, Grants, and Water Pricing)	○	○		○	○	○	○	○	●	○	○
Ecosystem Restoration		○	○	○				○	●	○	
Land Use Planning and Management	○	○		○					●	●	
Recharge Areas Protection					○	○		○			
Water-dependent Recreation		○	○	○				○	○	●	
Watershed Management	○	●	●	●	○		●	●	○	○	○
Flood Risk Management	○	○	○	○			●		○	○	○
Stakeholder/Community Involvement		●									
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

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.

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 7.8 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 2009*; 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 2013 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 Economic Incentives (Loans, Grants and Water Pricing) Ecosystem Restoration Forest Management Land Use Planning and Management Recharge Area Protection Water-Dependent Recreation Watershed Management	Provide opportunities for carbon sequestration, reforestation, and restoration/maintenance of urban land surfaces.
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, 2009

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