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Executive Summary

Introduction to the One Water One Watershed Plan

The Santa Ana Watershed Integrated Regional Water Management Plan (IRWMP) is known by stakeholders in the Watershed as the "One Water One Watershed" (OWOW) Plan, a name that originates in the plan's comprehensive view of the Watershed and water issues: an integral view encompassing all sub-regions, political jurisdictions, water agencies, and non-governmental stakeholders (private sector, environmental groups, and the public at large) in the watershed; one in which all types of water (imported, local surface and groundwater, stormwater, and wastewater effluent) are viewed as components of a *single* water resource, inextricably linked to land use and habitat, and that tries to limit impacts to natural hydrology.

The OWOW Plan was developed by a diverse group of stakeholders led by a Steering Committee composed of public officials from counties and cities in the watershed, representatives from the environmental, regulatory, and business communities, and representatives from the Santa Ana Watershed Authority (SAWPA). The Steering Committee was supported by technical experts grouped into ten disciplines (known as Pillars), ranging from water supply and quality, to climate change, to environmental justice.

The Santa Ana Watershed Project Authority (SAWPA) acted as the Regional Water Management Group (RWMG) for the process. While SAWPA facilitated the planning process and provided technical input and support through its staff and consultants, the development of the goals and strategies of the Plan, as well as the decision making process were prepared by the Steering Committee with support of the Pillars and with consideration to comments from the public at large.

The collaborative, transparent, and watershed-wide view embraced by the OWOW planning process from the onset, builds upon previous planning efforts in the watershed, such as the 2005 Santa Ana Integrated Watershed Plan, and is an attempt to change the way in which water and other environmental resources are managed in the watershed, moving from reliance on large centralized infrastructure projects to a systems approach that complements existing centralized infrastructure with decentralized facilities (e.g. groundwater desalination), technology, natural infrastructure, and human capital.

OWOW Vision and Mission

The vision of the OWOW Plan is:

1. A Watershed that is sustainable, drought-proofed and salt-balanced by 2030, and in which water resources are protected and water is used efficiently.
2. A Watershed that supports economic and environmental viability.
3. A Watershed that is adaptable to climate change.
4. A Watershed in which environmental justice deficiencies are corrected.
5. A Watershed in which interruptions to natural hydrology are minimized.
6. A new water ethic is created at the institutional and personal level.

The mission of the OWOW Plan is to create opportunities for collaboration to find sustainable watershed-wide solutions among diverse stakeholders from throughout the Watershed. The Plan will also provide a blueprint for water resources management in the Watershed for the next 30 years.

To achieve this vision and mission, stakeholders must address four major crises or threats which we have characterized as the Four Horsemen of the Apocalypse: 1) Climate Change resulting in reduced water supplies combined with increased water needs in the region; 2) Colorado River Drought Conditions resulting in reductions of imported supply due to upper basin entitlements and continued long-term drought; 3) San Joaquin-Bay Delta Vulnerability resulting in loss of supply due to catastrophic levee failure or changing management practices of the Delta; 4) Population Growth and Development resulting in interruptions in hydrology and groundwater recharge while increasing water needs.

Principles for Watershed Planning

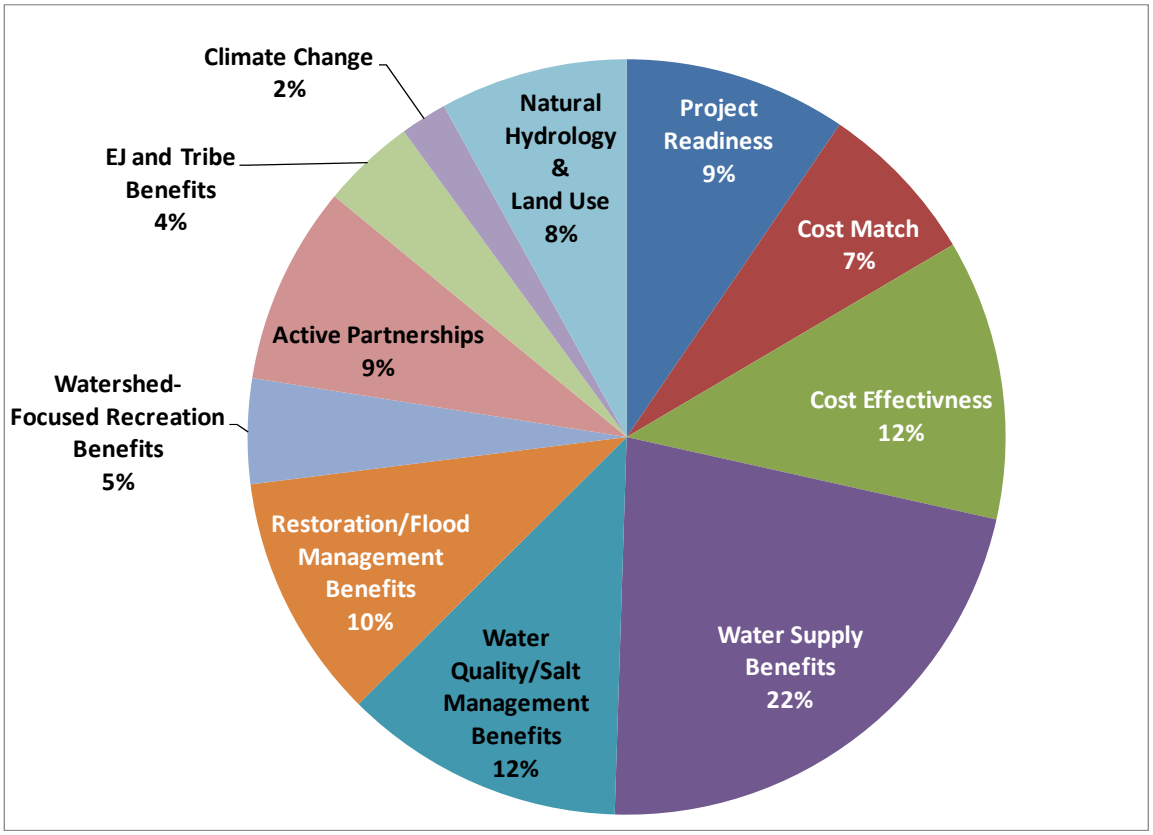
Several principles were applied during the development of the OWOW Plan:

- The planning process must be watershed-wide and bottom-up in order to allow for a holistic and systematic approach to watershed management.
- It is necessary to involve stakeholders representing counties, cities and water districts, as well as the private sector and the regulatory, environmental and environmental justice communities. The active participation of this diverse group of stakeholders integrates the different interests in the Watershed beyond political boundaries.
- The OWOW Plan and the projects included therein must pursue multiple objectives beyond the "traditional" objective of providing reliable water, and include ensuring reliable water supply, ensuring high quality water for all users, preserving and enhancing the environment, promoting sustainable water solutions, managing rainfall as a resource, preserving open-space and recreational opportunities, maintaining quality of life (including addressing the needs of disadvantaged communities), providing economically effective solutions, and improving regional integration and coordination.
- The OWOW Plan must advance a paradigm change from water *supply* to an integral water *management* mentality: moving from a mission of providing abundant high-quality water at the lowest cost possible, to one in which water resources are managed in a sustainable manner and with regard for the needs of the environment.
- Watershed-wide planning must transcend specific funding opportunities (e.g. State grants).
- The implementation of the Plan must result in agreements among the Watershed stakeholders on how to manage and operate the watershed.
- The Plan must improve life conditions throughout the Watershed, ensuring that an improvement in the welfare of one area is not at the expense of others.

Objectives and Targets of the OWOW Plan

In order to achieve the Watershed's vision, the Steering Committee and the Pillar Groups participated in numerous meetings and workshops aimed at developing and adopting specific objectives, targets, and high-level strategies for the watershed. **Figure 1** presents the objectives and their relative importance, as determined by the Steering Committee for the first round of IRWMP funding. As this plan is intended to be a tool in an iterative planning process, it is expected that the Steering Committee will reconsider the objectives and associated rankings to reflect changing conditions. Sub-objectives were established for each objective to increase clarity and granularity.

Figure 1 Objectives of the OWOW Plan



Using the objectives as overarching guiding principles, the Steering Committee then developed a number of high-level strategies, which include:

• Increased storage	• Maximizing preservation and use of native plants
• Reduced demand	• Developing risk-based water quality improvements
• Groundwater desalination	• Incorporating integrated water planning in General Plans
• Water recycling	• Managing public property for more than one use
• Consideration of stormwater as a water supply	• Creating watershed governance
• Valuing water differently	• Implementing watershed-wide education programs

Furthermore, the Pillar Groups developed, based on their technical expertise, 13 specific quantifiable targets that allow measuring the extent to which the plan objectives are being met, including:

1. Recycle and reuse 100% of the wastewater in the watershed.
2. Store water to account for half of watershed demand for 3 years.
3. Reuse all of Santa Ana River flow at least once.
4. Reduce potable water use by 20% by 2020.
5. Capture and recharge 80% of rainfall.
6. Fill gaps in riparian corridors to provide wetlands and linkages between open space and natural habitat.
7. Meet California FloodSAFE goals and construct soft bottom flood systems.
8. Meet water quality standards.
9. Remove salt from watershed to improve salt balance.
10. Complete the SAR Trail and connect all tributary corridors to it.
11. Assure adequate water supply and safe wastewater treatment and disposal.
12. Reduce greenhouse gas emissions from water management activities.
13. Increase resource efficient land use.

Benefits of the OWOW Plan

Benefits resulting from the implementation of the OWOW Plan, and from the planning process itself, will materialize at different time horizons and will have very different characteristics. While some specific projects will be operational within a couple of years, other more ambitious projects, such as those requiring significant investment, technological development, or new mindsets and behaviors, could take years or decades to be fully realized. Similarly, some *hard* projects will provide immediate tangible benefits (e.g. a new groundwater desalination facility), while *softer* projects will result in *less tangible* benefits in a longer timeframe, such as creating a new water ethic among water purveyor and users or changing our land use patterns.

Soft benefits of the Plan include:

- The adoption of a single set of values, goals, targets and high-level strategies for the watershed as a whole that provide a blueprint for water resources development over the next 20-30 years, developed with the input and buy-in of people from all corners of the watershed representing diverse and oftentimes competing interests.
- A list of prioritized multi-benefit projects – projects that provide benefits to more than one user or sub-region of the watershed and that address more than one environmental resource.
- A vision for the watershed future that transcends specific funding opportunities for local projects and integrates multiple interest (e.g. economic growth vs. environmental protection).

Hard benefits of the Plan upon implementation include, among other:

- Increased and more reliable water supplies.
- Improved water quality.
- Enhance habitat.
- Increased and enhance recreational opportunities.
- Green house gas emissions mitigation.

OWOW Planning Process

SAWPA officially launched the IRWMP planning effort during a meeting on April 17, 2007, in which 178 officials representing more than 100 agencies in Riverside, San Bernardino and Orange counties met to discuss the framework for the OWOW Plan, a shared vision of the Watershed. From the very beginning, the process has been opened to, and has received the participation of representatives from all geographic regions and political jurisdictions within the watershed, and from diverse representatives of different sectors of the community (governments, water agencies, development and environmental community, and the public at large).

The OWOW process was led by a Steering Committee composed of public officials from counties and cities in the Watershed, representatives from the environmental, regulatory, and business communities, and representatives from the Santa Ana Watershed Authority (SAWPA).

The Steering Committee was supported by numerous technical experts grouped into ten disciplines (known as Pillars), ranging from water supply and quality, to climate change, to environmental justice (See **Pillar Leaders** List). Participants from numerous agencies and organizations have volunteered to serve on the Pillar groups and committees and have addressed every aspect of water management planning. Participants integrated water supply with environmental needs, and included the environmental justice and disadvantaged communities in integrated water solutions.

SAWPA acted as the Regional Water Management Group (RWMG) for the process, and while SAWPA facilitated the planning process and provided technical input and support through its staff and consultants, the development of the goals and strategies of the Plan and the decision making

process were done by the Steering Committee with the support of the Pillars and with consideration to comments from the public at large.

The OWOW planning process was intended to be problem-focused with the goal of developing linkages across the region's varied geography and across the numerous disciplines that have an interest in water. Rather than focus on projects first, the Steering Committee suggested a planning process that focuses on the value of water to the region, then on how that water is managed, and finally, on the identification of specific projects. The process identified three broad areas where action is needed: the development of a water ethic that values water differently; a more collaborative approach to water management; and the construction of sustainable water infrastructure.

The fundamental concept for this planning process was to pull parties together in every aspect of the water arena – those who provide water, those who use it, and those who manage it – in a way that has never been done before, and in a way that goes beyond the interests of any one agency. This approach marked a major shift from previous IRWM planning efforts by greatly expanding the number and type of agencies and organizations involved in the process.

In developing the OWOW Plan, a decided "bottom up" approach for governance was envisioned. Unlike in previous SAWPA plans or other planning approaches across the State, every effort has been made to allow the key discussions of major water resource issues, concerns, problems, goals and objectives and potential solutions to originate and be first fully vetted at the stakeholder level. By expanding the involvement and collaboration to the *on-the-ground* level, greater buy-in and support was realized for this planning development process.

Pillar Groups

In order to manage the initial planning work, the stakeholders were organized into ten separate workgroups or *pillars* centered around the following water resource management areas.

1. Water Supply Reliability	2. Flood Risk Management
3. Water Quality Improvement	4. Environment and Habitat Enhancement
5. Water Recycling	6. Parks, Recreation, and Open Space
7. Water Use Efficiency	8. Climate Change
9. Water and Land Use	10. Environmental Justice

The Pillars consisted of approximately ten to 60 volunteers, depending on the topic and interest level, and included participants from local agencies, special districts, non-profit organizations, university officials, Native American tribes, and private citizens, led by a volunteer chair having expertise in that specific water resource area.

The Pillars were tasked with the definition of the Watershed problems for their respective discipline and in the identification and development of potential solutions and strategies. While

Pillars were asked to focus on one specific discipline based on their technical expertise, they were also asked to step out of their role and view problems from the other Pillars' perspectives. It was through this process that new synergies were developed and multi-benefit programs were formed.

Steering Committee

The next level of governance up from the foundation of the pillars was the OWOW Steering Committee, which consisted of ten representatives from across the Santa Ana River Watershed. The Committee was convened by the SAWPA Commission, and included two representatives from the SAWPA Commission representing water agencies, who serve as Convener and Vice-Convener; three County Supervisors - one from each county; three mayors - from large cities in each county; a business representative from the development community and; a representative from the environmental community.

The Steering Committee's role was to serve as the developer of plan goals and objectives for the Watershed, and to act as the oversight body that performs strategic decision making, crafts and adopts programmatic suites of project recommendations, and provides program advocacy necessary to optimize water resource protection for all.

Resource Management Strategies

The OWOW plan encourages the development of projects that:

- Provide watershed-wide benefits, over local projects that create problems elsewhere.
- Develop Multi-benefit projects, rather than more inefficient costly single purpose projects.
- Integrate all types of water (imported, local surface, local ground, stormwater, effluent) in a more comprehensive water management view.
- Integrate multiple interests (e.g. economic growth vs. environmental protection), rather than focus on conflict and litigation.
- Avoid and/or reverse impacts to natural hydrology.
- Reduce harm to others, rather than push project and environmental costs onto other communities.

Projects Included in the Plan

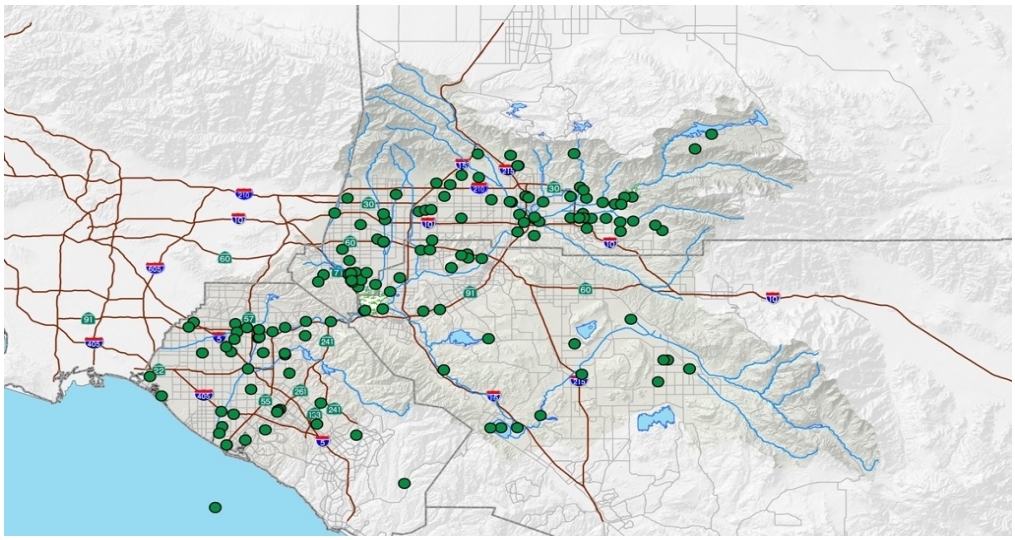
SAWPA issued an initial call for projects to be included in the OWOW Plan from any public agency or non-profit organization in the Watershed. The period for the preparation of project application was from May 17 to June 30, 2010. During this initial call for projects, project applications were evaluated in a two-step process to: 1) determine their eligibility to be included in the OWOW Plan, and, 2) to prioritize projects for potential Prop 84 funding based on their merits to address the Watershed goals and objectives.

The objective of this process was to develop a comprehensive and unique watershed-wide plan that transcends a request for Proposition 84, Chapter w funding. The intent was to develop a blueprint

for water resources management in the Watershed that incorporates all meritorious projects, beyond any specific short-term funding availability.

A total of 297 candidate projects were received from 64 diverse agency sponsors from throughout the Watershed. Project sponsors include water utilities, cities and counties, NGOs, the USDA Forest Service, and private-public partnerships. As shown in the map below, candidate projects are well distributed throughout the watershed (as shown in **Figure 2**).

Figure 2 Project Locations



During the call for projects, sponsors were encouraged to consider development and collaboration on watershed-wide, integrated projects that would provide multiple benefits to more than one agency or region of the Watershed. As shown on **Figure 3**, nearly 70% of received applications are for projects that provide a benefit for the entire watershed or multiple municipalities and sub-watersheds.

Furthermore, candidate projects provide a variety of benefits, as shown in **Figure 4**. Guaranteeing a sustainable, reliable, drought-proof and equitable water supply is one of the main objectives of the OWOW Plan and of the mandate of many relevant agencies in the Watershed. This results in 60% of candidate projects being related to water supply. Nevertheless, the remaining 40% address water quality, habitat restoration and flood control, and recreational and open space needs of the Watershed (**Figure 4**). Many of the projects also provide more than one type of benefit.

Figure 3 Project Benefit Split by the Extent of Impact on the Watershed

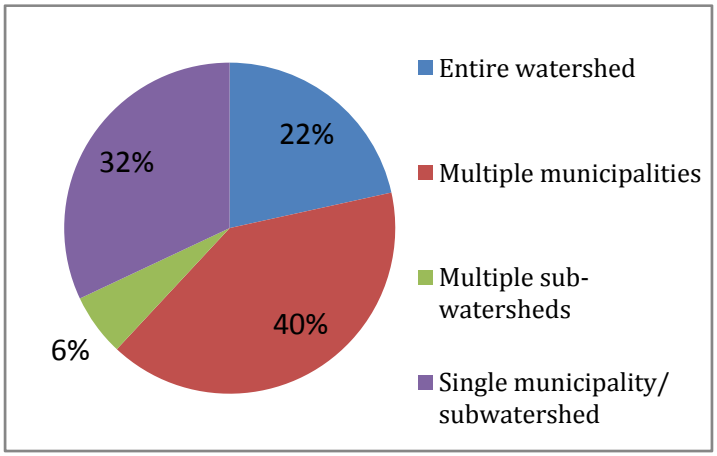
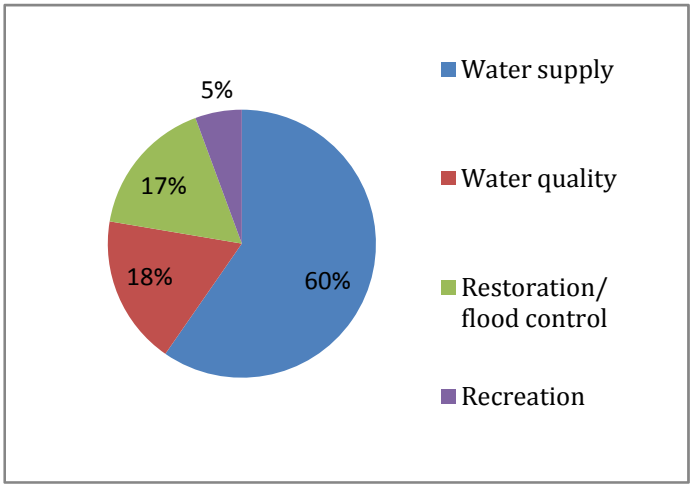


Figure 4 Watershed Projects by Benefit



Finally, a significant number of candidate projects will benefit disadvantaged (40%) and Tribal (14%) communities in the Watershed (**Figures 5 & 6**).

Candidate projects have a total cost estimate of $3,582 million, of which $1,682 million (47%) is being requested for grant funding under Proposition 84, Chapter 2. The remaining $1,900 million (53%) will be covered through a combination of local funds ($1,355 million) and federal contributions and SRF loans (**Figure 7**). On average, each project is requesting grant funds in the amount of $5.7 million, although the amount requested varies significantly from $34,000 to $100 million. These funding requirements represent a significant challenge for the Watershed.

Figure 5 Projects Benefiting Tribal Communities

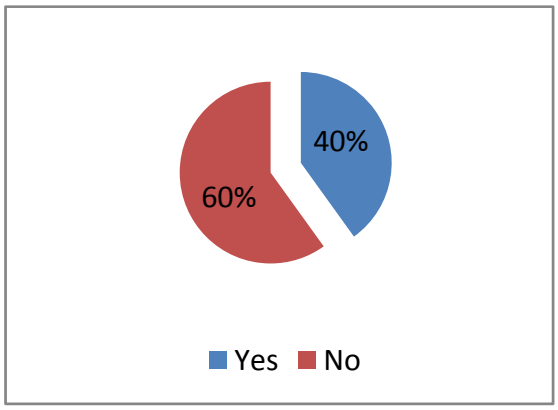
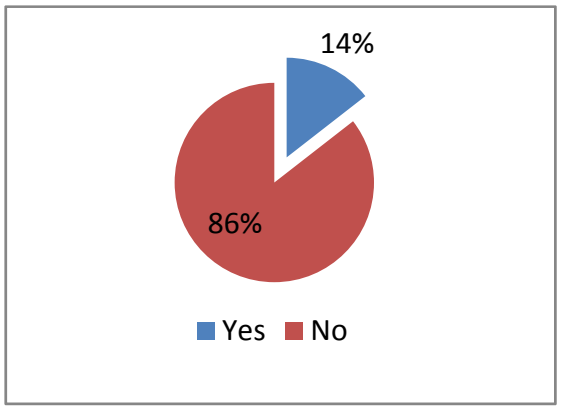


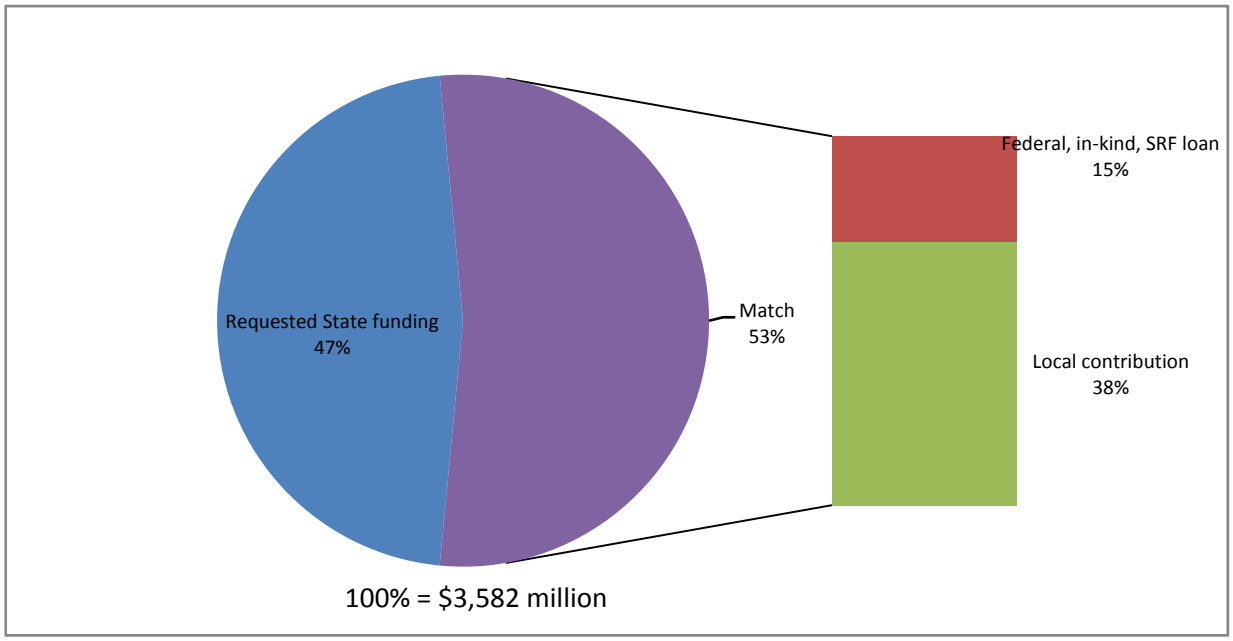
Figure 6 Projects Benefiting Disadvantaged Communities



As stated earlier, this planning process transcends specific funding cycles. Projects are included in the OWOW Plan and ranked based on their merit to address the Watershed's pressing needs, regardless of available funding opportunities at any given time. As funding programs become available, projects included in the OWOW Plan will be selected for funding.

However, it should be noted that any project list is dynamic. Projects are refined continuously and redefined between inception and implementation. The list reflects a response to conditions at a specified date. As the OWOW process encourages further collaboration and the development of multi-benefit, multi-purpose projects, a project list can also serve as a tool to identify new partners or project synergies. To remain viable planning tools and relevant to available funding sources, project lists should be updated regularly. Using the electronic data submission format from the first round of project submittals, it is possible to regularly update project information. With this information, the Steering Committee can track the Watershed's progress in meeting OWOW goals.

Figure 7 Funding Structure of Candidate Projects



Project Evaluation Process

Submitted project applications were evaluated by SAWPA staff in a transparent manner based on the information provided by the applicant and a pre-established process to determine: 1) their eligibility to be part of the OWOW Plan, and 2) their priority to receive Proposition 84, Chapter 2 funding in the initial expedited round. Under the direction of the Steering Committee, updated or additional information may be requested for subsequent rounds of funding.

This two-step process had as an objective the development of a comprehensive watershed plan per DWR guidelines, regardless of which projects included in the Plan receive Proposition 84 funding during the current funding cycle. As a result, the Plan will be a blueprint for the improvement of water resources management in the Watershed, and not merely a document for requesting funding. Projects in the Plan not receiving Proposition 84 funding at this time will be candidates for future funding opportunities, providing an incentive for project sponsors to participate in the watershed-wide plan.

Projects were selected to be included in the OWOW Plan based on the sponsor's eligibility, being located in the Watershed, and providing at least one of four benefits: water supply, water quality, habitat restoration/flood control, or recreational opportunities.

Candidate projects included in the OWOW Plan then were evaluated and prioritized for Proposition 84, Chapter 2 funding based on the degree to which they comply with Evaluation Criteria developed by SAWPA staff. These criteria were based on the goals and objectives, strategies and targets established by the Steering Committee and the Pillars.

After initial screening, highly ranked project proposals were reviewed in detail by an independent technical review panel. The panel considered technical and economic feasibility, OWOW goals and objectives, and relative ranking weights developed by the Steering Committee. This panel was tasked with verifying the data provided by project proponents and ensuring that the numeric ranking tools are applied consistently across projects.

Plan Performance and Monitoring

SAWPA will develop a plan to monitor the implementation of the OWOW Plan and the specific projects included. The monitoring will take place at two levels – plan and project – to:

- Ensure progress is being made toward meeting the objectives of the Plan.
- Ensure specific projects identified in the Plan are being implemented as planned in terms of schedule, budget, and technical specifications.
- Identify potential necessary modifications to the Plan or to specific projects, in order to more efficiently and effective accomplish the goals and objectives of the Plan.
- Provide transparency and accountability regarding the disbursement and use of funds for project implementation.

Program management and project administration will be performed by SAWPA, upon receipt of funding, following a process similar to the one used for projects funded through Propositions 13 and 50. SAWPA will serve as administrator for agreements between State Agencies and SAWPA, as well as program manager for the various programmatic requirements and related activities required through these agreements.

Monitoring at the plan level

SAWPA, along with the support of stakeholders in the Watershed, will evaluate the performance of the OWOW Plan in terms of accomplishing the plan objectives and targets. While objectives are overarching principles guiding water sustainability in the Watershed, targets are more specific and measurable, and can be mapped to specific objectives of the Plan. For this reason, plan performance indicators are aligned to individual targets. Nevertheless, it is important to point out that some targets are difficult to quantify (e.g. Increase resource efficient land use). It is anticipated that plan performance will be evaluated every two years. SAWPA will lead the effort, but active support from many stakeholders in the Watershed will be required to provide data and information, as well as insight.

Results of the bi-annual evaluation will be published by SAWPA on the OWOW Webpage, and will include the use of visual tools (i.e. dashboards) to show the progress to date in achieving the plan targets.

Monitoring at the project level

In addition to monitoring the performance of the OWOW Plan as a whole, the performance of specific projects in the OWOW Plan receiving funding will be evaluated every six months. The

evaluation will be led by SAWPA but will require extensive participation for the sponsor of the project in question.

Results of the semi-annual project evaluation will be published by SAWPA in the OWOW Webpage, and will include the use of visual tools (i.e. dashboards) to show the progress to date in the implementation of each project.

Adaptive Management

The dynamic nature of projects and plans in the Watershed will result in the need for frequent updates to the OWOW Plan. Because the Plan will be used by agencies in the Watershed to help integrate individual plans and to focus funding opportunities on projects that are most effective and ready to proceed, the information contained in the plan must remain current to be effective.

In recognition of the ever changing aspects of the planning process, SAWPA will update and refine this Plan every three to five years. The plan update will take into consideration recent development in the Watershed, such as projects implemented since the last review, and new understanding of the watershed issues. Furthermore, the results of the bi-annual performance review will be used to identify potential modification to the watershed strategy.

As new funding opportunities arise to support the implementation of the remaining water resource projects, SAWPA will continue to pursue these opportunities. With the support of local and State agencies, further progress can be made in meeting long-term goals of water sustainability for the region and the State.

Continued stakeholder involvement and plan success

Success of this continuous planning process depends on continued stakeholder engagement. The plan then will continue to be watershed-wide, open and transparent, and comprehensive. The Steering Committee and the Pillars will continue to function as representatives of the community at large and provide guidance and insight to the process.

As part of the bi-annual update process, stakeholder conferences will be convened to review progress to date in accomplishing targets and to identify and prioritize remaining gaps, as well as to revisit strategies.

Increased collaboration will lead to the development of more multi-benefit, multi-function projects leading to a new model for managing watershed issues. This new twenty-first century model will create a sustainable watershed, where all residents and the environment enjoy a successful future.

Chapter 1 One Water One Watershed

SAWPA

The Santa Ana Watershed Project Authority, or SAWPA, is a Joint Powers Authority, focusing on water supply and water quality. Its stated mission is to develop and maintain regional plans, programs, and projects that will protect the Santa Ana River basin water resources to maximize beneficial uses within the watershed in an economically and environmentally responsible manner. First formed in 1968 as a planning agency, SAWPA was reformed in 1972 with a mission to plan and build facilities to protect the water quality of the Santa Ana River Watershed, or simply, the Watershed. The agreements formalizing the current agency were signed in 1974 and went into effect in 1975.

The Watershed is home to over five million people in southern California, and the region's population is projected to grow to almost ten million people within the next 50 years. This growth certainly will accelerate the pressures already on the region's limited water resources. SAWPA has supported its five member water agencies and various stakeholder groups throughout the watershed including the Santa Ana Regional Water Quality Control Board (Regional Board) with developing and implementing plans to ensure that there is sufficient clean water to support all the water needs of the watershed into the future.

SAWPA Member Agencies

SAWPA carries out functions useful to its five member agencies: Eastern Municipal Water District (EMWD), Inland Empire Utilities Agency (IEUA), Orange County Water District (OCWD), San Bernardino Valley Municipal Water District (SBVMWD), and Western Municipal Water District (WMWD). The jurisdiction of SAWPA and its member agencies spans approximately 2,800 square miles of the Santa Ana Watershed encompassing much of Orange County, a sliver of Los Angeles County, and the major population centers of western Riverside and southwestern San Bernardino Counties. Each of these agencies plans and executes long-term projects and management programs of their own, but it is primarily agencies working through SAWPA that provide the vehicle for effective and concerted planning efforts on a regional basis.

Eastern Municipal Water District

Eastern Municipal Water District is a retail water agency servicing an area of approximately 555 square miles in western Riverside County. EMWD serves a population of approximately 675,000 in six incorporated cities and unincorporated portions of western Riverside County. In addition to its role as a retail agency, it also provides wholesale water to the sub-agencies Lake Hemet Municipal Water District, City of Hemet, City of San Jacinto, City of Perris, Nuevo Water Company, Elsinore Valley Municipal Water District (EVMWD), and Rancho California Water District.

As a member agency of the Metropolitan Water District of Southern California (MWD), EMWD gained a supply of imported water from the Colorado River Aqueduct (CRA) and ultimately, water from northern California through the State Water Project (SWP), which transports water from Northern California via the California Aqueduct. EMWD's initial mission was to deliver imported water to supplement local groundwater supplies. Over time, EMWD's role changed as additional agency responsibilities were added, including groundwater production and resource management, wastewater collection and treatment, and finally regional water recycling.

Inland Empire Utilities Agency

Inland Empire Utilities Agency's service area covers about 242 square miles in the southwestern corner of San Bernardino County, and serves a population of approximately 800,000. IEUA provides regional wastewater service and imported water deliveries to eight contracting agencies. These include the City of Chino, City of Chino Hills, Cucamonga Valley Water District (CVWD), City of Fontana, City of Montclair, City of Ontario, City of Upland, and Monte Vista Water District.

As a member agency of MWD, IEUA provides supplemental water, as well as regional wastewater treatment for both domestic and industrial clients, and energy recovery/production facilities. In addition, the Agency has become a recycled water purveyor, biosolids/fertilizer treatment provider, and continues to focus on water supply salt management for the purpose of protecting the regions vital groundwater supplies.

Orange County Water District

Orange County Water District's service area covers more than 350 square miles and the Orange County Groundwater Basin. The basin provides a water supply to more than 20 cities and water agencies, serving over 2.3 million people. OCWD owns 1,600 acres in and near the Santa Ana River (SAR) in Anaheim and Orange, which it uses to capture flows and recharge the groundwater basin. OCWD also owns 2,400 acres above Prado Dam, which it uses for water conservation and water quality improvement.

OCWD's mission is to manage and protect the Orange County Groundwater Basin in northern and central Orange County. The groundwater basin supplies approximately two-thirds of the water used by over two million residents in this District's service area. The balance is imported from the Colorado River and from Northern California through the Sacramento/San Joaquin Delta SWP by MWD.

San Bernardino Valley Municipal Water District

San Bernardino Valley Municipal Water District's service area covers about 325 square miles, primarily in southwestern San Bernardino County with a very small portion of its service area in Riverside County. The area within SBVMWD includes a population of around 600,000. SBVMWD spans the eastern two-thirds of the San Bernardino Valley, the Crafton Hills, a portion of the Yucaipa Valley, and includes the cities and communities of San Bernardino, Colton, Loma Linda, Redlands, Rialto, Bloomington, Highland, Grand Terrace, and Yucaipa. SBVMWD's mission is to import water into its service area through participation in the California SWP. SBVMWD also is charged with managing groundwater and surface water within its boundaries through various court judgments.

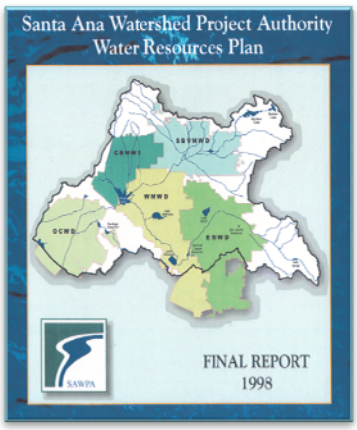
Western Municipal Water District

Western Municipal Water District's service area covers a 527 square mile area of western Riverside County with a population of about 825,000 people. WMWD serves more than 24,000 retail and eight wholesale customers with water from both the Colorado River and the SWP. As a member agency of MWD, WMWD provides supplemental water to the cities of Corona, Norco, and Riverside and the water agencies of Box Springs, Lee Lake, Elsinore Valley, and Rancho California, as well as serving customers in the unincorporated areas of El Sobrante, Eagle Valley, Temescal Creek, Woodcrest, Lake Mathews, and March Air Reserve Base. WMWD also operates and maintains domestic and industrial wastewater collection and conveyance systems for retail and contract services customers in Lake Hills, March Air Reserve Base, Home Gardens, Corona, and Norco.

About one-fifth of the water that WMWD purchases from the MWD comes from the CRA and about four-fifths from the SWP, which transports water from Northern California via the California Aqueduct. WMWD currently imports a small quantity of water from the San Bernardino basin and intends to increase these imports with the implementation of the Riverside-Corona Feeder project. WMWD also has several wells for pumping in its Murrieta Division.

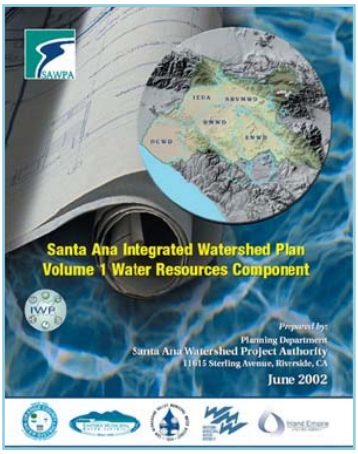
History of Santa Ana River Watershed Planning

Since its formation, SAWPA has been on the forefront of water resource planning for the region. Formed originally as a regional planning agency in 1967, SAWPA undertook the first water quality management program study for the Watershed. These early planning roots provided the important water quality data and analysis for the development of the first Regional Board Basin Plan. Since that time, SAWPA has worked closely with the Regional Board in all Water Quality Basin Plan Updates and watershed planning efforts.



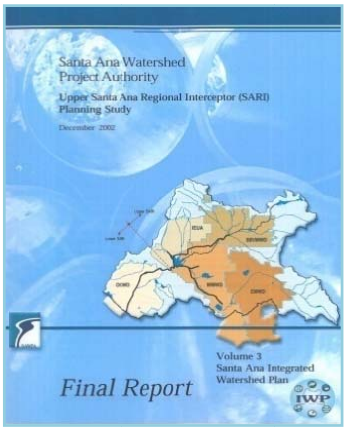
The 1998 SAWPA Water Resources Plan was one of the first watershed-wide water resource plans undertaken by SAWPA to optimize all available water resources in the watershed in an integrated fashion. This plan was initiated after MWD had kicked off their first Integrated Resource Plan in 1995. Because only three of the five SAWPA member agencies were MWD member agencies, the SAWPA Commission directed staff to prepare a similar water resource plan for the Watershed that would examine all available water resource development opportunities and assets within the Watershed. With one of the SAWPA member agencies, Valley District, also serving as an additional importing water agency and SWP Contractor within the Watershed besides MWD, new water resource development projects were identified. This plan was prepared entirely by SAWPA Planning staff.

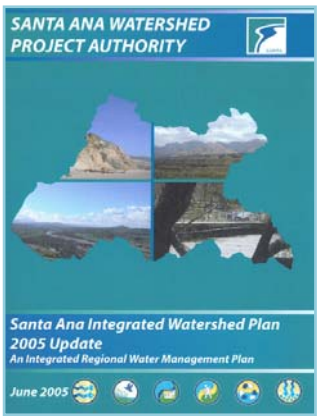
In 2002, SAWPA updated and expanded the water resources planning in its Santa Ana Integrated Watershed Plan (IWP), a three volume planning document that examines water resource management strategies to address regional needs in an integrated fashion. Water resource management strategies identified in this report included water storage, water quality protection and improvement, water recycling, storm & flood water management, and environment and habitat protection.



The first volume of the IWP is the Water Resources Component, a planning document that built upon member agency long-term water resource plans and management programs, thus providing a vehicle to ensure effective and concerted planning efforts on a regional basis. This volume also describes the necessary water resources projects to achieve zero reliance on imported water supply, and the amount of salt removal facilities necessary to achieve a salt balance in the watershed. The second volume of the IWP is the Environmental and Wetlands Component. It describes the watershed-wide wetlands program and watershed plan that integrates wetlands, trails, habitat, open space, education, and invasive species removal.

The third volume of the IWP is the Upper Santa Ana Regional Interceptor (SARI) Planning Component, which provides a foundational evaluation of the upper SARI, the watershed brine disposal pipeline, and a future long-term beneficial use of the SARI as the critical facility required to meet the SAWPA goal of transporting highly saline, non-domestic discharges out of the upper watershed to protect its groundwater resources.



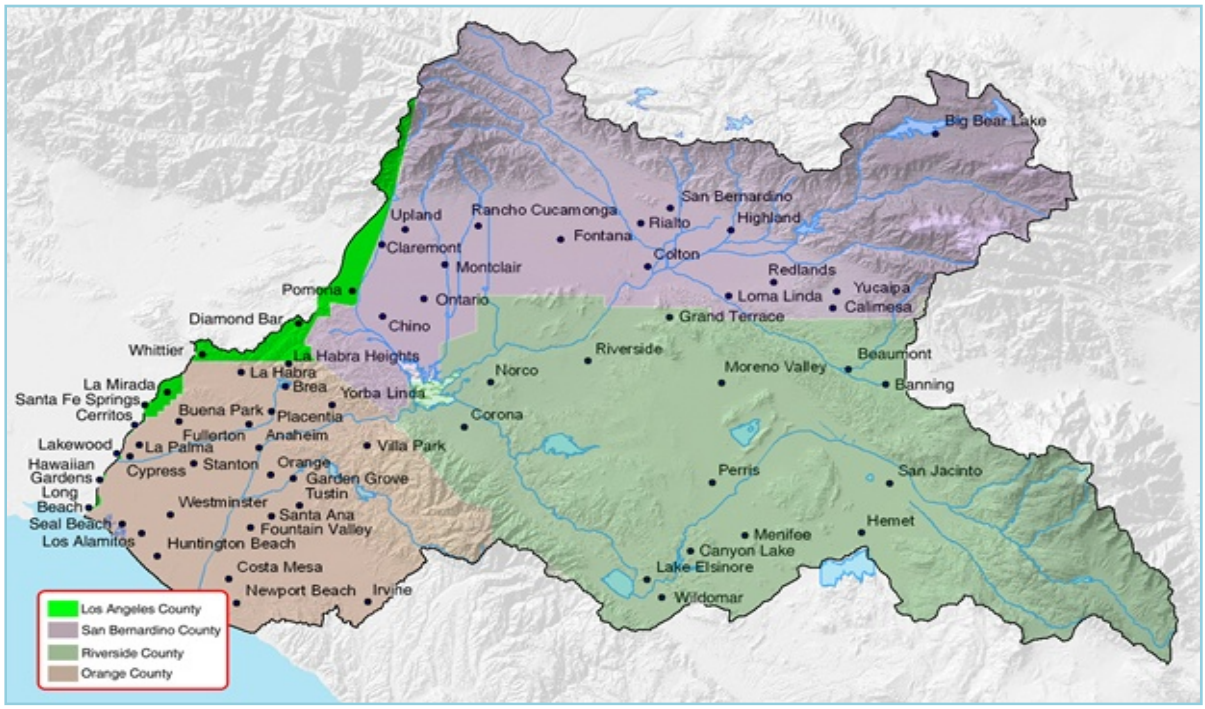


The first two volumes of the 2002 Integrated Regional Water Management Plan (IRWMP) were written and prepared by SAWPA Planning staff, with the third volume prepared by SAWPA's consultant, CDM. The 2002 three-volume report describes integrated water projects and provides justification for the first IRWMP in the State, described under the State Proposition 13 Water Bond. The success of this effort provided funding totaling $235 million for the Watershed.

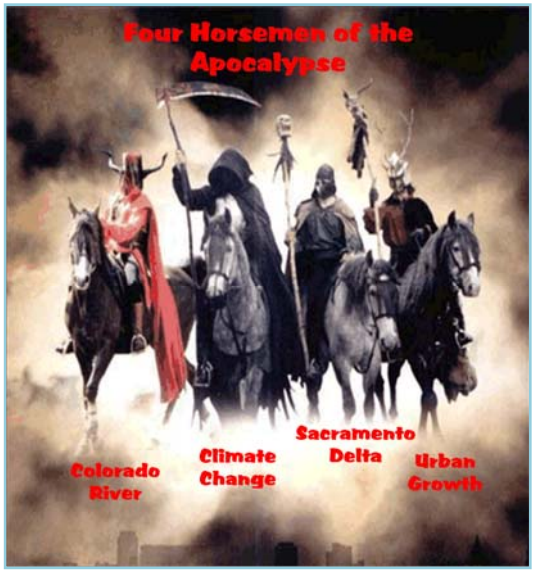
In 2005, SAWPA prepared the Santa Ana IWP 2005 Update, an IRWMP. This report, also prepared by SAWPA Planning staff, updated much of the work from the 2002 report incorporating the Urban Water Management Plans (UWMPs) performed by SAWPA member agencies and sub-agencies, and provided an updated listing of priority projects to achieve the goals of the watershed stakeholders. Recognizing the significant size of the watershed in geography and population, as well as the sheer complexity of coordination and integration of projects, the 2005 report sought to briefly describe and highlight the many detailed resource planning processes and documents that led to a list of proposed prioritized regional projects, as opposed to serving as a detailed technical or scientific water resource evaluation in itself. As a result of these efforts, the plan was ranked among the top ten IRWMPs by DWR staff, and provided the justification for $25 million from Proposition 50 IRWM implementation grant program.

The 2005 report also served as a clear indicator for local and State leaders of the enormous impact of the region on the State and Nation as noted by the following observations:

- Population of the region is larger than 41 U.S. states – 5.6 million people.
- Added over 75% of California's new jobs in the past 15 years.
- Will add over 20% of all new jobs in California in the next 15 years.
- Over 54% of the job growth for the State comes from the SAR region.



- Home to a 110-mile SAR Trail running from the San Bernardino Mountains to the Pacific Ocean.
- Contains some of the most sophisticated multi-agency groundwater management planning and salt management strategies in the U.S.
- Home to effective collaborative Regional Board/stakeholders efforts which now serve as a template for SWRCB strategic implementation.



In light of the growing need to address safe reliable water infrastructure, voters of the State of California passed Proposition 84 in 2006, which allocated $1 billion to integrated regions throughout the State. Concurrent with this support, significant water crises have arisen prompting SAWPA and the regional stakeholders to update the Santa Ana IWP, now called the One Water One Watershed (OWOW) Plan.

The vision of the OWOW Plan is a sustainable Watershed that is drought-proofed, salt-balanced, and supports economic and environmental viability. To achieve this vision, stakeholders must address four major crises or threats, which SAWPA has labeled the Four Horsemen of the Apocalypse. They are:

1) Climate Change resulting in reduced water supplies combined with increased water needs in the region.
2) Colorado River Drought Conditions resulting in reductions of imported supply due to upper basin entitlements and continued long-term drought.
3) San Joaquin Delta Vulnerability resulting in reductions or loss of supply due to catastrophic levee failure or changing management practices of the Delta.
4) Population Growth and Development resulting in interruptions in hydrology and groundwater recharge while increasing water needs.

Further description as to why these crises must be addressed herein follows.

Climate Change

One horseman impacting not just our region or State, but the entire world, is climate change. No longer considered conjecture, the worldwide scientific community consensus is that climate change or global warming is occurring and must be addressed immediately to offset the impact to water resources and the environment. The International Panel on Climate Change has stated that the world's climate is warming by an average of 1.3 degrees Fahrenheit in the past century. Unless current trends are reversed, global warming is projected to keep increasing and raise temperatures by as much as 11.5 degrees by the end of the century. The California Department of Water Resources' (DWR) report entitled, *Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water*, details how climate change already is affecting the State's water supplies, and sets forth a number of recommendations to help avoid or reduce climate change

impacts to water resources. The report indicated that global warming will present significant challenges to future water supply, water quality, ecosystem protection, and flood management. Assessments on water supply and other impacts from climate change indicate likely reductions in snow pack, earlier and larger peak stream flows, potential reduction in runoff, greater evaporative losses, declining ecosystem health, sea level rise, and more extreme weather events, including flood and droughts. Other management activities affected by climate change include the need to consider energy use and greenhouse emissions of water resource projects, as well as the regional vulnerability of water systems.

The DWR report proposes ten adaptation strategies in four categories to deal with the climate change crisis. One of these strategies suggests that regional and local entities implement a diverse portfolio of water management techniques to better address uncertainties of changing water patterns. The report continues by stating that the management approach of IRWM, already in place throughout the State, is a key part of Governor Schwarzenegger's vision for California's water future. The report states that IRWM will become the core strategy in water planning to adapt to the challenges posed by climate change.

Recognizing that drought conditions have been a concern for many years in the dry, semi-arid environment of southern California, the impacts of climate change likely will further exacerbate the challenges and problems of assuring adequate water supply for the future. In June 2008, the concerns of drought and possible climate change impacts became all too real when the State of California formally proclaimed that the State was in a drought and that immediate action was necessary. The drought was announced after two straight years of below-average rainfall, and very low snowmelt runoff – 55% of average conditions. Immediate action was proposed by the State to establish a 20% reduction goal in statewide water use and expand water conservation efforts.

Colorado River Drought Conditions

In addition to the statewide drought, another horseman of the Apocalypse that has impacted the SAR Region is the decreased imported water flow to southern California from the Colorado River. The Colorado River Basin covers a vast western multi-state region extending up into Wyoming, and descending through Utah, Colorado, Arizona, Nevada, and finally into California. Over the eight years prior to 2008, the Colorado River Basin experienced severe drought conditions with

records showing that these years were some of the driest consecutive years in the history of the basin. If the drought conditions continue, reservoirs along the river such as Lake Powell and Lake Mead will continue to drop, and thereby reduce storage releases and energy production.

As N. Christensen reported in his 2004 Climate Change report, *The Effects of Climate Change on Hydrology and Water Resources of the Colorado River Basin*, projections show that by 2050, the Colorado River flow would decline by 18% with the average Colorado River Basin water storage declining by 32%. Experts conducting studies of tree ring data in the Colorado River Basin have determined that severe and prolonged droughts, lasting up to 60 years or more, have occurred in the past and are likely to occur again. As population continues to grow throughout the dry desert southwest, the water levels at Lake Powell and Lake Mead likely will continue to drop, with some projection indicating that the lakes may become dry by 2025.

MWD, which serves as the importing water agency for most of southern California, relies heavily on the flows from the CRA to assure that water demands are met. In 2005, flows from CRA basic apportionment of 0.5 million AF along with various transfer programs, canal lining projects, and additional storage programs amounted to 0.75 million AF being delivered to its service area. With further CRA development and storage projects, MWD has set a goal in their last Integrated Regional Plan to reach 1.25 million AF. However, as this source of flows decreases, the concerns of meeting this goal and providing adequate water supply to meet the region's future water demands will intensify. Because the drought conditions, as well as climate change, are impacting the entire Colorado River Basin, river flows will be further depleted as a result of upper basin states maximizing their deliveries from the River and fully utilizing their entitlements to meet continued water demands. In the past year, diminished runoff and increased extractions resulted in a reduction of MWD's imported supplies by nearly a quarter. Consequently, assurances of even the basic apportionment of 0.5 million AF to MWD as one of the last river entitlements is now in jeopardy.

San Joaquin Delta Vulnerability

The San Joaquin Delta is home to over 750 plant and animal species. Out of 29 identified indigenous fish species, 12 of them are either threatened with extinction or already have become extinct. Endangered species include the spring-run and winter-run Chinook salmon and the Delta smelt. Other fish species are threatened as well, including longfin smelt, threadfin shad, and striped bass. Water diversions, urban development, loss of habitat, impaired water quality due to pesticides, and increased competition from invasive species are all factors thought to be influencing the decline; many scientists have warned that an ecological crash of the food web and the Delta food web is possible. In August 2007, with recent reports that Delta smelt populations had dropped significantly, State Court Judge Oliver Wanger ordered water exports reduced anywhere from 6 to 33% during the months of December through June, in order to protect the smelt. "The evidence is ncontradicted that

these project operations move the fish. It happens and the law says something has to be done about it," said Wanger.

The shutdown of the SWP interrupted water deliveries to water agencies throughout California, forcing many to utilize stored water reserves to serve some 25 million people, not to mention millions of acres of farmland. The reaction of water officials across the State was of shock and concern. Governor Schwarzenegger issued a press release, calling the ruling "a devastating blow to our water supply and economy", while Jeff Kightlinger of MWD stated, "Judge Wanger's decision to cut back water supplies doesn't address various other Delta problems and issues. Invasive species will continue to deplete food supplies for Delta smelt, pesticide runoff that can harm the estuary will persist, and the levee system will remain vulnerable to earthquakes and rising sea levels caused by climate change."

The crisis of the Delta centers not just on water pumping issues, but also on the condition of the Delta's levees, many of which were not properly designed. Concerns have arisen that if several key levees should fail due to increasing sea levels or earthquake conditions, water deliveries could be interrupted again. Looking long-term, rising sea levels caused by climate change also could push additional salt into the Delta, potentially affecting the quality or availability of drinking and irrigation water. As a result, public agencies are working together like never before to seek solutions to these problems to ensure continued deliveries of high quality Delta water for the foreseeable future.

Population Growth and Development

Most of the precipitation and snowmelt runoff occurs in the northern part of California, but the majority of the population lives in the drier central and southern portions of the State. This imbalance is not expected to change. According to population estimates issued by California's Department of Finance, four of the five southern California counties will add more than ten million people between now and 2050, an increase of 65% over year 2000 census numbers. Los Angeles is expected to remain the most populated county in California, followed by Riverside County, San Diego County, Orange County, and San Bernardino County, all of which portions of the most heavily populated areas fall within the Watershed. Overall, the State's total population will increase to 60 million people by the year 2050, an increase of over 56% from the 2000 census numbers.
With the increasing population growth, efforts to assure adequate water supply for the region will become more difficult. The challenge facing the Watershed is that some of the core population growth occurring in the State, as well as the Nation will arise out of this region. As population

increases, demands for adequate housing also will increase. The crisis to water resources is not the growth of development *per se*, but how the water is used in new development that assures sustainability.

In the Watershed, one of the most rapidly urbanizing and growing regions in the State, huge areas of land that historically captured and recharged natural runoff into the groundwater and provides important replenishment water for pumping gradually is being paved over. The runoff from development instead is directed to storm sewers and channels that discharge to downstream rivers and streams and eventually are lost to the ocean. This tremendous amount of water that is no longer percolating into the ground is picked up along parking lots and streets and further contaminated by oil, grease, trash, bacteria, and fertilizer additives applied to adjacent landscaping. These byproducts represent a major water quality threat to downstream water bodies, many of which have been listed by water quality regulators as impaired, requiring total maximum daily loads (TMDLs). Taken cumulatively, the water lost from the resulting development when sustainable land use and water use practices are not in place, if continued unchecked, will become a major water crisis for the region, and one of the four horsemen of the apocalypse impacting water resources. A need for a new water ethic for the preciousness of water, increased water capture and percolation, and improved land use practices will be required to handle this looming problem.

Santa Ana "One Water One Watershed" IRWMP Planning Effort

To address the four horsemen of the apocalypse, water agencies and stakeholders in the Watershed are working together to plan for climate change, long-term drought, further interruptions in Delta water, and population growth. This effort is being coordinated by SAWPA, who has helped coordinate water and sewer improvement projects for its member agencies for many years. It also has facilitated a number of task force efforts directed at specific water issues. But under SAWPA's leadership, the joint powers authority has expanded its integrated watershed planning outreach efforts to include every aspect of water and every stakeholder on a watershed-wide basis.

SAWPA officially launched this IRWM planning effort during a meeting in the City of Chino on May 24, 2007, in which 178 officials representing more than 100 agencies in Riverside, San Bernardino and Orange counties met to discuss the framework for the "OWOW Plan", a shared vision of the Watershed – a 2,650-square mile area from the San Bernardino Mountains westward to the Pacific Ocean. The goal and expectation was that this IRWMP would be far more comprehensive than any plan that could be developed by a single agency.

Participants from numerous agencies and organizations have volunteered to serve on committees and have addressed every aspect of water management planning, including water supply reliability, water quality improvement, water conservation, climate change, land use, flood risk management, environment and habitat enhancement, water recycling, as well as water use in parks, recreation and open space areas. Participants also integrated water supply with environmental needs and included environmental justice and disadvantaged communities' issues into integrated water solutions.

The fundamental concept for this planning process was to pull parties together in every aspect of the water arena—those who provide water, those who use it, and those who manage it—in a way that has never been done before and in a way that goes beyond the interests of any one agency. This approach marked a major shift from previous IRWM planning efforts by greatly expanding the number and type of agencies and organizations involved in the process. It is noted that some agencies' missions are so narrowly defined that they cannot easily plan for improvements that also would benefit surrounding constituencies.

With the advent of several water crises approaching or facing us now, the need to move forward with water resource integrated planning has become absolutely necessary. Through long-term collaboration among the many participating agencies, new synergies and multi-beneficial projects can be developed that focus on sustainability for the future. In this fashion, future funding can be leveraged for the benefit of everyone in the Watershed. It is clear that this type of planning also is critical for economic development. If water and the other amenities that go with it are not available, economic development will be curbed substantially.

Unlike previous IRWMPs prepared by SAWPA, the OWOW Plan is divided into two phases. The first phase focuses on integrated water resource planning without identification of specific priority projects.

Similar to a city or county general plan, the OWOW Plan provides an overall view of water resources with identification of current conditions and problem identification, current and future management strategies, and opportunities for collaboration and integration. Types of projects, rather than specific projects, have been identified in this first phase, similar to the relationship between a general plan to a specific plan. Individual projects will be reviewed, described and prioritized in the next phase of the OWOW Plan. The culmination of the first phase and all the stakeholder efforts were described at a major conference for the OWOW Plan held on January 29, 2009. The conference was entitled, *State of the Santa Ana River Watershed – Overcoming Boundaries*.

The goal of the conference was to continue to conduct outreach with watershed stakeholders to review efforts to find solutions to water issues in the Watershed. Through this conference, for the first phase of the OWOW Plan, organizers, including SAWPA are accomplishing the following:

- Further development of a regional "Santa Ana River Watershed" identity that encourages cooperation in addressing regional issues, both locally and legislatively.
- Inform those who manage water resources of possible interdisciplinary conflicts and create synergies (e.g., water supply and flood agencies manage the same surface water resources, but frequently manage resources in a manner counter-productive to each other's interests).
- Better engage the land use and business community, showcasing water supply and quality as cornerstones of sustainable economic growth.

The next phase of OWOW commenced on June 1, 2010, with a call for projects and the development of a rating and ranking system to attract the most cost effective, multi-beneficial, and sustainable water projects needed for the region and State. More details about the governance of this process are discussed below.

OWOW Governance

In developing the One Water One Watershed (OWOW) Integrated Regional Water Management (IRWM) plan for the Santa Ana River Watershed, a decided "bottom up" approach was envisioned for governance, as opposed to a "top down" approach. At the core of this approach was that unlike previous SAWPA IRWM plans or other IRWM planning approaches across the State, every effort has been made to allow the key discussions of major water resource issues, concerns, problems, goals and objectives, and potential solutions to originate and be fully vetted at the stakeholder level first – the stakeholders being the local agencies, organizations and other interested parties within the Santa Ana River Watershed. By expanding the involvement and collaboration of stakeholders at the "on-the-ground" level, it was possible to incorporate the deeper understanding of local issues afforded by stakeholders, and generate greater buy-in and support.

Consequently, if one were to ask where the governance for the Santa Ana River Watershed OWOW process originates, we believe it is at the grass-roots level, the foundation of a decentralized and collaborative "big tent" approach.

OWOW governance takes place at several levels:

- Involvement from the watershed community at large through the creation of ten working groups (referred to as **Pillars**) representing different water issues, and in charge of identifying issues, proposing potential solutions, and writing the OWOW Plan.
- The formation of a Steering Committee composed of elected officials and representatives from water districts, the private sector, the environmental community, and the regulatory community, tasked with the development of the goals and objectives of the plan, strategic decision-making, project prioritization, and issuing recommendations.
- SAWPA administration and staff in charge of facilitating this bottom-up approach to watershed planning.
- Additional open public participation through a series of public workshops and meetings, as well as open sessions of the Steering Committee and SAWPA Commission in which the OWOW process was discussed

Pillars

In order to manage the initial planning work, the stakeholders were organized into ten workgroups, or Pillars, centered on specific water resource management issue. These ten areas are aligned with the Resource Management Strategies identified in the Proposition 84 Guidelines, as summarized in the following table.

Pillar group	**Corresponding Prop 84 Guidelines Resource Management Strategies**
Land Use and Water	Increase water supply Improve water quality Practice resource stewardship
Water Supply Reliability	Reduce water demand Improve operational efficiency and transfers Increase water supply
Water Recycling	Increase water supply Improve water quality
Water Use Efficiency	Reduce water demand
Water Quality	Improve water quality
Environmental and Habitat Restoration	Practice resource stewardship
Stormwater Risk Assessment	Improve flood management
Environmental Justice	Included in Guidelines as part of Impact and Benefit Standard
Parks and Open Space	Not explicitly mentioned in Guidelines
Climate change	Included in Guidelines as separate standard

The pillar categories were chosen based upon a review of water resource management strategies defined in the California Department of Water Resources (DWR) State Water Plan, previous DWR guidelines for IRWMP development, and local water resource needs.

The Pillars consisted of approximately 10 to 60 volunteers depending on the topic and interest level. The volunteers included participants from local agencies, special districts, non-profit organizations, university officials, Native American Tribes, and private citizens. Each pillar was led by a volunteer with expertise in the water issue assigned to each particular group. The leaders were selected by the SAWPA Commission and approved by the Steering Committee, and were responsible for working with their groups in organizing, leading, and facilitating the planning process for their particular topic. At the end of the process, each pillar group prepared a chapter of the Plan, documenting current conditions and issues, and describing current and future watershed management strategies.

In addition to identifying issues and potential strategies for their particular area of interest, the pillars were asked to view the watershed problems from a multidisciplinary perspective that extended beyond their topic, and to consider other pillars' perspectives. For example, the water supply pillar had to keep into consideration environmental and habitat restoration issues when developing their strategies. Through this process, synergies were developed and multi-benefit programs were identified. For example, through this approach, it was possible to incorporate the understanding that many downstream water resource and water quality problems could be more effectively and efficiently addressed upstream at the source, thus requiring collaboration with other entities. Over time, this process of collaboration among the pillar groups provided a more unified vision that resulted in new integrated and multi-beneficial solutions to water resource challenges, and that increased collaboration among jurisdictions and geographies.

Another role of the Pillars was to provide support and input to the Steering Committee about the OWOW goals and objectives, based on their technical expertise in various water resource fields and their local knowledge.

It is important to point out that the planning approach taken for the development of this plan transcends previous integrated regional water resource planning efforts by deemphasizing planning solely as a prerequisite for an impending grant funding opportunity or for the development of a list of specific projects. Rather, the emphasis was placed on building a collaborative approach amongst stakeholders to help meet long-term (2025 time horizon) goals and objectives in an integrated and multi-beneficial manner.

After the completion of the Plan, the pillar groups will continue meeting to explore new opportunities for collaboration.

Steering Committee

The next level of governance up from the foundation of the pillars was the OWOW Steering Committee. The Committee, consisting of 11 representatives from throughout the watershed, was convened by the SAWPA Commission and included:

- 2 representatives from the SAWPA Commission, representing water agencies, who serve as Convener and Vice-Convener
- 3 County Supervisors - one from each county
- 3 mayors - from large cities in each county
- 1 business representative from the development community
- 1 representative from the environmental community
- 1 Regional Water Quality Control Board Member

The Steering Committee's role is to serve as the developer of integrated regional water management goals and objectives for the watershed and to act as the oversight body that performs strategic decision making, crafts and adopts programmatic suites of project recommendations, and provides program advocacy necessary to optimize water resource protection for all.

Furthermore, through the Steering Committee, the public at large can voice its opinion during its public meetings. Public meetings are held at least quarterly and are conducted in accordance with the Ralph M. Brown Act when discussing matters of policy and project selection.

The Steering Committee members serve a term of two years under their committee role. If a Steering Committee representative is termed out of office or resigns from the office seat, the representative may continue in the assigned Steering Committee role until the two-year term expires, if requested by the Steering Committee. Steering Committee members may be appointed for multiple terms.

SAWPA Administration

The other arm to the governance of the OWOW process includes the management function conducted by the Santa Ana Watershed Project Authority (SAWPA). As a regional water agency for the Santa Ana River Watershed, SAWPA has a long history of supporting regional collaborative efforts of this kind. As with previous IRWMP efforts for the Santa Ana River Watershed, SAWPA serves as support in providing administrative and facilitative assistance to the pillar groups and the Steering Committee for the overall OWOW plan development. Further, SAWPA provides computer tools to assist the Steering Committee and pillars in decision-making processes, provides planning documents to allow pillars to build upon previous existing plans, and performs significant public outreach and education about the integrated planning approach for the Santa Ana River Watershed.

As the administrator of OWOW and the Regional Water Management Group for the Santa Ana River Watershed, SAWPA worked closely with several sub-regional IRWM planning efforts in the watershed that took place prior to, or concurrent with, the OWOW planning process. Of particular interest was the need to assure that proper coordination and incorporation of the excellent work conducted by the sub-regional IRWM planning groups was included in the OWOW plan. SAWPA staff conducted outreach to all stakeholders of the sub-regional IRWM planning efforts, and invited their stakeholders to participate in the pillar processes. In some cases, SAWPA staff even participated in the sub-regional IRWM planning process. Where sub-regional IRWM plans previously were completed, these plans were shared with the pillars to serve as background material to their pillar planning efforts. In all cases, SAWPA took a lead role in coordinating the IRWM lead agencies to assure that their planning work would be folded into the OWOW watershed-wide process as

seamlessly as possible. It is understood that the Steering Committee will be responsible for the development and implementation of the project selection criteria.

As funding opportunities arise to implement the OWOW plan, the Steering Committee will provide to the SAWPA Commission an updated Santa Ana River Watershed IRWM plan and programmatic portfolio of projects specific to the funding opportunity. The SAWPA Commission will review the plan and programmatic project portfolio to ensure that these fulfill the intent and requirements of the specific funding mechanism, any legislative bill authorizing the funding, all legal requirements as defined by the funding administrative agency, and equitable application of the benefits of the project portfolio across the entire region. Review of these items and the project selection process will be conducted by the SAWPA Commission in a public hearing open to all interested stakeholders. If the SAWPA Commission is unable to ratify a specific portfolio of projects, the Commission will send it back to the Steering Committee.

Thereafter, SAWPA serves as the State liaison for the Santa Ana region, on behalf of the OWOW stakeholders, responsible for all final report submittals, plan adoption processes, grant application submittals, and administrative oversight for the Santa Ana OWOW IRMW Plan funding.

Planning Updates and Coordination

The OWOW Plan will be a "living document" and will be updated every three to five years in a coordinated manner with local, regional and statewide plans. Plan updates will be formally adopted by the Steering Committee and ratified by the SAWPA Commission. The pillar groups will continue to be an instrumental part of the update process by providing technical expertise and ensuring that the points of view of different disciplines and interests groups are taken into consideration.

Plan updates will incorporate, for example, changes to city General Plans, land use elements, Stormwater Management Plans, Water and Wastewater Master Plans, Urban Water Management Plans, County land use planning documents, and the Southern California Association of Governments (SCAG) land use data.

In addition, new water management strategies will be incorporated into future versions of the Plan as additional knowledge is gained on the state of the watershed, new technologies and best practices, and changes in policy and public mindsets. Furthermore, the Plan will be updated as necessary to comply with the requirements of future grant funding opportunities.

The OWOW Plan will be provided to cities, counties, water suppliers, nonprofit organizations, and other regional and State agencies for use in their water resource planning efforts. It is anticipated that the findings will support planning efforts and updates to General Plans, Strategic Plans, and other plans and programs. The document also will be helpful input to the Metropolitan Water District of Southern California Integrated Resources Plan, and the State of California DWR Water Plan.

OWOW Outreach Program

Engaging stakeholder involvement in a large, diverse watershed is challenging. It is unlikely that any one individual "knows" all of the stakeholders, and as such, the development of mailing lists and notification of workgroup meetings can be daunting. The OWOW process was designed to be different from other planning processes. One critical difference is that OWOW was designed to be a "bottom-up", rather than a "top-down" process. By encouraging participation from different groups of people and those holding varying viewpoints from throughout the Watershed, the capacity to reach larger numbers of stakeholders also grew.

Pillar Groups

As discussed in other sections of this document, the initial work of the OWOW process was done by planning pillars or subject area groups. Each group is led by a subject area expert, and that person brought their own list of potential participants to the process. For example, a water supply expert is likely to know other water supply experts within and outside the region. These individuals were invited to the process, and were an important addition to the vast mailing list maintained by SAWPA. Each Pillar leader is responsible for maintaining a list of contacts interested in their particular pillar, and SAWPA provides names of additional contacts. The knowledge and contacts of these pillar groups provide an important link to watershed stakeholders.

Web-Based Document Management

Pillar leaders were provided a Web-based tool to allow development of this document in a virtual Web-based environment that allowed collaborators from across the watershed to "check out" sections for writing and editing. Each pillar leader was able to control and track work flow/edits through a Web server. All participants and interested parties were able to request access to the server to view edits and working copies. Areas identified that required further discussion could be discussed on a publicly-accessible companion forum.

This Web-based discussion forum was established for each pillar group. Anyone interested was able to use the forum to discuss issues surrounding each section. This discussion forum provided a mechanism to collect information, receive comments, and facilitate communication across disciplines. How each group used the tool was dependent on their specific needs, with some groups preferring face-to-face dialogue, and others making use of conference calling and Web tools. Web-based discussion forums also provide for transparency and identification of new stakeholders.

SAWPA Distribution List

SAWPA primarily provided communication to stakeholders based on an extensive electronic mailing list maintained on by SAWPA. The list is regularly updated, and anyone requesting information is added to the list. Email contact allows regular communication with a broad group of stakeholders throughout the Watershed. The mailing list also includes stakeholders outside the Watershed who are interested in issues within the Watershed.

The master contacts database includes a rather diverse base of approximately 4,000 stakeholders. The focus of the database is those having an interest in water and representatives from cities located within the Watershed. It includes representatives from 121 agencies associated with water, from flood control, water conservation districts, and water supply agencies. It also includes contacts from the 66 incorporated cities within the Watershed, including mayors, key department heads, city council members, and planning commissioners. The database also includes an up-to-date list of members of the California legislature.

Also included are representatives from county, State, and Federal governments, Indian Tribes, the real estate community, members of the environmental, agricultural and development communities, consultants, trade associations, academia, media, nonprofit organizations, and others simply interested in water.

Newsletters

SAWPA has published 12 electronic OWOW newsletters since the inception of the program in the spring of 2007. The newsletter is distributed to everyone on the mailing list and is intended to provide background and updates on the OWOW program, as well as provide information on issues of interest to the Watershed community. To date, five of the OWOW Pillar leaders have included an article in the newsletter. These articles provide a link between a Pillar and the broader watershed community. This process will continue with other Pillar leaders to encourage conversation across disciplines and geography.

Beam Blasts

SAWPA also sent out six short electronic "beam blasts" to a subset of the distribution list. A beam blast is intended to provide a brief, one-page issue update to an audience interested in policy, rather than technical issues. This electronic communications are provided to policy makers and opinion leaders throughout the Watershed. They provide introductions to issues for those that may not have time to read newsletters or attend meetings. Several conference calls also were scheduled so that interested members of this group could receive briefings on watershed issues.

Podcasts

A podcast can be defined as a series of audio or video digital media files distributed over the Internet so that it can be played on personal computers or portable digital players. SAWPA posted two audio podcasts on its Website so that interested parties could become familiar with and participate in the OWOW process. Availability of these podcasts was announced using the SAWPA distribution list. SAWPA continues to work to ensure that stakeholders are informed and have the ability to participate. Podcasts also reduce the need to drive to a particular location to learn about a topic. As many individuals have limited time, this is a way to allow greater participation.

Twitter

SAWPA currently uses Twitter as a social media tool for providing updates and timely information of interest to watershed stakeholders. Frequency of stakeholder contact is sporadic, but occurs at least weekly.

Forums

SAWPA hosts an OWOW discussion forum to discuss specific projects or OWOW activities. This provides an effective means of communication with stakeholders about current plans, as well as a means for identifying and planning future collaborative activities. The forum also makes it possible to develop contacts across functional disciplines and geographic boundaries.

Public Meetings and Presentations

The core of any public outreach program is the direct contact with interested stakeholder groups. As part of the OWOW process, SAWPA staff has made 64 presentations to specific stakeholder groups to both inform and to invite participation. The initial OWOW kick-off meeting (May 24, 2007) was attended by over 200 interested parties from across the Watershed. SAWPA also hosted a town hall meeting (October 31, 2007) to initiate the public comment period on OWOW goals and objectives. During the summer of 2008, SAWPA hosted three meetings—July 17 in San Bernardino County, July 21 in Orange County, and July 24 in Riverside County—to discuss the benefits of collaboration and multi-benefit watershed projects. On January 31, 2009, SAWPA hosted a watershed conference with an expected attendance of 1,000 to discuss current conditions within the Watershed and talk about integrated, sustainable solutions. A draft OWOW integrated planning document was distributed for comment. The document also was posted on the SAWPA Website so those that did not attend the conference could participate.

SAWPA hosted its second annual OWOW watershed conference on April 22, 2010, to discuss the OWOW plan development to date, and the new DWR IRWM Plan standards and IRWM Proposal Solicitation Packages under Proposition 84. With an attendance of nearly 450, the goal was to develop a watershed focus and encourage collaboration in developing multi-benefit projects. Participants identified greater operational efficiencies and reduced environmental impacts as benefits of these kinds of projects.

SAWPA staff also has provided briefings and presentations to a number of specific groups. The presentations included a review of the OWOW program and an invitation to participate in the process. Representative presentations to specific groups are summarized below.

- Cities
- Agricultural Groups
- Business/Economic Development Groups
- Watershed Councils and Groups
- Presentations to Organizations

Presentations to Organizations

American Society of Civil Engineers

Association of California Water Agencies

California Foundation on Environment and the Economy

California Special Districts Association

California Water Policy 17 Conference

Inland Empire Water Conference

Metropolitan Water District of Orange County Water Policy Forum

National Water Research Institute

Orange County Water Summit

Regional Coordination Conference of Water Officials

Riverside County Water Symposium

San Manuel Band of Mission Indians

SAWPA 20 by 2020 Water Symposium

Urban Water Institute

Water Education Foundation

Western Riverside Council of Governments

Western Riverside County Agricultural Coalition

Area Focused Water Groups

Basin Technical Group of San Bernardino Valley Coastal Coalition

Inland Empire Utilities Agency Chino Creek Planning Group

Lake Elsinore & San Jacinto Watersheds Authority (LESJWA)

Newport Bay Watershed Executive Committee

San Antonio Canyon Stakeholders Committee

San Jacinto River Watershed Council

Santa Ana River Dischargers Association

Santa Ana River Watershed Alliance

Business/Economic Development Group

I-215 Corridor Economic Development Summit

Inland Action Group

Temecula Valley Chamber of Commerce

Valley Group

Agricultural Groups

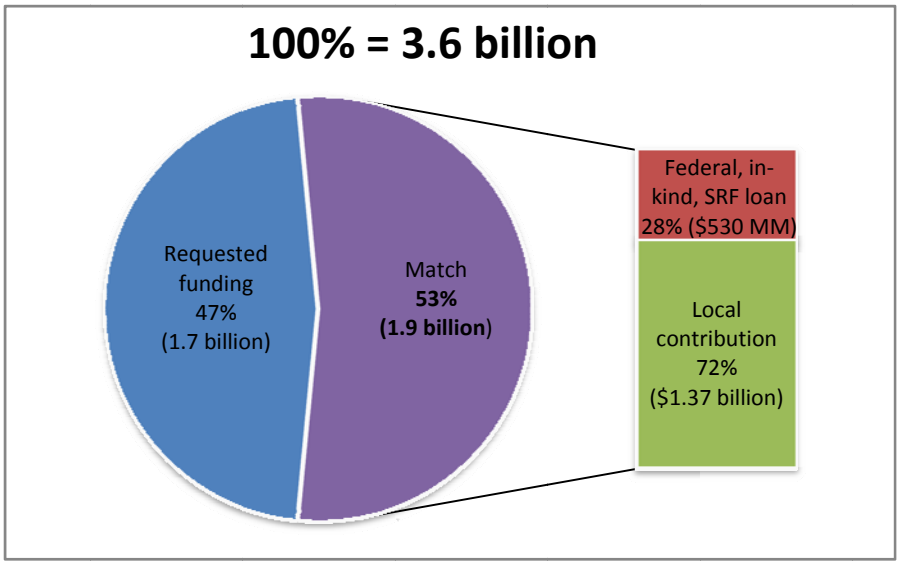
Riverside County Farm Bureau

Chapter 2 Funding

One of the biggest challenges to attaining true water sustainability in the Watershed is obtaining sufficient funding for planning and implementation of multi-benefit, multi-use integrated projects. Funding can come from a variety of sources including agency resources such as utility user fees and general revenues, funding available through regional agencies such as MWD for conservation and local resource projects, federal funding, state grant funding such as Proposition 84, and loans such as the State Revolving fund.

Integrated Regional Planning efforts conducted by SAWPA have been funded by the SAWPA member agencies. Integrated planning is listed as a line item and approved as part of the planning budget. The bottom-up approach of the OWOW plan was different. SAWPA contributed significant resources for support and facilitation of both the Steering Committee and the Pillars, but the watershed level analysis and goal setting was completed by a diverse group from across the watershed. Some participated as part of their assigned agency duties and some participated on their own time. As the scope of OWOW broadens, it will be a challenge to develop further funding sources that reflect the current broad view. The decision of water supply agencies to fund the support and facilitation of the entire process will be made each year by the SAWPA Commission.

Individual agencies have planned for the projects included in this Plan through their individual Capital Improvement Programs and through collaborative planning activities. This planning has included financial planning to ensure project implementation within a time period that yields the highest level of benefit in terms of efficiency, economies of scale, and cost avoidance. While significant seed money and partnerships currently are in place for various water projects in the Watershed, there are many more projects, both large and small that will require funding.



The year 2000 estimate for the complete ten-year Santa Ana Integrated Watershed Plan (IWP) was $3 billion dollars. In review of recent sub-regional IRWMPs funding needs, the combined estimated investment is over $3.6 billion dollars.

A total of 297 projects are included in this Plan, with a combined capital cost of $3.6 billion, which confirms previous estimates. Nevertheless, the total need in the Watershed is likely to exceed this amount, as probably not all projects needed by individual agencies were submitted in the call for projects.

It should also be noted that the integration of projects on the list into more integrated projects may result in significant cost savings. Early estimates show that multi-benefit projects can save 33% over single purpose projects.

Projects in the Plan range in capital cost from $80,000 to $133 million, with an average cost of $12.2 million. Project applicants are requesting grants for $1.7 billion, while the remaining $1.9 billion would be funded through a combination of local contributions, federal grants, and SRF loans (see following chart). The amount of grant funding requested is much higher than the funds allocated to the Watershed of $114 million.
Operation and maintenance costs (O&M) of proposed projects are not eligible for grant funding. A more detailed evaluation of the financial sustainability of proposed projects will be conducted as part of the economic analysis in the DWR Prop 84 IRWM Implementation grant application defined under the Proposal Solicitation Packages (PSPs).

Table 2.1 at the end of this chapter lists the projects, their anticipated costs, and requested grant funding. In addition to funding for project implementation, SAWPA is exploring funding opportunities for planning work through other State and Federal funding sources. This funding could be used for future updates of the OWOW Plan. In addition to SAWPA, individual agencies within the Watershed are likely to pursue grant funding for a variety of planning efforts. SAWPA would complement any planning grants with its own funds obtained from member agencies. The following section summarizes previous funding opportunities that may be replicated for funding the Plan's projects in the future, as well as anticipated sources of funding to meet the anticipated funding structure of each project.

Certainty of Funding

As described in more detail in Chapter 7, candidate projects were evaluated in two phases. First, all applications received were reviewed to determine inclusion in the Plan, resulting in the list of 297 projects. Then, all projects were ranked for their ability to address the objectives of the Plan. Information for the highest-ranked projects was validated via further analysis and interviews with project sponsors. Based on this review, the financial information provided appears to be reasonable.

During the preparation of DWR Prop 84 IRWM Implementation grant application defined under the Proposal Solicitation Packages (PSPs) for specific funding opportunities, the certainty of the proposed funding will be evaluated in more detail for each project as part of the required economic analysis.

Previous Funding Success

Through the efforts and planning foundation of the Santa Ana IWP, SAWPA has been remarkably successful in moving rapidly into project implementation since the passage of the State of California Proposition 13 Water Bond in March 2000. This includes contracting with the State Water Resources Control Board (SWRCB) to use $235 million in Proposition 13 Water Bond funds, matched with over $565 million in local agency funds, to construct over $800 million in projects that directly support the Santa Ana IWP.

Based on the State project goals for Proposition 13, SAWPA, the SWRCB, and the watershed stakeholders ultimately approved approximately 25 projects. The majority of these projects were for water supply and water quality improvements, with approximately $25 million set aside for environmental and habitat enhancement projects. Of these monies, about $20 million was designated for the SCIWP Arundo Removal Program and $5 million has been designated for the Irvine Ranch Water District (IRWD) Natural Treatment System. Together, these projects have generated approximately 300,000 acre-feet (AF) of new water supply for the region at a cost to the State of less than $100 per AF, and improved water quality in Newport Bay. Long term, the region proposes to store upwards of 1,000,000 AF of new water supplies, sufficient to withstand a multi-year drought without having to import water.

Use of SCIWP funds in the Watershed allowed partner agencies in the Watershed to effectively leverage State funds to implement water projects providing tremendous benefits for our region. Under the Proposition 13 Water Bond SCIWP program, $235,000,000 in grant funds was matched by local funding of $624,121,000. In essence, this is a leveraging factor of State fund use of 2.66 (for every dollar of state grants provided, $2.66 local dollars were used to implement the projects). The $235 million created 291,620 acre-feet per year (AFY) of new water for the region. The process of construction created 12,875 new jobs based on a ratio of 15.6 jobs/$1 million citied in the U.S. Bureau of Economic Analysis for the Inland Empire Model.

In 2002, the voters approved another water bond called State Proposition 50 IRWM program, which provided over $500 million for IRWM projects. Through a competitive grant application process, SAWPA was successful in being selected to receive $25 million from the IRWM. The SWRCB contract to implement the water resources projects in the Watershed was executed in March 2008. The local funding that will be provided to implement several major water resource projects in our region will amount to $229,661,000. This is a leveraging factor of State fund use of 9.19 (for every dollar of state grants provided, $9.19 local dollars will be used to implement the projects). It is projected that the $25 million from Proposition 50 will provide a savings of 32,280 AFY of potable water, newly recycled water supplies of 16,700 AFY, an additional recharge capacity of 257,000 AFY, and 600 acres of new riparian habitat throughout the Watershed. The economic impact from new jobs created by construction is significant with an estimated 3,975 new jobs.

Moving into the future to meet increasing water demands in this region will allow for more funding opportunities to arise for the implementation of projects to achieve Watershed sustainability. Often, these funding opportunities are directed to a specific resource management strategy or policy issue, so projects that may rank highest in importance or priority in the Watershed, as viewed by the water stakeholders, may or may not be the first to be funded. Consequently, the region will need to remain flexible in pursuing funding when it becomes available, keeping the larger picture of a

sustainable, drought proofed, salt balanced region that supports economic and environmental vitality as the long-term goal.

State Bond Funding

Of the many funding opportunities that may provide the most funding flexibility to the region in the near-term is a State bond measure described as Proposition 84 - The Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006. This bond measure was passed by the State of California voters in November 2006 and provides $5.388 billion to support various water resource needs in the State. State grant funds are available for several water resource needs, as delineated in different chapters of the Act.

Chapter 2 of the bond measure authorizes $1 billion for the IRWM Program. The bill defined an allocation statewide among 11 funding areas. The SAR Region will receive Proposition 84 funding in the amount of $114,000,000.

This link to **Table 2.1** provides a map of where in the Plan the different IRWM Plan Standards, per Proposition 84 Guidelines, are located. This Table can be found in the Appendices.

In addition to Chapter 2, there are several other chapters of Proposition 84 that could provide funding for specific projects within the SAR Region. Specifically:

- Chapter 3 directs $275 million to flood control projects and $40 million for flood protection corridor projects.
- Chapter 5 designates $18 million for an urban streams restoration program, and $90 million for a stormwater grant program to protect lakes, streams and rivers.

These grant programs largely are competitively available statewide, but would help provide supplemental funding to various projects in the region that meet the specific program guidelines.

Before funds from Chapter 2 could be used, however, the State legislature needed to appropriate funding for the authorized bond measures under Proposition 84 passed by voters in November 2006. In September 2008, funds were appropriated by the State Legislature for the Proposition 84 IRWM under SBxx1 appropriations. This first appropriation is considered an initial funding round for the program. Under this appropriation, $181,791,000 will be provided for implementation ($100,000,000), planning ($39,000,000), inter-regional projects ($22,091,000), and program delivery ($20,700,000). Based on preliminary feedback from DWR, the administering state agency for the IRWM program, the $100,000,000 for implementation will go to those regional water management groups that have prepared and adopted an IRWMP, and will meet the DWR guidelines for the funding. Draft guidelines were issued in March 2010 and are the basis for the documentation of the OWOW Plan.

In addition to Proposition 84, SBxx1 appropriation also includes funding for Proposition 1E – Disaster Preparedness and Flood Prevention Act. The original Proposition 1E bond measure authorized $4.1 billion. Under SBxx1, $150,000,000 was appropriated for seismic strengthening ($100,000,000), combined sewer systems ($20,000,000), urban stream stormwater flood management ($20,000,000), general stormwater flood management ($5,500,000), and program delivery ($4,500,000).

Because both Propositions 84 and 1E have as a requirement the development of or coordination with IRWMPs, the DWR will administer the programs in a combined process. Under this program, DWR has proposed an expedited round of funding so that projects can be implemented quickly. Major considerations for funding will include availability of a work plan, a budget, readiness to start, projects of need, costs defined, preferences stated, and benefits described. One of the primary focuses of the expedited funding will be support for critical water supply or water quality needs for disadvantaged communities. At least 10% of the $100,000,000 of the Proposition 84 implementation funding must be directed to disadvantaged communities. In addition, at least 20% must be directed to agricultural and urban water conservation projects necessary to meet the Governor's goal for 20% water demand reduction by the Year 2020.

For the SAR Region, the possible funding that may be available under SBxx1 for Proposition 84 expedited funding could range from $12,666,667 to $38,000,000 depending on the success of funding in other funding areas. For Proposition 1E, the funding cap is $30 million per project. Future rounds of funding will support planning grants for continued IRWM planning development and more implementation grant funding may be available in 2011. It is envisioned that many of the priority projects that are identified by the OWOW Steering Committee will be funded for implementation in the SAR Region.

In mid-2009, concept proposals were requested from DWR under Proposition 84, Chapter 5, Stormwater Grant Program (SWGP). $90 million was authorized toward the reduction and prevention of stormwater contamination of rivers, lakes, and streams. Five percent of these funds are reserved for assistance to disadvantaged communities. Ten percent of the authorized funds can be used to finance planning and monitoring necessary for the design, selection, and implementation of SWGP projects. The SWRCB will be distributing the funds under two rounds of funding, $45 million each.

Draft guidelines for the SWGP indicate that the local match of 5%, 10% or 20% is dependent upon whether the communities supported are small and severely disadvantaged, small and disadvantaged, or other, respectively. The minimum grant is $250,000 per project, and the maximum grant amount is $5 million per project. Eligible projects include Low Impact Development (LID) projects that help control runoff and those projects that help comply with Total Maximum Daily Load (TMDL) requirements for contamination arising from pathogens, metals, and trash pollutants.

Other sources of State funding include the Water Use Efficiency Program, which currently is administered by DWR and is funded through various bond initiatives, and provides grant funding for agricultural and urban water conservation programs. DWR's Assembly Bill 303, Local Groundwater Assistance Program, funds groundwater management, data collection, modeling, monitoring, and assessment programs.

State Loan Programs (State Revolving Fund)

Other State grants and various loan programs also are available under the State Revolving Loan Program, Agricultural Water Conservation Loan Program, and other sections of Proposition 84. It was through the State Revolving Loan Program that the majority of the Santa Ana Regional Inceptor (SARI) was constructed to transport high saline brine from the Watershed to the ocean after treatment. Over $60 million in loans have been received by SAWPA alone to accomplish this major infrastructure facility that is so vital to water quality improvement in the Watershed. Other agencies have had similar successes building infrastructure projects using these funding sources.

On September 26, 2008, the United States Congress introduced the Economic Stimulus Bill, H.R. 7110 – Job Creation and Unemployment Relief Act of 2008 (bill). This bill was to address the nation's need to bolster the economy and create jobs. In the current bill, Title I, Chapter 2, explains utilization of the Federal Capitalization Grants for State Revolving Funds pertaining to water and wastewater infrastructure. The California Clean Water State Revolving Fund would receive an amount in excess of $450 million; however, the total allotment could increase. Once enacted, fund priorities will focus on "shovel-ready" projects that would create jobs immediately. These additional funds may provide a source of funding for projects within the Watershed.

Federal Funding Sources

The federal grant funding sources currently are limited, but may change pending the impacts of various federal economic stimulus packages proposed to support nationwide infrastructure improvements. The U.S. Bureau of Reclamation's (USBOR) Challenge Grant Program provides funding for water management programs and projects in the western United States. This grant program might help fund the implementation of water conservation projects. USBOR also provides funding for water recycling programs and basin study programs. EPA provides funding for environmental improvement projects. In addition, funding can be directed for implementation of projects under the IRWMP, through the Federal Energy and Water Development Appropriations legislation funneled through the Army Corp of Engineers (Corps).

Flood agencies have a long history of partnering with the Corps to build flood infrastructure, and recently the Corps has been granted the authority to develop ecosystem restoration projects with local sponsors. Many of these projects have 65% Corps and 35% local sponsor cost share that allows the leveraging of local resources.

Local Funding Sources

Historically, the Watershed region has demonstrated a strong commitment to providing matching local funds for State grant-funded water projects. The amount of local match typically required in the past water bonds as defined by the State administrating agency, SWRCB and the DWR, is 25%. The SAR Region has far exceeded this required local match minimum by showing a much higher percentage of local revenue so that more regionally important water projects could be constructed. Agencies often leverage existing Capital Improvement Program funds to accelerate development and implementation of projects.

Local funding can come from a variety of sources, and one of the most effective local on-going sources is the MWD programs. The MWD maintains a number of funding programs to offset the costs of various water resource programs. For example, MWD's Local Resources Program is targeted to support water recycling and groundwater development projects, such as desalting, to help reduce the overall water demand within its service area. This program can provide subsidies of up to $250/AF over 25-year terms. Another program that MWD offers is a rebate program for water use efficiency programs, devices, and measures throughout its service area. These programs are offered to residential, commercial and industrial, agricultural, and public sector entities, and have proven to be a tremendous success across southern California. Unfortunately, since the SAR Region falls partially out of MWD's boundaries, there are some entities in the Watershed region that would not be eligible to participate in these programs.

Aside from the local funding support of regional entities, local rate revenue generation is another possible source of funding for the region. Further, with current nationwide economic conditions, the number of economically disadvantaged communities is expected to increase in many areas of the Watershed region. Under these conditions, increasing water rates to compensate for capital improvements necessary to address existing and future water demands is becoming more challenging.

In some communities, local funding can take the form of a local revenue bond. These bonds typically are dedicated to specific types of improvements and require a vote by the electorate. Similar to various local propositions that were passed in some coastal regions dedicated to supporting ocean and beaches, local revenue bonds could be brought to the voters to assure adequate local funding for various water resource improvements in the Watershed. With increasing uncertainty about dependable imported water supplies from the Bay Delta due to environmental concerns and SWP reductions, as well as Colorado River drought conditions also resulting in flow reductions to southern California, funding to support local reliable supplies such as recycled water and clean up of local groundwater supplies have received increased attention throughout California. The challenge with a top-down California approach is that the State's ability to issue bonds may be limited. However, with Watershed communities hit hard by the recession and potential increases in water rates to compensate for the ever decreasing water supplies, the passage of a new fee for regional or local water supplies by the majority of property owners, or 2/3 majority of the electorate, would represent a formidable challenge. Still, early discussions regarding this approach are being explored by several upper watershed agencies. The ability to "control one's destiny" at a regional level not only ensures that regional priorities are met, but that the region has a say in ranking those priorities.

The following **Table 2.2** presents the proposed funding structure for all projects in the OWOW Plan, including a preliminary assessment on the certainty of funding. It should be noted that these funding estimates are preliminary and are self-reported.

Table 2.2 Proposed Funding Structure for All OWOW Plan

Project name	Agency	Total Project Amount	Requested Funding Amount	Local Contribution Amount	Federal Contribution Amount	In-Kind Contribution Amount	SRF Loan Amount	Certainty of capital funding	Certainty of O&M funding
Fullerton Creek Channel (OCFCD Facility No. A03) from downstream I-5 Freeway to downstream Dale Street.	Orange County, Public Works, Flood Control Section, Flood Programs	$8,400,000	$2,100,000	$6,300,000				Yes, this project is on the Flood Control Capital Improvement Project Plan, which is a list of prioritized projects through a 7-year period. This channel system is one of OCFCD's highest priority capital improvement projects. When the downstream segments are constructed, this project will advance the tiers towards the budgeted year. If it advances to a budgeted year in mid-fiscal year, funds will be appropriated to construct this project.	Yes. Funds for flood control capital improvement projects, including operation and maintenance come mainly from property taxes and state contributions. Operation and maintenance is ongoing for this channel system and is budgeted every fiscal year.
Planning & Integration Assistance Program	California Resource Connections	$200,000	$150,000			$25,000			
San Bernardino River Corridor Revitalization	California Resource Connections								
Place-Based GIS Land Use Design Tool to Protect Watershed Function in the Upper SAR Watershed	California Resource Connections	$475,000	$475,000						
Brookhurst Widening Bio-Swale and Synthetic Turf Installation	City of Anaheim	$1,600,000	$800,000						City right-of-way maintenance funds are available for maintenance and are anticipated to be available in perpetuity.
ARTIC Use of GWRS Water for Irrigation and Groundwater Recharge	City of Anaheim	$4,000,000	$2,000,000					Multiple grant funds have been obtained, primarily Measure M and State Transit Improvement.	Yes

Water Recycling Demonstration Project	City of Anaheim	$8,000,000	$1,600,000	$6,400,000				The first phase of the Project is budgeted in the City's Capital Improvement budget. An amount of $6,277,000 is budgeted for FY 2010 and $342,000 for FY 2011.	For O&M of the project, an amount of $30,000 has been budgeted for FY 2011, and $250,000 for FY 2012.
Water Use Efficiency Improvements/Brackish Groundwater Treatment & Constructed Wetland Installation at Yorba Regional Park	City of Anaheim	$200,000	$100,000	$100,000					
Modjeska Park Parking Detention/Infiltration Facility (Design Only)	City of Anaheim	$250,000	$125,000	$125,000				Funding for required match of the project will be from the City's storm drain construction fund.	Funding for the maintenance of the project will be integral to the City's regular operational maintenance of storm drain facilities.
Shallow Aquifer Pumping for Non-potable Uses	City of Anaheim	$3,720,000	$1,600,000	$2,120,000					
Urban Runoff Reuse - Anaheim Hills Golf Course	City of Anaheim	$9,800,000	$4,900,000	$4,900,000					
Platinum Triangle/ARTIC and Disneyland Resort Area Water Recycling Project	City of Anaheim	$16,500,000	$8,250,000	$8,250,000					
Ball Road Regional Recycled Water Project	City of Anaheim	$20,000,000	$10,000,000	$10,000,000					
Orange County/ Beaumont Conjunctive Use Water Project	City of Anaheim	$66,000,000	$33,000,000	$33,000,000					
Randolph Creek Water Quality and Habitat Enhancement Project	City of Brea	$870,000	$700,000	$170,000				CIP Budgeted for FY 2010/2011	The City will provide funding for their part of the project, and with funding for construction, the other partners will help cover the rest of the O&M funds.
Crescent Avenue Sewer Replacement	City of Buena Park	$2,376,000	$950,400	$675,600			$750,000		O&M for this replacement sewer will be through the City of Buena Park sewer forces. It will be funded through sewer fees as is the sewer being replaced.

Construction of a Reclaimed Water Pipeline to Buena Park, California	City of Buena Park	$5,000,000	$500,000	$500,000	$4,000,000				
Magnolia Channel Detention Basin	City of Chino	$83,600	$62,700	$19,855		$1,045			
Drainage A Detention Basin	City of Chino	$5,200,000	$3,900,000	$617,500	$617,500	$65,000			
Arlington Desalter Connection Project No. 27-1208 & Western Municipal Water District Promenade Connection	City of Corona	$800,000	$400,000					The Corona Department of Water & Power will fund their cost matching portion through a CIP that is part of the FY 2010-11 approved budget entitled "Arlington Desalter Interconnection."	The Corona Department of Water and Power has City Council approval to pay for Operations & Maintenance funding through water rates.
Norco/Stagecoach Park Recycled Waterline	City of Corona Department of Water and Power	$3,700,000	$1,850,000					Funding for City of Corona Department of Water and Powers share has been funded in the approved CIP budget for FY 2010-11 under a project entitled "Stagecoach Park Recycled Waterline."	The City of Corona City Council has approved the payment of O&M costs through water rates.
Industrial Way Water Quality and Storm Drain Improvement Project	City of Costa Mesa	$3,000,000	$2,400,000	$600,000				The portion of funding from Local contribution has been secured through City's Drainage Fee Fund	The maintenance of this project when completed will be incorporated into the City's storm drain maintenance and water quality program that will be covered by the City's General Funds for the future years that the system will be in operation.
Fairview Park Wetlands and Riparian Habitat Project	City of Costa Mesa	$4,560,000	$2,200,000	$960,000	$1,400,000			Federal funding from the US Army Corps of Engineers has been expended on the construction of Phase I of the project. The City's match of $960,000 was used for Phase I construction and the	O&M funding will be included in the annual parks maintenance budget for Fairview Park.

								completion of the plans and specifications.	
Cypress Nature Park Restoration Project	City of Cypress	$1,557,180	$1,443,180			$114,000			
City of Fontana Flood Control and Aquifer Recharge Program	City of Fontana	$6,000,000	$1,000,000	$500,000			$4,500,000	The City has submitted application to the State Water Resources Control Board for SRF Loan funds for construction of Phase 1 improvements. To complete the City's application, the City intends to complete the project report and credit review report by the end of July 2010. Plans and specifications will be submitted in August resulting application approval in September. The funding program does not have an expiration date. State grant (SWRCB RW Grant) and local (Water) funds also are secure.	The systems will be operated and maintained by the City with current budgeted forces.
Citywide Street Median Rehabilitation Project	City of Garden Grove	$6,161,000	$4,000,000	$2,161,000				The City of Garden Grove has secured matching funds for these proposed projects.	Currently, the City dedicates General Funds to the maintenance and operation of all street medians.
Patterson Street Storm Drain Upgrade	City of Garden Grove	$3,600,000	$3,240,000	$360,000				Local funding has been secured and will be allocated to the project once awarded.	Operation and maintenance funding for this existing structure is already in place.
Yockey/Newland Storm Drain Line B-5 Phase 2	City of Garden Grove	$5,067,000	$3,800,000	$782,000	$485,000			Currently, the City is awaiting EPA's response on a grant award in the amount of $485,000 for Yockey Newland	Adequate provisions will be made for the establishment and long-term maintenance of the storm drain. The City will perform maintenance of

								Phase 2. City matching funds have been secured for the second phase of this project.	the project site. Additionally, every storm drain is cleaned annually with special attention given after rainy periods.
East Garden Grove Wintersburg Channel Urban Runoff Diversion Project, Phase I	City of Huntington Beach	$5,488,700	$5,200,000		$288,700				
The Quail Valley Groundwater Infiltration Improvements Project	City of Menifee	$250,000	$250,000						
The Project consists of two detention basins & approximately 11,800 lineal feet of open channel and storm drains from Juniper Flats westerly. It represents Phase 1 of the four-phase MDP.	City of Menifee	$6,000,000	$3,500,000	$2,000,000		$500,000		The $2 million local match is already available in the form of cash collections from a locally established Community Facilities District (CFD) which are being held by County of Riverside Flood Control on behalf of the ADP property owners. Funds would be released to this project upon request. Up to $500,000 has been committed separately by the ADP property owners, who to-date have already expended $27 million to complete design, environmental, and right-of-way acquisition.	The County of Riverside Flood Control and Water Conservation District will pay for a portion of the O&M, with the remainder covered by a Landscape Maintenance District or a second Community Facilities District to be established by the City of Menifee that has been already agreed upon by the ADP property owners.
Cucamonga Creek Watershed Regional Water Quality Project (Mill Creek Wetlands)	City of Ontario	$20,000,000	$10,000,000	$10,000,000				The Project is funded through Development Impact Fee construction agreements and is included in the Ontario General Plan. As such, the Project is certain to be funded and constructed.	Maintenance will be funded through Development Impact Fees and long term through the Operations and Maintenance Community Facilities District.

Water Use Efficiency Program	City of Ontario Municipal Utilities Company	$150,558	$75,218	$75,340				Total project cost has been included in the fiscal year 2010-11 capital budget.	
Water Well Decontamination - City of Redlands	City of Redlands	$2,100,000	$2,000,000	$50,000		$50,000		This project will be funded through in-kind staff resources dedicated to accomplishing the project. Local contribution will be secured by dedicating funds from rate payer accounts to toward the implementation of this project.	Funding for O&M will be covered using rate payer accounts, from which the required funding for O&M will be obligated for the life of the project.
Riverside North Aquifer Storage and Recovery Project	City of Riverside	$12,500,000	$2,000,000					The funding for this project will be secured in each agency's capital improvement program (CIP). The City of Riverside's financial commitment to this project has been secured and is included in its current adopted CIP. The other project partners have verbally committed to the project and have varying time frames for securing their portion of the funding. The longevity of the funding is expected for the duration of the project.	The majority of the O&M funding for this project will be provided by the City of Riverside. The City of Riverside will provide O&M funding for the life of the project.
Recycled Water Transmission Main (Santa Ana River Segment)	City of Riverside	$26,000,000	$2,000,000					The funding for this project will be obtained through bonds, water rate fees, and grant programs. The longevity of the funding is expected for the duration of the project.	The City will provide O&M funding for the life of the project.

San Bernardino Clean Water Factory – Phase III	City of San Bernardino Municipal Water Department	$6,981,170	$3,490,585					Funding is secured by SBMWD Board adopted CIP and USBR assistance agreement.	SBMWD Board approval for O&M costs through water rates, sewer fees, and/or other fees.
San Bernardino Clean Water Factory – Phase I	City of San Bernardino Municipal Water Department	$2,728,776	$1,000,000					Funding is secured by SBMWD Board adopted CIP, USEPA Grant award, and USBR assistance agreement.	SBMWD Board approval for O&M costs through water rates and/or other fees.
San Bernardino Clean Water Factory – Phase II	City of San Bernardino Municipal Water Department	$18,000,000	$9,000,000					Funding is secured by SBMWD Board adopted CIP, USEPA Grant award, and USBR assistance agreement.	SBMWD Board approval for O&M costs through water rates, sewer fees, and/or other fees.
San Bernardino Clean Water Factory – Phase VI	City of San Bernardino Municipal Water Department	$65,593,000	$32,796,500						
San Bernardino Clean Water Factory – Phase V	City of San Bernardino Municipal Water Department	$77,791,000	$38,895,500						
San Bernardino Clean Water Factory – Phase IV	City of San Bernardino Municipal Water Dept	$122,624,000	$61,312,000						
Tustin Avenue Well	City of Tustin	$4,500,000	$2,250,000	$2,250,000				The project will be funded through a bond sale. The Water rates have recently been increased to secure the bond.	The O&M costs will be funded by the City of Tustin Water Services operational funds.
City of Tustin Main Street Facility Improvements	City of Tustin	$300,000	$150,000	$150,000				The City has recently approved a 5 year water rate increase to pay for the project	Not Applicable
Rawlings Reservoir Replacement	City of Tustin	$15,000,000	$7,500,000	$7,500,000				The City has recently raised its water rate to fund the project.	Funds would be set aside in the Water Divisions Operating Budget for reservoir maintenance repairs.
14th Street Groundwater Recharge and Storm Water Quality Treatment	City of Upland	$5,000,000	$3,750,000	$1,250,000				Local matching funds are available for appropriation.	This project will be incorporated into the Uplands Basin Operation and Maintenance

Integration Facility									program.
Wilson III Basins Project and Wilson Basins/Spreading Grounds	City of Yucaipa	$9,100,000	$7,100,000	$2,000,000				$2.0 Million in local funding available now and forever unless reallocated by the City Council.	San Bernardino County Flood Control District has verbally agreed to maintain Flood Control Facility in perpetuity.
Infiltration and Inflow Reduction Program	Costa Mesa Sanitary District	$3,000,000	$2,400,000	$600,000				The portion of funding from Local contribution has been secured through City of Costa Mesa's Drainage Fee Fund	The maintenance of this project when completed will be incorporated into the City of Costa Mesa's storm drain maintenance and water quality program which will be covered by the City of Costa Mesa's General Funds for the future years that the system will be in operation.
CMSD #101 West Side Pumping Station Abandonment	Costa Mesa Sanitary District	$3,000,000	$1,000,000	$2,000,000				Funding has been secured by yearly contributions of $250,000 in the District's Capital Improvement Program (CIP).	O&M will decrease as a result of the project as 8 existing sewer pumping stations will be abandoned and the need for one sewer pumping station in the north half of the Banning Ranch alleviated.
Serrano Creek Restoration Plan	County of Orange	$3,345,212	$1,338,085	$1,739,527		$267,600		The local contribution will be cost shared by the project partners and will be budgeted by the project partners in the appropriate years.	The project partners will provide the funding for the long term O&M of the project, unless the project is built to Orange County Flood Control District (OCFCD) standards. If built to OCFCD standards then OCFCD will accept the facility and provide long term O&M.
Borrego Canyon Wash Stabilization and Restoration Project	County of Orange/OC Watersheds	$3,232,000	$1,939,200	$646,400		$646,400			
Construction & Quantitative Evaluation of the Low Impact Development Retrofit Project for Orange County Public Works Glassell Yard, Orange, California	County of Orange/OC Watersheds Program	$3,000,000	$2,000,000	$500,000		$500,000			The facility currently belongs to the County of Orange who will continue to maintain it as owners of the buildings.

Proposed 12-inch Village of Heritage	Cucamonga Valley Water District	$3,600,000	$2,700,000	$900,000					
Proposed 8-inch Redhill Park Lateral	Cucamonga Valley Water District	$336,000	$252,000	$84,000					
New 12-inch recycled water main to the Redhill Golf Course	Cucamonga Valley Water District	$600,000	$450,000	$150,000					
Biodiesel Feedstock Production	Eastern Municipal Water District	$18,200,000	$13,000,000						
Perris II Desalination Facility	Eastern Municipal Water District	$57,000,000	$28,700,000	$6,300,000	$22,000,000			EMWD has funding under the 2000 Water Resources Development Act (WRDA) for design and construction of the Perris II Desalter in the amount of $25 million. This program is administered by the USACOE and is comprised of 75% federal grant and 25% local share. The remaining federal share is $22M, and the remaining local contribution is $6.3M.	Funding is secured each year through the District's operating budget process.
San Jacinto Wildlife Area Habitat Sustainability and Enhancement Utilizing Recycled Water	Eastern Municipal Water District	$150,000	$75,000	$50,000		$25,000			
Storm Water Capture and Groundwater Recharge in the Perris North Groundwater Management Zone	Eastern Municipal Water District	$200,000	$100,000	$60,000		$40,000			Funding is secured each year through the District's operating budget process.
Hemet/San Jacinto Integrated Recharge and Recovery Program Phase II	Eastern Municipal Water District	$2,400,000	$1,800,000	$600,000				EMWD has entered into escrow to purchase the property that would be used for recharge. This represents at least 25% of the projected project costs.	O&M funding is secured each year through the operating annual budget process.

French Valley Recycled Water Distribution Pipeline Project	Eastern Municipal Water District	$3,192,800	$2,394,600	$798,200					Funding is secured each year through the District's operating budget process.
San Jacinto Recycled Water Distribution Pipeline Project	Eastern Municipal Water District	$3,809,480	$2,857,110	$952,370					Funding is secured each year through the District's operating budget process.
Perris Valley Recycled Water Distribution Pipeline Project	Eastern Municipal Water District	$3,821,520	$2,866,140	$955,380					Funding is secured each year through the District's operating budget process.
San Jacinto Indirect Potable Reuse	Eastern Municipal Water District	$2,000,000	$1,000,000	$1,000,000				The District has appropriated $25,000 via work order 412754 to support Facility Planning of this project.	Funding will be secured each year through the District's operating budget process.
Perris Water Filtration Plant Reject Recovery Facility	Eastern Municipal Water District	$6,765,828	$5,074,371	$1,691,457				This project will be financed from the Service Area No. 41 (Mills) Replacement and System Betterment Construction Reserve. Total Project Cost $6,765,828 (Board Letter M-231/09 Dated November 4, 2009).	Funding is secured each year through the District's operating budget process.
The San Jacinto Citrus In-Lieu Recycled Water Pond Pump Station and Distribution Pipeline Project	Eastern Municipal Water District	$7,240,000	$5,430,000	$810,000	$1,000,000				Funding is secured each year through the District's operating budget process.
East Diamond Valley Recycled Water Storage Pond and Distribution Pipeline Project	Eastern Municipal Water District	$10,783,600	$8,087,700	$2,695,900					Funding is secured each year through the District's operating budget process.
The Menifee Recycled Water Pond Pump Station and Distribution Pipeline Project	Eastern Municipal Water District	$11,980,320	$8,985,240	$2,370,080	$625,000				Funding is secured each year through the District's operating budget process.
EMWD Desalination Recovery Enhancement and Brine Concentrate Management Demonstration Facility	Eastern Municipal Water District	$12,000,000	$9,000,000	$1,300,000	$1,600,000	$100,000			Funding is secured each year through the District's operating budget process.

North Trumble Recycled Water Storage Ponds	Eastern Municipal Water District	$12,100,000	$9,075,000	$3,025,000				The project was included in the 2009/10 EMWD 5-year CIP. Additionally, EMWD is working to secure the additional funding through the combination of the grants application and EMWD Board appropriation.	Funding is secured each year through the District's operating budget process.
Sun City Force Main and Recycled Water Pipeline Replacement	Eastern Municipal Water District	$12,610,000	$9,458,000	$3,152,000				2008 COP Bond Issue Funding and Internal Reserve Funding	Funding is secured each year through the District's operating budget process.
Quail Valley Sewer Improvements (Subarea 9)	Eastern Municipal Water District	$18,932,000	$14,199,000	$4,733,000				Received a $180,222 Grant from the State Water Resources Control Board (SWRCB) for preliminary design of the Quail Valley Sewer Improvements (Subarea 9). The District's match was set at 22% ($39,649), for a total budget of about $220,000. District Expenses thus far for Subarea 9 exceed $223,000. Previously the District spent $130,000 for a feasibility study of the Quail Valley Community, to conduct research on alternative technologies, and to search for project funding.	Funding is secured each year through the District's operating budget process.
PVRWRF Biosolids Dryer Facility	Eastern Municipal Water District	$13,000,000	$7,800,000	$5,200,000					
Perris II Desalter Ancillary Facilities	Eastern Municipal Water District	$42,000,000	$31,500,000	$10,500,000					Funding is secured each year through the District's operating budget process,

Quail Valley Sewer Improvements (Subareas 1-8)	Eastern Municipal Water District	$56,762,000	$42,572,000	$14,190,000					Funding is secured each year through the District's operating budget process.
Temescal Gardens	Elsinore Valley Municipal Water District	$1,000,000	$750,000	$250,000				EVMWD has implemented an ascending block rate conservation structure for its water customers. A portion of penalty rates collected each year has been set aside for water conservation projects. The funding for this project constitutes a portion of that set aside funding.	O&M costs will be minimal and managed by the homeowner.
Temescal Gardens Online	Elsinore Valley Municipal Water District	$300,000	$200,000	$100,000				EVMWD has implemented an ascending block rate conservation structure for its water customers. A portion of the penalty revenue has been set aside for funding water conservation projects such as this. The local funding is only a portion of the amount set aside.	As with our existing Website, O&M for the design Website will be funded out of the EVMWD general fund.
Wineville Extension Pipeline	Inland Empire Utilities Agency	$11,212,500	$8,409,375	$2,803,125					O&M expenses will be funded through IEUAs operating revenue, which is supported through service charges and fees.
Watershed Action Plan	Inland Empire Utilities Agency	$1,000,000	$750,000					The County of San Bernardino has budgeted funds for the local portion.	
Ely Basin Cla Valve Replacement and Electrical Service	Inland Empire Utilities Agency	$98,091	$73,568	$24,523					O&M expenses will be funded through IEUAs operating revenue, which is supported through service charges and fees.
San Sevaine Lateral and Turnouts	Inland Empire Utilities	$2,631,701	$1,973,776	$657,925					O&M expenses will be funded through IEUAs operating revenue, which

	Agency								is supported through service charges and fees.
Hickory Basin Conservation Berm Outlet Modification	Inland Empire Utilities Agency	$92,752	$69,564	$23,188					O&M expenses will be funded through IEUAs operating revenue, which is supported through service charges and fees.
Hickory / Banana Basin Turnout Flow Meter	Inland Empire Utilities Agency	$101,567	$76,175	$25,392					O&M expenses will be funded through IEUAs operating revenue, which is supported through service charges and fees.
Montclair Basin SCADA Improvements	Inland Empire Utilities Agency	$132,567	$99,425	$33,142					O&M expenses will be funded through IEUAs operating revenue, which is supported through service charges and fees.
Regional Public Sector Program	Inland Empire Utilities Agency	$665,000	$500,000	$150,000		$15,000			
Motorized Gate Actuator Installation at RP-3	Inland Empire Utilities Agency	$710,776	$533,082	$177,694					O&M expenses will be funded through IEUAs operating revenue, which is supported through service charges and fees.
Jurupa Pump station	Inland Empire Utilities Agency	$871,487	$653,615	$217,872					O&M expenses will be funded through IEUAs operating revenue, which is supported through service charges and fees.
Regional Commercial Incentive Program	Inland Empire Utilities Agency	$415,000	$250,000	$150,000		$15,000			
Regional Residential Landscape Retrofit Program	Inland Empire Utilities Agency	$315,000	$200,000	$100,000		$15,000			
Jurupa Force Main Outlet Modifications	Inland Empire Utilities Agency	$1,555,113	$1,166,335	$388,778					O&M expenses will be funded through IEUAs operating revenue, which is supported through service charges and fees.
Agency Wide Lighting Improvements	Inland Empire Utilities Agency	$1,670,000	$1,252,500	$417,500					

IEUA Regional Water Budget Program	Inland Empire Utilities Agency	$315,000	$200,000	$100,000		$15,000			
Agency Wide Aeration System Modifications	Inland Empire Utilities Agency	$2,000,000	$1,500,000	$500,000					O&M expenses will be funded through IEUAs operating revenue, which is supported through service charges and fees.
RP-2 Digester Gas System Modifications	Inland Empire Utilities Agency	$2,997,000	$2,247,750	$749,250				Project is part of IEUA Regional Capital Fund	
RP-5 Wind Turbine	Inland Empire Utilities Agency	$3,000,000	$2,250,000	$750,000					
RP-2 Cogeneration Facility Expansion	Inland Empire Utilities Agency	$4,000,000	$3,000,000	$1,000,000					O&M expenses will be funded through IEUA's operating revenue, which is supported through service charges and fees.
Renewable Energy Expansion Program	Inland Empire Utilities Agency	$4,000,000	$3,000,000	$1,000,000					O&M expenses will be funded through IEUA's operating revenue, which is supported through service charges and fees.
Digester Gas Cleaning System	Inland Empire Utilities Agency	$4,479,000	$3,359,250	$1,119,750					O&M expenses will be funded through IEUA's operating revenue, which is supported through service charges and fees.
City of Chino Local Recycled Water Distribution Facilities	Inland Empire Utilities Agency	$7,000,000	$5,250,000	$1,750,000					O&M expenses will be funded through IEUA's and the City of Chino's operating revenue, which is supported through service charges and fees.
City of Fontana Local Recycled Water Distribution Facilities	Inland Empire Utilities Agency	$8,000,000	$6,000,000	$2,000,000					O&M expenses will be funded through IEUA's operating revenue, which is supported through service charges and fees.
RP-1 Cogeneration Facility Expansion	Inland Empire Utilities Agency	$8,300,000	$6,225,000	$2,075,000					O&M expenses will be funded through IEUA's operating revenue, which is supported through service charges and fees.
City of Chino Hills Local Recycled Water	Inland Empire	$10,000,000	$7,500,000	$2,500,000					O&M expenses will be funded through IEUA's

Distribution Facilities	Utilities Agency								operating revenue, which is supported through service charges and fees.
Regional Residential Landscape Financing Program	Inland Empire Utilities Agency	$240,000	$150,000	$75,000		$15,000			
Turner Basin Improvements	Inland Empire Utilities Agency	$13,453,000	$10,089,750	$3,363,250					The ground water recharge in the Chino Basin is supported by the IEUA and Chino Basin Watermaster through each agency's regular operating expenses. It is the goal of the project to have all park and recreational features be self funding through park entry fees and park equipment rentals.
Local Recycled Water Laterals Construction	Inland Empire Utilities Agency	$25,000,000	$18,750,000	$6,250,000					O&M expenses will be funded through IEUA's operating revenue, which is supported through service charges and fees.
IEUA Regional Landscape Evaluation Program	Inland Empire Utilities Agency	$165,000	$100,000	$50,000		$15,000			
Central Area Recycled Water Project	Inland Empire Utilities Agency	$27,920,000	$20,940,000	$6,980,000					O&M expenses will be funded through IEUA's operating revenue, which is supported through service charges and fees.
RP-1 Secondary System Modifications	Inland Empire Utilities Agency	$30,200,000	$22,650,000	$7,550,000					O&M expenses will be funded through IEUA's operating revenue, which is supported through service charges and fees.
RP-5 De-bottlenecking and RP-2 Capacity Improvement	Inland Empire Utilities Agency	$39,000,000	$29,250,000	$9,750,000					O&M expenses will be funded through IEUA's operating revenue, which is supported through service charges and fees.
930-Zone Pipeline & Reservoir, Expansion of the CCWRF-RP-1 S. Zone Pump Station & Installation of a Parallel Line to RP-1 Outfall	Inland Empire Utilities Agency	$39,338,000	$29,503,500	$9,834,500					O&M expenses will be funded through IEUA's operating revenue, which is supported through service charges and fees.

Local Recycled Water Laterals Construction	Inland Empire Utilities Agency	$25,000,000	$12,500,000				$12,500,000		Funded through IEUA's operating revenue, which is supported through user charges and fees.
Regional Recycling Plant No.5 Expansion	Inland Empire Utilities Agency	$70,000,000	$52,500,000	$17,500,000					O&M expenses will be funded through IEUA's operating revenue, which is supported through service charges and fees.
Cypress Channel Multipurpose Corridor	Inland Empire Utilities Agency	$7,600,000	$5,700,000	$100,000	$1,750,000	$50,000			
Chino Creek Multipurpose Corridor	Inland Empire Utilities Agency	$13,900,000	$10,425,000	$3,300,000		$175,000			
Temescal Creek Master Trail and Park Project	Inland Empire Waterkeeper	$3,030,000	$3,000,000	$10,000		$10,000			
Tustin Legacy Wells 1, 2, 3, and 4	Irvine Ranch Water District	$17,900,000	$1,000,000						
Syphon Reservoir Expansion	Irvine Ranch Water District (IRWD)	$70,000,000	$17,500,000	$52,500,000				Funding for the project planning is secure through Board approval of IRWD's capital budget for FY 2010/11. The project design and construction will be funded in future capital budgets.	IRWD will provide full O&M funding for the project. Through its rates and charges, IRWD recovers costs from its water retail customers for O&M in its annual operating budget. Each customer is assessed a monthly service fee as part of the water bill.
Reservoir Management System at 5 Domestic Water Reservoirs	Irvine Ranch Water District	$2,500,000	$1,250,000					The funds have been secured from bonds already sold and bonds to be sold.	Once construction is completed and is operational, O&M for these facilities will be included in IRWDs Operational budget.
University of California Irvine Water Use Efficiency Upgrades	Irvine Ranch Water District	$115,000	$34,000	$56,000		$25,000		IRWD funding is subject to continued Board approval. The IRWD Board of Directors is supportive of funding water use efficiency projects within the University campus system. Also, the	

								IRWD funding is based on the District's avoided cost for water and wastewater, and therefore cost effective for the district to continue to offer funding.	
Construction Circle Recycled Water Conversion Project	Irvine Ranch Water District	$1,000,000	$790,000	$210,000					
Commercial, Industrial & Institutional Water Use Efficiency Upgrades	Irvine Ranch Water District	$3,880,000	$1,000,000	$880,000		$2,000,000		IRWD funding is subject to continued Board approval. The IRWD Board of Directors is supportive of funding water use efficiency projects within the commercial, industrial and institutional customer class. Additionally, the IRWD funding is based on the District's avoided cost for water and wastewater, and therefore cost effective for the district to continue to offer funding.	IRWD is committed to providing staff support to administer the CII Water Use Efficiency Upgrade Program. The operation and maintenance of all water use efficiency upgrade equipment is explicitly stated in the program agreement as the participating customer's responsibility. Customers unable to provide adequate evidence that the water savings will be realized are not approved for participation in the program.
Syphon Reservoir Integration Project	Irvine Ranch Water District	$6,900,000	$2,000,000	$4,900,000				Funding for the project has been secured through Board approval of IRWDs capital budget for FY 2010/11.	IRWD will provide full O&M funding for the project. IRWD through its rates and charges recovers costs from its water retail customers for O&M in its annual operating budget. Each customer is assessed a monthly service fee as part of the water bill.
Baker Water Treatment Plant Project	Irvine Ranch Water District	$62,000,000	$10,000,000	$52,000,000				Funding for the project has been secured through Board approval of IRWD and partner agencies capital	IRWD and partner agencies will provide O&M funding for the life of the project (50 yrs). A formal agreement has been reached among all

								budget for FY 2010/11.	partner agencies with Board approvals.
Natural Treatment System Facility No. 62 (NTS-62)	Irvine Ranch Water District	$2,460,000	$440,000	$1,027,200	$992,800			Funding for the proposed project has been secured through Board approval of IRWDs capital budget for FY 2010/11.	IRWD will provide full O&M funding for the project. IRWD through its rates and charges recovers costs from its water retail customers for O&M in its annual operating budget. Each customer is assessed a monthly service fee as part of the water bill. In addition, IRWD has been working with the County and Cities for cost-sharing as appropriate.
SMART Landscapes	Irvine Ranch Water District	$290,000	$100,000	$120,000		$70,000		IRWD can provide funding of $0.50 per square foot for turf removal. IRWDs source of funds is derived from conservation revenues and is included in IRWDs annual operating budgets. There is the possibility of additional grant from regional conservation funding through the Municipal Water District of Orange County or Metropolitan Water District of Southern California, but this is not confirmed.	The project proposes providing one-time incentives to customers to upgrade landscapes to more water-efficient landscapes by replacing turf with water efficient irrigation and climate appropriate plants. All O&M would be the responsibility of the property owner.
Well 53	Irvine Ranch Water District	$1,700,000	$400,000	$1,300,000				Funding for the project has been secured through Board approval of IRWDs capital budget for FY 2010/11. IRWD will utilize its capital funds for project construction. IRWDs capital funds	IRWD will provide full O&M funding for the project. IRWD through its rates and charges recovers costs from its water retail customers for O&M in its annual operating budget. Each customer is assessed a monthly service fee as

								are provided by a combination of connection fees and property tax revenues.	part of the water bill.
Irvine Ranch Water District Advanced Metering Infrastructure (AMI) Project	Irvine Ranch Water District	$2,125,000	$500,000	$1,275,000		$350,000		Funding for the proposed pilot project has been secured through Board approval of IRWDs capital budget for FY 2010/11.	IRWD will provide full O&M funding for the project. The project installs advanced water meters that will assist in improving demand management. IRWD through its rates and charges recovers costs from its water retail customers for O&M in its annual operating budget. Each customer is assessed a monthly service fee as part of the water bill.
Strand Ranch Water Banking Project Recovery Wells and Conveyance Facilities	Irvine Ranch Water District	$7,353,000	$1,800,000	$5,553,000				The Strand Ranch Water Banking Project Recovery Wells and Conveyance Facilities project is included in the IRWD 2010-11 Capital Budget. IRWD will utilize its capital funds for project construction. IRWDs capital funds are provided by a combination of connection fees and property tax revenues.	IRWD will provide full O&M funding for the project. IRWD through its rates and charges recovers costs from its water retail customers for O&M in its annual operating budget. Each customer is assessed a monthly service fee as part of the water bill.
Natural Treatment System Site 67	Irvine Ranch Water District	$19,700,000	$5,500,000	$8,688,000	$5,512,000			IRWD has a cooperative agreement with Bureau of Reclamation through Title XVI for $5,512,000. IRWD will fund the non-state share through capital funds approved in the IRWD 2010-11 Capital Budget.	IRWD will provide full O&M funding for the project. IRWD through its rates and charges recovers costs from its water retail customers for O&M in its annual operating budget. Each customer is assessed a monthly service fee as part of the water bill.

								IRWDs capital funds are provided by a combination of connection fees and property tax revenues.	
Wells 21 and 22 Project	Irvine Ranch Water District	$39,768,000	$10,000,000	$19,826,000	$9,942,000			Funding for the project has been secured through Board approval of IRWDs capital budget for FY 2010/11. IRWD will utilize its capital funds for project construction. IRWDs capital funds are provided by a combination of connection fees and property tax revenues.	O&M costs will be funded by water sales and monthly meter charges.
Joint Anaheim/IRWD Well Field	Irvine Ranch Water District	$40,000,000	$5,000,000	$35,000,000					
Orange Park Acres Groundwater Supplies and Conveyance Facilities	Irvine Ranch Water District	$25,000,000	$6,250,000	$18,750,000				Funding for the project has been secured through Board approval of IRWDs capital budget for FY 2010/11. IRWD will utilize its capital funds for project construction. IRWDs capital funds are provided by a combination of connection fees and property tax revenues.	IRWD will provide full O&M funding for the project. IRWD through its rates and charges recovers costs from its water retail customers for O&M in its annual operating budget. Each customer is assessed a monthly service fee as part of the water bill. Also, there are funds that were provided as a part of the OPAMWC consolidation/agreement.
Roger B. Teagarden Ion Exchange Treatment Plant (IXP) Expansion	Jurupa Community Services District	$10,200,000	$1,000,000	$9,200,000					O&M funding is from fees and sewer rates collected by JCSD.
Non-Potable Water Distribution System and Indian Hills Wastewater Treatment Plant Rehabilitation	Jurupa Community Services District	$19,520,000	$1,000,000	$18,520,000					O&M funding is from fees and sewer rates collected by JCSD.
Eastvale Water Recycling Project	Jurupa Community Services	$28,000,000	$1,000,000	$27,000,000					O&M funding is from fees and sewer rates collected by JCSD.

	District								
Non-Potable Water Distribution System and Van Buren Bridge Recycled Water Pipeline	Jurupa Community Services District_	$8,920,000	$1,000,000	$7,920,000					O&M funding is from fees and sewer rates collected by JCSD.
San Jacinto Watershed Nutrient TMDL Pollutant Trading Study	Lake Elsinore and San Jacinto Watersheds Authority	$250,000	$125,000	$125,000					
San Jacinto Urban Runoff Treatment & Control	Lake Elsinore and San Jacinto Watersheds Authority	$250,000	$125,000	$125,000					
Lake Elsinore Water Quality Modeling	Lake Elsinore and San Jacinto Watersheds Authority	$300,000	$150,000	$150,000					
Stormwater Treatment Wetlands for Canyon Lake	Lake Elsinore and San Jacinto Watersheds Authority	$300,000	$150,000	$150,000					
San Jacinto River Riparian Habitat Restoration	Lake Elsinore and San Jacinto Watersheds Authority	$300,000	$150,000	$150,000					
Canyon Lake Dredging Enhancements	Lake Elsinore and San Jacinto Watersheds Authority	$550,000	$275,000	$275,000					
Hypolimnetic Oxygenation System for Canyon Lake	Lake Elsinore and San Jacinto Watersheds Authority	$800,000	$400,000	$400,000					
Canyon Lake Alum/Phoslock Treatment	Lake Elsinore and San Jacinto Watersheds Authority	$1,500,000	$750,000	$750,000					
Lake Elsinore & Canyon Lake Nutrient TMDL Monitoring	Lake Elsinore and San Jacinto Watersheds	$1,500,000	$750,000	$750,000					

	Authority								
Lake Elsinore Fishery Enhancement	Lake Elsinore and San Jacinto Watersheds Authority	$1,700,000	$850,000	$850,000					
Lake Elsinore Alum/Phoslock Treatment	Lake Elsinore and San Jacinto Watersheds Authority	$2,500,000	$1,250,000	$1,250,000					
Colored Water Treatment Facility Technology Replacement and Expansion	Mesa Consolidated Water District	$24,000,000	$2,000,000	$22,000,000				The Mesa Consolidated Water District Board of Directors has approved a capital budget for project with plan to issue certificate of participation bonds to fund construction.	The Mesa Consolidated Board will increase rates as necessary to fund the O&M costs of this water supply project. A portion of the O&M costs will be funded by the Metropolitan Water District of Southern California's Local Resources Program through the Municipal Water District of Orange County through fiscal year ending 2025 and by Orange County Water Districts Water Quality Program indefinitely.
Second Lower Cross Feeder Project	Municipal Water District of Orange County	$50,000,000	$12,500,000	$37,500,000					
In-Conduit Hydroelectric Project	NLine Energy, Inc.	$950,000	$450,000	$350,000	$150,000				
Restoration of the Lower Santa Ana River Marsh	Orange Coast River Park	$2,260,000	$1,000,000	$250,000	$1,000,000	$10,000			
Huntington Harbor Water Quality Improvement Program	Orange County Coastkeeper	$320,650	$240,150					Matching funds will be provided by Orange County Coastkeeper as in kind services. Matching funds will be available when project is funded	

Wintersberg Chanel Source Identification Study	Orange County Coastkeeper	$278,000	$208,500					Funding match will be provided by Orange County Coastkeeper through in kind services. Project funds will be available upon project funding.	No O&M funding is necessary for the project.
Orange County LID Implementation Project	Orange County Coastkeeper	$420,481	$315,361					Matching funds have been secured. Orange County Coastkeeper will provide the matching funds through in kind services. The funds are available upon project funding.	O&M funding will be provided by the individual property owners that participate in the project.
Huntington Harbor Copper Reduction Project	Orange County Coastkeeper	$630,000	$472,500					The matching funds will be provided by Orange County Coastkeeper as in kind services. The funds will be available upon project funding.	No O&M funding is necessary for this project.
Rhine Channel Remediation Project	Orange County Coastkeeper	$4,000,000	$2,000,000					The City of Newport Beach has committed to funding the match for the project. The funding will be available when the project is funded	No O&M funding is necessary. This is a one-time project.
Central Orange County Trash Reduction Project	Orange County Coastkeeper	$355,418	$266,566					The matching funds will be provided by Orange County Coastkeeper through in kind services. The funds are available pending project funding.	
Santa Ana River Interceptor (SARI) Line Relocation Project	Orange County Flood Control District	$86,000,000	$43,000,000	$43,000,000				The Board of Supervisors for the Orange County Flood Control District has approved the financing for the SARI Line Relocation Project. Funds will be obtained from Flood Control funds and loans that have	After completion of construction, the SARI Line will be conveyed to the Orange County Sanitation District for O&M.

								been secured for the project.	
Recycled Water Reservoir	Orange County Great Park Corporation	$3,500,000	$2,300,000	$1,200,000					
Co-generation Facilities Cooling Water System Modifications and Upgrades Project J-109.	Orange County Sanitation District (OCSD)	$9,094,000	$1,000,000	$8,094,000				OCSD has a long-term financial plan for this project and funds have been secured for its completion. Funding is collected from fees and sewer rates and issuance of COPs.	O&M funding is provided through fees and sewer rates collected by OCSD. The long-term financial plan for the O&M of this Project is part of OCSD annual operating budget.
								OCSD closely monitors its two-billion Capital Improvement Program through its Project Control Database System which provide project management tools and oversight to individual project phases, i.e. planning, design, construction, including bid process, and essential targets for meeting overall project performance.	
Pharmaceutical Collection Program	Orange County Sanitation District	$185,000	$90,000	$90,000		$5,000		OCSD has a long-term financial plan for this Project. OCSD funding has been secured for completion of this Project. OCSD receives funding through fees and sewer rates.	O&M funding is provided through fees and sewer rates collected by OCSD. A long term financial plan for O&M of this project has been established and is currently a part of OCSD annual operating budget.
Sludge Dewatering, Odor Control, and Primary Sludge Thickening at Plant No. 1, Project No. P1-101	Orange County Sanitation District	$100,000,000	$1,000,000	$98,700,000	$300,000			OCSD has a long-term financial plan for this Project and funds have been secured for its completion. Funding is collected from fees and sewer rates, issuance of	O&M funding is provided through fees and sewer rates collected by OCSD. The long-term financial plan for the O&M of this Project is part of OCSD annual operating budget.

								COPs, and federal grant funding.	
								OCSD closely monitors it's two-billion Capital Improvement Program through its Project Control Database System which provide project management tools and oversight to individual project phases, i.e. planning, design, construction, including bid process, and essential targets for meeting	
Orange County Regional Stormwater Infiltration Program	Orange County Water District	$2,000,000	$500,000						OCWD pays for the O&M costs of capital projects through the revenue generated by the Replenishment Assessment (RA) payments from groundwater producers. Semiannually, OCWD collects RA from member agencies that pump groundwater from OCWD's groundwater basin. Every fiscal year, OCWD budgets the O&M costs of each project under the general fund.
Subsurface Recharge	Orange County Water District								OCWD pays for the O&M costs of any capital project through the revenue generated by the RA payments from OCWD's member agencies (i.e. groundwater producers). Semiannually, OCWD collects RA from member agencies that pump groundwater from OCWD's groundwater basin. Every fiscal year,

									OCWD budgets the O&M costs of each project under the general fund.
Santiago Enhanced Recharge	Orange County Water District	$840,000	$210,000					OCWD maintains a stable revenue stream through its sale of groundwater. OCWD has an annual operating budget of $115 M, with cash reserves currently estimated at $169 M. Historically, the District has funded large capital projects with long-term debt. The District has high credit ratings from Standard & Poor's and Fitch and Moody's. These ratings enable the District to access low interest rate debt instruments.	OCWD pays for the O&M costs of any capital project through the revenue generated by the RA payments from OCWD's member agencies (i.e. groundwater producers). Semiannually, OCWD collects RA from member agencies that pump groundwater from OCWD's groundwater basin. Every fiscal year, OCWD budgets the O&M costs of each project under the general fund.
Recharge Basin Rehabilitation	Orange County Water District	$850,000	$212,500						OCWD pays for the O&M costs of any capital project through the revenue generated by the RA payments from OCWD's member agencies (i.e. groundwater producers). Semiannually, OCWD collects RA from member agencies that pump groundwater from OCWD's groundwater basin. Every fiscal year, OCWD budgets the O&M costs of each project under the general fund.
South Basin Groundwater Protection Project Interim Remediation	Orange County Water District	$2,800,000	$700,000						

Mid-Basin Injection Demonstration	Orange County Water District	$4,900,000	$1,225,000					The funding of this project is approved and included in the multiple-year debt funded Capital Improvement Program for fiscal years 2010-11 to 2011-12. OCWD maintains a stable revenue stream and has an annual operating budget of $115 M, with cash reserves currently estimated at $169 M. OCWD high credit ratings from Standard & Poor's and Fitch & Moody's, and these ratings enable OCWD to access low interest rate debt instruments.	OCWD pays for the O&M costs of any capital project through the revenue generated by the RA payments from OCWD's member agencies (i.e. groundwater producers). Semiannually, OCWD collects RA from member agencies that pump groundwater from OCWD's groundwater basin. Every fiscal year, OCWD budgets the O&M costs of each project under the general fund. OCWDs fiscal year starts on July 1 and ends on June 30 of the following year.
MTBE Interim Remediation	Orange County Water District	$15,000,000	$3,750,000						
Mid-Basin Injection Project	Orange County Water District	$18,000,000	$4,500,000						Once a project is approved, OCWD pays for the O&M costs of any capital project through the revenue generated by the RA payments from OCWD's member agencies (i.e. groundwater producers). Semiannually, OCWD collects RA from member agencies that pump groundwater from OCWD's groundwater basin. Every fiscal year, OCWD budgets the O&M costs of each project under the general fund.
Groundwater Replenishment System - Flow Equalization	Orange County Water District	$23,218,000	$5,804,500						OCWD pays for the O&M costs of any capital project through the revenue generated by the RA payments from

									OCWD's member agencies (i.e. groundwater producers). Semiannually, OCWD collects RA from member agencies that pump groundwater from OCWD's groundwater basin. Every fiscal year, OCWD budgets the O&M costs of each project under the general fund.
North Basin Groundwater Protection Project	Orange County Water District	$42,000,000	$10,500,000						
Groundwater Replenishment System Expansion	Orange County Water District	$104,000,000	$26,000,000						OCWD pays for the O&M costs of any capital project through the revenue generated by the RA payments from OCWD's member agencies (i.e. groundwater producers). Semiannually, OCWD collects RA from member agencies that pump groundwater from OCWD's groundwater basin. Every fiscal year, OCWD budgets the O&M costs of each project under the general fund.
Five Coves and Lincoln Basins Bypass Pipeline	Orange County Water District	$6,440,000	$1,610,000	$4,830,000				The funding of this project has been approved by OCWD Board of Directors and is included in the multiple-year debt funded Capital Improvement Program for fiscal year 2010-11. OCWD maintains a stable revenue stream and has an annual operating budget of	OCWD pays for the O&M costs of any capital project through the revenue generated by the RA payments from OCWDs member agencies (i.e., groundwater producers). Semiannually, OCWD collects RA from member agencies that pump groundwater from OCWDs groundwater basin. Every fiscal year,

								$115 M, with cash reserves currently estimated at $169 M. OCWD has high credit ratings from Standard & Poor's and Fitch & Moody's and these ratings enable OCWD to access low interest rate debt instruments.	OCWD budgets the O&M costs of each project under the general fund. OCWDs fiscal year starts on July 1 and ends on June 30 of the following year.
Enhanced Water Conservation at Prado	Orange County Water District	$5,500,000	$1,375,000						OCWD pays for the O&M costs of any capital project through the revenue generated by the RA payments from OCWD's member agencies (i.e. groundwater producers). Semiannually, OCWD collects RA from member agencies that pump groundwater from OCWD's groundwater basin. Every fiscal year, OCWD budgets the O&M costs of each project under the general fund. This project is a study, thus ongoing O&M would not apply.
Sunset Gap Seawater Intrusion	Orange County Water District	$700,000	$175,000	$525,000				OCWD maintains a stable revenue stream through its sale of groundwater. OCWD has an annual operating budget of $115 M, with cash reserves currently estimated at $169 M. Historically, the District has funded capital projects with long-term debt. The District has high credit ratings from Standard & Poor's and Fitch and Moody's. These ratings enable the	Existing water quality O&M staff will support the groundwater level monitoring and sampling activities after the project is complete.

								District to access low interest rate debt instruments. In June 2010, OCWD approved funding for project construction from reserves.	
Recharge Water Sediment Removal Demonstration Project	Orange County Water District	$1,570,000	$392,500	$1,177,500				The funding of this capital project has been approved by OCWD Board of Directors and is included in the Capital Improvement Program for the fiscal year 2010-11.	OCWD pays for the O&M costs of any capital project through the revenue generated by the RA payments from OCWD's member agencies (i.e., groundwater producers). Semiannually, OCWD collects RA from member agencies that pump groundwater from OCWD's groundwater basin. Every fiscal year, OCWD budgets the O&M costs of each project under the general fund. OCWDs fiscal year starts on July 1 and ends on June 30 of the following year.
Prado Basin Sediment Management Project	Orange County Water District	$2,500,000	$625,000	$1,875,000					OCWD pays for the O&M costs of any capital project through the revenue generated by the RA payments from OCWDs member agencies (i.e., groundwater producers). Semiannually, OCWD collects RA from member agencies that pump groundwater from OCWDs groundwater basin. Every fiscal year, OCWD budgets the O&M costs of each project under the general fund. OCWDs fiscal year starts on July 1 and ends on June 30 of the following year.

Santiago Basins Intertie	Orange County Water District	$2,800,000	$700,000	$2,100,000				The funding of Santiago Basins Intertie Project has been approved by OCWD Board of Directors and is included in the multiple-year funding of capital improvement program. OCWDs fiscal year starts on July 1 and ends on June 30 of the following year.	OCWD pays for the O&M costs of any capital project through the revenue generated by the RA payments from OCWDs member agencies (i.e., groundwater producers). Semiannually, OCWD collects RA from member agencies that pump groundwater from OCWDs groundwater basin. Every fiscal year, OCWD budgets the O&M costs of each project under the general fund.
Santiago Basins Pump Station	Orange County Water District	$3,100,000	$775,000	$2,325,000				The funding of this Project has been approved by OCWD Board of Directors and is included in the multiple-year debt funded capital improvement program for fiscal year 2010-11. OCWD maintains a stable revenue stream and has an annual operating budget of $115 M, with cash reserves currently estimated at $169 M. OCWD has high credit ratings from Standard & Poor's and Fitch & Moody's and these ratings enable OCWD to access low interest rate debt instruments.	OCWD pays for the O&M cost of any capital project through the revenue generated by the RA payments from OCWDs member agencies (i.e., groundwater producers). Semiannually, OCWD collects RA from member agencies that pump groundwater from OCWDs groundwater basin. Every fiscal year, OCWD budgets the O&M costs of each project under the general fund. OCWDs fiscal year starts on July 1 and ends on June 30 of the following year.
Raymond Basin Enhancement Project	Orange County Water District	$3,600,000	$900,000	$2,700,000				The funding of Raymond Basin Enhancement Project has been approved by OCWD Board of Directors and is included in the multiple-year funding	OCWD pays for the O&M costs of any capital project through the revenue generated by the RA payments from OCWD member agencies (i.e., groundwater producers). Semiannually, OCWD

								of capital improvement program for fiscal years 2010-11 and 2011-12. OCWDs fiscal year starts on July 1 and ends on June 30 of the following year.	collects RA from member agencies that pump groundwater from OCWDs groundwater basin. Every fiscal year, OCWD budgets the O&M costs of each project under the general fund.
Placentia Basin Enhancement Project	Orange County Water District	$3,800,000	$950,000	$2,850,000				The funding of Placentia Basin Enhancement Project has been approved by OCWD Board of Directors and is included in the multiple-year funding of capital improvement program for fiscal years 2010-11 through 2012-13. OCWDs fiscal year starts on July 1 and ends on June 30 of the following year.	OCWD pays for the O&M costs of any capital project through the revenue generated by the RA payments from OCWDs member agencies (i.e., groundwater producers). Semiannually, OCWD collects RA from member agencies that pump groundwater from OCWDs groundwater basin. Every fiscal year, OCWD budgets the O&M costs of each project under the general fund.
Prado Basin Sediment Management Demonstration Project	Orange County Water District	$4,250,000	$1,062,500	$3,187,500				The funding of Prado Basin Sediment Management Demonstration Project has been approved by OCWD Board of Directors and is included in the multiple year funding of the capital improvement program (from fiscal year 2010 to 2012-13).	OCWD pays for the O&M costs of any capital improvement project through the revenue generated by the collection of RA from OCWDs member agencies (i.e., groundwater producers). Semiannually, OCWD collects RA from member agencies that pump groundwater from OCWDs groundwater basin. Every fiscal year, OCWD budgets the O&M costs of each project under the general fund. OCWDs fiscal year starts on July 1 and ends on June 30 of the following year.

Mira Loma Recharge Basin	Orange County Water District	$6,100,000	$1,525,000	$4,575,000				OCWD maintains a stable revenue stream through its sale of groundwater. OCWD has an annual operating budget of $115 M, with cash reserves currently estimated at $169 M. Historically, the District has funded large capital projects with long-term debt. The District has high credit ratings from Standard & Poor's and Fitch and Moody's. These ratings enable the District to access low interest rate debt instruments.	OCWD pays for the O&M costs of any capital project through the revenue generated by the RA payments from OCWD's member agencies (i.e. groundwater producers). Semiannually, OCWD collects RA from member agencies that pump groundwater from OCWD's groundwater basin. Every fiscal year, OCWD budgets the O&M costs of each project under the general fund.
Alamitos Barrier Improvement Project	Orange County Water District	$20,000,000	$5,000,000	$15,000,000					OCWD pays for the O&M costs of any capital project through the revenue generated by the RA payments from OCWD's member agencies (i.e., groundwater producers). Semiannually, OCWD collects RA from member agencies that pump groundwater from OCWD's groundwater basin. Every fiscal year, OCWD budgets the O&M costs of each project under the general fund. OCWDs fiscal year starts on July 1 and ends on June 30 of the following year.
Recharge Water Sediment Removal Project	Orange County Water District	$26,000,000	$6,500,000	$19,500,000					Once a capital has been approved by OCWD Board of Directors, OCWD pays for the O&M costs of any capital project through the revenue generated by the RA payments from

									OCWD's member agencies (i.e., groundwater producers). Semiannually, OCWD collects RA from member agencies that pump groundwater from OCWD's groundwater basin. Every fiscal year (from July 1 to June 30), OCWD budgets the O&M costs of each project under the general fund.
Temescal Creek Wetlands	Orange County Water District	$3,000,000	$750,000	$1,500,000	$750,000				OCWD pays for the O&M costs of any capital project through the revenue generated by the RA payments from groundwater producers. Semiannually, OCWD collects RA from member agencies that pump groundwater from OCWD's groundwater basin. Every fiscal year, OCWD budgets the O&M costs of each project under the general fund.
Fletcher Basin Rehabilitation	Orange County Water District	$5,000,000	$1,250,000	$3,750,000				The funding of this project is approved and included in the multiple-year debt funded capital improvement program for fiscal years 2010-11 to 2011-12. OCWD maintains a stable revenue stream through its sale of groundwater. OCWD has an annual operating budget of $115 M, with cash reserves currently estimated at $169 M. OCWD has high credit ratings from Standard & Poor's and Fitch & Moody's, and these ratings	OCWD pays for the O&M costs of any capital project through the revenue generated by the RA payments from OCWD's member agencies (i.e. groundwater producers). Semiannually, OCWD collects RA from member agencies that pump groundwater from OCWD's groundwater basin. Every fiscal year, OCWD budgets the O&M costs of each project under the general fund. OCWD's fiscal year starts on July 1 and ends on June 30 of the following year.

								enable OCWD to access low-interest rate debt instruments.	
Mill Creek Diversion Project	Orange County Water District	$7,000,000	$1,750,000	$3,500,000	$1,750,000				OCWD pays for the O&M costs of capital projects through revenue generated by the RA payments from groundwater producers. Semiannually, OCWD collects RA from member agencies that pump groundwater from OCWDs groundwater basin. Every fiscal year, OCWD budgets the O&M costs of each project under the general fund.
River Road Treatment Wetlands	Orange County Water District	$8,500,000	$2,125,000	$4,250,000	$2,125,000				OCWD pays for the O&M costs of any capital project through the revenue generated by the RA payments from groundwater producers. Semiannually, OCWD collects RA from member agencies that pump groundwater from OCWD's groundwater basin. Every fiscal year, OCWD budgets the O&M costs of each project under the general fund.
Chino Creek Wetlands	Orange County Water District	$12,000,000	$3,000,000	$6,000,000	$3,000,000				OCWD pays for the O&M costs of any capital project through the revenue generated by the RA payments from groundwater producers. Semiannually, OCWD collects RA from member agencies that pump groundwater from OCWD's groundwater basin. Every fiscal year, OCWD budgets the O&M

									costs of each project under the general fund.
Groundwater Interception and Conveyance System for Selenium Load Reduction at the Lower Peters Canyon Wash, Orange County, California	Orange County Watersheds Program	$1,250,000	$500,000			$750,000		The matching fund has been secured through a cost-share agreement with all watershed cities and other stake holders.	The County and funding partners will maintain the project for the foreseeable future through the funding agreement.
East Garden Grove-Wintersburg Channel (OCFCD Facility No. C05) from upstream Warner Avenue to downstream Goldenwest Street.	Orange County, Public Works, Flood Control Section, Flood Program	$22,000,000	$5,500,000	$16,500,000				Yes, this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is OCFCD's highest priority capital improvement project; when the downstream segments are constructed, this project will advance the tiers towards the budgeted year. If it advances to a budgeted year in mid-fiscal year, funds will be appropriated to construct this project. Funds for flood control capital improvement projects, including op	Yes. Funds for flood control capital improvement projects, including operation and maintenance come mainly from property taxes and state contributions. Operation and maintenance is ongoing for this channel system and is budgeted every fiscal year.
East Garden Grove-Wintersburg Channel (OCFCD Facility No. C05) from upstream Quartz Street to upstream Bushard Street.	Orange County, Public Works, Flood Control Section, Flood Programs	$15,000,000	$3,750,000	$11,250,000				Yes, this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is OCFCD's highest	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted

								priority capital improvement project; when the downstream segments are constructed, this project will advance the tiers towards the budgeted year. If it advances to a budgeted year in mid-fiscal year, funds will be appropriated to construct this project. Funds for flood control capital improvement projects.	every fiscal year.
Ocean View Channel (OCFCD Facility No. C06) from upstream of the Confluence with East Garden Grove-Wintersburg Channel (C05) to downstream Beach Boulevard.	Orange County, Public Works, Flood Control Section, Flood Programs	$2,175,000	$543,750	$1,631,250				Yes, this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is OCFCD's highest priority capital improvement project; when the downstream segments are constructed, this project will advance the tiers towards the budgeted year. If it advances to a budgeted year in mid-fiscal year, funds will be appropriated to construct this project. Funds for flood control capital improvement projects.	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.

Ocean View Channel (OCFCD Facility No. C06) from upstream of Beach Boulevard to downstream of Newland Street.	Orange County, Public Works, Flood Control Section, Flood Programs	$2,570,000	$642,500	$1,927,500				Yes, this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is OCFCD's highest priority capital improvement project; when the downstream segments are constructed, this project will advance the tiers towards the budgeted year. If it advances to a budgeted year in mid-fiscal year, funds will be appropriated to construct this project. Funds for flood control capital improvement projects.	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.
Ocean View Channel (OCFCD Facility No. C06) from downstream of Bushard Street to downstream of Brookhurst Street.	Orange County, Public Works, Flood Control Section, Flood Programs	$5,600,000	$1,400,000	$4,200,000				Yes, this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is OCFCD's highest priority capital improvement project; when the downstream segments are constructed, this project will advance the tiers towards the budgeted year. If it advances to a budgeted year in mid-fiscal year, funds will be appropriated to construct this project. Funds for	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.

								flood control capital improvement projects.	
Carbon Creek Channel (OCFCD Facility No. B01) from upstream Beach Boulevard to upstream Dale Street.	Orange County, Public Works, Flood Control Section, Flood Programs	$7,000,000	$1,750,000	$5,250,000				Yes, this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is one of OCFCD's highest priority capital improvement projects; when the downstream segments are constructed, this project will advance the tiers towards the budgeted year. If it advances to a budgeted year in mid-fiscal year, funds will be appropriated to construct this project. Funds for flood control capital improvement projects.	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.
Carbon Creek Channel (OCFCD Facility No. B01) from upstream Orange to upstream Beach Boulevard.	Orange County, Public Works, Flood Control Section, Flood Programs	$7,500,000	$1,875,000	$5,625,000				Yes, this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is one of OCFCD's highest priority capital improvement projects; when the downstream segments are constructed, this project will advance	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.

								the tiers towards the budgeted year. If it advances to a budgeted year in mid-fiscal year, funds will be appropriated to construct this project. Funds for flood control capital improvement projects.	
Brea Creek Channel (OCFCD Facility No. A02) at Beach Boulevard.	Orange County, Public Works, Flood Control Section, Flood Programs	$8,400,000	$2,100,000	$6,300,000				Yes this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel segment flows underneath Beach Boulevard, SR-39 which is owned and operated by Caltrans. We have cooperated with Caltrans in the design and await funding from the state for this project. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions.	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.
Fullerton Creek Channel (OCFCD Facility No. A03) from downstream Beach Blvd. including undercrossing to downstream I-5 Freeway.	Orange County, Public Works, Flood Control Section, Flood Programs	$8,400,000	$2,100,000	$6,300,000				Yes, this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is one of OCFCD's highest priority capital improvement projects; when the downstream segments are constructed, this	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.

								project will advance the tiers towards the budgeted year. If it advances to a budgeted year in mid-fiscal year, funds will be appropriated to construct this project. Funds for flood control capital improvement projects.	
Carbon Creek Channel (OCFCD Facility No. B01) from downstream Western Avenue to upstream Orange (including both under crossings).	Orange County, Public Works, Flood Control Section, Flood Programs	$9,100,000	$2,275,000	$6,825,000				Yes, this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is one of OCFCD's highest priority capital improvement projects; when the downstream segments are constructed, this project will advance the tiers towards the budgeted year. If it advances to a budgeted year in mid-fiscal year, funds will be appropriated to construct this project. Funds for flood control capital improvement projects.	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.
East Garden Grove-Wintersburg Channel (OCFCD Facility No. C05) from upstream Beach Boulevard to downstream Woodruff Street.	Orange County, Public Works, Flood Control Section, Flood Programs	$9,600,000	$2,400,000	$7,200,000				Yes, this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is OCFCD's highest priority capital improvement project; when the	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.

								downstream segments are constructed, this project will advance the tiers towards the budgeted year. If it advances to a budgeted year in mid-fiscal year, funds will be appropriated to construct this project. Funds for flood control capital improvement projects.	
Fullerton Creek Channel (OCFCD Facility No. A03) from downstream Western Ave to downstream Beach Blvd.	Orange County, Public Works, Flood Control Section, Flood Programs	$9,800,000	$2,450,000	$7,350,000				Yes, this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is one of OCFCD's highest priority capital improvement projects; when the downstream segments are constructed, this project will advance the tiers towards the budgeted year. If it advances to a budgeted year in mid-fiscal year, funds will be appropriated to construct this project. Funds for flood control capital improvement projects.	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.
Peters Canyon Channel (OCFCD Facility No. F06) from Confluence with San Juan Creek Channel (F05) to downstream Barranca parkway.	Orange County, Public Works, Flood Control Section, Flood Programs	$9,800,000	$2,450,000	$7,350,000				Yes this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is one of OCFCD's highest	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted

								priorities; it is the last segment of the channel system to be constructed. Funds for flood control capital improvement projects, including operation and maintenance come mainly from property taxes and state contributions; this project is listed on the third tier from being budgeted.	every fiscal year.
Newland Storm Channel (OCFCD Facility No. C05S01) from Confluence with C05 channel to downstream McFadden Avenue.	Orange County, Public Works, Flood Control Section, Flood Programs	$10,000,000	$2,500,000	$7,500,000				Yes, this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is one of OCFCD's highest priority capital improvement project; when the downstream segments are constructed, this project will advance the tiers towards the budgeted year. If it advances to a budgeted year in mid-fiscal year, funds will be appropriated to construct this project.	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.
Newland Storm Channel (OCFCD Facility No. C05S01) from downstream McFadden Avenue to downstream Bolsa Avenue	Orange County, Public Works, Flood Control Section, Flood Programs	$10,000,000	$2,500,000	$7,500,000				Yes, this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is one of OCFCD's highest priority capital improvement project; when the	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.

								downstream segments are constructed, this project will advance the tiers towards the budgeted year. If it advances to a budgeted year in mid-fiscal year, funds will be appropriated to construct this project.	
East Garden Grove-Wintersburg Channel (OCFCD Facility No. C05) from upstream Ocean view Channel (C06) Confluence to downstream Beach Boulevard.	Orange County, Public Works, Flood Control Section, Flood Programs	$11,000,000	$2,750,000	$8,250,000				Yes, this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is OCFCD's highest priority capital improvement project; when the downstream segments are constructed, this project will advance the tiers towards the budgeted year. If it advances to a budgeted year in mid-fiscal year, funds will be appropriated to construct this project.	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.
East Garden Grove-Wintersburg Channel (OCFCD Facility No. C05) from upstream Bushard Street to upstream the intersection of McFadden Street/Brookhurst Street.	Orange County, Public Works, Flood Control Section, Flood Programs	$11,000,000	$2,750,000	$8,250,000				Yes, this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is OCFCD's highest priority capital improvement project; when the downstream segments are constructed, this	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.

								project will advance the tiers towards the budgeted year. If it advances to a budgeted year in mid-fiscal year, funds will be appropriated to construct this project.	
Santa Ana Gardens Channel (OCFCD Facility No. F02) from downstream Alton to Segerstrom.	Orange County, Public Works, Flood Control Section, Flood Programs	$11,200,000	$2,800,000	$8,400,000				Yes this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is one of OCFCD's highest priorities; it is the last segment of the channel system to be constructed. Funds for flood control capital improvement projects, including operation and maintenance come mainly from property taxes and state contributions; this project is listed on the third tier from being budgeted.	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.
Santa Ana-Delhi Channel (OCFCD Facility No. F01) from Upper Newport Back Bay to downstream of Mesa Drive.	Orange County, Public Works, Flood Control Section, Flood Programs	$12,350,000	$3,087,500	$9,262,500				Yes this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is one of OCFCD's highest priorities; it is the last segment of the channel system to be constructed. Funds for flood control capital improvement projects, including operation and maintenance come	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.

								mainly from property taxes and state contributions; this project is listed on the third tier from being budgeted.	
East Garden Grove-Wintersburg Channel (OCFCD Facility No. C05) from 300-feet downstream the intersection of Haster Street/Lampson Avenue to 800-feet upstream.	Orange County, Public Works, Flood Control Section, Flood Programs	$14,560,000	$3,640,000	$10,920,000				Yes, this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is OCFCD's highest priority capital improvement project; when the downstream segments are constructed, this project will advance the tiers towards the budgeted year. If it advances to a budgeted year in mid-fiscal year, funds will be appropriated to construct this project. Funds for flood control capital improvement projects,	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.
Lane Channel (OCFCD Facility No. F08) from Von Karman to 1000' downstream Redhill Avenue	Orange County, Public Works, Flood Control Section, Flood Programs	$15,000,000	$3,750,000	$11,250,000				Yes this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is one of OCFCD's highest priorities; it is the last segment of the channel system to be constructed. Funds for flood control capital improvement projects, including operation and maintenance come	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.

								mainly from property taxes and state contributions; this project is listed on the third tier from being budgeted.	
Lane Channel (OCFCD Facility No. F08) from Confluence with F05 channel to Von Karman	Orange County, Public Works, Flood Control Section, Flood Programs	$15,500,000	$3,875,000	$11,625,000				Yes this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is one of OCFCD's highest priorities; it is the last segment of the channel system to be constructed. Funds for flood control capital improvement projects, including operation and maintenance come mainly from property taxes and state contributions; this project is listed on the third tier from being budgeted.	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.
Peters Canyon Channel (OCFCD Facility No. F06) from Barranca Parkway to Warner Avenue.	Orange County, Public Works, Flood Control Section, Flood Programs	$16,800,000	$4,200,000	$12,600,000				Yes this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is one of OCFCD's highest priorities; it is the last segment of the channel system to be constructed. Funds for flood control capital improvement projects, including operation and maintenance come mainly from property	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.

								taxes and state contributions; this project is listed on the third tier from being budgeted.	
Westminster Channel (OCFCD Facility No. C04) from downstream Bolsa Chica Street to upstream the intersection of Springdale Street and Edinger Avenue.	Orange County, Public Works, Flood Control Section, Flood Programs	$16,900,000	$4,225,000	$12,675,000				Yes, this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is a high priority; it overflows into the largest Special Flood Hazard Area in Orange County, the East Garden Grove-Wintersburg Channel. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions.	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.
Carbon Creek Channel (OCFCD Facility No. B01) from upstream Gilbert Street to downstream I-5 Freeway including B01P01 & B01B02	Orange County, Public Works, Flood Control Section, Flood Programs	$20,000,000	$5,000,000	$15,000,000				Yes, this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is one of OCFCD's highest priority capital improvement projects; when the downstream segments are constructed, this project will advance the tiers towards the budgeted year. If it advances to a budgeted year in	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.

								mid-fiscal year, funds will be appropriated to construct this project. Funds for flood control capital improvement projects,	
Westminster Channel (OCFCD Facility No. C04) from upstream the intersection of Springdale Street and Edinger Avenue to downstream Bolsa Avenue.	Orange County, Public Works, Flood Control Section, Flood Programs	$21,000,000	$5,250,000	$15,750,000				Yes this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is a high priority; it overflows into the largest Special Flood Hazard Area in Orange County, the East Garden Grove-Wintersburg Channel. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions.	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.
Santa Ana-Santa Fe Channel (OCFCD Facility No. F10) from confluence with Peters Canyon Channel to downstream Redhill Avenue.	Orange County, Public Works, Flood Control Section, Flood Programs	$21,000,000	$5,250,000	$15,750,000				Yes this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is one of OCFCD's highest priorities; it is the last segment of the channel system to be constructed. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions; this	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.

								project is listed on the third tier from being budgeted.	
Haster Retarding Basin and Pump Station (OCFCD Facility No. C05B02/C05PS1)	Orange County, Public Works, Flood Control Section, Flood Programs	$27,119,078	$6,779,770	$20,339,308				Yes, this project is on the Flood Control Capital Improvement Project Plan which is a list of prioritized projects through a 7-year period. This channel system is OCFCD's highest priority capital improvement project; when the downstream segments are constructed, this project will advance the tiers towards the budgeted year. If it advances to a budgeted year in mid-fiscal year, funds will be appropriated to construct this project. Funds for flood control capital improvement projects.	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.
East Garden Grove-Wintersburg Channel (OCFCD Facility No. C05) from Tidegates to upstream Warner Avenue.	Orange County, Public Works, Flood Control Section, Flood Programs	$44,000,000	$11,000,000	$33,000,000				Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. This project has been budgeted for this fiscal year and will continue to be budgeted in next fiscal year if necessary. This is OCFCD's highest	Yes. Funds for flood control capital improvement projects, including O&M come mainly from property taxes and state contributions. O&M is ongoing for this channel system and is budgeted every fiscal year.

								priority capital improvement project.	
Lake Mathews Watershed Master Water Quality Improvement Project Phase II	Riverside County Flood Control & Water Conservation District	$8,000,000	$6,000,000	$2,000,000				$1.3 M has been secured among the 3 project partners. This project is shown in current budgets.	O&M funding will be provided by MWD and the RCFC&WCD. Maintenance is provided by agencies with stable funding sources.
San Jacinto River Gap Project	Riverside County Flood Control & Water Conservation District	$40,000,000	$30,000,000		$6,000,000	$4,000,000			O&M will be provided by the Lead Agency in perpetuity. This funding is certain.
Well 17 & 18 Water Treatment Facility	Rubidoux Community Services District	$5,000,000	$5,000,000						Potential adjustment to user fees to cover the costs of O&M for this project.
Goldenwest 6 MG Tank	Rubidoux Community Services District	$4,750,000	$4,750,000						The project will have minimal initial impact to the RCSD O&M budget.
24" Mission Blvd Pipeline (Carrera to Goldenwest tank)	Rubidoux Community Services District	$1,500,000	$1,500,000						Proposed project will have minimal impact on existing O&M costs.
Rubidoux Community Services District Emergency Interconnections	Rubidoux Community Services District	$2,000,000	$2,000,000						Proposed project will have minimal impact on existing O&M costs.
Septic System Source Water Elimination Water Source Protection Project	Rubidoux Community Services District	$3,000,000	$3,000,000						Potential adjustment to user fees to cover the costs of O&M for this project.
Pacific Avenue 16" and 12" Water Pipeline	Rubidoux Community Services District	$1,000,000	$1,000,000						The proposed project will have minimal impact on existing O&M costs.
A Shared Workspace is the Foundation for Collaborative Watershed	S4S Solutions Inc.	$80,000	$60,000			$20,000			

Management.									
Cactus Basins No. 4 and No. 5	San Bernardino County Flood Control District	$21,600,000	$6,600,000	$15,000,000					The project is located in the Flood Control Districts Zone 2. As such, the project will receive perpetual O&M funding through the zones budget by various means of revenue such as property taxes, interests, and various fees. District staff has discretion as to how the budget is appropriated and can make adjustments to ensure that all existing facilities within the zone are properly maintained and operated.
Mission Zanja Creek Feasibility Study	San Bernardino County Flood Control District	$1,000,000	$250,000	$750,000				The project is located in the Flood Control Districts Zone 3. As such, the project will receive perpetual O&M funding through the zones budget by various means of revenue such as property taxes, interests, and various fees. District staff has discretion as to how the budget is appropriated and can make adjustments to ensure that all existing facilities within the zone are properly maintained and operated.	The project is located in the Flood Control Districts Zone 3. As such, the project will receive perpetual O&M funding through the zones budget by various means of revenue such as property taxes, interests, and various fees. District staff has discretion as to how the budget is appropriated and can make adjustments to ensure that all existing facilities within the zone are properly maintained and operated.
Cable Creek Basin and Spreading Grounds	San Bernardino County Flood Control District	$1,000,000	$250,000	$750,000				The project is located in the Flood Control Districts Zone-2. District staff has proposed that the project be funded in Fiscal Years 2010/11 and 2011/12.	The project is located in the Flood Control Districts Zone-2. As such, the project will receive perpetual O&M funding through the zones annual budget by various means of revenue such as property taxes, interests,

									and various fees. District staff has discretion as to how the budget is appropriated and can make adjustments to ensure that all existing facilities within the zone are properly maintained and operated.
Lytle Cajon Basin	San Bernardino County Flood Control District	$1,000,000	$250,000	$750,000					The project is located in the Flood Control Districts Zone 2. As such, the project will receive perpetual O&M funding through the zones budget by various means of revenue such as property taxes, interests, and various fees. District staff has discretion as to how the budget is appropriated and can make adjustments to ensure that all existing facilities within the zone are properly maintained and operated.
Etiwanda/San Sevaine Basins 1 through 4	San Bernardino County Flood Control District	$4,000,000	$1,000,000	$3,000,000					The project is located in Flood Control District Zone 1. As such, the project will receive perpetual O&M funding through the zones budget by various means of revenue such as property taxes, interests, and various fees. District staff has discretion as to how the budget is appropriated and can make adjustments to ensure that all existing facilities within the zone are properly maintained and operated.

West Fontana Basin	San Bernardino County Flood Control District	$10,000,000	$2,000,000	$8,000,000					The project is located in the Flood Control Districts Second Zone. As such, the project will receive perpetual O&M funding through the zones budget by various means of revenue such as property taxes, interests, and various fees. District staff has discretion as to how the budget is appropriated and can make adjustments to ensure that all existing facilities within the zone are properly maintained and operated.
Cactus Basins No. 3 and No. 3A	San Bernardino County Flood Control District	$10,000,000	$1,000,000	$9,000,000					The project is located in the Flood Control Districts Second Zone. As such, the project will receive perpetual O&M funding through the zones budget by various means of revenue such as property taxes, interests, and various fees. District staff has discretion as to how the budget is appropriated and can make adjustments to ensure that all existing facilities within the zone are properly maintained and operated.
Seven Oaks Dam and Reservoir Construction Area	San Bernardino Valley Municipal Water District	$31,322,347	$23,491,760	$7,830,587				Funding will be provided by SBVMWD.	Annual maintenance cost estimated at $2,951,309.
DWR Pump Station Alternative 2	San Bernardino Valley Municipal Water District	$23,000,000	$17,475,000	$5,525,000				Funding will be provided by SBVMWD.	

DWR Pump Station Alternative 1	San Bernardino Valley Municipal Water District	$23,000,000	$17,475,000	$5,525,000				Funding will be provided by SBVMWD.	
Surface Water Treatment Plant(s)	San Bernardino Valley Municipal Water District	$70,000,000	$52,500,000	$17,500,000				Funding will be provided by SBVMWD.	Annual maintenance cost estimated at $1,900,000.
Active Recharge Project in the Tributaries of the Santa Ana River	San Bernardino Valley Municipal Water District							TBD. Conceptual Design Phase.	
West End Pump Station	San Bernardino Valley Municipal Water District	$10,000,000	$7,500,000	$2,500,000				Funding will be provided by SBVMWD.	Annual maintenance cost estimated at $872,000.
Lytle Creek Turnout	San Bernardino Valley Municipal Water District	$2,300,000	$1,725,000	$575,000				Provided by SBVMWD.	Annual maintenance cost estimated at $362,752.
Orange Street Connector Pipeline	San Bernardino Valley Municipal Water District	$4,900,000	$3,675,500	$1,225,000				Funding will be provided by SBVMWD.	Annual maintenance cost estimated at $427,280.
Santa Ana River Construction Area	San Bernardino Valley Municipal Water District	$41,061,082	$30,795,812	$10,265,270				Funding will be provided by SBVMWD.	Annual maintenance cost estimated at $4,010,600.
Baseline Feeder West Extension	San Bernardino Valley Municipal Water District	$30,300,000	$22,725,000	$7,575,000				Funding will be provided by SBVMWD.	
City Creek Crossing	San Bernardino	$5,200,000	$3,900,000	$1,300,000				Funding will be provided by	Annual maintenance cost estimated at $453,440

	Valley Municipal Water District							SBVMWD.	
Model Institutional Water Conservation Makeover	San Bernardino Valley Municipal Water District	$345,000	$258,750	$86,250				A variety of grant, rebate, and public funds available for this purpose will be utilized. Additional funding will be provided by SBVMWD. In-kind assistance from CSUSB faculty and students will be donated in-kind.	Annual maintenance cost estimated at $30,084
Yucaipa Lakes Pipeline Replacement	San Bernardino Valley Municipal Water District	$760,000	$570,000	$190,000				Funding will be provided by SBVMWD.	Annual maintenance cost estimated at $66,272.
Mentone Pipeline	San Bernardino Valley Municipal Water District	$1,090,000	$817,500	$272,500				Funding will be provided by SBVMWD.	Estimated to be $95,048 (assuming project life of 20 years).
Devil Canyon Construction Area	San Bernardino Valley Municipal Water District	$1,720,000	$1,290,000	$430,000				Funding will be provided by SBVMWD.	Annual maintenance cost estimated at $157,984.
Redlands Reservoir	San Bernardino Valley Municipal Water District	$1,800,000	$1,350,000	$450,000				Funding will be provided by SBVMWD.	Annual maintenance cost estimated at $156,960.
Glen Helen Turnout	San Bernardino Valley Municipal Water District	$1,860,000	$1,395,000	$465,000				Funding provided by SBVMWD.	Annual maintenance cost estimated at $362,752.
San Bernardino Pump Station #1	San Bernardino Valley Municipal	$2,900,000	$2,175,000	$725,000				Funding will be provided by SBVMWD.	

	Water District								
Baseline Feeder Pump Station (East and/or West Alternative)	San Bernardino Valley Municipal Water District	$3,100,000	$2,325,000	$775,000				Funding will be provided by SBVMWD.	
Yucaipa Connector	San Bernardino Valley Municipal Water District	$4,500,000	$3,375,000	$1,125,000				Funding will be provided by SBVMWD.	Annual maintenance cost estimated at $392,400.
Alabama Street Well Field	San Bernardino Valley Municipal Water District	$4,500,000	$3,375,000	$1,125,000				Funding will be provided by SBVMWD.	Annual maintenance cost estimated at $392,400.
San Bernardino Reservoir	San Bernardino Valley Municipal Water District	$4,500,000	$3,375,000	$1,125,000				Funding will be provided by SBVMWD.	
Baseline Feeder Well Replacement Project	San Bernardino Valley Municipal Water District	$7,430,000	$5,572,500	$1,857,500				Funding will be provided by SBVMWD, West Valley Water District, City of Rialto and Riverside Highland Water Company.	
Enhanced Stormwater Capture and Recharge along the Santa Ana River	San Bernardino Valley Municipal Water District	$8,000,000	$6,000,000	$2,000,000				Funding will be provided by SBVMWD, WMWD, and the City of Riverside.	Annual maintenance cost estimated at $977,600.
Alabama Street Connector Pipeline	San Bernardino Valley Municipal Water District	$9,000,000	$6,750,000	$2,250,000				Funding will be provided by SBVMWD.	Annual maintenance cost estimated at $784,800.
South End Feeder	San Bernardino Valley Municipal Water	$11,500,000	$8,625,000	$2,875,000				Funding will be provided by SBVMWD	No, but annual cost will be $1,002,800 for its projected 20 year lifespan.

	District								
San Bernardino Pump Station #2	San Bernardino Valley Municipal Water District	$12,000,000	$9,000,000	$3,000,000				Funding will be provided by SBVMWD.	Annual maintenance cost estimated at $1,046,400.
Yucaipa Lakes Pump Station	San Bernardino Valley Municipal Water District	$12,900,000	$9,675,000	$3,225,000				Funding will be provided by SBVMWD.	Annual maintenance cost estimated at $1,364,880.
Lytle Creek Construction Area	San Bernardino Valley Municipal Water District	$13,500,000	$10,125,000	$3,375,000				Funding will be provided by SBVMWD.	Annual maintenance cost estimated at $1,364,400.
Enhanced Stormwater Capture and Recharge along the Santa Ana River Phase II	San Bernardino Valley Municipal Water District	$22,000,000	$16,500,000	$5,500,000				Funding will be provided by SBVMWD, Western Municipal Water District and the City of Riverside.	Annual maintenance cost estimated at $1,000,000.
9th Street Feeder	San Bernardino Valley Municipal Water District	$24,100,000	$18,075,000	$6,025,000				Funding will be provided by SBVMWD.	Annual maintenance cost estimated at $2,101,520.
Foothill Pipeline Enlargement	San Bernardino Valley Municipal Water District	$25,000,000	$18,750,000	$6,250,000				Funding will be provided by SBVMWD.	Annual maintenance cost estimated at $2,180,000.
Morton Canyon Hydroelectric Generation Plant	San Bernardino Valley Municipal Water District	$38,000,000	$28,500,000	$9,500,000				Funding will be provided by SBVMWD.	Annual maintenance cost estimated at $3,313,625.
Central Feeder Pipeline	San Bernardino Valley Municipal Water District	$41,213,536	$30,910,152	$10,303,384				Funding provided by SBVMWD.	

North Lake Project	San Bernardino Valley Municipal Water District	$133,000,000	$99,750,000	$33,250,000				Funding will be provided by SBVMWD.	Annual maintenance cost estimated at $11,597,600.
Water Conservation Demonstration Garden	San Bernardino Valley Municipal Water District	$115,000	$86,250	$28,750				Valley District will fund the project and in-kind assistance from the CSUSB faculty and students will be donated in-kind. Also, in-kind donations from plant suppliers are being discussed, but anything not donated will be covered by Valley District.	Valley District is overseeing the project and will provide O&M funding. ($10,028)
Constructed Wetland Habitat Restoration and Water Reclamation project for the Santa Ana River Borrow Pit.	San Bernardino Valley Water Conservation District	$4,400,000	$1,000,000		$2,400,000	$1,000,000			
Upper Santa Ana Watershed Alluvial Scrub Habitat Restoration Project and Mitigation Banking Assessment	San Bernardino Valley Water Conservation District	$225,000	$130,000	$35,000		$60,000		The collaborative partnerships and verbal commitments of matching funds and in-kind support, together offers multiple-objective benefits. The project scope is integrated with existing programs that are mutually beneficial for each entity as well as benefiting the watershed and IRWMP goals. Primary benefits include: cost savings; Job creation in an area facing 15% unemployment; Carbon sequestration; Water Supply and watershed protection.	Proposal includes IRWMP Basin Management Objectives (BMOs): management of the groundwater basins (San Bernardino Basin Area), cooperation with BTAC to monitor groundwater levels for liquefaction risk reduction, avoiding impacts of the various groundwater contaminant plumes, enhancing spreading basins' capabilities, and recycling wastewater for groundwater enhancement. This project will work within these constraints and are included in the District's O&M budget scope.

Santa Ana Watershed Vireo Monitoring and Breeding Bird Surveys	Santa Ana Watershed Association	$1,167,846	$875,885			$291,961		Funding is secure for the match portion of the total, provided through SAWAs operational funding. Certainty is 90 percent.	
Brine Line (SARI) Solids Control Structures	Santa Ana Watershed Project Authority	$2,000,000	$1,500,000					A total of $611,010 has been secured for the project from Proposition 50 funds. These funds are independent of the amount identified above.	O&M costs will be included in the Brine Line (SARI) annual budget.
Brine Line Maintenance Access Structures, Reach V and Reach IVB	Santa Ana Watershed Project Authority	$5,600,000	$4,600,000	$1,000,000					O&M of the SARI line is included within the SAWPA two year budget. The budget is approved by the Commission every two years.
Inland Empire Brine Line Capacity Pool Program	Santa Ana Watershed Project Authority	$6,025,000	$4,150,000	$1,875,000				Local share consists of use of pipeline capacity owned by SARI member agencies.	Participation in the program by local business partners provides O&M funding
Characterization and optimization of cost-effective treatment wetlands for surface water quality improvement	Santa Ana Watershed Project Authority	$300,000	$150,000	$150,000					
Big Bear Lake Hypolimnetic Oxygenation System	Santa Ana Watershed Project Authority	$1,500,000	$1,125,000	$375,000					
Brine Line (SARI) Flow Equalization Structure	Santa Ana Watershed Project Authority	$2,000,000	$1,500,000	$500,000					O&M of the SARI Flow Equalization Structure would be included in the SARI Enterprise Operation and Maintenance budget.
Brine Line (SARI) SCADA System	Santa Ana Watershed Project Authority	$25,000,000	$4,000,000	$1,000,000			$20,000,000		O&M funding for the project is funded through SAWPAs two year budget for O&M of the Brine Line. The budget is approved by the SAWPA Commission every two

									years.
Repairs to the Unlined RCP Reach IVA and Reach IVB Santa Ana Regional Interceptor (SARI)	Santa Ana Watershed Project Authority	$25,000,000	$4,000,000	$1,000,000			$20,000,000		O&M funding for the project is funded through SAWPAs two year budget for O&M of the Brine Line. The budget is approved by the SAWPA Commission every two years.
Borrego Canyon Wash Bypass Channel Improvements within the portion of Shea/Baker Ranch Property (Bypass Channel)	Shea/Baker Ranch, LLC	$15,500,000	$6,200,000			$9,300,000			
San Bernardino National Forest Ecological Restoration and Watershed Improvement	USDA Forest Service - San Bernardino National Forest	$8,001,000	$1,000,000	$277,000	$6,012,000	$712,000		For 2010, the In-Kind and about half of the federal contribution has been secured. The plan is expected to take 3 years to implement with the total funding equaling $8 million.	O&M is not applicable in general. Funding to complete the 2200 acres of wildfire reduction fuels treatment and associated watershed and habitat improvement projects will take 3 years and then be complete.
1N09 Reconstruction and Water Quality Improvement	USDA Forest Service - San Bernardino National Forest	$430,000	$215,000		$215,000				
Perchlorate Wellhead Treatment System Pipelines	West Valley Water District	$1,541,000	$1,541,000						
Perchlorate Wellhead Treatment System Wells and SCADA	West Valley Water District	$1,315,000	$1,315,000						
Arlington Basin Water Quality Improvement Project	Western Municipal Water District	$726,000	$216,000	$51,000				Included in Westerns operating budget.	Not applicable for a study.
La Sierra Pipeline Project	Western Municipal Water District	$16,000,000	$3,000,000	$9,000,000	$4,000,000			Reclamation funds authorized under H.R. the Omnibus Land Management Act of 2009; Western funds included in Westerns capital improvement	O&M funding covered in Water Supply Reliability Fee adopted by Western and going in to affect September 1, 2010.

								program.	
Chino II Desalter Treated Water Pump Station	Western Municipal Water District	$2,970,000	$1,485,000	$1,485,000				Yes, budgeted for in Westerns capital improvement program	O&M funds will be covered by sale of resultant product water
Chino Creek Wellfield, Wells 1, 2, and 3	Western Municipal Water District	$6,700,000	$1,675,000	$5,025,000				The project is included in Westerns Capital Improvement Program.	The project will be a part of Westerns O&M budget once constructed.
Arlington Desalter Biodenitrification Construction	Western Municipal Water District	$10,780,000	$5,390,000	$5,390,000				Budgeted for in Westerns capital improvement program	O&M funds will be covered by sale of resultant product water
Riverside-Corona Feeder Wells	Western Municipal Water District	$7,500,000	$2,000,000	$3,625,000	$1,875,000			Covered in Water Supply Reliability Fee adopted by Western which will go in affect September 1, 2010. Federal funds authorized under H.R. the Omnibus Land Management Act of 2009.	Once constructed the project will become a part of Westerns O&M budget.
Chino II Desalter Brine Minimization	Western Municipal Water District	$30,600,000	$4,590,000	$18,360,000	$7,650,000			Funds budgeted for in Westerns capital improvement program.	O&M funds will be covered by sale of resultant product water.
San Jacinto Watershed Urban and Agricultural Land Use Survey and Impervious Surface Mapping	Western Riverside County Agriculture Coalition	$625,000	$312,500	$25,000		$287,500			
TOTAL		**$3,573,715,736**	**$1,679,678,400**	**$1,349,107,497**	**$87,440,000**	**$21,540,506**	**$57,750,000**		

Chapter 3 Watershed Setting

Physical Setting, Hydrology, and Geomorphology

Dunne and Leopold (1978) define a watershed as an area of land that drains water, sediment, and dissolved materials to a common outlet at some point along a stream channel.

The Santa Ana River Watershed, depicted in **Figure 3-1**, drains a 2,650 square-mile area. The watershed is home to over 6 million people and includes the major population centers of parts of Orange, Riverside, and San Bernardino Counties, as well as a sliver of Los Angeles County.

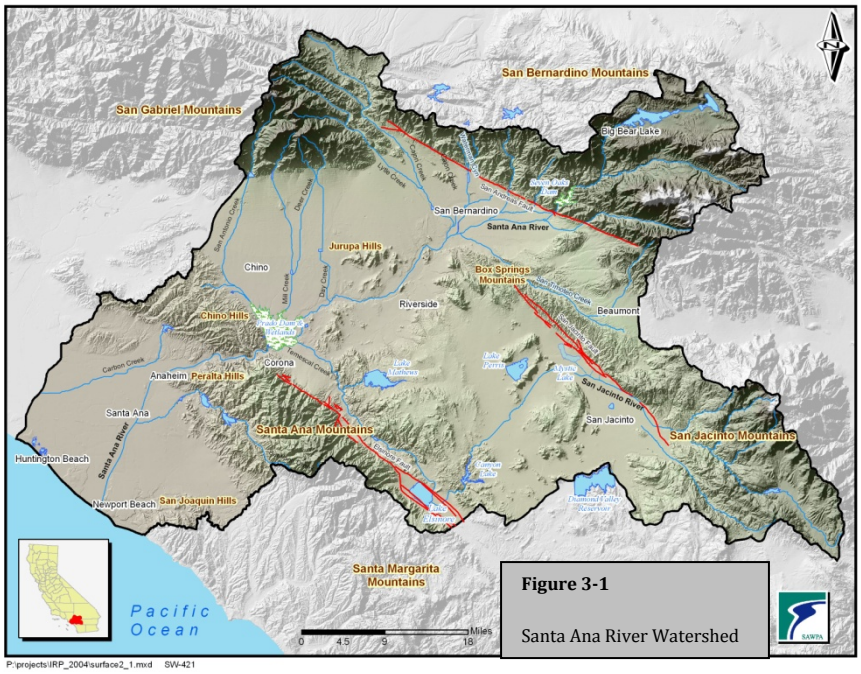


Figure 3-1

Santa Ana River Watershed

The Santa Ana River flows over 100 miles and drains the largest coastal stream system in southern California. It discharges into the Pacific Ocean at the City of Huntington Beach. The total length of the SAR and its major tributaries is about 700 miles.

The watershed boundaries nearly match the boundaries of the Santa Ana Regional Water Quality Control Board, an organization with whom SAWPA has worked closely for many years. In addition, its boundaries match the IRWM region and the recognized Santa Ana Funding Area, as defined by the Proposition 84 IRWM program. Although there are many sub-watershed planning efforts, OWOW attempts to bring all these efforts, as well as all different jurisdictions in the watershed, into a single watershed-wide vision. Over the years, SAWPA has participated in the development of sub-regional IRWM plans, with the understanding that such plans would be complementary to OWOW.

Today much of the lower Santa Ana River has lost its historical character.

Geologic and Hydrologic Features of the Watershed

Much of the movement of materials, energy, and organisms associated with the channel environment and adjoining upland environment depend on the movement of water within the Watershed. To the extent that this movement is altered, so does the potential exist for the system to become "dysfunctional" for species that depend on it for life support. That is, alteration of water movement via damming or channelization can reduce ecosystem functionality. Refer to **Figure 3-2** for an illustration of water and sediment transport throughout a watershed.

Figure 3-2 Water and sediment transport through the Watershed.

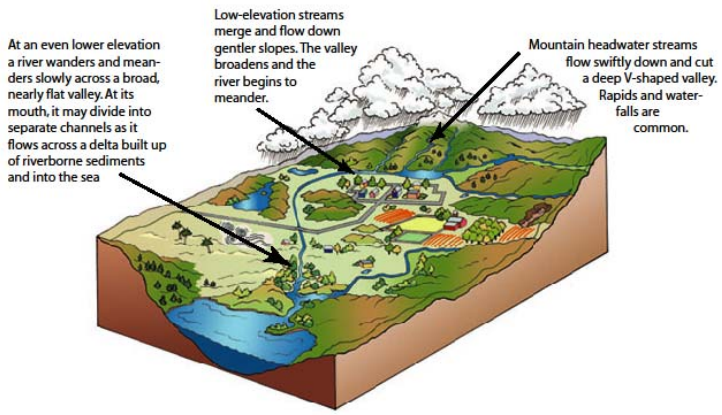


Figure 2-2: Channel & Floodplain Features
Channel & floodplain characteristics change from headwaters to mouth

Today, only 20% of the SAR is a concrete channel, the majority being near the mouth of the river. Discharge from publicly owned treatment works (POTWs) have changed natural surface flows and provides base flow in many parts of the River's drainage network. This treated wastewater has altered the natural system by providing year-round river flow. As populations have increased, urban runoff and wastewater flows have increased. Between 1970 and 2000, the total average volume rose from less than 50,000 to over 146,000 acre-feet per year (AFY), as measured at the Prado Dam. Base flow is expected to rise to 370,000 AFY by 2025, a projected increase of 153 percent since 1990.

The geologic and hydrologic features of the Watershed or geomorphology – the study of the classification, description, nature, origin, and development of present landforms and their relationships to underlying structures – and of the history of geologic changes as recorded by these surface features includes the following features. The upper watershed or headwaters, including the highest point in the drainage system, is delineated by the east-west ridgeline of the San Gabriel and San Bernardino Mountains. Over this ridgeline lies the Mojave Desert, which is part of the Lahontan Basin. This upper "erosion" zone of the watershed has the highest gradient, highest erosion level of new sediment to the system, and fastest stormwater runoff. As flows consist mainly of snowmelt and storm runoff from the undeveloped land in the San Bernardino National Forest, water quality tends to be high, with low concentrations of total dissolved solids (TDS), nitrates, and other pollutants. In this zone, the SAR channel is confined in its lateral movement, contained by the slope of the high, mountainous terrain. Within the upper watershed, the SAR and its tributaries travel around large boulders and over sand and gravel bars punctuated by pools and riffles reaching depths of about six feet.

In addition to the Santa Ana River, several other important watersheds make up the Santa Ana region. The Newport Bay sub-watershed encompasses an area of approximately 154 square miles. The sub-watershed is bounded to the north by the Santiago Hills (Loma Ridge) and to the south by the San Joaquin Hills. The Tustin Plain, a broad alluvial valley, occupies the major portion of this watershed. The Newport Bay sub-watershed is within the USGS hydrologic unit no. 18070204. The Newport Bay sub-watershed is composed of the San Diego Creek sub-watershed, with an area of 119 square miles, which is the largest system draining into Upper Newport Bay. The Santa Ana-Delhi Channel drains 17 square miles and Big Canyon Wash drains 2 square miles. The remaining 16 square miles are divided among several small sub-watersheds that discharge into lower Newport Bay.

Two other important watersheds in the Santa Ana region include the Anaheim-Bay Huntington Harbor (AB-HH) and Lower San Gabriel River/Coyote Creek. The AB-HH watershed encompasses an area of 81 square miles. The main surface water systems that provide drainage in this watershed are the Bolsa Chica Channel that provides drainage to the Anaheim Bay-Huntington Harbor Complex; and the East Garden Grove-Wintersburg Channel that carries flow to Bolsa Bay and ultimately to Huntington Harbor.

The Coyote Creek Watershed encompasses an area of 85 square miles within the Santa Ana region. This watershed is located in the northernmost portion of the County of Orange. This watershed straddles the Los Angeles and Orange County border in its upper reaches and then continues through Orange County until it discharges into the San Gabriel River in Long Beach.

Sedimentary and crystalline materials from the upper watershed move down slope through a process fed by storm pulses; therefore, sediment does not move at a continuous speed. River flow from Seven Oaks Dam to the City of San Bernardino consists mainly of storm flows, flows from the Lower San Timoteo Creek, and groundwater that is rising due to local geological features. From the City of San Bernardino to the City of Riverside, the river flows perennially and much of the reach is operated as a flood control facility. The principal tributary streams in the upper Watershed originate in the San Bernardino and San Gabriel Mountains. These tributaries include San Timoteo, Reche, Mill, Plunge, City, East Twin, Waterman Canyon, Devil Canyon, Cajon Creeks, and University Wash from the San Bernardino Mountains; and Lone Pine, Lytle, Day, Cucamonga, Chino, and San Antonio Creeks from the San Gabriel Mountains.

From the City of Riverside to the recharge basins below Imperial Highway, river flow in Orange County consists of highly treated POTW effluent, urban runoff, irrigation runoff water, imported water applied for groundwater recharge, and groundwater forced to the surface by underground barriers (SAWPA, March 2004). Near Corona, the SAR cuts through the Santa Ana Mountains and the Peralta-Chino Hills, which together form the northern end of the Peninsular Ranges in southern California. The SAR then flows down onto the Orange County coastal plain where the channel lessens in gradient, the valley floor is reached, and the soft features of the channel where sediment has deposited are more prevalent. Floodplains are strewn with boulders and characterized by sand and gravel washes. Within this valley floor, the transport and depositional processes are less confined by higher terrain as water, dissolved material and sediment move toward the sea. Over time, aquatic and terrestrial wildlife have adapted to this dynamic process and channel form.

However, rapid urbanization has artificially increased the rate of sedimentation and loss of habitat in this part of the watershed, negatively affecting water quality and wildlife habitat.

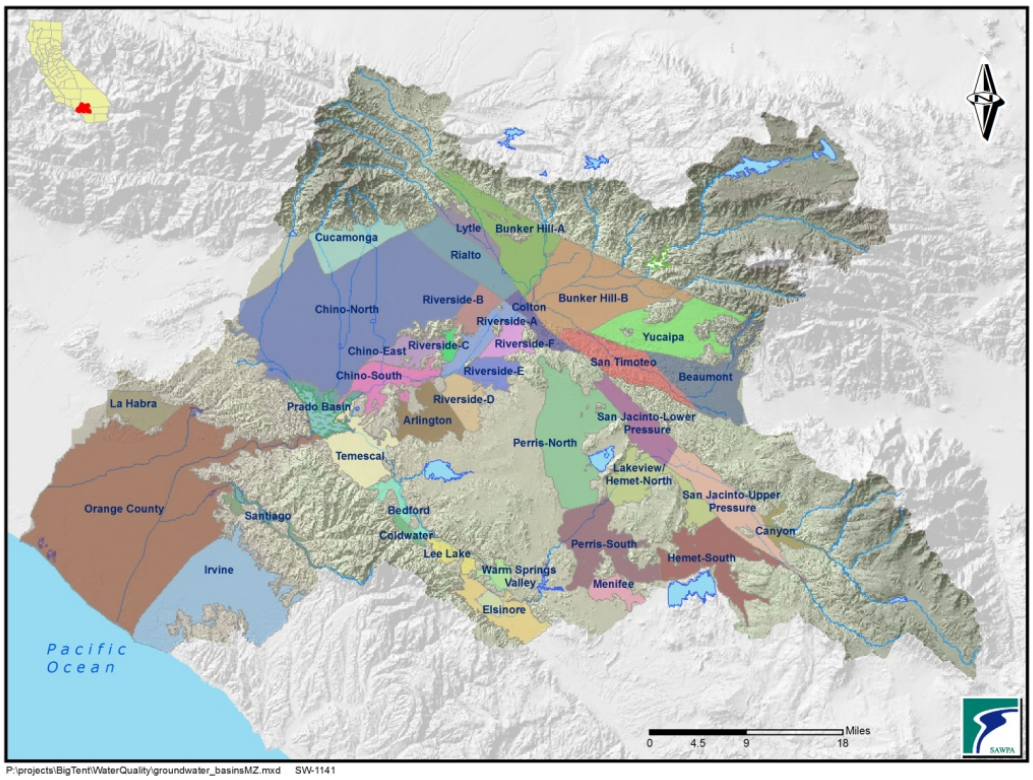
In the southern portion of the Watershed, the regional boundary divides the Santa Margarita River drainage area, which is not part of the Watershed, from that of the San Jacinto River. The San Jacinto River, which is part of the Watershed, starts in the San Jacinto Mountains, runs westerly through Canyon Lake and normally ends in Lake Elsinore. In wet years, the San Jacinto River will overflow the lake and connect with the SAR through the Temescal Wash. Flood flows from the San Jacinto River produce a broad, shallow wetlands area called Mystic Lake.

Prado Wetlands Area

The Orange County coastal plain is composed of alluvium derived from the mountains. Upstream from the Santa Ana Canyon lay Prado Dam and Prado Wetlands; SAR flows are passed through the Prado Wetlands to improve water quality and remove nitrates before being used for Orange County Groundwater Basin recharge. Santiago Creek, the only major tributary to the lower SAR, joins the SAR in the City of Santa Ana. The lower limit of both the groundwater recharge area and the SAR's ordinary flows is 17th Street in the City of Santa Ana. Prior to channelization of the lower part of the SAR, the channel used to meander slowly across broad flood plains. Currently, the SAR is a concrete channel from 17th Street in the City of Santa Ana to Adams Avenue in Huntington Beach. The riverbed is ordinarily dry from 17th Street in the City of Santa Ana to the Victoria Street Bridge. The Greenville-Banning Channel, which carries stormwater discharge and urban runoff, is channelized to the Victoria Street Bridge where it joins the SAR. Discharge from the Greenville-Banning Channel combines with tidal flow from the Pacific Ocean and the SAR is wet from the Victoria Street Bridge to the mouth of the SAR.

Groundwater in the watershed is highly controlled by the geology of the area, in both the configuration of bedrock and by the extensive faulting. Most groundwater basins are unconfined, much like a bowl full of sand that has water poured in halfway, see **Figure 3-3**. However, the variable depth to bedrock, and the presence of faults cause pressure zones where water flows towards (or to) the ground surface. In general, groundwater flows the same direction as surface waters from the mountains in the east/north to the Pacific Ocean in the west. There are about 40 groundwater basins in the watershed (depending on how they are defined and boundaries are drawn); many are inter-related. Some of the largest groundwater basins include the Chino Basin (Chino/Ontario/Fontana area), the Orange County Basin, the Bunker Hill Basin (San Bernardino), the San Timoteo Basin (Yucaipa/Banning/Beaumont area), and the San Jacinto/Hemet Basins.

Figure 3-3 Santa Ana River Watershed: Groundwater Management Zones



Four primary faults transverse the Watershed, with other minor faults either branching off of, or running parallel to, the major faults. Within the upper watershed, the San Andreas Fault divides the San Bernardino Mountains from the San Gabriel Mountains and branches off into the San Jacinto Fault near San Bernardino. Known as southern California's most active fault, the San Jacinto Fault affects groundwater in the San Jacinto River and the SAR, forcing groundwater to the surface at the Bunker Hill Dike. Toward the central watershed, the Elsinore-Whittier Fault passes under the Prado Dam from the northwest to the southeast. Toward the coast, the Newport-Inglewood Fault enters the region from the Los Angeles area and passes offshore near Newport Beach.

Climate

The climate of the Watershed is considered Mediterranean with hot, dry summers, and cooler, wetter winters.

Average annual precipitation ranges from 12 inches per year in the coastal plain to 18 inches per year in the inland alluvial valleys, reaching 40 inches or more per year in the San Bernardino Mountains (**Figure 3-4**). Most of

Snowcapped San Gabriel Mountains

the precipitation occurs between November and March in the form of rain with variable amounts of snow in the higher mountains of the Watershed. The climatological cycle of the region results in high surface water flows in the spring and early summer period, followed by typically low flows during the dry season. Winter and spring floods generated by precipitation in the high mountains are not uncommon. Similarly, during the dry season, severe thunderstorms in the high mountains periodically have generated torrential floods in local streams.

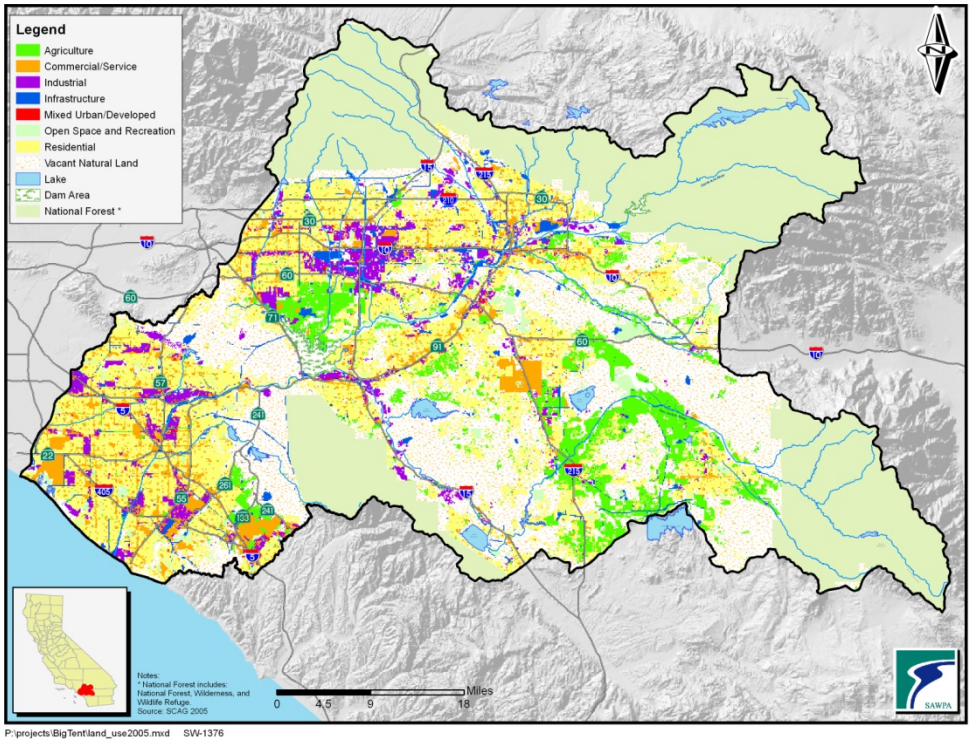
Potential Climate Change Impacts in the Region

Potential climate impacts and implications for the watershed, as well as strategies to reduce GHG emissions and improve adaptability are presented in Chapter 5.9.

Land Use

The Watershed is substantially urbanized; about 32 percent of the land use is residential, commercial, or industrial. Agricultural land, once accounting for virtually all of the use of the watershed during the days of the ranchos, now accounts for a mere ten percent. Instead of a scattered population of indigenous peoples, the watershed now supports over 5 million people. **Figure 3-5** presents a breakdown of the major land use categories of the Watershed obtained from the SCAG 2005 land use dataset.

Figure 3-5 Santa Ana River Watershed: 2005 Land Use



Biological Resources

Habitat Modification

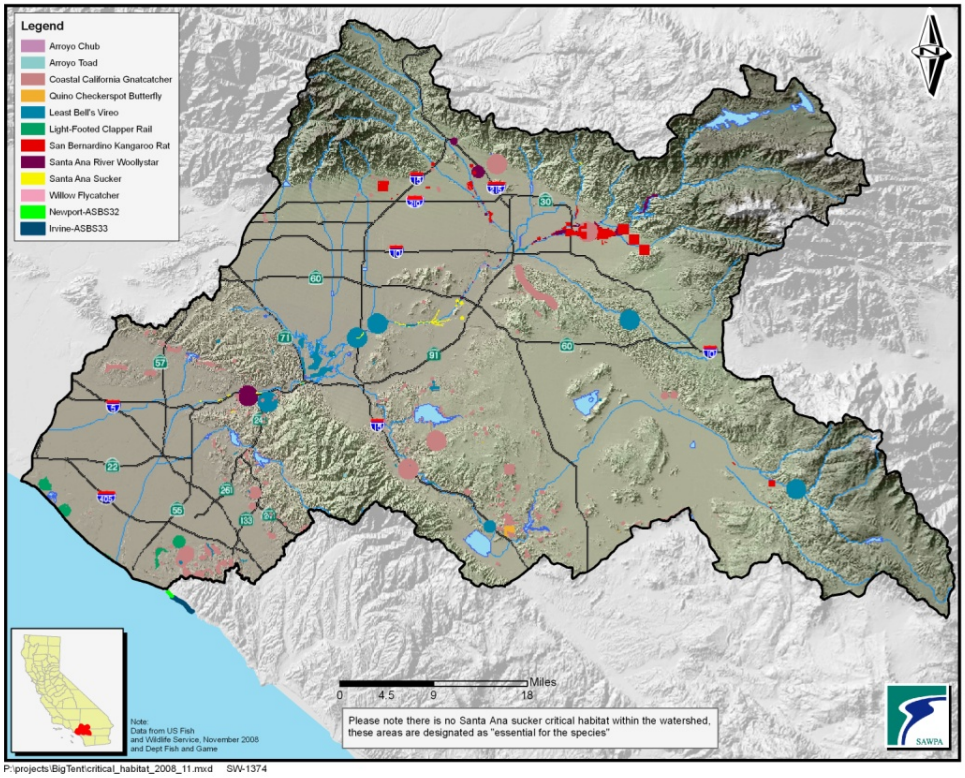
As noted by Moyle (2002), most of California's inland waterways today bear little resemblance to the streams and lakes encountered by the first European explorers and settlers. In the Watershed, this observation is certainly true as flood control and channelization activities have left portions of streams channelized and concrete-lined where once riparian forests grew along a meandering stream. Fortunately, today only 20% of the SAR is concrete-lined. Dam construction and flood control activities were not the only factors influencing the Watershed in ways that adversely impact habitat critical for aquatic resources. The following factors have also played a role:

- Stream channel alteration
- Draining of streams and lakes, especially adjacent wetlands
- Livestock grazing and the impact on aquatic and riparian vegetation, sedimentation, and water pollution
- Historical logging practices
- Bark Beetle infestation
- Mining, particularly in-stream aggregate mining
- Watershed changes resulting in cumulative affects to aquatic resources

Special Status Species

Second only to Hawaii, the State of California is home to the highest number of endangered species in the United States. As defined within the Federal Endangered Species Act of 1973, an endangered species is any animal or plant listed by regulation as being in danger of extinction throughout all or a significant portion of its geographical range. A threatened species is any animal or plant that is likely to become endangered within the foreseeable future throughout all or a significant portion of its geographical range. Federal law prohibits the "take" of any individuals or habitat of federally listed species without a special permit. In addition to federal laws, the State of California has its own California Endangered Species Act, with a separate listing of species and separate laws governing take of listed species. Enforcement of the Federal Endangered Species Act is administered by the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service, while the California Department of Fish and Game (CDFG) enforces the California Endangered Species Act. Refer to **Figure 3-6** for a map of critical habitat within the Watershed.

Figure 3-6 Santa Ana River Watershed: Critical Habitat



The varied geography and natural features of the Watershed provide habitat for a number of Federally and/or State-listed species. As the Santa Ana Integrated Watershed Plan (IWP) focuses on the resources in and around the SAR, listed species of concern herein are those that occupy aquatic, wetland, riparian, or riparian adjacent areas. Of these, two are plants – the Santa Ana River woolly star (*Eriastrum densifolium*) and the slender-horned spine flower (*Dodecahema leptoceras*); one fish – the Santa Ana River sucker (*Catostomus santaanae*); one amphibian – the arroyo toad (*Bufo californicus*); three birds – the least Bell's vireo (*Vireo bellii pusillus*), the southwestern willow flycatcher (*Empidonax traillii*), and the bald eagle (*Haliaeetus leucocephalus*); two mammals – the San Bernardino kangaroo rat (*Dipodomys merriami parvus*) and Stephen's kangaroo rat (*Dipodomys panamintinus*); and one insect – the Delhi Sands flower-loving fly (*Rhaphiomidas terminatus abdominalis*). Any project or policy recommended by the Santa Ana IWP will need to assess potential impacts to listed species, and incorporate measures to avoid impacts to these species.

Current Aquatic Resources

Fish

The SAR historically provided habitat for eight species of native fish (species have multiple forms). Only four native non-game freshwater fishes are currently found in non-estuarine waters: arroyo chub, Santa Ana speckled dace, Santa Ana sucker, and threespine stickleback. All of these remaining fishes have limited distributions and face possible extirpation. As previously mentioned, the Santa Ana sucker is listed by the Federal

The Santa Ana sucker is a Federally endangered fish native to the Santa Ana River

government as a "threatened" species pursuant to the Endangered Species Act. Currently, the western brook lamprey, steelhead, and unarmored threespine stickleback are known to be extirpated from the Watershed. The Pacific lamprey has been observed once in the past 47 years and it likely is extirpated as well. Introduced forms of the rainbow trout have been extensively stocked in the watershed for sport fishing for over 100 years, and it is unknown if any genetically pure rainbow trout stocks endemic to the Watershed remain. The partially armored threespine stickleback was widely planted in the Watershed for mosquito control in the early 1900s and is now found out of its natural historical range, e.g., Big Bear Lake. In contrast, at least 33 fishes have been introduced into the Watershed and are currently present. New species can be expected to be found at any time due to inter-basin water transfers, ship ballast water hitchhikers, bait bucket introductions, and hobbyists disposing of unwanted fishes. Many of the introduced fishes are widespread, while a few are restricted to specific locations or habitats. Of the current inventory of introduced fishes, most were introduced by government agencies to serve as a food resource, for insect control, for sport fishing, or to serve as forage for sport fishes. A smaller number of fish have become established after arriving inadvertently via inter-basin water transfers or in ships' ballast water. For a detailed discussion of the introduction of fishes to California, the reader is directed to Dill and Cordone (1997). Additional information about introductions of fishes to southern California is presented by Swift *et al*. (1993). Supplemental records can be found in Moyle (2002).

Amphibians

During the last 50 years, population growth and urban development in southern California has displaced many amphibian species, and encroached upon much of former amphibian habitat. Several species are thought to be extinct, and many others have fragmented populations, which are at risk of extirpation. Amphibians especially are sensitive to environmental changes that alter the hydrology, ecology, and geology of a region because they have evolved, highly specialized adaptations that have allowed them to exist in these relatively arid regions. Introduced species also have been a major contributor to the decline in amphibian populations in southern California. These non-native species increase competition for food sources, as well as prey upon many of the native amphibians.

Reptiles

The CDFG considers the Southwestern pond turtle (*Clemmys marmorata*) a species of "special concern". Recent reports on *C. marmorata* in southern California indicate that a few viable populations remain in the regions (see also Brattstrom 1988). Approximately six to eight viable populations of the turtle remain south of the Santa Clara River system in California. Droughts have exacerbated the negative effects of habitat alteration accumulated over many years over much of this region from changes in land and water use, and abusive grazing practices. In particular, most western pond turtle populations examined in this region appear to show an age structure increasingly biased towards adults, indicating little or no recruitment is taking place. Recent surveys indicate that the southwestern pond turtle also is seriously threatened throughout most of its range outside of California.

Birds

Riparian ecosystems harbor the highest number of bird species in the arid and semi-arid parts of the southwestern United States. Riparian habitat provides productive breeding grounds and offers vital over-wintering and migration stop-over areas for migrating birds. Loss and degradation of riparian habitat have negatively impacted bird populations throughout the watershed. Other factors affecting bird populations are brood parasitism by the brown-headed cowbird, and disruption of natural hydrological regimes from dams and levees.

Least Bell's vireo, a federally listed bird species

The Federally endangered least Bell's vireo has experienced recent population growth within the watershed due to aggressive management activities within Prado Basin and on adjacent lands. Within the basin, the population rose from 19 nesting pairs in 1986 to 123 nesting pairs in 1993. By the end of 1996, the count stood at 195 nesting pairs. This stunning recovery is due to the provision of a high quality habitat for the bird species, in part, due to invasive species removal, a project in place to control populations of the predatory cowbird, and efforts on the part of the USFWS, OCWD, a number of Resource Conservation Districts (RCDs), and others.

The Federally endangered southwestern willow flycatcher also is affected by cowbird brood parasitism. The implementation of cowbird management programs in addition to preservation and restoration of riparian deciduous shrub habitat is needed to reduce current populations. The bald eagle, listed by the USFWS as endangered in 1978 has experienced population growth over the past two decades. The bald eagle could be considered a USFWS success story: reclassified as "threatened" in 1995 and first proposed for delisting in 2000. Delisting of a species is the USFWS's ultimate goal and only happens when specific recovery goals have been met for a species. Unfortunately, delisting is an infrequent occurrence. In the case of the bald eagle, delisting has been delayed while the USFWS determines how the species would be managed once it is no longer classified as threatened.

Factors Affecting Aquatic Resources

Introduced Species

The 33 species of introduced fishes greatly outnumber the four remaining native fish species. The number of species, *per se*, is not the problem but, rather, the impact that introduced fishes and other aquatic organisms, have on the native fishes of the Watershed. Introduced fishes have dramatically changed the composition of the watershed's fish community and now act as a deterrent to the restoration and enhancement of the native fishes that remain. The manner in which introduced fishes can affect the aquatic resources of the Watershed are:

- Competition between native and introduced fishes for food and space
- Predation by introduced species on native fishes
- Habitat interference by introduced fishes that change habitat characteristics
- Introduction of diseases that may infect native fish or other aquatic animals
- Hybridization between closely related species

Water Pollution

Fortunately, water quality in the SAR has improved in recent years due to technological developments and water quality planning. Most of the native fishes of the Watershed are adapted to clear, unpolluted water that can support food resources and provide the various habitat conditions necessary to complete their respective life cycles. While fish kills, due to the spill of toxic substances into streams, are dramatic examples of the effects of pollution, these instances are acute, or short-term, rather than chronic. More insidious, however, are the chronic effects on aquatic resources of non-lethal forms of pollution that decrease growth, inhibit reproduction, or impair movement. Chronic elevated water temperatures or high sediment loads are an example of this type of pollution, even though toxic chemicals are not involved. Other examples include elevated but non-toxic levels of ammonia, increases in salinity, and low levels of dissolved oxygen (DO). Because most of the remaining native freshwater fishes live, at some time, in treated wastewater, the issue of chronic, low-level pollution is of great concern, although the quality of wastewater has increased markedly in past years.

Exploitation

Over-exploitation of rainbow trout/steelhead, primarily by angling, was a major factor in driving the native populations to low levels, and perhaps to extinction. Over-fishing, in turn, led to the stocking of hatchery fish and the introduction of various exotic species as angling alternatives to the native trout. The intensity of over-exploitation is illustrated by a report in the July 17, 1892 edition of the *Citrograph*, a Redlands newspaper, which reported that three boys fishing in Bear Creek, a tributary to the SAR in San Bernardino County, had caught 592 trout in three hours. Similar reports are common in the historical press.

It was not until 1872 that the California Legislature banned the use of nets, weirs, baskets, traps, explosives, and poisons as acceptable means of harvesting trout. Unfortunately, there was no one to enforce the statute, nor was there any limit on the number of fish that could be harvested by legal means. The over-exploitation of trout became such a problem in the watershed that in 1894, San Bernardino County, on its own authority, finally took action and limited the number of trout a person could catch to 50 per day. The State of California did not take similar action until 1905, when the harvest was limited to 50 trout per day and 25 total pounds. By then, the native stocks already had become depleted in the Watershed.

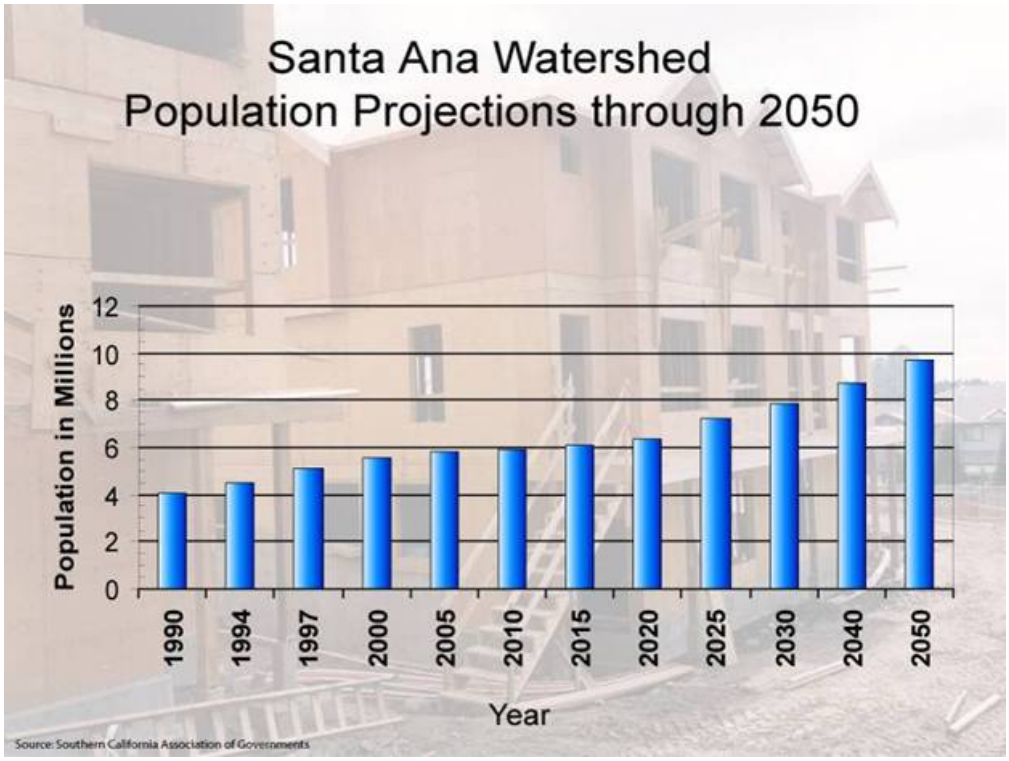
Each of the aforementioned factors has acted in concert over a long period of time to reduce the native fish community of the Watershed to that which remains today. The Santa Ana IWP recognizes that history cannot be undone and the aquatic community cannot be restored to its pre-settlement condition; however, a conservation strategy can be implemented that will ensure the long-term viability of the Watershed's aquatic communities

Population and Population Projections

The Santa Ana River Watershed has experienced significant population growth in recent years and is expected to continue growing at a considerable pace over the next 40 years. According to the Santa Ana Integrated Watershed Plan (SAIWP) 2005 Update, the Watershed had a population of 5.1 million in 2002, and is expected to reach 9.9 million by 2050, or an average annual growth rate of 1.3 percent (**Figure 3-7**). The recent recession most likely will slow this growth rate substantially. Although recent SCAG reports show that the Santa Ana Watershed will continue to grow and reach long–term population estimates, the timeline is uncertain. Until the issues of higher unemployment and high-foreclosure rates within the region are resolved, population growth rates will be slowed.

The SAIWP estimates that much of future population growth will take place in Riverside and San Bernardino counties, as Orange County is fairly built out. According to the U.S. Census Bureau, Riverside County grew by 37.5% between 2000 and 2009 (or an annual average of 3.6%), compared to 9.1% for the state of California as a whole (an average of less than 1% per year). Population growth will continue at an average of 1.9% per year through 2035, according to Riverside County Center for Demographic research.

Figure 3-7 Population Projections



Based on SCAG estimates prepared by Beacon Economics

Similarly, San Bernardino County grew by 18.0% in the same period (or 1.8% per year), or almost twice the State rate. In contrast, Orange County grew by 6.3% in the same period, below the State average.

Population growth will exacerbate some of the issues previously described for the Watershed if no action is taken. In particular, population growth could result in more habitat fragmentation, reduction of impervious surfaces, modification of natural hydrology, increased water demand, and increased waste generation. The types of multi-benefit and multi-jurisdictional or watershed-wide projects promoted by the OWOW plans could help reverse this trend.

Infrastructure Systems

In order to suggest ways to improve water reliability for the future, the existing water infrastructure system must be considered as the foundation to build upon. Particularly in this Watershed, when we describe water infrastructure, we are describing not just the large-scale systems, services, and facilities that are necessary to support the collection, storage, treatment and delivery of water to customers in the region, but also many other systems, service and facilities, such as trails, parks, and land use that may use or have a nexus with water. In addition, since water demands and supplies are interrelated to a variety of other natural and man-made support systems, several different maps are included in this chapter to fully convey the opportunities to coordinate among infrastructure systems, as well as land use for the development of multi-beneficial integrated projects.

The importance of an effective water-related infrastructure system cannot be understated. Evaluations of the infrastructure in the Watershed were conducted by the American Society of Civil Engineers in 2005 as conveyed in two separate infrastructure report cards, one for the San Bernardino and Riverside Counties and one for the Orange County. These infrastructure report cards evaluated the condition, capacity, operations and security as criteria for assigning grades to the systems. In the San Bernardino and Riverside counties, the most populated and developed areas of the counties lie within the western portions (Inland Empire) and within the SAR Region.

In review of the water-related infrastructure grades for the Inland Empire, room for improvement clearly exists, particularly as this area struggles to maintain and provide water-related infrastructure for two counties that, over the past decade, have experienced some of the most rapid population growth in the nation.

In Orange County, the strains of an increasingly built-out area with a population base of 2,846,289 (2000 census), the second most populous county in the State of California, have resulted in both surface quality and groundwater recharge concerns to meet the needs in this area. New infrastructure is required to clean up urban runoff, increase groundwater recharge, treat increasing wastewater flows for recycled use, and expand capture of upper watershed flows to recharge the groundwater supply.

To best understand the water-related infrastructure in the Watershed, some sense of the water development history of the region is appropriate. Prior to the Mission and Rancho periods of the 1800s, the primary land use in the Watershed consisted of grazing cattle and horses. With the advent of Mormon settlements, agricultural lands began to be developed, utilizing the readily

available surface springs as a dependable source of irrigation water. As more and more settlers arrived and communities sprang up demanding more water supplies, issue of water rights arose along with competition for the best diversion points. Gradually, a system of water rights was established and shares in a water supply became marketable commodities. As agricultural activity continued to increase in the inland areas of the Watershed, more and more infrastructure was needed to provide the necessary water. First windmills, then motors, and finally, deep well turbines were installed. Gradually over time with increasing urbanization, the dominant land use of the region, agriculture, was subsumed by residential, commercial and industrial areas to serve a burgeoning population drawn to the semi-arid warm climate of this region (see Year 1933-2000 Land Use Transition Maps).

In the late 1920s, to assure adequate water supplies for the population growth of southern California and following the lead of the City of Los Angeles in its construction of the LA Aqueduct in the early 1910s, efforts commenced to raise money to import water from other places. MWD built and still operates the CRA, which each year imports millions of AF of water westward across the Mojave Desert and into the SAR Region. After SWP facilities were extended into the region in the early 1970s, State Water Contractors received deliveries from northern California's Bay Delta region to constructed pipelines to deliver imported water to serve the rapidly growing water demands of the region. Connections were established for the SAR Region by four State Water Contractors: MWD, Valley District, San Gorgonio Pass Water Agency (SGPWA), and the San Gabriel Valley Municipal Water District.

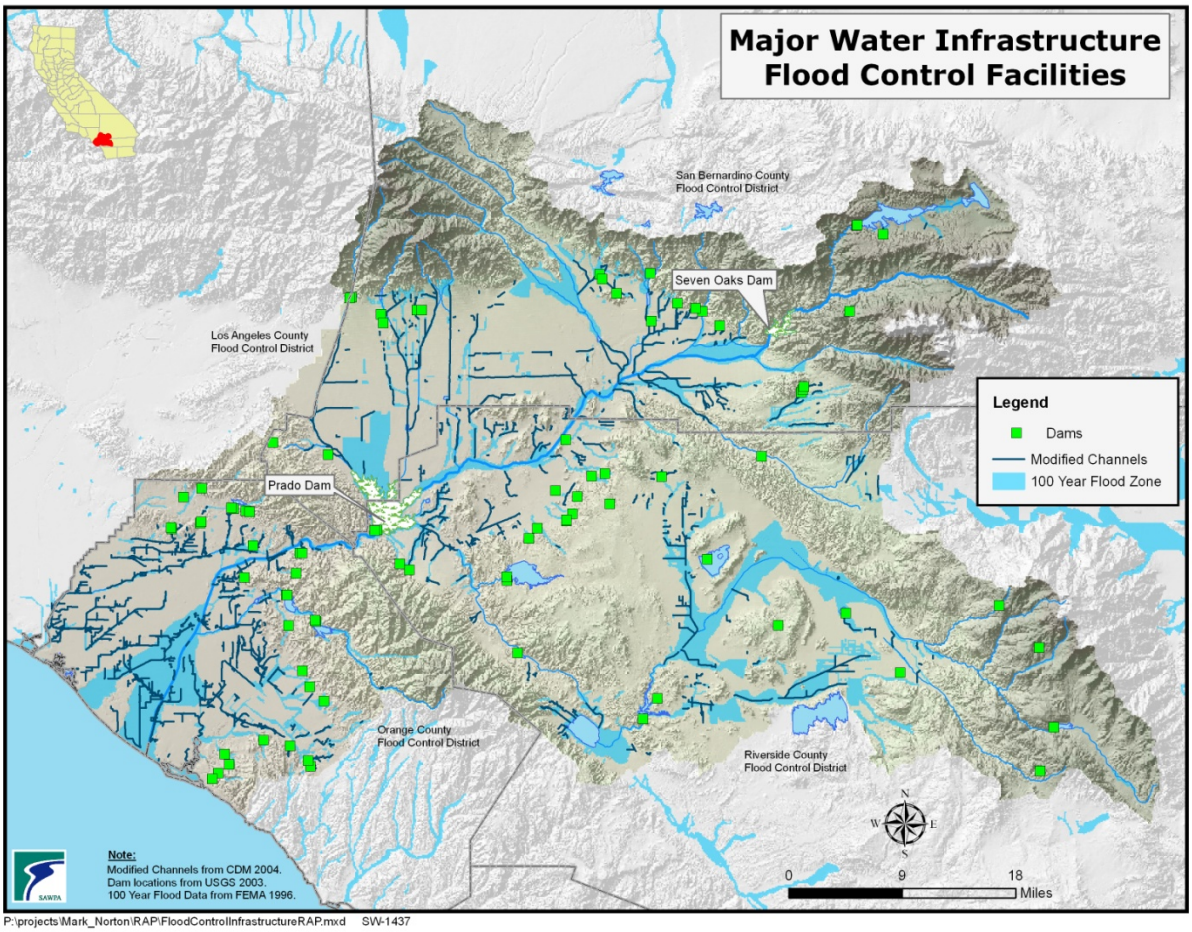
After use of available local and imported water by urban populations, wastewater treatment infrastructure collects and treats the effluent at locations throughout the Watershed, but with the majority located near the SAR due to their proximity to a discharge location. Gradually over time, the once perennial flows of the SAR, which often dwindled to a near trickle during the summer months in the late 1800s, were replaced with predominantly steady and reliable, tertiary-treated discharge flows that could be captured downstream for reuse and recharge by downstream entities.

Inland Empire Brine Line (Santa Ana Regional Interceptor)

One of the most predominant concerns arising from the heavy use of the Watershed for past agricultural practices, and now from the imported water and use of water, is the buildup of salts. Almost a century of agricultural and industrial use has resulted in salts and other constituents of concern infiltrating many aquifers and streams within the Watershed. As the Watershed continues to grow, cities encroach ever closer in proximity to dairies and other agricultural operations. To counter this added stress to the stream and groundwater supplies, producers have developed advanced methods of reducing potential conflicts. Technologically advanced wastewater control infrastructure has been rigorously employed, and negative impacts from agricultural runoff continue to be minimized. Nevertheless, the existing salts and contaminants present in the Watershed from past practices still need to be removed, as improving water quality is inextricably linked to improving water supplies and implementing a comprehensive groundwater storage program.

As part of the solution to the TDS issues within the Watershed, SAWPA constructed approximately 93 miles of the 16- inch to 84-inch SARI to convey non reclaimable high saline brine out of the Watershed. These brine flows are collected throughout the upper Watershed and sent to Orange County Sanitation District (OCSD) wastewater treatment facilities before final discharge to the ocean. SAWPA owns capacity rights in SARI downstream of Prado Dam, and owns the SARI pipeline upstream of Prado Dam. With projected future growth, both developmentally and economically, the Watershed's reliance on this 100-mile long pipeline will continue to be a critical factor in the overall plan to minimize future drought impacts, achieve the desired salt balance, and improve the quality of the water resources in the upper SAR Basin. Therefore, maintaining the integrity of the SARI line and optimizing its future use are of utmost importance.

As indicated, a variety of infrastructure and related maps of the SAR Region follow herein depicting what exists today. As we in the Watershed move forward with an eye on sustainability, future water infrastructure improvements will be key to achieving a sustainable balance. Keeping these systems, on which we depend so completely, in a good state of repair, is not a luxury, but prudent self-interest. Without a continued and reliable flow of infrastructure services, the viability of the region, as defined by our quality of life and economic well being, is put at risk. It is up to us now to assure that adequate infrastructure is in place to meet the needs of the region for tomorrow.



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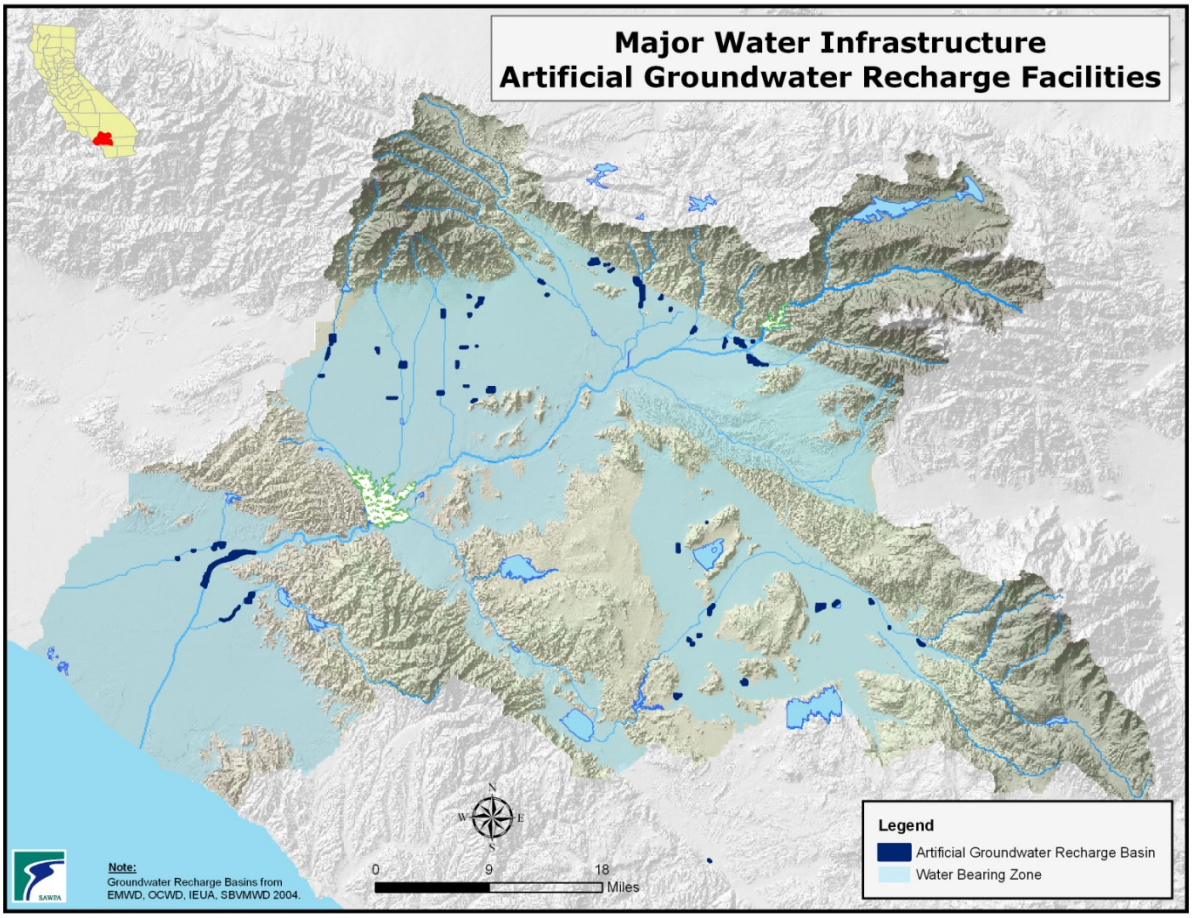

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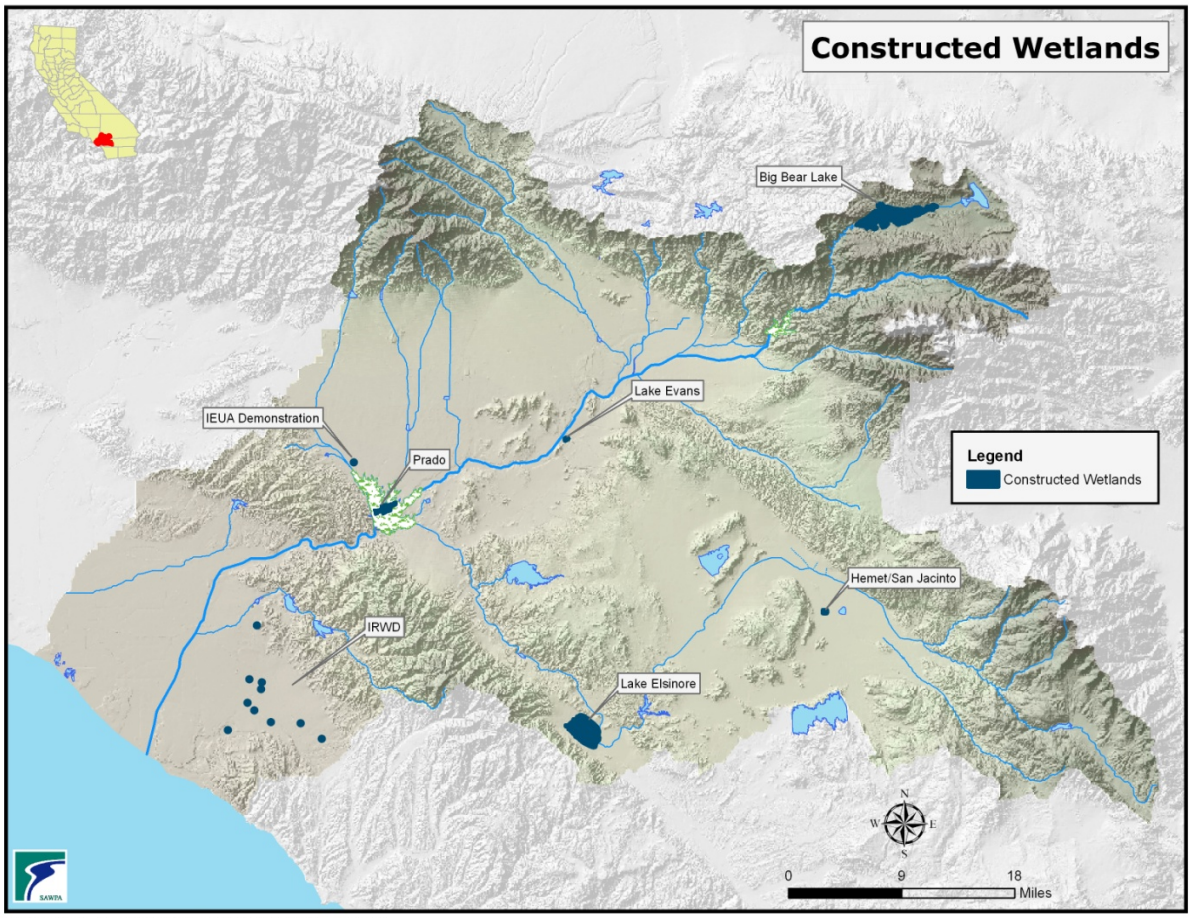

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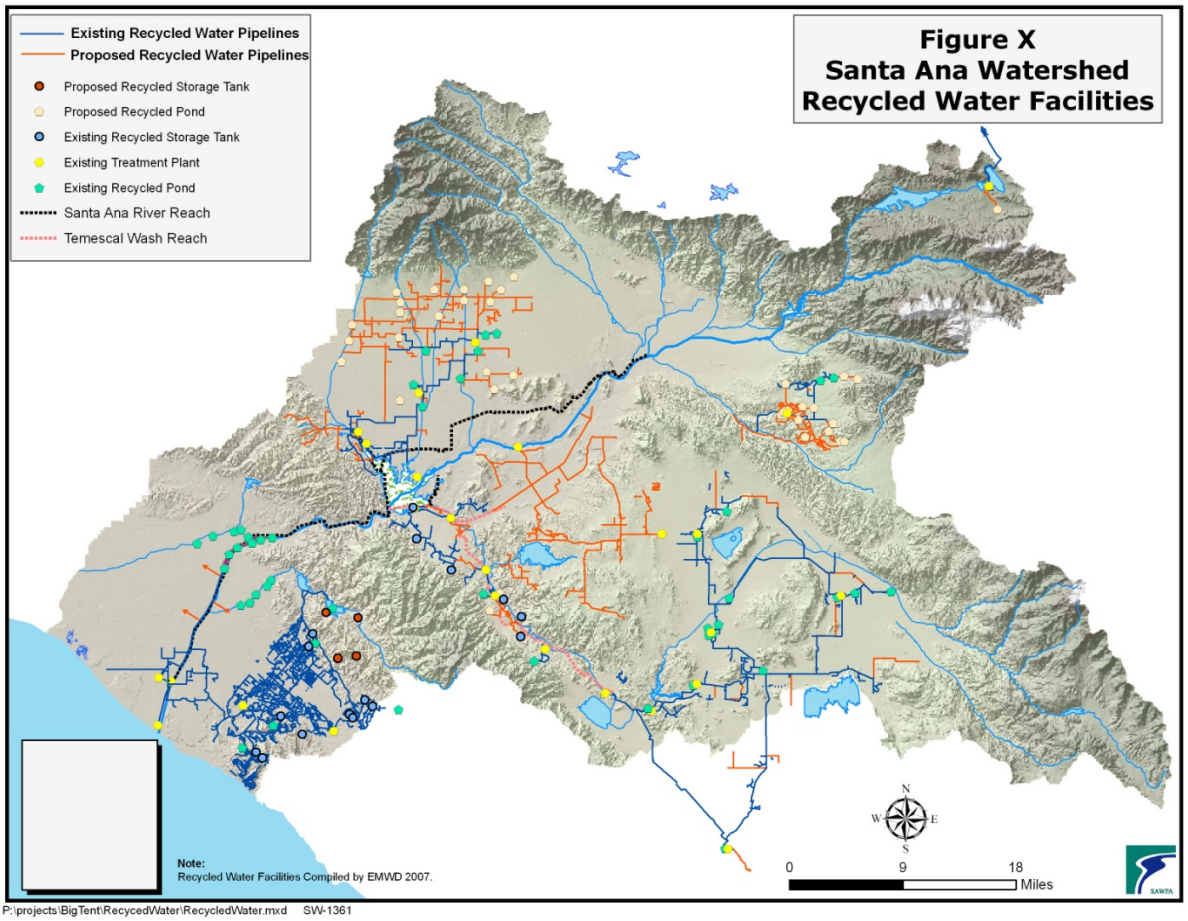

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Chapter 4 Institutional Setting & Collaborative Efforts

As is likely to occur within any watershed, the sometimes conflicting goals or priorities of various watershed agencies can hinder progress. Within the Watershed there are over 100 large and small water districts (**Figure 4-1** below), local, regional, State and Federal agencies, and public/private stakeholder groups. SAWPA recognizes that all of these stakeholders have their own valid interests in ensuring that there is sufficient clean, reliable water in the watershed, and SAWPA takes the initiative to keep all of these groups working together to solve the Watershed's issues.

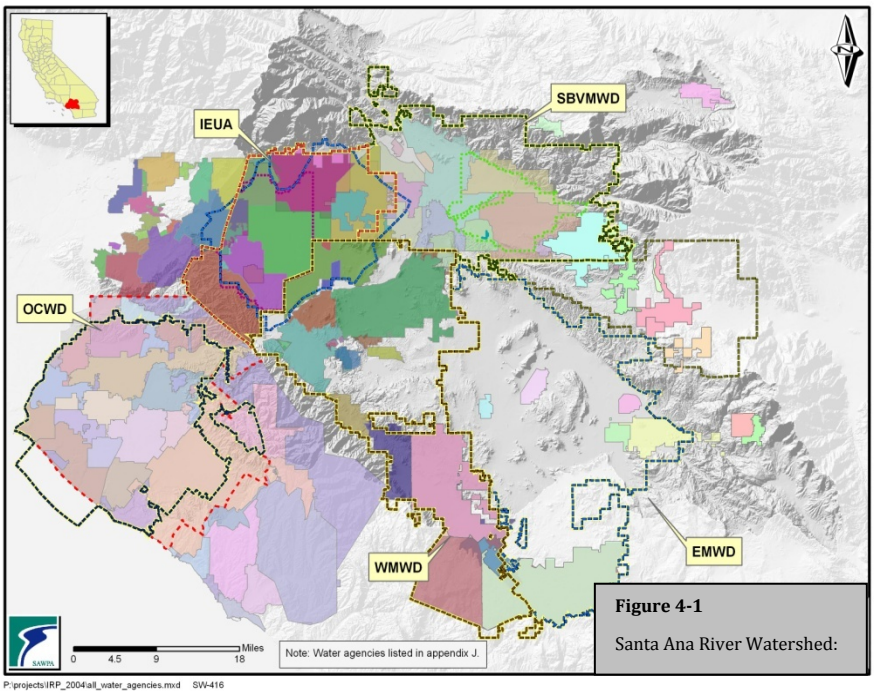


Figure 4-1

Santa Ana River Watershed:

SAWPA strives for a collaborative approach to bring together the planning community, including both public and private sector planners, to advance the benefits of planning on a watershed scale and integrating watershed thinking into the everyday planning process. Working with varied interests and agendas, this watershed planning process has opened the doors to great partnerships, funding opportunities, connectivity, and increased awareness of planning projects and opportunities both in the city next door, and in the community on the other side of the Watershed.

As many cities and counties are in the process of updating their General Plans, funding opportunities and greater collaboration between water agencies, non-governmental organizations, and local land use authorities are facilitating beneficial projects such as conservation, open space, restoration, enhancement, connectivity, and multi-benefit approaches. In this way, planners are finding themselves in a new place, one of noting the quality

of these projects and how to get them through the regulatory planning process with more agreement and greater speed. State law is helpful in this process because Conservation, Safety, Open Space, and Land Use Elements are required elements of every General Plan in the State of California. These elements provide essential components of good watershed plans. In addition, newly proposed Fire Hazard Planning, as well as the more traditional floodplain management guidelines for preparation of General Plans include helpful explanations and instructions for planners trying to make sense of how watershed planning can be and should be integrated into General Plan Updates.

In developing regional plans and prioritizing multi-benefit projects, it is important to not only coordinate efforts with other planning agencies within the region, but it is equally important to coordinate across regional boundaries. During the preparation of the Santa Ana IRWMP, SAWPA staff exchanged information and discussed priorities with planners from regions adjoining the Watershed. For example, SAWPA staff coordinated closely with planners and project proponents in south Orange County, the Los Angeles and San Gabriel River valleys, Upper Santa Margarita, Mojave and Coachella Valley regions.

Collaborative Efforts within the Santa Ana River Watershed

SAWPA, as the leading regional water resource agency for the Santa Ana River Watershed and region, plays a major role in administering, participating, coordinating, and facilitating efforts to address regional water management issues. In fact, since its formation, this has been one of the major purposes of SAWPA in supporting the resolution of water issues and conflicts, and is one of the primary reasons why it was formed in the first place. From the early 1930s to the late 1960s, litigation occurred between upstream and downstream water agencies in the watershed over water rights issues affecting the Santa Ana River, and an adjudicated settlement occurred. As part of the recommendations for the adjudicated settlement, the need for a way to resolve regional differences and conflicts in a cooperative approach was suggested and realized by the creation of SAWPA. The cooperative approach exists today by the regular meetings among the SAWPA member districts but also among the many multi-agency and multi-organizations that SAWPA supports through what is described as the "SAWPA Roundtable".

Some of the past collaborative efforts that have resulted in outstanding results include the following:

- Santa Ana Basin Plan Updates
- San Jacinto Basin Plan Update
- Nitrogen TDS Task Force
- Santa Ana River Use Attainability Analysis
- Biological Denitrification Research
- Chino Basin Water Resources Management Study
- Riverside Colton Conjunctive Use
- Redlands Toxic Study
- Southern California Regional Water Reclamation and Reuse Study
- Southern California Water Recycling Initiative
- Wellhead Treatment

The results of the Nitrogen and TDS Task Force serves as an outstanding template for salt management evaluations and was sighted as an outstanding example of collaborative efforts to resolve a water quality issues by the State Water Resources Control Board.

Utilizing the capable skills of SAWPA staff, multi-agency agreements are developed, consultant contracts are managed, and discussion meetings are administered. The end products of these efforts are successful programs and projects that represent the best in collaboration and facilitation support services. In addition, by the positive and cooperative relationship that SAWPA has with the Santa Ana Regional Water Quality Control Board, SAWPA has served as an effective liaison between the regulators and regulated community in producing effective partnerships and working relationships.

The following task forces and workgroups are examples of watershed partnerships that SAWPA has administered and formed by working closely with the Regional Board in response to the need for updating various components of the Basin Plan.

Agriculture and Dairy Efforts

The San Jacinto Basin Resource Conservation District , in partnership with dairy operators in the San Jacinto River Watershed and represented by the Western Riverside County Agricultural Coalition (WRCAC), is developing an Integrated Regional Dairy Management Plan (IRDMP) to select and implement practices consistent with regional goals for water quality and environmental protection. This progressive roadmap approach is the first effort of its kind to address dairy management on a regional scale.

The IRDMP will incorporate several key components into an overall plan for dairies in the San Jacinto River Watershed. Part of this process involves defining issues and objectives and identifying appropriate solutions. Primary objectives and activities include the following:

- Source Identification for Phosphorus, Nitrates, and Salts in the San Jacinto Watershed and Identification of Technologies and Alternative Control Measures Report
- Transport and Fate of Nitrate and Pathogens at a Dairy Lagoon Water Application Site: An Assessment of CNMP Performance
- Comprehensive Nutrient Management Plan for the San Jacinto River Watershed
- California Dairy Quality Assurance Program
- Irrigation Efficiency Study
- Voluntary Agricultural TMDL Program (WRCAC)
- Agriculture Database Tool Development
- Irrigation Technology Study

- Irrigation Management Study
- IRDMP with BMP Implementation in the San Jacinto River Watershed

Basin Monitoring Program Task Force

The Basin Monitoring Program Task Force is a collaborative effort of public and private sector agencies and interests to conduct water quality evaluations in the Watershed. The Task Force was formed as a spinoff of the TIN/TDS Task Force in 2003 with the mission of implementing the monitoring requirements required as part of the original TIN/TDS Task Force effort. These monitoring requirements include a triennial update of the ambient groundwater quality throughout all the groundwater basins in the Watershed, an annual report on the Nitrogen and TDS in the SAR for Reaches 2, 4 and 5, and an optional annual monitoring program with report to justify an increased nitrogen loss coefficient of more than 25%. Agencies participating in this task force are largely the same as those who participated in the TIN/TDS Task Force and have elected to combine their efforts and provide watershed-wide monitoring reports rather than providing separate reports for each of their separate jurisdictions.

Big Bear TMDL Task Force

To address lake quality problems at Big Bear Lake, a new multi-agency task force was formed in 2008. This task force is working closely with the Regional Board in meeting new surface water quality regulations known as TMDLs to help restore Big Bear Lake. The task force serves an important role in assisting local stakeholders address the Regional Board TMDL implementation tasks to be undertaken by specific stakeholders.

Chino Basin Partners

Through the collaboration of community leaders including the Milk Producers Council, IEUA, Chino Basin Watermaster, and many others, the Chino Basin has developed an award winning organics management and groundwater protection strategy that offers an integrated (multiple benefit) watershed plan for treating, recycling, and reusing organic materials. This partnership is working to deliver significant water and air quality improvements for the region, enhance the reliability of local water supplies, generate clean renewable energy and recycled organic materials, provide significant local economic benefits, and contribute to enhanced wildlife habitats within the Chino Basin. Innovative projects include state-of-the-art anaerobic digesters and composting facilities, as well as the construction of California's first platinum Leadership in Energy and Environmental Design (LEED) rated water and energy- efficient office building that serves as the headquarters for IEUA.

Crest-to-Coast Partnership

SAWPA has been working with the Crest-to-Coast Partnership in assisting efforts to complete the entire SAR Crest-to-Coast Trail and add parkway elements to the river. The Santa Ana River Trail is a continuous multi-use regional trail system and parkway along the SAR corridor. The effort is funded by the counties and cities in the watershed, and by environmental groups interested in facilitating the completion of the 110 miles of trail system. Three county parks districts—Orange County, San Bernardino County, and Riverside County—are leading the charge with help from the Wildlands Conservancy in completing this process. The trail is viewed as a valuable resource providing multi-benefit opportunities including connectivity, transportation alternatives, scenic relief to urban dwellers, recreational activities, and linear parkways with opportunities for environmental restoration as well as education.

Emerging Constituents Workgroup

Based on an April 2008 agreement between the Regional Board and nine local imported water recharge agencies, the signatories to the agreement agreed to develop a plan to investigate "emerging constituents" in water that is intentionally recharged to local aquifers. In general, the phrase "emerging contaminants" refers to a relatively large group of man-made chemical compounds

for which the EPA and the State of California have not enacted a numeric water quality objective or a numeric translator for relevant narrative objectives, nor has the California Department of Public Health (CDPH) adopted a Maximum Contaminant Level (MCL). These compounds also are sometimes called "emerging contaminants or pollutants," and/or "unregulated chemicals" and/or "emerging chemicals-of-concern." To prepare this plan, an Emerging Constituents Workgroup was formed among the signatories and interested parties, such as POTWs, to design and implement the proposed study of emerging constituents. The Workgroup is administered by SAWPA.

The Workgroup's initial investigation was divided into two phases. Phase I surveyed current water quality monitoring programs, regulatory issues, stakeholder concerns, analytical methods, and state-of-the-science, with respect to potential public health and environmental impacts. Phase I culminated in a written report to the Regional Board in December 2008 characterizing the workgroup's preliminary findings. Phase II covered the development of an appropriate water quality characterization program designed to address the concerns raised by regulatory agencies and other stakeholders throughout the watershed. The Workgroup submitted the Phase II report to the Regional Board in December of 2009. An annual sampling program for emerging constituents is prepared by the workgroup and is submitted to the Regional Board.

The Friends of Harbors, Beaches and Parks

The Friends of Harbors, Beaches and Parks was established to promote the protection, enhancement, and expansion of Orange County Regional Parks, Open-Space preserves, recreational trails, and coastal recreational facilities. With a paid membership of over 500 persons and organizations, the Friends of Harbors, Beaches and Parks work with numerous partners including local cities, Orange County nonprofit organizations, and private entities. This group has proposed to create a 1,400-acre park at the mouth of the SAR. This park would be assembled from a patchwork quilt of neighboring lands owned and individually managed by three cities, the County of Orange, several regional, State, and Federal agencies, and private entities. SAWPA has coordinated with this group in addressing water resource and water quality issues particularly in the Huntington Beach and Newport Bay areas of Orange County.

Imported Water Recharge Workgroup

On January 18, 2008, a cooperative agreement for imported water recharge entitled "Cooperative Agreement to Protect Water Quality and Encourage the Conjunctive Uses of Imported Water in the Santa Ana River Basin" was approved by the Regional Board and nine imported water recharging agencies in the Watershed. In accordance with the cooperative agreement, the recharging parties are required to complete a summary of the amount and quality of imported water recharged during the previous three-year period, as well as a projection at six-year intervals of the ambient water quality in each groundwater management zone that is being recharged with imported water. SAWPA serves as administrator of this effort. Principles of agreement on implementation and modeling were completed in July 2009.

Lake Elsinore & San Jacinto Watersheds Authority (LESJWA)

LESJWA is a joint powers authority entrusted with $15 million from the State of California Proposition 13 Water Bond to improve water quality and wildlife habitats, primarily in Lake Elsinore, as well as in Canyon Lake and the surrounding San Jacinto River Watershed. LESJWA members include Riverside County, City of Lake Elsinore, City of Canyon Lake, Elsinore Valley Municipal Water District, and SAWPA, which serves as LESJWA administrator. LESJWA's mission is to support planning, design and implementation of projects to improve water quality in the lakes and watersheds, to secure reliable funding to operate and maintain water quality improvement projects, to serve as administrator of the Lake Elsinore and Canyon Lake TMDL Task Force and a water quality trading program for the San Jacinto River Watershed and to seek ongoing reliable revenue to operate LESJWA JPA in fulfillment of its mission. LESJWA provides a framework in the Watershed to strengthen working relationships between member agencies and stakeholders in an effort to better identify solutions to water and habitat problems that no single agency could effectively address before.

Using the $15 million grant funding and other Federal and State grants, SAWPA and LESJWA have led the way in several major improvements made to Lake Elsinore, Canyon Lake, and for the San Jacinto River Watershed. These include a carp removal program, well improvements for lake stabilization, lake mixing systems, lake aeration, lake dredging, nutrient removal for lake level stabilization using recycled water, and fish stocking.

Lake Elsinore and Canyon Lake Nutrient TMDL Task Force

The Lake Elsinore and Canyon Lake Nutrient TMDL Task Force is comprised of local stakeholders seeking to address the nutrient TMDLs defined by the Regional Board for two impaired water bodies in the San Jacinto River Watershed – Canyon Lake and Lake Elsinore. This Task Force was organized and formed by SAWPA and LESJWA to address water quality targets in a cost effective manner among over 20 agencies and coalitions, including Federal, State, and local agencies. The Task Force meets monthly and includes representatives from local cities, Riverside County, agriculture and dairy, environmental groups, as well as the regulatory community. At the request of the Regional Board, SAWPA served as a neutral facilitator for the early TMDL development process for Lake Elsinore and Canyon Lake.

Middle Santa Ana River Pathogen TMDL Task Force

The Middle SAR Pathogen TMDL Task Force is a collaborative effort of public and private sector agencies and interests focused on the development of pathogen TMDLs for SAR Reach 3, its tributaries, and other water bodies in the Chino Basin area. Formed in 2007, the Task Force has been working on several pathogen-related activities and studies for the Chino Basin. The objectives of this Task Force are to implement a number of tasks identified by the Regional Board in their 2005 Amendment to the Basin Plan. These include the implementation of a watershed-wide monitoring program to assess compliance with REC-1 beneficial use water quality objectives for fecal coliform, evaluate numeric targets established for *E. coli*, and identify and implement measures to control sources of impairment. The Task Force works with the Regional Board in the formulation of pathogen TMDL allocation and implementation strategies. SAWPA serves as the neutral facilitator and administrator of the Task Force.

Nitrogen and TDS Task Force

In 1996, a multi-agency task force was formed to re-evaluate the nitrogen and TDS groundwater objectives in the Watershed based on the best data and science available. The Task Force, led by SAWPA, included 23 water and wastewater agencies, as well as the Regional Board. Under this effort, a massive data compilation and analysis was conducted for groundwater quality to determine both historical and ambient water quality. The focus of this evaluation was on nitrogen and TDS. Under this agreement, the first maximum benefit demonstrations in the State were conducted for effective management of a groundwater management area. The results of the studies were incorporated into the Santa Ana Basin Plan. The efforts by the Regional Board and local stakeholders are now recognized as a statewide template for regional collaboration among regulators and the regulated community, and have saved millions of dollars by protecting groundwater basins.

Orange County Water District and Municipal Water District of Orange County Groundwater Basin Study

OCWD and Municipal Water District of Orange County updated a study on the feasibility and necessary infrastructure required to expand the operating range of the OCWD Groundwater Basin from an overdraft of 500,000 AF to 600,000 AF, 700,000 AF, or even greater if possible. The current operating range of the groundwater basin allows for an overdraft condition of up to approximately 500,000 AF. Seawater intrusion issues begin to occur when the basin is overdrafted by this amount. Additionally, some groundwater production wells will have a difficult time operating with the lower water levels associated with an overdraft greater than this amount. With much larger overdraft conditions, localized subsidence issues also may occur.

Depending upon the necessary infrastructure to sustain larger overdraft conditions, and any additional infrastructure to allow for the utilization of the new storage space, it could be very economical to expand the operating range of the OCWD groundwater basin, which would create additional storage volume for the southern California region.

Prado Basin Sediment Management Project

The objective of the Prado Basin Sediment Management Project is to remove sediment from behind Prado Dam in order to increase water storage capacity. The secondary purpose of this project is to induce sediment movement through the dam to recreate a natural sediment transport regime.

Since the construction of Prado Dam in 1941, the average annual sediment accumulation is estimated at 700 AFY. This sediment accumulation is due to both the natural deposition of materials as water from the four main tributaries (Chino Creek, Mill-Cucamonga Creek, SAR and Temescal Creek) flows to Prado Basin, as well as the artificial blockage of sediment flow from the dam. Blockage of natural sand deposition in the recharge section of the river results in armoring and subsequently the lowering of percolation rates.

OCWD has met with the U.S. Army Corps of Engineers to discuss the issue of sediment management. Both parties have agreed to conduct a feasibility study to determine the most effective and environmentally responsible method, and to construct a pilot sediment transport channel concurrently or after the feasibility study is completed.

Riverside Basin Groundwater Modeling

The Riverside Groundwater Basin is a large alluvial fill basin that is bounded by major faults and topographic barriers. Recharge to the basin occurs by the underflow from basins to the north, contributions from the SAR, and from percolation of surface water runoff from the surrounding uplands, particularly the Box Spring Mountains to the east.

The City of Riverside currently produces about 18,000 AFY of water from the southern portion of the Riverside

Basin and is planning to increase production up to a total of 45,000 AFY in the future. To address the issues associated with increasing groundwater production in the southern portion of the Riverside Basin, SAWPA is assisting the City of Riverside in developing a groundwater flow modeling study.

Santa Ana River Dischargers Association

The Santa Ana River Dischargers Association is an ad hoc group of approximately ten wastewater treatment agencies that are located in the upper Watershed and generally discharge to the SAR or its tributaries. The group serves as a coordinating body in addressing existing and future wastewater treatment regulations and permit requirements. One of the major annual activities of the group is the administration and preparation of a report on mercury concentrations from fish sampling which is then provided to the Regional Board. The Santa Ana River Dischargers Association also has served as a funding party for past regional studies such as the SAR Use Attainability Analysis and the Nitrogen and TDS Evaluation, administered through SAWPA. The group meets monthly and currently is conducting an evaluation of cyanide measurement procedures at wastewater treatment plants.

San Jacinto River Watershed Council

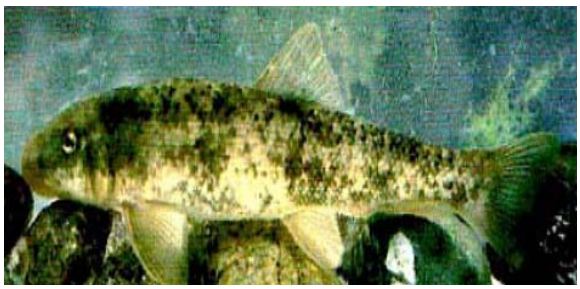
The San Jacinto River Watershed Council (SJRWC) is a multi-agency non-profit group of watershed stakeholders within the San Jacinto River Watershed, a sub-watershed of the Watershed. Among the members are local government, water agencies, agriculture, dairy owners, and environmental representatives. Their purpose is to coordinate with stakeholders to ensure that the current and potential uses of the San Jacinto River Watershed's resources are sustained, restored, and where possible, enhanced, while promoting the long-term social and economic vitality of the region. SAWPA is a member of the SJRWC's governing board. Under an agreement and funding with the State, the SJRWC administered the first Integrated Regional Watershed Plan for the San Jacinto Basin, a sub-region of the Watershed.

Santa Ana River Watershed Alliance

In, 2004, the Department of Conservation provided a grant to Earth Resource Foundation to help implement water conservation and better water quality management practices within the lower watershed. This grant led to the formation of the Santa Ana River Watershed Alliance (SARWA), which is composed of over 50 stakeholders from throughout the watershed. The goal of SARWA is to develop a public understanding of the issues within the watershed and the tasks being undertaken to address them, and to foster support among public and private organizations and agencies for the advance of watershed management.

Santa Ana Sucker Conservation Team

The Santa Ana Sucker Conservation Team is a multi-agency group effort formed by SAWPA, established to coordinate applied research and direct efforts toward the recovery and delisting of the Santa Ana sucker fish species. Work under this activity allows program participants to continue routine maintenance activities with a Regional Programmatic Section 7 consultation. Partners providing financial support include the City of Riverside, City of San Bernardino, County of Orange RDMD, OCSD, OCWD, RCFCWCD, San Bernardino County Flood Control District, and SAWPA. Other participants include the USFWS, CDFG, the Regional Board, Riverside-Corona RCD, and the City of Corona. The group has completed a draft Conservation Program for the threatened fish, which has been submitted to the USFWS. This program enumerates activities that may be undertaken by organizations within the Watershed to minimize effects on the sucker.



Santa Ana Watershed Association

The Santa Ana Watershed Association (SAWA) is a group composed of four RCDs (San Jacinto Basin, Inland Empire, Riverside-Corona, and Elsinore-Murrieta-Anza), OCWD, and several other participating agencies. The group is committed to the protection and improvement of areas within the Watershed. Major focuses of SAWA are the removal of invasive species, which is a significant problem throughout the Watershed, native habitat enhancement, and the protection of endangered and threatened species. SAWA has an active Arundo removal program, biological monitoring program, and education program.

Stormwater Quality Standards Task Force

The Stormwater Quality Standards Task Force is a collaborative effort of public and private sector agencies and interests. The Task Force was formed in 2003 to assist the Regional Board in providing additional data and science in the evaluation of the REC-1 beneficial use designation and associated water quality objectives for the River. Beneficial use designations and water quality objectives define the quality of point and non-point discharges into receiving waters. These receiving waters are

regulated by the Regional Board and municipal stormwater entities, as well as other regulated business, industrial, and development groups, who are interested in providing the best available information to update the water quality objectives and designated beneficial uses of receiving waters. Task Force members will develop a basin-wide assessment of existing conditions of receiving waters and of existing beneficial uses supported by those waters, and identify data gaps and other areas where further assessment is needed.

The Task Force is composed of all three county flood control agencies, and was formed with SAWPA as the Task Force administrator. The work of this Task Force has resulted in one of the most detailed photographic data collection efforts of tributaries' beneficial uses in the country, as well as new pathogen water quality standards based on the best available data and science.

Southern California Water Recycling and Brine Management Studies

Over the past two decades, cooperative partnerships have been forged among the U.S. Bureau of Reclamation (USBOR) and various southern California agencies to evaluate ways to maximize water recycling and manage salt, which often inhibits the use of water recycling. In the mid-90s, the first large-scale study was called the Southern California Comprehensive Water Reclamation and Reuse Study (SCCWRRS). This cooperative effort is a partnership of the following agencies: the USBOR, DWR, Central Basin and West Basin Municipal Water Districts, City of Los Angeles, City of San Diego, MWD, San Diego County Water Authority, SAWPA, and South Orange County Reclamation Authority. The six million dollar, six-year study culminated in a comprehensive evaluation to reach a long-term goal of recycling over one million AF by the year 2020.

Follow up studies included the Southern California Water Recycling Initiative, which covered a programmatic EIR/EIS for the short-term implementation plan; a regional evaluation of regulatory issues facing projects, regional salinity management opportunities, and Year 2010 to 2020 implementation plans. This study, similar to the SCCWRRS, was conducted under a 50-50 cost share with the USBOR.

In 2008, a new multi-agency cooperative study among southern California agencies and the USBOR was kicked off, entitled the Southern California Regional Brine Concentrate Management Study. The goal of this new Study is to update existing brine management resources, evaluate existing pilot and bench scale projects and research, assess existing and potential regulatory trends, and use the information to participate in the recommendation and selection of the next project phase: develop one or more projects as a full scale demonstration pilot study; develop analytical models and research project(s) to address information gaps and model scenarios; and/or develop general design plans for constructing a brine-concentrate facility. An additional goal of the Study is to identify opportunities to build a consensus on brine-concentrate management between government, industry, and the public in an environmentally and economically sound manner. The study was completed in late 2009.

In May 2010, SAWPA applied for federal funding to partner with Reclamation to conduct a Basin Studies Program for the Santa Ana River Watershed. In August 2010, SAWPA was announced as the

funding recipient, one of six basin studies funded by Reclamation across the country. The 50-50 cost share study will assist the next update to the OWOW plan.

Southern California Salinity Coalition

On April 2, 2002 the Southern California Salinity Coalition officially was incorporated as a non-profit organization formed to provide a means of coordinating the efforts of stakeholders to address the critical need to remove salt from water supplies and preserve water resources, in the best interests of California and its citizens. The organization is composed of 12 member agencies including SAWPA, Calleguas Municipal Water District, Central and West Basins Municipal Water Districts, City of Los Angeles Department of Water and Power, IEUA, Irvine Ranch Water District, Los Angeles County Sanitation District, MWD, Mojave Water Agency, OCSD, OCWD, and the Water Replenishment District of Southern California. The National Water Research Institute serves as the administrator.

Southern California Wetlands Recovery Program

The Southern California Wetlands Recovery Program is a multi-agency group working cooperatively to acquire, restore, and enhance coastal wetlands and watersheds between Point Conception and the international border with Mexico. Using a non-regulatory approach and an ecosystem perspective, the Wetlands Partnership will work together to identify wetland acquisition and restoration priorities, prepare plans for these priority sites, pool funds to undertake these projects, implement priority plans, and oversee post-project maintenance and monitoring. The goal of the Southern California Wetlands Recovery Program is to accelerate the pace, the extent, and the effectiveness of coastal wetland restoration in southern California through developing and implementing a regional prioritization plan for the acquisition, restoration, and enhancement of southern California's coastal wetlands and watersheds. Ultimately, the Wetlands Program's efforts will result in a long-term increase in the quantity and quality of the region's wetlands.

Team Arundo

Team Arundo is recognized throughout the State of California as a leader in the removal of *Arundo donax*, a rapidly growing and water thirsty species of giant reed that has infested the Watershed. Partners include SAWA, the Riverside County Parks and Open-Space District, RCFCWCD, OCWD, the Orange County Public Works, the Monsanto Company, the Orange County Conservation Corps, the California Conservation Corps, and SAWPA, which serves as administrator. Historically, the Nature Conservancy also has participated in Team Arundo. Team Arundo members have undertaken a number of ambitious invasive species removal and restoration projects throughout the Watershed. The foresight and leadership of these groups have proven instrumental in elevating the need for Arundo removal to an issue of statewide and federal importance.

SAWPA strives for a collaborative approach to bring together the planning community; however, it cannot address all watershed planning issues and concerns, nor will it fit together all existing plans and policies of every agency within the watershed. In these cases, SAWPA coordinates with the sponsors of these activities and provides resources when possible.

Newport Bay Executive Committee

The Newport Bay Watershed Executive Committee is the successor to the Upper Newport Bay Sediment Control Executive Committee established through a cooperative agreement in the early 1980s. The Cities of Newport Beach, Tustin, and Irvine, the County of Orange, the California Department of Fish and Game, and The Irvine Company entered into an agreement to develop and implement a comprehensive program to manage sediment in San Diego Creek and Upper Newport Bay. The Executive Committee was formed by a cooperative agreement in 1999, and now includes in its interests the impairments of Newport Bay caused by nutrients, toxics, and pathogens in addition to sediment, as well as related integrated water resource planning. Additional members have been added over time including the Santa Ana Regional Water Quality Control Board, Irvine Ranch Water District and the cities of Santa Ana and Costa Mesa. Members of the Executive Committee are elected, appointed, or executive level managers, with one member from each of the signatories to the agreement. It typically meets four to six times a year with meetings governed by the Brown Act. The Executive Committee provides strategic direction for environmental enhancement programs in the watershed, advocacy of these programs to the elected/appointed boards of the member organizations, and a forum for discussion of watershed environmental issues.

Nitrogen and Selenium Management Program (NSMP)

The NSMP Working Group consists of staff level technical representatives of watershed stakeholders that include state, county, and city agencies, water districts, and private entities that have agreed to fund and implement a Work Plan to address selenium and nitrogen groundwater-related inflows in the Newport Bay Watershed. The Working Group was created in response to a permit issued by the Santa Ana Regional Water Quality Control Board (R8-2004-0021) to regulate short-term groundwater-related discharges. Since the adoption of the Order in December 2004, the Working Group has conducted scientific assessment and research on methods of source control and treatment. Additionally, the Working Group realizes that public participation and input is an integral component of the implementation of the Work Plan. Therefore, as part of its public participation strategy, the Working Group also provides for "Participating Member" positions. Participating members are not members of the Working Group per se, but are involved in all discussions and decisions of the Working Group, with the exception of funding decisions related to the Work Plan. Unlike Working Group members, Participating Members are not required to financially contribute to the Work Plan.

Collaborative Efforts with Areas Adjacent to the Watershed

The Santa Ana IRWM region is surrounded by six other IRWM regions, as shown in the map below, including: South Orange County Watershed Management Area, Upper Santa Margarita, Greater Los Angeles County, Gateway Region, Coachella Valley and Mojave.

Of these six regions, the largest opportunities for coordination and cooperation are Los Angeles, South Orange County, and Gateway. Coordination with Orange County is frequent, as part of Orange County is located in the watershed and there are multiple forums for coordination. As part of this planning effort, meetings were held with Greater Los Angeles and Gateway.

SAWPA proactively seeks meeting with neighboring regions quarterly to share and stay abreast of critical issues, ongoing efforts, and opportunities for collaboration in the region.

The watershed area encompasses the service areas of many local agencies and organizations. There are over 120 local agencies contained within the watershed that may be considered water entities.

Overview of Governing Laws, Judgments and Agreements

This section briefly describes some of the governing laws, judgments, and agreements in place that have had significant influence on water management in the Watershed. Below is a general overview of these documents.

Settlement Agreement between City of San Bernardino and City of Riverside and Riverside Water Company, 1922

In November 1922, after a Supreme Court of the State of California decision, the City of San Bernardino (Plaintiff) and the City of Riverside, and Riverside Water Company (Defendants) negotiated a settlement agreement to take, divert, and use water from the "San Bernardino Artesian Basin," Lytle Creek, Warm Creek, and Devil Canyon Creek. The agreement was approved by the San Bernardino County Superior Court in a stipulated judgment that constituted authorities and rights of the parties for taking, diverting, and using the water. The court also established a provision for daily record keeping of all the diversions and use of water by all said parties.

Colorado River Compact, 1922

Storage and regulation of the Colorado River was essential for the flood protection and development of its lower basin (portions of California, Nevada, Arizona, Utah and New Mexico), but also to ensure an adequate water supply for appropriators in its upper basin (portions of Wyoming, Utah, Colorado,

New Mexico, and Arizona). As unregulated flow of the river began to be apportioned by users in the lower basin, an allocation of use of the Colorado River system water between the basins became imperative. Thus, on November 24, 1922, the Colorado River Compact was signed allocating use of the Colorado River system water between the basins with internal allocations remaining to interests within each basin. The Compact provided Colorado River system use allocations of 7.5 million acre-feet (AF) for both the upper and lower basins, and an additional one million AF for the Lower basin.

Seven-Party Agreement, 1931

A contract was signed on April 24, 1930, between the Federal Government and the MWD providing for the storage and delivery of up to 1,050,000 AF of Colorado River water annually. The contract later was supplemented to provide for further allocation of use among agricultural use. The supplementary water delivery contract was based on an agreement, signed on August 18, 1931, which became known as the "Seven-Party Agreement." The agreement was approved by DWR and submitted to the Secretary of the Interior with the recommendation that a system of priorities be incorporated as a uniform clause in all California water contracts. One of the priorities included delivery of water in excess of California's annual 4,400,000 AF entitlement.

Rialto Basin Judgment, 1961

The Rialto-Colton Basin was adjudicated in the Lytle Creek Water and Improvement Company vs. Fontana Ranchos Water Company, et. al., San Bernardino County Superior Court Action 81264, entered on December 22, 1961. Limits on groundwater extractions are based on the average of the spring-high water level elevations of three wells within the basin. The pro-rata water productions by each party (City of Colton, City of Rialto, Fontana Union Water Company, Citizen Land and Water Company, and Lytle Creek Water Improvement Company) are based on the “spring-high water level” in the three index wells as described below:

Above 1002.3 feet	Unlimited
Between 1002.3 feet and 969.7 feet	As imposed by the judgment
Below 969.7 feet	Reduced by 1% for every foot the average is below 969.7

At the request of the stipulating parties, Valley District monitors compliance with the decree, and has done so since the early 1990s.

Chino Basin-City of Pomona Agreement, 1968

This agreement, negotiated prior to the final settlement of the Orange County/Chino and Western/San Bernardino Judgments was effective October 20, 1968. It provides the means by which the City of Pomona can pay its share of Prado Settlement costs and costs associated with IEUA's obligation to deliver a primary contribution of 16,875 AFY to the SAR near Prado Dam. The City of Pomona produces water from wells in the Chino Groundwater Basin that are outside the IEUA boundaries. The City of Pomona is sharing in these costs because the area they are pumping from is tributary to the SAR at Prado Dam.

Orange County/Chino Judgment, 1969

On October 18, 1963, OCWD filed a complaint against more than 2,500 water users in the upper watershed of the SAR Basin to seek an adjudication of water rights. In 1968, additional cross-complaints were filed which expanded the adjudication requirements to include 1,500 water users downstream of Prado Dam.

On April 17, 1969 the California Superior Court stipulated a judgment known as the Orange County/ Chino Judgment. The Orange County/Chino Judgment established the entitlements and obligations of the following water districts: OCWD, WMWD, Chino Basin Municipal Water District (CBMWD, now known as IEUA), and Valley District. All other defendants and cross-defendants were dismissed within the Orange County/Chino Judgment. The provisions of the Orange County/Chino Judgment became effective on October 1, 1970.

The Orange County/Chino Judgment stipulated the physical solution that Valley District is responsible for providing an average annual adjusted base flow of 15,250 AF at Riverside Narrows. In addition, IEUA and WMWD are required to provide an average annual adjusted base flow of 42,000 AF at the Prado Dam. Water users downstream of Prado Dam, the lower Watershed, also have the right to all storm flow that occurs at the Prado Reservoir. The Orange County/Chino Judgment allows for unlimited conservation, spreading, and impoundment of water by the upper Watershed users as long as the Riverside Narrows and Prado Dam requirements are met.

Western/San Bernardino Judgment, 1969

A suit was filed on March 1, 1963, by WMWD and others seeking a general adjudication of water rights within the San Bernardino Basin area. Increasing groundwater withdrawals were causing concern as groundwater resources made up a large portion of the supply to the Cities of San Bernardino, Redlands, and Riverside. WMWD and Valley District viewed the Orange County/Chino suit as a vehicle by which a settlement over San Bernardino Basin water resources could be achieved. When settlement documents were prepared for the Orange County/Chino suit, WMWD prepared settlement documents for their own suit. Possibly because of the interrelated nature of the two suits, both sets of settlement documents were entered. The California Superior Court instituted a judgment on April 17, 1969.

The Western/San Bernardino Judgment determined the rights of groundwater extraction from the San Bernardino Basin area and provided for replenishment of that area. The San Bernardino Basin is defined as the area above the Bunker Hill Dike excluding the Yucaipa, San Timoteo, Oak Glen, and Beaumont Basins. This Judgment also established the base rights and replenishment requirements for the Colton Basin, Riverside Basin area within San Bernardino County, and Riverside Basin area within Riverside County.

At the same time, the Judgment ordered the appointment of a Watermaster. The Watermaster is a committee consisting of one representative each from Valley District and WMWD. The Watermaster determines and verifies the amounts of water diverted and pumped from local streams and from the groundwater basins identified in the Western/San Bernardino Judgment.

Once the determinations and verifications are complete, the Watermaster then maintains annual accounting of surface and groundwater production so the Court can compare the verified entitlements.

Western, Chino Basin, County of Riverside, Riverside County Flood Control and Water Conservation District Agreement, 1969

WMWD, IEUA, the County of Riverside, and the Riverside County Flood Control and Water Conservation District (RCFCWCD) entered into an agreement on March 24, 1969. The parties agreed on several items that impacted the effectiveness of Orange County/Chino Judgment.

RCFCWCD would transfer its water right applications for storage of water in Prado Dam to OCWD. This agreement required that RCFCWCD would sign the "Stipulation and Order Re-Dismissal of Certain Defendants" in the Orange County/Chino Judgment. WMWD and IEUA agreed that they would not object to the use of 10,000 AF of base flow at the Prado Dam for the purpose of maintaining recreation lakes. These lakes would have to be constructed after January 1, 1974, and before January 1, 1984.

Also, WMWD and IEUA would have the right to produce base flow by eliminating phreatophytes or by pumping groundwater on lands acquired by the RCFCWCD.

Chino Basin-Western Agreement, 1970

The Orange County/Chino Judgment stipulates that IEUA and WMWD are jointly obligated to provide an average annual adjusted base flow of 42,000 AF at Prado Dam. The purpose of the Chino Basin-Western Agreement, effective October 1, 1970, is to specify the rights and obligations of the parties with respect to the satisfaction of their obligations under the Orange County/Chino Judgment.

This agreement specifies that each party is required to deliver to the SAR, or vicinity, an adjusted primary contribution of 16,875 AFY. Primary contributions are not allowed to include rising water at Riverside Narrows, underflow from Chino Basin Groundwater Basin, or effluent from the Jurupa Community Services District wastewater treatment plant.

This agreement also states that the primary contributions from IEUA and WMWD mostly shall be effluent from municipal wastewater treatment facilities. Effluent from Ontario, Upland, Fontana, Montclair, Chino, and the Cucamonga County water districts will be used to satisfy IEUA obligations. Effluent from wastewater treatment facilities in Corona and Riverside will supply WMWD obligations. Through September 1980, IEUA and WMWD were allowed to supplement their deliveries with groundwater. However, beginning October 1, 1980, the agreement states that either party shall refrain from supplementing their primary contributions with groundwater.

Western-City of Corona Agreement, 1970

This agreement, effective October 1, 1970, provides a commitment of portions of the City of Corona treatment plant effluent for meeting WMWD obligation under the Orange County/Chino Judgment and as specified in the Chino Basin-Western Agreement.

Under this agreement, the City of Corona is obligated to deliver to the SAR 1,625 AFY of wastewater treatment plant effluent. This quantity of water is subject to adjustments based on quality.

The City of Corona can receive credits for adjusted contributions that are greater than is required. These credits can be applied to meet obligations in any given year, but must deliver at least 1,430 AF.

Western-City of Riverside Agreement, 1970

This agreement, effective October 1, 1970, provided commitment of wastewater effluent by the City of Riverside to WMWD for use in meeting base flow requirements of the Orange County/Chino Judgment. The City of Riverside would deliver to the vicinity of Riverside Narrows 15,250 AFY from its treatment plants.

The City of Riverside can receive credits for adjusted contributions that are greater than is required. These credits can be applied to meet obligations in any given year, but must deliver at least 13,420 AF.

If, in the future, the Court modifies WMWD's obligation under the Orange County/Chino Judgment, or if modifications occur to the Western-Chino Basin Agreement, modifications to reduce Riverside obligation under this agreement can be made.

If Riverside is forced to reduce its pumping from any area within the Santa Ana River Basin and replenishment is not being provided by WMWD, or if other pumpers are not subject to similar restrictions, then Riverside has the right to reduce its obligation under this agreement. In these circumstances, Riverside can reduce its effluent commitment by 3,000 acre-feet, which is meant to offset Riverside's reduced pumping. As an alternative, Riverside can increase its pumping by 3,000 acre-feet elsewhere in the Santa Ana River Basin.

Santa Ana River-Mill Creek Cooperative Water Project Agreement, 1976

The SAR-Mill Creek Cooperative Water Project Agreement (informally known as the Exchange Plan) executed in May 1976, is an agreement among nine agencies and water companies in eastern San Bernardino Valley. The nine parties to the Exchange Plan are as follows:

- Redlands Water Company
- Bear Valley Mutual Water Company (Bear Valley Mutual)
- Crafton Water Company
- North Fork Water Company [East Valley Water District]
- Lugonia Water Company
- City of Redlands
- San Bernardino Valley Water Conservation District (SBVWCD)
- Yucaipa Valley Water District
- Valley District

In an effort to avoid pumping costs and to lower the overall cost of water, the parties have agreed to the exchange of water from the SAR, Mill Creek, and the SWP. The agreement is described as a "bucket-for-bucket exchange," whereby a party to the agreement provides a "bucket" of their water to a second, higher elevation party, and the second party provides a "bucket" of water from an alternate, lower elevation source back to the original party. To facilitate exchanges, parties to the

agreement share their existing facilities. However, specific facilities (called Cooperative Water Project facilities) were built and are operated by Valley District in part to accommodate Exchange Plan deliveries. Given the three water sources and the available facilities, there are multiple delivery possibilities.

Big Bear Municipal Water District/North Fork Water Co. Judgment, 1977

Bear Valley Dam, which forms Big Bear Lake, is the only major dam that affects runoff into Seven Oaks Dam. Big Bear Lake is a water conservation reservoir presently owned by the Big Bear Municipal Water District (Big Bear Municipal). Big Bear Lake is located on Bear Creek, a tributary to the SAR. The lake has a drainage area of about 38 square miles.

Bear Valley Mutual and its predecessors constructed, owned, and operated Big Bear Lake as a supplemental water supply reservoir to meet the irrigation water supply demand within the Bear Valley Mutual service area in the easterly end of the San Bernardino Valley. Historical irrigation releases during dry periods sometimes caused low water levels in Big Bear Lake.

As recreation uses of Big Bear Lake became more important, Big Bear Municipal sought to control the water levels in the lake. On February 4, 1977, a stipulated judgment was entered in San Bernardino County Superior Court for Case No. 165493 *Big Bear Municipal Water District vs. North Fork Water Co. et al.* Big Bear Municipal obtained the opportunity to furnish "in-lieu" water from several other named sources other than Big Bear Lake to meet the water supply demands of Bear Valley Mutual. Big Bear Municipal was allowed to retain an amount of water in Big Bear Lake equal to the amount of water furnished in-lieu to Bear Valley Mutual. Big Bear Municipal explored and implemented the alternate sources. Providing water from these alternate in-lieu sources resulted in water being retained in Big Bear Lake to stabilize the water levels in the lake.

On May 1, 1987, Big Bear Municipal adopted operating criteria for Big Bear Lake that contain conditions regarding when Big Bear Municipal will release water from Big Bear Lake and when Big Bear Municipal will acquire in-lieu water for Bear Valley Mutual.

On February 16, 1995, the Regional Board adopted Order No. 95-4, which requires that Big Bear Municipal make releases from Big Bear Lake through Bear Valley Dam to provide water for preservation of fish in Bear Creek.

On February 1, 1996, Big Bear Municipal and Valley District entered into an agreement that provides for Valley District to furnish all in-lieu water that Big Bear Municipal needs to meet the water supply demands of Bear Valley Mutual.

As a result of the stipulated Judgment, Big Bear Lake now is maintained at higher levels for recreational uses. The lake will spill (*i.e.*, need to release water because the reservoir is full) more often than occurred under the historic irrigation supply operation. However, inflow to the SAR during irrigation months may be less than historic irrigation releases. Inflow to the SAR during winter months may be greater than under the historic operation of Bear Valley Dam. The changes in operation of Big Bear Lake from an irrigation water supply reservoir to a recreation reservoir result in changes in the timing and amounts of water Big Bear Lake and Bear Creek contribute to the SAR.

Chino Basin Judgment, 1978

The Chino Basin Judgment was issued, January 27, 1978 by the California Superior Court for the County of San Bernardino. It adjudicated the groundwater rights in the Chino Basin. The judgment is a stipulated settlement developed by the basin producers on their behalf by IEUA, the City of Chino, *et al*.

The adjudication was based upon a physical solution in which the safe yield of the Chino groundwater basin was determined to be 140,000 AFY. The safe yield is defined as the long-term average annual amount of groundwater that can be produced without creating undesirable results.

Through the judgment and the Watermaster process, assessments are levied so that studies of hydrologic conditions and operations of the Chino Groundwater Basin can be undertaken, and contracts prepared. The maintenance and improvement of water quality within the Chino Basin is one of the major responsibilities of the Watermaster as addressed in the judgment.

The Watermaster staff maintains an annual accounting of stored water and extractions, and can develop a basin management plan taking into consideration both quantity and quality. To develop a plan, the financial feasibility and economic impact of the plan must be confirmed. An important objective in the management of the Chino Groundwater Basin waters is to limit impacts on producers due to unreasonable pumping patterns or recharge practices.

San Bernardino-City of San Bernardino, City of Riverside Agreement, 1981

This agreement, signed on December 22, 1981, among San Bernardino, and Board of Commissioners of the Cities of San Bernardino and Riverside, was made pursuant to the agreement between Valley District and WMWD regarding additional extractions from the San Bernardino Basin area. Annual extraction of additional water is limited to 10,000 AF as specified in the San Bernardino-Western Agreement. This agreement stipulates that all parties making additional extractions will pump from the artesian zone of the San Bernardino Basin. To monitor the effects of the additional extractions, this agreement identifies that water levels will be monitored at the specific wells.

San Bernardino-Western Agreement, 1981

This agreement, signed December 22, 1981, was created as a vehicle to allow specified groundwater producers to pump and export additional San Bernardino Basin groundwater. A surplus of natural groundwater existed in the artesian zone, and extraction of this additional water was determined to be in the interest of sound water resources management. The official designation of this agreement is "Agreement Regarding Additional Extractions from the San Bernardino Basin Area."

An agreement was reached that the additional extractions would be made through the pumping from wells operated by the City of Riverside or pumping by other Valley District producers. The maximum amount of water is limited to 10,000 AFY or less such that the withdrawals would not impose replenishment obligations on San Bernardino. This agreement specified that import water will not be required for replenishment of the additional water extracted. The basic term of this agreement is ten years, but will continue beyond this period until such time as written that either party provides termination.

Three amendments have been applied to this agreement. The first, signed on December 5, 1984, provided for increased extractions for calendar year 1984 only. The extraction limit for 1984 was increased to 13,000 AF. Amendments 2 and 3 were added May 20, 1987 and January 20, 1988, respectively, to increase extractions to 15,000 AF for each of these calendar years.

San Bernardino-Western Agreement, 1983

As groundwater levels continued to rise in the early 1980s, it became apparent that the existing agreement for additional extractions from the Bunker Hill Pressure Zone was not going to relieve the developing emergency water level situation. As a result, an agreement was developed for temporary additional extractions from the San Bernardino Basin area. This agreement, effective October 19, 1983, applied only to natural water supply. Import water was not considered within this agreement. The high groundwater levels have resulted primarily from natural and artificial water recharge during several very wet years.

Valley District and WMWD agreed that an additional amount not-to-exceed 40,000 AFY could be extracted from the artesian zone to help relieve water level problems. The agreement specified that this amount of water could be extracted annually for a six-year period. These extractions were to be permitted in addition to those allowed in the Western/San Bernardino Judgment, which can be made without replenishment obligations.

This agreement was approved by the Superior Court of Riverside County of June 27, 1984. There was, however, no water ever extracted from the San Bernardino Basin under this agreement.

San Bernardino-Western, Orange County, Riverside, and San Bernardino City Agreement, 1985

This agreement signed on February 25, 1985, among Valley District, WMWD, OCWD, and the Cities of Riverside and San Bernardino provided for an emergency program for relieving high groundwater problems within the San Bernardino Basin area. The extraction program involved production of 8,000 AF of natural water for delivery to Orange County spreading grounds via the SAR channel. Extractions made from the basin are in addition to those permitted in the Western/San Bernardino Judgment. The program was agreed to last six months and end on June 30, 1985.

Each of the participants agreed to maximize production from the artesian zone of the San Bernardino Basin, and to extract from the zone relying upon other water sources capable of providing water to the same areas.

Under this agreement, Valley District was obligated to monitor water levels for the purpose of administering the agreement. Within the agreement, OCWD determined on a day-to-day basis if water produced is usable at its spreading basins within Orange County. OCWD also was to reimburse the cost of the approved production of the emergency extractions. Extractions made without approval were to be made at the expense of the parties producing the water.

This agreement was extended on August 21, 1985, such that emergency extractions were allowed and reimbursable through December 31, 1985. Both the agreement and its extension were approved by the Superior Court of Riverside County.

Monterey Agreement, 1994

In the early 1990s, the California drought and new environmental constraints brought the allocation process for the SWP to the forefront of debate between DWR and the State water contractors. Many agricultural contractors were upset that payments for the SWP still were being required by DWR when water deliveries were being decreased or totally cut off to some contractors. Urban contractors also were concerned about decreasing supplies, as well as an inflexible system that wouldn't allow them to better manage allocated supplies by storing water outside their service area for later use within their service area, for example.

In December 1994, the Monterey Agreement was reached between DWR and the agricultural and urban SWP contractors. The Monterey Agreement is a set of principles that covers a number of issues, including water allocation, use of SWP facilities, water management, and financial rate management.

The Agreement resolves past disputes over the allocation among contractors of SWP water supplies, which now will be allocated on the basis of entitlement. It also provides opportunities for contractors to improve their water supply reliability in the short-term. These opportunities include allowing more flexible use of existing SWP facilities through, for example, use of the California Aqueduct to transport water purchased from non-SWP sources, and access to about half of the storage in Perris and Castaic Reservoirs in southern California by the contractors paying for them.

The Monterey Agreement also provides opportunities for better water management of currently limited SWP supplies by allowing water to be stored outside a contractor's service area for later use within its service area. It also included a rate management program that allows DWR to better handle unanticipated cash flow problems, and involves a reduction in charges for all contractors when SWP cash flow permits.

By May of 1996, 21 of the 29 contractors holding contracts had signed the amendment. In addition, an environmental impact report (EIR) was completed for Monterey Agreement implementation. However, this EIR was challenged in court. These legal challenges continue to delay implementation of the Amendment.

Big Bear Municipal and Valley District Agreement, 1996

On February 1, 1996, BBMWD and Valley District entered into an agreement that provides for Valley District to furnish all in-lieu water that BBMWD needs to meet the water supply demands of Bear Valley Mutual.

As a result of the stipulated Judgment, Big Bear Lake now is maintained at higher levels for recreational uses. The lake will spill (*i.e.*, need to release water because the reservoir is full) more often than occurred under the historic irrigation supply operation. However, inflow to the SAR during irrigation months may be less than historic irrigation releases. Inflow to the SAR during winter months may be greater than under the historic operation of Bear Valley Dam. Changes in the operation of Big Bear Lake from an irrigation water supply reservoir to a recreation reservoir result in changes in the timing and amounts of water Big Bear Lake and Bear Creek contribute to the SAR.

Chino Basin Peace Agreement, 2000

Part of the 1978 Chino Basin Judgment was that the Chino Basin Watermaster would develop an Optimum Basin Management Program (OBMP) and update it every five years. The OBMP had four goals: enhance basin water supplies, protect and enhance water quality, enhance management of the basin, and equitably finance the OBMP.

As part of the development of the OBMP, a historic Chino Basin Peace Agreement between all affected stakeholders in the basin was finalized in June 2000. This Peace Agreement set forth the terms and conditions for the construction and operation of Chino Basin desalters and a general template for the purchase and sale of desalted water.

Integrated Regional Water Management Planning Act, 2002

The California Legislature passed Senate Bill 1672 in 2002, the IRWM Planning Act that the Governor signed into law. The Bill added Part 2.2 (commencing with Section 10530) to Division 6 of the Water Code: Conservation, Development and Utilization of State Water Resources.

The IRWM Planning Act authorized a "regional water management group" to prepare and adopt a regional plan in accordance with certain procedures that addresses programs, projects, reports, or studies relating to water supply, water quality, flood protection, or related matters, over which any local public agency that is a participant in that group has authority to undertake.

The law requires DWR, the California State Water Resources Control Board (SWRCB), and the State Department of Health Services to include in any set of criteria used to select the projects and programs for grant funding "…a criterion that provides a benefit for qualified projects or programs."

To comply with the requirements of the law, DWR and SWRCB prepared standards (also referred to as IRWM Guidelines) for preparation of IRWMPs. In addition, they established set criteria for selection of the projects and programs to be funded under Chapter 8 of Proposition 50, the IRWM Implementation Grant Program.

The guidelines state that, "The intent of the IRWM Grant Program is to encourage integrated regional strategies for management of water resources, and to provide funding through competitive grants for projects that protect communities from drought, protect and improve water quality, and improve local water security by reducing dependence on imported water."

This Santa Ana IRWMP, the OWOW plan, is prepared in compliance with the IRWM Planning Act, DWR and SWRCB Guidelines, and the intent of the grant program.

Groundwater Management Planning Act, 2002

In 2002, Senate Bill 1938, Groundwater Management Planning Act of 2002 was enacted into law. This law amended Assembly Bill 3030, which authorized a local agency to prepare and implement a groundwater management plan. This law requires a local agency that elects to develop a groundwater management plan to follow specific requirements, including public notification and public involvement process as summarized below.

- Make available to the public a written statement describing the manner in which interested parties would be allowed to participate in the development of the plan.
- For the purposes of qualifying as a groundwater management plan and for receiving State funds administered by DWR for the construction of groundwater projects or groundwater quality projects, prepare and implement a plan that includes certain basin management objectives (BMOs) and components, and adopt certain monitoring protocols.
- The law requires the local agency to submit a copy of the plan to DWR in an electronic format, if practicable, approved by the DWR, and DWR would be required to make copies available to the public.
- Prior to adopting a resolution of intention to draft a groundwater management plan, a local agency shall hold a hearing after publication of notice on whether to adopt a resolution of intention to draft a groundwater management plan, pursuant to this part for the purposes of implementing the plan and establishing a groundwater management program. At the conclusion of the hearing, the local agency may draft a resolution of intention to adopt a groundwater management plan pursuant to this part for the purposes of implementing the plan and establishing a groundwater management program. Upon written request, the local agency shall provide any interested person with a copy of the resolution of intention.
- The local agency shall prepare a groundwater management plan within two years of the date of the adoption of the resolution of intention. If the plan is not adopted within two years, the resolution of intention expires, and no plan may be adopted except pursuant to a new resolution of intention adopted in accordance with this chapter.
- After a groundwater management plan is prepared, the local agency shall hold a second hearing to determine whether to adopt the plan. Notice of the hearing shall be given pursuant to Section 6066 of the Government Code. The notice should include a summary of the plan and shall state that copies of the plan may be obtained for the cost of reproduction at the office of the local agency. At the second hearing, the local agency shall consider protests to the adoption of the plan. At any time prior to the conclusion of the hearing, any landowner within the local agency may file a written protest or withdraw a protest previously filed.

Senate Bill 1938 does not require local agencies to prepare a groundwater management plan for the basins that are managed through adjudications. These long-standing adjudications govern the water rights and management of the basins. Any groundwater management planning would need to conform to the provisions of those adjudications and would require agreement and approval of the parties in those adjudications. The basins in the upper Watershed are adjudicated "in gross". The agencies in the region, however, decided to prepare the plan because they strongly support the intent of the law that states, "It is the intent of the Legislature to encourage local agencies to work cooperatively to manage groundwater resources within their jurisdictions. The preparation of certain basin management objectives will assist local agencies in optimizing local resources while protecting groundwater and surface water resources. The preparation of basin management objectives also will facilitate an understanding of the basin or sub-basin, thereby allowing local agencies, individually and cooperatively, to meet local, regional, and State water needs through conjunctive management, while ensuring that no particular water supply is jeopardized."

A purpose of this Santa Ana IWP is to meet the intent and requirements of Senate Bill 1938.

Seven Oaks Accord, 2004

On July 21, 2004, Valley District, WMWD, the City of Redlands, East Valley Water District, Bear Valley Mutual, Lugonia Water Company, North Fork Water Company, and Redlands Water Company signed a settlement agreement known as the Seven Oaks Accord (Accord). The Accord calls for Valley District and WMWD to recognize the prior rights of the water users for a portion of the natural flow of the SAR. In exchange, the water users agree to withdraw their protests to the water right application submitted by Valley District on behalf of itself and WMWD. All the parties to the Accord have agreed to support the granting of other necessary permits to allow Valley District and WMWD to divert water from the SAR. By means of the Accord, Valley District agreed to modify its water right applications to incorporate implementation of the Accord. Additionally, the Accord calls for Valley District to develop and manage a groundwater spreading program that will maintain groundwater levels at a number of specified wells owned and operated by the other parties. This integrated management of the basin will be adopted within five years of SWRCB approval of the water right applications.

Management of water resources in the Valley District/WMWD service area takes place within a complex legal and institutional framework, as will be discussed in the next section. Development of a comprehensive, coordinated regional water management plan will involve the cooperation of many parties interested in water management in addition to the signatories of the Accord. The Accord provides the framework and a cooperative environment for major water entities in the upper Watershed to prepare a plan for the integrated management of the region's surface water and groundwater resources. This Santa Ana IWP enhances and refines the current management and planning activities within the region and develops regional water management strategies and the framework for their implementation.

Beaumont Basin Judgment, 2004

In February 2003, the San Timoteo Watershed Management Authority (STWMA) filed suit in Riverside County Superior Court to adjudicate pumping and storage rights in the Beaumont Basin. The STWMA and the major pumpers developed a Stipulated Agreement to resolve the lawsuit. In February 2004, the Stipulated Agreement was approved by the Court.

This Stipulated Agreement established pumping rights among the two major classes of pumpers, overlying and appropriative. The overlying pumpers were assigned fixed rights with some flexibility to vary their maximum use during any five-year period. The safe yield established in the Stipulated Agreement is 8,650 AFY. The total of the overlying producers' rights is equal to the safe yield.

Collectively, the overlying pumpers produce substantially less than their aggregate rights. Appropriators' rights are stated as a percentage or fraction of water in the safe yield that is not used by the overlying pumpers.

The Stipulated Agreement provides for the orderly transition of land use and associated water uses through detailed provisions that require the assignment of rights from an overlying pumper to an appropriator when the appropriator provides service to the lands of the overlying pumper.

The Stipulated Agreement declares that there is a temporary surplus of water in the basin of 160,000 AF. The temporary surplus can be used by the appropriators during the first ten years of

the Stipulated Agreement. The appropriators will store the unused portion of the temporary surplus for use in subsequent years. The intent of removing the temporary surplus is to create additional evacuated storage space in the basin for use in storing supplemental water. The Stipulated Agreement gives control of the evacuated storage space in the basin, and the overall management of storage to the Watermaster.

Settlement Agreement with San Bernardino Valley Water Conservation District, 2005

Within the settlement agreement dated August 9, 2005, Valley District, WMWD, and SBVWCD have agreed to work cooperatively to develop an annual groundwater management plan.

Memorandum of Understanding with the City of Riverside, 2005

In September 2005, Valley District, WMWD, and the City of Riverside entered into a Memorandum of Understanding (MOU). The MOU stated that the intent of Valley District/WMWD is to work cooperatively with the City of Riverside to devise institutional and physical arrangements through which the City could directly benefit from "new conservation" undertaken as part of the Western Judgment and the pending Valley District/WMWD water right applications. The MOU states, "The Parties (Valley District, WMWD, and the City of Riverside) shall engage in good-faith negotiations with the goal of reaching a long-term agreement relating to the purchase, storage, and sale to Riverside by WMWD of imported water stored in the SBBA, and relating to storage, transport and delivery of conservation water from the Seven Oaks Dam..."

Chino Basin Peace II Agreement, 2008

Following the Chino Basin Peace Agreement, numerous studies have been completed, reviewed, and amended pursuant to comments by the Court's consultants. Based on these studies and negotiations, the Watermaster has proposed documents to further implement the OBMP through a suite of measures commonly referred to as the "Peace II Agreement". The Peace II Agreement involves a basin management strategy to secure hydraulic control through a coordinated groundwater extraction plan and desalting.

Soboba Water Rights Settlement Act, 2008

Decades of litigation between the Soboba Band of Luiseño Indians and MWD, EMWD, and Lake Hemet Water District ended with the signing of the Soboba Water Rights Settlement Act.

Under this settlement, MWD will deliver 7,500 AF of water a year for the next 30 years to EMWD and Lake Hemet Water District. This will enable the water agencies to recharge the San Jacinto Groundwater Basin to help fulfill the Soboba Band's water rights and terminate chronic groundwater overdrafts. The plan eventually will put pumping from the basin on a safe-yield basis, where no more water is taken out of the aquifer than is restored through natural and artificial recharge.

Institutional Controls and Settlement Agreement (ICSA)

The City of San Bernardino Municipal Water Department (SBMWD) is a party to a consent decree lodged with the United States District Court (Court), Central District of California, Western Division. On August 18, 2004, the Consent Decree obligated SBMWD to operate and maintain a system of wells and treatment plants known as the Newmark Groundwater Contamination Superfund Site (Newmark Site).

The Newmark Site specifically treats groundwater contaminated with trichloroethylene (TCE) and perchloroethylene (PCE). SBMWD is required by the terms of the Consent Decree, entered on March 23, 2005, to enact institutional controls and implement an ordinance providing for the protection and management of the Interim Remedy set forth in the Record of Decisions and Explanation of Significant Differences prepared by the U.S. Environmental Protection Agency (EPA).

The City of San Bernardino Ordinance No. MC-1221, approved in March 2006, establishes the management zone boundaries within the City of San Bernardino for water spreading and water extraction activities. The Consent Decree requires the City of San Bernardino to implement an ordinance to ensure that activities occurring in the management zone do not interfere or cause pass-through of contaminants from the Newmark and Muscoy Operable Units. The Interim Remedy requires the extraction of contaminated groundwater from the Bunker Hill Groundwater Basin and within the Newmark and Muscoy Operable Units, and treatment of the groundwater to meet all State and Federal permits and requirements for drinking water. A permit by the SBMWD pursuant to the provisions outlined in the ordinance should first be obtained for any spreading (artificial recharge) or extracting (well pumping) within the Management Zones, as defined in the ordinance.

An ICSA has been executed to develop and adopt a successor agreement, titled Institutional Controls Groundwater Management Program (ICGMP), between the following parties:

- City of San Bernardino Municipal Water Department
- West Valley Water District
- Valley District
- East Valley Water District
- WMWD
- City of Colton
- City of Riverside
- Riverside Highland Water Company

The parties listed above will not be subject to the provisions of City of San Bernardino Ordinance No. MC-1221 as long as each is a party to the ICSA and, subsequently, the ICGMP Agreement.

Agreement Relating to the Diversion of Water from the SAR System among WMWD, Valley District, and City of Riverside

In July 2004, a Settlement Agreement Relating to the Diversion of Water from the SAR System (the Seven Oaks Accord) was signed. The agreement requires Valley District and WMWD to develop a groundwater spreading program in cooperation with other parties, "That is intended to maintain groundwater levels at the specified wells at relatively constant levels, in spite of the inevitable fluctuations due to hydrologic variation." Other requirements are as follows:

- The groundwater management plan shall identify target water-level ranges in the specified "index wells" subject to the requirement that such spreading will not worsen high groundwater levels in the Pressure Zone.
- Thresholds of significance in terms of SAR water diverted by Valley District and WMWD, and spreading by all parties should be observed.
- The determination as to whether a certain groundwater management action will "worsen" high groundwater levels in the Pressure Zone are made through the use of the integrated surface and groundwater models.
- An "integrated management program" must be "adopted" within five years of the date the SWRCB grants a permit to Valley District/WMWD to divert water from the SAR. Valley District and WMWD have presented their data to the SWRCB and were told that any permit "terms" would be available in late 2007.
- Water users agree to limit spreading to conform to an annual management plan.

Cooperative Agreement to Protect Water Quality and Encourage the Conjunctive Uses of Imported Water in the SAR Basin

Water agencies within the SAR Watershed recognize the importance of protecting the quality of its groundwater resources. In July 2007, many of these agencies (Parties) entered into an agreement with the Regional Water Quality Control Board, Santa Ana Region (Regional Board) for purposes of monitoring and improving water quality within the SAR Region. The agreement is limited in scope and specifically addresses Salinity Objectives.

Generally, the agreement requires that the Parties analyze the effects on water quality of recharging imported water into groundwater basins. This analysis will be compiled into a report and submitted to the Regional Board every three years (Triennial Water Quality Report). In addition, any new project that will include the recharge of imported water must analyze its effects prior to implementation.

Chapter 5.0 Current Resources & Management Strategies

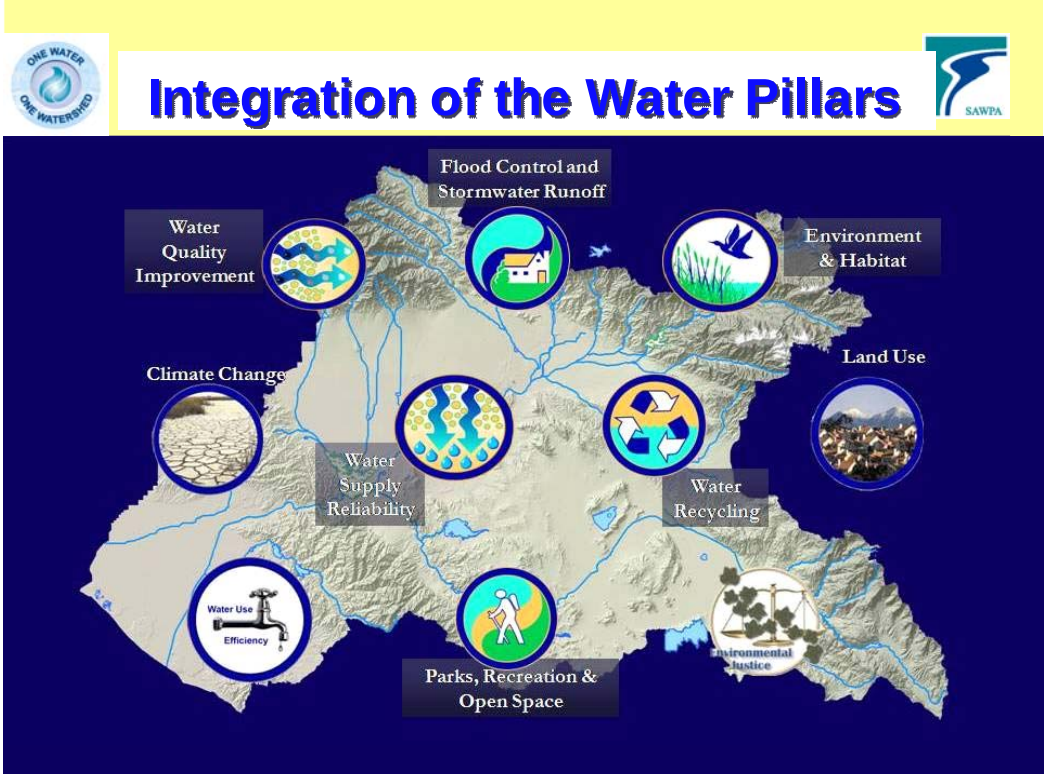
Introduction

In the early stages of the planning process, various resource management strategies were evaluated. In 2000, as reflected in SAWPA's early integrated water resource plans, six resource management strategies were developed that covered a broad spectrum of water resource planning. At the time, the integration of these six strategies 1) Groundwater Cleanup and Purification, 2) Water Storage, 3) Flood Protection, 4) Wetlands, Habitat, and the Environment, 5) Water Recycling and 6) Recreation and Conservation was considered innovative in proposing a new way to support the needs of water resources in a region. Past water resource management practices focused primarily on water supply functions without considering the more expansive and integrated benefits of integrating other resource management strategies.

The groundwork for implementation of this approach was set into place with the passage of Chapter 6 Watershed Protection Program, Article 5 Southern California Integrated Watershed Program under Proposition 13 Safe Drinking Water, Clean Water, Watershed Protection and Flood Protection Act in the Year 2000, in which $235 million dollars was directed to support implementation of integrated multi-benefit projects in the Santa Ana Region. Using this template, the State Department of Water Resources adopted SAWPA's integrated regional approach with the development of new guidelines for statewide implementation of this concept under the Integrated Regional Water Management Program for Proposition 50, Chapter 8 in the Year 2002. Under this program, integrated regional strategies were encouraged for the management of water resources and to provide funding, through competitive grants, for projects that protect communities from drought, protect and improve water quality, and improve local water security by reducing dependence on imported water. The program was jointly administered by the Department of Water Resources and the State Water Resources Control Board and was intended to promote an integrated and regional approach to water management.

To further emphasize the importance of integrated regional water management planning, the State incorporated the integrated resource management approach into its California Water Plan Update 2005 and again in its 2009 Update. This latest plan emphasizes the value of an integrated regional water management approach using multiple resource management strategies as the first of 13 objectives for the implementation of the California Water Plan.

In 2006, in light of new threats to water resources in the Santa Ana region and to the State overall, as previously described as the four horsemen of the apocalypse, SAWPA reviewed its past resource management strategies, the resource management strategies defined in the California Water Plan, previous DWR guidelines for IRWMP development, and local water resource needs. A total of ten broad- based resource management strategies were defined and are depicted in the graphic below.



To assure that these resource management strategies for the OWOW plan are comprehensive and fully reflect the resource management strategies as defined in the California Water Plan Update 2009, the OWOW Plan resource management strategies or pillars are aligned with the Resource Management Strategies identified in the Proposition 84 Guidelines, as summarized below:

Pillar Group	Corresponding Proposition 84 Guidelines Resource Management Strategies
Land Use and Water	Increase water supply Improve water quality
Water Supply Reliability	Reduce water demand Improve operational efficiency and transfers
Water Recycling	Increase water supply Increase water quality
Water Use Efficiency	Reduce water demand
Water Quality	Improve water quality
Environmental and Habitat Restoration	Practice resource stewardship
Stormwater Risk Assessment	Improve flood management
Environmental Justice	Included in Guidelines as part of Impact and Beneficial Standard
Parks and Open Space	Not explicitly mentioned in Guidelines
Climate Change	Included in Guidelines as separate standard

In order to manage the initial planning work, the stakeholders were organized into ten workgroups, or Pillars, centered on a specific water resource management issue. Discussion of the formation of the Pillars and their work approach is previously described in Chapter 1 - OWOW Governance.

Technical Analysis

Table 5.0-1 summarizes the studies, models, and other technical methodologies used in the development of the OWOW Plan. This Table can be found in the Appendices.

Pillar Chapter Development

Each of the following ten chapters of this report have been written and prepared by the respective OWOW water management strategy committees (Pillars), and represent the culmination of work by the Pillar chair and the Pillar members (local stakeholders). Unlike a single agency or consultant-prepared report, SAWPA did not significantly modify the following Pillar chapters, other than minor editing, in order to ensure that the work developed through the grassroots stakeholder-driven OWOW process was genuinely conveyed intact, and best reflects the interests, issues, and potential solutions of interested stakeholders in the Watershed.

Each Pillar was led by a recognized expert in their subject area, and was selected by the SAWPA Commission. A list of Pillar leaders can be found here **(Pillar Leaders).** The list of Pillar Leaders may be found in the Appendices. Local stakeholders participated in a number of Pillar or subject area meetings held in person throughout the Watershed, or virtually using Web-based meeting technology. The number of meetings scheduled for each particular group was determined by the individual Pillar leaders. Additional stakeholders with an interest in particular subject areas were referred to Pillar leaders for inclusion into the process.

Each of the following chapters reflects the direction given to each Pillar by SAWPA to first prepare a list of current conditions, describe current management strategies, identify problems, review the goals and objectives of the Steering Committee, and describe strategies to address the problems as they relate to their respective water management strategy. As a next step, each Pillar leader was asked to list opportunities for collaboration among other Pillars, and as a group, worked to define the benefits of collaboration. The results of the collaboration and benefit assessment are described in later chapters.

Chapter 5.1 Water Supply

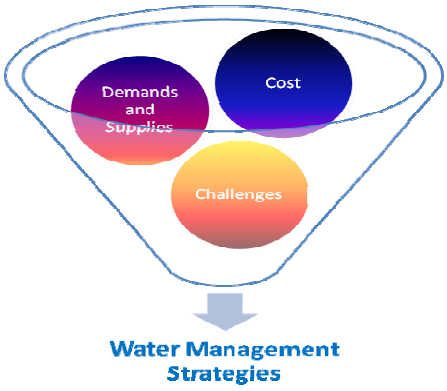
Introduction

The climate and geography of the State of California present a unique challenge to the management and delivery of water. While most of the State's precipitation falls on the northern portion of the State, most of California's population resides in the semi-arid, southern portion of the state. Water is diverted, stored, and then transferred from the water-rich north to the more arid central and southern sections of the state through the California State Water Project (SWP), the Central Valley Project, and the Los Angeles Aqueduct.

In addition to the projects that transport water from the north to the south, the southern coastal area relies on water imported through Metropolitan Water District of Southern California's (MWDSC) Colorado River Aqueduct (CRA). The U.S. Bureau of Reclamation and seven basin states manage the Colorado River (CR) system under the authority of the Secretary of the Interior and for the benefit of seven "basin states". Over-allocation of this resource, along with a U.S Supreme Court Decision (*Arizona v. California, 1964*) and population and economic growth, led to the recent California "4.4 Plan" and Quantification Settlement Agreement (QSA). The QSA limits California's share of the CR Supply to 4.4 million acre-feet (maf). As a result of these actions, MWDSC's supply from the CR was significantly reduced, especially during extended dry periods.

In the past, a buffer supply was developed by constructing new facilities such as dams and/or aqueducts to provide supply for future growth. Today, the gap between supply and demand has closed and increasing emphasis is placed on conservation and development of local supplies. Building new facilities is costly and such projects face strict environmental review before they can be approved. This has caused California to seek more creative and sustainable solutions to water resource management.

The Santa Ana River Watershed (Watershed) lies in semi-arid southern California. Like many other areas, the Watershed is carefully evaluating water supplies and demands and seeking creative, cost-effective strategies to provide a reliable water supply into the future. Water supply reliability will be challenged by state droughts, droughts on the CR, the vulnerability of the Sacramento-San Joaquin River Bay-Delta, and the threat of climate change. Designing a diverse and flexible water resource management system that can meet these challenges will help to ensure water reliability and a sustainable and vibrant economy for the Watershed.



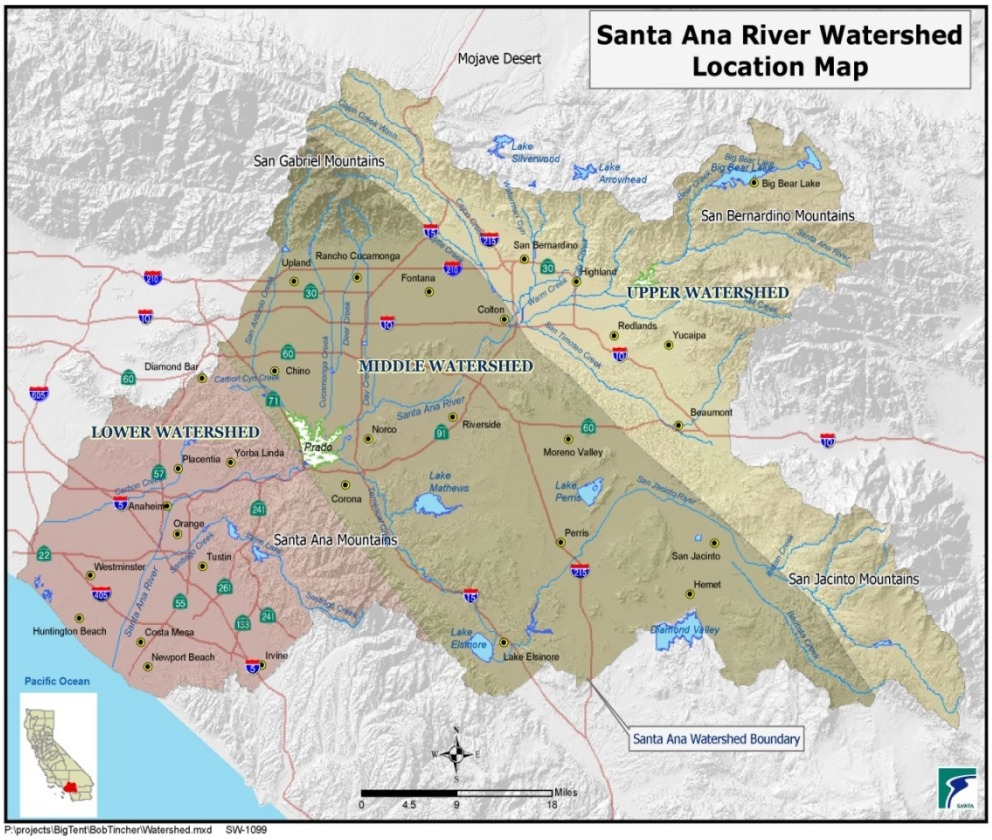
The *One Water One Watershed* (OWOW) collaborative process has facilitated the discussion of water management and sustainability throughout the Watershed. The key objective for water supply reliability is a cost-effective and diverse water supply and water storage portfolio that makes better use of existing facilities and supplies; improves overall water use efficiency; achieves a practical level of inter-connections and redundancy; and optimizes water storage for use during drought

periods. This section of the plan focuses on how to maintain a robust and reliable water supply within the watershed.

Current Conditions

There are five principal wholesale agencies that form SAWPA and manage roughly one-fifth of the water supplies within the Watershed, both local and imported. In addition to these regional water agencies, the Watershed also contains portions of four counties represented, as well as retail and wholesale water agencies. For purposes of this report, the analysis has been organized by three general areas: Upper Watershed, Middle Watershed, and Lower Watershed. These areas are subsets of ONE WATERSHED (**Figure 5.1-1**). The regional water agencies within each general area are described below.

Figure 5.1-1 Watershed Areas



Upper Watershed

San Bernardino Valley Municipal Water District (Valley District) is a State Water Contractor and provides imported water from the SWP to local retail agencies in its 325 square mile service area to supplement and enhance groundwater resources. Valley District's service area generally includes the cities and communities of San Bernardino, Colton, Loma Linda, Redlands, Rialto, Bloomington, Highland, Grand Terrace, and Yucaipa. Valley District is a member agency of the Santa Ana Watershed Project Authority (SAWPA).

San Gorgonio Pass Water Agency (SGPWA) is a State Water Contractor, and provides imported water from the SWP to local retail agencies in its 225 square mile service area to supplement and enhance groundwater resources. SGPWA's Service area includes Calimesa, Beaumont, Banning, Cherry Valley, Cabazon, and Morongo Indian Reservation. The SGPWA service area straddles the Watershed, with its western two-thirds in the watershed and eastern one-third in the Whitewater River watershed.

Middle Watershed

Eastern Municipal Water District (EMWD) is a member agency of MWDSC and provides both water and sewer service throughout its 555 square mile service area. Major communities include Moreno Valley, Hemet, San Jacinto, Perris, Sun City, Menifee, Winchester, and parts of Temecula, and Murrieta. In addition to retail customers, EMWD wholesales water through seven local water agencies. EMWD is a member agency of SAWPA.

Western Municipal Water District (WMWD) is a member agency of MWDSC and provides water service throughout its 510 square mile service area in western Riverside County. Within its boundaries lie the communities of Jurupa, Rubidoux, Riverside, Norco, Corona, Elsinore Valley, and parts of Temecula. WMWD serves imported water directly to customers who are located in the unincorporated and non-water bearing areas around Lake Mathews and portions of the City of Riverside. Ten wholesale customers are served by WMWD with both CR and SWP water. WMWD is a member agency of SAWPA.

Inland Empire Utilities Agency (IEUA) is a member agency of MWDSC and provides water and sewer services to a 242 square mile area in the western portion of San Bernardino County. Within its boundaries lie the Cities of Chino, Chino Hills, Fontana, Montclair, Ontario, Rancho Cucamonga, and Upland. IEUA is a member agency of SAWPA. IEUA also is completely within the boundaries of the Chino Basin Watermaster.

Chino Basin Watermaster (Watermaster) is a consensus-based organization facilitating the development and utilization of the Chino Groundwater Basin. The Watermaster consists of various entities pumping water from the Basin including cities, water districts, water companies, agricultural, commercial, and other private concerns. The Watermaster's mission is "to manage the Chino Groundwater Basin in the most beneficial manner and to equitably administer and enforce the provisions of the Chino Basin Watermaster Judgment", Case No. RCV 51010 (formerly Case No. SCV 164327).

Lower Watershed

Orange County Water District (OCWD) manages groundwater within its 355 square mile service area. Within its boundaries lie the Cities of Anaheim, Buena Park, Costa Mesa, Fountain Valley, Fullerton, Garden Grove, Huntington Beach, Irvine, La Palma, Los Alamitos, Newport Beach, Orange, Placentia, Santa Ana, Seal Beach, Stanton, Tustin, Villa Park, Westminster, and Yorba Linda. OCWD recharges the groundwater basin with surface water flows from the Santa Ana River (SAR) and Santiago Creek, recycled water from the OCWD Groundwater Replenishment System, and imported water which is purchased from the Municipal Water District of Orange County. OCWD is a member agency of SAWPA.

Municipal Water District of Orange County (MWDOC) is a member agency of MWDSC and sells imported water to 29 retail water agencies and cities in north and south Orange County. MWDOC also sells water to OCWD. MWDOC also straddles the Watershed, with its northernmost portion being in the Watershed and its southern portion being outside of the Watershed.

Within each of these regional agencies, there are a number of retail water agencies. For purposes of brevity, these local agencies have not been individually listed in this report. However, these agencies did provide invaluable input into the OWOW process.

Water Demand and Sources

The total water demand for the Watershed is the summation of the water demand projections from each of the regional water agencies. Most of these demand projections were obtained from the most recently published *Urban Water Management Plan(s)* (UWMP), *Water Master Plan(s)*, or similar report(s). These regional projections include the demand of the local retail water agencies within each regional agency. There are some retail agencies that overlay more than one regional agency. In these cases, the retail agency's demand would be split between the regional agencies to avoid any double-counting.

The Urban Water Management Planning Act (Act) requires that planning projections be evaluated over at least a 20 year period. Most of the agencies within the Watershed projected their demands for a 25 year period ending in 2030. This report provides the actual water demands for 2005 along with the water demand projections through 2030.

Water demands within the Watershed are met through a combination of both local and imported water supplies. Local resources include precipitation in the form of snow pack, surface flow and groundwater. Imported resources for the Watershed are primarily from the CRA and the SWP.

Figure 5.1-2 Resources Used to Meet 2005 Demand

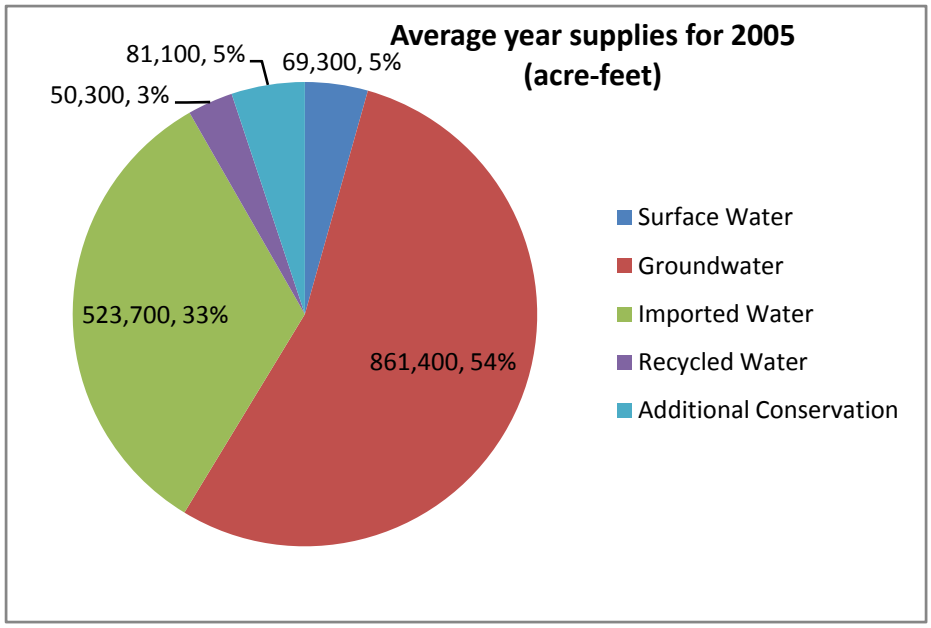
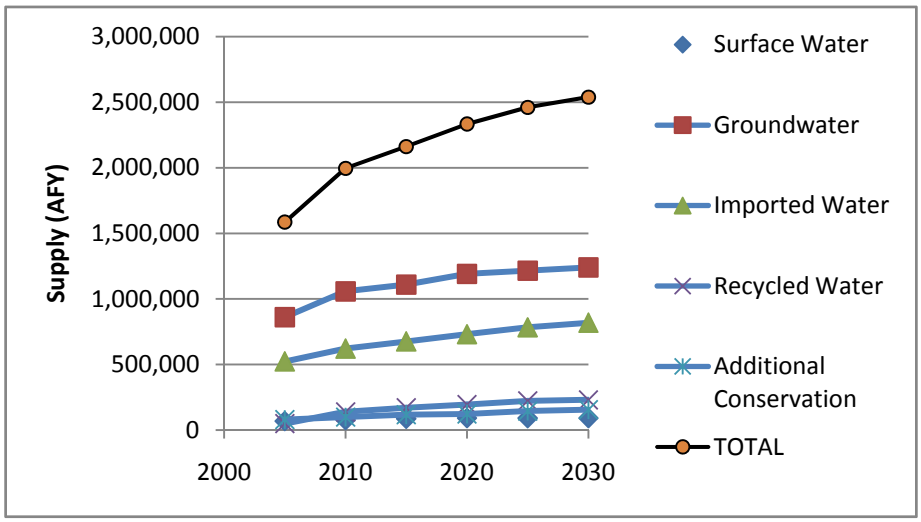


Figure 5.1-2 shows the resources used to meet 2005 demand in the Watershed. Altogether, local resources (groundwater, surface water and recycled water) met approximately two-thirds of the demand. The remaining one-third of demand was met with imported water from the SWP and the CRA.

The following chart and table presents the projected water supply mix through 2030 for the region for an average year. Overall water supply is expected to increase from 1,585,800 AFY in 2005 to 2,539,400 AFY in 2030. This represents an increase of 54% over the 25-year period, or average annual increase of 1.7%.



The rate at which the supply of different sources will increase varies from 1.1-1.2% per year for surface water, groundwater, and imported water, which can be considered "traditional" sources of water, to 2.9% for additional conservation and 7.5% for recycled water. These projections, if materialized, imply a gradual shift toward more sustainable water sources.

Supplies to Meet Ultimate Demands - Santa Ana River Watershed

Average Year Supplies (acre-feet per year)

Year	Surface Water	Groundwater	Imported Water	Recycled Water	Additional Conservation	TOTAL
2005	69,300	861,400	523,700	50,300	81,100	1,585,800
2010	77,200	986,200	708,200	211,700	99,700	2,083,000
2015	87,200	1,037,900	691,900	242,900	119,100	2,179,000
2020	92,000	1,119,500	704,800	267,400	123,900	2,307,600
2025	92,000	1,143,900	704,800	295,400	147,600	2,383,700
2030	92,000	1,172,500	704,800	303,300	164,400	2,437,000
Average annual change	1.1%	1.2%	1.2%	7.5%	2.9%	1.7%

The following table presents projected supplies under a multi-year drought scenario. Similar to the average year scenario, total supplies will increase by 1.8% per year, albeit from a slighter lower base (1,573,600 AFY vs 1,585,800 AFY). The most notable difference is a lower growth in supplies from less drought-tolerant sources, such as surface and imported water, coupled with a higher increase in groundwater use and a significant increase in conservation.

Multi-year Drought Supplies (acre-feet per year)

Year	Surface Water	Groundwater	Imported Water	Recycled Water	Additional Conservation	TOTAL
2005	53,900	866,100	513,900	56,900	82,900	1,573,700
2010	55,000	1,018,900	600,900	217,900	131,300	2,024,000
2015	59,500	1,046,000	637,600	245,300	159,100	2,147,500
2020	59,500	1,164,900	632,400	269,800	186,500	2,313,100
2025	64,500	1,195,900	626,400	298,000	216,000	2,400,800
2030	64,500	1,232,500	622,300	305,900	246,700	2,471,900
Average annual change	0.7%	1.4%	0.8%	7.0%	4.5%	1.8%

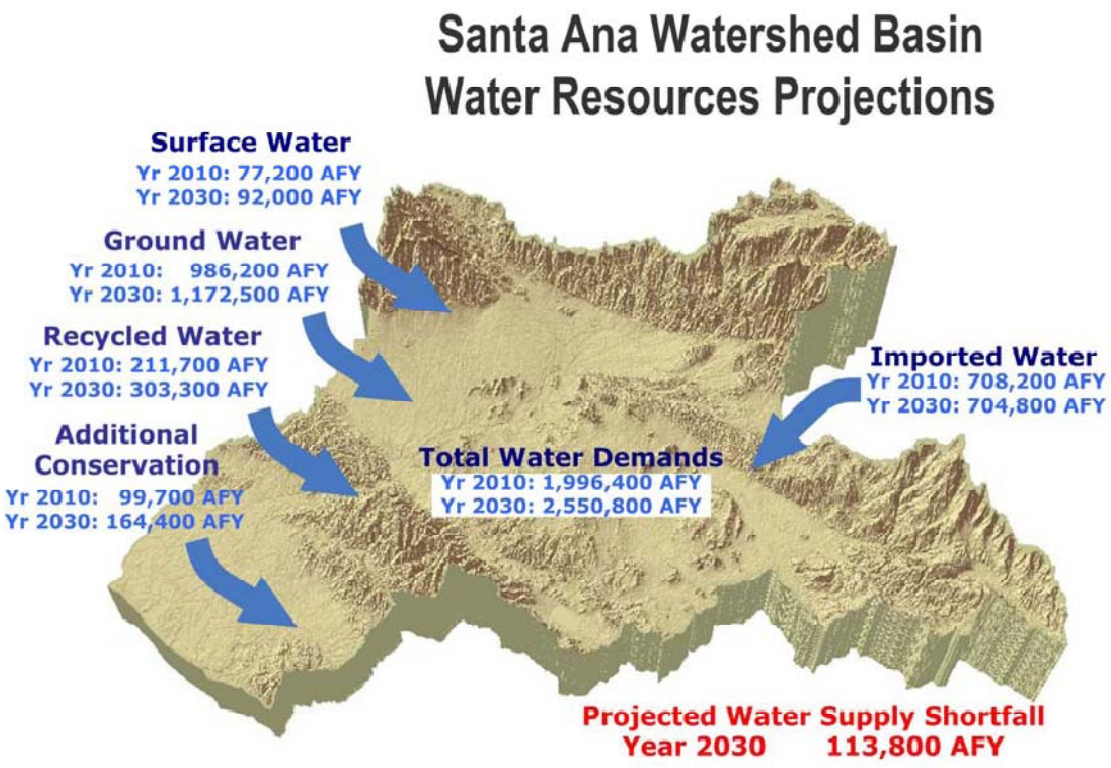
Finally, the next table shows the supply under a multi-year drought scenario. Similar to the single-year drought scenario, there would be a significant increase in recycled water and additional conservation, combined with a net decline in the supply of surface water and in total supply.

Single Year Drought Supplies(acre-feet per year)

Year	Surface Water	Groundwater	Imported Water	Recycled Water	Additional Conservation	TOTAL
2005	46,000	874,600	512,100	56,900	85,900	1,575,500
2010	37,100	1,045,700	694,600	214,000	119,700	2,111,100
2015	37,100	1,103,500	743,800	245,300	141,800	2,271,500
2020	37,100	1,222,300	732,500	269,800	159,100	2,420,800
2025	42,100	1,241,700	718,800	298,000	190,200	2,490,800
2030	42,100	1,265,600	707,000	305,900	218,600	2,539,200
Average annual change	-0.3%	1.5%	1.3%	7.0%	3.8%	1.9%

Figure 5.1-3 shows anticipated water supplies to the Watershed for 2010 and 2030. A supply shortfall of 113,800 AFY is anticipated if no action is taken to develop sustainable sources.

Figure 5.1-3 Anticipated Water Supplies to the Watershed for 2010-2030



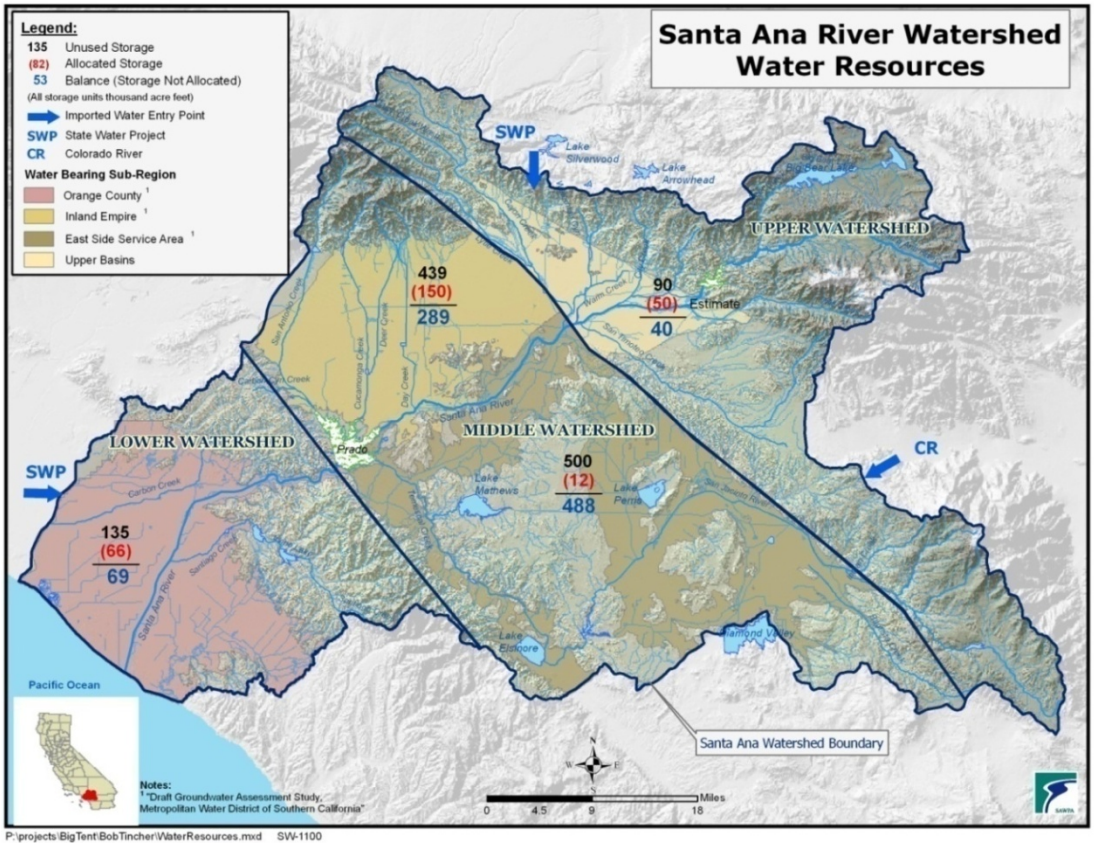
Local Water

Groundwater

The underground pore space between soil granules provides a location to store water, referred to as groundwater, which can be later extracted using wells. This underground storage space functions essentially like a series of underground reservoirs. These underground reservoirs, or basins, range from a few hundred to over one thousand feet in thickness. Basins upstream from Prado Dam underlie about 1,200 square miles of the Watershed, while basins downstream from Prado Dam underlie about 400 square miles of the Watershed. Nearly all of the basins within the watershed have a calculated "safe yield" which was calculated using past hydrology and assumes that past hydrology will repeat itself. The safe yield is the amount of water that can be annually pumped from a basin on a permanent basis without emptying the basin.

In general, the Watershed relies heavily on the groundwater basins for both storage and water supply. **Figure 5.1-4** generally shows the larger groundwater basins within the Watershed along with any available storage capacity (individual basins and sub-basins have been omitted for clarity). These basins provide storage space for local and imported water supplies that can be used during droughts or other shortages.

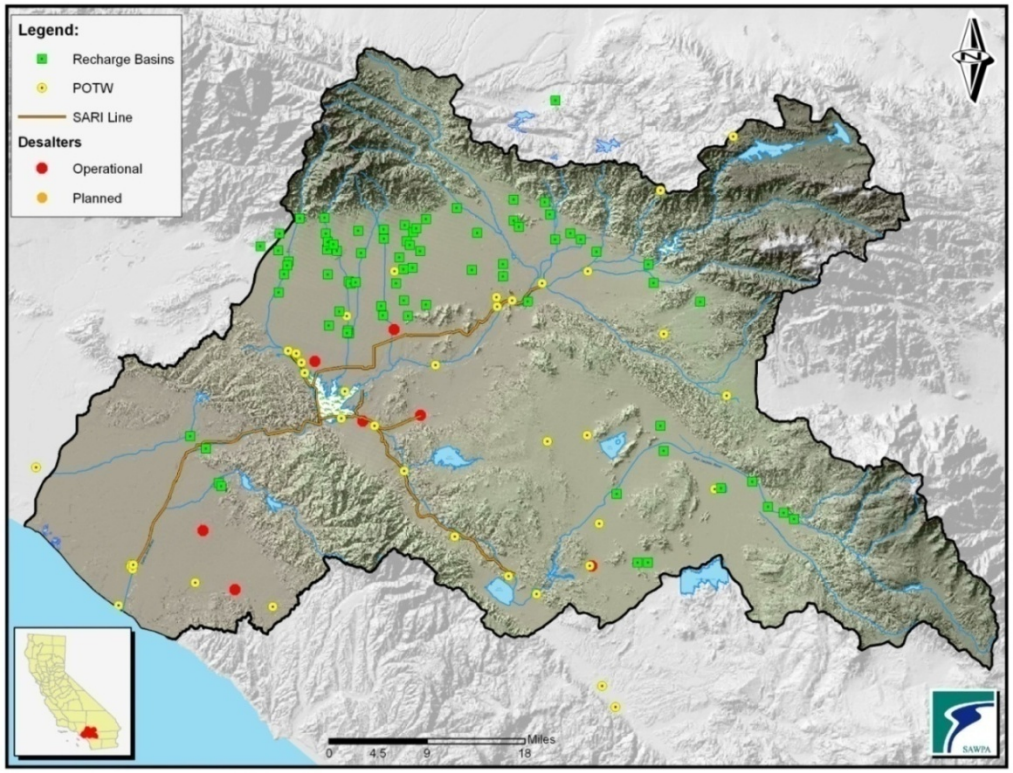
Figure 5.1-4 Groundwater Resources within the Watershed (Thousand acre-feet)



As mentioned above, the amount of water produced from these underground basins is limited to the safe yield of the basin. However, the yield of these basins can be increased by artificial replenishment.

Artificial replenishment involves storing additional water in the basin(s), over and above the natural replenishment. The most common type of artificial replenishment is "spreading" water into open "pits", or basins, and allowing it to soak into the ground down to the "water table". Another commonly used method is called "in-lieu" replenishment. This method involves replacing groundwater with another source of water. This corresponding reduction in groundwater pumping results in less water being removed from the basin which effectively acts to replenish the groundwater supply. Finally, the most costly method of artificial replenishment is to inject the water into the basin using an injection well(s). Of the various methods available for artificial recharge, spreading basins are the most economical and the most common throughout the Watershed. **Figure 5.1-5** shows the locations of spreading basins in the Upper, Middle and Lower Watershed.

Figure 5.1-5 Artificial Recharge Basins and Desalters



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One challenge to groundwater supplies in the Watershed is "contamination", by total dissolved solids (TDS or salinity) and nitrates. These salts accumulate mostly through use and evaporation, but also are introduced to the water supply by way of agricultural fertilizers and septic tanks. Further, other forms of contamination found in the Watershed are TCE, PCE (commonly used solvents) and Perchlorate (fertilizer, fireworks and explosives). All these forms of contamination must be removed using various treatment methods before it can be introduced into the water supply system.

Local Surface Water

In 2005, the amount of local surface water from rivers and streams that was diverted and used accounted for approximately 5% of the total water supply. Local surface water is largely seasonal, meaning that most of the water comes in the "wet" or rainy season, and is dramatically reduced in the "dry" season to snowmelt, natural springs, and treated wastewater flows. Facilities, such as dams and flood control detention basins divert and slow storm runoff providing some additional groundwater replenishment. However, in the Upper Watershed, only a fraction of storm runoff is being diverted and used as surface water. In other portions of the Watershed, the exact opposite is true. Much of the runoff from the Upper and Middle Watershed is captured by the U.S. Army Corps of Engineers' Prado Dam and later is used by the Lower Watershed. A similar opportunity is available in the Upper Watershed at the U.S. Army Corps of Engineers Seven Oaks Dam.

Imported Water

In 2005, the CR and the SWP met approximately one-third of the demand. Water is imported into the area by MWDSC (SWP and CR), SGPWA (SWP) and Valley District (SWP). **Figure 5.1-6** shows the regional infrastructure and the entry points for the SWP and the CR.

Figure 5.1-6 Regional Infrastructure within the Watershed

As shown on **Figure 5.1-6**, there are significant regional pipelines (48 inch diameter and larger) and surface storage reservoirs in the Watershed. These pipelines provide opportunities for water transfers, especially in an emergency situation. **Table 5.1-1** provides a list of surface water reservoirs in the Watershed and their capacities.

Table 5.1-1 Surface Water Reservoir Capacities

Reservoir	Capacity (acre-feet)
Lake Arrowhead	48,000
Big Bear Lake	73,000
Diamond Valley Reservoir	800,000
Lake Elsinore	45,000
Canyon Lake	12,000
Lake Mathews	178,500
Lake Perris	120,000
Prado Dam	Flood control and conservation
Seven Oaks Dam	Flood control (conservation pending)
Lake Silverwood	74,970
Irvine Lake	25,000

Evaluate Water Supply Reliability

The first step toward evaluating the water supply reliability for the Watershed was to establish the criteria by which it would be measured. To maintain consistency with existing State of California requirements, it was decided to evaluate the Watershed using the scenarios given in the Act. These scenarios are summarized in **Table 5.1-2**.

Table 5.1-2 Water Supply Reliability Scenarios Provided in the Act

Scenario	Description
Average conditions[1]	What are the water supply reliability vulnerabilities given average supplies to the region?
Single year drought[1]	What are the water supply reliability vulnerabilities given a single year of drought?
Multi-year drought[1]	What are the water supply reliability vulnerabilities given a multi-year drought?
50% reduction in imported water supplies[1]	What are the water supply reliability vulnerabilities if the Watershed loses 50% of imported water supplies?
Catastrophic Interruption[1]	What are the water supply reliability vulnerabilities if a catastrophic interruption occurs due to an earthquake or other disaster?

In addition to the above scenarios, **Table 5.1-3** provides a list of additional scenarios developed as part of the OWOW process. Collectively, **Tables 5.1-2** and **5.1-3** provide a complete list of the evaluated scenarios.

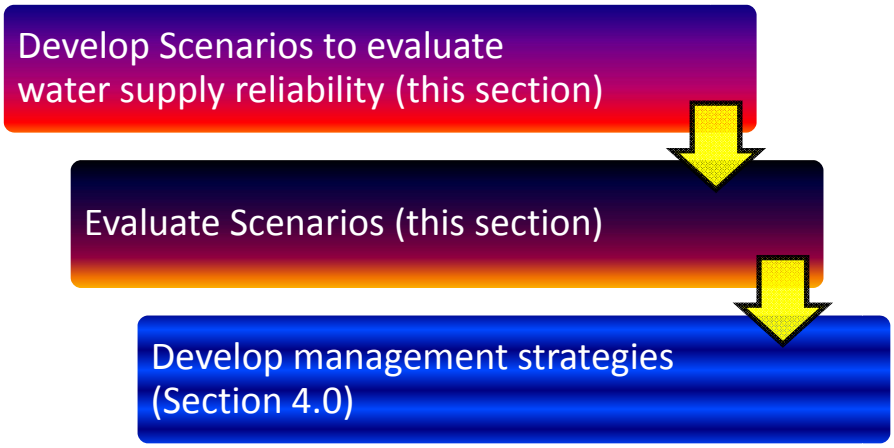
Table 5.1-3 Additional Water Supply Reliability Scenarios Evaluated as part of the OWOW Process

Scenario	Description
Flow restrictions in the Sacramento-San Joaquin Delta	How is water supply reliability affected by the current flow restrictions in the Delta as presented in the Draft 2007 SWP Reliability Report?
Climate Change	What are the water supply reliability vulnerabilities given the assumed effects of climate change as presented in the Draft 2007 State Water Project Reliability Report?
Zebra and/or Quagga Mussels	What are the water supply reliability vulnerabilities of the Zebra Mussel and/or the Quagga Mussel were to infiltrate the SWP?
Sediment Transport	How does sediment transport at Seven Oaks Dam and/or Prado Dam affect water supply reliability?
Wildfire	How does the threat of wildfire affect water supply reliability?
Channel Armoring	How does channel armoring in the SAR affect water supply reliability?
Water quality degradation	How does water quality degradation affect water supply reliability?
Terrorism	How does terrorism affect water supply reliability?

[1] Scenario presented in the Urban Water Management Planning Act.

All of the scenarios pose a threat to water supply reliability. The evaluation consisted of analyzing anticipated water supplies for each of these scenarios to determine if they are adequate to meet the anticipated demands. If anticipated demands are less than anticipated supplies, the system is deemed reliable. If anticipated demands are greater than anticipated supplies, water management strategies will need to be developed to offset these deficits. **Figure 5.1-7** provides an overview of the evaluation process.

Figure 5.1-7. Overview of the Water Supply Reliability Evaluation Process



The scenarios analyzed in this document represent a "snapshot" in time. As new challenges and constraints to water supply reliability are identified, they will require evaluation.

Evaluate Water Supply Reliability Scenarios

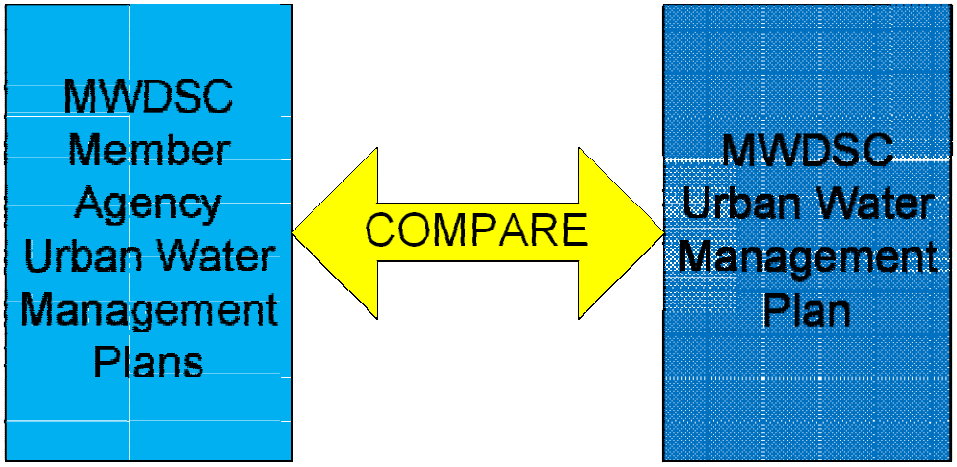
Nearly all of the water agencies within the Watershed are required to evaluate their water supply reliability every five years and publish the results in an UWMP. Because the OWOW process is evaluating many of the same scenarios that are evaluated in these UWMPs, the evaluation of these scenarios for the watershed consisted of compiling and analyzing the existing UWMP data. Certain assumptions also were used in the evaluation and are included in **Table 5.1-4**. The supplies that were included in the various UWMPs included groundwater, surface water, recycled water and imported water.

Table 5.1-4 Assumptions Used for Evaluation of Water Supply Reliability

Item	Assumptions
Groundwater	Limited to the "safe yield" of each basin.
Imported Water	The following documents were used to estimate the anticipated deliveries of imported water given average, single year drought and multi-year drought hydrological conditions: State Water Project Delivery Reliability Report, 2005 The Metropolitan Water District of Southern California Urban Water Management, November, 2005 supplemented with data from MWDSC.

The three hydrologic scenarios evaluated as part of the OWOW process are the same scenarios evaluated in UWMPs throughout the Watershed. As each agency that prepared an UWMP is responsible for determining that supplies are adequate to meet demands, the analysis for this report simply could be a summation of the individual UWMP results. However, a different methodology was used to analyze and provide some verification of the planning numbers in the UWMPs. First, realizing that the UWMP values for surface water and groundwater are based upon long-term averages, the analysis could be simplified by assuming these values are "fixed". The same assumption also can be applied to recycled water. Given these simplifying assumptions, the only water source that could be analyzed was imported water.

Figure 5.1-8 Evaluation of the MWDSC Imported Water Supplies Involved a Comparison of the Member Agencies' UWMPs to the MWDSC UWMP



There are three agencies that import water into the Watershed: 1) Valley District, 2) SGPWA, and 3) MWDSC. Of the three, MWDSC provides nearly 90% of the imported water into the Watershed. However, the MWDSC UWMP does not break the imported water demand down by member agency. Therefore, the MWDSC UWMP and the member agency UWMPs could not be easily compared. MWDSC estimated that about 24% of their total imported water deliveries serve the OWOW area. Using this figure, the total amount of MWDSC imported supplies could be estimated for the OWOW area and then compared to the amount of imported water shown in their member agencies UWMPs.

Average Year (Benchmark)

Averages can be somewhat useful in simplifying the evaluation of data sets, such as water supplies, which have significant fluctuations. Evaluating average water supplies can also be used as a benchmark for comparison purposes. This scenario evaluates the water supply reliability for the watershed by comparing average water supplies to projected demands.

To evaluate this scenario, water supply data for the "average year" scenario was compiled from the various UWMPs. This data essentially provides the planned water sources given "average" hydrologic conditions. **Figure 5.1-9** summarizes the data and shows that local water sources meet

almost 68% of the demand with about 32% coming from imported water. Although "additional conservation" is not really a supply, it has been presented as a supply to highlight the fact that the water agencies will require additional conservation, over and above that which already is occurring to meet the demands into the future. **Figure 5.1-10** shows that projected imported water supplies will be greater than demands through 2015, but likely will be inadequate to meet projected demand beginning in 2025. After the year 2025, demands will continue to exceed supplies until the deficit reaches about 90,000 AF in 2030. About 17,500 AF of the deficit is expected to occur in the SGPWA[2]. The remainder of the deficit will occur in the Middle and Lower Watershed.

Figure 5.1-9 Comparison of Total Demand (by source) versus the Projected Supply

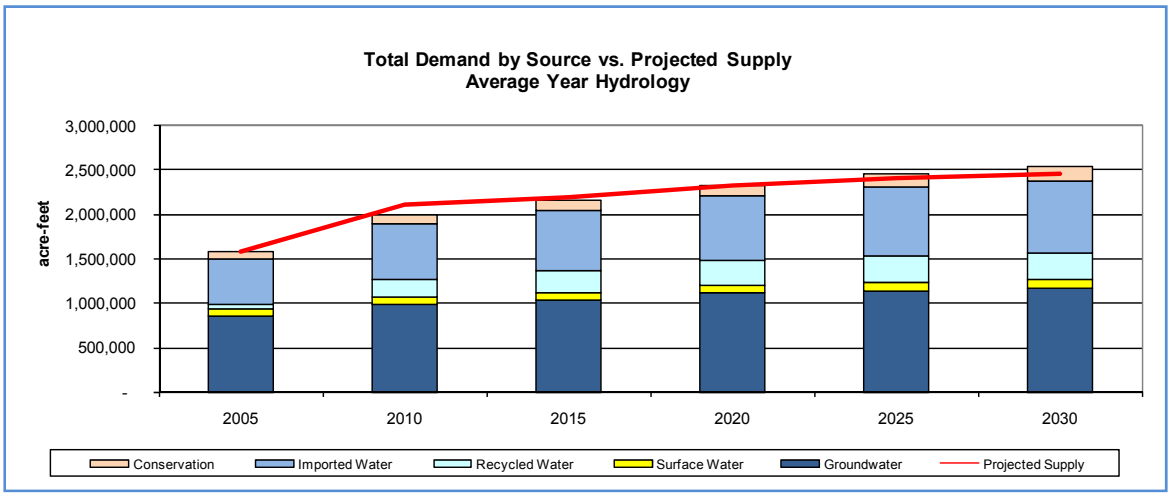
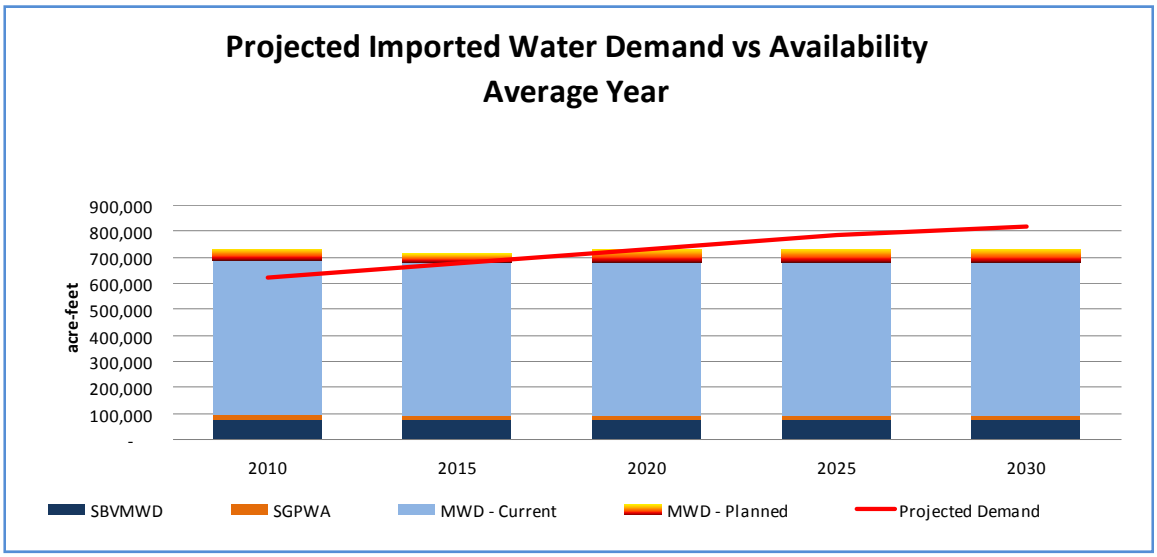


Figure 5.1-10 Imported Water Demand versus Availability for Average Hydrologic Conditions



[2] Upper SAR Watershed Integrated Regional Water Management Plan, Table 3-12, November 2007, pg. 3-20.

Given average hydrologic conditions, the Watershed will not be able to meet its needs beginning in 2020. By 2030, the deficit is expected to reach about 90,000 AF annually. Approximately 17,500 AF of the deficit is expected to occur in the SGPWA, with the remainder occurring in the Middle and Lower Watershed. Water management strategies to overcome this deficit are provided in the *Management Strategies to Improve Water Supply Reliability* section.

Single-Year Drought

To evaluate this scenario, water supply data for the "single year drought" scenario was compiled from the various UWMPs. This data essentially provides the planned water sources given a single year of drought. **Figure 5.1-11** summarizes the UWMP data and shows that local water sources meet about 75% of the demand with about 25% coming from imported water. The figure also shows a surplus during a single year drought. This overall surplus is partly due to the method of analysis used to estimate the amount of imported water supplies and demands, but also is due to MWDSC storage programs. These programs store water in wet years for later delivery in drought years. Although there may be an overall surplus, the SGPWA projects a shortage of 27,000 AF in a single year of drought.

Figure 5.1-11 Anticipated Demand (by source) versus Projected Supply for a Single Year of Drought

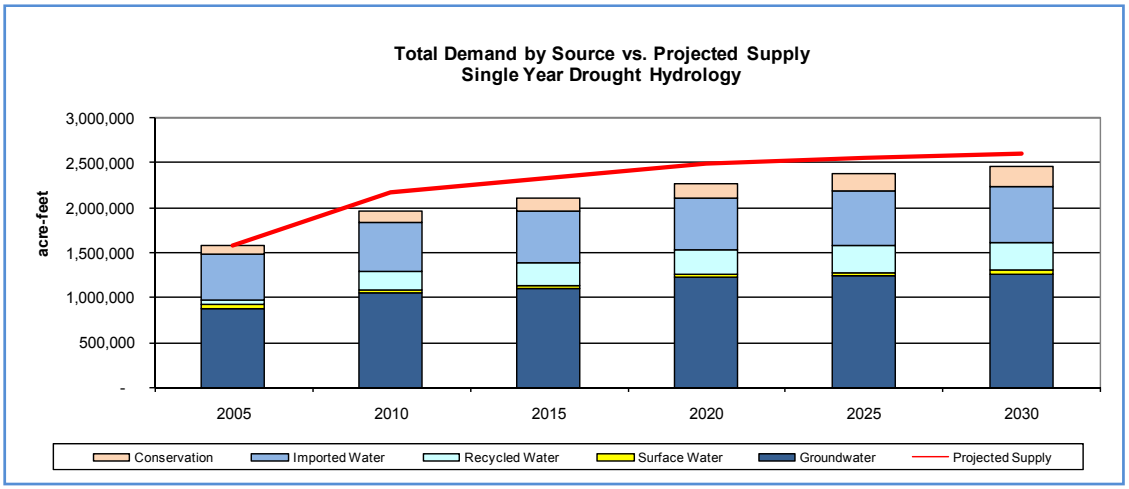
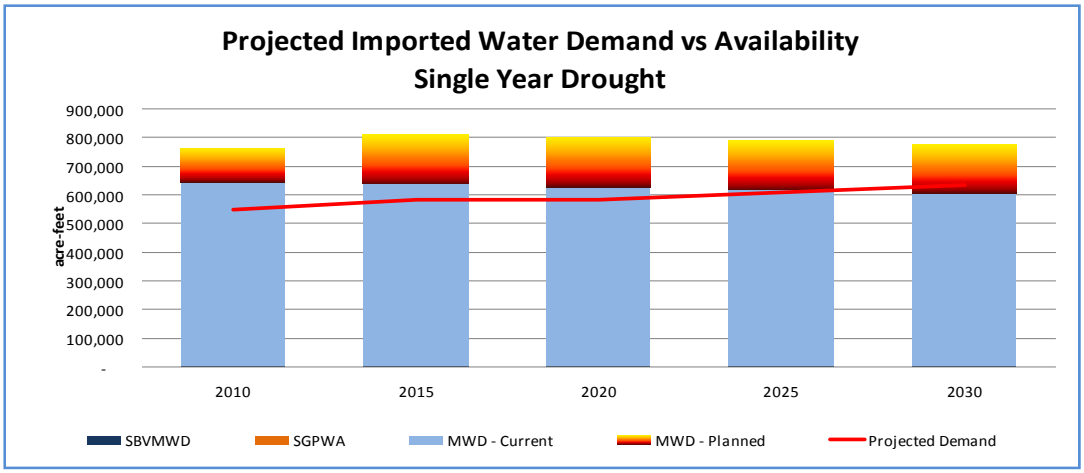


Figure 5.1-12 summarizes the projected demand versus supply of imported water given a single year of drought. In a single year drought, DWR estimates that the SWP will only be able to deliver about 5% of its capacity. This effectively means that the SWP is almost completely shut off during a single year drought. However, despite the extremely low estimated delivery from the SWP in a single drought year, the Watershed is still estimated to have enough imported water due to MWDSC storage programs (although the chart shows a surplus, that "surplus" water would likely be used in another part of the MWDSC service area). As stated above, although there may be an overall surplus in the Watershed, the SGPWA is projecting a shortage of 27,000 AF in a single year of drought.

Given a single year of drought, the Watershed will have an overall surplus of water due mostly to MWDSC storage programs. However, although he overall Watershed is projected to have a surplus,

SGPWA is projecting a 27,000 AF deficit during a single year of drought. Water management strategies to overcome this deficit are provided in the *Management Strategies to Improve Water Supply Reliability* section.

Figure 5.1-12 Projected Imported Water Demand versus Availability in a Single Year of Drought



Multi-Year Drought

This scenario evaluates the water supply reliability for the Watershed assuming a multi-year drought. The MWDSC UWMP analyzes a three year drought (1990-92). DWR analyzes a four year drought in their Reliability Report (1931-34).

To evaluate this scenario, water supply data for the "multi-year drought" scenario was compiled from the various UWMPs. This data essentially provides the water sources they plan to use given a multi-year drought. **Figure 5.1-13** summarizes the UWMP data and shows that they plan to have local water sources meet about 73% of the demand with 27% coming from imported water.

Figure 5.1-13 Projected Demands (by anticipated source) versus Projected Supply during a Multi-Year Drought

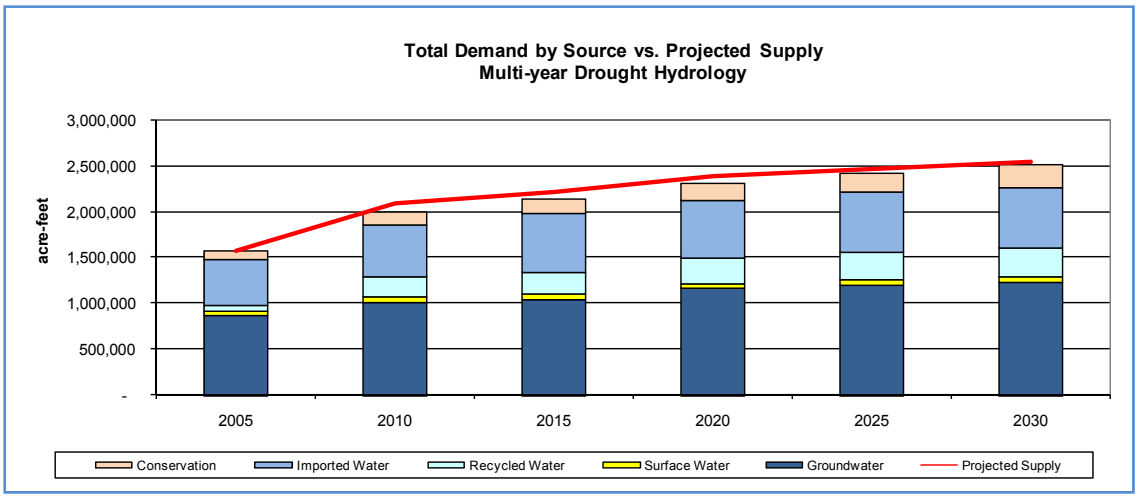
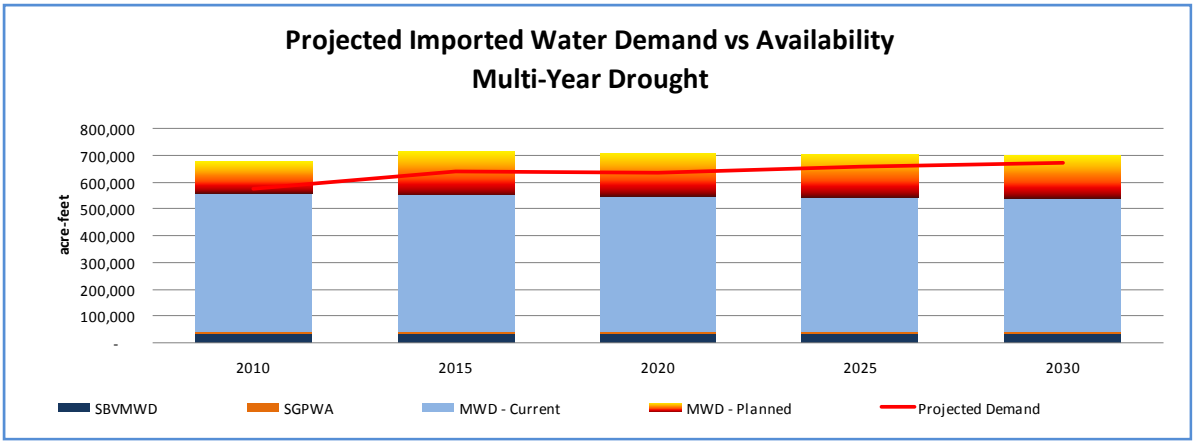


Figure 5.1-14 summarizes the projected need versus supply of imported water given a multi-year drought. In a multi-year drought, DWR estimates that they will only be able to deliver about 38% of the total capability on the SWP. However, despite the low estimated delivery from the SWP in a multi-year drought, the Watershed is still estimated to have a surplus in imported water due to MWDSC storage programs. Although there may be an overall surplus in the Watershed, SGPWA is projecting a shortage of 24,000 AF in a multi-year drought.[3]

The Watershed will be able to meet its needs during a multi-year drought due mostly to the storage programs implemented by MWDSC. However, despite this overall surplus, SGPWA is expecting a deficit of about 24,000 AF during a multi-year drought. Water management strategies to overcome this deficit are provided in the *Management Strategies to Improve Water Supply Reliability* section.

Figure 5.1-14 Projected Imported Water Need versus Availability for a Multi-Year Drought



Evaluate a Short-term 50% Reduction in Imported Water Supplies

One of the scenarios water agencies must evaluate as part of their UWMP is a 50% reduction in supplies. To maintain consistency with this requirement, it was decided to evaluate a 50% reduction in imported water supplies for the Watershed. However, both a single year drought and multi-year drought result in greater reductions in imported water supplies than 50%. Therefore, any strategies that are implemented to overcome the drought scenarios also will overcome this scenario.

As both the single-year drought and multi-year drought scenarios result in reductions of imported water greater than 50%, any management strategies implemented to overcome those scenarios also will overcome this scenario.

[3] Upper Santa Ana River Watershed Integrated Regional Water Management Plan, Table 3-12, November 2007, pg. 3-20.

Evaluate a Catastrophic Interruption in Water Supplies

The water system that serves both local and imported water to the watershed is made up of a variety of facilities including pipes, canals, and levees that are all susceptible to damage or failure from a catastrophic event. The catastrophic events that were evaluated as part of the OWOW process are earthquake, Delta levee failure, power failure, wildfire, and terrorism. While catastrophic events may not be avoided entirely, measures can be developed and set in place to minimize the interruption to water service following a catastrophic event. These measures include: assessing the vulnerability of systems, quantifying available resources, determining optimal use of resources, increasing the flexibility of distribution systems, increasing regional coordination and establishing repair priorities.

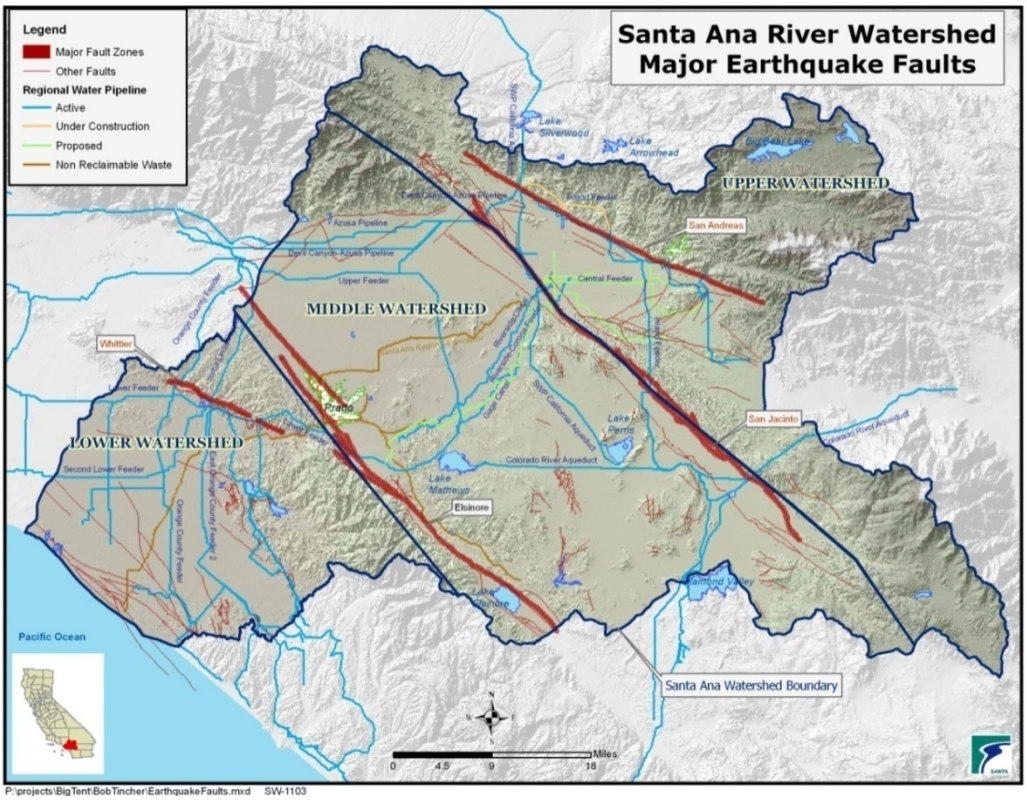
Evaluate the Effect of an Earthquake on Water Supplies

The Watershed is located within a seismically active region of southern California. As shown on **Figure 5.1-15**, six active major earthquake faults and a number of smaller faults extend through the Watershed. As shown on **Table 5.1-5**, a seismic event along one of the major active faults within the Watershed could result in an earthquake in the range of magnitude 6.0 to 8.0 on the Richter Scale.

Table 5.1-5 Estimated Maximum Richter Magnitude for Various Faults in the

Fault	Maximum Magnitude
San Andreas	8.0
San Jacinto	7.5
Elsinore	6.8
Chino	6.5
Whittier	6.8
Peralta Hills	6.6
Puente Hills	7.5
Newport/Inglewood	6.9

Figure 5.1-15 Major Earthquake Faults in the Watershed



Depending on the intensity of the earthquake and location of the epicenter, catastrophic damage and interruptions of water service could occur throughout the Watershed. Regional water conveyance systems, including the CRA; the Upper, Lower and Coastal Feeder Systems; as well as the East Branch of the California Aqueduct (a.k.a Foothill Pipeline) could sustain significant damage from a major earthquake that would interrupt the delivery of imported water supplies to the Watershed. It also would make it difficult to transport water regionally within the Watershed. Additionally, damage could occur to local water transmission systems operated by retail water agencies within the Watershed, such as the Gage Canal, Riverside Canal, and the Riverside 42-inch and 48-inch pipelines. In addition to the potential damage to transmission facilities, damage also could occur to groundwater pumping facilities, water storage facilities, and water treatment plants as a result of seismic shaking impacts and/or from liquefaction impacts in areas that have high groundwater tables.

Based upon past seismic events, it is assumed that the impacts of a seismic event will be short-term. Due to the uncertainty tied to seismic events (magnitude, epicenter, etc.), it is not possible to determine the exact impact of a seismic event on water supply. However, the Watershed can implement strategies that will better prepare the Watershed for such an event. These strategies are provided in the *Management Strategies to Improve Water Supply Reliability* section.

Evaluate a Delta Levee Failure on Water Supplies

The California Delta is a region where two of California's largest rivers, the Sacramento River and the San Joaquin River meet. The Sacramento-San Joaquin Delta is the hub of the State's water supply system. About two-thirds of all California residents and millions of acres of irrigated farmland rely on the Delta for water from the SWP and the Federal Central Valley Project. The structural integrity of the delta levee system is vital to maintain water supplies to southern

California. However, the Delta levee system is aging and a considerable amount of the land along the Delta levee system has subsided below sea level. The earthen levees are subject to risk from earthquakes, flooding and salt water intrusion. Catastrophic damage sustained by the levees would result in interruptions to SWP supplies to the Watershed due mostly to saltwater intrusion.

A Delta levee failure would reduce deliveries on the SWP for 15 to 27 months[4] depending on the severity of the failure. Assuming the duration of this catastrophic event is limited to 15 months, it is very similar to the effects of a single year drought in which SWP supplies are assumed to be reduced to 5%. Thus, the strategies that are implemented to offset the effects of a single year drought would be helpful for a Delta Levee failure. These strategies are provided in the *Management Strategies to Improve Water Supply Reliability* section. Assuming a 27 month repair period, the effects of this catastrophic interruption would be very similar to a multi-year drought. Thus, the strategies that are implemented to offset the effects of a multi-year drought also would be helpful to offset this event. Should the levee failure(s) occur after a drought period when stored water supplies are severely depleted, other emergency strategies would need to be implemented, such as extreme conservation.

Evaluate a Power Failure on Water Supplies

Power failure can occur as isolated incidents or as part of larger event such as a regional power grid failure caused by a catastrophic event. During a large-scale power failure, water conveyance systems, water treatments plants, and ground water pumping wells could cease to operate.

Most power officials believe that under a scenario when only a portion of the regional power grid fails, the loss of power should not extend beyond 24 hours. However, under a scenario where all three grids of the North American Grid fail, the loss of power could extend for days. Depending on how much of the grid is lost and the length of time it takes to repair, the loss of power could have a profound impact on water delivery.

Power failure likely would have a short-term impact on water supply reliability. Due to the uncertainty of this scenario, it is not possible to determine the exact impact. However, the same strategies that will help to prepare for an earthquake will help prepare for such an event. These strategies are provided in the *Management Strategies to Improve Water Supply Reliability* section.

Evaluate Wildfire on Water Supplies

Wildfire can damage water delivery facilities or the power infrastructure used by water facilities. In addition, the loss of vegetation resulting from a wildfire can change runoff patterns, increase sediment, and reduce water storage. There also are potential water quality concerns associated with ash falling into surface reservoirs, which could overwhelm filtration plants as turbidities increase by orders of magnitude.

The effects of wildfire likely will have a short-term impact on water supply. Possible effects are loss of vegetation, change in runoff patterns, increased sedimentation, reduced natural water storage, and ash falling into surface reservoirs. Due to the uncertainty of this scenario, it is not possible to

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[4] Resource Management Associates, Inc., *Delta Levees Seismic Risk Assessment Modeling 30 and 50 Breach Scenarios*, March 2005, p. 15.

determine the exact impacts. However, the same strategies that will help to prepare for an earthquake will help prepare for such an event. These strategies are provided in the *Management Strategies to Improve Water Supply Reliability* section.

Evaluate the Effects of Terrorism on Water Supplies

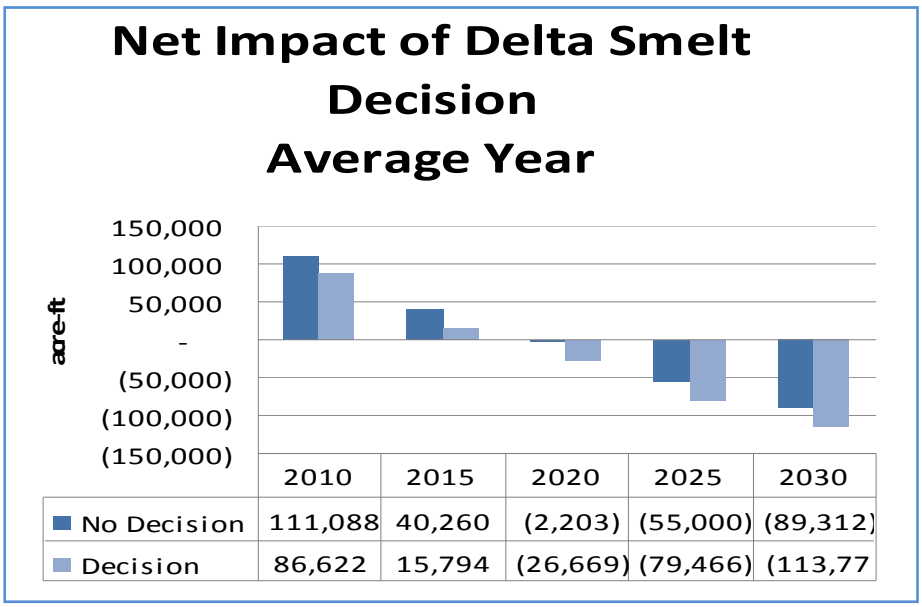
There is always a possibility that water infrastructure could be targeted by terrorists. Water agencies have responded to this potential threat by reducing public access to water infrastructure or even the information about infrastructure. They have also responded by increasing security measures at their facilities.

The effects of a terrorist attack likely will cause short-term reduction in water supply reliability. Due to the uncertainty of this scenario, it is not possible to determine the exact impacts. However, the same strategies that will help to prepare for an earthquake will help prepare for such an event. These strategies are provided in Management *Strategies to Improve Water Supply Reliability.*

Evaluate Delta Flow Restrictions on Water Supplies

In 2007, the federal court ordered "interim" operating rules to protect a small fish called the delta smelt. This scenario evaluates the impacts of this interim decision if it were to become permanent. DWR has analyzed the long-term impacts of these interim operating rules on SWP deliveries in The State Water Project Delivery Reliability Report 2007 (2007 Report)[5]. **Figures 5.1-16, 5.1-17,** and **5.1-18** show the net overall impact of this decision on the Watershed given average hydrology, a single year of drought or a multi-year drought. In these figures, a positive number indicates a "surplus" and a negative number indicates a "deficit".

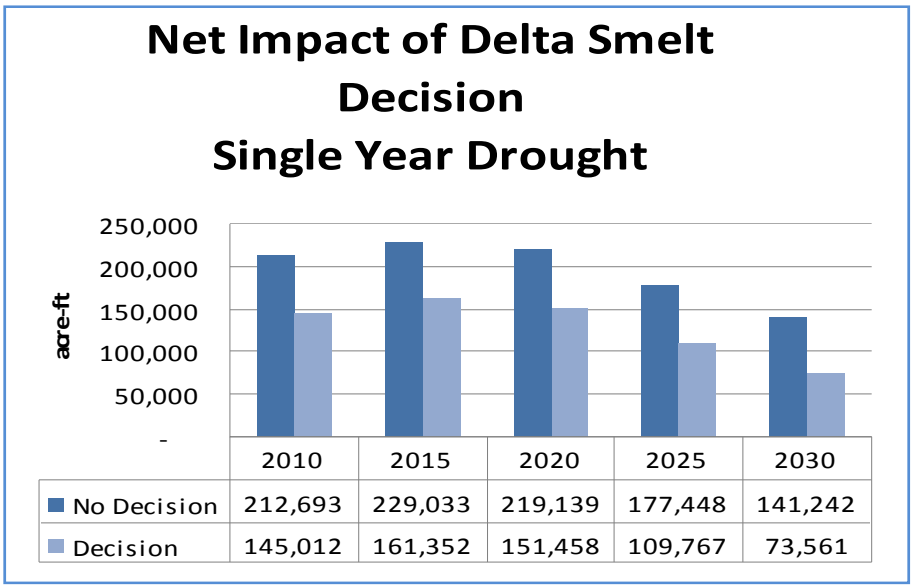
Figure 5.1-16 Net Impact of Delta Smelt Decision on the Water Budget for the Watershed given Average Hydrologic Conditions



	2010	2015	2020	2025	2030
No Decision	111,088	40,260	(2,203)	(55,000)	(89,312)
Decision	86,622	15,794	(26,669)	(79,466)	(113,77

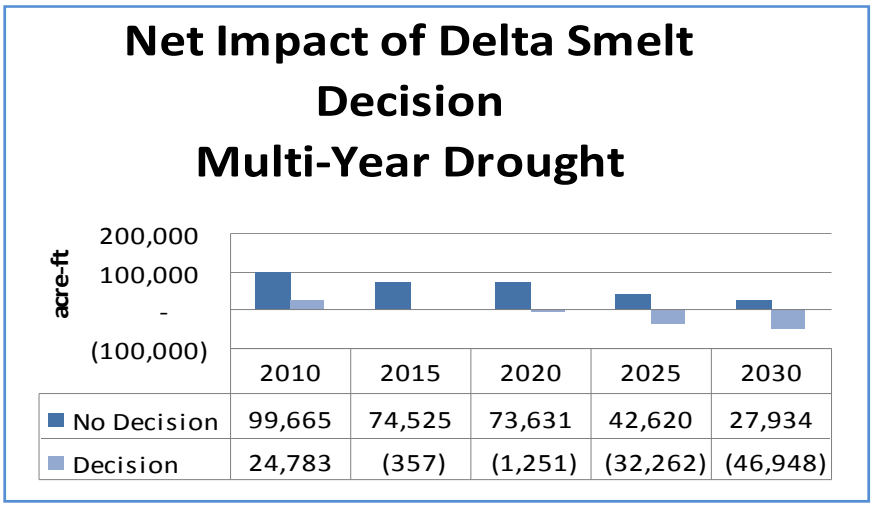
[5] The State Water Project Delivery Reliability Report 2007, pp. 42 – 49.

Figure 5.1-17 Net Impact of Delta Smelt Decision on the Water Budget for the Watershed given a Single Year of Drought



Should the Delta Smelt Decision remain permanent, it will have a negative impact on water supply reliability within the Watershed. Strategies to help overcome this deficit are included in the *Management Strategies to Improve Water Supply Reliability* section.

Figure 5.1-18 Net Impact of Delta Smelt Decision on the Water Budget for the Watershed given a Multi-Year Drought



Evaluate Climate Change on Water Supplies

Temperature data suggest that California's climate is getting warmer. This phenomenon is being referred to as "Climate Change". Climate change could have an impact on water supply reliability. Potential impacts include reduction in snow pack, changes in the timing and amount of runoff, changes in the frequency and magnitude of extreme storm events, increased watershed vegetation

demands due to higher evapotranspiration rates, changes in future agriculture and urban water demands, changes in sea level rise, and increased potential for salt water intrusion to the Sacramento-San Joaquin Delta and groundwater basins near the coast.

Presently, the extent of climate change impacts is uncertain. DWR has analyzed the long-term impacts of climate change on SWP deliveries in their 2007 The State Water Project Delivery Reliability Report (2007 Report)[6]. The results of the climate change analysis actually result in an increase in reliability when compared to the analysis without climate change[7]. Since it does not result in lower reliability like other scenarios analyzed in the OWOW process, it is not analyzed in this report.

Although current analysis is suggesting that climate change may not have a long-term impact on imported water supplies, there is still much uncertainty regarding this phenomenon. Realizing that this phenomenon could have long-term impacts on water supply reliability and that the exact effects are unknown, the Watershed may want to consider implementing a "contingency factor" as a management strategy. For example, a contingency factor of 10% would mean that future water supplies must exceed calculated demands by at least 10% to cover any unknown effects of climate change.

Evaluate the Impact of Quagga and/or Zebra Mussels on Water Supplies

Quagga Mussels and the closely related Zebra Mussels are small shellfish, usually less than half inch in size that can live and reproduce in pipes. When they do, they clog water systems and intake pipes causing hundreds of millions of dollars in maintenance and/or damage costs annually. Once they are established, they are very difficult to eradicate. The Quagga Mussel has been discovered in Lake Mead, the CRA, and a local reservoir in San Diego County. There is concern that Quagga Mussels could become more widespread and migrate into the watershed through untreated water pipelines or larvae carried by boats and watercraft vehicles.

Mussels can clog pipelines. Strategies to help prevent impacts from this invasive species will be provided in the *Management Strategies to Improve Water Supply Reliability* section.

Evaluate the Effects of Santa Ana River Channel Armoring and Sediment Transport

The SAR is a productive recharge "facility" that helps replenish the Watershed's groundwater basins. The transport and deposition of sediment along the SAR is critical to maintaining existing groundwater recharge capacity. A sandy river bottom allows surface water to percolate easily into the groundwater basin and maximizes recharge rates. If this process is interrupted, the amount of recharge can be reduced.

The transport and disposition of sand within the SAR is interrupted when it is trapped by both the Seven Oaks Dam and Prado Dam. Seven Oaks Dam traps sediment at the base of the San Bernardino Mountains while Prado Dam traps sediment just upstream of Orange County. This entrapment of the sand causes negative impacts on the recharge capacity of the riverbed.

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[6] State of California, The Resources Agency Department of Water Resources, The State Water Project Reliability Report 2007, August 2008, pg. 49.

[7] State of California, The Resources Agency Department of Water Resources, The State Water Project Reliability Report 2007, August 2008, compare Table 6.4 and Table 6.13.

In addition, as the sand washes away and no longer is being replaced by sand from upstream, the river bottom gradually transitions from a "soft" bottom to a coarser bottom that includes heavier material such as gravel and cobbles. The gravel and cobbles eventually interlock with fine sediments and form an "armored" layer. This process is referred to as "channel armoring," which can reduce the recharge rate of the river. A Groundwater Recharge Study prepared by OCWD estimates that the armoring of the SAR has resulted in a loss of percolation of about 1% per year. With a long-term degradation of recharge rates, longer stretches of the river would be needed to recharge the same amount of water that is recharged today or some other kind of mitigation would be required.

Additionally, sediment loading behind the two dams can reduce surface water storage volumes. The continued build up of sediment behind the dams will reduce the overall storage capacity of the dams, which will, in turn, reduce the amount of storm flow that can be temporarily stored and released for groundwater recharge.

Channel armoring could reduce recharge rates along the SAR. Sediment transport could reduce storage volumes behind Prado Dam and Seven Oaks Dam thereby reducing the amount of stormwater that can be captured and used.

Evaluate the Effects of Water Quality Degradation on Water Supplies

Water supply reliability in the Watershed can be improved by reinstating local water resources that have been avoided due to poor water quality. For example, some groundwater basins in the Watershed have been impacted by high concentrations of salts. In the past, rather than pump and treat this poorer quality water, many groundwater producers chose to replace it with another source(s) of water that did not require treatment. This same approach also has been used in groundwater basins that were polluted by volatile, organic compounds and other contaminants. If, instead, these local resources were to be treated and used, they effectively would become "new" sources of water within the Watershed which would act to increase water supply reliability. Water supply reliability can be increased if water resources that were avoided in the past due to poorer water quality are, instead, treated and utilized.

Table 5.1-6 Summary of Water Supply Reliability Scenarios

Short-term Impacts	Long-term Impacts
Catastrophic Interruption	Average Hydrologic Conditions
Earthquake[1]	
Power outage[1]	Single-year Drought Hydrologic Conditions
Mussels[1]	
Wildfire[1]	Multi-year Drought Hydrologic Conditions
Water quality degradation	
Terrorism[1]	Climate Change[1]
	Sediment Transport[1]

1 Actual effects uncertain.

Summary of Evaluation Results

The water supply reliability scenarios that were evaluated as part of this analysis can really be broken into two general categories, short-term impacts and long-term impacts. **Table 5.1-6** summarizes the two general categories. Those in the short-term category are difficult to quantify. Those in the long-term category are more easily quantified except for climate change, sediment transport and channel armoring which are still under investigation.

A summary of the evaluation results for the average, single year drought and multi-year drought scenarios is included in **Table 5.1-7.** The *Management Strategies to Improve Water Supply Reliability* section presents various management strategies that can be used to offset any projected shortfall(s). The shortfall will primarily occur in the Upper Watershed.

Table 5.1-7 Summary of Evaluation Results with and without the "Interim" Delta Smelt Decision

Year	Average		Single Year Drought		Multi-Year Drought	
	No Decision	Smelt Decision	No Decision	Smelt Decision	No Decision	Smelt Decision
2010	111,088	86,622	212,693	145,012	99,665	24,783
2015	40,260	15,794	229,033	161,352	74,525	(357)
2020	(2,203)	(26,669)	219,139	151,458	73,631	(1,251)
2025	(55,000)	(79,466)	177,448	109,767	42,620	(32,262)
2030	(89,312)	(113,778)	141,242	73,561	27,934	(46,948)

Management Strategies to Improve Water Supply Reliability

Reliability Goal

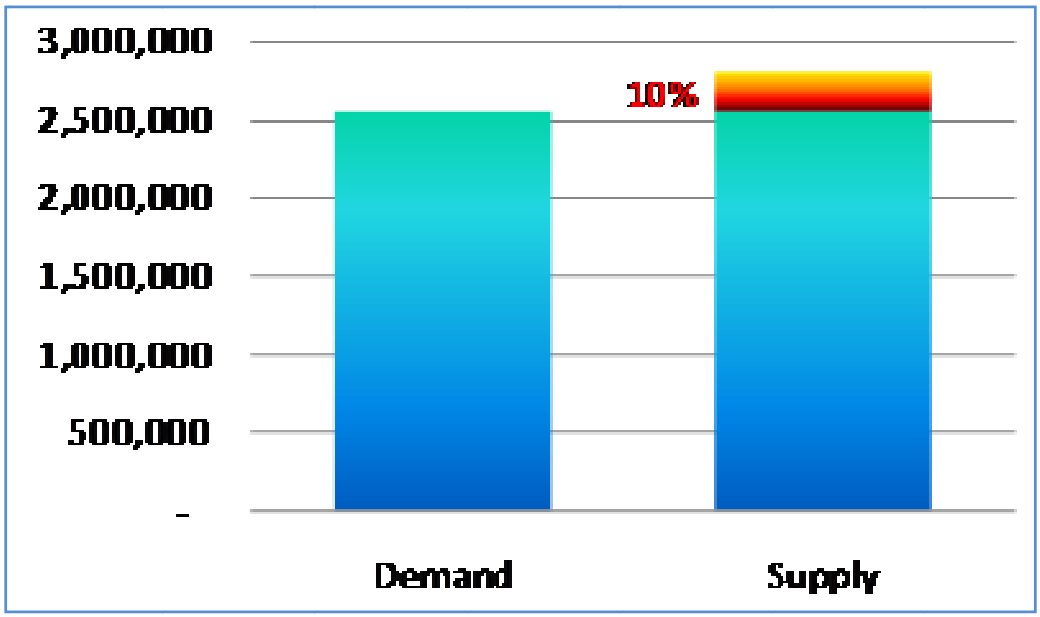
As shown in the *Evaluate Water Supply Reliability* section, the Watershed will experience an estimated deficit between supplies and demand. **Table 5.1-8** summarizes the calculated deficits for each scenario.

Table 5.1-8 Calculated Deficits based on Scenario

Scenario	Calculated Deficit
Average	114,000
Single-year drought	0
Multi-year drought	47,000
Maximum deficit	**114,000**

In addition to the above calculated deficits, there are also many uncertainties including the unknowns of future weather, the effects of climate change and any legal restrictions that could be placed on water supplies such as those restrictions placed on the State Water Project as part of the "Delta Smelt Decision". One way to prepare for these uncertainties is to develop "extra" water supply options to exceed the projected demand by a certain amount, or "contingency factor". For the OWOW process, the contingency factor was established at 10% (**Figure 5.1-19**) of the overall water budget for the watershed, or 255,000 acre-ft. The summation of the contingency amount and the maximum calculated deficit provide an overall "reliability goal" of 369,000 acre-ft above the maximum projected demand.

Figure 5.1-19 To Help Overcome Uncertainty, a 10% Contingency Factor was Established



Management Strategies

To achieve the reliability goal of 369,000 AF, the following water management strategies were developed:

Reduce Demand

- Increase water use efficiency

Optimize Imported Water

- Increase utilization of imported water
- Improve reliability of imported water

Develop new sources of supply

- Capture more stormwater
- Increase the use of recycled water
- Import treated wastewater from outside the watershed
- Desalt the Pacific Ocean

Increase storage

- Increase surface water storage
- Increase groundwater storage
- Increase water banking

Implement emergency measures

- Local emergency plans
- Mutual Aid
- System interconnections
- Extraordinary conservation

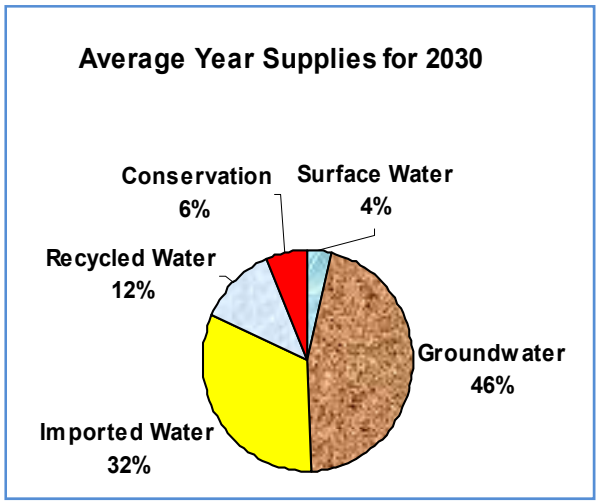
Each of the above strategies will be developed in more detail within this section.

Strategies that Reduce Demand

The term "Demand management" generally is used to describe any strategy that reduces the demand for drinking water. The two main demand management strategies used in the watershed are recycled water and water use efficiency (formerly water conservation). With regard to water conservation, there are a variety of programs that have been implemented throughout the Watershed. See the Water Use Efficiency Section for an explanation of the current programs.
With regard to water recycling, the watershed, as a whole, is fairly efficient. Flows discharged in the upper and middle watershed are almost entirely re-used downstream. See the Recycled Water Section for an explanation of the current programs.

Governor's 20% reduction by 2020:

Estimated benefit: 50,000 AF



On February 28, 2008, Governor Schwarzenegger wrote to leadership of the California State Senate, outlining key elements of a comprehensive solution to problems in the Sacramento-San Joaquin Delta. The first element on the Governor's list was "a plan to achieve a 20 percent reduction in per capita water use statewide by 2020." While many of the details are still being developed, it is generally understood that the 20 percent goal can be achieved by any combination of water conservation and water recycling. Based on the water budget information for 2030, 18% of the water budget for the Watershed will be met by conservation and water recycling. Therefore, to achieve this goal, the Watershed will have to increase conservation and recycling by at least two percent, or 50,000 AF.

Water Use Efficiency (Water Conservation)

Estimated benefit (over and above the 20 percent reduction by 2020 program instituted by the Governor):

Water use efficiency is comprised of any technology or change in public behavior that results in lower per capita water use. Some of the water use efficiency programs in the Santa Ana River Region include financial incentives for consumers who implement new water efficient technologies, as well as public education regarding the various ways that water use can be reduced around their homes or businesses. The water budget data compiled for the OWOW process includes estimated figures for water use efficiency. However, the Water Use Efficiency Pillar estimates that these figures could increase by implementing the programs mentioned in the Water Use Efficiency Section.

The Water Use Efficiency Pillar has identified several high-priority water use efficiency strategies for further development and some that could be implemented immediately (see Water Use Efficiency Section 5.4). One of the proposed strategies is to promote the development and enforcement of water use efficiency legislation at the local, State and Federal levels. Such legislation would require new development (residential and commercial) within the Watershed to implement water use efficiency technologies. In addition to legislation, more work needs to be done to educate and encourage the public to make more efficient use of their water resources. "Tiered" water rates, which reward those who use less water, also are recommended throughout the Watershed.

Another way to save water is to reduce one of the only measurable "losses" in the Watershed, evapotranspiration. Evapotranspiration is the combined water loss associated with evaporation and transpiration. Evaporation is the movement of water to the air from the land surface and water bodies. Transpiration is the movement of water into plants and the subsequent loss of water as vapor through its leaves.

The losses associated with evaporation might be reduced by developing and implementing specific programs to increase the amount of shaded area such as planting trees or constructing shade structures. However, more analysis will be required to determine whether or not the increased water use by any new shade trees would offset any potential decrease in evaporation associated with their shade. Provided this strategy is effective, it would be most appropriate in the areas of the Watershed with the highest evaporation rates, namely the upper and middle Watershed.

The losses associated with transpiration could be reduced by developing and implementing specific programs which remove plants with higher transpiration rates such as turf grass and Arundo, wherever practical.

The *Water Use Efficiency* section of this report provides more detailed plans and programs for water use efficiency in the Watershed.

Optimize Imported Water Strategies

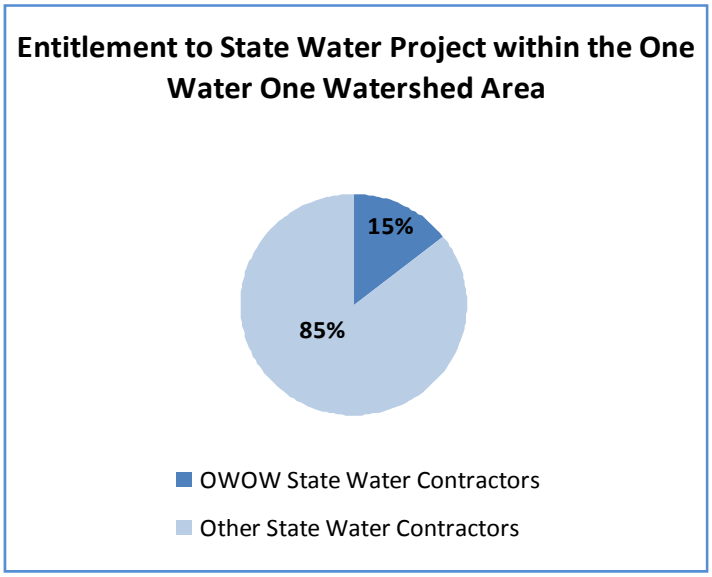
As seen in the *Evaluate Water Supply Reliability* section, the Watershed is dependent upon imported water to meet one-third of its needs into the future. However, the reliability of this source of water has proven to be less certain, at times, due to unforeseen circumstances such as the "Delta Smelt Decision" in 2007. This historic decision resulted in one of the single largest court-ordered SWP delivery reductions in state history to protect the endangered Sacramento/San Joaquin Delta smelt (fish). As a result of this and other problems in the Delta, the SWP operates below its delivery capacity. However, the Watershed may be able to implement strategies that could help offset the various uncertainties, and possibly even increase the amount of imported water available to the Watershed.

"Base Load" off of imported water

Estimated benefit: 70,000 AF annually

To help improve operations through the Delta, the Governor of the State of California formed the *Delta Blue Ribbon Panel* (Panel). The Panel has made recommendations that would improve operations through the Delta. One such recommendation involves the implementation of a new delivery pattern that is the opposite of the current delivery pattern. The current delivery pattern is to import less water in wet years due to lower demands and abundant local supplies and to import more water during dry years when demands are high. The current delivery pattern has resulted in unused imported water during wet years and more extreme water conservation measures during dry years when imported water is not readily available. The proposed delivery pattern would take more imported water when it is available

Figure 5.1-20 OWOW Portion of the SWP



during wet years. **Figure 5.1-21** shows that nearly 10 MAF of imported water from the SWP went unused since 1990[8], or approximately 470,000 AFY. Assuming the Watershed were able to make use of this water in a wet year and that it would get approximately 15%[9] (**Figure 5.1-20**) of the water, the overall yield of the SWP for the Watershed could be increased by as much as 70,000 AFY. It also is worthy to note that this simplified analysis does not include unused supplies from the CR system. Although this system is fully subscribed, there also may be wet years when undelivered water from the CR system also could be available.

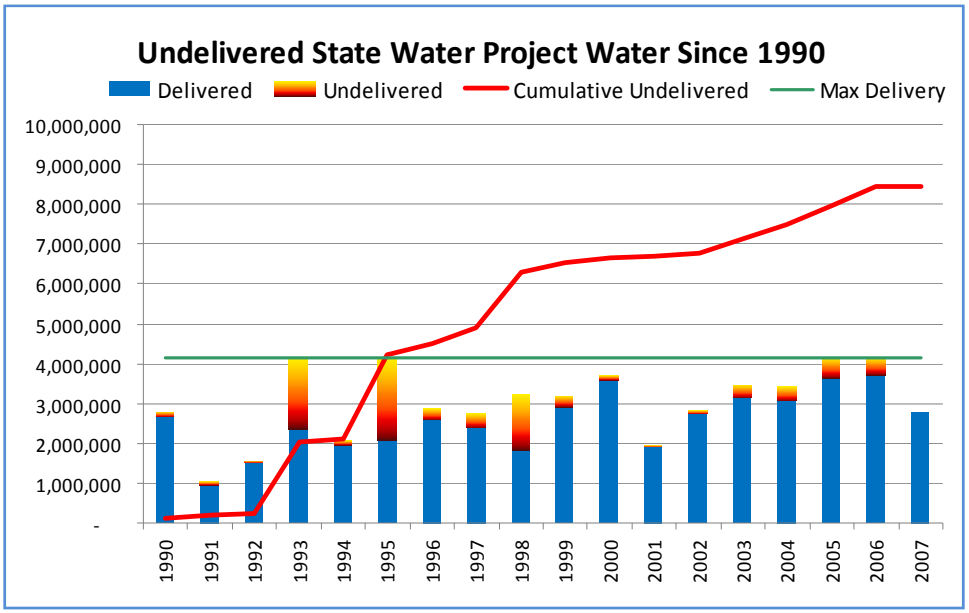
This strategy has been labeled "base loading off of imported water" because the general concept involves utilizing all imported water sources first. Since the current delivery pattern is to reduce the amount of imported water during wet years, nearly all of the water imported in a wet year can be viewed as additional yield. This strategy also could result in a change in cash flow. In wet years, more money would be spent on imported water. However, this increase in negative cash flow likely would be offset by a savings in dry years when water agencies are not forced to purchase water on the "open market" due to shortages of imported water. These open market purchases can be orders of magnitude higher than the cost of imported water.

To evaluate the feasibility of this concept, a simplified evaluation was performed to determine what facilities would be required, if any, to implement this strategy. The evaluation consisted of answering the following questions:

How much imported water can the Watershed currently put to use during a wet year? In the future?

Can the Watershed rely almost entirely on groundwater during dry years when there is less imported water available?

Figure 5.1-21 Undelivered SWP Water since 1990



[8] 1990 was the first year the Department of Water Resources had the facilities available to deliver 100% of State Water Project entitlement.
[9] Approximate State Water Project entitlement for the watershed as a percentage.

Below, **Figure 5.1-22** summarizes the answer to the first question of how much wet year imported water can be put to use currently and into the future. As seen in this figure, the watershed is not currently able to utilize all of its wet year entitlement. However, utilizing facilities that are already planned to be implemented, the watershed will be able to utilize all wet year water in the future.

This strategy assumes that the increased yield of imported water will result in more stored groundwater through artificial recharge and in lieu recharge. Therefore, the full benefit will not be realized unless there are adequate facilities to extract and deliver the stored water during drought periods.

Figure 5.1-2 The Amount of Imported Water the Watershed can put to Use in a Wet Year

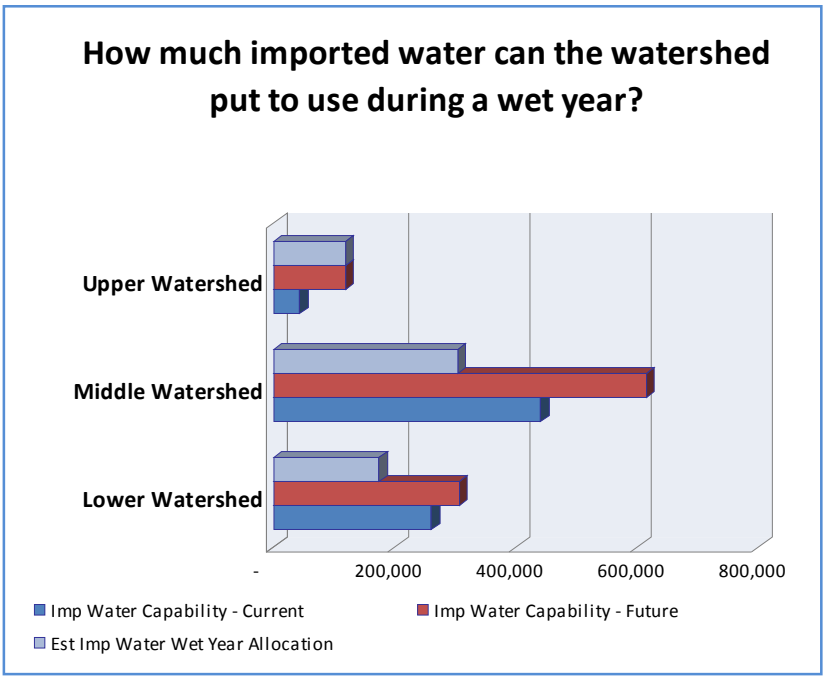
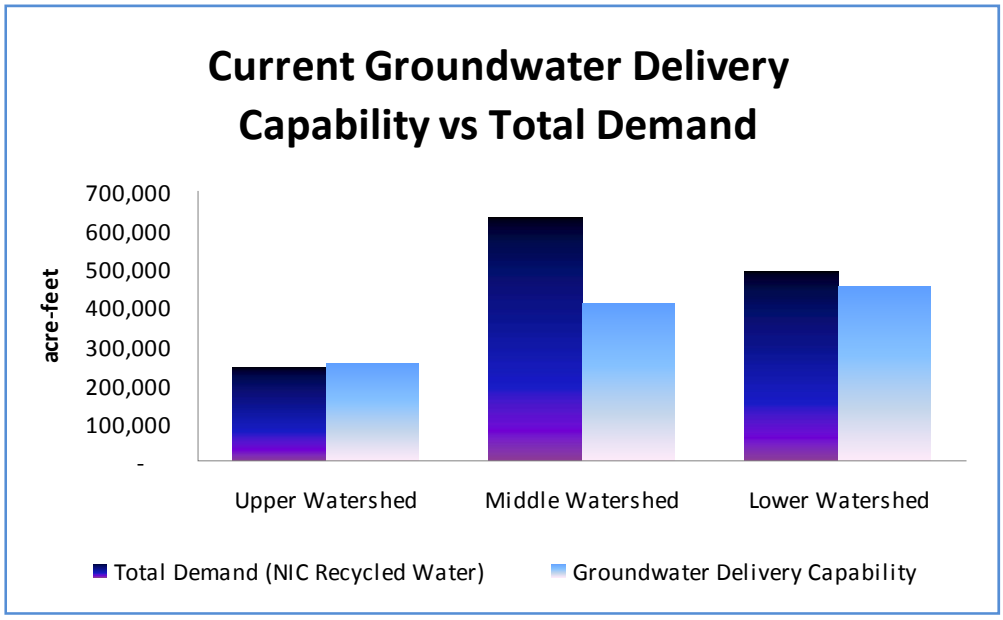


Figure 5.1-23 shows that the Upper and Lower Watershed currently have the groundwater delivery capability to meet demands during a drought year when imported water is less available. However, the Middle Watershed does not currently have the groundwater delivery capability to fully implement this strategy, and would need to increase this capability over time.

Figure 5.1-23 Current Groundwater Delivery Capability versus Total Demand



In summary, this strategy of "base loading" off of imported water appears feasible and could enhance the watershed's utilization of imported water and provide enhanced reliability during drought periods. However, to fully implement this strategy will require the construction of additional facilities to fully utilize wet year deliveries of imported water and additional groundwater delivery facilities to almost completely rely on stored groundwater during drought periods. **Table 5.1-9** summarizes the additional facilities necessary to fully implement this management strategy.

Table 5.1-9 Additional Capability Required to Fully Implement the "Base Load Off of Imported Water" Concept (AF)

	Additional Groundwater Delivery Capability	Additional Imported Water Capability
Upper Watershed	--	75,800
T	225,079	175,311
Lower Watershed	36,000	45,500

Although more facilities are required to fully implement this strategy, this strategy could be implemented on a smaller scale and then gradually increased over time.

Delta Conveyance Facility

Estimated benefit: Increased reliability

Nearly all of the reduction of imported water deliveries through the SWP is due to environmental and other problems in the Delta. The *Delta Vision Blue Ribbon Task Force* has been assigned the task to develop solutions for the Delta. One solution to help protect aquatic species while also protecting SWP deliveries (SWP deliveries are only a portion of the total flow through the Delta) is to transport them "around" the Delta in some sort of "Delta conveyance facility." Not only would this "Delta conveyance facility" protect deliveries, but it also would improve SWP water quality.

Prevent Invasive Species from Clogging Infrastructure

Estimated benefit: Improved reliability and reduced costs

Quagga Mussels and the closely related Zebra Mussels are small shellfish, usually less than half inch in size. Once only found in the Great Lakes, the Quagga Mussel has now been discovered in Lake Mead, the CRA, and a local reservoir in San Diego County. They will live and reproduce in pipes causing them to clog. Once they are established, they are very difficult to eradicate. Quagga Mussels can be controlled by super chlorination and drying out, sometimes requiring the temporary drawing down of water supplies. The additional maintenance costs associated with controlling these mussels could cost tens of millions of dollars a year. There is concern that Quagga Mussels could become more widespread and migrate into the Watershed through untreated water pipelines or larvae carried on boats and other watercraft. The Watershed should participate in any programs, such as the one initiated by MWDSC, which target the prevention of these species from entering water infrastructure.

Develop New Sources of Supply Strategies

One way to directly improve the water supply reliability for the Watershed is to identify and develop "new" sources of water supply. The following are opportunities to develop new supplies for the watershed.

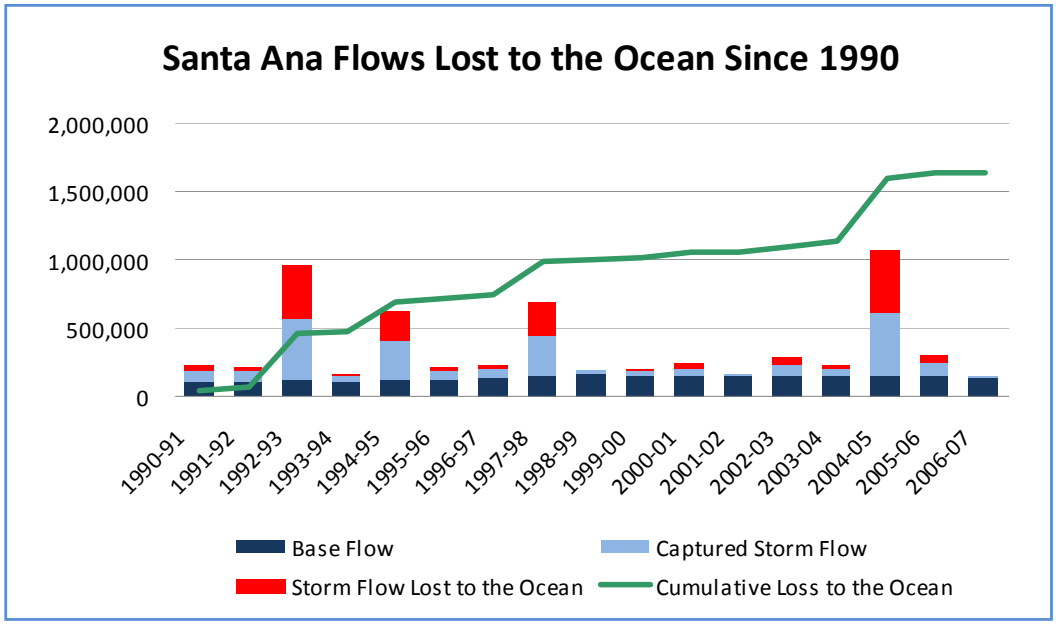
Capture and use more stormwater.

Estimated benefit: 25,000 AFY

As seen in **Figure 5.1-4**, in addition to the SAR, there also are a large number of tributaries to the SAR, each of which convey stormwater. Because this water originates in the mountains, it can be diverted relatively high in elevation allowing it to be delivered by gravity which saves energy costs. In addition to the low energy cost, this water also is very high quality, which helps the Watershed achieve both surface water and groundwater quality objectives established by State and Federal agencies. Therefore, the Watershed should work toward implementing strategies which increase the diversion and use of more stormwater.

Capturing stormwater runoff within the Watershed presents an interesting challenge due to the "flashy" hydrology. **Figure 5.1-24** shows how much stormwater has gone to the Pacific Ocean over the past 16 years. As the figure shows, most of the uncaptured flow came during "flood" years when it was nearly impossible to capture. However, if these flood years are removed, there is still an opportunity to capture approximately 25,000 AF annually. Water agencies have identified a number of strategies to increase the capture of stormwater.

Figure 5.1-24 Stormwater Flow Lost to the Ocean since 1990



One strategy for capturing more stormwater involves working with flood control agencies to re-operate flood control facilities with the goal of increasing stormwater capture. For example, when weather forecasts do not show any impending storms, the flood control agencies may be able to release stormwater at a slower rate. This relatively minor operational change would make stormwater flows easier to capture and put to use. It also would result in impounding the water longer, which would increase artificial recharge during the "holding period".

Another way to increase stormwater capture would be to work with flood control agencies to increase the size of existing, or new, detention basins. Larger detention basins would slow the flow and increase the recharge area, which would increase the amount of stormwater that is artificially recharged. In addition to this increased recharge, the larger basins also would provide greater flood protection. A related strategy would be to construct additional surface water reservoirs within the Watershed. Unlike detention basins, which need to be drained every year before the flood season, surface water reservoirs provide the added flexibility of allowing the water to be stored until it is needed. In addition, surface water reservoirs also provide a storage location(s) for other sources of

water such as imported water. Although effective, both of these strategies would be viable only in areas of the Watershed that have vacant land.

Another strategy to increase stormwater capture would be to implement new development standards that promote the construction of infrastructure that increases the infiltration of stormwater such as porous concrete, infiltration galleries, and perforated pipelines. These facilities could be implemented in public areas such as parking lots, schoolyards, parks and greenbelts, as well as private areas, by establishing a requirement in local development codes.

Recycled Water Strategies

Treating and reusing wastewater, referred to as "recycled water", provides one of the most reliable sources of water in the Watershed. Wherever recycled water can be put to use, it effectively replaces a like amount of potable water. Over the years, the Watershed has seen significant accomplishments in the development of recycled water. In fact, at present, nearly all of the recycled water from the upper and middle Watershed is being discharged into the SAR and is being reused at various locations downstream. In the future, the upper and middle Watershed plan to develop enhanced recycling programs that could change the place of use for much of this resource. Should enhanced recycling occur in the upper and middle Watershed, it would reduce the amount of recycled water flowing to the lower Watershed. This likely would result in the lower Watershed increasing local recycling programs (see *Recycle sewage effluent from Orange County Sanitation District Plant No. 1/Plant No. 2 that is currently flowing to the ocean* below), increasing conservation measures, desalting the ocean and/or purchasing more imported water. Another alternative might be for the upper, middle and lower Watersheds to enter into some form of agreement to keep some recycled water flows in the SAR. Under this alternative, the upper and middle Watershed would continue to discharge recycled water to the SAR for delivery downstream, by gravity. The lower Watershed would then provide a "replacement" source, of like quantity and reliability, to the upper and middle Watershed. Although many details would need to be worked out, such a concept could potentially save the Watershed a significant amount of money in capital costs and energy costs.

Recycle sewage effluent from Orange County Sanitation District Plant No. 1 that is currently flowing to the ocean.

Estimated benefit: Approximately 85,400 AFY

As presented in the Recycled Water Chapter of this report, by 2030 the Orange County Sanitation District expects to "dispose" of 84,500 AF of effluent into the ocean each year from its Plant No. 1. This effluent could be treated and used for a variety of purposes including the offset of any reduction in recycled water flows to the Lower Watershed due to recycling in the Upper and Middle Watersheds.

Recycle sewage effluent from Orange County Sanitation District Plant No. 2 that currently is flowing to the ocean.

Estimated benefit: 151,200 AFY

As presented in the Recycled Water Chapter of this report, by 2030 the Orange County Sanitation District expects to "dispose" of 151,200 AF of effluent into the ocean each year from its Plant No. 2. However, based on current Department of Public Health (DPH) requirements, this water cannot be recycled because it includes the effluent from the Santa Ana Regional Interceptor (SARI) pipeline which contains discharges from the Stringfellow Hazardous Waste Site, and other sources that would require further characterization by DPH. The Watershed should consider working with DPH on a strategy that would allow this effluent to be recycled.

Importation of recycled water from outside the Watershed

Estimated benefit: Requires more investigation

There may be opportunities to import recycled water from outside the Watershed. Any recycled water imported into the watershed would be viewed as a new supply.

Desalt the Pacific Ocean

Estimated benefit: 70,000 AFY

The lower Watershed has an abundant water source that includes a high concentration of salt which is better known as the Pacific Ocean! While ocean desalination generally is considered technically and institutionally feasible, it also is subject to significant regulatory scrutiny depending upon the environmental impact of the specific project. It also requires significant energy that is costly. Over the last five years, a number of water agencies have been investing significant effort and funds in ocean desalination program development work. There are currently two sites along coastal Orange County that have completed extensive exploratory work and permit approvals to construct desalination facilities:

Dana Point Ocean Desalination Project

- Estimated Cost: $136 million
- Estimated Supply: 16,000 AFY
- Estimated Unit Cost: $1,287 per AF
- End Use: Drinking water
- Anticipated Construction: 2013-2015 timeframe.

Poseidon Resources Huntington Beach Desalination Project

- Estimated Cost: $300 million
- Estimated Supply: 55,000 AFY
- Estimated Unit Cost: $950 per AF
- End Use: Drinking water
- Anticipated Construction: Currently in permitting phase

The cost of this water is significantly more expensive than any other current source of supply. As treatment methods improve, treating this abundant source of water may become more cost effective which could significantly enhance overall water supply reliability in the Watershed.

Increase Storage

In general, the hydrology for the watershed can be characterized by a short series of wet years followed by a longer series of dry years. When the wet years come, they tend to be really wet, or "flood" type years. Thus, a fundamental water management challenge for the State and the watershed is to capture the water during wet years, when it is plentiful, and store it for later use during dry years. The water may be stored in surface water reservoirs or the groundwater basins within the Watershed.

Surface Water Storage

Estimated benefit: water supply following an emergency, increased reliability during drought (related to "base load" concept)

As shown in **Table 5.1-1**, the Watershed is fortunate to have a number of surface water reservoirs. However, additional surface storage space would allow the capture of additional stormwater and "unused" imported water. Not only do surface water reservoirs provide a location to store water when it is available, but they also enhance reliability during a disaster. Therefore, the Watershed should work toward increasing surface water storage both inside and outside the region. Due to the fast development within the Watershed, the number of potential reservoir sites inside the Watershed continues to diminish every year. Potential surface storage opportunities outside of the Watershed would include any additional reservoirs constructed as part of the SWP and/or the CRA.

Groundwater Storage

In addition to additional surface water storage, the Watershed also should pursue the utilization of any unused groundwater storage both inside and outside the Watershed. Like a surface water reservoir, these underground reservoirs provide a place to store wet year supplies for later use during extended drought periods. The following management strategies would enhance groundwater storage:

"Base Load" off of imported water (see Optimize Imported Water Strategies)

This concept was presented under *Optimize Imported Water Strategies* and involves importing all available imported water. The net effect of this strategy is to increase groundwater storage which later would be available during drought periods.

Utilize unused groundwater capacity within the watershed

Estimated benefit: increased reliability during drought (related to "base load" concept)

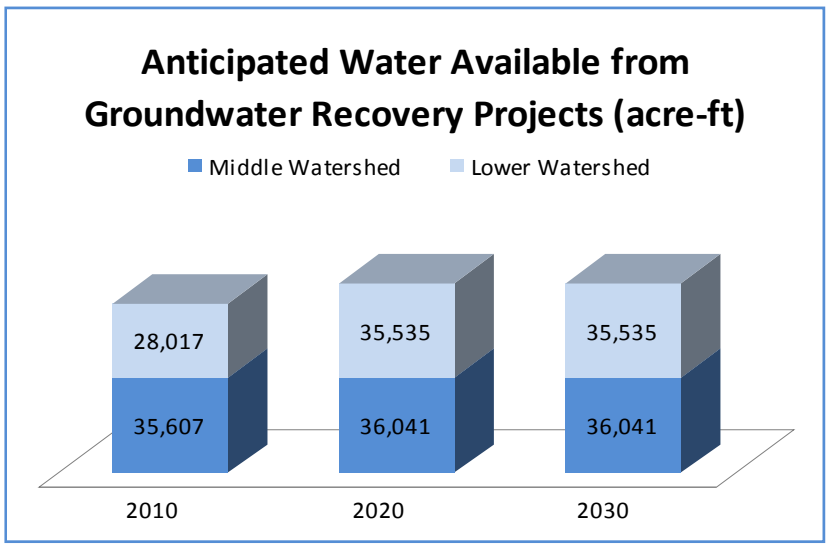
Figure 5.1-4 provides an estimate of the amount of unused groundwater storage capacity in the Watershed. Regardless of the source, the Watershed should work collectively toward filling this unused capacity with wet year water that could then be used during drought years.

Recover "tainted" groundwater (salt, contaminants, color, odor, etc.) basins within the Watershed

Estimated benefit: 70,000 AFY

Some groundwater basins in the Middle and Lower Watershed have been abandoned or have not been fully utilized due to high salt content, contamination, color, odor or some other concern. Projects to pump and treat water in these basins, or portions thereof, provide restoration of groundwater storage that may not have been historically available for municipal use. In addition to recovering this groundwater storage space, it also could result in additional groundwater yield. **Figure 5.1-25** shows the anticipated amount of water that the Watershed is anticipating from groundwater recovery projects.

Figure 5.1-25 Anticipated Water Available from Groundwater Recovery Projects



Pursue groundwater storage opportunities outside the watershed.

Estimated benefit: increased reliability during drought (related to "base load" concept)

Although the Watershed has a significant amount of unused groundwater storage, it may not be easily accessible to the entire Watershed. In some cases, it may be more efficient to participate in a groundwater storage opportunity outside the Watershed. These storage opportunities are often referred to as "water banks" and are located throughout the State. Both the upper and lower Watersheds have plans to utilize water banks as storage locations for water available during wet years.

Emergency Measures Strategies

Estimated benefit: Improved recovery time following a disaster

Despite careful planning, there will still be catastrophic events and unforeseen circumstances. Although the timing and extent of such events or circumstances are unknown, the following strategies will help the watershed prepare for the unknown.

Local Emergency Plans

Each of the water agencies within the Watershed must have an emergency plan that complies with both the Standardized Emergency Management System (SEMS) and the National Incident Management System (NIMS).

Mutual Aid and Coordination

All of the water agencies should have mutual aid agreements in place. One mutual aid option used by many of the water agencies is to join the California Water/Wastewater Agency Response Network (CalWARN), www.calwarn.org. CalWARN provides a "standard" mutual aid agreement, and also maintains a database of personnel and equipment that could be made available during an emergency. It is recommended that each of the water agencies in the Watershed join CalWARN and "upload" their personnel and equipment data. In addition to participating in mutual aid agreements, the water agencies also may want to consider additional coordination with one another through a regional group. Two such groups already have been formed in the Watershed: Water Emergency Response Organization of Orange County (WEROC), and the Emergency Response Network of the Inland Empire (ERNIE). Water agencies should consider partnering with one of these groups or, perhaps, forming an additional group, if necessary.

System Interconnections

Wherever possible, water agencies should pursue interconnections to increase redundancy and provide aid during an emergency situation.

Extraordinary Conservation

"Extraordinary" conservation would be required following an extreme catastrophic event such as an earthquake. In these situations, the only way demands can be met is by asking the public to implement extraordinary conservation measures such as halting all outside irrigation, limiting the frequency of bathing, etc. In the upper Watershed, outside uses account for nearly 70% of water use. Thus, this type of extreme conservation could reduce demands in the upper watershed by the same amount.

Water Management Strategies

Table 5.1-10 summarizes the estimated benefits of the various management strategies developed in the OWOW process. In those cases where there is not enough information to adequately quantify the benefit; it has been labeled "more investigation".

Table 5.1-10 Summary of Water Management Strategies and Estimated Benefits

No.	Strategy (in no particular order)	Estimated Benefit (AFY)
1	Comply with 20% reduction by 2020	50,000
2	Increase Water Use Efficiency	More investigation
3	Reduce Evapotranspiration	More investigation
4	Base Load off imported water	70,000
5	Construct Delta Conveyance Facility	More investigation
6	Capture more stormwater	25,000
7	Recycle wastewater flowing to the ocean	215,000
8	Recycle the Santa Ana Regional Interceptor Effluent	38,000
9	Import recycled water from outside the watershed	More investigation
10	Ocean Desalination	70,000
11	Recover Tainted Groundwater Basins	70,000
12	Increase Storage (surface and groundwater)	More investigation
13	Water Banking (outside the watershed)	
14	Emergency Measures	Preparation for catastrophic event
	TOTAL	**538,000**

Even without quantities for the strategies labeled "more investigation", the estimated annual benefit of the management strategies greatly exceeds the reliability goal of 369,000 AF. However, given the uncertainty of future hydrologic conditions and other unknowns, it is strongly recommended that most, if not all, of the above strategies be implemented to further improve reliability in the Watershed and, perhaps, even the State. The data suggests that the deficit will not occur until 2020, which means there is time to fully develop those strategies that require more development.

Figure 5.1-26 shows that each of these strategies helps to overcome the anticipated vulnerabilities of each scenario. Therefore, implementation of one, or more, of the listed strategies is not dependent upon overcoming a particular scenario. All of the strategies will help in all of the scenarios.

Figure 5.1-26 Which Management Strategies Apply to the Various Reliability Scenarios

Management Strategies \ Scenarios	Average	Drought	Climate Change	Other Shortages	Disaster
Reduce Demand	●	●	●	●	●
Optimize Imported Water	●	●	●	●	●
Develop New Sources of Supply	●	●	●	●	●
Increase storage	●	●	●	●	●
Emergency Measures	●	●	●	●	●

A summary of agreements, judgments, and compacts regulating water use can be found in Chapter 4.

References

EMWD 2005 Urban Water Management Plan
IEUA 2005 Urban Water Management Plan
MWDOC 2005 Urban Water Management Plan
SBVMWD 2005 Urban Water Management Plan
WMWD 2005 Urban Water Management Plan
SAWPA – Maps from Various Documents
SAWPA 2002 IRP

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Chapter 5.2 Water Quality Improvement

Introduction

This chapter presents a general overview of water quality issues in the Santa Ana River Watershed and programs to improve water quality. The three focus areas of this chapter, surface water, groundwater, and ocean water quality, are described from the top of the Watershed downstream to the ocean. This discussion includes the significant impact of imported water supplies and stormwater runoff on water quality.

Surface water discharges to the ocean impact ocean water quality. Ocean water, defined as the zone from the beach to three miles offshore, and bays and estuaries near the coast, are included in this report, reflecting the comprehensive, integrated approach utilized in the development of the new Integrated Regional Water Management Plan (IRWMP).

This chapter also includes coastal watersheds such as Anaheim Bay-Huntington Harbor, Newport Bay, and Newport Coastal streams as well as Coyote Creek and Carbon Creek in the San Gabriel River Watershed in the northern part of the Watershed. Although outside the Santa Ana River Watershed boundaries, these areas are within the jurisdiction of the Santa Ana Regional Water Quality Control Board (Region 8).

Brief History of Santa Ana River Watershed

The Santa Ana River (SAR), its tributary streams, and the groundwater basins provided adequate water for early inhabitants of the Watershed. By the late nineteenth century, the region had developed a successful agricultural economy. By the early twentieth century, expanding farms and orchards along with increased population began to outgrow available water supplies. The Colorado River Aqueduct (CRA) was the first facility to bring imported water into the region, followed by the State Water Project (SWP).

By the time of passage of the California Porter-Cologne Water Quality Act in 1969, population growth, agriculture, and industry already had created a legacy of water quality problems. Agricultural irrigation, fertilizer use, and dairy operations added nutrients and salts to groundwater supplies. Use of pesticides contributed to the contamination of soils and groundwater. In some areas, chemicals used in military facilities and industrial processes were improperly disposed of, resulting in the migration of hazardous substances into groundwater. Impacts from urbanization of the Watershed included stormwater runoff from urban areas, non-storm nuisance flows from landscape irrigation, increased salt concentrations, and elevated levels of nutrients.

Local agencies, non-governmental organizations, and other stakeholders, with the support of regulatory agencies, have made progress in restoring the quality of water in the Watershed. Challenges still remain.

Regulatory Framework

Drinking Water Regulations

The California Safe Drinking Water Act (Health and Safety Code, Section 116270 et seq.) directs the California Department of Public Health (CDPH) Division of Drinking Water and Environmental Management to set standards for drinking water quality. Drinking water regulations are addressed in Title 17 and Title 22 of the California Code of Regulations. These include establishing the Maximum Contaminant Limits (MCLs) and treatment requirements for potable water and recycled water.

Water Quality Control Plan, Santa Ana River Basin

The State Water Resources Control Board (SWRCB) and the Santa Ana Regional Water Quality Control Board (Regional Board) are responsible for implementing California's Porter-Cologne Water Quality Control Act and the Federal Clean Water Act. These State and Federal laws, and associated regulations and policies, provide the overall framework for managing water quality. Extensive voluntary efforts of stakeholders play an important role in protecting and improving water quality in the Watershed.

The Water Quality Control Plan, Santa Ana River Basin (Basin Plan) guides the Regional Board's water quality control programs, water quality management decisions, and enforcement efforts. The Basin Plan establishes water quality standards, which include beneficial uses, water quality objectives (WQOs), and implementation plans to achieve the standards.

Beneficial uses include human uses, such as municipal water supply and agricultural supply, as well as environmental uses such as wildlife habitat. WQOs are set to establish reasonable protection of the beneficial uses. WQOs and beneficial uses are specified according to water body type: ocean waters, enclosed bays and estuaries, inland surface waters, and groundwater.

Since its last major revision in 1995, the Basin Plan has been amended eleven times. Amendments added Total Maximum Daily Loads (TMDLs) in 1998, 1999, 2003, 2004, 2005 and 2006; made provisions for and included time schedules in waste discharge requirements (2000); revised bacterial objectives in ocean waters (1997); and incorporated a revised Nitrogen/Total Dissolved Solids (N/TDS) management plan (2004). To implement the N/TDS plan, stakeholders and the Regional Board formed the Basin Monitoring Task Force. The Task Force is developing and implementing a monitoring program for nitrate and TDS in both groundwater and surface water in the Watershed.

Basin Plan amendments are adopted through a public basin planning process. The process requires approval by the Regional Board, SWRCB, California Office of Administrative Law, and United States Environmental Protection Agency (U.S. EPA). The Regional Board establishes priorities for Basin Plan revisions approximately every three years; the latest of these triennial reviews was conducted in 2006.

The primary methods of enforcing water quality regulations are through the issuance of the (Federal) National Pollutant Discharge Elimination System (NPDES) Permits and State Waste Discharge Requirements (WDRs). In California, both permit programs are administered by the SWRCB and the Regional Boards. These permits regulate discharges to surface water bodies of both wastewater and urban runoff from municipal and industrial systems and stormwater runoff from municipal separate storm sewer systems, industrial sources, and construction sites. Permit requirements are based on technology-based limits for wastewater and maximum extent practicable (MEP) standard for stormwater intended to meet water quality standards.

Total Maximum Daily Loads

The Federal Clean Water Act Section 303(d) requires states to identify as impaired those waters that do not or are not expected to meet water quality standards. Impaired water bodies are placed on the Clean Water Act Section 303(d) List of Water Quality Limited Segments which initiates a process to develop TMDLs. A TMDL is considered to be adopted when approved by the Regional Board, the SWRCB, the California Office of Administrative Law, and the U.S. EPA.

A TMDL defines how much of a pollutant a water body can tolerate and still meet water quality standards. Each TMDL must account for all sources of the pollutant, including: discharges from wastewater treatment facilities; non-point source pollutants in runoff from residential areas, forested lands, agriculture, streets or highways, etc.; soils/sediments polluted with legacy contaminants such as DDT and PCBs; on-site disposal systems (septic systems); and deposits from the air. Projected growth that could increase pollutant levels may be considered. TMDLs allocate allowable pollutant loads for each source and identify management measures that, when implemented, will assure that water quality standards are attained.

California Toxics Rule

The California Toxic Rule was promulgated by the U.S. EPA to set numeric water quality criteria for priority toxic pollutants and other provisions for water quality standards to be applied to California waters. The criteria apply to all inland surface waters and enclosed bays and estuaries regulated by the Clean Water Act.

California Ocean Plan

The California Ocean Plan (Ocean Plan) is the state water quality control plan for ocean waters prepared by the SWRCB as required by the Clean Water Act. The plan is implemented by SWRCB and the coastal Regional Boards. It lists beneficial uses for marine waters including protection of Areas of Special Biological Significance (ASBS), rare and endangered species, marine habitat, fish migration, recreation, fishing, aesthetic enjoyment, and others. Narrative and numerical WQOs are set to protect designated beneficial uses. The objectives are implemented through a program that sets waste discharge limitations, monitoring, and enforcement. Through a triennial review process, the plan sets priorities for actions over the next three-year period.

Ocean Water-Contact Standards- AB 411

In 1996, AB 411 (Wayne) required the establishment of bacteriological ocean water quality standards to protect public health (CCR Sections 7956-7962). Contaminated runoff and untreated sewage spills are two of the most common factors that negatively impact ocean water quality. The AB 411 standards require that waters adjacent to ocean and bay public beaches be monitored for total coliforms, fecal coliforms, and enterococci bacteria. When any waters adjacent to a public beach fail to meet any of the standards, warnings are issued to the public. In the event that sewage is known or suspected, access to the affected waters is restricted.

Emerging Constituents Workgroup

As part of the issuance of a tentative Waste Discharge Requirement General Order in 2006, the Regional Board requested that a program be developed to study and evaluate the potential water quality impacts of emerging constituents in imported water. A study group was convened with recharging agencies that were party to the cooperative agreement for water recharge as well as wastewater treatment agencies in the Santa Ana Region. The group is charged with surveying current water quality monitoring programs, regulatory issues, stakeholder concerns, analytical methods and the state-of-the-science with respect to potential public health and environmental impacts of emerging constituents. A written report of the workgroup's preliminary findings will be provided to the Regional Board. Thereafter, the workgroup will develop an appropriate water quality characterization program designed to address the concerns raised by regulatory agencies and other stakeholders throughout the Watershed.

Constituents of Emerging Concern

The potential impact of trace levels of constituents of emerging concern in water supplies is becoming an increasing concern for the water and wastewater agencies, regulators, and the public. These constituents, also referred to as 'emerging constituents', include a wide range of chemical constituents including pharmaceuticals, personal care products, pesticides, and other synthetic organic compounds. Potential constituents may include thousands of chemicals in consumer and health-related products such as drugs, food supplements, fragrances, sun-screen agents, deodorants, and insect repellants. Typically, these constituents of emerging concern are found at low concentrations (*i.e.*, parts per trillion) in water bodies. Some of these chemicals enter surface water through the discharge of treated effluent when the public disposes of unused pharmaceuticals through the sewer system or the pharmaceuticals that are consumed are not entirely broken down in the human body.

Constituents of emerging concern currently are not regulated by federal or state agencies and very few have regulatory levels or California Notification Levels. In general, when detected, the chemicals occur at low concentrations in surface water. Although ecological impacts to fish and other wildlife have been shown for some of these trace contaminants in water bodies, much less is known about potential human health effects. However, some of these constituents are known or suspected to have endocrine disrupting effects if present at a sufficiently high concentration. In

addition, concerns are being raised about the potential reproductive and developmental effects of these compounds. There is a significant amount of research being done in the area of ecological and human health effects and new information continues to be developed on the significance of this issue.

No Drugs Down the Drain

To reduce disposal of pharmaceuticals through the sewer system, a group of agencies including the City of Riverside and the Orange County Sanitation District (OCSD) are sponsoring a 'No Drugs Down the Drain' program. This effort is working to educate the public regarding the disposal of pharmaceuticals and provide options to disposal through the sewer system. By reducing the disposal of unused pharmaceuticals through the sewer system, the concentrations of pharmaceuticals that enter surface water through treated effluent discharge can be reduced. Additional information is available at www.nodrugsdownthedrain.org.

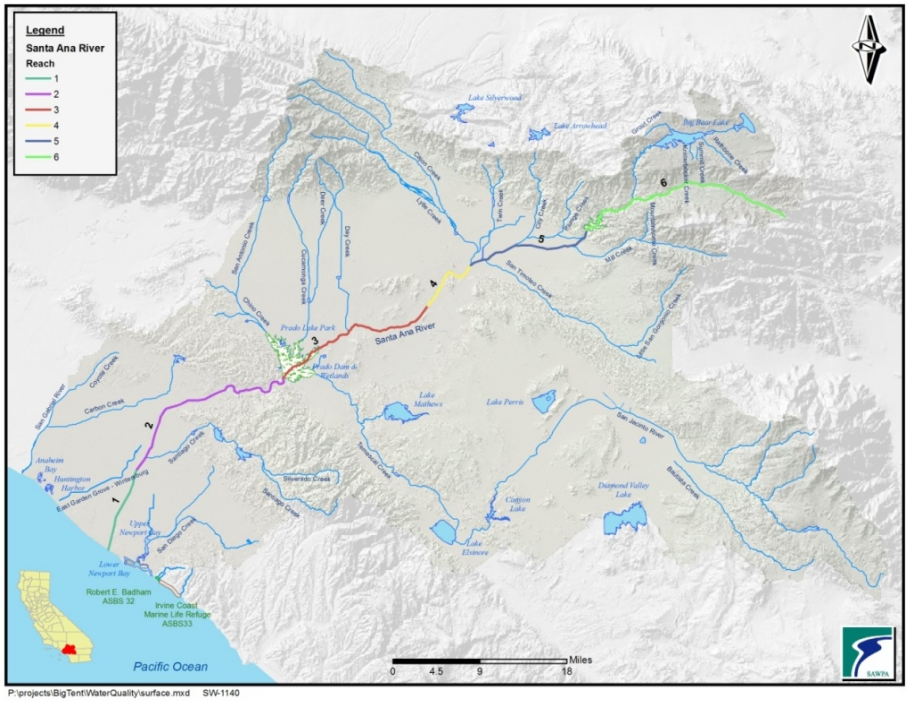
A major driver in characterizing these constituents in water supplies is the use of newly developed analytical methods. As laboratory methods improve, new tests can detect substances at lower and lower concentrations. As many of these methods are not standard, they are considered research methods with development still ongoing. As part of the methods development process, issues such as method detection limits and intra- and inter-laboratory comparisons are being evaluated.

More research is needed on the public health significance of low level concentrations of these constituents. Knowledge of the potential human health effects at low concentrations is very limited and significant data gaps exist in trying to establish levels of human health risk or regulatory limits. However, public concern is a significant issue and will need to be addressed before complete scientific-based health information is available.

Surface Water

Surface water in this section includes rivers, streams, creeks, lakes, and bays and estuaries. These waters provide many benefits to the Watershed including water supply, habitat, and recreation.

Figure 5.2-1 Santa Ana River Watershed, Surface Waters



Current Conditions

Water in less developed and non-agricultural areas of the Watershed is typically the highest quality water in the Watershed. Agricultural, industrial, commercial, and residential developments over the last approximately

150 years have degraded surface water quality. Pollutants include nutrients, sediment, pesticides and microbial contaminants such as bacteria. Concentrations of soluble mineral substances commonly referred to as 'salinity' or 'TDS', also impact surface water quality. In developed areas and agricultural areas, stormwater carries pollutants from roads, parking lots, and other sources, degrading the quality of water as it flows downstream. The following sections describe surface water conditions in each Reach of the Santa Ana River Watershed as defined by the Basin Plan and shown in **Figure 5.2-1**.

Water bodies that do not meet water quality standards are identified as impaired and are placed on the 303(d) List of Water Quality Limited Segments. A water body remains on the list until a TMDL is adopted and the water quality standards are attained or there are sufficient data to demonstrate that water quality standards have been met and delisting should take place.

Figure 5.2-2 shows the locations of impaired water bodies where the Regional Board has yet to begin the process of developing TMDLs. Surface water bodies where TMDL projects are in the process of development, as shown on the Regional Board's TMDL project list, are shown in **Figure 5.2-3**.

Figure 5.2-2 Santa Ana River Watershed, Impaired Water Bodies

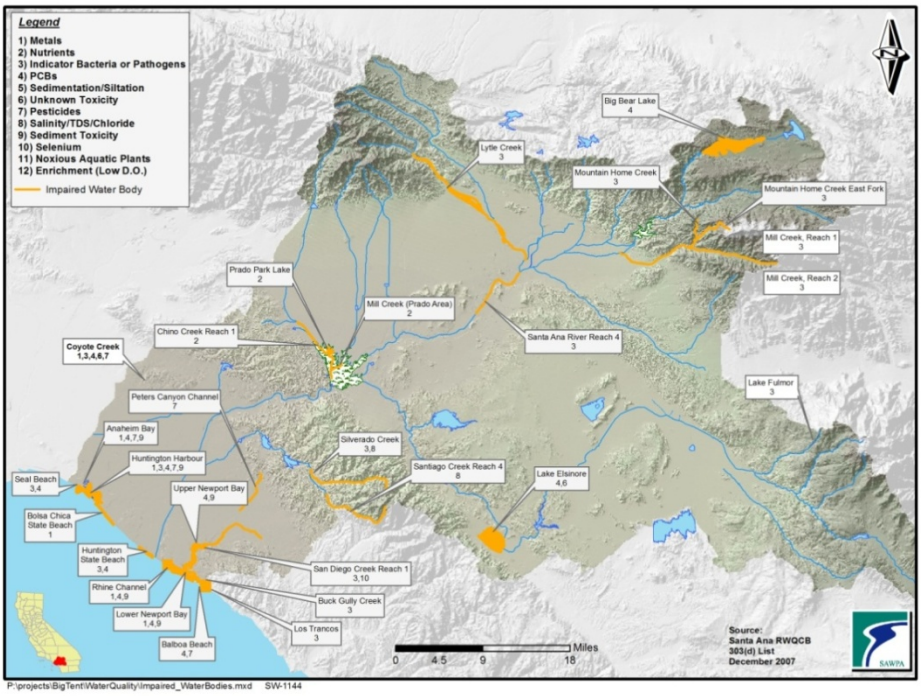
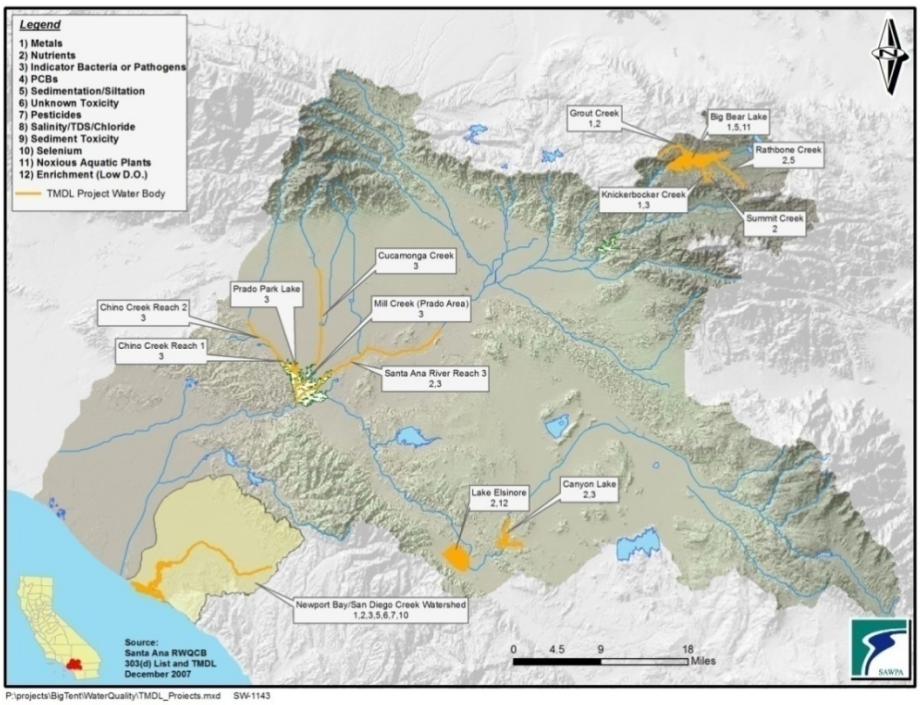


Figure 5.2-3 Santa Ana River Watershed, TMDL Projects



Past and present land use practices have negatively impacted water quality in Big Bear Lake. Impairments and current TMDL projects are shown in **Tables 5.1-1** and **5.2-2.**

Table 5.2-1 2006 CWA 303(d) List of Water Quality Limited Segments Requiring TMDLs – Big Bear Lake Watershed

Water Body	Pollutant/Stressor	Potential Sources	Proposed TMDL Completion
Big Bear Lake	Copper, mercury	Resource extraction	2007
	PCBs	Unknown	2019

Source: California Regional Water Quality Board, Santa Ana Region

Table 5.2-2 TMDL Projects – Big Bear Lake Watershed

Water Body	Pollutant (s)	TMDL Project	Status
Big Bear Lake	Metals	Metals TMDLs for the Big Bear Lake Watershed	Other Action
	Noxious aquatic plants Nutrients	Nutrient TMDL for Dry Hydrological Conditions for Big Bear Lake	Implementation Phase
	Sedimentation/Siltation	Sediment TMDLs for Big Bear Lake and Rathbone Creek	Other Action

Source: California Regional Water Quality Board, Santa Ana Region
Note: Other Action – A process other than a TMDL is being pursued or considered for the impaired water body/pollutant combination. 'Other Action' includes a pending 303(d) delisting, a recommended delisting, or implementation through permits or other regulatory actions.

Big Bear TMDL Task Force

In response to water quality problems in Big Bear Lake, local agencies created an informal workgroup in 2000 to implement projects to improve lake water quality including dredging, alum application and aquatic plant control, and to work cooperatively with the Regional Board on TMDLs as they were developed. Once TMDLs were formally enacted, the workgroup determined that a more formal task force was needed to implement TMDL requirements. In 2008, SAWPA was utilized to convene and administer a task force which developed a multi-agency task force agreement that allows all defined responsible agencies to combine resources to cost effectively conduct monitoring, studies, and Best Management Practices (BMPs) to address water quality challenges in the region.

Shay Creek, Shay Meadows, and Baldwin Lake are relatively undeveloped areas that contain natural resources highly valued by stakeholders. Shay Creek and Baldwin Lake have threatened and endangered plant species as well as the endangered, unarmored three-spine stickleback fish and a unique wetlands system. The U.S. Fish and Wildlife Service, U.S. Forest Service, and the California Department of Fish and Game are interested in restoring the quality of these waters.

Grout, Knickerbocker, Summit, and Rathbone (Rathbun) Creeks, tributaries to Big Bear Lake, are listed as impaired, as shown in **Table 5.2-3**.

Table 5.2-3 TMDL Projects in the Big Bear Lake Watershed

Impaired Water Body	Pollutant (s)	TMDL Project	Status
Grout Creek	Metals	Metals TMDLs for the Big Bear Lake Watershed	Other Action
	Nutrients	Nutrient TMDLs for Big Bear Lake Tributaries	Under development
Knickerbocker Creek	Metals	Metals TMDLs for the Big Bear Lake Watershed	Other Action
	Pathogens	Knickerbocker Creek Bacterial Indicators	Implementation Phase (compliance will be addressed through MS4 permit)
Rathbone Creek	Nutrients	Nutrient TMDLs for Big Bear Lake Tributaries	Under development
	Sedimentation/ siltation	Sediment TMDLs for Big Bear Lake and Rathbone Creek	Other Action
Summit Creek	Nutrients	Nutrient TMDLs for Big Bear Lake Tributaries	Under development

Mountain Home Creek and mountain reaches of Mill Creek and Lytle Creek are impacted by high seasonal recreational use and/or flow through remote residential communities. Impairments are shown in **Table 5.2-4**

Table 5.2-4 2006 CWA 303(d) List of Water Quality Limited Segments Requiring TMDLs

Water Body	Pollutant/Stressor	Potential Sources	Proposed TMDL Completion
Lytle Creek, Mountain Home Creek, Mountain Home Creek-East Fork, Mill Creek- Reaches 1 & 2	Pathogens	Unknown nonpoint source	2019

The water quality of Reach 6 (the SAR upstream of the Seven Oaks Dam) and Reach 5 (the Seven Oaks Dam to the San Jacinto Fault) and their tributaries is generally very good, with low to very low levels of TDS, indicator bacteria, or other pollutants. Impounding water behind the Seven Oaks Dam reduces water quality because of sediment entrapment and algae growth. This may render some of the impounded water unsuitable for use unless additional treatment is provided. The U.S. Army Corps of Engineers is studying this problem.

Many of the mountain reaches of these streams support self-sustaining populations of trout and other indigenous aquatic species. Several rare, threatened, and endangered species inhabit these areas including the unarmored three spine stickleback, the San Bernardino kangaroo rat, the yellow-legged mountain frog, the speckled dace, the Santa Ana woolly star, the least Bell's vireo, and the Southwest Willow Flycatcher.

Reach 5 and its primary tributaries are believed to meet the Basin Plan's water quality standards. However, this may be due to the lack of recent or rigorous water quality assessments rather than a true indication of water quality. Segments of many of these streams support or have the potential to support a wide range of beneficial uses.

Santa Ana River Reach 4

Reach 4 includes the river from the San Jacinto Fault down to Mission Boulevard Bridge in Riverside. In this reach, all the WQOs are being met except for fecal coliform. **Table 5.2-5** summarizes the 303(d) listing for pathogens for Reach 4.

Table 5.2-5 2006 CWA 303(d) List of Water Quality Limited Segments Requiring TMDLs

Water Body	Pollutant/Stressor	Potential Sources	Proposed TMDL Completion
Santa Ana-Reach 4	Pathogens	Nonpoint source	2019

Santa Ana River Reach 3 and Chino Basin Surface Water Bodies

Reach 3 includes the portion of the river from Mission Boulevard Bridge to Prado Dam. Rising waters feed small creeks tributary to Reach 3 that are important breeding and nursery areas for native fish. Excessive nutrient loading in Reach 3 was addressed by amendments to the Basin Plan as recommended by the N/TDS Task Force. Watershed partners are working closely with regulators to improve the quality of impaired water bodies and to develop TMDLs as shown in **Tables 5.2-6** and **5.2-7**.

Table 5.2-6 2006 CWA 303(d) List of Water Quality Limited Segments Requiring TMDLs – Santa Ana River, Reach 3

Water Body	Pollutant/ Stressor	Potential Sources	Proposed TMDL Completion
Chino Creek-Reach 1 and Mill Creek (Prado Area)	Nutrients	Agriculture, dairies	2019
Prado Park Lake	Nutrients	Nonpoint source	2019

Table 5.2-7 TMDL Projects - Santa Ana River Watershed, Reach 3

Impaired Water Body	Pollutant(s)	TMDL Project	Status
Chino Creek-Reach 1, Mill Creek (Prado Area); SAR-Reach 3, Prado Park Lake	Pathogens	Bacterial Indicator TMDLs for the Middle SAR Watershed Water Bodies	Implementation Phase
Chino Creek-Reach 2; Cucamonga Creek- Valley Reach	High coliform count		
SAR – Reach 3	Nitrate	SAR, Reach 3 Nitrate TMDL	Implementation Phase

Middle Santa Ana River TMDL Task Force

In 2007, in support of local stakeholders, SAWPA formed a multi-agency task force to address the pathogen TMDLs in the Santa Ana River Reach 3 and its tributaries. This area was named the Middle SAR by the Regional Board. This task force includes county agencies, cities, dairies, and agricultural operators. Work to date has included source assessment monitoring, research on pathogen indicators, and pilot BMPs evaluations.

Prado Wetlands

The Orange County Water District (OCWD) operates the Prado Wetlands in Riverside County to remove nitrogen from SAR water. During non-storm conditions, the river flow upstream of the Prado Wetlands consists predominately of tertiary-treated effluent discharged from wastewater treatment plants. Before reaching the Prado Dam, river water is diverted through 465 acres of constructed wetlands with more than 50 engineered ponds. Following wetland treatment, the water is then discharged into Chino Creek, and then back to the SAR. The wetlands serve as a natural, cost-effective treatment to reduce nitrate levels before the water flows to Orange County, where it is used for groundwater recharge. The Prado Basin is home to several rare and endangered bird and waterfowl species. More than 124 acres are set aside as protective habitat for the endangered least Bell's vireo and Southwestern Willow Flycatcher.

Temescal Creek

Temescal Creek, also called Temescal Wash, stretches approximately 25 miles from Lake Elsinore to Prado Basin. However, water overflows from the lake to the creek only during very wet periods. For most of the year, portions of the creek are dry, and flow in Temescal Creek originates downstream of Lake Elsinore. Water quality in the creek is impacted by non-point source pollution.

Recycled water produced at Eastern Municipal Water District's (EMWD) Regional Water Reclamation Facilities, Elsinore Valley Municipal Water District's Regional Water Reclamation Facility, City of Corona's Wastewater Treatment Plant IB, and Lee Lake Water District's Wastewater Treatment Plant is discharged to Temescal Creek.

Lake Elsinore & San Jacinto Watersheds Authority

In 2000, as a result of the passage of State Proposition 13 Water Bond, a new joint powers authority (JPA) called the Lake Elsinore & San Jacinto Watersheds Authority (LESJWA) was formed among local agencies to implement water quality improvements for Canyon Lake and Lake Elsinore. SAWPA serves as the administrator for the JPA and as a LESJWA Board member. Utilizing local and State Proposition 13 grants funds, from 2002–2008, lake improvements have been implemented including lake dredging, an aeration system, nutrient removal, pumping and pipeline conveyance facilities to convey recycled water, and groundwater for lake level stabilization. As a result, significant improvements in water quality have been observed in recent years. More improvements are planned by LESJWA to support efforts to meet TMDL standards at both lakes.

San Jacinto Watershed

The San Jacinto River (SJR) originates in the San Jacinto Mountains and flows through the San Jacinto Valley. The valley, although undergoing considerable development, still contains citrus orchards, dairy farms, and other agricultural operations.

The SJR passes through Railroad Canyon to Canyon Lake before draining into Lake Elsinore. Lake Elsinore is a natural endpoint for its tributaries, and has no natural outlet. Historically, the lake was known to dry completely; imported and recycled water are now used to maintain the water level. To provide a water outlet during heavy rains, Lake Elsinore was modified to allow overflow into Temescal Creek, which drains into the SAR.

Nutrients from sources such as septic systems, farming, and poor land use practices can cause significant algae growth in the lake, thereby impairing recreational use and degrading aesthetic values. Moreover, excessive algae growth in the lake depletes dissolved oxygen resulting in occasional fish kills.

Lake Elsinore and Canyon Lake Nutrient TMDL Task Force

In 2006, LESJWA administered the formation of a multi-agency task force to address nutrient TMDLs for Lake Elsinore and Canyon Lake. Over 20 agencies joined the task force to work with the Regional Board to implement new surface water quality regulations. Both lakes now have extensive stormwater and lake monitoring systems. Additional accomplishments for Canyon Lake include a lake quality management plan, evaluation studies on aeration systems, and a voluntary monitoring program for pathogens. This task force established one of the first TMDL agreements signed by federal, state, and local parties. This cooperative effort to address nutrients and pathogens enabled local agencies to combine efforts, economically address water quality challenges, and pursue additional grant funding for this process.

Lake Elsinore is on the 303(d) list as impaired for PCBs and unknown toxicity. Nutrient TMDLs for Lake Elsinore and Canyon Lake have been developed as shown in **Tables 5.2-8** and **5.2-9**. A Nutrient Source Assessment, a Nutrient Management Plan, and a Bacteria Source Assessment have been completed on Canyon Lake. The bacterial indicator TMDL for Canyon Lake may be revised by the Regional Board if the Stormwater Quality Standards Task Force's recommended change of the REC-1 Pathogen Standards from fecal coliform to E. coli is adopted into the Basin Plan. Should this change occur, Canyon Lake would be in compliance with REC-1 standards and taken off the 303(d) list.

Table 5.2-8 2006 CWA 303(d) List of Water Quality Limited Segments Requiring TMDLs – San Jacinto Watershed

Water Body	Pollutant/Stressor	Potential Sources	Proposed TMDL Completion
Lake Fulmor	Pathogens	Unknown nonpoint source	2019
Lake Elsinore	PCBs	Source unknown	2019
	Unknown toxicity	Unknown nonpoint source	2007

Table 5.2-9 TMDL Projects – San Jacinto Watershed

Impaired Water Body	Pollutant (s)	TMDL Project	Status
Canyon Lake (Railroad Canyon Reservoir)	Nutrients	Nutrient TMDLs for Lake Elsinore and Canyon Lake	Implementation Phase
	Pathogens	Bacterial Indicator TMDLs for Canyon Lake	Other Action
Lake Elsinore	Nutrients	Nutrient TMDLs for Lake Elsinore and Canyon Lake	Implementation Phase
	Organic Enrichment/ Low Dissolved Oxygen		

Lake Perris

Lake Perris, located in western Riverside County, is owned and operated by the California Department of Water Resources (DWR) and is the 2,000-acre terminal reservoir of the East Branch of the California Aqueduct (State Water Project). The lake is a source of water for the Metropolitan Water District of Southern California (MWDSC). Water quality concerns, including pathogens, taste and odors, algal toxins, and anoxia within the lake's bottom layer, have limited its use for water supplies.

Recreational activities at the lake include body-contact recreation such as swimming and water skiing and non-body contact activities such as boating, fishing, camping, and hiking. Over a million people visit each year, with an estimated 50 percent of the peak season visitors involved in body-contact recreation. Beach closures occur in spite of implementation of several BMPs aimed at reducing coliform levels.

The SWRCB provided funding to MWDSC to study microbial contamination at the lake. The studies concluded that body-contact recreation was a key source of fecal contamination and recommended voluntary alternatives to swimming in the lake, such as swim lagoons, water play areas and other water features. Modeling and risk analysis suggest that such alternatives would reduce the consumer health risk by one-half (to approximately a 5 percent probability of exceeding the U.S. EPA maximum risk level). A CALFED Science Panel in March 2005 concurred with the main findings of the report.

Santa Ana River Reaches 2 and 1 and Santiago Creek Watershed

Reach 2 extends from Prado Dam to 17th Street in the City of Santa Ana. In this reach, the OCWD recharges as much of the river water as possible into the Orange County groundwater basin. Reach 1 extends from 17th Street in the City of Santa Ana to the ocean. In Reach 1, the Talbert and Huntington Beach Channels drain urban and stormwater runoff from the western side of the Watershed carrying flow to the Talbert Marsh along the coast. The Greenville-Banning Channel drains the southeast side of the Watershed and carries flows to the SAR. This area also includes Huntington Beach State Park.

Although neither reach of the SAR is listed for any impairment, the river's main tributary in Orange County, Santiago Creek, has several impairments as does its tributary, Silverado Creek. Water quality impairments in this area are shown in **Table 5.2-10**.

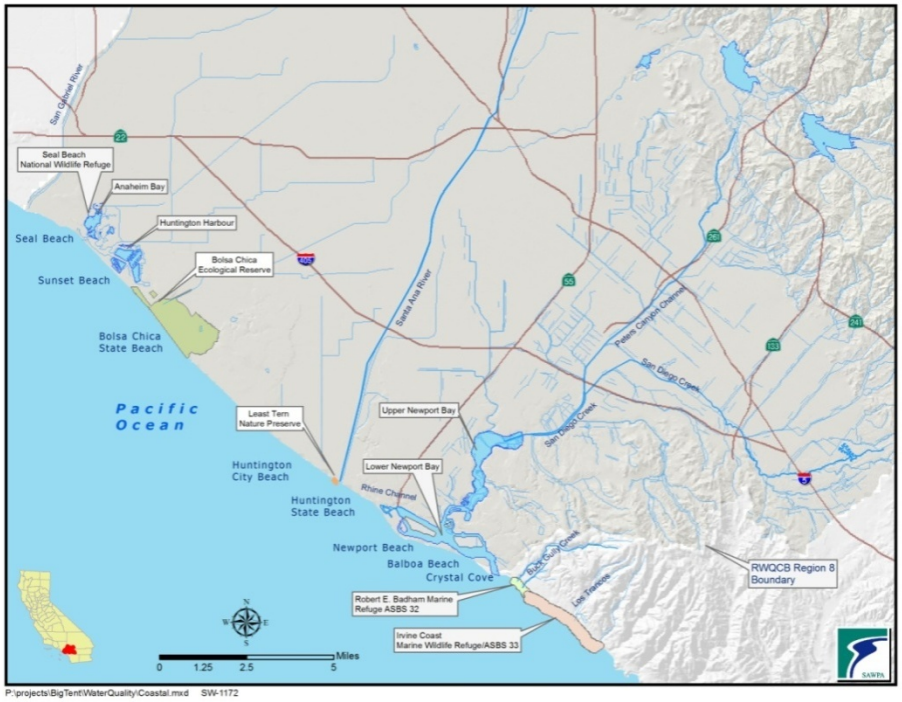
Table 5.2-10 2006 CWA 303(d) List of Water Quality Limited Segments Requiring TMDLs – Santa Ana River Watershed, Reaches 1 and 2

Water Body	Pollutant/Stressor	Potential Sources	Proposed TMDL Completion
Santiago Creek-Reach 4	Salinity, TDS, chlorides	Source unknown	2019
Silverado Creek	Pathogens, Salinity/TDS/ Chlorides	Unknown nonpoint source	2019
Huntington Beach State Park	Enterococcus indicator bacteria, PCBs	Source unknown	2019

West Orange County and Coastal Watersheds

This section discusses the water quality challenges facing coastal bays and harbors and coastal area tributary streams, as shown in **Figure 5.2-4**.

Figure 5.2-4 Coastal Area



San Gabriel River Watershed- Coyote Creek

The San Gabriel River Hydrologic Unit lies within Los Angeles and Orange Counties. Approximately 86 square miles are within Orange County. The area is drained by a number of tributaries to the San Gabriel River, including Coyote Creek and Carbon Creek that originate in the foothills of northern Orange County. This area is highly urbanized and dry weather urban runoff and wet weather stormwater runoff discharge pollutants into the river. Seal Beach is located just south of the mouth of the San Gabriel River and is impacted by local drainage as well as the water quality of the river. TMDLs for Coyote Creek are listed in **Table 5.2-11**.

Table 5.2-11 2006 CWA 303(d) List of Water Quality Limited Segments Requiring TMDLs – San Gabriel Watershed

Water Body	Pollutant/Stressor	Potential sources	Proposed TMDL Completion
Coyote Creek	Metals	Source unknown; nonpoint source	LARWQCB approved July 2006
	Toxicity	Point source	2008
	Coliform bacteria, diazinon, pH	Point, nonpoint source	2019
Seal Beach	Enterococcus, PCBs	Source unknown	2019

Anaheim Bay - Huntington Harbour Watershed

The Anaheim Bay-Huntington Harbor Watershed covers approximately 80 square miles in northwestern Orange County. One of its three tributaries, the Los Alamitos Channel, drains into the San Gabriel River. The Bolsa Chica Channel empties into the Anaheim Bay-Huntington Harbor complex. The East Garden Grove-Wintersburg Channel drains through Bolsa Bay into Huntington Harbor.

The Anaheim Bay-Huntington Harbor complex is located at the northwestern edge of Orange County. Cattle ranching, agriculture, and commercial port facilities preceded rapid urbanization in the 1940s. Discharges containing metals and pesticides from a variety of sources including boating-related activities; stormwater, urban, and agriculture runoff; and past historical inputs have negatively impacted water quality. Impairments in Anaheim Bay and Huntington Harbor are shown in **Table 5.2-12**.

Table 5.2-12 2006 CWA 303(d) List of Water Quality Limited Segments Requiring TMDLs – Anaheim Bay-Huntington Harbor Watershed

Name	Pollutant/Stressor	Potential Sources	Proposed TMDL Completion
Anaheim Bay	Dieldrin (tissue), nickel, PCBs, sediment toxicity	Source unknown	2019
Huntington Harbor	Chlordane, copper, lead, nickel, PCBs, sediment toxicity	Source unknown	2019
	Pathogens	Urban runoff, storm sewers	2019
Bolsa Chica State Beach	Copper, nickel	Source unknown	2019

Newport Bay Watershed

The Newport Bay Watershed covers approximately 152 square miles in central Orange County draining into Upper Newport Bay. San Diego Creek drains 80 percent of the Watershed, with Santa Ana Delhi Channel draining 15 percent.

San Diego Creek

San Diego Creek Reach 1 and Reach 2 impairments and TMDL projects are listed in **Tables 5.2-13** and **5.2-14**. The TMDLs include all San Diego Creek tributaries.

Table 5.2-13 TMDL Projects - Newport Bay/San Diego Creek Watershed

Impaired Water Body	Pollutant	TMDL Project	Status
San Diego Creek-Reach 1	Metals	San Diego Creek and Newport Bay Metals TMDLs	Technical TMDLs
	Nutrients	Nutrient TMDL for the Newport Bay-San Diego Creek Watershed	Implementation Phase
	Pesticides	San Diego Creek-Newport Bay Organochlorine Compounds TMDLs	Technical TMDLs
		Diazinon and Chlorpyrifos TMDL for San Diego Creek and Upper Newport Bay	Implementation Phase
	Siltation	Sediment TMDL for the Newport Bay-San Diego Creek Watershed	Implementation Phase
San Diego Creek-Reach 2	Metals	San Diego Creek-Newport Bay Metals TMDL	Technical TMDLs
	Nutrients	Nutrient TMDL for the Newport Bay-San Diego Creek Watershed	Implementation Phase
	Siltation	TMDL for Sediment in the Newport Bay-San Diego Creek Watershed	Implementation Phase
	Unknown toxicity	Addressed by metals and organochlorine TMDLs	

Table 5.2-14 2006 CWA 303(d) List of Water Quality Limited Segments Requiring TMDLs – Newport Bay/San Diego Creek Watershed

Name	Pollutant/Stressor	Potential Sources	Proposed TMDL Completion
San Diego Creek-Reach 1	Selenium	Source unknown	2007
	Fecal coliform	Urban runoff, storm sewers, other urban runoff	2019
	Toxaphene	Source unknown	2019
San Diego Creek-Reach 2	Metals	Urban runoff/storm sewers	2007
Peters Canyon-Channel	DDT, Toxaphene	Source unknown	2019

Newport Bay

San Diego Creek flows into Upper Newport Bay. The bay is a unique area containing a fragile coastal ecosystem that is designated as a State Ecological Reserve. Newport Bay is divided into two distinct areas. The 750-acre Upper Bay begins at the Pacific Coast Highway Bridge and extends five miles inland. The Lower Bay encompasses the area below the bridge and includes the Rhine Channel; it is separated from the ocean by Balboa Peninsula.

Upper Newport Bay (CCA No. 69)

Upper Newport Bay, a Critical Coastal Area (CCA) with a significant ecosystem, is the receiving waters for impaired flows emanating from the San Diego Creek Watershed. It supports seven diverse estuarine habitats with several hundred species of marine and terrestrial flora and fauna including six federal and state listed, threatened, and endangered species (five bird species, one plant species). The Bay's fish diversity is rated as the highest of the seven major coastal embayments between San Diego and Point Conception; it provides critical habitat for commercially and ecologically important species, such as California halibut, sand bass, gobies, topsmelt, and anchovy. Impairments and TMDL projects for Upper Newport Bay are listed in **Tables 5.2-15** & **5.2-16**.

Table 5.2-15 2006 CWA 303(d) List of Water Quality Limited Segments Requiring TMDLs – Newport Bay/San Diego Creek Watershed

Name	Pollutant/Stressor	Potential Sources	Proposed TMDL Completion
Newport Bay, Lower	Copper	Source unknown	2007
	Chlordane, DDT, PCBs, sediment toxicity	Source unknown	2019
Newport Bay, Upper (Ecological Reserve)	Copper	Source unknown	2007
	Chlordane, DDT, metals, PCBs, sediment toxicity	Source unknown	2019
Rhine Channel	Copper, lead, mercury, PCBs, sediment toxicity, zinc	Source unknown	2019
Balboa Beach	DDT, dieldrin, PCBs	Source unknown	2019

Lower Newport Bay and Rhine Channel

The Lower Newport Bay with two main channels is a small boat harbor berthing 9,000 boats. The Rhine Channel is located at the western end of lower Newport Bay. It has been designated by the Regional Board as one of Orange County's hot spots for toxic sediments. Years of operating canneries, metal plating companies, and shipyards deposited PCBs, mercury, and other pollutants in the channel. Several studies have documented contamination in the channel. Impairments and TMDL projects in the Lower Bay and Balboa Beach are listed in **Tables 5.2-15** & **5.2-16**.

Table 5.2-16 TMDL Projects - Newport Bay Watershed

Name	Pollutant/ Stressor	Potential Sources	Status
Newport Bay, Lower	Metals	Organochlorine Compounds and Metals TMDL, Lower Newport Bay: Rhine Channel	Technical TMDLs
		San Diego Creek and Newport Bay Metals TMDLs	
		Newport Bay-an Diego Creek Selenium TMDLs	
	Nutrients	Nutrient TMDL for the Newport Bay-San Diego Creek Watershed	Implementation Phase
	Pathogens	TMDL for Fecal Coliform Bacteria in Newport Bay	Implementation Phase
	Pesticides/Priority Organics	San Diego Creek-Newport Bay Organochlorine Compounds TMDLs	Technical TMDLs
		Organochlorine Compounds and Metals TMDL, Lower Newport Bay: Rhine Channel	
	Siltation	TMDL for Sediment in the Newport Bay-San Diego Creek Watershed	Implementation Phase
Newport Bay, Upper (Ecological Reserve)	Metals	San Diego Creek and Newport Bay Metals TMDLs	Technical TMDLs
		Newport Bay-San Diego Creek Selenium TMDL	
	Nutrients	Nutrient TMDL for the Newport Bay/San Diego Creek Watershed	Implementation Phase
	Pathogens	TMDL for Fecal Coliform Bacteria in Newport Bay	Implementation Phase
	Pesticides	Diazinon and Chlorpyrifos TMDL for San Diego Creek and Upper Newport Bay	Implementation Phase
		San Diego Creek-Newport Bay Organochlorine Compounds TMDLs	Technical TMDLs
	Siltation	TMDL for Sediment in the Newport Bay-San Diego Creek Watershed	Implementation Phase

Newport Bay Watershed Toxics TMDLs

In addition to SWRCB TMDLs, the U.S. EPA has also promulgated Toxics TMDLs in the Newport Bay Watershed. U.S. EPA established technical TMDLs (without implementation plans) for toxic pollutants in San Diego Creek and Newport Bay on June 14, 2002. Regional Board staff is developing the State required Basin Plan amendments, including implementation plans. These TMDLs are listed in **Table 5.2-17**.

Table 5.2-17 Newport Bay Watershed Toxics TMDLs

Water Body	Element/Metal	Organic Compound
San Diego Creek	Cd, Cu, Pb, Se, Zn	Chlorpyrifos, Diazinon, Chlordane, Dieldrin, DDT, PCBs, Toxaphene
Upper Newport Bay	Cd, Cu, Pb, Se, Zn	Chlorpyrifos, Chlordane, DDT, PCBs
Lower Newport Bay	Cu, Pb, Se, Zn	Chlordane, Dieldrin, DDT, PCBs
Rhine Channel	Cu, Pb, Se, Zn, Cr, Hg	Chlordane, Dieldrin, DDT, PCBs

Newport Coastal Streams Watershed

The Newport Coastal Streams Watershed encompasses approximately eight square miles south of the Newport Bay Watershed. Several coastal canyons drain this area directly into the ocean, into two ASBS. Both Buck Gully and Los Trancos Creeks are listed as impaired for fecal coliform and total coliform, as shown in **Table 5.2-18**. The City of Newport Beach conducted a study of the water quality of eight coastal canyon creeks (Newport Coast Flow and Water Quality Assessment Final Report, January 2007) to determine if conditions protect beneficial uses and to investigate sources of water quality impairments

Table 5.2-18 2006 CWA 303(d) List of Water Quality Limited Segments Requiring TMDLs

Name	Pollutant/Stressor	Potential Sources	Proposed TMDL Completion
Buck Gully Creek and Los Trancos (Crystal Cove Creek)	Fecal coliform, total coliform (downstream of Pacific Coast Highway)	Source unknown	2019

Nitrogen and Selenium Management Plan

Nitrogen is an essential nutrient that causes algal blooms when present in excessive quantities. Selenium is a naturally occurring substance that is found in ancient marine sediments in the foothills of Newport Bay Watershed. When selenium is released to surface water bodies, such as by groundwater discharge, it accumulates in the food chain to levels that can be harmful to fish and birds.

In renewing the region-wide permit for discharges that pose an insignificant (de minimus) threat in 2003, the Regional Board issued a separate de minimus permit for the Newport Bay Watershed for short term groundwater-related discharges. The concern was that high levels of nitrogen and selenium in groundwater discharges would violate established TMDLs. The Regional Board recognized that numerical effluent limits for selenium would be difficult if not impossible to meet as there is no technically feasible treatment technology available for short term groundwater discharges. Instead, the Regional Board established a working group to develop a comprehensive understanding of and a management plan for controlling levels of selenium and nitrogen in groundwater discharges. The participating Watershed stakeholders agreed to fund and implement the Nitrogen and Selenium Management Plan which is scheduled to be completed in 2009.

Current Management Strategies for Surface Water

As described in the previous sections, regulatory efforts aimed at maintaining and improving surface water quality and cleaning up poor quality water are based on implementing the Basin Plan. Non-regulatory approaches are also being implemented to protect and improve water quality.

Attaining water quality standards is a framework identified in the federal Clean Water Act and its associated regulations, and includes four components:

- Protecting beneficial uses.
- Attaining water quality objectives to protect beneficial uses.
- Implementing the State and Federal anti-degradation policies.
- Executing the Implementation Plan.

The approaches available to manage surface water quality include managing urban runoff through municipal NPDES permits, developing Drainage Area Management Plans (DAMP) and water quality management plans for new development and redevelopment, and encouraging low impact development. Protection of surface waters also can be achieved through construction of wetlands, implementing BMPs, using brine lines, and building and operating appropriate wastewater treatment facilities. These tactics are listed in **Table 5.2-19**.

Table 5.2-19 Surface Water Quality Goals, Strategies, and Tactics

Goal	Strategies	Tactics
• Water Quality Standards attained (includes California Toxics Rule)	• Protect good surface water quality • Clean up poor quality surface water • Re-evaluate water quality standards where appropriate	• Monitoring water quality • Protecting source water • Wastewater treatment by publicly owned treatment works (POTWs): source control, tertiary treatment, and nutrient removal • Urban runoff management • NPDES permits for other dischargers such as dewatering operations • TMDLs • Brine lines • BMPs that include constructed wetlands • Research • Public outreach

Stormwater Quality Standards Task Force

As a follow up to the 2002 triennial review of the Basin Plan, the Stormwater Quality Standards Task Force was convened with representatives from major water, wastewater, and stormwater management agencies, environmental groups, the Regional Board and U.S. EPA. Funding for the effort was provided by the stormwater programs of Orange, Riverside, and San Bernardino Counties; SAWPA; and the OCSD.

The Task Force has met regularly since 2003 to evaluate key issues related to beneficial use designations and water quality objectives for water contact recreation. These issues include: 1) the definitions of body contact recreation (e.g., swimming) and non-contact recreation (e.g., beachcombing) beneficial uses; 2) the factors that should be considered in setting WQOs for body contact and non-body contact recreation beneficial uses; and 3) Surveying water bodies in the Watershed with body contact beneficial use designation to assess the level of use.

The Task Force implemented a program to monitor the frequency and nature of activity associated with specific water bodies. Digital cameras were installed to record images of the water bodies at 15-minute intervals. These records, totaling over 100,000 images, provided an unprecedented record of the incidence of water contact recreation in a number of water bodies. Some sites with limited access and highly engineered concrete-lined channels had essentially no body contact recreation, while other sites with better access and more attractive conditions had documented evidence of recreational use.

One of the guiding principles of the Task Force is that efforts to protect and improve water quality should be targeted to achieve the greatest public health benefit, especially in areas where people come in contact with the water. The recommendations of the Task Force currently are being reviewed with the Regional Board.

Future Water Quality Issues

In addition to addressing present water quality problems in the Santa Ana River Watershed, regulators and stakeholders will likely face new challenges including:

- Establishing new pathogen indicators.
- Reevaluating water quality standards to assure that limited resources are allocated appropriately.
- Amending the Basin Plan including additions to the 303(d) list.
- Setting new residual chlorine objectives.
- Establishing nutrient objectives.
- Setting new statewide sediment toxicity standards.
- Addressing constituents of emerging concern.
- Managing sediment loading.
- Encouraging appropriate low-impact development.
- Evaluating the effects of water use efficiency on wastewater treatment plants and recycled water.
- Remediating pollution from septic systems.

Existing Management Plans

A variety of water quality management plans have been prepared within the Watershed. This section discusses existing plans.

Santa Ana Integrated Watershed Plan, 2005 update

SAWPA's Santa Ana Integrated Watershed Plan discusses the resources of the Santa Ana River Watershed including hydrogeology, land use, biological resources, water supply, water quality, flood control, and demographics. This Plan presents integrated regional watershed management strategies including water storage, water quality improvements, water recycling, flood protection, wetlands, environment and habitat, as well as recreation and conservation. A recommended regional implementation plan also is presented and includes regional priorities, impacts and benefits, institutional structure, schedule, and monitoring performance. The plan was prepared by SAWPA and funded by SAWPA member agencies.

Upper Santa Ana River Watershed IRWMP (November 2007)

The Upper Santa Ana Water Resources Association members, lead by the San Bernardino Valley Municipal Water District (Valley District), prepared the Upper Santa Ana River Watershed IRWMP to address water management issues in the Upper Santa Ana River Watershed. This plan aims to evaluate water management opportunities, improve water supply reliability, reduce dependence on and optimize the use of imported water, and assist local agencies to optimize management and protection of water resources in the region. This plan's objectives include improving surface and groundwater management, water supply reliability, the quality of surface water and groundwater

resources, and ecosystem and environmental restoration. This plan was funded in part by the State of California Proposition 50 IRWMP Planning Grant and by local funding sources.

Western Municipal Water District, IRWMP (October 2006)

Western Municipal Water District prepared their IRWMP to evaluate water management alternatives, address long range water supply planning to meet future demands, and increase system reliability as the amount of available supply of imported water becomes less certain. This plan was funded in part by the State of California Proposition 50 IRWMP Planning Grant and by local funding sources.

This IRWMP identifies and evaluates management strategies that aim to increase local water supplies and to address local and regional water quality concerns. The report focuses predominately on projects that result in an increase in available local water supplies. Projects were ranked with an emphasis on those with regional benefits and based on total percent of demand met. A plan for water conservation also was included.

San Jacinto River IRWMP (December 2007)

Water resources in the SJR Watershed are particularly important due to high demand from urban, agricultural, and recreational users. The nutrient TMDL for Canyon Lake and Lake Elsinore, as well as NPDES stormwater permits are regulatory drivers for improved management of water resources. The IRWMP area consists of the SJR Hydrologic Unit. Most of the Watershed falls within Riverside County; with only a small portion extending into Orange County. The SJR, Salt Creek, Perris Valley Storm Drain, Mystic Lake, Perris Reservoir, Canyon Lake, and Lake Elsinore are the dominant hydrologic features in the Watershed. Through a collaborative process, the SJR IRWMP was developed and led by the San Jacinto River Watershed Council (SJRWC) with financial assistance from the State of California Proposition 50 Grant and in-kind support and input from a number of member and partnering agencies.

Chino Creek Integrated Plan (2006)

The Chino Creek Integrated Plan was prepared by a broad stakeholder group and administered by the Inland Empire Utilities Agency (IEUA). This plan focuses attention on the lower Chino Creek area as a step in the process of preserving and restoring the Prado Basin. IEUA, with a grant from SWRCB, technical support from OCWD, and funding from the City of Chino, worked with stakeholders over the course of four years to prepare the plan.

Integrated Plan goals were identified as implementable, multi-barrier strategies aimed at reducing pollutants and providing multi-purpose opportunities such as constructing treatment wetlands and natural flood control technologies. Recommended projects identified in the Integrated Plan aim to create recreational linkages, provide public education, develop sustainable development projects for the built environment, preserve habitat, and environmental restoration.

North Orange County Watershed Management Area IRWMP

With a wide range of stakeholders, the County of Orange is preparing the North Orange County Watershed Management Area (WMA) IRWMP. This IRWMP will be used to guide watershed management programs and support the region in pursuing funding opportunities. The plan's objectives will include:

- Protecting and enhancing water quality in the region, including current and planned TMDLs.
- Enhancing local water supplies.
- Promoting flood management.
- Enhancing wetlands.
- Addressing runoff and its related impacts from existing and future and uses.
- Enhancing public education programs.
- Reducing invasive species and enhance habitat.
- Promoting environmental justice.

Coyote Creek Watershed Management Plan (January 2007)

The Coyote Creek Watershed Management Plan provides a blueprint for improving the health of the Watershed through multi-objective projects, policies, and site design guidelines. Rather than focusing on the ecological problems that have resulted from piecemeal management of land and water resources, it serves as a user guide on how to improve the management of the Watershed for maximum social, economic, and environmental benefit.

Central Orange County Integrated Regional Water Management Plan (COC IRWMP)

The County of Orange led the first Integrated Regional Water Management effort for the Central Orange County Watershed Management Area (WMA) which culminated in the production of the Phase I Central Orange County IRWM Plan (IRWMP). The Phase I IRWMP was undertaken to provide a bridge between existing and developing watershed planning efforts, allowing for more effective collaboration and greater opportunity to leverage agency resources across jurisdictions. It had a strong emphasis on the sensitive coastal resources, Areas of Special Biological Significance and Critical Coastal Areas (CCAs) that are located within the Central Orange County WMA. The Phase I IRWMP was also developed to meet Proposition 50 priorities. The Phase I IRWMP was integral to subsequent watershed planning efforts led by the City of Newport Beach.

In January 2006, the City of Newport Beach was awarded a planning grant by the State Water Board through Proposition 40 for preparation of an Integrated Coastal Watershed Management Plan (ICWMP) to address ASBS and CCA issues along Newport Coast. Much of the material in the ICWMP was used during the preparation of the Phase I Central Orange County IRWMP. In May 2006, the City of Newport Beach was awarded a second planning grant by the California Department of Water Resources through Proposition 50 for the preparation of an IRWMP for the Newport Bay Watershed including data collection, analysis, and formulation of policy and guidelines. Though building on some new elements, this Phase II effort incorporated the Phase I Central Orange County IRWMP.

The County of Orange is currently leading an effort to complete Phase III of the Central Orange County IRWMP. Phase III will be a compilation and revision of the first two IRWMPs; the information contained in the Phase I and Phase II plans will form the basis of the Phase III plan. The purpose of the Central Orange County IRWM Plan is to provide a local plan that bridges the gap between existing and developing watershed planning efforts, allowing for more effective collaboration and greater opportunity to leverage agency resources across jurisdictions. Extensive water resource program development and implementation has occurred in this region over the past three decades, with agency partnerships, agreements, and the formation of a formal stakeholder involvement structure. The water quality issues are daunting; within this region there are eight waterbody segments listed on the State Water Resources Control Board 2006 Section 303(d) list and there are five Total Maximum Daily Loads (TMDLs) for nutrients, fecal coliform, sediment, toxics, and organophosphate pesticides, with more TMDLs pending. Water quality has been the overarching issue that has brought the water resource and land use agencies, environmental groups, and other stakeholders within the region together in the spirit of collaboration. Public agencies and private interests have entered into numerous cooperative agreements to leverage financial resources for the development of programs that implement studies, best management practices (BMPs), and other control measures consistent with regulatory requirements and regional goals for watershed conditions. These water quality-related projects and programs have not been undertaken with a narrow focus or single purpose; the stakeholders within this region, both public and private, understand the nexus between growth, land use decisions, water resource management, and watershed impacts. This region has experienced significant population growth over the past 20 years, with development of former agricultural lands and increased numbers of people in the established urban areas. In addition to addressing water quality issues, the water and wastewater agencies have established partnerships to develop local resources, including groundwater and recycled water, to ensure a reliable source of water supply and to minimize the need for imported water. Public agencies and private entities have implemented a broad range of multi-purpose projects and programs to protect and enhance watershed conditions. The IRWM Plan builds on this history of successful collaboration and furthers the interests of the stakeholders through this integrated planning approach.

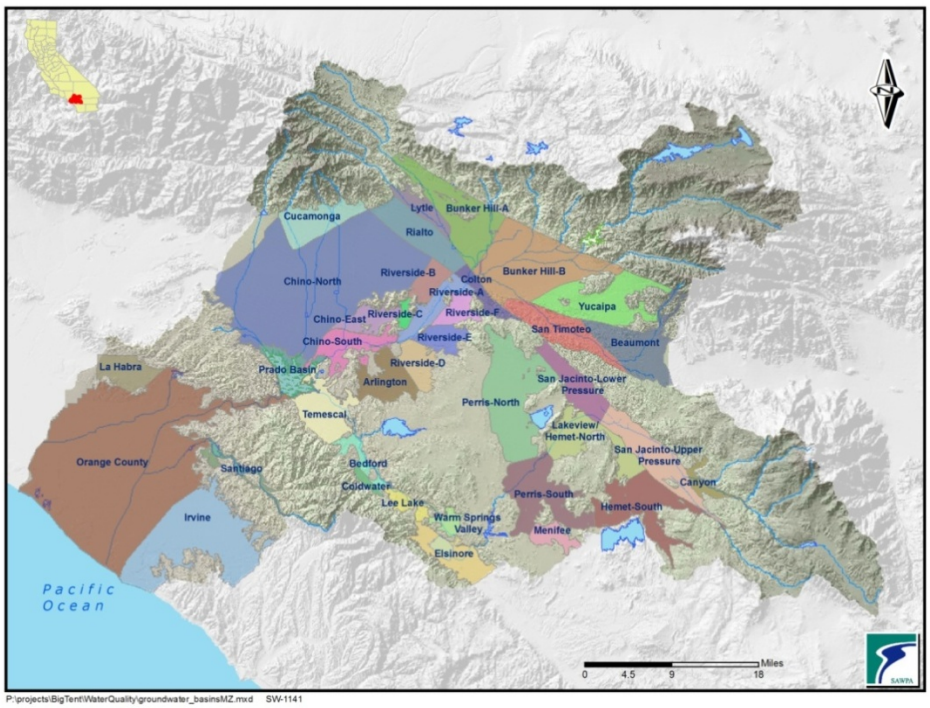
Groundwater

Groundwater is a major source of water supply in the Watershed. Protection of this source is critical to maintain the viability of local water supplies. The Basin Plan identifies 39 groundwater management zones in the Santa Ana River Watershed as shown in **Figure 5.2-5**.

Basin Plan amendments that were approved by the Regional Board in 2004 provide a comprehensive, watershed approach to controlling nitrogen and TDS in the Watershed, while also encouraging water recycling and reuse.

This section describes the TDS and nitrate-nitrogen WQOs and current ambient water quality. Ambient water quality, as defined here, is based on the twenty year period ending in 2006. Where the ambient water quality is better than the WQO, this increment is referred to as the assimilative capacity.

Figure 5.2-5 Santa Ana River Watershed: Groundwater Management Zones

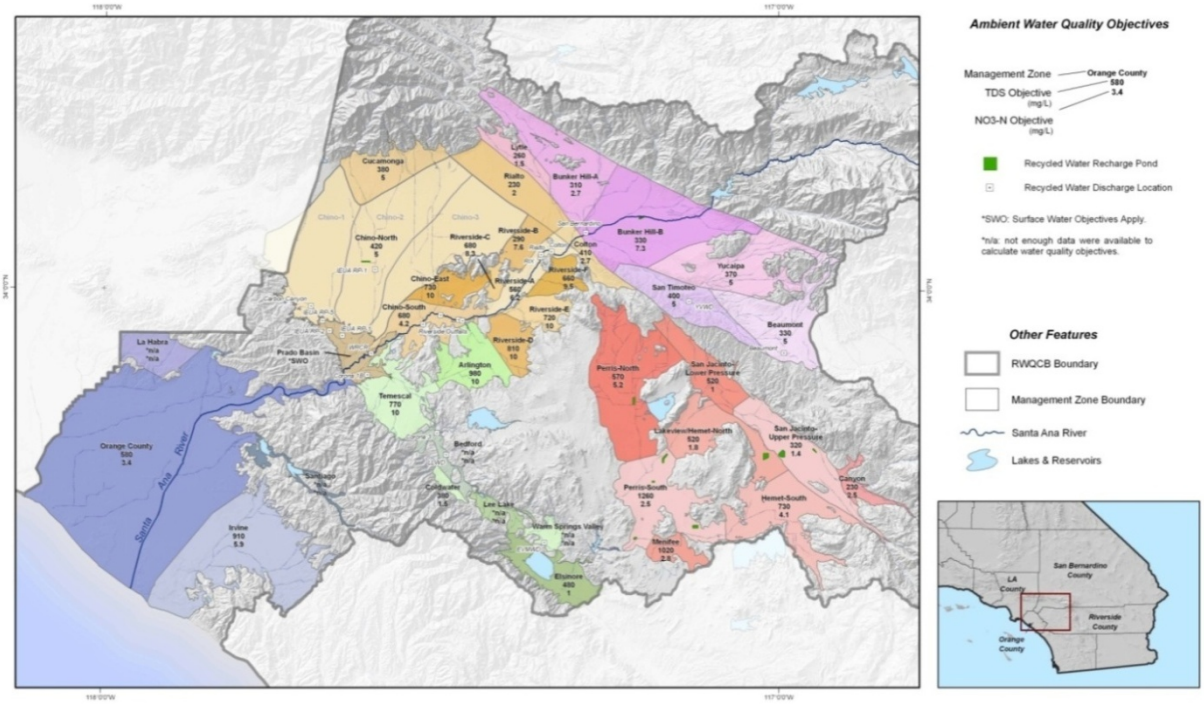


All but five groundwater management zones in the Watershed have TDS and nitrate WQOs identified in the Basin Plan. In this discussion, the groundwater management zones are grouped as follows:

- Upper Santa Ana River Basin
- Chino Basin
- Middle Santa Ana River Basin
- San Jacinto River Basin
- Lower Santa Ana River Basin

The Basin Plan requires that concentrations of TDS and nitrate in each groundwater management zone be estimated every three years. These ambient conditions are compared to the WQOs to determine the amount of assimilative capacity in each zone. In areas where there is no assimilative capacity, the Regional Board will not permit waste discharges that degrade water quality. **Figure 5.2-6** shows the ambient WQOs for TDS and nitrates in groundwater management zones. Ambient water quality for the years 1987-2006 for nitrates is shown in **Figure 5.2-7** and for TDS in **Figure 5.2-8**.

Figure 5.2-6 Ambient Water Quality Objectives



Current Conditions

High salt and nitrate concentrations are two long-standing groundwater quality issues in the SAR Watershed. Sources of elevated levels include mineral content in the sediments, recharge and drainage patterns, source water quality, irrigation, wastewater discharges, and historic land use. Managing levels of TDS in groundwater basins is a significant challenge as the recycling of waste water increases in the Watershed. Each cycle of residential water use typically adds approximately 200 mg/L of salt to the water. Industrial and commercial operations may contribute higher levels. Construction and use of salinity management facilities, such as brine lines and desalters, are being used to prevent salt-build up and to remediate high TDS groundwater basins.

Figure 5.2-7 Ambient Water Quality Objectives 1987-2006 – Nitrates

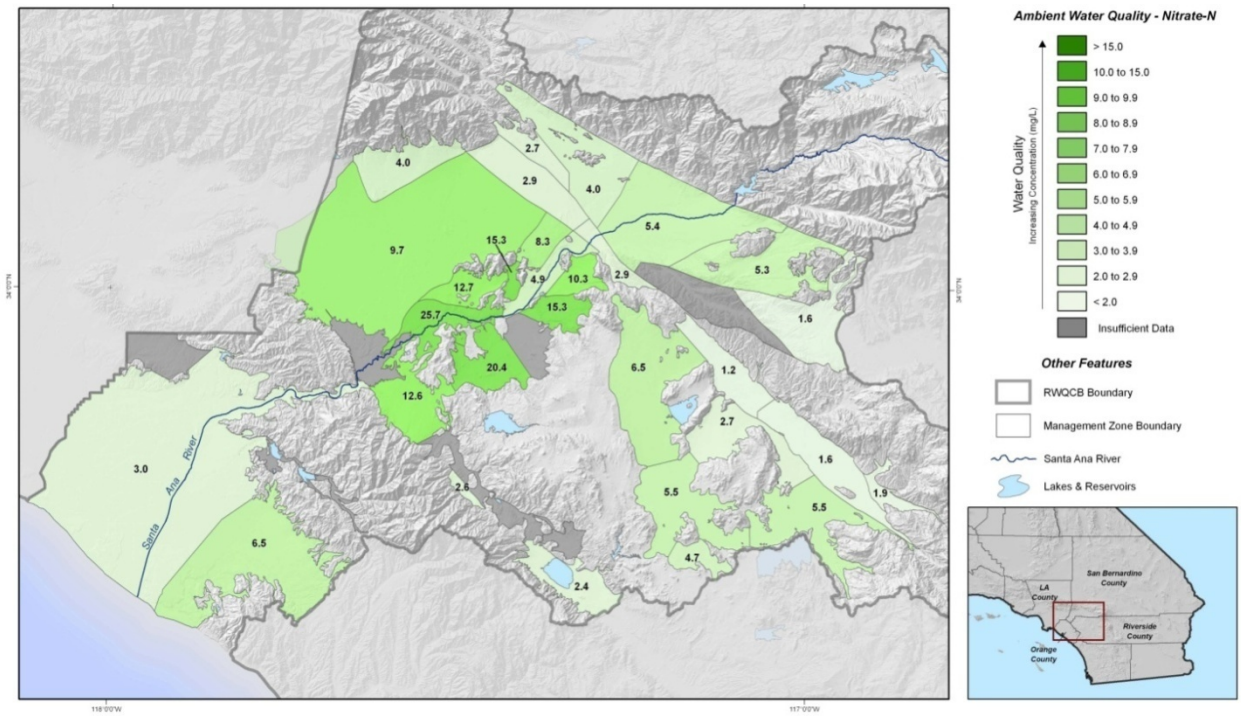
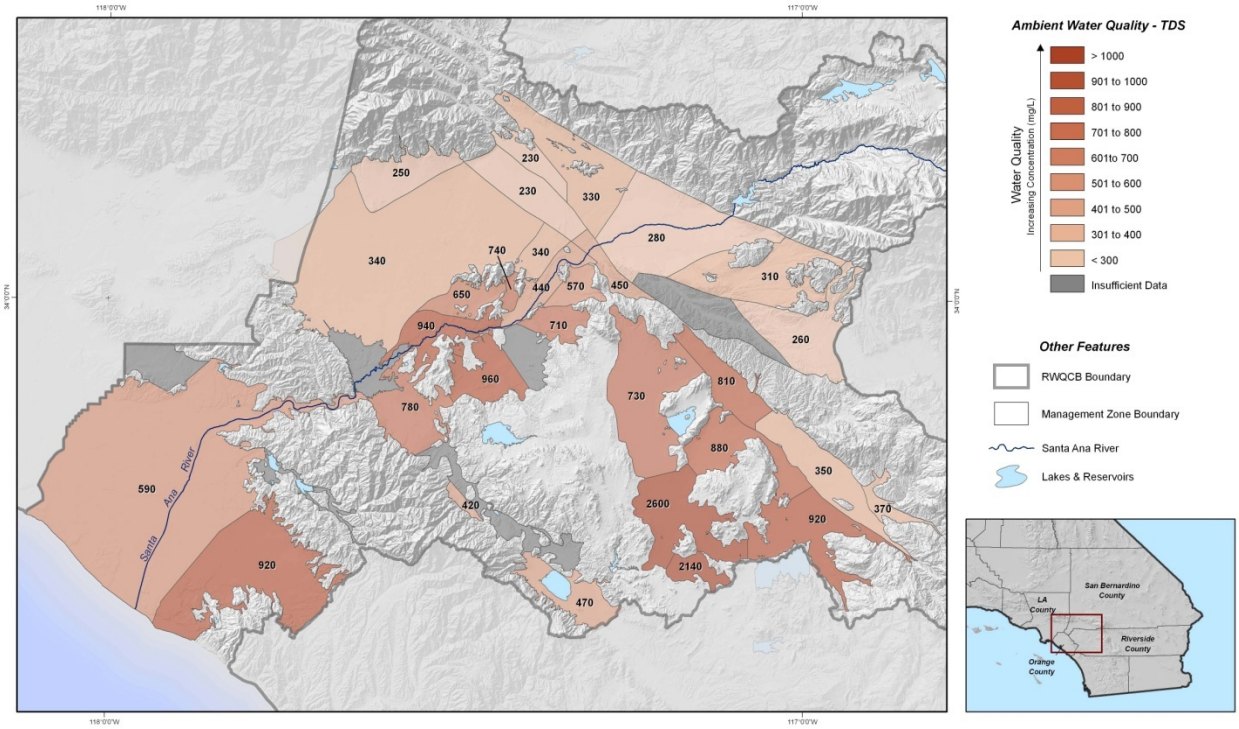


Figure 5.2-8 Ambient Water Quality Objectives 1987-2006 – TDS



Elevated levels of nitrates in groundwater originate primarily from use of fertilizers, confined animal feedlots, and waste water treatment facilities. Areas with elevated nitrates (nitrate-nitrogen greater than the MCL of 10 mg/L, using the ambient water quality statistics) in groundwater are shown in **Figure 5.2-9**.

Approximately 25 years ago, volatile organic compounds (VOCs) were discovered in groundwater in some areas. More recently, contamination due to perchlorate has become a major concern in some portions of the Watershed. Areas with groundwater contamination above the primary MCLs for VOCs and perchlorate are shown in **Figure 5.2-10**.

Figure 5.2-9 Groundwater with Elevated Nitrate Levels

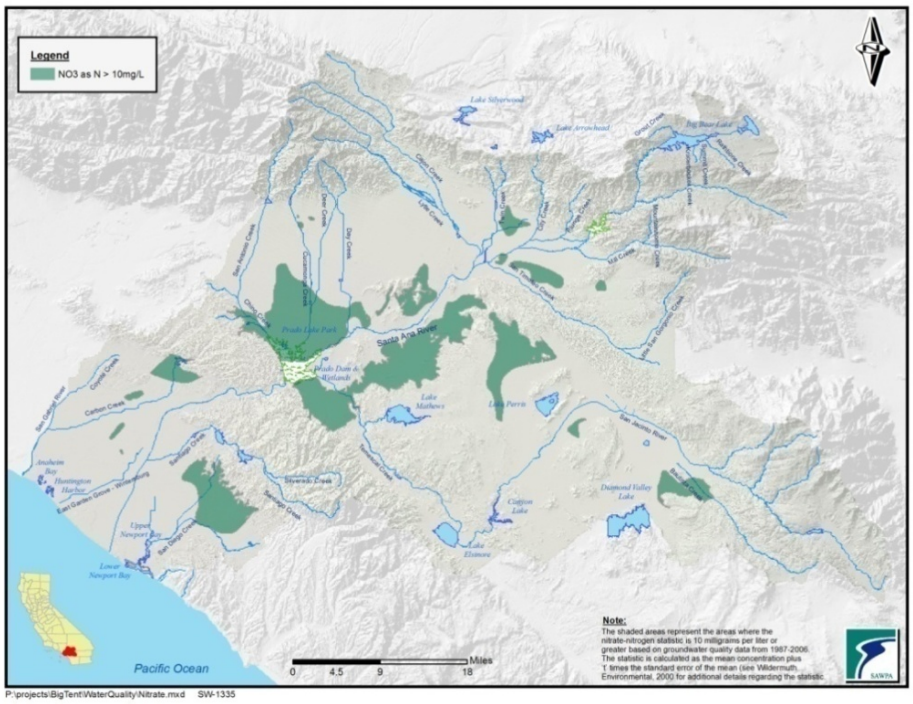
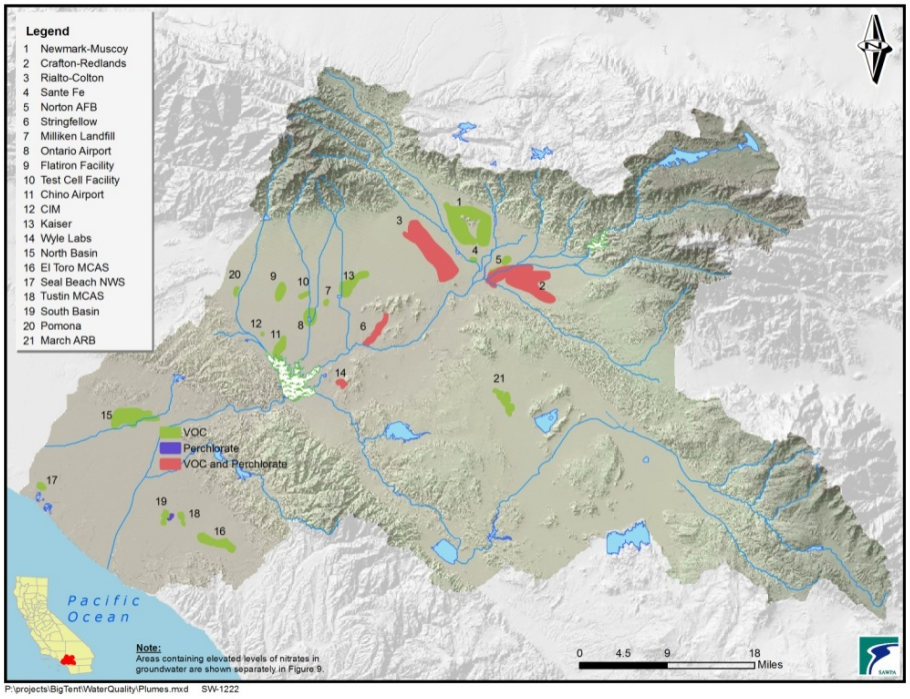


Figure 5.2-10 Groundwater Contamination Plumes



Upper Santa Ana River Basin

The Upper Santa Ana River Basin is divided into seven management zones. TDS and nitrate WQOs and current ambient water quality levels are summarized in **Table 5.2-20**.

In the Bunker Hill management zones, the largest area of groundwater contamination is the Newmark Superfund Site. Treatment plants are operating to remove VOC contamination. A total of thirteen extraction wells produce on average approximately 26,000 AFY, which is treated at the four treatment plants.

In the Bunker Hill B management zone, a six-mile long plume of VOC and ammonium perchlorate contamination, known as the Crafton-Redlands Plume, was first detected in the early 1980's. Approximately 46 drinking water wells have been affected. A number of well head treatment units and treatment plants to remove these contaminants are being operated by the Cities of Redlands, Loma Linda and Riverside.

Cherry Valley is an unincorporated area located northeast of the City of Beaumont, in the Beaumont management zone. The community is not served by a sanitary sewer system. The only source of drinking water for the community is the groundwater. A study commissioned by the San Timoteo Watershed Management Authority indicated an ongoing degradation of the quality of the groundwater due to nitrate. The source of the nitrate was attributed to the onsite waste treatment systems, *i.e.*, septic systems.

Table 5.2-20 Water Quality Objectives for Upper Santa Ana River Basins

Management Zone	TDS		Nitrate-nitrogen	
	Water Quality Objective (mg/L)	Ambient Quality (mg/L)	Water Quality Objective (mg/L)	Ambient Quality (mg/L)
Big Bear Valley	300	NA	5.0	NA
Beaumont	330	260	5.0	1.6
Bunker Hill A	310	330	2.7	4.0
Bunker Hill B	330	280	7.3	5.4
Lytle	260	230	1.5	2.7
San Timoteo	400	NA	5.0	NA
Yucaipa	370	310	5.0	5.3

Source: Wildermuth Environmental (2008)

Table 5.2-21 Water Quality Objectives for Chino Basin and Rialto

Management Zone	TDS		Nitrate-nitrogen	
	Water Quality Objective (mg/L)	Ambient Quality (mg/L)	Water Quality Objective (mg/L)	Ambient Quality (mg/L)
Chino North	420	340	5.0	9.7
Chino East	730	650	10.0	12.7
Chino South	680	940	4.2	25.7
Colton	410	450	2.7	2.9
Cucamonga	380	250	5.0	4.0
Rialto	230	230	2.0	2.6

Source: Wildermuth Environmental (2008)

The County of Riverside has adopted three ordinances to ban new septic systems unless the systems are designed to remove 50 percent of the nitrogen in the discharged wastewater. Beaumont Cherry Valley Water District is in the process of providing sewer service to a major portion of the area and has applied for State Revolving Fund loans for the project.

Chino Basin, Cucamonga, and Rialto Management Zones

The Chino Basin is divided into three management zones. This section covers these three zones, and the adjacent Cucamonga, Colton, and Rialto management zones. The Basin Plan established "maximum benefit" and "anti-degradation" TDS and TIN water quality for the Chino and Cucamonga management zones as summarized in **Table 5.2-21**.

The Chino Basin is experiencing rapid commercial and residential development. The groundwater quality in the basin is generally good, with better groundwater quality found in the northern portion where recharge occurs. Salinity (TDS) and nitrate concentrations increase in the southern portion of

the Basin. Between 2001 and 2006, about 80 percent of the private wells south of Highway 60 had nitrate concentrations greater than the MCL. Pollution from point sources and emerging contaminants are concerns for the overall groundwater quality in Chino Basin. Constituents that have the potential to impact groundwater quality include VOCs, arsenic, and perchlorate.

Groundwater in several areas is impacted by elevated levels of perchlorate. Sources of perchlorate include the Stringfellow Acid Pits and Chilean nitrate fertilizer that was imported in the early 1900s for the citrus industry.

Newmark Cleanup Restores Groundwater Supplies

In 1980, the California Department of Health Services discovered the chlorinated solvents tetrachloroethylene (PCE) and trichloroethylene (TCE) in several municipal water supply wells in the northern San Bernardino/Muscoy region. Investigations into the extent of contamination led the U.S. EPA to place the area on the National Priorities List in 1989. This Superfund site was determined to contain two plumes originating from the same source near the site of a closed World War II Army site: an approximately eight-mile Newmark plume and an approximately six-mile Muscoy plume.

Contamination impacted 25 percent of the municipal water supplies for the City of San Bernardino. In addition, 75 percent of the water supplies for the City of Riverside downgradient of the contamination plume were threatened as were water supplies for the Cities of Colton, Loma Linda, Fontana, and Rialto.

The San Bernardino Municipal Water Department, in cooperation with the U.S. EPA, constructed thirteen extraction wells to contain the plume and treat the contaminated groundwater. As a result, 12 of the 20 contaminated wells were brought back into operation; clean up operations continue.

Pictured below is a façade house built around one of the extraction wells.

EPA Well 111 with façade house.

In the Rialto management zone, at least 20 wells providing 40,135 gallons per minute (gpm) of domestic water supply capacity to the Cities of Rialto and Colton, West Valley Water District and Fontana Water Company have been contaminated by perchlorate. Well head treatment is operating on 11 of these wells.

Arsenic at levels above the MCL appears to be limited to the deeper aquifer zone near the City of Chino Hills. Total chromium and hexavalent chromium, while currently not a groundwater issue for Chino Basin, may become so, depending on the promulgation of future standards.

Maximum Benefit Demonstrations in Santa Ana River Watershed

A successful template for groundwater quality management is the maximum benefit demonstration utilized in the Chino Basin and the Beaumont/Yucaipa basins. Stakeholders collaborated with the Regional Board to demonstrate that groundwater quality can be protected not solely based on historical quality (the "antidegradation" objectives). Instead, the Regional Board agreed to "maximum benefit" objectives to protect groundwater quality for the "maximum benefit to the people of the State".

In the Chino, Beaumont and Yucaipa basins, local stakeholders proposed programs to implement local cooperative projects such as groundwater desalination plants and expanded stormwater capture and recharge basins in order to protect groundwater basin quality and meet existing and downstream beneficial uses. Through an aggressive series of monitoring requirements, the State will be able to assure that water quality is protected. The antidegradation objectives are defined as the default condition if the commitments made to protect water quality are not attained. The success of this multi-agency approach to maximize the use of water resources while protecting water quality as defined by the SWRCB serves as a progressive water management and water quality protection example for other regions in the state, according to the SWRCB.

Middle Santa Ana River Basin

The management zones for the Middle Santa Ana River Basin are listed in **Tables 5.2-22** and **5.2-23**. Agriculture and dairy activities are suspected to be partially responsible for elevated salt and nitrate concentrations in the groundwater. As the population within the Riverside Basins continues to grow, homes, commercial centers, new industry, and warehouses are replacing agriculture and open space.

Several active sites in the City of Riverside's groundwater production system have increased monitoring schedules due to the presence of contaminants including: nitrate, PCE, dibromochloropropane (DBCP), and perchlorate. As a result, the City of Riverside has implemented blending plans, increased monitoring schedules, and installed well-head treatment to address these elevated levels. Blending plans also are being used to reduce nitrate levels in wells exceeding allowable limits.

Table 5.2-22 Water Quality Objectives for Riverside Area Management Zones

Management Zone	TDS		Nitrate-nitrogen	
	Water Quality Objective (mg/L)	Ambient Quality (mg/L)	Water Quality Objective (mg/L)	Ambient Quality (mg/L)
Riverside-A	560	440	6.2	4.9
Riverside-B	290	340	7.6	8.3
Riverside-C	680	740	8.3	15.3
Riverside-D	810	NA	10.0	NA
Riverside-E	720	710	10.0	15.3
Riverside-F	660	570	9.5	10.3

Source: Wildermuth Environmental (2008)

Table 5.2-23 Water Quality Objectives for Arlington, Elsinore, Corona Area

Management Zone	TDS		Nitrate-nitrogen	
	Water Quality Objective (mg/L)	Ambient Quality (mg/L)	Water Quality Objective (mg/L)	Ambient Quality (mg/L)
Arlington	980	960	10	20.4
Bedford	NA	NA	NA	NA
Coldwater	380	420	1.5	2.6
Elsinore	480	470	1.0	2.4
Lee Lake	NA	NA	NA	NA
Temescal	770	780	10.0	12.6

Source: Wildermuth Environmental (2008)

San Jacinto River Basin

Agricultural activities in the San Jacinto River Basin are suspected to be partially responsible for elevated salt and nitrate concentrations in the groundwater. Septic tank discharges are creating significant water quality problems that have triggered local agency and the Regional Board's regulatory response in the unincorporated areas of Quail Valley (north of Canyon Lake) and Enchanted Heights (west Perris). The basin is dotted with several other areas believed to be at risk of water quality degradation from septic systems. A septic system management plan has been developed by Riverside County Flood Control.

A Groundwater Salinity Management Program, developed by EMWD, addresses several water quality issues in this area. The Perris South Sub-basin contains a surplus of marginal to unusable quality groundwater that flows into the adjacent high quality Lakeview Sub-basin, rendering several wells unusable and threatening the remaining production of the basin. Due to the unavailability of imported water, blending to improve water quality is not an option. Therefore, three desalination facilities, two constructed and one being designed, will recover high TDS water in the Menifee and Perris South Groundwater Management Zones for potable use. In addition to

providing clean drinking water, the desalters will play a role in reducing the migration of brackish groundwater into areas of good quality groundwater.

Several active wells are operating with increased monitoring schedules due to the confirmed presence of various contaminants including nitrate, TCE, PCE, TDS, and other VOCs. The combined output of these wells is approximately 2.4 percent of EMWD's total water supply. The CDPH permits the blending of well water with imported water from MWDSC Mills Filtration Plant. Treatment is not required, and monitoring indicates no increase in contaminant levels over time. WQOs are shown in **Table 5.2-24**.

Table 5.2-24 Water Quality Objectives for San Jacinto River Basins

Management Zone	TDS		Nitrate-nitrogen	
	Water Quality Objective (mg/L)	Ambient Quality (mg/L)	Water Quality Objective (mg/L)	Ambient Quality (mg/L)
Canyon*	230	370	2.5	1.9
Hemet – South	730	920	4.1	5.5
Lakeview/Hemet-	520	880	1.8	2.7
Menifee	1020	2140	2.8	4.7
Perris – South	1260	2600	5.2	6.5
Perris – North	570	730	2.5	5.5
San Jacinto – Lower	520	810	1.0	1.2
San Jacinto – Upper**	320	350	1.4	1.6

Source: Wildermuth Environmental (2008)

Lower Santa Ana River Basin

The Lower Santa Ana River Basin contains four groundwater management zones: Orange County, Irvine, La Habra, and Santiago. The La Habra and Santiago Management Zones have minimal pumping and TDS and nitrate WQOs have not been established due to the scarcity of data. This section focuses on the Orange County and Irvine Management Zones, which are important sources of water in Orange County.

Orange County Groundwater Basin

The Orange County Groundwater Basin is the source of approximately 60 to 70 percent of the water supply for 2.3 million people. Of this total production, about 90 percent meets drinking water standards without treatment. The remaining 10 percent requires treatment for VOCs, salts, or other constituents. WQOs for nitrates and TIN/TDS are listed in **Table 5.2-25**.

A shallow VOC plume exists in the Anaheim/Fullerton area where VOC concentrations exceed MCLs over approximately six square miles. To address this plume, the North Basin Groundwater Protection Project is being designed to extract and treat VOC-contaminated groundwater and

recharge treated water back into the groundwater basin. Other VOC plumes exist in Orange, Santa Ana, the Seal Beach Naval Weapons Station, and the now closed Tustin Marine Corps Air Station. Various other sites have generally shallow VOC contamination or other contaminants. The Tustin desalters, using reverse osmosis and ion exchange, treat high TDS, nitrate, and perchlorate levels in a section of Tustin. Areas in Garden Grove have groundwater with high nitrate concentrations that are likely the result of historic agricultural practices.

Table 5.2-25 Water Quality Objectives for Lower Santa Ana River Basin Management

Management Zone	TDS		Nitrate-nitrogen	
	Water Quality Objective (mg/L)	Ambient Quality (mg/L)	Water Quality Objective (mg/L)	Ambient Quality (mg/L)
Orange County	580	590	3.4	3.0
Irvine	910	920	5.9	6.5
La Habra	NA	NA	NA	NA
Santiago	NA	NA	NA	NA

Source: Wildermuth Environmental (2008)

Irvine Management Zone

The Irvine Management Zone is a sub-basin of the Orange County Groundwater Basin. Water naturally flows between the boundaries but the operation of the Irvine Desalter limits movement of water between the two management zones.

Groundwater contaminated with VOCs exceeding MCLs from the now closed El Toro Marine Corps Air Station also contains high TDS and nitrate concentrations. The Irvine Desalter, using reverse osmosis, air stripping, and carbon absorption, was built to treat the contaminated water. Water treated for VOC contamination is distributed after treatment through the Irvine Ranch Water District non-portable system (irrigation and other non-potable uses); water treated for high TDS and nitrate is distributed through the potable system.

Current Management Strategies for Groundwater

Three goals are defined for groundwater quality. These goals are:

- Attaining water quality standards.
- Meeting drinking water standards.
- Achieving salt and nutrient balances.

Attaining water standards is a framework identified in the federal Clean Water Act and its associated regulations, and includes four components:

- Protecting beneficial uses.
- Attaining water quality objectives to protect beneficial uses.
- Implementing the State and Federal anti-degradation policies.
- Executing the Implementation Plan.

Meeting drinking water standards will require the attainment of both maximum contaminant levels for primary drinking water contaminants and secondary drinking water standards. Goals for improving groundwater quality and protecting groundwater supplies also include achieving a salt and nutrient balance. Strategies and tactics to achieve these goals are listed in **Table 5.2-26**.

Table 5.2-26 Groundwater Quality Goals, Strategies, and Tactics

Goals	Strategies	Tactics
• Water Quality Standards attained • Drinking water standards (DWS) met • Salt and nutrient balance achieved	• Protect good quality groundwater • Clean up poor quality groundwater • Re-evaluate water quality standards where appropriate	• Monitoring, assessment & reporting • Source water protection programs • Pollutant source identification & control • Groundwater treatment Pump and treat for local plumes Wellhead treatment (e.g., for arsenic) Desalters • Brine lines • Recharge of recycled, stormwater & imported water • Research • Public outreach

Existing Groundwater Management Plans

2005 Regional Groundwater Management Plan

A Regional Groundwater Management Plan was prepared by SAWPA in 2005. SAWPA is not directly responsible for managing groundwater basins in the Watershed. However, the agency coordinates numerous groundwater management planning efforts within the Watershed. This plan describes the water and groundwater management plans in the Santa Ana River Watershed.

Upper Santa Ana Basin Plans

In 2005, the Upper Santa Ana Water Resources Association developed an Integrated Regional Groundwater Management Plan (IRGM Plan) to address major water management issues for the communities of the Upper Santa Ana River Watershed. Valley District led the planning effort. The plan developed a process for managing the San Bernardino Basin Area and identified proposed regional projects. The two management objectives were to improve water reliability during drought periods and reduce liquefaction, and to protect water quality and maximize conjunctive use opportunities. Computer models were used to evaluate the various water management strategies.

San Jacinto Basin Plans

The West San Jacinto Groundwater Basin Management Plan was adopted in 1995. Annual reports on the status of groundwater and water resources efforts in the area have been published since 1996. The 2007 Annual Report compiled, reviewed, evaluated, and analyzed 2007 groundwater quality and water level monitoring program data; summarized groundwater-related changes; and reported results of an extraction monitoring program and on the status of previous recommendations.

To the east, the Hemet/San Jacinto Water Management Plan was completed in November 2007 by EMWD, Lake Hemet Municipal Water District, and the Cities of Hemet and San Jacinto to guide and support responsible water management. The plan's objectives include reducing the historical impact of overdraft caused by past groundwater production, increasing recharge of the groundwater basin, providing for the water rights of the Soboba Tribe, ensuring water supply reliability, providing for planned urban growth, and protecting and enhancing water quality. Options to increase water supply and reliability include developing underutilized sources particularly recycled water and imported water. To accomplish the plan's objectives, the Hemet/San Jacinto Integrated Recharge and Recovery Program is being implemented. This program includes the construction of numerous water supply and conjunctive use projects such as direct and in-lieu recharge, increased use of recycled water, increased conservation, and improved monitoring.

Chino Basin Watermaster, Optimum Basin Management Plan, State of the Basin Report 2006 (June 2007)

The Chino Basin Watermaster (CBWM) is the manager of Chino groundwater basin. CBWM prepared the Optimum Basin Management Plan which describes the state of the basin in terms of historical groundwater levels, storage, production, water quality, and safe yield. Current and projected water demands and water supply plans are described. The goal of the plan is to develop a groundwater management program that enhances the safe yield and the water quality of the basin, enabling all groundwater users to produce water from the basin in a cost-effective manner. The plan includes a monitoring program for groundwater levels, as well as programs for monitoring well construction, abandonment, and destruction.

City of Corona, Department of Water and Power, Groundwater Management Plan (June 2008)

The City of Corona prepared a Groundwater Management Plan for the Temescal, Bedford, and Coldwater sub-basins. The conditions of each groundwater basin were described including groundwater levels, production, and quality. Current and projected water demands and supplies were evaluated. Basin management objectives were determined and management strategies were set. Objectives include to:

- Manage the groundwater basin in a sustainable manner.
- Prevent substantial water level declines in the Channel Aquifer.
- Protect groundwater quality in the unconfined aquifer.
- Maintain required outflow at Prado Dam.
- Monitor groundwater levels, quality, and storage.

OCWD Groundwater Management Plan (2009 Update)

The OCWD prepared the Groundwater Management Plan 2009 Update for the Orange County Groundwater Basin to identify key issues related to groundwater management. The three major objectives are to protect and enhance groundwater quality, to protect and increase the Basin's sustainable yield, and to increase the efficiency of operations. Recommendations in the report to proactively manage the Basin include:

- Monitoring water quality and groundwater levels.
- Managing groundwater recharge.
- Managing groundwater quality by controlling seawater intrusion, evaluating emerging constituents, and preventing future contamination.
- Implementing projects to clean up existing contamination problems.
- Preparing an integrated demand and supply program.

Imported Water Quality

Water agencies in the Santa Ana River Watershed receive imported water from the CRA and the SWP. The majority of this imported supply used by local agencies is received from the MWDSC. The Valley District and the San Gorgonio Pass Water Agency also provide imported water from the SWP to local agencies within their service areas. The quality of imported water that is used for recharging groundwater directly affects groundwater quality. Because imported water is a significant source of potable water in the region, it affects the quality of discharges from wastewater treatment plants for certain constituents, such as salinity.

CRA and SWP source water is of high quality. This section provides a summary of key water quality constituents within the imported water systems. Source water protection activities aimed at maintaining a safe and reliable imported water supply are described.

Colorado River

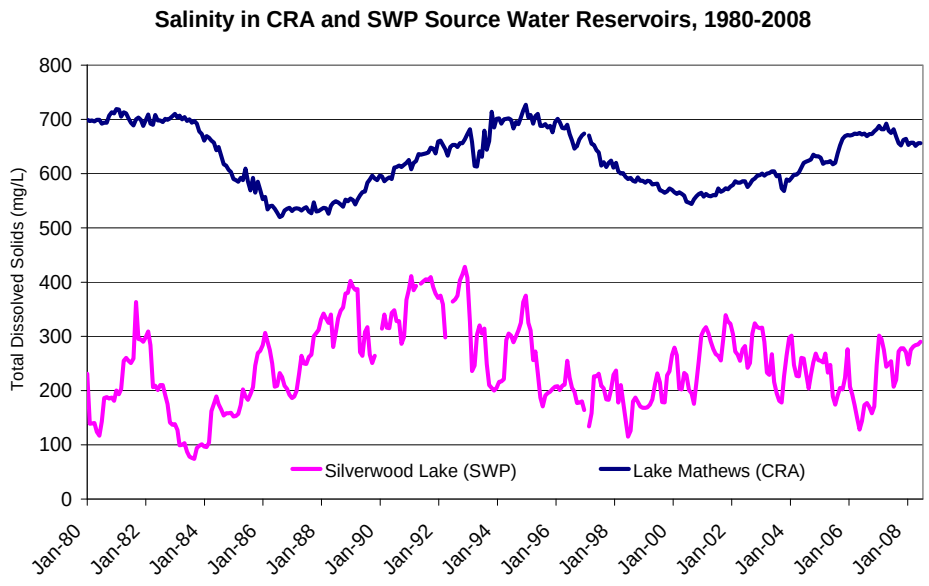
This section describes water quality in the CRA system.

Salinity

Colorado River salinity fluctuates from year to year but on average remains relatively stable. TDS at the intake to the CRA peaked at 720 mg/L in 1994, gradually came down to 539 mg/L in 2000, and has recently trended upward as a result of drought conditions within the Colorado River. **Figure 5.2.11** shows TDS levels at Lake Mathews, a terminal reservoir on the CRA system.

Salinity in the basin is due to both natural sources and anthropogenic activities. MWDSC's goal is to achieve a salinity concentration of 500 mg/L for treated waters in order to reduce financial impacts to water consumers, impediments to recycling projects, and salt buildup in groundwater basins. This goal has been met primarily by blending Colorado River water with SWP supplies. It is anticipated that there may be periods when this goal cannot be achieved.

Figure 5.2-11 Imported Water TDS Levels



Nutrients

Phosphorus is the limiting nutrient for algal growth in the CRA system. Currently there is no regulatory limit for total phosphorous in drinking water. Despite relatively low concentrations (near 0.010 mg/L), any increase can cause algal growth; excessive growth causes unpleasant taste and odor, filter clogging, organic carbon, and toxins.

Increasing wastewater discharges from the Las Vegas area to Lake Mead may increase nutrient loads in the lower Colorado River system. MWDSC and other stakeholders are working closely with Las Vegas area wastewater agencies to implement measures to protect downstream uses.

A large number of septic systems are located near Lake Havasu, the intake for the CRA. Even though there is no direct evidence that these septic systems are increasing nitrate levels in the lower Colorado River, many communities are converting to centralized wastewater treatment systems. Nitrate levels in recent years at the intake of the CRA have averaged approximately 1 mg/L, well below the nitrate MCL of 45 mg/L measured as nitrate.

Perchlorate

Perchlorate has been detected at low levels in MWDSC's CRA water supply. In 1997, perchlorate contamination in the Colorado River was traced to Las Vegas Wash with the likely sources being two chemical manufacturing sites in Henderson, Nevada. In 2002, MWDSC adopted a Perchlorate Action Plan that established a comprehensive program to address perchlorate levels. Since 2006, monitoring has indicated non-detectable levels (less than 2 µg/L) entering MWDSC's conveyance system.

Uranium

Uranium is a naturally occurring radioactive element found at low levels in rock, soil, and water. A 12 million-ton pile of uranium tailings from a former uranium mill site near Moab, Utah lies approximately 750 feet from the Colorado River, approximately 650 miles upstream of the CRA intake at Lake Havasu. Although uranium levels at the intake are much lower than the MCL, rainwater has been seeping through the tailings pile, contaminating the local groundwater, and flowing into the river. The United States Department of Energy (DOE) is responsible for disposing the tailings offsite, which will require continued Congressional support over the next several years.

Chromium VI

There is a contaminated groundwater plume located adjacent to the Colorado River near Needles, California. This plume contains hexavalent chromium (chromium VI), a form of chromium used as an anti-corrosive agent. The chromium VI groundwater plume exists from past waste disposal practices at the Topock Pacific Gas and Electric gas-compressor station adjacent to the Colorado River near Needles, California. The California Department of Toxic Substances Control is the lead regulatory agency responsible for the investigation and cleanup activities for the site. Chromium VI levels in the river downstream of the site have been mostly non-detect (<0.03 μg/L) with an occasional low background level (0.03-0.04 μg/L).

State Water Project

This section describes water quality in the SWP system.

Organic Carbon and Bromide

Organic carbon and bromide in SWP water react with disinfectants during the water treatment process. Some disinfection byproducts are considered carcinogenic and may cause adverse reproductive or developmental effects in animals at very high doses. Along the East Branch of the California Aqueduct, total organic carbon levels have ranged between 2.3 and 6 mg/L, with bromide levels ranging from 0.05 to 0.35 mg/L. Ozone treatment has been added to two of MWDSC's water treatment plants to reduce the formation of chlorine disinfection byproducts. Three other plants are expected to be online in 2009.

Salinity

Salt in the Sacramento and San Joaquin Rivers originates from natural sources, agricultural discharges, urban runoff and seawater intrusion. Although TDS concentrations in the East Branch of the California Aqueduct averages 250 mg/L, concentrations can vary significantly in response to hydrologic conditions in the Delta watersheds. SWP supplies, significantly lower in TDS concentrations than the Colorado River, are blended with CRA water to reduce the salinity of delivered water. TDS at Silverwood Lake, a reservoir along the East Branch of the SWP system, is shown in **Figure 5.2-11** (previous page).

Nutrients

Wastewater discharges and agricultural drainage in the Delta are two primary sources of nutrient loading to the SWP. Between 1998 and 2005, nitrate levels at the intake to the California Aqueduct ranged from 0.4 to 8.0 mg/L. Although these levels are well below the nitrate MCL of 45 mg/L, they are higher than those found in the Colorado River.

Cooperative Agreement to Protect Water Quality and Conjunctive Uses of Imported Water in the Santa Ana River Basin

On April 19, 2006, the Regional Board released a tentative Waste Discharge Requirement General Order to regulate imported SWP, Colorado River Water and imported well water that is used to recharge groundwater management zones in the Santa Ana Region. In response, SAWPA, its member districts, and other water management agencies proposed an alternative approach to assure that nitrogen and TDS levels of imported water would not degrade groundwater basins in the region.

With the support of the Regional Board, a workgroup of interested agencies developed and signed a cooperative agreement. The agreement directs the nine importing water agencies to prepare a summary of the amount and quality of imported water recharged, a 20-year projection of the ambient water quality (Nitrogen and TDS) for each groundwater management zone at six year intervals, and a comparison of current ambient water quality to prior six year ambient water quality.

Arsenic

Arsenic is a naturally occurring element found in rocks, soil, water, and air, and is used in certain agricultural applications, wood preservatives, paints, dyes, and soaps. Of all the regulated inorganic chemicals, arsenic is the most problematic in SWP supplies. Groundwater in the Central Valley which can contain substantial concentrations enters the CRA through water exchange and banking programs. These programs are managed to protect downstream water quality while also meeting supply targets. Routine monitoring between 2001 and 2005 at key SWP locations recorded maximum concentrations of 4 μg/L. Although levels are still below the MCL of 10 μg/L, increasing coagulant dosages during drinking water treatment may be needed to maintain safe levels for delivered water.

Salinity and Nutrient Management

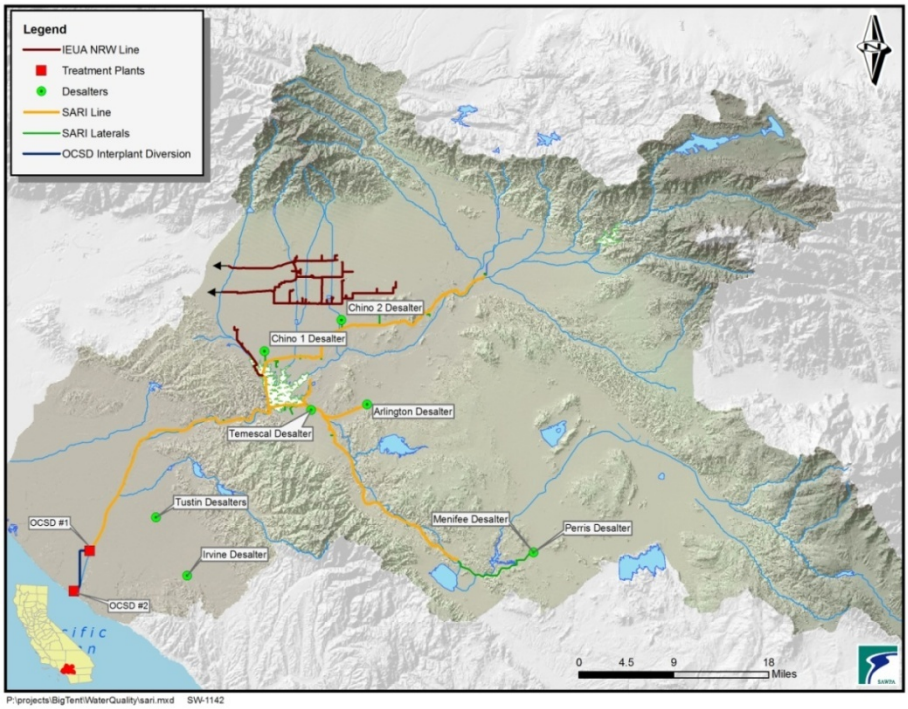
As stated earlier in this report, two of the most serious water quality problems in the Santa Ana River Watershed are the buildup of TDS in surface and groundwater and nitrogen levels. This section discusses on-going efforts aimed at achieving and maintaining a salt balance in the Watershed, and efforts to manage nitrogen.

Salinity Management Facilities

The Santa Ana Regional Interceptor (SARI) line was built by SAWPA over a period of 25 years (1975-2000) to collect and transport industrial brine that could not be treated at local (inland) wastewater treatment facilities. The section of the 93-mile-long SARI line that runs above the Riverside-Orange County line (Reaches IV and V) is owned and operated by SAWPA. Reach IV serves the cities of Riverside, Chino, and San Bernardino; Reach V lies along the Temescal Wash and terminates near the City of Lake Elsinore. In Orange County, the SARI (Reaches I, II, and III) is owned by OCSD.

The SARI line is used to dispose of brine from groundwater desalters, industrial wastewater high in TDS concentrations, water with high nutrient levels, and other domestic and industrial wastewater. The wastewater is treated at OCSD's treatment plant in Huntington Beach prior to discharge to the ocean. Additional brine lines have been constructed by IEUA (NRW line) and the IRWD (SIBL). Salinity management facilities in the Watershed are shown in **Figure 5.2-12**. These facilities are vital to on-going protection of water quality in the Watershed.

Figure 5.2-12 Santa Ana Region Salinity Management



In January 2010, SAWPA completed the Phase 1 Salinity Management Plan Technical Memorandum (CDM 2010), which identifies a significant long-term salt imbalance in the Watershed, despite progress made over the years through the implementation and operation of the SARI line, groundwater desalters, and other projects and activities with salt reduction as a primary goal. Much of the discussion in this section is taken from this report.

Salinity problems are anticipated to exacerbate if no action is taken, as the import of surface water continues, particularly from the Colorado River Aqueduct which has a TDS concentration of 650 mg/L; water reuse increases, effectively increasing the salinity of the recycled water supply if demineralization is not provided; and as industrial and commercial growth continues.

In fact, the Salinity Management Plan projects that the seven groundwater management zones in the Watershed modeled will exceed Basin Plan TDS standards in the future, as groundwater extraction and saltier water import continues. Five of the seven management zones have some assimilative capacity that will allow them to meet TDS standards for some years (Beaumont, Bunker Hill-B, Chino-North, Elsinore, and Yucaipa); while the remaining two already are in excess of TDS standards and thus have no assimilative capacity available (Bunker Hill-A and Temescal).

Future salt removal needs in the Watershed will be driven by 4 main regulatory limits:

- TDS objectives in the Basin Plan.
- EPA secondary MCL for TDS in the potable water supply.
- TDS discharge limits in the NPDES permits of POTWs.
- TDS concentrations in recycled water that exceed the Basin Plan water quality objectives, thus preventing its use for irrigation or recharge in zones with no assimilative capacity.

TDS Objectives in Basin Plan: As previously mentioned, two of seven management zones in the Watershed have no assimilative capacity, and are already in excess of Basin Plan TDS criteria. For the remaining five, it is anticipated that desalination or other mitigation will be required if and when TDS concentration is within 10 mg/L of the standard. It is anticipated that this condition would occur by 2028 for Beaumont, 2016 for Yucaipa, and 2023 for Chino-North.

EPA Secondary MCL: The 500 mg/L secondary MCL may be exceeded in the future if mitigation measures are not taken. Potential measures include desalting, blending, importing lower-salinity water, and capturing and recharging more stormwater upstream of supply wells. According to the Salinity Management Plan, at least eight of 59 management zones in the Watershed will exceed potable water TDS standards and will require action.

TDS Discharge from POTWs: Similar to potable water, the Salinity Management Plan estimates likely exceedances of TDS effluent discharge limits by wastewater treatment plants in the Watershed. Plants exceeding NPDES limits, with TDS effluent concentrations in the 490 to 700 mg/L range, will require actions such as desalinating all or a portion of the effluent. According to these estimates, eight out of 12, POTWs in the region will require action at some point over the next 30 years.

TDS concentrations in recycled water: TDS concentration in recycled water is a function of the salinity in the original potable water supply (*i.e.*, imported water and/or groundwater), which drives the salinity of effluent and in any salt reduction actions being taken. As described above, salinity issues are anticipated for groundwater basins, potable water supplies, and eventually wastewater effluent. Desalination of all or a portion of effluent may be required in the future in some areas to allow water recycling.

The Salinity Management Plan describes a number of projects planned or ongoing in the Watershed that will address salinity issues. These projects include:

- Yucaipa Valley Water District wastewater desalting and reuse.
- City of Riverside water supply and wastewater desalination projects.
- Western Municipal Water District and City of Corona water supply projects.
- Eastern Municipal Water District groundwater desalter expansion and wastewater desalting and reuse.

Even with the implementation of these projects, a gap for salt removal remains. The Salinity Management Plan identifies potential long-term options to address the need for additional salt removal, including:

- Best Management Practices (BMPs).
- Desalters for water supply.
- Desalters for wastewater.
- Zero liquid discharge/evaporative ponds.
- LACSD Non-reclaimable wastewater system.

Best management practices: BMP's include source control measures aimed at reducing salt mass balances that would otherwise be discharged to ground or surface waters, or introduced into the wastewater stream. Examples of BMPs include: eliminating salt-based domestic water softening devices, promoting the use of low-salt detergents, addressing salt runoff, and implementing pre-treatment programs.

Desalters for water supply: As previously mentioned, there are some agencies whose blended water supply could slightly exceed the 500 mg/L secondary MCL. Agencies potentially could add additional source water desalination because it is cost effective or because there are limited alternative supplies.

Desalters for wastewater: Similar to potable water, some agencies potentially will exceed TDS effluent discharge limits. Agencies could reduce TDS in their effluent by implementing additional source control programs; reducing TDS of source water, as mentioned above; or adding desalination to all or a portion of their effluent stream. Providing advanced treatment to secondary effluent would also increase the possibility of reusing the effluent, including indirect potable water reuse via groundwater recharge or surface storage augmentation.

Zero liquid discharge: Some agencies in the Watershed are exploring brine concentration projects to reduce the quantity of flows to the SARI line, while exporting the same amount of salt but at a higher concentration.

LACSD non-reclaimable wastewater system: IEUA owns 60 miles of pipelines used to convey high TDS water to an interceptor owned by LACSD for treatment at Carson Treatment Plant and ocean discharge. Capacity is available (approximately six MGD) for additional brine disposal through this system.

The Salinity Management Plan projects a need for future brine exports in the amount of 35.5 MGD, which is approximately 23% greater than the nominal capacity of the SARI. This is equivalent to nearly 271,000 tons of salt per year. This amount does not include 2.27 MGD of domestic wastewater discharges that could potentially be eliminated from the SARI.

Project	**Salt load (tons/yr)**			**Brine flow (mgd)**				
	Current/ near term	**Future**	**Total**	**Current/ near term**	**2010-2015 increase**	**2015-2025 increase**	**Beyond 2025 increase**	**Total**
Water supply desalting	131,392	38,144	169,536	10.08	0.32	5.00	--	15.40
Wastewater & recycled water desalting	8,760	69,170	77,930	1.20	0.80	11.55	0.00	13.55
Unspecified desalting (1)	--	24,006	24,006	--	--	--	3.74	3.74
Other								
Domestic wastewater	--	Remove	0	2.27	0.00	Remove (-2.27)	0.00	0.00
Direct industrial connection & waste haulers	--	--	0	0.69	0.50	1.00	0.60	2.79
Total	**140,152**	**131,320**	**271,472**	**14.24**	**1.62**	**15.28**	**4.34**	**35.48**

The Phase 2 SARI Planning Technical Memorandum (CDM, May 10, 2010), complements the Salinity Management Plan as well as identified strategies and their associated cost to address the anticipated deficit in the capacity of the SARI. Six potential reconfigurations of the SARI system were considered:

1. *Baseline*: Continue use of current configuration in which SARI flows to OCSD POTWs prior to ocean discharge.

2a. *Centralized in-line brine minimization*: All water flows are diverted from the SARI to a centralized facility with biological treatment and desalination. Concentrate will flow back to SARI, and in turn to OCSD and the ocean.

2b. *Decentralized brine minimization*: Groundwater desalters implement further concentrate management via secondary RO process, thus reducing flows to the SARI.

3a. *Direct ocean discharge with brine minimization*: Groundwater desalters implement further concentrate management via secondary RO process, and discharge directly to a new parallel pipeline to the ocean. Pretreatment will be required for some discharges to keep BOD concentrations below 30 mg/L.

3b. *Direct ocean discharge without brine minimization*: Groundwater desalters discharge brine without further concentration directly to a new parallel pipeline to the ocean. Pretreatment will be required for some discharges to keep BOD concentrations below 30 mg/L.

4. *Salton Sea discharge*: A new 125 pipeline from south of Prado Dam to the Salton Sea is built to transport all SARI flows, with no treatment at OCSD.

SAWPA prepared the SARI Market Analysis (EEC August, 2009) to gain an understanding of how the use of the SARI by industry and other brine dischargers could be increased to increase revenue and reduce cost to all users. Several factors impacting the use of the SARI were identified, along with potential solutions. SAWPA believes that a stronger marketing effort is needed to convey to potential users the value they will receive from discharging brine to the SARI when compared to other alternatives, SAWPA estimates that waste disposal to the SARI costs approximately $0.05 per gallon, compared to a cost of $0.20 per gallon of discharging to other alternatives in the Los Angeles basin.

Colorado River Basin Salinity Control Forum

The Colorado River Basin Salinity Control Forum, established by the Colorado River Basin states in 1973, has developed projects to meet agreed-upon numeric criteria along the Lower Colorado River. The Salinity Control Program projects include improving agricultural irrigation practices in the Upper Colorado River Basin and reducing salinity from natural sources. The federal government and Colorado River Basin states contribute approximately $50 million annually for this effort.

Basin Monitoring Program Task Force

On January 22, 2004, the Regional Board approved the Basin Plan Amendment for Nitrogen and TDS. Approximately 20 specific agencies throughout the Watershed were charged with the responsibility to conduct several monitoring and analyses programs for nitrogen and TDS. These requirements included the preparation of an annual water quality report for the SAR and a triennial report to determine the ambient water quality (Nitrogen and TDS) in each groundwater management zone. To cost-effectively prepare these reports, a task force which included the Regional Board, was convened in 2004 with SAWPA as the administrator to conduct the data gathering, consultant support and river analyses programs.

Southern California Salinity Coalition

The Southern California Salinity Coalition (SCSC; www.socalsalinity.org) was formed in 2002 to address the critical need to control salinity in water supplies and to protect the water resources in California from increasing salinity. SCSC's purpose is to coordinate salinity management strategies and programs, including research projects, with water and wastewater agencies throughout southern California. Members of the coalition include major water and sewer districts in San Bernardino, Riverside, Orange, Los Angeles, and San Diego Counties; the National Water Research Institute; and SAWPA. SCSC's objectives are to:

- Establish proactive programs to address the critical need to remove salts from water supplies.
- Preserve, sustain, and enhance the quality of source water supplies.
- Support economic development.
- Help drought-proof the community.
- Reach out to the general public on salinity problems.

Future Issues

Due to increased water usage, irrigation and agricultural use, and other activities, the control of salinity will continue to be a challenge for the region. Inland desalination studies of brackish water must be funded as well as construction of facilities for concentrate disposal and management to help address salinity issues. The use of high quality imported water and region-wide planning to promote BMPs for reducing runoff impacts will continue to be essential. Managing salinity inputs to wastewater collections from water softeners also is an important factor in protecting water quality and maintaining the ability to use recycled water.

Control of salinity will continue to be a challenge. Desalinization studies must be funded and additional facilities for brine disposal are needed. From a salinity standpoint, it is preferable for the Watershed to use SWP supplies compared to CRA supplies. Shortages of SWP supplies due to regulatory issues in the Sacramento-San Joaquin Delta or other factors can significantly impact the TDS concentrations in surface water and groundwater in the Watershed. When SWP supplies are decreased, the percentage of the imported supply that comes from the CRA is increased, resulting in increased salinity in the imported supply. As water is used, discharged, and used again downstream, this increase in salinity affects downstream users in addition to the area that first used the water.

Nutrient Management

Elevated nitrogen and phosphorus concentrations come from municipal and industrial wastewater, septic tanks, animal wastes, and agricultural and lawn fertilizers. Nitrogen-containing and phosphorus-containing compounds act as nutrients in streams and rivers. Nitrate in freshwater can cause oxygen depletion. Desalination facilities or desalters, in operation in Chino, San Jacinto, and Orange County basins reduce nutrient concentrations in groundwater. Brine lines also are being used to export high nutrient water to the OCSD for treatment and disposal to the ocean.

TDS and Nitrate Management in the Chino Basin

For many years, the Chino Basin was home to one of the highest concentrations of dairies in the world. Waste discharges from years of dairy operations, as well as discharges from other commercial operations, left the southern portion of Chino Basin with a serious salt-imbalance. While the water quality in the northern portion of the basin remained high, increasing TDS and nitrate levels degraded groundwater in the south, threatening the quality of Chino Basin's groundwater supplies and SAR water that was flowing into Orange County's groundwater recharge basins.

The Regional Board addressed the impacts of salt loads from dairy operations by adopting waste discharges requirements, which included the requirements for dairies to adopt engineered waste management programs and manure control programs. The Chino Basin Desalter Authority, composed of IEUA and other local agencies, operates two desalters to pump out and remove contaminants in the groundwater. OCWD operates wetlands in the Prado Basin to naturally filter out nitrates. In addition, economic changes have led to a decline in number of dairies located in the Chino Basin.

These efforts have begun to reduce levels of TDS and nitrate in the basin. Plans are underway by IEUA and the CBWM as part of their maximum benefit agreement with the Regional Board for construction of an additional desalter and to expand other programs to improve groundwater quality in this area.

Ocean Water

This section focuses on issues related to ocean water quality. The primary emphasis with ocean water is maintaining water quality in order to protect marine resources and public health. Furthermore, the quality of ocean water may become a concern for drinking water if seawater desalination facilities are built to create new water supplies.

Current Condition

Ocean water quality is evaluated using a number of different parameters and constituents related to beneficial uses. In the Basin Plan, one of the key beneficial uses is full body contact recreation, known as REC-1.

The California Health and Safety Code requires ocean waters adjacent to public beaches be tested for indicator bacteria to ensure public safety. This program, created by AB 411, establishes uniform and consistent water quality monitoring, response, and public notification requirements for the entire California coastline. The water quality standards established by AB 411 have been incorporated into the State Water Board's California Ocean Plan and by reference into the Basin Plan. In addition to recreation, the ocean waters also support important habitat areas, including two ASBS and their related onshore Critical Coastal Areas (CCAs).

Compliance with California Health and Safety Code Standards

The County of Orange Health Care Agency implements AB 411 for Orange County's beaches, harbors, and bays shown in **Figure 5.2-4**.

Regulatory compliance is determined from the percentage the time standards were met. Beach Mile Days (BMDs) are calculated from the number of days and the linear area of ocean or bay front that is in violation of the AB 411 standards. BMD represents the loss of beneficial use of ocean recreational waters. **Table 5.2-27** lists total number of BMDs posted for beaches due to violation of AB411 standards.

Table 5.2-27 Total Number of Beach Mile Days Posted for Open Coastal Ocean Water Areas

	Seal/Surfside/Sunset	Bolsa Chica	Huntington City	Huntington State	Newport Beach	Crystal Cove
2000	3.7	5.4	10.1	67.6	2.2	1.3
2001	0.4	0.1	1.4	14.8	0.7	0.3
2002	1.2	0.9	1.2	23.8	1.2	0.1
2003	0.3	0.8	0.8	41.9	1.4	0.2
2004	2.4	0.1	0.5	10.6	1.2	0.1
2005	0.1	0.4	0.4	12.1	6.0	0.0
2006	0.6	0.7	0.9	21.9	1.9	0.4
2007	0.5	0.6	1.4	61.0	0.6	0.1
2008	1.3	0.2	0.7	26.2	0.6	0.4
2009	0.5	0.1	0.5	11.0	0.6	0.0

Orange County beaches on the CWA 303 (d) list are shown in **Table 5.2-28**.

Table 5.2-28 2006 CWA 303(d) List of Water Quality Limited Segments Requiring TMDLs

Name	Pollutant/Stressor	Potential Sources	Proposed TMDL Completion
Balboa Beach	DDT, Dieldrin, PCBs	Source unknown	2019
Bolsa Chica State Beach	Copper, nickel	Source unknown	2019
Huntington Beach State Park	Enterococcus, PCBs, Indicator Bacteria	Source unknown	2019
Seal Beach	Enterococcus, PCBs	Source unknown	2019

Newport Beach Marine Life Refuge (CCA No. 70/ASBS No. 32)

The Newport Beach Marine Life Refuge is bounded to the west by a line heading oceanward 1,000 feet along Poppy Avenue in Corona Del Mar and to the east by a line heading oceanward 1,000 feet along the westerly limits of Crystal Cove State Park. It extends from the mean high tide line to 1,000 feet offshore or 100 feet of ocean depth, whichever is nearer. This ASBS is so designated to protect dolphin breeding areas and other marine species. Water quality is impacted by the following:

- Stormwater and dry weather runoff from Buck Gully, its major tributary and from over two dozen direct discharge pipes from residential neighborhoods along the coastal edge of the ASBS.
- Sediment transported from Buck Gully and coastal bluffs.
- Beachgoer scavenging and trampling, despite educational efforts to discourage taking of tide pool species.

Southern California Coastal Water Research Project (SCCWRP)

SCCWRP was formed in 1969 as a JPA to conduct research about the effects of wastewater and other discharges to the Southern California coastal marine environment. Its mission is to contribute to the scientific understanding of linkages among human activities, natural events, and the health of the Southern California coastal environment; communicate this understanding to decision makers and other stakeholders; and recommend strategies for protecting the coastal environment for this and future generations.

SCCWRP's 14 member agencies include representatives of city, county, state, and federal government agencies responsible for monitoring and protecting the marine environment. SCCWRP brings together a multidisciplinary team of scientists to address complex environmental problems; recommend protection strategies; and foster communication and cooperation between scientists, the regulated community, and regulators.

SCCWRP is a recognized leader in environmental research. Accomplishments include developing new environmental monitoring methods and defining the mechanisms by which biota are potentially affected by anthropogenic inputs. SCCWRP has participated in some of the most significant scientific discoveries, technology and methodology developments, and environmental policy decisions of the past thirty years.

The 2008-09 Research Plan focuses on the following topics:

- Introduction of substances into the environment.
- Release, transfer, fate, and effects of pollutants of concern.
- Impacts of nutrients, specifically nitrogen and phosphorus.
- Effects of surface water runoff on aquatic ecosystems.
- Understanding the microbiology of beach environments to assess the risk of illness to swimmers and to enable managers to rapidly detect harmful pathogens.
- Creating a more comprehensive regional data base on environmental conditions.

Additional information may be found at :www.sccwrp.org

Irvine Coast Marine Life Refuge (CCA No. 71/ASBS No. 33)

The Irvine Coast Marine Life Refuge is bounded by the Newport Beach Marine Life Refuge to the west and to the east by a line heading oceanward 1,000 feet along the Irvine Cove cliffs at the edge of Laguna Beach. It extends from the mean high tide line to 1,000 feet offshore or 100 feet of ocean depth, whichever is nearer. Like its immediate neighbor, this ASBS is designated to protect dolphin breeding areas and other waterborne species. It is impacted by the following:

- Stormwater and dry weather runoff from the Pelican Hill/Point area and from Los Trancos Canyon and Muddy Creek.
- Stormwater and dry weather runoff from direct discharge facilities draining through Crystal Cove State Park, Pacific Coast Highway, and Pelican Point.
- Beachgoer scavenging despite educational efforts to discourage taking of tide pool species.
- Sediment transported from Los Trancos Canyon, Muddy Creek, and coastal bluffs.
- Pollutants from upcoast and downcoast discharges.

Algae water quality issues

Algae are found universally in all aquatic environments. Under certain conditions, harmful algae blooms can occur. Some species of algae are capable of producing potent biotoxins. The California Health and Safety Code prohibits the consumption of sport-harvested sea mussels every year from May 1 to October 31 because of risk of Paralytic Shellfish Poisoning (PSP). PSP toxins concentrate in the tissue of filter feeders like mussels. The toxin is harmless to the shellfish but extremely toxic to people and animals when consumed.

In early April 2007, a large harmful algae bloom (HAB) of Pseudo-nitzschia occurred in coastal waters from Santa Barbara County to Orange County. This was one of the largest outbreaks in recent history resulting in the deaths of many sea birds and marine mammals and an early quarantine on mussel consumption.

The cause of these blooms is not clearly understood. Oceanographic currents, wind, nutrient levels, sunlight, temperature and global sea temperature oscillations like El Nino are thought to be factors.

Recently the association between bloom initiation and nutrient associated rainfall runoff and anthropogenic sources has been raised. Research is ongoing into this complex issue.

Current Management Strategies for Ocean Water

The major goal for ocean water quality improvement is to achieve water quality standards, which includes meeting beneficial uses and WQOs, preventing anti-degradation and meeting California's Ocean Plan and AB 411 standards. Goals, management strategies, and tactics are summarized in **Table 5.2-29**.

Table 5.2-29 Ocean Water Quality (including Bays, Estuaries, and Tidal Prisms) Goals, Strategies, and Tactics

Goals	Strategies	Tactics
Water Quality Standards attained (includes Ocean Plan and AB 411 standards)	• Protect good quality ocean water • Clean up poor quality ocean water	• Monitoring • Source water protection • POTWs implement source control & treatment • Urban runoff managed through NPDES/DAMP • NPDES permits for other dischargers • Implement State Non-Point Source (NPS) Plan • TMDLs • Constructed wetlands • Localized urban runoff treatment systems • Surface water diversions to POTWs or other treatment systems • Research • Public outreach

The Newport Coast Watershed Management Program works on water quality issues from Buck Gully in Corona del Mar to Morro Canyon. These concerns include canyon stability, impacts to sensitive marine life areas, water quality impacts due to dry-weather nuisance flows, and invasive plants. This watershed program, organized by the City of Newport Beach, coordinates efforts between City staff, community members, property owners, jurisdictional agencies, and other interested parties.

Orange County Coastkeeper

The Orange County Coastkeeper, founded in 1999, is a non-profit organization dedicated to the protection and preservation of the marine habitats and watersheds of Orange County through programs of education, restoration, enforcement and advocacy. Members work with businesses, developers, cities, elected officials and regulatory agencies to develop solutions to the problems of polluted urban runoff. The long-term goal is to protect and preserve all of Orange County's water bodies and restore them to healthy, fully functioning systems that will protect recreational uses and aquatic life.

CHALLENGE: Identification and Solutions

Table 6.2-30 identifies current challenges for water quality management. The challenges were identified by members of the Water Quality Improvement Pillar. Because of the broad scope of issues, the diversity of challenges is significant. A range of potential solutions for each challenge are identified and categorized by the type of water body affected and the nature of the challenge (institutional/political, financial, regulatory, or insufficient data). Each item listed in the table is discussed in more detail below.

Table 5.2-30 Water Management Challenges

	Challenge	Water Body			Constraint			
		Groundwater	Surface Water	Ocean Water	Institutional/ Political	Financial	Regulatory	Insufficient Data
1	Additional resources are needed to conduct needed Basin Planning	X	X	X	X	X	X	X
2	Setting priorities for water quality improvement	X	X	X	X	X	X	
3	Barriers to regional stormwater BMPs		X	X	X	X	X	X
4	Agencies prefer local solutions and projects over regional solutions	X	X	X	X		X	
5	Barriers to infiltration BMPs	X	X				X	
6	Indications of fecal contamination in stormwater		X	X	X	X	X	X
7	Floatable debris is a challenge to control		X	X	X	X	X	
8	Standard lab methods are not available for many contaminants of emerging concern	X	X	X				X
9	Improperly located and maintained septic systems are a threat to water quality	X	X	X	X	X	X	
10	Water conservation increases concentrations of some pollutants entering treatment plants	X	X		X	X		
11	Managing TDS and nutrient levels in surface and groundwater is difficult and expensive	X	X		X	X	X	X
12	Funding for necessary projects is insufficient	X	X	X	X	X	X	
13	Impacts from contaminants of emerging concern are not well known	X	X	X				X
14	Acquiring land in urban areas to build new facilities is challenging and costly	X	X	X	X	X		
15	Some parties responsible for groundwater contamination cannot be located	X				X	X	
16	The ability to assess fines for violations of water quality regulations or permits is limited at the local level	X	X	X	X		X	
17	Some contaminated wells are not always well managed	X			X	X		
18	Solving one water quality problem may create a new problem or constraint	X	X	X	X		X	X
19	Water quality problems caused by public behavior are difficult to overcome	X	X	X	X			
20	Development may outpace understanding of water quality impacts	X	X	X	X		X	X
21	Urbanization and flood control projects impact water quality	X	X	X	X	X	X	

Challenge 1 Insufficient Resources for Basin Planning

The Regional Board's resources are marginally sufficient to conduct the evaluations identified in the triennial review of the Basin Plan. The year 2006 triennial review list identifies 36 issues. These include a range of issues, such as considering changes to beneficial use designations and associated WQOs and reviews of adopted TMDLs. Due to insufficient resources, the Regional Board is not able to address all the issues identified in the triennial review.

Potential Solution:

- Secure additional resources to conduct the work identified in the Regional Board's triennial review of the Basin Plan.

Challenge 2 Setting of Priorities for Water Quality Improvement

Water quality problems that pose the greatest risk to human health and the environment should receive the highest priority for funding, public agency staff resources, and other resources. The current fiscal limitations of the federal, state, and local governments are such that sufficient resources are unavailable to simultaneously solve all the water quality issues in the Watershed. Each of the three focus areas: ocean water, surface water, and groundwater have a range of water quality issues that need to be addressed.

Potential Solutions:

- Create a process to determine the water quality problems that present the greatest human health and environmental risk.
- Allocate funding, public agency staff resources, and other resources to priority projects.

Challenge 3 Barriers to Regional Stormwater BMPs

Building regional treatment systems for stormwater would enable treatment of pollutants carried by stormwater over significant areas to a single, large-scale treatment site. Regional treatment would have operational and cost efficiencies due to economy of scale. The prohibition on discharge of stormwater where pollutants exceed the MEP standard creates a barrier to this approach.

Potential Solutions:

- Clarify the definition of MEP for stormwater that will receive subsequent treatment in a regional BMP.
- Modify beneficial use designations in channels used to transport stormwater to regional systems.
- Continue to require source control and treatment control BMPs at individual project sites.
- Identify alternative permitting approaches.

Challenge 4: Local vs. Regional Solutions

The advantages of multi-agency, regional solutions for water issues are becoming more evident and pressures to implement regional solutions are increasing. Historically, the water and wastewater industries operate locally with agency-owned facilities. This results in redundant, patchwork solutions to regional problems.

Potential Solutions:

- Develop approaches to increase regional dialogue.
- Develop strategies to foster greater pooling of resources and cost sharing.
- Identify areas where regional efforts would have the greatest impact and likelihood of success and target those areas for implementation of regional projects.

Challenge 5: Barriers to Infiltration BMPs

Although they have been found to be effective for typical storms and cost-effective on a parcel-level, municipalities are reluctant to approve infiltration BMPs, such as infiltration wells in the unsaturated zone, because no single agency can approve their design or application. Regulatory requirements for infiltration BMPs are unclear.

Potential Solutions:

- Develop a regional groundwater quality task force that could establish specifications and guidelines for municipalities so innovative systems could be approved.
- Work with local universities to study treatment systems appropriate for the local climate and land use patterns.

Challenge 6: Indications of Fecal Contamination in Stormwater

Many BMPs have been implemented, yet rivers, beaches, harbors, and bays in the Watershed are affected by stormwater that contains microbial indicators of fecal contamination. Capturing and containing stormwater for later treatment would require vast areas of land and large facilities, which would be used sporadically due to the infrequent nature of storms in the Watershed.

Potential Solutions:

- Research innovative approaches to reducing the fecal contamination load entering surface water bodies.
- Assess health impacts from human versus nonhuman sources of fecal contaminations.
- Assess the relationship between fecal indicators and health risks.
- Develop quantitative sanitary survey criteria to assess watersheds in urban and non-urban environments.

Challenge 7: Floatable Debris Poorly Controlled

Floatable debris encompasses a wide range of material from sub-millimeter particles to beverage and food containers, from "nurdle" feed stock pellets to toys and recreational equipment. Floatable debris impacts beneficial uses, particularly following periods of stormwater runoff or high tides.

Potential Solutions:

- Provide financial incentives to local governments and non-governmental organizations to develop programs addressing floatable debris, including outreach and source controls programs.
- Develop updated trash and litter control ordinances for adoption by municipalities.
- Coordinate with the State Board's Marine Debris Steering Committee.

Challenge 8: Standard Lab Methods Not Available for Emerging Constituents

When potential new chemical and microbial contaminants are identified as a concern for water quality there is often no standard analytical method available to test these constituents. In some cases, monitoring for these new emerging contaminants may be required before standard methods are available.

Potential Solutions:

- Collaborative efforts among water, wastewater, and regulatory agencies should be created to prioritize the development of new analytical methods.
- Regulatory authorities and dischargers should coordinate with the CDPH prior to issuing new permits to ensure the requested analytical methods have been developed and approved.

Challenge 9: Septic Systems

Onsite wastewater treatment or septic systems often are neither designed nor maintained properly and cause negative impacts to groundwater quality. Water quality impacts are particularly an issue in areas with a high density of onsite wastewater treatment systems. The rehabilitation of existing onsite wastewater treatment systems is expensive.

Potential Solutions:

- Identify an agency to take the lead in working for expansion of sewer service to areas outside local sewering agency jurisdictions.
- Extend the sewer collection system to areas where onsite wastewater systems are used.
- Amend laws to simplify annexations of areas without local or regional sewer providers to agencies that can provide those services.
- Provide source protection to reduce concentrations of emerging contaminants.
- Increase minimum lot size allowed for use of septic systems.

Challenge 10: Water Conservation and Pollutant Concentrations

Water use efficiency and conservation practices can increase the concentration of some pollutants entering treatment plants and may cause compliance challenges, such as with TDS limits.

Potential Solutions:

- Support the elimination of domestic water softening devices that discharge into the sewer system.
- Promote the use of solid waste containers for disposal of food waste, pharmaceuticals, and household chemicals.
- Develop and implement outreach programs to identify and promote the use of detergents and household products with low salt levels.
- Address the long-term need for increased brine disposal capacity.

- Include higher loading levels in new treatment plant design criteria and during the CEQA and permit processes for new reclamation projects.
- Promote the use of collection facilities and programs to take back unused pharmaceuticals and distribute smaller amounts to patients where possible.

Challenge 11: Salt Management

Increased concentrations of TDS or salinity in our water supplies are problematic in the Watershed. In many streams and basins, there is a lack of assimilative capacity for TDS or the current ambient TDS concentration exceeds the WQOs. Nutrients are also increasing in groundwater basins.

Potential Solutions:

- Promote regional efforts to establish BMPs for reducing impacts from salt in runoff.
- Promote the establishment of mitigation plans for recycled water reuse projects.
- Ensure the long-term viability of existing brine lines.
- Expand the existing brine lines to areas that need them.
- Evaluate and recommend financial incentives for desalination studies and facilities.
- Cooperate with MWD to create incentives for use of best quality imported water sources.
- Encourage regulatory agencies to recognize exporting certain brines and constituents as regulatory relief/offsets for wastewater permitting requirements.
- Develop new and effective concentrate management options

Challenge 12: Funding Inadequate

New regulations, new technology, and emerging environmental concerns increase cost pressures on public agencies that manage water. Water quality improvement funds are hard to obtain. For example, funding from the State Revolving Fund is inadequate and Proposition 218 imposes limits on new funding. Public officials may be reluctant to increase water rates due to concerns about public opposition and the potential precedent that would be set if a public vote fails.

Potential Solutions:

- Provide federal and state funds for water and wastewater infrastructure banks.
- Consider a ballot measure to amend Proposition 218.
- Prepare strategies to address legal decisions that are adverse to public agencies setting or increasing fees to fund water improvements.
- Encourage regulating agencies to clearly identify goals of new regulations and to plan implementation to ensure that the new regulations will be effective.
- Develop approaches to effectively communicate to the public the need for new investment to address our challenging water supply needs.

Challenge 13: Constituents of Emerging Concern Poorly Understood

New analytical methods for constituents of emerging concern make it possible to detect chemical constituents at very low concentrations. More information is needed to determine the potential human toxicological or environmental risk from these emerging contaminants.

Potential Solutions:

- Outreach to affected agencies and the Regional Board on current state of studies and research.
- Evaluate joint opportunities to conduct studies.
- Encourage the development of human health and ecological risk levels for specific compounds.
- Develop a list of appropriate surrogates and indicators of water quality for monitoring these constituents.
- Develop a monitoring plan for specific water bodies and facilities.
- Test water bodies and facilities for the appropriate set of constituents.
- Support the creation of a Blue Ribbon Commission by SWRCB and CDPH to make recommendations for monitoring of contaminants of emerging concern in recycled water.
- Collaborate on public information outreach.

Challenge 14: Land Acquisition for Projects

In urban areas, it is difficult and costly to gain access to land to construct new water quality improvement facilities. In the case of groundwater cleanup facilities, the land needed for extraction wells and treatment facilities may not be located where the contamination originated.

Potential Solutions:

- Develop financial incentives for property owners to make their land available for cleanup facilities. In the case of groundwater contamination, limit those incentives to the property owners who are not responsible for the contamination.

Challenge 15: Responsible Parties Cannot Be Located

In some areas, the party responsible for groundwater contamination is unknown, insolvent, or defunct.

Potential Solutions:

- Work with State and Federal agencies to obtain grants, including the U.S. Dept of Agriculture for perchlorate cleanup.
- Set up an orphan share fund.

Challenge 16: Ability of Local Government to Assess Fines is Limited

Local agencies are increasingly required by the Regional Board and other state agencies to enforce a variety of water quality and other regulations. The Government Code limits the amount of some fines and penalties local agencies can assess. Local enforcement authority has limited regulatory jurisdiction over some agencies such as school districts.

Potential Solutions:

- Consider consolidating enforcement authority to the regulating agency.
- Expand local agencies' enforcement authority.
- Develop a panel to discuss the current regulatory environment, interagency impacts, and impacts to business and residents such as groundwater discharge permitting requirements.

Challenge 17: Some Production Wells in areas of Groundwater Contamination are not Managed Properly

When an existing well becomes contaminated, groundwater producers sometimes react by shutting down the well and either locating a new well or expanding production from existing wells in uncontaminated areas. These actions frequently lengthen the time required to cleanup groundwater contamination. Contamination would, in general, be cleaned up more quickly if the affected wells continue to be pumped and treatment provided. In addition, some local rules and regulations preclude contamination cleanup.

Potential Solutions:

- Develop incentives for groundwater producers to provide treatment for wells producing contaminated water.
- Change existing local rules and regulations that act as barriers to cleaning up water contamination.

Challenge 18: Unintended Consequences

In seeking to solve one water quality problem, a proposed project may cause a new problem. For example, an agency protects surface water quality through infiltration of urban runoff that could negatively impact groundwater quality.

Potential Solutions:

- Develop strategies to increase communication, planning and cooperation among all stakeholders.
- Monitor programs for infiltration BMPs at selected sites in the Watershed to collect data regarding potential impacts to groundwater quality.

Challenge 19: Public Behavior Difficult to Change

The behavior of individuals and businesses directly impacts water quality. Most initiatives aimed at fostering sustainable behavior rely upon large-scale information campaigns and utilizing education and/or advertising to encourage behavior change. Studies show that behavior change rarely occurs as a result of simply providing information. Initiatives delivered at the community level focusing on removing barriers to an activity while simultaneously enhancing the activities are more effective.

Potential Solutions:

- Develop, pilot, and evaluate the effectiveness of strategies to change public behavior.
- Foster sustainability in the Watershed by effectively encouraging individuals and businesses to adopt behaviors that are aimed at reducing water runoff and preventing pollution.
- Support efforts to increase the public perception of the value of water.

Challenge 20: Development May Outpace Understanding of Water Quality Impacts

Areas with rapid growth, such as Riverside and San Bernardino Counties, are experiencing large scale alteration of land use patterns. Local governments have difficulty planning for the impacts of growth on complex water quality issues such as flood management, sediment transport, nutrient loading, and habitat alteration. New water quality problems are not identified due to lack of information, scientific studies, and funds.

Potential Solutions:

- Educate local officials so water quality concerns become core issues.
- Conduct studies to identify water quality challenges in rapidly developing areas.

Challenge 21: Urban Runoff Causes Water Quality Degradation

Many portions of the Watershed (e.g., Chino Basin and San Jacinto Basin) are rapidly changing from open space and agricultural to urban land use. In large areas of the Watershed, urbanization and flood control projects have virtually eliminated the groundwater recharge that formerly took place in natural stream channels and flood plains. This has caused significant changes in runoff quantities and in the types and amounts of pollutants carried into surface water bodies, causing a number of water quality problems. The increases in runoff are due directly to the increase in impervious surfaces. Typical urban runoff pollutants include pet waste, turf fertilizers, pesticides, air pollutant deposits, and various synthetic chemicals. In addition, the reduced recharge of the local groundwater basin lowers ambient groundwater quality, reduces assimilative capacity, and decreases the amount of groundwater that can be pumped sustainably from the groundwater basin.

Potential Solutions:

- Promote Low Impact Development principles by designing features into the infrastructure, landscape, and buildings/housing projects that will minimize runoff and cause infiltration of runoff into the ground, such as pervious pavement and vegetated buffer strips.
- Recognize in regulatory and funding frameworks that using design and retrofit technology options to minimize runoff and increase infiltration in urban areas is beneficial to meeting water quality and TMDL goals.

Description of Data Collection Process

Greg Woodside, OCWD, chaired the Water Quality Pillar Committee and coordinated the preparation of this report. Committee members, listed below, provided direction and assisted in collecting the information contained in this report and reviewed and commented on draft versions. The committee met in person and also held conference calls on a number of occasions. Peter Vitt at SAWPA provided invaluable assistance preparing the GIS maps. Gerry Thibeault of the Regional Board also reviewed and commented on a draft version of the report.

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Chapter 5.3 Water Recycling

Summary

The Recycled Water Pillar chapter reviews water reuse activities in the Santa Ana River (SAR) Watershed, including agricultural and landscape irrigation, creating groundwater barriers against seawater intrusion, habitat creation, environmental enhancement, and lake stabilization. In addition, the "greenhouse effect" of recycled water is evaluated.

Fifteen of 18 water reclamation/recycling agencies identified within the SAR Watershed provided detailed information including current and projected treatment plant capacities, plant flows, amounts of water recycled and disposed, how recycled water is used, and recycled water storage facility volumes. The agencies and their facilities are described in the chapter. Projections in the same categories also are provided in five-year increments through 2030.

Water recycling will be an increasingly important part of California's sustainable water future. However, challenges related to recycled water projects are varied and range from regulatory issues, ability to handle storage/seasonal variability, water quality impacts, salinity management to public acceptance, perception, and policy issues.

Strategies to address water quality impacts are being addressed by the Emerging Constituents Work Group which is made up of stakeholders and the Regional Water Quality Control Board, Santa Ana Region (Regional Board). In some management zones, the maximum benefit process is being used to set maximum benefit objectives.

Additional storage for recycled water is planned, but a more comprehensive effort needs to be developed.

Desalination of brackish groundwater addresses salinity management issues. Also, some agencies are conducting investigations relating to zero liquid discharge from desalters to further refine the process.

Orange County Water District (OCWD) is putting high quality, treated recycled water into the basin thereby improving water quality by lessening overall salinity.

In addition, some agencies are making recycled water available to individual residences for yard irrigation and toilet flushing; and meeting water quality specifications through specialized treatment improving user confidence and acceptance with specialized user advice and user support groups, promoting public acceptance, improving public perception, and working to develop potentially favorable policies.

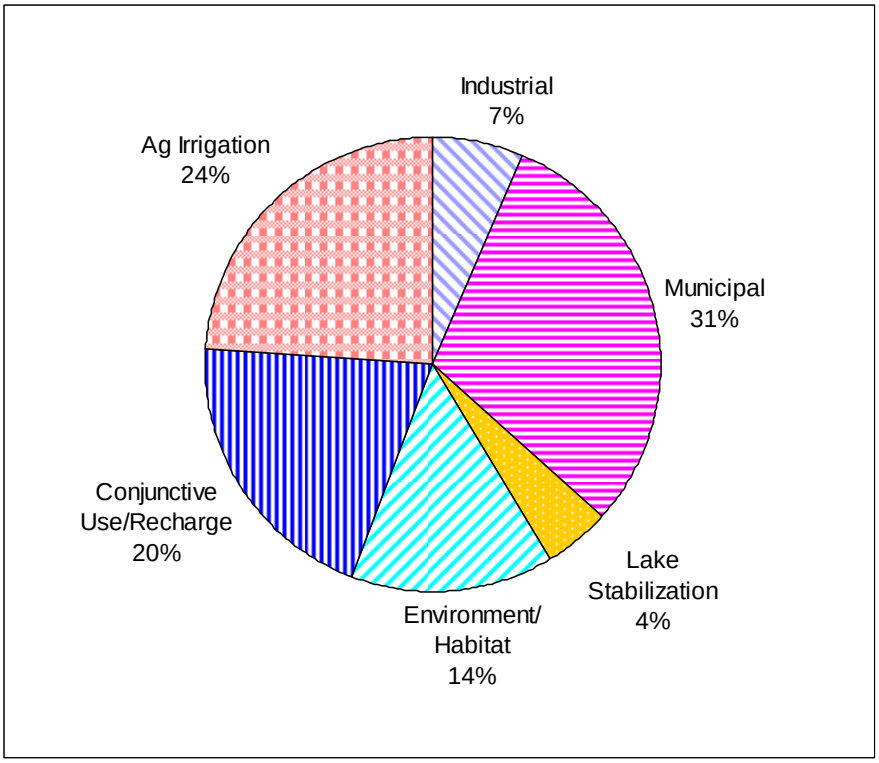
Introduction

Water recycling, also known as water reclamation or water reuse, is a reliable, economically feasible, and environmentally sensitive means to preserve the State's potable water resources, assist with drought mitigation, and reduce the demand on potable water supplies.

Statewide, over 525,000 acre-feet (AF) of wastewater is recycled each year according to the California Department of Water Resources. Currently, recycled water is used to: 1) irrigate crops, landscaped areas, golf courses, and freeway medians; 2) replenish groundwater basins; 3) flush toilets and urinals; and 4) act as a barrier to sea water intrusion into freshwater groundwater basins. In addition, it also is increasingly used by industry in cooling processes, in new home and other construction, and for other purposes. In the future, the level of recycling will increase to help meet the needs of the State's burgeoning population.

The SAR Watershed is dependent on imported water sources due to a variety of factors including the geographic location of the region, limited local water supplies, a growing population, and the prospect of future sustained drought years. In addition, the area is now faced with reductions in the amount of imported water supplies it can obtain from both the Colorado River and the State Water Project. The long-term transfer of Arizona's and New Mexico's allocations of Colorado River water to southern California have been eliminated to meet increased demands for water in Arizona and Nevada, which are now requiring their full share of water. Southern California's allocation of State Water Project water has been reduced to meet environmental needs in the San Francisco Bay/Sacramento-San Joaquin Delta and its tributaries. This reduction in imported supplies, along with population growth in the region, make identifying new water sources as well as reducing water use through water conservation measures, imperative for the region.

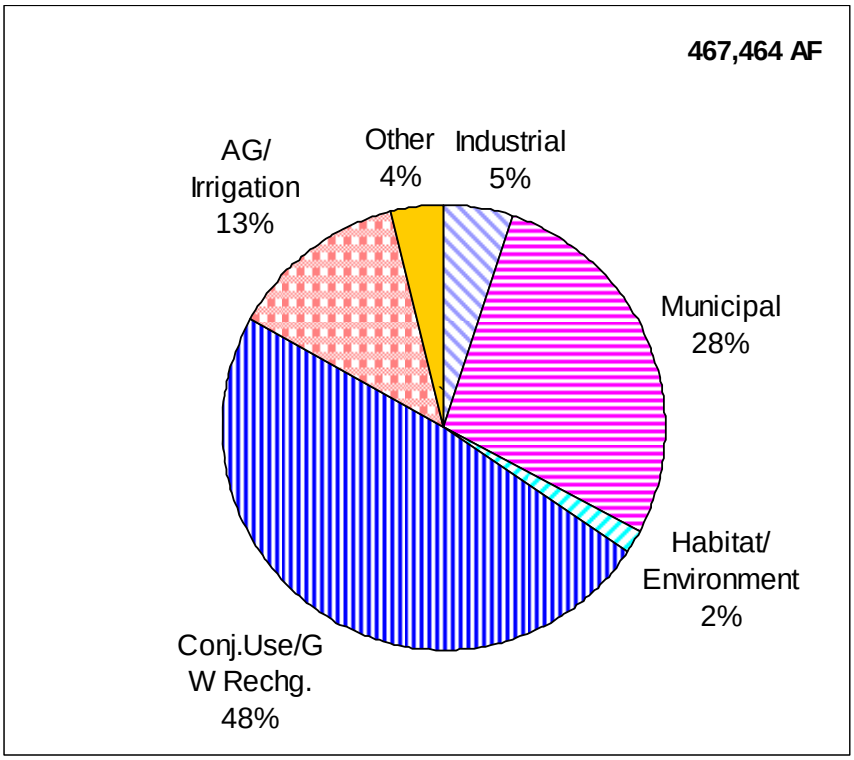
Figure 5.3-1 Current Rate of Recycled Water Use within the Watershed



Currently, agencies within the Watershed have the capacity to treat nearly 800,000 acre-feet per year (AFY). Current plant flows total nearly 550,000 AFY and approximately 101,500 AFY of recycled water is used to meet

water needs such as industrial and municipal uses, habitat creation and environmental enhancement, conjunctive use and groundwater recharge, landscape and agricultural irrigation, and conjunctive use/recharge within the SAR Watershed. The 101,500 AFY figure does not include recycled water discharged to the SAR that is subsequently captured and recharged. **Figure 5.3-1** depicts the current fate of recycled water use within the Watershed.

Figure 5.3-2 Estimated Distribution of the 467,000 AF in 2030



As urban and suburban growth and development in the Watershed continue, an increasing amount of recycled water will be available while the traditional demand by agricultural customers will decrease. This creates a challenge to establish a growing recycled water market for commercial, industrial, and institutional customers as well as developing innovative and creative markets elsewhere.

Current projections for 2030 indicate wastewater treatment plant flows of more than 750,000 AFY with more than 467,000 AFY of those flows recycled. **Figure 5.3-2** depicts the estimated distribution of the 467,000 AF in 2030.

Recycled water supplies are fairly constant year round, but demands are seasonal in many areas; therefore, storage plays an important role in recycled water management. Currently, agencies within the Watershed maintain more than 58,000 AF of storage capacity in ponds, reservoirs, and other impoundments. More storage is planned for the future.

Recycled water plays an important role in each of the other One Water One Watershed Pillars and is interlinked with them. It is an important element in increasing water supply reliability while also addressing other Pillars' issues. Recycled water has been successfully shown to be an ideal water source for environmental enhancement and habitat creation. Adding disadvantaged communities to sewer systems not only improves groundwater quality, it also increases the amount of recycled water available as a resource that can be used in lieu of potable water in many situations.

The *Collaboration and Integration with Other Pillars* section contains a table outlining linkages between the Recycled Water Pillar and the other Pillars.

Today, recycled water is more important than ever and is a critical element in water resources management. Water recycling is one of many effective ways to conserve potable water. Water recycling involves the use of water that normally would be discharged as treated wastewater to inland or coastal bodies of water. Wastewater was once a liability, something to be disposed of or thrown away. Today it is an asset, every gallon of water that can be reused at least once means that one more gallon can remain underground or need not be imported from northern California or the Colorado River. Promoting the use of reclaimed or recycled water, providing for the conservation and reuse of all water resources, and utilizing reclaimed or other non-potable water for any approved purpose to the maximum extent possible under the laws of the State of California makes sense. It makes sense to reclaim and recycle what was once "wastewater" by turning it into an asset that extends the potable water supply, generates revenue, and provides irrigation water for arid and semi-arid water-scarce areas. This liability is now an asset to be maximized and wisely utilized wherever and whenever possible.

Current Conditions

Recycled water has been used in the Watershed for many years to supplement local and imported potable supplies. Water reclamation involves treating wastewater to State standards and safe for State-approved non-potable applications. Approximately 101,500 AFY of recycled water currently is being used to meet water needs such as municipal (31%), agricultural irrigation (24%), groundwater recharge (20%), habitat and environmental (14%), industrial (7%), and lake stabilization (4%) applications within the SAR Watershed (see **Figure 5.3-1**).

The above percentages do not include the treated wastewater discharged into the SAR in San Bernardino and Riverside Counties that is subsequently put to use by OCWD. Except during periods of high storm flow, OCWD currently recharges all the flow in the SAR using surface recharge basins in Anaheim and Orange. The Orange County Judgment imposes a physical solution that requires parties above Riverside Narrows to deliver a minimum quantity (12,420 AF) and quality of water downstream. The cumulative requirement is 42,000 AFY at Prado Dam. However, since upstream recycling is just becoming economical in the upper and middle watershed, OCWD has received considerably more than this minimum flow for many years. From 1997 to 2007, the amount of SAR baseflow (SAR flows excluding baseflow and non-tributary flows) recharged in Orange County averaged 150,000 AFY. Including these figures in the above percentages would result in groundwater recharge being the major use of recycled water. Over time, much of the treated wastewater that is currently flowing in the SAR will be recycled upstream, thereby reducing the treated wastewater flow in the river. When this occurs, OCWD will replace these "lost" flows by recycling more of the wastewater that flows into the ocean, importing more water, desalting the ocean, or some other new source of supply.

In the past decade, a number of varied and large recycling projects have been completed or initiated. Irvine Ranch Water District's (IRWD) innovative dual-plumbed water system, which supplies recycled water to commercial buildings for use in flushing toilets and urinals, pioneered such use. Today, over 40 such commercial buildings using disinfected tertiary recycled water exist. Elsinore Valley Municipal Water District (EVMWD) uses recycled water to help replenish and enhance Lake Elsinore, a natural recreational lake long-plagued with severe seasonal evaporation losses. The focus of the program is to stabilize lake levels, improve water quality, and enhance Lake Elsinore as a regional aesthetic and recreational resource.

Orange County Sanitation District (OCSD) and OCWD developed a major Groundwater Replenishment System (GWRS) to treat wastewater usually discharged to the ocean using microfiltration, reverse osmosis, and ultraviolet disinfection. This purified water is equivalent to or better than the quality of drinking water and meets all State and Federal drinking water standards. The water is pumped to spreading ponds near the SAR for percolation into the groundwater basin, with some injected along the coast as a barrier to seawater intrusion. In addition, OCWD has a long history of success with its well-known Water Factory 21, a major program in which municipal wastewater was treated and injected into the groundwater basin to prevent seawater intrusion and protect and replenish local groundwater supplies.

The Inland Empire Utilities Agency (IEUA) is expanding water reuse within its service area through rapid implementation of a distribution network that will provide recycled water for direct non-potable use and groundwater replenishment. In 2005, IEUA and the Chino Basin Watermaster received the necessary permits to begin Phase 1 of their recycled water groundwater replenishment program. Phase 2, which more than doubles the capacity of the replenishment program, was permitted in June 2007. IEUA also has embarked on a massive effort to increase direct deliveries of recycled water to municipal and industrial customers, including power plants, golf courses, and agriculture.

The San Bernardino Valley Municipal Water District (Valley District) currently is working with other agencies within its service area to recycle more of the treated wastewater that currently flows into the SAR. Without recycling its wastewater, the Valley District service area will not have enough water resources to meet future demands. The City of San Bernardino Municipal Water Department (SBMWD) is investigating enhanced tertiary treatment methods at its secondary water reclamation plant. This enhanced treatment will allow the SBMWD to use this recycled water for groundwater recharge and direct delivery in the Upper SAR Basin. Numerous other water agencies have been proactive in water recycling efforts and/or projects; they are described in the *Facilities* section below.

Recycled water currently represents the fourth largest water supply source to the SAR Watershed, accounting for approximately four percent of total water demands. Including OCWD's recharge of SAR flows, the percentage of water demands met by water recycling or indirect recycling is approximately 14 percent. This figure includes only direct use applications such as landscape and agricultural irrigation as well as commercial and industrial uses. As infrastructure is developed, recycled water is projected to surpass surface water to become the third largest supply source for the Watershed.

Facilities

The agencies in the SAR Watershed engaged in wastewater treatment and/or water recycling, listed alphabetically, are discussed below.

Big Bear Area Regional Wastewater Agency (BBARWA)

In July 1973, individual subsurface sewage disposal systems (septic tank leach field systems) were found by the Regional Board to be no longer adequate to serve the growing needs of the Big Bear Valley.

The State Water Resources Control Board (SWRCB) and the California Department of Public Health (CDPH), along with the City of Big Bear Lake, Big Bear City Community Services District (BBCCSD), and the County of San Bernardino, determined that consolidating the region's wastewater treatment facilities would be the best approach to protecting the valley's abundant natural resources and handling wastewater treatment and disposal. BBARWA was formed to decide how this process would be achieved and to take advantage of Federal Clean Water Act funds. The regional wastewater treatment plant owned and operated by BBARWA began operation in March 1974. The treatment plant is located within 93.5 acres, adjacent to Baldwin Lake. It provides wastewater conveyance, treatment, and disposal for the residents of the Big Bear Valley.

The service area for BBARWA includes the entire Big Bear Valley (79,000 acres) and is served by three separate collection systems: the City of Big Bear Lake, representing approximately 47% of the total flow; BBCCSD, representing approximately 48% of the total flow; and the County of San Bernardino Service Area 53B, representing approximately 5% of the total. Each underlying agency maintains and operates its own wastewater collection system, and delivers wastewater to the BBARWA's interceptor system for transport to the regional plant.

City of Beaumont and Beaumont-Cherry Valley Water District (BCVWD)

Beaumont's wastewater treatment plant serves an area entirely within the service area of the BCVWD, but the City of Beaumont is responsible for the collection and treatment of wastewater. BCVWD and the City of Beaumont coordinate on recycled water projects for reuse of treated wastewater. The City of Beaumont presently is making modifications and enhancements to the plant to increase plant capacity. It is planned that the community of Cherry Valley will be sewered to the City of Beaumont's treatment plant through BCVWD's latent wastewater power. The City of Beaumont previously expanded and upgraded its treatment plant to a full reclamation facility. This was in response to a Regional Board request to upgrade the level of treatment to allow continued discharge to Cooper's Creek, a tributary to San Timoteo Creek. In lieu of discharging effluent to the creek, the City of Beaumont and BCVWD, through a two party cooperative agreement, agreed to implement a water recycling project, since the effluent limits for discharge to the creek currently are equivalent to that required for water recycling. The City of Beaumont will operate the treatment facility and deliver treated water to BCVWD for recycling.

City of Colton Public Works Department

An abundant local water supply is one of Colton's greatest assets. The City of Colton sits on one of the largest potable aquifers in the State of California; therefore, 100% of the City of Colton's water comes from deep water wells.

The Colton Water Reclamation Facility provides both primary and secondary treatment. The reclaimed water is then sent to the Rapid Infiltration and Extraction (RIX) Facility in San Bernardino (See below under City of San Bernardino). All of the City of Colton's flows are sent to RIX Facility for treatment, except when the river allows a 20:1 dilution for their secondary treated waters. No recycled water is sold by the City of Colton for use by customers.

City of Corona

The City of Corona owns and operates wastewater treatment plants with a combined treatment capacity of 15 million gallons per day (MGD). The original plant was constructed in 1968, and since then, two new treatment plants have been added with several million dollars in upgrades and modifications to meet growth and new regulatory requirements. The City of Corona is now reclaiming wastewater for irrigation of City parks, local golf courses, and landscape maintenance districts. Treated effluent not reclaimed is discharged to Temescal Creek or sent to percolation ponds for groundwater recharge.

The City of Corona has developed water recycling system supplies that will meet its projected growth to 2030. It already has constructed $44,000,000 worth of pumping and distribution facilities. The recycling system will provide non-potable service throughout a major portion of the City of Corona. The remaining portion of the construction program will provide greater flexibility in the distribution of recycled water and the ability to use an existing debris basin for groundwater recharge.

Wastewater Treatment Plant #1, consisting of Wastewater Treatment Plants #1A and #1B, and Wastewater Treatment Plant #3 are currently in operation. Wastewater Treatment Plant #1A discharges to local percolation ponds, and Wastewater Treatment Plant #1B discharges to the SAR and the recycled water distribution system.

City of Norco

The City of Norco's Sewer Maintenance Division provides for the continued maintenance and operation of the City of Norco's sanitary sewer system as well as for the annual cost of effluent treatment. This division has the primary responsibility of providing scheduled routine maintenance of the sanitary sewer system, operation and maintenance of the ten lift stations as well as providing for emergency maintenance repair response.

The City of Norco's Recycled Water Piping Project resulted in the installation of over seven miles of pipeline, a small reservoir, and pump station to create a new recycled water distribution system to deliver up to 895 AFY of recycled water.

The City of Norco does not operate a treatment plant; they are served by the Western Riverside County Wastewater Authority.

City of Redlands

Originally built in the early 1960's, the City of Redlands' Wastewater Treatment Facility operated for decades as a secondary treatment facility, percolating effluent into the groundwater basin. In 2000, a more stringent discharge requirement for total inorganic nitrogen (TIN) and the opportunity to offset potable water use spurred the City of Redlands to upgrade the plant to provide tertiary treatment. They negotiated with a local power generator to provide high quality recycled water that the power company would purchase for use as cooling water. After studying alternatives, the City of Redlands decided on an upgrade that resourcefully combines the solids separations process of submerged membranes with the biological nitrification/de-nitrification process to supply high quality recycled water, while using less expensive traditional secondary treatment technology to treat a portion of the flow for percolation.

To meet basin plan requirements, the upgraded facility removes nitrogen from 9.5 MGD of wastewater to a level of less than 10 mg/L of TIN. The membrane bioreactor (MBR) train treats up to six MGD of the total flow to meet or exceed Title 22 requirements for low-turbidity, disinfected effluent. The plant's conventional train can treat the remaining 3.5 MGD to a lower quality for percolation in existing ponds.

In 2004, the plant began producing high quality tertiary effluent as the largest MBR facility in the United States.

The new recycled water treatment facility allows the City of Redlands to recover some of the costs of treatment through the sale of effluent and provides the area with a new source of water, leaving the local groundwater and imported water supplies for domestic use.

City of Rialto

Serving the City of Rialto, the Rialto Wastewater Treatment Plant handles waste from a community of approximately 75,000 people – treating approximately two billion gallons of wastewater per year. The City of Rialto maintains over 150 miles of sewer mains. The new treatment plant is expected to be fully operational at the start of the new fiscal year. The plant soon will be powered by used kitchen grease, waste sludge, and a hydrogen fuel cell, making it the nation's first system to power a hydrogen fuel cell using methane gas from decomposing greases and sewage wastes.

City of Riverside

The Regional Water Quality Control Plant (RWQCP) is located on a 121-acre site in Riverside, south of the SAR. It consists of two secondary treatment plants, one tertiary treatment plant, and sludge handling facilities that treat wastewater from Riverside and three community service districts: Edgemont, Jurupa, and Rubidoux.

Effluent from Riverside's RWQCP is discharged through the Hidden Valley Wetlands Enhancement Project for nutrient removal and environmental enhancement at an average rate of 11,500 AFY. This water enters the SAR downstream of the wetlands with minimal loss to evaporation or transpiration.

City of San Bernardino

The SBMWD has operated its Water Reclamation Plant (WRP) since 1973. The WRP is a 33 MGD Regional Secondary Treatment facility that provides wastewater treatment services for the City of San Bernardino, Loma Linda, East Valley, San Bernardino International Airport, Patton State Hospital, and unincorporated San Bernardino County areas.

The RIX Facility receives approximately 33 MGD of secondary treated wastewater from the WRP and the City of Colton's Wastewater Reclamation Facility. Natural bio-filtration is employed through the use of percolation basins and ultra-violet disinfection is used to meet the State of California Title 22 tertiary standards in addition to the discharge standards specified in a separate NPDES permit issued to the RIX facility. RIX treated wastewater consistently meets or exceeds required discharge standards and is often superior in quality to effluent produced through conventional tertiary facilities.

The SBMWD is investigating alternatives to reduce the hydraulic loading to its RIX facility by utilizing enhanced tertiary treatment methods at its secondary water reclamation plant. This effort will allow the SBMWD to reuse a large portion of its recycled water for groundwater recharge and direct delivery uses in the Upper SAR Basin. The Upper SAR Basin is dependent upon the recycled water from this regional plant to meet future water demands.

Eastern Municipal Water District (EMWD)

EMWD has been treating wastewater within its service area since the 1960's. Originally, treated effluent was disposed of through on-site percolation/evaporation ponds. As flows increased, the District began marketing recycled water to local farmers for the irrigation of feed and fodder crops and began extending transmission facilities to deliver this recycled water to these new customers.

EMWD's five regional treatment plants today serve some 130,000 connections, including those originating with local water agencies and municipalities.

In 1991, EMWD applied for and received funding through the U.S. Bureau of Reclamation to develop a recycled water “backbone” transmission system, which greatly expanded the District's ability to deliver recycled water to a growing customer base. Subsequent facility improvements in the recycled water system are now in place linking all of the District's regional water reclamation facilities (RWRF). System pressurization projects also have been implemented to provide the level of service required for municipal and industrial customers throughout the majority of the recycled water system.

Within its 555-square mile service area, EMWD owns or operates five RWRFs, four of which are located in the SAR Watershed. These regional treatment plants today serve some 130,000 connections, including those originating with local water agencies and municipalities. A network of pipelines extends for nearly 1,200 miles, supported by 35 lift (pumping) stations. The nearly $50,000,000 “backbone” recycled water distribution system links the five RWRFs in order to move recycled water supplies to areas of demand. The RWRFs are:

- The ***San Jacinto Valley RWRF***, a 255-acre facility west of the City of San Jacinto, serves a growing population living within its 167-square mile service area. Recently converted to

tertiary treatment, the facility provides recycled water to dairies and other agricultural customers as well as the 10,000 acre California Department of Fish and Game's San Jacinto Wildlife Area (SJWA) adjacent to Lake Perris. The SJWA was the first state wildlife refuge to utilize reclaimed water for habitat development. In addition, EMWD's Hemet/San Jacinto Multipurpose Constructed Wetlands is located at the site. The wetlands were constructed to provide habitat and environmental enhancement, additional treatment of secondary treated wastewater, and opportunities for public education and other public benefits. One to three MGD of recycled water flow through the award-winning wetlands prior to entering EMWD's recycled water distribution system for subsequent reuse.

- The ***Moreno Valley RWRF*** provides water reclamation for most of the ever-expanding Moreno Valley. In addition to providing recycled water for agriculture, this plant provides recycled water for greenbelt and median strip irrigation at the Moreno Valley Ranch development.
- The ***Perris Valley RWRF***, centrally located in EMWD's service area, receives sewage from a 120-square mile area including Perris, Sun City, Romoland, Homeland, and a portion of Moreno Valley. The recycled water is sold for agricultural irrigation and to duck clubs.
- The ***Sun City RWRF*** redirects wastewater from residents living within a 57-square mile area and sends it to the Perris Valley RWRF for processing. Although this plant processes no wastewater on-site at this time, wastewater treatment could begin again in a few years. Two desalters, the Menifee Desalter and the Perris I Desalter, are used to desalinate brackish groundwater are located at the site. A brine line was constructed from the RWRF downstream to Temescal Canyon for eventual disposal into the Santa Ana Regional Interceptor (SARI), a larger brine line that follows the SAR. A third desalter, the Perris II Desalter, is in the design stage and will also be located at the same facility.
- Although located in the Santa Margarita River Watershed, the ***Temecula Valley RWRF*** does pump reclaimed water ten miles north to the Winchester Ponds in the San Jacinto Watershed when additional storage is required or for other operational reasons.

Elsinore Valley Municipal Water District (EVMWD)

Long plagued with severe seasonal evaporation losses, Lake Elsinore is a natural recreational lake that annually loses 14,000 AF of water to evaporation. In January 2002, the Regional Board granted EVMWD a permit to discharge recycled water via its Regional Wastewater Treatment Plant into Lake Elsinore for two years under a pilot project to research the effects of recycled water on the lake — the treatment plant already discharges four MGD of tertiary treated water into Temescal Creek. On June 28, 2002, members of the Recycled Water Task Force, the EVMWD Board of Directors and staff, and Lake Elsinore City officials joined to celebrate the first release of recycled water into Lake Elsinore. This was the first time that recycled water had been released into a recreational lake in California. About 2,000 AF of recycled water was released in the remaining six months of 2002.

In 1984, EVMWD purchased the City of Lake Elsinore's aging sewer system. That same year, they received State and Federal loans and grants to fund a new regional sewer system under the Clean Water Act. The Railroad Canyon Wastewater Treatment Plant was completed and online serving

the Canyon Lake Community the same year. In 1986, the Regional Wastewater Treatment Plant with a two MGD capacity was dedicated and in operation. In 2005, the facilities secondary biological process was upgraded to achieve a TIN of less than 10 mg/L.

Though currently operational, the Horsethief Canyon Wastewater Reclamation Plant is scheduled to be replaced in about 2012. Approximately 1.25 AF/day of recycled water from this is utilized in parks, green belts, and median strips throughout the community. The Alberhill Regional Wastewater Facility is to be constructed and on line in 2015 and will be expanded in 2-3 MGD phases.

Inland Empire Utilities Agency (IEUA)

IEUA currently operates five regional wastewater treatment plants, all producing tertiary treated water meeting full body contact recreation standards that is ultimately discharged to the SAR. They are:

- Regional Water Recycling Plant No. 1 (RP-1) has been in operation since 1948 and serves the cities of Ontario, Rancho Cucamonga, Upland, Montclair, Fontana and an unincorporated area of San Bernardino County.
- Regional Water Recycling Plant No. 2 (RP-2) has been in operation since 1960. In 2004, IEUA's RP-2 stopped processing wastewater, but continues to treat solids from Regional Water Recycling Plant No. 5 (RP-5) and the Carbon Canyon Wastewater Recycling Facility (CCWRF).
- Regional Water Recycling Plant No. 4 (RP-4) is located in the City of Rancho Cucamonga at the intersection of 6th Street and Etiwanda Avenue. The plant serves both the Cucamonga Valley Water District and the City of Fontana. An eight-mile, 30-inch pipeline transports the final effluent to the Cucamonga Flood Control Channel at Regional Plant No. 1. The flood control channel is tributary to the SAR.
- RP-5 is located immediately east of IEUA's Administrative Headquarters in the City of Chino and began operation in March 2004. Wastewater treatment at RP-2 was relocated to this facility that serves both the City of Chino and the City of Chino Hills.
- The CCWRF, located in the City of Chino, has been in operation since May 1992. The facility serves the areas of Chino, Chino Hills, Montclair, and Upland.

The five treatment plants provide the source of recycled water for rapidly increasing uses such as landscape irrigation, power generation and groundwater replenishment. In the recently completed IEUA platinum LEED headquarters building, recycled water is used for toilet flushing and landscape irrigation. Adjacent to the headquarters building, IEUA has constructed a water education park with wetlands that process recycled water.

An extensive network of piping has been installed by IEUA to allow distribution of recycled water to municipal and industrial customers and several recharge sites are now percolating recycled water for underground storage. The regional distribution network continues to be expanded and new customers are continually being added. Future projects call for additional piping, storage, and pumping capabilities.

Irvine Ranch Water District (IRWD)

Michelson Water Reclamation Plant in Irvine and the Los Alisos Water Reclamation Plant in Lake Forest treat wastewater collected within the IRWD using advanced, or tertiary, treatment. The recycled water distribution system, which is comprised of over 300 miles of pipeline and 15 storage facilities including three open reservoirs, provides recycled water to over 4,000 sites including fields and orchards planted with a variety of fruits, vegetables, and nursery products. Recycled water also is used to irrigate landscapes including parks, schools, golf courses, streetscapes, and open space managed by many community associations. About 300 estate-sized residential lots also use this water for front and backyard irrigation. Many water features such as the lake at Mason Park are filled with recycled water.

Wastewater flows from the Michelson Plant that are greater than what is needed for reuse or storage are sent to OCSD for treatment and ocean disposal. Flows from the Los Alisos Plant that are greater than what is needed for reuse are treated to secondary levels and discharged for ocean disposal through South Orange County Wastewater Authority‘s system. With minor exceptions, tertiary treated wastewater is not discharged to the ocean.

In 1991, IRWD became the first water district in the nation to obtain health department permits for the interior use of recycled water from a community system. Recycled water is used for toilet flushing in IRWD's facilities as well as over 40 commercial office buildings constructed with dual piping systems, and for cooling towers and industrial uses such as carpet dyeing. Potable demands in these buildings have dropped by as much as 75 percent due to the use of recycled water.

Lee Lake Water District (LLWD)

LLWD is a California Water District formed in 1965 in order to provide water and wastewater services to the residents of the Temescal Valley between the Cities of Lake Elsinore and Corona. LLWD is within the service area of the Western Municipal Water District (WMWD), who is a member of the Metropolitan Water District of Southern California (MWDSC). LLWD obtains its water from MWDSC, who imports it from northern California. The water then is treated at the Henry J. Mills Water Filtration Plant in Riverside.

LLWD operates the Lee Lake Water Reclamation Facility located just east of the Wild Rose Business Park. During the most recent expansion of the Reclamation Facility, the capacity was increased to treat 1.575 MGD of raw sewage and produce tertiary reclaimed water usable for landscape irrigation and other non-consumptive purposes. Currently, LLWD reclaims 100% of the plant flow during the summer months for the Retreat Golf Course irrigation demands and landscaping within the Wild Rose Business Park.

Orange County Sanitation District (OCSD)

OCSD operates the third largest wastewater agency west of the Mississippi River. For over 50 years, they have collected, treated, and disposed of and/or reclaimed the wastewater generated by 2.5 million people living and working in central and northwestern Orange County.

OCSD has two operating facilities that treat wastewater from residential, commercial, and industrial sources in central and northwest Orange County. OCSD releases treated water into the ocean through a 120-inch diameter offshore pipeline that extends 4.5 miles from shore to the discharge point approximately 200 feet below the ocean surface. A 78-inch diameter emergency standby pipeline stretches one mile from shore. An abundance of marine life has taken up residence along both pipelines.

In 2008, OCSD and OCWD began operation the Ground Water Replenishment System. This water supply project reuses 72,000 AFY of advanced treated wastewater. The project purifies highly-treated wastewater that was previously released to the ocean. Using advanced water treatment facilities, the water is purified through microfiltration, reverse osmosis and ultraviolet disinfection to levels that far exceed drinking water standards. The purified water is recharged into the Orange County Groundwater Basin either by injection along the coast as a barrier to protect the basin from seawater intrusion or by percolation in ponds in Anaheim.

Orange County Water District (OCWD)

OCWD's primary responsibility is managing the vast groundwater basin under north and central Orange County that supplies water to more than 20 cities and water agencies, serving more than two million Orange County residents. Since 1933, OCWD has replenished and maintained the groundwater basin at safe levels while more than doubling the basin's annual yield. This important source of water provides local groundwater producers with a reliable supply of high-quality water.

OCWD primarily recharges the basin with water from the SAR and to a lesser extent with imported water purchased from the MWDSC. Per the Orange County Judgment, the parties above Riverside Narrows must deliver a minimum quantity of baseflow (12,420 AFY) downstream. The cumulative requirement is 42,000 AFY at Prado Dam. This water along with stormflow enters the groundwater basin via settling or percolation ponds in the cities of Anaheim and Orange. Behind Prado Dam (constructed and owned by the U.S. Army Corps of Engineers for flood prevention), OCWD owns 2,400 acres in Riverside County, which OCWD uses for water conservation, water quality improvement, and environmental enhancement.

The GWRS discussed above is a joint project of OCSD and OCWD. Additionally, the Green Acres Project is a water recycling effort that provides recycled water for landscape irrigation at parks, schools and golf courses as well as for industrial uses. Since 1991, the Green Acres Project has provided an alternate source of water in the Cities of Costa Mesa, Fountain Valley, Huntington Beach, Newport Beach and Santa Ana.

Western Municipal Water District (WMWD)

WMWD provides wastewater service to areas of unincorporated Riverside County north and east of Lake Mathews within its retail water service boundary. This area is served by the Western Water Recycling Facility (WWRF), which currently is a one MGD wastewater treatment facility producing secondary treated recycled water. The plant is undergoing expansion to three MGD capacity with the capability of providing tertiary treated recycled water; completion is expected in mid-2010.

The WWRF currently provides recycled water to the Riverside National Cemetery and the General Archie J. Old Golf Course for landscape irrigation. With future tertiary treatment capability, the recycled service area will expand to the west providing recycled water for commercial and institutional irrigation use.

WMWD is a member agency of the Western Riverside County Regional Wastewater Authority (WRCRWA) and the contract operator of the WRCRWA Wastewater Treatment Plant, an eight MGD plant capable of producing tertiary treated recycled water. The plant currently operates with a live stream discharge to the SAR, but with a recycled water distribution system, can provide recycled water to the City of Norco and to the Jurupa Community Services District service area. The WRCRWA is in the early planning stages of an expansion project to 11-146 MGD capacity. They are in the final planning stages of providing recycled water to the City of Norco, but distribution infrastructure is required in the City (see City of Norco discussion above).

WMWD also operates a 3.5-mile pipeline and pump station capable of delivering up to 500 AFY of treated groundwater from the March Air Reserve Base Groundwater Recovery Project used to irrigate the Riverside National Cemetery and the General Archie J. Old Golf Course.

Yucaipa Valley Water District (YVWD)

The H. N. Wochholz Regional Water Recycling Facility (WRWRF) was originally constructed in 1986 with a capacity of three MGD. In 1992, YVWD expanded the treatment facility and added a tertiary treatment process. In 2008, the YVWD completed a treatment enhancement and expansion project that increased capacity at the facility to over six MGD with microfiltration and ultraviolet disinfection to produce high quality recycled water. The enhancement also included facilities necessary to meet YVWD's maximum benefit obligations implemented by the Regional Board in the 2004 Basin Plan. Recycled water from the WRWRF can be used to irrigate crops, orchards, and golf courses, in addition to being used as high quality water for cooling, boiler-feed, or other industrial process purposes.

The YVWD operates a Non-Potable Water Distribution System that currently provides over 1,000 AF of non-potable water per year. This system will be expanded in the future to provide individual homes with recycled water for front yard and rear yard irrigation. This program is expected to reduce the potable water demand at a new home by 50%-60%.

To further enhance the quality of the recycled water, the YVWD is in the process of constructing a brine line facility that will remove salinity in the recycled water supply from 500mg/L to about 300 mg/L. Additional treatment with reverse osmosis membranes will provide YVWD with the ability to perform groundwater injection of ultra-pure recycled water to augment long-term groundwater supplies.

Figure 5.3-3 shows the recycled water systems in the SAR Watershed. Included in the display are existing and proposed recycled water pipelines, existing and proposed wastewater treatment plants, existing and proposed storage tanks, existing storage ponds, and the SARI. Agencies that provided map information include BBARWA, City of Corona, City of Riverside, EMWD, EVMWD, IEUA, IRWD, LLWD, OCSD, OCWD, WMWD, and YVWD.

Plant Capacities & Recycled Water Use

Water reclamation facilities operating in the Watershed are shown in **Table 5.3-1** along with effluent water quality [Total Dissolved Solids (TDS) and Total Nitrogen) and sources of supply. Sources of supply indicated in the table include State Project Water (SPW), Colorado Aqueduct (CA), local groundwater (LGW), and others (OT). The data were provided by the agencies listed in the table.

In the watershed, recycled water is used for industrial and municipal uses; lake stabilization; habitat creation, enhancement, and other environmental uses; conjunctive use and groundwater recharge; and agricultural irrigation. In the City of Riverside, recycled water is used in the Hidden Valley Wetlands prior to live stream discharge into the SAR.

Figure 5.3-3 Santa Ana River Watershed Recycled Water Systems

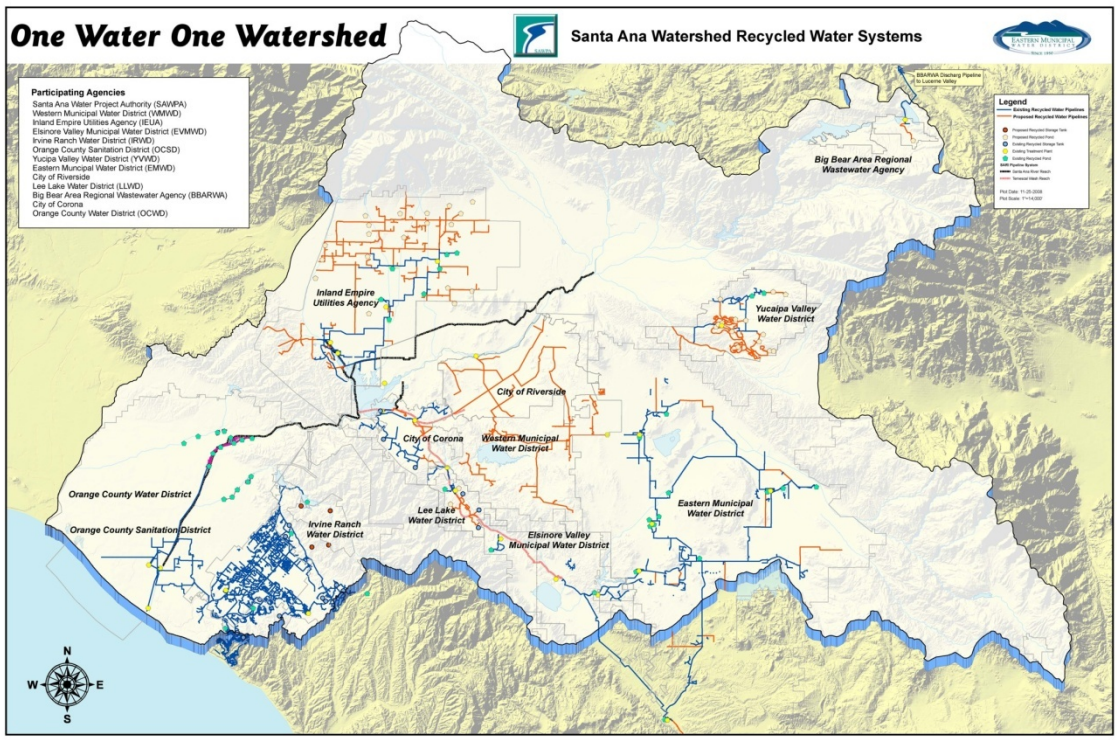


Table 5.3-1 Current (2005) Reclamation Plant Capacities, Flows, and Water Quality

Agency/Facility	Plant Capacity AFY	Plant Flow AFY	Quality mg/L		Source(s) of Supply
			TDS	TIN	
BBARWA	5,489	3,317	475	4.5	LGW
City of Beaumont WWTP #1	4,480	No Data Received			
City of Colton WRF	11,648				
City of Corona WWTP #1	12,876	10,237	748	4.6	SPW, CA, LGW
City of Corona WWTP #3	1,120	455	806	4.1	SPW, CA, LGW
City of Redlands WWTP	6,720	4,704	410	5.0	
City of Rialto WWTP	13,104				
City of Riverside RWQCP	44,840	38,100	600	11.5	LGW
City of San Bernardino WRP	37,000	29,000	550	13.0	LGW
EMWD – Moreno Valley RWRF	17,900	14,092	481	10.5	SWP, LGW
EMWD – Perris Valley RWRF	12,300	11,802	712	14.4	SPW, CA, LGW
EMWD – San Jacinto Valley RWRF	12,300	9,347	563	13.6	SPW, CA, LGW
EMWD – Temecula Valley RWRF	15,700	13,646	713	9.1	CA, LGW
EVMWD – Regional WWTP	8,964	5,782	700	4.5	SPW, CA, LGW
EVMWD – Railroad Canyon WWRP	1,457	872		5.0	SPW, CA, LGW
EVMWD – Horsethief Canyon WWRP	560	468	700	25.0	SWP
EVMWD – Alberhill RWWF	---	---	---	---	---
IEUA – all treatment plants combined	86,700	71,800	500	8.0	LGW, SWP
IRWD – all plants	22,965	19,733	625	10.0	SPW, CA, LGW, OT
LLWD	1,759	1,008	580	7.0	SPW
OCSD Plant No. 1	228,480	98,560	950	DNM*	
OCSD Plant No. 2	188,160	173,600	1,250	DNM*	
San Bernardino/Colton RIX Facility	45,000	33,000	510	7.0	LGW
Western Water Recycling Facility	1,120	560	550	<1.0	SPW
WRCRWA WWTP	8,950	5,000	600	<10.0	SPW, LGW
YVWD H. N. Wochholz RWRF	7,500	4,200	495	10.0	SPW, LGW
Totals	797,092	549,283	AFY		

NOTES:

** OCSD/OCWD GWR System – Plant Capacity and Flows will each total 72,000 AFY in 2008

* San Bernardino/Colton RIX – 43,000 AFY Plant Flow includes over-extraction

DNM = Do Not Measure

Table 5.3-2 demonstrates how the different agencies in the watershed dispose of recycled water. The types of disposal indicated in the table include:

- LSD = Live Stream Discharge
- OD = Ocean Discharge
- DP = Disposal Pond
- OT = Other

In addition, flows from the City of Colton Water Reclamation Facility and San Bernardino Water Reclamation plant go to the San Bernardino/Colton RIX Facility.

Table 5.3-2 Current (2005) Recycled Water Uses

Agency/Facility:	Amount Recycled (AFY)								Type Disposal ***
	Industrial Use	Municipal Use	Lake Stabilization	Habitat/ Environ.	Conjunctive Use/GW Recharge	AG Irrigation	Total Recycled	Total Disposal	
Big Bear A. R. W. Agency	---	---	---	---	13	3,304	3,317	---	None
City of Beaumont WWTP #1	No data received								
City of Colton Water Rec.Fac.	San Bernardino/Colton RIX Facility								
City of Corona WWTP #1 ****	66	1,903	---	---	---	97	2,066	8,171	LSD, DP, OT
City of Corona WWTP #3 ****	---	40	---	---	---	415	455	0	LSD, OT
City of Redlands WWTP	2,016	---	---	---	2,688	---	4,704	---	---
City of Rialto Wastewater TP	No data received								
City of Riv. Reg. WQCP *	---	300	---	11,500	---	---	11,800	26,300	LSD
City of San Bernardino WRP	---	---	---	---	---	---	---	29,000	To RIX Facility
EMWD – all treatment plants	461	3,245	---	1,950	11,970	14,987	32,613	16,274	LSD
EVMWD Reg. WW Recl. Plant	---	---	4,549	1,233	---	---	5,782	---	none
EVMWD – Railroad Canyon	---	872	---	---	---	---	872	---	none
EVMWD –Horsethief Canyon	---	468	---	---	---	---	468	---	none
EVMWD – Alberhill	---	---	---	---	---	---	---	---	none
IEUA – all treatment plants	1,000	3,700	---	---	1,000	2,200	7,900	63,900	LSD
IRWD – all treatment plants	68	18,992	---	---	---	673	19,733	---	OD
Lee Lake Water District	---	40	---	---	---	---	40	968	LSD
OCSD Plant No. 1	---	---	---	---	---	---	---	88,560	OD
OCSD/OCWD GW Replen.Sys.**	---	---	---	---	5,000	---	5,000	---	none
OCWD Green Acres Proj.	3,000	---	---	---	---	2,000	5,000	---	none
OCSD Plant No. 2	---	---	---	---	---	---	---	173,600	
San Bern./Colton RIX Facility	---	---	---	---	---	---	---	33,000	LSD
Western Water Recycling Facility	---	---	---	---	---	560	560	---	---
W. Riv. Co. Reg. WW Auth.	---	---	---	---	---	---	---	5,000	LSD
Yucaipa Valley Water District		1,180	---	---	---	50	1,230	2,970	LSD
Totals	6,611	30,740	4,549	14,683	20,671	24,286	101,540	447,743	

Notes:
* Disposal includes 11,500 AFY used for habitat at Hidden Valley Wetlands prior to Live Stream Discharge
** Will be 72,000 F/Y in 2008.
*** Types of Disposal: Live Stream Discharge (LSD), Ocean Discharge (OD), Disposal Pond (DP), Other (OT).
**** Values are calculated based on total recycled water used and plant flows

Projected Plant Capacities & Recycled Water Use

There are numerous demands on water in the Watershed. The area is rich in agriculture, and still contains concentrations of citrus, dairy, and other crops and livestock that demand significant quantities of water. The area also has a large industrial/commercial base, and its rapidly expanding population requires, and will continue to require, a large quantity of water, now and in the future. In the year 2000, the Watershed required 1.4 million acre-feet (MAF) of water (467 billion gallons) to meet demand. Projections are that this demand will increase 47% in the next 40 years, so that, in 2050, the Watershed will require 2.1 MAF (687 billion gallons) of water to meet demands.

Future water supply projections indicate a shift from reliance on groundwater and imported water to increases in the use of recycled water and surface water. Given the imbalance between water pumped and water recharged, it should not be surprising that, under such intense settlement pressures and water demands, future water supplies will depend upon increased groundwater recharge. Future water supply planning includes increased groundwater recharge and measures to reduce impacts to native aquatic communities, while meeting increased water demands due to regional population growth.

Table 5.3-3 provides projections for reclamation facility capacities and flows in the years 2010, 2015, 2020, 2025, and 2030, and **Table 5.3-4** provides water quality projections and sources of supply for those same years. **Tables 5.3-5** to **5.3-9** provide projections for types of recycled water use.

Table 5.3-3 Projected Treatment Plant Capacities and Flows

Agency/Facility	Design Capacity AFY					Flow AF				
Years	2010	2015	2020	2025	2030	2010	2015	2020	2025	2030
Big Bear ARWA	5,489	5,489	5,489	5,489	5,489	2,100	2,100	2,100	2,100	2,100
Beaumont, City	No data received					No data received				
Colton, City	All flows go to the San Bernardino/Colton RIX Facility					6,800	7,300	7,885	8,500	9,150
Corona WWTP 1	12,875	16,235	16,235	16,235	16,235	10,304	12,992	12,992	12,992	12,992
Corona WWTP 2	1,120	1,120	1,120	1,120	1,120	507	896	896	896	896
Redlands, City	No projections available					No projections available				
Rialto, City	No data received					No data received				
Riverside RWQCP	44,800	58,300	58,300	58,300	67,400	42,400	47,300	51,300	55,377	67,400
San Bernardino	37,000	37,000	37,000	37,000	54,000	30,800	33,200	35,750	38,520	41,500
EMWD MVRWRF	17,900	20,170	20,170	20,170	20,170	16,696	18,590	19,935	20,865	21,145
EMWD PVRWRF	12,300	24,652	24,652	24,652	24,652	17,469	22,758	26,030	28,103	29,762
EMWD SJRWRF	12,300	15,688	15,688	15,688	15,688	10,768	12,292	13,424	14,220	14,847
EMWD TVRWRF *	15,700	15,700	25,773	25,773	25,773	15,990	16,909	17,974	19,072	20,159
EVMWD RWRC	8,964	13,447	13,447	17,929	17,929	7,933	10,455	12,404	14,197	16,808
EVMWD RCWRP	1,457	1,457	2,241	2,241	2,241	872	1,457	1,782	2,219	2,241
EVMWD HCWRP	560	Plant to be replaced in 2015				475				
EVMWD AWRP		2,241	2,241	5,603	5,603		1,188	2,219	3,362	5,042
IEUA	94,500	97,900	112,470	112,470	119,200	78,400	85,100	90,700	96,300	100,800
IRWD	37,527	37,527	43,128	43,128	43,128	26,203	26,091	27,948	29,251	29,615
Lee Lake WD	2,520	2,520	2,520	2,520	2,520	952	1,120	1,344	1,456	1,568
OCSD No. 1	228,480	201,600	201,600	201,600	201,600	103,264	122,080	138,880	154,560	168,000
OCSD No. 2	188,160	188,160	188,160	188,160	188,160	161,280	161,280	161,280	161,280	161,280
SB/Colton RIX	45,000	45,000	45,000	45,000	45,000	34,800	30,600	26,635	22,920	19,450
WWRF	3,360	3,360	5,600	5,600	5,600	1,500	1,500	3,000	4,000	4,000
WRCRWA	8,950	13,440	13,440	15,700	15,700	8,000	11,000	13,000	14,000	15,000
YVWD	7,500	10,000	12,300	12,300	12,300	5,500	7,500	9,175	9,900	10,620
Totals	786,462	808,765	844,333	851,075	883,905	583,013	633,708	676,653	714,090	754,375

* EMWD's TVRWRF is in the Santa Margarita Watershed, but some recycled water is used in the Santa Ana Watershed

Table 5.3-4 Projected Treatment Plant Water Quality and Sources of Supply

Agency/Facility	Water Quality - TDS mg/L					Water Quality - TIN mg/L					Source(s) of
Years	2010	2015	2020	2025	2030	2010	2015	2020	2025	2030	Supply **
Big Bear ARWA	600	600	600	600	600	4.5	4.5	4.5	4.5	4.5	LGW
Beaumont, City											
Colton, City											
Corona WWTP 1	780	780	780	780	780	4.6	4.6	4.6	4.6	4.6	SWP, CA. LGW
Corona WWTP 2	866	866	866	866	866	4.1	4.1	4.1	4.1	4.1	SWP, CA. LGW
Redlands, City											
Rialto, City											
Riverside RWQCP	600	600	600	600	600	10.0	10.0	10.0	10.0	10.0	LGW
San Bernardino	550	550	550	550	550	13.0	13.0	13.0	13.0	13.0	LGW
EMWD MVRWRF	401	500	500	500	500	16.7	8.0	8.0	8.0	8.0	SWP, LGW
EMWD PVRWRF	665	650	650	650	650	10.9	8.0	8.0	8.0	8.0	SWP, CA. LGW
EMWD SJRWRF	584	600	600	600	600	10.0	8.0	8.0	8.0	8.0	SWP, LGW
EMWD TVRWRF *	679	700	700	700	700	8.0	8.0	8.0	8.0	8.0	CA, LGW
EVMWD RWRC	700	700	700	700	700	4.5	4.5	4.5	4.5	4.5	SWP, CA. LGW
EVMWD RCWRP	Data not available					5.0	5.0	5.0	5.0	5.0	SWP, CA. LGW
EVMWD HCWRP	700					25.0					SWP
EVMWD AWRP		700	700	700	700		5.0	5.0	5.0	5.0	SWP
IEUA	500	500	500	500	500	8.0	8.0	8.0	8.0	8.0	SWP, LGW
IRWD	625	625	625	625	625	10.0	10.0	10.0	10.0	10.0	SWP,CA,LGW,OT
Lee Lake WD	600	640	660	680	700	<13.0	<13.0	<13.0	<13.0	<13.0	SWP, LGW
OCSD No. 1	950	950	950	950	950	Not measured					
OCSD No. 2	2,000	2,100	2,200	2,300	2,400	Not measured					Secondary Effluent
OCSD/OCWD GWRS	70	70	70	70	70	2.8	2.8	2.8	2.8	2.8	Combination
OCWD Green Acres	950	950	950	950	950	20.0	20.0	20.0	20.0	20.0	Combination
SB/Colton RIX	510	510	510	510	510	7.0	7.0	7.0	7.0	7.0	LGW
WWRF	550	550	550	550	550	<10.0	<10.0	<10.0	<10.0	<10.0	SWP
WRCRWA	600	600	600	600	600	<10.0	<10.0	<10.0	<10.0	<10.0	Combination
YVWD	500	325	325	325	325	10.0	5.0	5.0	5.0	5.0	LGW, SWP

Notes:
* EMWD's TVRWRF is in the Santa Margarita Watershed, but some recycled water is used in the Santa Ana Watershed
** SPW = State Project Water; CA = Colorado River Aqueduct; LGW = Local Groundwater

Table 5.3-5 Projected 2010 Plant Flows, Recycled Water Use, and Disposal (AF)

Facility:	2010	Recycled Water Use							Disposal	
	Plant Flows	Industrial	Municipal	Habitat/ Environ.	Conj Use/GW Rechg	AG/ Irrigation	Other ***	Total Recycled	Total Disposal (*)	Type of Disposal (**)
Big Bear ARWA	**2,100**				500	1,600		**2,100**		None
City of Beaumont										
City of Colton	**6,800**								**6,800**	to RIX
City of Corona WWTP 1	**10,304**	52	1,903		1,120	5,549		**8,624**	**1,680**	LSD, DP, OT
City of Corona WWTP 2	**507**	40				467		**507**		None
City of Redlands								**0**		
City of Rialto								**0**		
City of Riverside RWQCP	**42,400**		3,000			10,000		**13,000**	**29,400**	LSD
City of San Bernardino	**30,800**					2,800		**2,800**	**28,000**	to RIX
EMWD	**60,923**	5,000	7,700	4,300	17,000	13,400		**47,400**	**13,523**	LSD
EVMWD RWRC	**7,933**			1,120			6,813	**7,933**		None
EVMWD RCWRP	**872**		872					**872**		None
EVMWD HCWRP	**475**		475					**475**		None
EVMWD AWRP								**0**		None
IEUA	**78,400**	7,000	18,000	50	15,000	10,000		**50,050**	**28,350**	LSD
IRWD	**26,203**	315	20,088			5,800		**26,203**		OD
Lee Lake WD	**952**	100	600	20				**720**	**232**	LSD
OCSD No. 1/OCWD	**103,264**	3,000			72,000	2,000		**77,000**	**26,264**	OD
OCSD No. 2	**161,280**							**0**	**161,280**	OD
SB/Colton RIX	**34,800**						2,800	**2,800**	**32,000**	LSD
WWRF	**1,500**				500	1,000		**1,500**		
WRCRWA	**8,000**					1,000		**1,000**	**7,000**	LSD
YVWD	**5,500**		3,200	1,680				**4,880**	**620**	LSD
Totals	**583,013**	**15,507**	**55,838**	**7,170**	**106,120**	**53,616**	**9,613**	**247,864**	**335,149**	

* Includes 16,000 AF from City of San Bernardino that goes to the RIX Facility
** Types of Disposal: Live Stream Discharge (LSD), Ocean Discharge (OD), Disposal Pond (DP), Other (OT).
*** Other Uses: San Bernardino/Colton RIX - Excess flows sold to other agencies for reuse

Table 5.3-6 Projected 2015 Plant Flows, Recycled Water Use, and Disposal (AF)

Facility:	2015	Recycled Water Use							Disposal	
	Plant Flows	Industrial	Municipal	Habitat/ Environ.	Conj Use/GW Rechg	AG/ Irrigation	Other ***	Total Recycled	Total Disposal (*)	Type of Disposal (**)
Big Bear ARWA	**2,100**				500	1,600		**2,100**		None
City of Beaumont										
City of Colton	**7,300**								**7,300**	to RIX
City of Corona WWTP 1	**12,992**	57	1,903		2,239	7,113		**11,312**	**1,680**	LSD, DP, OT
City of Corona WWTP 2	**896**	40				856		**896**		None
City of Redlands								**0**		
City of Rialto								**0**		
City of Riverside RWQCP	**47,300**		7,500			12,000		**19,500**	**27,800**	LSD
City of San Bernardino	**33,200**				6,985	2,915		**9,900**	**23,300**	to RIX
EMWD	**70,549**	5,000	10,950	4,300	18,250	13,200		**51,700**	**18,849**	LSD
EVMWD RWRC	**10,455**			1,120			9,335	**10,455**		None
EVMWD RCWRP	**1,457**		1,457					**1,457**		None
EVMWD HCWRP								**0**		None
EVMWD AWRP	**1,188**		1,188					**1,188**		None
IEUA	**85,100**	8,000	25,500	50	15,000	10,000		**58,550**	**26,550**	LSD
IRWD	**26,091**	297	23,114			2,680		**26,091**		OD
Lee Lake WD	**1,120**	110	700	25				**835**	**285**	LSD
OCSD No. 1/OCWD	**122,080**	3,000			97,000	2,000		**102,000**	**20,080**	OD
OCSD No. 2	**161,280**							**0**	**161,280**	OD
SB/Colton RIX	**30,600**						2,800	**2,800**	**27,800**	LSD
WWRF	**1,500**				500	1,000		**1,500**		
WRCRWA	**11,000**					3,000		**3,000**	**8,000**	LSD
YVWD	**7,500**		4,000	1,680	1,820			**7,500**		
Totals	**633,708**	**16,504**	**76,312**	**7,175**	**142,294**	**56,364**	**12,135**	**310,784**	**322,924**	

* Includes 16,000 AF from City of San Bernardino that goes to the RIX Facility

** Types of Disposal: Live Stream Discharge (LSD), Ocean Discharge (OD), Disposal Pond (DP), Other (OT).

*** Other Uses: San Bernardino/Colton RIX - Excess flows sold to other agencies for reuse

Table 5.3-7 Projected 2020 Plant Flows, Recycled Water Use, and Disposal (AF)

Facility:	2020	Recycled Water Use							Disposal	
	Plant Flows	Industrial	Municipal	Habitat/ Environ.	Conj Use/GW Rechg	AG/ Irrigation	Other ***	Total Recycled	Total Disposal (*)	Type of Disposal (**)
Big Bear ARWA	**2,100**			32	1,000	1,068		**2,100**		None
City of Beaumont										
City of Colton	**7,885**								**7,885**	to RIX
City of Corona WWTP 1	**12,992**	63	1,903		3,359	5,987		**11,312**	**1,680**	LSD, DP, OT
City of Corona WWTP 2	**896**	40				856		**896**		None
City of Redlands										
City of Rialto										
City of Riverside RWQCP	**51,300**		10,000			15,000		**25,000**	**26,300**	LSD
City of San Bernardino	**35,750**				13,070	3,930		**17,000**	**18,750**	to RIX
EMWD	**77,363**	5,000	13,200	4,300	19,500	13,200		**55,200**	**22,163**	LSD
EVMWD RWRC	**12,404**			1,120			11,284	**12,404**		None
EVMWD RCWRP	**1,782**		1,782					**1,782**		None
EVMWD HCWRP										None
EVMWD AWRP	**2,219**		2,219					**2,219**		None
IEUA	**90,700**	9,000	38,000	50	15,000	6,000		**68,050**	**22,650**	LSD
IRWD	**27,948**	300	25,048			2,600		**27,948**		OD
Lee Lake WD	**1,344**	120	800	30				**950**	**394**	LSD
OCSD No. 1/OCWD	**138,880**	3,000			133,880	2,000		**138,880**	**0**	OD
OCSD No. 2	**161,280**								**161,280**	OD
SB/Colton RIX	**26,635**						2,800	**2,800**	**23,835**	LSD
WWRF	**3,000**				1,500	1,500		**3,000**		
WRCRWA	**13,000**					4,000		**4,000**	**9,000**	LSD
YVWD	**9,175**		5,000	1,680	2,495			**9,175**		
Totals	**676,653**	**17,523**	**97,952**	**7,212**	**189,804**	**56,141**	**14,084**	**382,716**	**293,937**	

* Includes 16,000 AF from City of San Bernardino that goes to the RIX Facility

** Types of Disposal: Live Stream Discharge (LSD), Ocean Discharge (OD), Disposal Pond (DP), Other (OT).

*** Other Uses: San Bernardino/Colton RIX - Excess flows sold to other agencies for reuse

Table 5.3-8 Projected 2025 Plant Flows, Recycled Water Use, and Disposal (AF)

Facility:	2025	Recycled Water Use							Disposal	
	Plant Flows	Industrial	Municipal	Habitat/ Environ.	Conj Use/GW Rechg	AG/ Irrigation	Other ***	Total Recycled	Total Disposal (*)	Type of Disposal (**)
Big Bear ARWA	**2,100**			32	1,000	1,068		**2,100**		None
City of Beaumont										
City of Colton	**8,500**								**8,500**	to RIX
City of Corona WWTP 1	**12,992**	63	1,903		4,479	4,867		**11,312**	**1,680**	LSD, DP, OT
City of Corona WWTP 2	**896**	40				856		**896**		None
City of Redlands										
City of Rialto										
City of Riverside RWQCP	**55,377**		15,000			15,000		**30,000**	**25,377**	LSD
City of San Bernardino	**38,520**				19,640	4,460		**24,100**	**14,420**	to RIX
EMWD	**82,260**	5,000	15,750	4,300	20,750	13,200		**59,000**	**23,260**	LSD
EVMWD RWRC	**14,197**			1,120			13,077	**14,197**		None
EVMWD RCWRP	**2,219**		2,219					**2,219**		None
EVMWD HCWRP										None
EVMWD AWRP	**3,362**		3,362					**3,362**		None
IEUA	**96,300**	11,000	45,000	250	20,000	5,000		**81,250**	**15,050**	LSD
IRWD	**29,251**	310	26,441			2,500		**29,251**		OD
Lee Lake WD	**1,456**	130	900	35				**1,065**	**391**	LSD
OCSD No. 1/OCWD	**154,560**	3,000			146,000	2,000		**151,000**	**3,560**	OD
OCSD No. 2	**161,280**								**161,280**	OD
SB/Colton RIX	**22,920**						2,800	**2,800**	**20,120**	LSD
WWRF	**4,000**				2,000	2,000		**4,000**		
WRCRWA	**15,000**					5,000		**5,000**	**10,000**	LSD
YVWD	**9,900**		5,500	1,680	2,720			**9,900**		
Totals	**715,090**	**19,543**	**116,075**	**7,417**	**216,589**	**55,951**	**15,877**	**431,452**	**283,638**	

* Includes 16,000 AF from City of San Bernardino that goes to the RIX Facility

** Types of Disposal: Live Stream Discharge (LSD), Ocean Discharge (OD), Disposal Pond (DP), Other (OT).

*** Other Uses: San Bernardino/Colton RIX - Excess flows sold to other agencies for reuse

Table 5.3-9 Projected 2030 Plant Flows, Recycled Water Use, and Disposal (AF)

Facility:	2030	Recycled Water Use							Disposal	
	Plant Flows	Industrial	Municipal	Habitat/ Environ.	Conj Use/GW Rechg	AG/ Irrigation	Other ***	Total Recycled	Total Disposal (*)	Type of Disposal (**)
Big Bear ARWA	**2,100**			32	1,500	568		**2,100**		None
City of Beaumont										
City of Colton	**9,150**								**9,150**	to RIX
City of Corona WWTP 1	**12,992**	63	1,903		4,479	4,867		**11,312**	**1,680**	LSD, DP, OT
City of Corona WWTP 2	**896**	40				856		**896**		None
City of Redlands										
City of Rialto										
City of Riverside RWQCP	**67,400**		21,400			20,000		**41,400**	**26,000**	LSD
City of San Bernardino	**41,500**				25,500	5,700		**31,200**	**10,300**	to RIX
EMWD	**85,913**	5,000	17,500	4,300	22,000	13,200		**62,000**	**23,913**	LSD
EVMWD RWRC	**16,808**			1,120			15,688	**16,808**		None
EVMWD RCWRP	**2,241**		2,241					**2,241**		None
EVMWD HCWRP										None
EVMWD AWRP	**5,042**		5,042					**5,042**		None
IEUA	**100,800**	15,000	48,000	250	23,000	4,000		**90,250**	**10,550**	LSD
IRWD	**29,615**	310	26,805			2,500		**29,615**		OD
Lee Lake WD	**1,568**	140	1,000	40				**1,180**	**388**	LSD
OCSD No. 1/OCWD	**168,000**	3,000			146,000	2,000		**151,000**	**17,000**	OD
OCSD No. 2	**161,280**								**161,280**	OD
SB/Colton RIX	**19,450**						2,800	**2,800**	**16,650**	LSD
WWRF	**4,000**				2,000	2,000		**4,000**		
WRCRWA	**15,000**					5,000		**5,000**	**9,000**	LSD
YVWD	**10,620**		6,000	1,680	2,940			**10,620**		LSD
Totals	**754,375**	**23,553**	**129,891**	**7,422**	**227,419**	**60,691**	**18,488**	**467,464**	**285,911**	

* Includes 16,000 AF from City of San Bernardino that goes to the RIX Facility

** Types of Disposal: Live Stream Discharge (LSD), Ocean Discharge (OD), Disposal Pond (DP), Other (OT).

*** Other Uses: San Bernardino/Colton RIX - Excess flows sold to other agencies for reuse

Current Management Strategies

Recycled water has been used in the Watershed for many years to offset potable demands. Water reclamation projects involve treating wastewater to State-defined standards and a level that is safe for State-approved non-potable applications. Approximately 101,500 AFY of recycled water is currently used to meet water needs such as landscape irrigation, agricultural irrigation, groundwater recharge, and commercial and industrial applications within the Watershed. In addition, many golf courses, cemeteries, schoolyards, parks, street medians, and freeway landscapes in the watershed are irrigated with recycled water. When OCWD's recharge of SAR baseflow is included, the figure greatly increases.

Overall, the largest use of recycled water in the Watershed is for groundwater recharge. During non-storm periods, the SAR flow primarily becomes treated effluent. This effluent or recycled water coming from upstream water reclamation facilities meets the upper watershed's 42,000 AFY annual obligation at Prado Dam that is diverted to river recharge basins in Orange County.

Current Efforts

Current management strategies in addition to those mentioned elsewhere include planning efforts as demonstrated by planned and conceptual recycled water projects as described below.

EMWD has entered into a cooperative agreement with the U.S. Army Corps of Engineers for the San Jacinto River Ecosystem Restoration Feasibility Study. This study will evaluate and determine the feasibility of restoring the river ecosystem and the use of different water supply sources including recycled water for ecosystem restoration in conjunction with groundwater recharge.

EMWD is participating in a Demineralization and Non-Potable Water Conversion Feasibility Study with Rancho California Water District. The study is investigating the feasibility of demineralization of recycled water, and the feasibility of conversion of agricultural demands, such as avocado groves and other crops, to this non-potable water source.

City of Riverside – On May 20, 2008, the SWRCB approved a wastewater change petition filed by the City of Riverside to ultimately reduce the amount of treated wastewater currently discharged to the SAR by approximately 11,000 AFY. This would allow the City of Riverside to expand its current recycled water program from 290 AFY to 41,400 AFY by 2025. It is estimated that the City of Riverside's water use is projected to increase to approximately 105,000 AFY by 2020. To be able to meet these future projected needs without increasing the City of Riverside's reliance upon imported State Water purchases, it will be critical for the City of Riverside to significantly expand its use of the recycled water recently made available.

IEUA recently developed a Three Year Business Plan to rapidly expand the recycled water distribution system and increase recycled water use by 35,000 AFY. The capital program emphasizes increased system storage as well as distribution system piping and piping to reach high capacity recharge sites. The business strategy, while regional in nature, is founded on the principle of partnerships

with IEUA member agencies, both from a water marketing standpoint and a capital facilities standpoint. The partnerships are having the effect of "supercharging" the capital program through conversion of member agency owned local potable water facilities to regional recycled water facilities.

LLWD has completed a recycled water master plan that will allow for the connection of the local parks and schools in the near future. They also have partnered with the City Of Corona in its Ground Water Management Plan for the basins underlying LLWD's boundaries. LLWD currently is investigating potential groundwater recharge options.

OCWD also is evaluating future phases of the joint OCSD/OCWD GWRS. Phase 1 of the GWRS has been completed to produce 72,000 AFY of purified water. Phases 2 and 3 could produce up to 48,000 AFY additional supplies. Implementation of Phases 2 and 3 would further reduce the amount of effluent discharged to the ocean. Because they would reduce the amount of water discharged to the ocean, Phases 2 and 3 are a new regional water source that would increase the net overall supply of water to the watershed.

SBVMWD does not own or operate a wastewater treatment plant within its service area. However, recycled water is a foundational part of the region's water budget as they move toward the future. As a result, SBVMWD has begun working with the owners of the wastewater treatment plants within its service area on the concept of a recycled water master plan. The goal of the recycled water master plan is to recycle approximately 34,000 AF.

WMWD continues to expand its recycled water production capabilities through the WWRF Phase 2 expansion project. When completed in 2010, the plant will be capable of producing up to three MGD of tertiary-treated recycled water. Plans call for eventually expanding to five MGD.

WMWD possesses an extensive non-potable distribution system that includes both storage and pumping capabilities. They will employ this system as the backbone distribution system to expand use of recycled water (for irrigation) within its service area. One major commercial area (Meridian Business Center) and one large residential community already are dual-piped for recycled water use and a new Riverside Unified School District (RUSD) high school has been retrofitted to allow recycled water use. Two new large residential projects (including a golf course development) will be conditioned to install dual plumbing. WMWD also will work with RUSD to dual plumb new campuses, including a new middle school west of the Orangecrest area.

WMWD and the City of Riverside currently are conducting joint planning for recycled water use. The intent is to allow maximum use of recycled/non-potable water in the City of Riverside's greenbelt area that will take advantage of elevation differences, thus reducing energy (pumping) costs. The system also will distribute non-potable groundwater through the legacy canal system thereby maximizing use of local water resources.

WMWD is working with the Riverside County Ben Clark Training Center to site a large recycled water storage impoundment on their facility located just south of Van Buren Boulevard and west of I-215. This proposed 600 AF impoundment would serve the County as a dive/water training facility while providing wet weather storage for recycled water produced by the WWRF, a truly unique and innovative use of recycled water.

Finally, WMWD is in the early stages of evaluating the use of recycled water to recharge local groundwater basins as a new source of supply. As total summer irrigation demands likely will exceed recycled water supply, recharge will probably be limited to winter months. Close coordination with the Regional Board and CDPH will be required.

YVWD adopted a Strategic Plan in August 2008, which outlines the methods used to maximize the use of recycled water to meet future water demands. This policy requires new homes to install dual water meters to provide potable water and non-potable water to each property. The use of recycled water delivered to residential and commercial properties for irrigation is expected to reduce future potable water demands by 50%-60% per equivalent dwelling unit. This policy will require YVWD to implement a salinity control program which will provide extremely high quality recycled water to new neighborhoods providing a sustainable water supply for the future.

Other reclamation projects in the Watershed include innovative uses such as toilet flushing in high-rise buildings and residential landscaping irrigation, as evidenced by recycled water programs in IRWD.

Barriers and Constraints

Challenges related to recycling projects include: regulatory requirements, brine line constraints, storage/seasonal constraints, financial constraints, water quality management, and public perception. They are discussed below.

Regulatory Requirements

Regulations for the use of recycled water come from several sources:

- CDPH (Title 22 and Title 17).
- Memoranda per addendums from the CDPH.
- EPA Guidelines.
- Regional Board requirements.
- Individual agencies Best Management Practices.

Some of the regulatory restrictions and best management practices relating to the use of recycled water include:

- Recycled water must not be used in areas that are tributary to a potable drinking water source.
- Recycled water must not be used within 50 feet of a domestic well.
- Recycled water must not spray on drinking fountains, eating areas, walkways, passing vehicles, buildings, domestic water facilities, sitting areas or areas not under control of the user.
- Recycled water irrigation can only occur during non-public access hours if access to the site is unrestricted.
- Controls must be in place to minimize run off and ponding of water.
- No hose bibs are allowed in public access areas.

- All recycled water uses must follow a detailed plan check and inspection process which may include cross-connection shutdown testing.
- Required annual site inspection and every four year cross-connection testing.
- Adequate signage must be posted to inform public, employees, and others of recycled water use.
- Adequate measures should be taken to prevent body contact activities, such as wading and/or swimming, at restricted recreational impoundments with secondary-treated recycled water.
- Limited use of secondary-treated recycled water for crop irrigation.

In 2009, The SWRCB developed a statewide Recycled Water Policy to establish more uniform requirements for recycled water projects.

Table 5.3-10 shows uses allowed for Disinfected Tertiary Recycled Water, Disinfected Secondary-2.2 Recycled Water, Disinfected Secondary-23 Recycled Water, and Undisinfected Secondary Recycled Water. Types of uses are divided into four categories: irrigation, impoundments, cooling/air conditioning, and other uses.
The Air Resources Board of the EPA has developed a Scoping Plan for AB32 that contains the main strategies California will use to reduce the greenhouse gases (GHG) that cause climate change. The Scoping Plan has a range of GHG reduction actions which include direct regulations, alternative compliance mechanisms, monetary and non-monetary incentives, voluntary actions, and market-based mechanisms such as a cap-and-trade system.

The *Climate Change Draft Scoping Plan, June 2008 Discussion Draft* requires that "National Pollution Discharge Elimination System (NPDES) permits be amended to require preparation and implementation of water recycling plans at wastewater treatment plants in communities that rely on imported water supplies and communities where water recycling would otherwise require less energy than current water supplies." The aim of the proposal is to reduce GHG emissions by reducing the use of energy to transport water throughout the State. In some cases, increasing water recycling will result in a net decrease in GHG emissions.

State efforts aimed at reducing GHG emissions through water recycling requirements in NPDES permits should be implemented in a manner consistent with the California Water Plan. Focusing on recycling may contribute to significant GHG emission reductions.

Table 5.3-10 Summary of Recycled Water Uses Allowed in California

	Type of Recycled Water Use:	Disinfected Tertiary Recycled Water	Disinfected Secondary-2.2 Recycled Water	Disinfected Secondary-23 Recycled Water	Undisinfected Secondary Recycled Water
Irrigation	Food Crops - recycled water contacts the edible portion of the crop, including root crops	**Yes**	**No**	**No**	**No**
	Parks, playgrounds, school yards, unrestricted-access golf courses	**Yes**	**No**	**No**	**No**
	Residential landscaping	**Yes**	**No**	**No**	**No**
	Any other irrigation uses not prohibited by other provisions of the Calif. Code of Regulations	**Yes**	**No**	**No**	**No**
	Food crops, surface-irrigated, above ground edible portion, and not in contact with recycled water	**Yes**	**Yes**	**No**	**No**
	Cemeteries	**Yes**	**Yes**	**Yes**	**No**
	Freeway landscaping	**Yes**	**Yes**	**Yes**	**No**
	Restricted-access golf courses	**Yes**	**Yes**	**Yes**	**No**
	Ornamental nursery stock and sod farms with unrestricted public access	**Yes**	**Yes**	**Yes**	**No**
	Pasture for milk animals for human consumption	**Yes**	**Yes**	**Yes**	**No**
	Non-edible vegetation with access control to prevent use as park, playground, or school yard	**Yes**	**Yes**	**Yes**	**No**
	Orchards with no contact between edible portion and recycled water	**Yes**	**Yes**	**Yes**	**Yes**
	Vineyards with no contact between edible portion and recycled water	**Yes**	**Yes**	**Yes**	**Yes**
	Non-food bearing trees, including Christmas trees, not irrigated less than 14 days before harvest	**Yes**	**Yes**	**Yes**	**Yes**
	Fodder and fiber crops and pasture for animals not producing milk for human consumption	**Yes**	**Yes**	**Yes**	**Yes**
	Seed crops not eaten by humans	**Yes**	**Yes**	**Yes**	**Yes**
	Food crops undergoing commercial pathogen destroying processing before consumption by humans	**Yes**	**Yes**	**Yes**	**Yes**
Impoundments	Non-restricted recreational impoundments, with supplemental monitoring for pathogenic organisms	**Yes**	**No**	**No**	**No**
	Restricted recreational impoundments and publicly accessible fish hatcheries	**Yes**	**Yes**	**No**	**No**
	Landscape impoundments without decorative fountains	**Yes**	**Yes**	**Yes**	**No**
Cooling/AC	Industrial or commercial cooling or air conditioning involving cooling towers, evaporative condensers, or spraying that creates a mist	**Yes**	**No**	**No**	**No**
	Industrial or commercial cooling or air conditioning not involving cooling towers, evaporative condensers, or spraying that creates a mist	**Yes**	**Yes**	**Yes**	**No**
Other Uses	Groundwater recharge	Allowed under special RWQCB permit			
	Flushing toilets and urinals	**Yes**	**No**	**No**	**No**
	Priming drain taps	**Yes**	**No**	**No**	**No**
	Industrial process water that may contact workers	**Yes**	**No**	**No**	**No**
	Structural fire fighting	**Yes**	**No**	**No**	**No**
	Decorative fountains	**Yes**	**No**	**No**	**No**
	Commercial laundries	**Yes**	**No**	**No**	**No**
	Consolidation of backfill material around potable water pipelines	**Yes**	**No**	**No**	**No**
	Artificial snow making for commercial outdoor uses	**Yes**	**No**	**No**	**No**
	Commercial car washes, not heating the water, excluding the general public from the washing process	**Yes**	**No**	**No**	**No**
	Industrial boiler feed	**Yes**	**Yes**	**Yes**	**No**
	Non-structural fire fighting	**Yes**	**Yes**	**Yes**	**No**
	Backfill consolidation around nonpotable piping	**Yes**	**Yes**	**Yes**	**No**
	Soil compaction	**Yes**	**Yes**	**Yes**	**No**
	Mixing concrete	**Yes**	**Yes**	**Yes**	**No**
	Dust control on roads and streets	**Yes**	**Yes**	**Yes**	**No**
	Cleaning roads, sidewalks, and outdoor work areas	**Yes**	**Yes**	**Yes**	**No**
	Flushing sanitary sewers	**Yes**	**Yes**	**Yes**	**Yes**

Legal Agreements

Orange County Judgment – In 1963, OCWD filed suit against substantially all water users in the area tributary to Prado Dam seeking adjudication of water rights on the SAR. The litigation ultimately involved over 4,000 served water users and water agencies, the four largest of which were OCWD, Valley District, WMWD, and the Chino Basin Municipal Water District (now IEUA). Given the magnitude of the potential litigation, these four districts and other parties developed a settlement that was approved by the Orange County Superior Court in a stipulated judgment entered on April 17, 1969 (Orange County Judgment). The Orange County Judgment imposes a physical solution that requires parties above Riverside Narrows to deliver a minimum quantity (12,420 AF) and quality of water downstream. The cumulative requirement is 42,000 AFY at Prado Dam. A provision of the Orange County Judgment related to water recycling establishes that once the minimum flow requirements are met, the upper area parties "…may engage in unlimited water conservation activities, including spreading, impounding, and other methods, in the area above Prado reservoir..." It goes on to say that OCWD is "…restrained from pumping, producing and exporting or directly or indirectly causing water to flow…" from the upstream areas into OCWD except to "salvage evapo-transpiration losses…" which is limited to 5,000 AFY. The Orange County Judgment is administered by the five-member SAR Watermaster that reports annually to the court and the four representative agencies. Valley District, IEUA, and WMWD nominate one member each to the Watermaster; OCWD nominates two members; and members then are appointed by the court.

Brine Line Constraints

The SARI was first envisioned in the early 1970s and is a critical component of salt management in the Watershed. The SARI line provides a vital system to remove salt (TDS) from the upper watershed and to collect and transport non-reclaimable industrial brine from industrial processes and desalters that cannot be effectively treated at local treatment facilities. These high TDS wastes are subject to stringent discharge limits as part of the Basin Plan Objectives and are included in the NPDES limits for Santa Ana discharging POTWs.

The SARI line was constructed by the Santa Ana Watershed Project Authority (SAWPA), who owns capacity rights in or owns outright approximately 93 miles of 16" to 84" pipeline. SAWPA shares in the cost of maintaining the SARI in Orange County and is solely responsible for operation and maintenance activities in Riverside and San Bernardino Counties. Most of the pipeline was constructed during 20 years in a series of reaches or sections. Reaches I, II, and III, owned by OCSD, are located in Orange County and are parallel to the SAR. In these reaches, parts of the pipeline lie beneath the low flow channel of the River and may be subject to erosion damage. OCSD uses grade stabilizers and other methods to protect the SARI line. Above the Riverside County line, Reaches IV and V are owned and operated by SAWPA. Reach IV (which is subdivided into Reaches IV-A through IV-E) provides service to areas roughly bounded by the Cities of Riverside, Chino, and San Bernardino. Reach V lies along Temescal Wash and terminates near the City of Lake Elsinore. The SARI line then conveys the wastes to OCSD Plant No. 2 in Huntington Beach for treatment and ocean discharge.

Excess capacity has been available in the SARI line, and domestic wastewater was added to the SARI line. In the future, it will be important to have the flexibility to redirect the domestic wastewater

currently conveyed in the SARI line to wastewater treatment facilities. Treated SARI line flow may be recyclable when it is not commingled with domestic wastewater. However, even with advanced treatment, such as reverse osmosis to remove the elevated levels of TDS, it is unclear what additional steps might be required to make this waste stream recyclable.

Storage/Seasonal Constraints

The recycled water supply is not dependent on weather patterns; supply is fairly constant throughout the year. For these reasons, recycled water is viewed as one of the most reliable sources of water in the Watershed. However, because recycled water is used primarily for irrigation purposes and associated seasonal demands, recycled water demands can be variable and are often affected by weather and the season. In some areas, demands increase in dry years. However, wet years generally pose a greater operational challenge as customer demand decreases and storage facilities fill. Storage during periods of low demand is necessary to meet high demand during other times of the year. The amount of available recycled water storage varies greatly between agencies. Some have little or no storage and others have thousands of AF of storage. Each agency's existing and proposed recycled water storage facility capacities are shown on **Table 5.3-11**.

Financial Constraints

The cost of infrastructure to produce, store, and distribute recycled water is expensive. Given that demands for recycled water are more scattered throughout communities, recycled water distribution pipelines are built only where demands justify the expense and where customers agree to use recycled water. This is especially true where sites need to be retrofitted to use recycled water as opposed to newly constructed sites where rules may dictate its use. Other issues include the cost of recycled water use to the customers as well as administration of the recycled water system by both the distributor and user. Because of the cost, there are sites where there may be willing customers but no infrastructure to serve them. Grant funds and other forms of financial aid can help make some projects viable, but other projects still may not be financially viable.

Other issues include the cost of recycled water use to the customers as well as administration of the recycled water system by both the distributor and user.

Costs associated with recycled water use could include retrofitting of existing systems, required inspections and cross-connection shutdown testing, employee training, and use site maintenance. Administrative requirements include extensive permitting, recordkeeping, and reporting requirements.

Each use area also must have a Site Supervisor knowledgeable of the use area system and recycled water use restrictions. The Site Supervisor must be available at all times to correct any condition that does not conform to use area requirements specified by regulations and the recycled water distributor.

Table 5.3-11 Recycled Water Storage Facility Capacity

Agency Owning and/or Operating Storage Ponds	Existing Storage (AF)	Proposed Storage (AF)
Big Bear Area Reg. Wastewater Agency	---	---
City of Beaumont	No Data Received	
City of Colton	---	---
City of Corona	21.40	---
City of Redlands	---	---
City of Rialto	---	---
City of Riverside	---	---
City of San Bernardino	---	---
Eastern Municipal Water District	7,300.00	---
Elsinore Valley Municipal Water District	30.70	---
Inland Empire Utilities Agency	1.84	350.59
Irvine Ranch Water District	23,619.00	13.20
Lee Lake Water District	1.00	15.00
Orange County Sanitation District	---	---
Orange County Water District *	26,000.00	---
San Bernardino/Colton RIX Facility	---	---
Western Municipal Water District	40.00	650.00
Western Riverside County Regional WWTP	---	---
Yucaipa Valley Water District	18.42	65.24
Total Recycled Water Storage Capacity (AF)	57,032.36	1,094.03

* Water in OCWD's storage ponds could include SAR water, imported MWDSC water, or recycled water from the GWRS. In general terms, OCWD does not intentionally store MWDSC or GWRS water, since they would rather recharge it; however, when they put water into the recharge facilities, some of the water is temporarily in storage before it is recharged.

Water Quality Management

Increases in groundwater TDS are a function of the recharge of saline water resulting from agricultural activities, urban runoff, imported water, septic tanks, and recycled water activities. They also are attributed in part to the legacy of salt contamination from past land use practices. The TDS impacts of agriculture on groundwater usually originate from fertilizer use on crops, consumptive use, and dairy waste disposal.

Water quality, as it pertains to higher salinity supplies, is another significant issue. On average, approximately 80 percent of water delivered to the Watershed from MWDSC comes from the Colorado River, which has high salinity content, expressed in terms of TDS. In 2007, the Colorado River water had an average TDS of 650 mg/L while SPW averaged about 260 mg/L. Water with TDS greater than 500 mg/L is problematic to many of the crops grown in the region.

Higher TDS source water also poses a special problem for water recycling facilities because conventional treatment processes are designed to remove suspended particles, but not dissolved salts. TDS removal, or demineralization, requires an advanced treatment process, which can increase project costs significantly. Residential use of water typically adds 200 to 300 mg/L of TDS to the wastewater stream, and self-regenerating water softeners can add another 60 to 100 mg/L. If an area receives a water supply that has a TDS of more than 700 mg/L, and residents add 300 mg/L or more through normal use, the recycling facility will produce recycled water with a TDS concentration of 1,000 mg/L or more.

In general, TDS over 1,000 mg/L becomes problematic for industrial reuse customers and virtually unusable for many agricultural customers. This greatly limits the potential uses and marketability of recycled water. Nutrients such as nitrate present similar issues as TDS.

Salinity management for expanded use of recycled water and protection of the adjacent high-quality groundwater basins is a continuing issue.

Public Perception

Some attempts to reintroduce purified wastewater into the aquifers, rivers, and reservoirs from which water agencies draw their supplies have generally met opposition from citizens' groups with the result being stalled water recycling projects in cities from San Diego to Tampa, Florida. This opposition comes more from a knee-jerk response to wastewater—the "yuck" factor—than from concerns about the water's chemical composition. This reaction ignores the reality that water reuse is as old as time. The water cycle guarantees that nature uses the same supply of water over and over again; people have been reusing water for centuries.

Other uses of recycled water also may encounter public resistance where there is a perception of health risk from direct contact or incidental ingestion, especially with regard to potentially sensitive populations. For example, irrigation of a public golf course might be considered acceptable while irrigation of an elementary school playground unacceptable because of the potential exposure of children.

A successful example is OCWD's GWRS where treated recycled water undergoes an advanced treatment process that includes two membrane filtration systems – microfiltration and reverse osmosis, and treatment by ultraviolet light and hydrogen peroxide. Once purified, the water is sent to spreading basins. The newly purified water seeps into the ground, like rain, and blends with groundwater. The GWRS provides a new drought-proof water source for northern and central Orange County, reducing reliance on imported water. Additionally, the GWRS will save additional funds in the future by improving the quality of the water in the Orange County groundwater basin. This successful effort utilized widespread public outreach activities involving the scientific,

political, and other communities to assist in informing the public and addressing potential public perception issues.

Every time we take a drink, we're consuming water that has been used many times before. Furthermore, as southern California struggles with climate change, continuing Colorado River drought, San Joaquin Delta vulnerability, and population growth, water reuse will become even more important — perhaps enough to make the thought of drinking purified recycled water more acceptable to the general public.

Concepts and Ideas for the Future

Concepts, ideas, and/or suggestions for future types of recycled water projects were received from IEUA, EMWD, OCWD, and SAWPA and are summarized in the sections below.

Increase Direct Reuse

Direct reuse of recycled water for industrial use, irrigation, and agriculture can be increased by:

- Expanding and strengthening recycled water distribution, storage, and pumping facilities, including local laterals.
- Assisting with on-site retrofit costs.
- Making recycled water available to individual residences for yard irrigation and toilet flushing.
- Meeting custom recycled water, water quality specifications for select customers and uses through specialized treatment.
- Improving user confidence and acceptance with specialized user advice and user support groups.
- Expanding recycling opportunities through advanced treatment.
- Conducting geographic analysis of demands and supplies.
- Exploring possible multi-beneficial projects working with other pillars.
- Investigate and promote increasing public and regulatory acceptance for new uses for recycled water.
- Reviewing backflow protection requirements.

Increase Recycled Water Recharge

Recycled water recharge can be increased by:

- Implementing river flow recharge projects.
- Increasing groundwater recharge with recycled water.
- Resolving limitations on water recycling created by the use of the SARI to convey both non-reclaimable waste and domestic wastewater.
- Utilizing recycled water for habitat creation/enhancement and groundwater recharge.
- Initiating long term plans for treating recycled water to a high level for local recharge similar to OCSD/OCWD GWRS project.

Increase Recycled Water/Energy Savings

Recycled water and energy savings can be increased by:

- Reducing recycled water energy demands with additional distribution system pressure zones.
- Evaluating possible interagency agreements to accept recycled water from another agency's upstream Publicly Owned Treatment Works (POTW) to take advantage of gravity flow and accompanying energy savings.
- Investigating ways to increase recycling of water flowing to the ocean during wetter years.
- Encouraging industries, such as large commercial facilities, to segregate wastewaters to discharge as much as practical to the local, reclaimable sewer rather than to non-reclaimable waste lines (SARI).
- Investigating/implementing brine concentrate management utilizing secondary desalination.
- Investigating the energy saving potential of satellite treatment plants.
- Providing additional treatment to hazardous waste flow in the SARI to allow local non-potable reuse of the flow and to increase overall supply.
- Decreasing the amount of water lost to the ocean to increase the overall water supply to the Watershed.

Concepts Requiring Further Investigation

The OWOW process provided a forum to discuss new concepts. Due to time constraints, some of these concepts could not be adequately investigated and accepted prior to completion of the OWOW report. These concepts are being included in the document to stimulate further discussion and possible investigation.

Currently, during non-storm periods, nearly all the flow of the SAR from the upper and middle watersheds is treated wastewater effluent and the flow greatly exceeds the minimum flow requirements imposed on the upper and middle watershed by the 1969 Judgment. This water is currently used "downstream" via artificial recharge in the lower watershed. However, as seen in **Figures 5.1-23** and **5.1-24** in the *Water Supply Reliability* section of the OWOW report, the water budgets for the upper and middle watershed are dependent upon the future reuse of this recycled water within their respective areas. When this occurs, it will reduce flows into the river. When this happens, the lower watershed will have to "replace" this water by recycling more of their own wastewater which currently flows into the ocean, importing more water, desalting ocean or some other new source of water. Recycling in the upper and middle watersheds also will require a significant investment in infrastructure by the upper and middle watershed.

One of the goals of the OWOW process was to bring water agencies together in hopes of developing creative solutions to the various water management challenges. Through this process, a variety of recycled water concepts have been developed, some of which may prevent the need for the upper and middle watersheds to construct recycled water infrastructure while keeping the treated effluent in the SAR for use by the lower watershed. These concepts are generally outlined in **Table 5.3-12**.

Table 5.3-12 Proposed Recycled Water Concepts

Concept	Description	Advantages	Disadvantages
Closed Loop "Traditional"	Upper, middle and lower watersheds build infrastructure to reuse their treated wastewater within their respective areas.	Each area of the watershed benefits from the high reliability of treated wastewater (much more reliable than imported water) and disposal to the ocean is reduced significantly.	Requires construction of recycled water infrastructure in the upper, middle and lower watersheds.
Exchange Concept No. 1	Treated wastewater continues to flow from upper to middle to lower by gravity. The lower watershed provides imported water to the upper watershed to makeup for their loss of recycled water.	Reduced recycled water infrastructure cost in the watershed. Upper and middle watersheds use higher quality imported water.	Imported water is less reliable than recycled water. Thus, the upper and middle watersheds trade high reliability water for low reliability water.
Exchange Concept No. 2	SGPWA pays for a recycled water infrastructure in the upper watershed. In return, the upper watershed provides SGPWA a like amount of imported water. Treated wastewater continues to flow from the middle watershed to the lower watershed by gravity. In return, the lower watershed provides imported water to the middle watershed.	Helps SGPWA obtain needed water supply. Upper and lower watersheds benefit from highly reliable recycled water. Reduces the need for recycled water infrastructure in the middle watershed. Middle watershed uses higher quality imported water.	Cost of recycled water infrastructure in the upper watershed. Middle watershed trades high reliability recycled water for low reliability imported water. Significant quantities of recycled water are still discharged to the ocean.
Exchange Concept No. 3	SGPWA purchases imported water from the lower watershed equal to that of the amount of treated wastewater that flows from the upper watershed. The Upper and middle watershed continue to gravity flow treated wastewater to the lower watershed. The lower watershed provides imported water to upper and middle watershed.	Helps SGPWA obtain needed water supply. Less water infrastructure required in the watershed. Upper and middle watersheds use higher quality imported water.	Upper and middle watersheds continue use of imported water which is less reliable than recycled water.

While the "exchange" concepts may save the cost of recycled water infrastructure, they also could result in poorer water supply reliability for those areas that agree to take imported water in exchange. This reduced reliability may be mitigated by additional water or additional funding to the party that agrees to accept the more expensive and/or lower reliable water supply. It also could be mitigated by transferring imported water "real time" into a water bank to ensure that it is available when needed. There likely are many other ideas and variations that could be explored as part of this concept.

Due to the complexity of the issues, as well as legal constraints and other factors, it is recommended that discussions on these divergent views be initiated.

Collaboration and Integration with Other Pillars

The ten One Water One Watershed Pillars are interconnected and support each others' efforts. Examples of linkages are numerous and varied. For the Climate Change Pillar, the "Greenhouse Effect" can be reduced by using recycled water instead of energy-intensive imported water. Recycled water can be used for habitat creation, environmental enhancement, and river restoration benefiting the Environment and Habitat Pillar. Using recycled water benefits both the Water Supply Reliability and Water Use Efficiency Pillars in a myriad of ways when it is used to replace potable water from either groundwater or imported sources. Using recycled water for groundwater barriers against either seawater intrusion or groundwater contaminant plumes provides direct benefits to the Water Quality Improvement Pillar.

Table 5.3-13 shows in greater detail where the Water Recycling Pillar links with and supports the efforts of the other Pillars.

Table 5.3-13 Linkages between the Water Recycling Pillar and Other Pillars

Pillar	Benefits to Other Pillars
Climate Change	Reduce the "Greenhouse Effect" by using recycled water instead of energy-intensive imported water. Reduce recycled water energy demands with additional distribution system pressure zones. Institute inter-agency agreements to take advantage of gravity flows for energy savings. Investigate energy saving potential of satellite treatment plants.
Environmental Enhancement and Habitat	Use recycled water for habitat creation and environmental enhancement. Develop recycled water storage ponds in areas to increase waterfowl habitat. Use recycled water for river restoration and recharge.
Environmental Justice	Connect disadvantaged communities to sewer systems (investigate grant funding).
Flood Control and Stormwater Management	Harvest storm water to supplement recycled water uses. Harvest storm water for groundwater recharge.
Parks, Recreation, and Open-Space	Increase irrigation of parks and recreation areas with recycled water. Use recycled water for snow making at commercial ski areas. Use recycled water for snowmaking, let snow melt, run downstream, and recharge. Build recycled water storage ponds in areas for use as esthetic impoundments.
Water and Land Use	Convert agricultural groundwater pumpers to recycled water use whenever possible. Use recycled water for construction water where possible. Require new commercial establishments to use recycled water if appropriate.
Water Quality Improvement	Use recycled water for underground seawater or contaminant plume barriers. Eliminate septic systems by increasing sewer service to prevent groundwater contamination.
Water Supply Reliability	Increases water supply reliability since recycled water is the most reliable source of water in the Watershed. Increase potable supply by increasing recycled water uses. Change public perception of recycled water; overcome "yuck" factor to increase direct use. De-mineralize and treat recycled water for blending with other water sources for expanded uses. Convert agricultural groundwater pumpers to recycled water , i.e. groundwater exchange programs. Increase groundwater recharge using recycled water to increase potable supplies. Partner with CalTrans to use recycled water for freeway landscaping and for dust control on road and street construction to decrease potable water use. Coordinate with fire departments to use recycled water whenever possible; provide hydrants and connections to decrease potable water use.
Water Use Efficiency	Maximize programs to substitute recycled water for potable water whenever possible. Use of recycled water can lead to reduced runoff.

Data Collection Process

Inquiries were sent to each agency along with sample blank tables containing space for data similar to that found in this chapter. The agencies were requested to reply via email with their completed tables and maps of their facilities. For general information about each agency or facility, agency and city Websites were searched and a brief write up about the agency was generated. These then were sent to the individual agencies for their review and comments. Multiple opportunities for review of the chapter were provided during the process.

References

References used in the preparation of the Water Recycling Pillar include:

California Department of Water Resources, *Draft 2009 Update of the California Water Plan,* 2009

California Environmental Protection Agency, Air Resources Board, *Climate Change Draft Scoping Plan, June 2008 Discussion Draft*

Individual agency's and city's correspondence and webpages

Santa Ana Watershed Project Authority, *Santa Ana Integrated Watershed Plan 2005 Update*, June 2005

Santa Ana Watershed Project Authority's webpage (sawpa.org)

U.S. Bureau of Reclamation, *Southern California Comprehensive Water Reclamation and Reuse Study, Phase II, Executive Summary*, July 2002

Contributors

The following stakeholders provided data and information, reviewed and commented upon the text, and/or provided ideas and concepts for the development of the One Water One Watershed Water Recycling Pillar.

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Chapter 5.4 Water Use Efficiency

Background

The Santa Ana Watershed Project Authority recognizes the importance and need for planning for future water resource needs. Together with the other One Water One Watershed (OWOW) Pillars, the Water Use Efficiency (WUE) Pillar is an integrated component of SAWPA's portfolio of existing and planned water supply strategies to ensure a sustainable watershed for future generations.

SAWPA's 2005 Integrated Regional Water Management Plan (IRWMP) established the foundation of the continuing evolution of the water supply portfolio to move toward self-sufficiency, and away from dependence on imported water sources. In recent years, the SAR Watershed has faced threats to its water supply and quality of life because of a prolonged drought along the Colorado River, Sacramento-San Joaquin Delta vulnerability, climate change, and rapid population growth and development. SAWPA will respond to the threats posed by the following "Four Horsemen of the Apocalypse:"

- Colorado River Continuing Drought may result in reductions of imported water supply due to upper basin entitlements and continued long-term drought.
- Sacramento -San Joaquin Delta Vulnerability may result in reductions or loss of supply due to catastrophic levee failure or changing management practices of the Delta.
- Climate Change may result in reduced water supplies combined with increased needs in the region.
- Population Growth and Development may result in interruptions in hydrology and groundwater recharge while increasing water needs.

Through collaboration and development of regional partnerships, SAWPA will create a sustainable Santa Ana River Watershed. This Watershed will be drought-proofed, salt-balanced, and will support economic and environmental viability in the year 2030.

The WUE element of the IRWMP is the product of a growing regional effort to diversify our portfolio of water supplies, drought-proof the watershed, and ensure a reliable water supply into 2030. The terminology, "water use efficiency" implies and supports efficient use of all water resources at all times. To begin identifying how to support existing water conservation strategies, enhance existing programs and measures, develop new WUE efforts, and be a model for others in this arena, a comprehensive long-term WUE plan needs to be envisioned and developed.

Introduction

Assessing the current and existing WUE conditions and resources will identify opportunities for agencies in the SAR Watershed and partnering agencies outside the purview of the watershed to work together to maximize expertise, share resources, apply for various WUE program funding sources, collaborate on regional public awareness initiatives, and expand implementation of WUE programs.

The reader will notice that the term "water use efficiency" has been used in place of "water conservation" in this chapter. In the past, "water conservation" was used in many state and local water planning documents to mean the effective and appropriate use of water by consumers. However, it is the consensus of the WUE pillar that this effective and appropriate use of water is more accurately described by the term "water use efficiency." Furthermore, the phrase "water conservation" usually is associated with water-saving programs that are implemented when water supplies are compromised due to drought or a water shortage brought on by an emergency situation thereby implying a water "diet." By using the phrase "water use efficiency" in future program implementation activities, and in educational and outreach efforts, the WUE team intends to convey and emphasize year-round, long-term improvements in how we use water while maintaining quality of life standards.

Current Conditions

Description of Resource Management

With pressures on available local groundwater and imported water supplies in the watershed increasing due to continuing drought conditions, increasing population, climate change impacts and mandated cutbacks in imported water, collaborative and integrated water resource planning is critical for a sustainable future. A study by the Pacific Institute, "Waste Not, Want Not: The Potential for Urban Water Conservation in California," concludes that WUE is the most cost-effective way to maximize diminishing water supplies, which makes it one of the most important components for diversifying the region's water portfolio in the coming years.

Over the past decade, significant WUE measures have been implemented by southern California water agencies. These programs include the large-scale replacement of old inefficient water fixtures and the upgrade of building and plumbing codes in the State requiring low-flow toilets and showerheads in all new development. It is anticipated that these types of regulatory mandates will continue to be enhanced as emerging technologies become available. Through these programs, the amount of water imported into much of southern California has remained fairly constant, sufficiently meeting demands despite significant development and population increases. However, with the water supply outlook continuing to worsen, WUE will be a critical resource management strategy that this region will need to embrace.

WUE measures can be categorized as "active" programs, such as rebates, or "passive" programs, such as the incorporation of WUE into standardized plumbing codes. Currently, the majority of WUE water savings is achieved through passive measures. Active WUE measures, however, will provide for a more holistic approach to watershed planning and help usher a social transformation in water consumption attitudes and standards among the public and water industry. Through a

combination of active and passive measures, it is estimated that over 20% of forecasted water demand in the SAR Watershed can be met through the implementation of aggressive WUE programs.

This subsection describes the current urban water resources available to the SAR Watershed. It also describes resource management programs currently implemented or participated in by SAWPA member agencies, and other partners within the watershed. These programs include: the OWOW initiative, programs offered by the State of California Department of Water Resources (DWR) Office of Water Use Efficiency and Transfers, the California Urban Water Conservation Council's (CUWCC) Memorandum of Understanding Regarding Urban Water Conservation; Metropolitan Water District of Southern California (MWDSC) Conservation Measure Funding, the United States Bureau of Reclamation (USBR) programs, other current resource management programs; and trends in WUE legislation.

One Water One Watershed (OWOW)

SAWPA has established the OWOW initiative, part of which is the WUE element, to update the IRWMP for the Santa Ana Region, and to address the watershed's water resources in a holistic manner. This forward-thinking effort in integrated regional planning is an ever-expanding process of outreach and collaboration among stakeholders in the SAR Watershed. The innovative planning initiative will serve as a model for other areas in the State and the country.

Agencies, consultants, environmental groups, and regulators involved in water conservation and WUE in the watershed were contacted to form the WUE Pillar, and to select a Pillar Chair. The WUE Pillar group met regularly to discuss ideas, strategies, and priorities that would prove to be regionally significant and beneficial to developing a vision for the future. A complete list of contributors to the WUE Pillar group is provided at the end of this chapter.

To begin the OWOW initiative, two eco-charettes were held for the participants, including the influential watershed decision-makers on OWOW's Steering Committee and the IRWMP Planning Pillars Chairs. These eco-charettes created a forum to discuss ideas and priorities for the pursuit of sustainable water resources. During these interactive and meaningful discussions, nine objectives were established as guiding principles for the IRWMP including:

- Provide Reliable Water Supply
- Preserve and Enhance the Environment
- Promote Sustainable Water Solutions
- Ensure High Quality Water for All Users
- Provide Economically Effective Solutions
- Improve Regional Integration and Coordination
- Manage Rainfall as Resource
- Preserve Open Space and Recreation Opportunities
- Maintain Quality of Life

The consensus of the eco-charette participants was that the OWOW effort needed to be bold and innovative to meet the watershed's WUE vision of transforming consumer behaviors and instill a new water ethic among all public and private sectors. The WUE element of the IRWMP aims to be equally pioneering and aggressive by suggesting new ideas, programs, and partnerships to achieve our goals and objectives. The WUE Pillar coordinates closely with the Water Supply Reliability, Water and Land Use, Climate Change, Environmental Justice, and Water Quality Improvement Pillars in order to effectively address areas of common concern.

DWR Office of Water Use Efficiency and Transfers

The DWR Office of Water Use Efficiency and Transfers offers several WUE programs that are utilized by water agencies in the SAR Watershed. These programs include funding from the WUE Grant Program that was established by Propositions 50 and 84; The Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002; providing and updating the State Model Local Water Efficient Landscape Ordinance; and consulting with the State Energy Commission to develop performance standards and labeling requirements for water-efficient landscape irrigation equipment.

The Office of Water Use Efficiency and Transfers also offers an urban planning assistance program to assist urban water suppliers meet the requirements of the Urban Water Management Planning (UWMP) Act by preparing comprehensive and useful water management plans, implementing water conservation programs, and understanding the requirements of the Act. As of late 2008, DWR will be required to evaluate all applications for WUE grant and loan financing on the applicant agency's compliance with, and implementation of, its UWMP. Additionally, the DWR also will need to establish by 2010 a "standard of excellence" in water demand management in a Memorandum of Understanding that thereafter will give funding precedence to agencies that achieve this standard.

California Urban Water Conservation Council (CUWCC)

The CUWCC is a partnership of water suppliers, environmental groups, and others interested in conserving California's greatest natural resource – WATER. The CUWCC was created in 1991 to increase efficient water use statewide through partnerships among urban water agencies, public interest organizations, and private entities. A significant number of agencies within the SAR Watershed are signatories to their "Memorandum of Understanding Regarding Urban Water Conservation in California" (MOU), which is the foundation of the CUWCC. The MOU created a negotiated framework between water agencies and environmental groups to facilitate expedited implementation of reasonable water conservation measures. The agencies that are signatories to the MOU have agreed to implement 14 comprehensive urban water conservation Best Management Practices (BMPs) intended to reduce long-term urban water demands, and to consider water conservation on an equal basis with other water resource management options.

The BMPs established in the MOU are listed in **Table 5.4-1** below. Many of these BMPs are significant to the future success of WUE programs and planning efforts in the state of California. However, with close to 400 MOU signatories, differences exist between how each agency implements and tracks the BMPs. For instance, public outreach methods and marketing strategies vary among agencies in the SAR Watershed due to differences in each agency's size and resources.

Some of the agencies within the SAR Watershed who are signatories to the CUWCC's MOU are pursuing regional and collaborative WUE planning efforts and funding programs, yet because these agencies are geographically located outside of MWDSC's service territory, they are finding it difficult to implement the CUWCC's BMP programs in the same robust fashion as their MWDSC counterparts.

Table 5.4-1 CUWCC's BMPs

BMP 1	Residential Surveys
BMP 2	Residential Retrofits
BMP 3	System Water Audits
BMP 4	Metering
BMP 5	Landscape
BMP 6	Clothes Washers
BMP 7	Public Information
BMP 8	School Education
BMP 9	Commercial, Industrial & Institutional
BMP 10	Wholesaler
BMP 11	Rates
BMP 12	Conservation Coordinator
BMP 13	Waste Prohibitions
BMP 14	ULFTs
Potential BMPs	

In addition to the BMP list, the CUWCC is developing a Flex Track Menu of options that can be implemented by participating agencies to help them meet their savings goals for a particular BMP measure. Agencies choosing this option are responsible for achieving water savings greater than or equal to that which they would have achieved using only the BMP list items. Menus currently are available for the Residential, Commercial, Industrial and Institutional (CII), and landscape BMPs. Through this type of innovative approach, smaller agencies, as well as those that are implementing extraordinary conservation measures will be able to better demonstrate their efforts to achieve water savings.

MWDSC WUE Measure Funding

Through a water conservation commitment to its member agencies, MWDSC provides incentive funding for a wide variety of WUE programs, devices, and measures throughout its service area. These programs are offered to residential, commercial and industrial, agricultural, and public sector

entities. In 2008, MWDSC issued a call for Extraordinary Conservation measures and outlined some of the tools that they would develop to help their member agencies achieve its call for increased water savings. MWDSC launched a region-wide residential rebate program to help make it simpler for the over 18 million people in their service territory to take advantage of rebates through a one-stop shop concept. The program known as SoCal Water$mart is proving to be very effective, and has increased the convenience factor for the average southern California consumer. To help defray the criticism of those that would point the finger at public agencies as some of the largest water wasters, MWDSC created the Accelerated Public Sector Program to provide funding opportunities to public agencies to help them implement WUE programs and practices. The program has proved to be a tremendous success, especially with cities and school districts across the southland. MWDSC is developing a water waste ordinance for their member agencies and local jurisdictions to adopt. It is anticipated that it will eventually be required as a pre-requisite criteria to participate in any of MWDSC's WUE and other funding programs. MWDSC hosts a monthly WUE meeting for conservation coordinators to share information and learn about important changes in the field. Certain entities (including Pillar participants, San Bernardino Valley Municipal Water District (Valley District) and the City of Yucaipa), are within the SAR Watershed but lie outside of MWDSC's boundaries, and are therefore not eligible to participate in these programs. It is crucial that watershed planners find ways to encourage the development of similar WUE programs and funding opportunities for these communities, especially since many of these areas fall within the auspices of the Environmental Justice Pillar and are home to disadvantaged stakeholders.

Current Resource Management Programs

A variety of WUE management programs, pilot programs, and outreach efforts have been implemented by SAWPA member agencies, MWDSC, cities and counties, and other entities from within the Watershed. These programs include:

- California Friendly Homes
- Targeted Water Conservation Programs
- Water-wise Ordinances and Design Guidelines for New and Existing Developments
- Green Building and LEED Standards
- Development Mitigation Credits for New WUE Programs
- Weather-Based Irrigation Controller (WBIC) Programs
- Agricultural and High Water Use Residential and Commercial Audits and Evaluations
- Landscape Irrigation Budgets
- Rotating Sprinkler Nozzles for Sprinkler Heads Rebates
- High-Efficiency Nozzles for Large Landscape Heads
- Turf Reduction Rebate Programs (Cash for Grass)
- Synthetic Turf Rebate Programs

- Residential and Professional Landscape Classes (California Friendly)
- Landscape Audit Programs
- Regional Landscape Alliances
- Variable Flow Pumping Systems for HOAs, Municipalities, etc.
- Custom-Sized, Pressure-Specific Pump and WBIC Packages
- US EPA Water Sense Certification Programs
- Ultra-Low-Flow Toilet (ULFT) Rebates
- High-Efficiency Toilet Rebates
- Multi-Family High-Efficiency Toilet (HET) – Direct Install
- High-Efficiency Clothes Washer (HECW) Rebates and Added Incentives
- Industrial Water Use Reduction Audits and Incentive Programs
- Swimming Pool Cover and Rain Barrel Rebates
- Public Sector Incentive Programs
- CII Water Use Surveys & Rebate Program
- Hotel and Tourism Industry Programs
- HOA Outreach and Training Programs (Changes to CCRs)
- Industrial Process Performance Improvements Programs
- Allocated Budgeted (Tiered) Water Rates
- University Sponsored Water Institutes
- Fundraising Projects with Water-wise Plant Palettes
- Community Outreach Programs and Water Festivals
- Public Awareness and Communications Campaigns
- School Education Programs
- Water Conservation Demonstration Gardens
- Water-wise Landscape Contests, Gardening Guides and CDs

Various water agencies and other water related organizations in the Watershed will implement WUE programs on a regional basis deemed to have a high probability of success and are cost-effective but will not duplicate MWDSC's conservation efforts. SAWPA, on behalf of the OWOW stakeholders and participants, will apply for grant funding to complement and expand on existing efforts.

Current WUE Policy and Legislation

The California Legislature has been active in creating and passing legislation regarding WUE. Recent legislation passed by the California Legislature, such as AB 566, AB 662, AB 715, AB 1420, AB 1560, AB 1881, are guiding and shaping the way for WUE. AB 566 requires, rather than permits, the model landscape ordinance (per the Water Conservation Act) to include climate information for irrigation scheduling based on

the California Irrigation Management Information System (CIMIS) system. AB 662 requires the minimum standards for operating efficiency of water-using devices/appliances be based on those efficiencies that will reduce the energy and water consumption rates, and that do not result in any added total costs over the designed life of the appliances concerned. AB 715 requires that all toilets sold or installed in California use no more than an average of 1.6 gallons per flush, and that all urinals sold or installed in California use no more than an average of one gallon per flush. It also requires that, on and after January 1, 2014, all toilets and all urinals, other than blow-out urinals, sold or installed in California are high-efficiency toilets (1.28 gallons per flush or less) and urinals. AB 1420 requires eligibility for any grant or loan to an urban water supplier awarded or administered by DWR, State Water Resources Control Board (SWRCB) or the Bay-Delta Authority to be conditioned on the implementation of the water demand management measures described in the UWMP. DWR is required to convene an independent panel to provide recommendations to the legislature relating to adoption, implementation, and reporting of demand management measures. The DWR also must identify demand management measures that achieve a standard of excellence. AB 1560 requires the Energy Commission to prescribe, by regulation, water conservation design standards for new residential and new nonresidential buildings. Additionally, the DWR prepared a Water Efficient Landscape Model Ordinance as part of the implementation of AB 1881.

On November 6, 2009, the State Legislature approved Senate Bill 7 – Statewide Water Conservation as part of the State Comprehensive Water Package. This legislation establishes one of the most progressive mandates to establish statewide water use efficiency standards in the State's history. The bill includes the following:

SB 7 creates a framework for future planning and actions by urban and agricultural water suppliers to reduce California's water use. For the first time in California's history, this bill requires the development of agricultural water management plans and requires urban water agencies to reduce statewide per capita water consumption 20 percent by 2020. Specifically, this bill:

- Establishes multiple pathways for urban water suppliers to achieve the statewide goal of a 20 percent reduction in urban water use.
- Specifically, urban water suppliers may:
    - Set a conservation target of 80 percent of their baseline daily per capita water use.
    - Utilize performance standards for water uses that are specific to indoor, landscape, and commercial, industrial and institutional uses.
    - Meet the per capita water use goal for their specific hydrologic region as identified by DWR and other state agencies in the 20 percent by 2020 Water Conservation Plan.
    - Use an alternate method that is to be developed by DWR before December 31, 2010.
- Requires urban water suppliers to set an interim urban water use target and meet that target by December 31, 2015 and meet the overall target by December 31, 2020.
- Requires DWR to cooperatively work with the California Urban Water Conservation Council to establish a task force that shall identify best management practices to assist the commercial, industrial, and institutional sector in meeting the water conservation goal.

- Requires agricultural water suppliers to measure water deliveries and adopt a pricing structure for water customers based at least in part on quantity delivered, and, where technically and economically feasible, implement additional measures to improve efficiency.
- Requires agricultural water suppliers to submit Agricultural Water Management Plans beginning December 31, 2012, and include in those plans information relating to the water efficiency measures they have undertaken and are planning to undertake.
- Makes ineligible for State grant funding any urban or agricultural water supplier who is not in compliance with the requirements of this bill relating to water conservation and efficient water management.
- Requires DWR to report to the Legislature in 2013, 2016 and 2021, on agricultural efficient water management practices being undertaken and reported in agricultural water management plans.
- Requires the DWR, the State Water Resources Control Board, and other state agencies to develop a standardized water information reporting system to streamline water reporting required under the law.

Regional WUE Strengths, Weaknesses, Opportunities and Threats

As part of the process of evaluating the region's overall WUE performance and future WUE planning efforts, a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis was conducted to determine best strategies and the most effective course of action. The identified Strengths, Weaknesses, Opportunities and Threats, which are further categorized as physical, institutional, and customer-related are summarized in the SWOT analysis described below.

Strengths

The regional WUE strengths lie primarily in the activities and experience of the regional water agencies and their sub-agencies. SAWPA consists of five major water and wastewater agencies: Valley District, Inland Empire Utilities Agency, WMWD, Eastern Municipal Water District, and Orange County Water District. Many of these agencies also serve as the primary wholesale water agency for sub-agencies within their service area.

Through SAWPA, multi-agency forums or roundtables are held among member agencies to provide interagency communication, communication with the public, and communication with regulating bodies. It is also through these forums that agencies can share their technical and practical expertise in WUE program implementation. By meeting together to discuss issues and concerns, a unified message and response is continually refined and implemented by agencies for important issues such as the water crisis and future policy initiatives. Additionally, other organizations including non-profit entities, coalitions, and environmental interest groups, as well as larger institutions such as MWDSC and USBR, have been instrumental in helping to create and maintain the region's vision for a sustainable watershed.

Weaknesses

The regional WUE weaknesses lie generally in the differences in implementation of WUE programs, available agency resources for those programs, and in customer awareness and attitudes toward WUE.

With so many water agencies participating in regional processes, there are sometimes conflicting goals or priorities that can hinder progress. There also seems to be a gap in the distribution and implementation of conservation programs in various portions of the region. One reason is the ineligibility for conservation funding of those agencies that do not fall within the MWDSC boundaries. Public outreach and marketing methods vary due to the differences in the size and resources of agencies, budgets, and number of agency staff dedicated to WUE programs. This variance translates into customers within the same region not being similarly informed, and thereby not attuned to local water usage issues and regional water conservation measures.

Additionally, the Santa Ana Region is limited in the number of landscaping professionals, contractors, and other trade staff members who are knowledgeable about WUE, water-efficient techniques, and technologies; and who can serve as resources for water customers looking to implement WUE measures. It will be important to forge partnerships with industry groups and large retailers to help bring about a transformation in the marketplace by making it easier for consumers to purchase new water efficient irrigation devices.

Opportunities

One of the key opportunities that can be implemented is the use and reiteration of the term "water use efficiency" instead of "water conservation" in any education or outreach to the stakeholders and the community. As explained previously, the word "conservation" usually conjures a negative image of a water "diet", which is generally associated with times when water supplies are compromised due to drought. By using the phrase "water use efficiency," agencies convey the importance of efficient use of water resources at all times and encourage water-wise behaviors as an integral part of customers' lifestyles.

The weaknesses noted earlier also are opportunities to build new strengths. By using the OWOW WUE Pillar forum, agencies can collaborate on projects that will provide regional benefits by maximizing shared resources and developing new relationships and programs.

Other opportunities available to the regional WUE effort are mainly customer-oriented: changing expectations and behaviors; inspiring and motivating WUE; and providing information, training, and support programs regarding WUE and technologies. The opportunity for increased solution-oriented collaboration among water agencies and professionals is also a key opportunity.

There are many opportunities for WUE measures in the region. With the continuation of regional marketing measures, WUE issues can reach a broader audience throughout the region. SAWPA and local agencies will have an enhanced role to advance WUE by embracing emerging technologies, and creating grant-funded technical assistance for the region. Other WUE opportunities include new programs such as US EPA's WaterSense, training classes for landscapers and the public, and the possibility of developing a contractor certification program. Better coordination with water agencies and cities will help promote new WUE ordinances based on AB 1881, the California Model

Local Water Efficient Landscape Ordinance, such as the Riverside County Water Efficient Landscape Requirements Ordinance, County Ordinance 859; new water-efficient development; and the use of allocated tiered water rates. There also is an opportunity for SAWPA and local agencies to partner with the area's energy utilities on marketing and incentive programs for CII water users that target water use and water-related energy use. All of these opportunities will be designed to motivate customers to increase their WUE.

As implementation measures are enacted to comply with AB 32, California Global Water Solutions Act of 2006, to control greenhouse emissions, the advantages in reduced energy use of WUE applications become readily apparent. As indicated in **Figure 5.4-1** on the following page, WUE is ranked as the most energy efficient of water supply source per kWh/AF in southern California based on research conducted by Dr. Robert Wilkinson, Director Water Policy Program, UC Santa Barbara.

Figure 5.4-1 Energy Intensity of Selected Water Supply Sources in Southern California

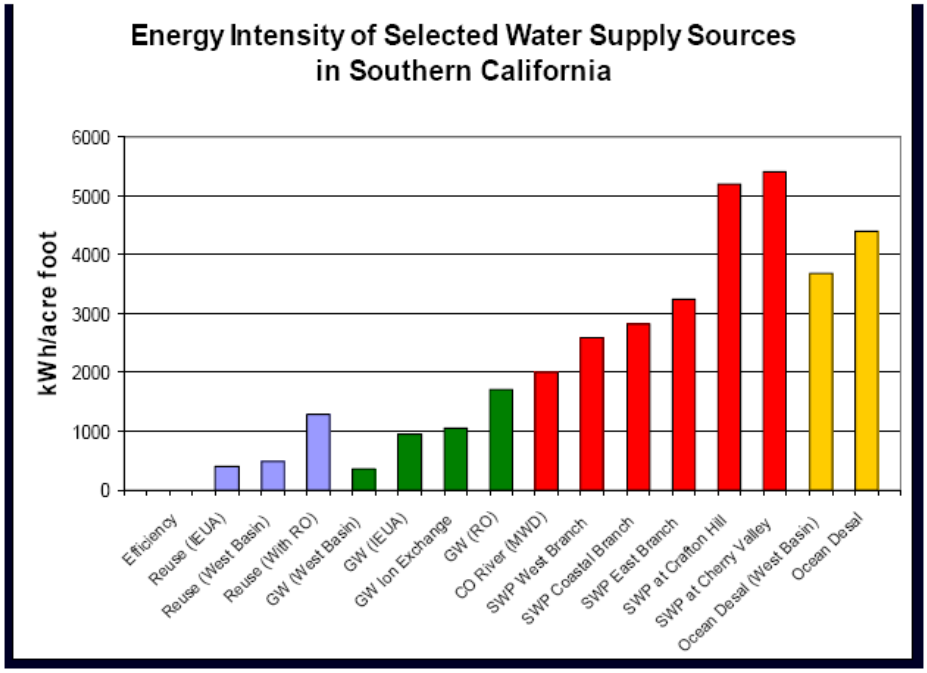
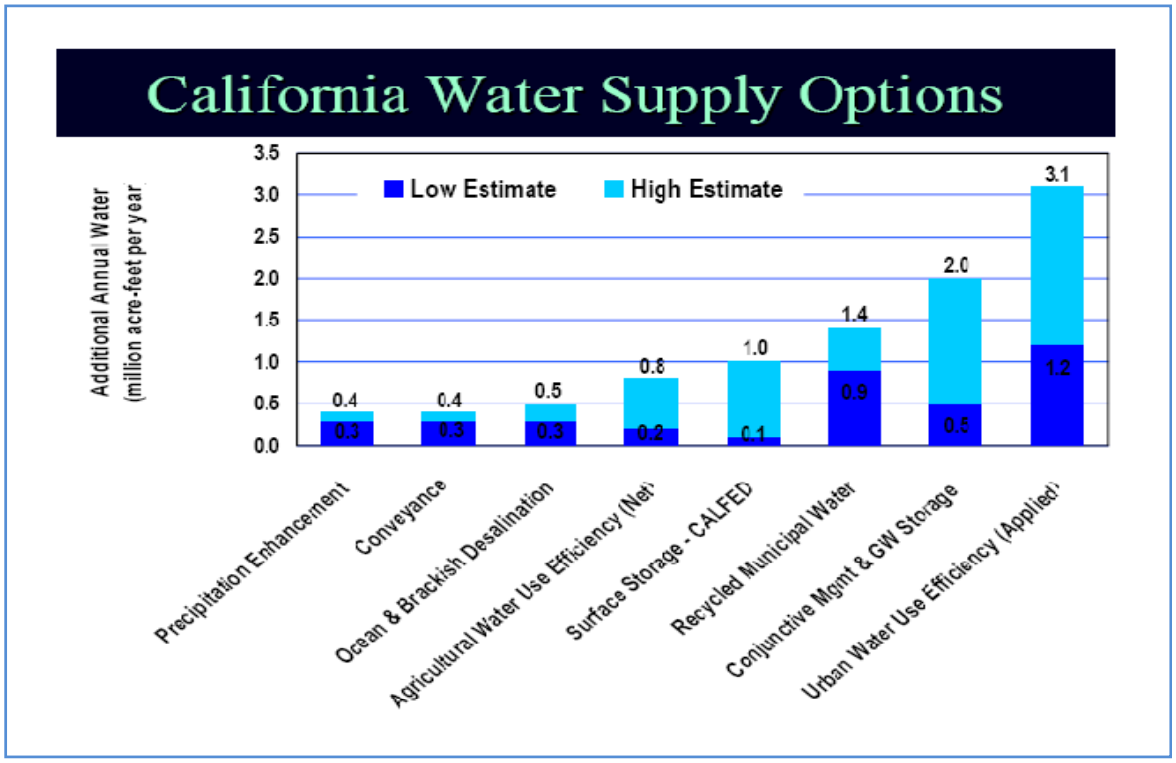


Figure 5.4-2 California Water Supply



Further, under **Figure 5.4-2**, of the many California water supply options available, urban WUE offers the largest supply available under low and high estimates statewide.

Threats

Funding, population growth, water infrastructure maintenance, and legislation are several main issues that could inhibit the regional WUE programs. The region is in need of programs to promote efficient use of its water supply while facing a possible cutback on grant funding. Other issues include political pressures, the need for agencies to remain cost-effective, and recent legislation requiring compliance with UWMPs.

Several of these threats are embodied in AB 1420, a bill signed by Governor Schwarzenegger in October 2007 regarding water demand management measures and water management grant or loan funds. This legislation states that eligibility for any grant or loan to an urban water supplier awarded or administered by DWR, the SWRCB, or the Bay-Delta Authority is to be conditioned on the implementation of the water demand management measures (DMMs) described in the supplier's UWMP. If the supplier is not in compliance with any of the DMMs in its UWMP, it will not be eligible for state funding grants or loans.

Agencies will have to work together to examine these potential threats and create a plan for moving forward if faced with any of these challenges.

Identification & Implementation of Strategies to Improve Resources

With their key goal to reduce demand for imported supplies received from the State Water Project and Colorado River, SAWPA, its member agencies, and other retail agencies in the Watershed are developing water-efficient strategies to become more self-reliant and sustainable. To identify opportunities for using water more efficiently, existing conditions and regional resources were identified and analyzed by the Pillar committee members.

WUE Measures

The WUE Pillar Group meetings gathered information and ideas on potential new conservation opportunities, programs, and emerging technologies that could be implemented in the SAR Watershed. The WUE team developed two primary points of agreement: 1) the main focus of WUE's current and future efforts should shift from indoor residential water use to landscape and CII water use, and 2) regionally standardized WUE programs should be implemented throughout the watershed.

To develop a plan and outline strategies to accomplish these items, the WUE Pillar members held quarterly meetings to exchange information and ideas, partner and support each other's efforts, and coordinate with SAWPA staff. Through these meetings, a comprehensive list was created to summarize existing and potential new opportunities for WUE efforts. The WUE list was created by the Pillar. It lists several conservation measures by the following categories: Regional Programs and Incentives; Landscape; CII; Financial and Policy Initiatives (also refer to *Current Conditions* section), and Partnerships and Outreach. Pillar members were invited to check off the WUE measures they currently were implementing, and measures they wanted to pursue. Using this information, the Pillar was able to review everyone's efforts and validate their agreed vision to focus on landscape and CII water use, and regionally standardized WUE programs.

The following is the list of the WUE Pillar's list of programs determined to be the most effective in the categories listed above:

Regional Programs and Incentives

- ***Promulgate High Efficiency Toilets (HETs) and High Efficiency Clothes Washer (HECWs)***

  Toilets and clothes washers typically account for 27% and 22%, respectively of residential indoor use, representing the most significant remaining savings potential for indoor use. (Note: Aggressive showerhead replacement programs in the early 1990's, in addition to plumbing code changes, have resulted in high saturation levels for low-flow showerheads). With replacing a toilet that uses 3.0 gallons or more per flush with one that uses 1.28 gallons per flush or less, a resident may receive $100, depending on the toilet selected and the incentive offered by the local water provider.

Incentives also exist for residents who want to buy a new HECW that uses less water and energy than conventional washers. These incentives encourage residents to invest in and install WUE devices that will be used frequently in their households.

Building upon the success of indoor WUE programs provides the groundwork to now shift the focus to outdoor and landscape water conservation measures. Out of all of the topics in the WUE matrix, the landscape category had the most conservation measures identified by the Pillar. The Irrigation System Improvements (audits and equipment) and the CII Large-Scale and Key Account Audits and Implementation measures were the ones that were ranked the highest in the Landscape category, which reinforces the Pillar's focus on landscape and CII water use.

- ***Utilize MWD's Regional Support for WUE Rebate Incentive Programs***

  MWDSC has implemented a program that allows water agencies to customize their rebates by adding additional incentives. The program also allows agencies to target markets, analyze data, and implement new approaches. MWDSC rolled out SoCal Water$mart, a regional residential rebate program where any resident within MWDSC's general service area will be eligible to apply for rebates on water efficient purchases for the home directly from MWDSC, thereby eliminating the ineligibility of customers who live in non-participating MWDSC areas. The Landscape Water Use Efficiency Statewide Market Survey conducted by the Water Resources Institute at California State University, San Bernardino, shows that rebates would provide motivation for a significant percentage of decision-makers for residential and managed properties to invest in landscape water efficiency technologies.

Landscape

- ***Irrigation System Improvements (Audits and Equipment)***

  Irrigation of residential and certain types of commercial landscapes currently is one of the largest uses of water. Landscape water use can be reduced by up to 30% by simply repairing broken or damaged irrigation components, adjusting pressure, retrofitting with more efficient components, and scheduling irrigation properly. A simple system improvement is retrofitting spray head sprinkler nozzles with rotating sprinkler nozzles. The rotating sprinkler nozzles apply water at one-third the rate of spray heads, thereby allowing the sprinklers to run for longer periods of time before runoff occurs.

  A significant system improvement that can be accomplished in combination with other irrigation improvements to reduce landscape water use by 20% or more is the installation of a "smart" irrigation controller. It estimates or measures depletion of available plant and soil moisture, and replenishes water as needed while minimizing excess water use. It adjusts water application throughout the irrigation season without human intervention. There are two types of smart controllers: 1) sensor-based controllers, which use historical weather data plus temperature and precipitation monitoring, or information provided by an on-site weather station; and 2) signal-based controllers that use localized weather data provided by the CIMIS or an equivalent. The benefits of encouraging and promoting the use of smart controllers include reduction of outdoor water use, healthy and attractive landscaping, reduction of runoff and non-point source pollution, and improved water quality.

Commercial, Industrial, Institutional (CII)

- ***CII Large Scale and Key Account Audits and Implementation***

  Large-scale CII customers use water in unique ways that must be examined for opportunities to save water on an industry-wide or individual basis. To assist with this, MWDSC has the Water Savings Performance Program that provides audits and retrofits to large industrial water users. Financial assistance is provided for documented water savings derived from projects implemented under the program that meet the qualifying criteria.

  Equipment for the proposed improvements may be purchased or leased. Typical process improvements that qualify include installation of equipment to capture, treat, and reuse water that otherwise would be discharged to the sewer, and replacement of existing equipment with more efficient process improvements resulting in reduced water demand.

  Another program aimed at institutional water users is the Public Sector Program, initiated by MWDSC in 2007 to provide funding to public agencies to implement WUE devices. There is dual opportunity to retrofit internal components, such as implementing high-efficiency toilets and urinals, and to retrofit external components, such as installing smart or central controllers and synthetic turf. The public sector market was targeted because the general public looks to public agencies to set a standard and because public agencies generally have the labor to install retrofits but not the funding.

  On a smaller scale, many local water agencies have obtained grant funding to implement local programs to assist commercial users in retrofitting to more efficient devices.

- ***Save Water, Save A Buck Program (SAB)***

  MWDSC's SAB Rebate Program, in which three of the four eligible SAWPA member agencies participate, is tailored specifically for the CII sector. Rebates are available for several water-efficient technologies to help lower water and sewer bills, reduce energy costs, and address environmental impacts. The program also allows regional marketing to key strategic partners, including device vendors. The lifetime water-savings for technologies installed to date in southern California through the SAB program is anticipated to be over 20 billion gallons.

  The growing population in this semi-arid region puts an ever-increasing strain on the limited water supply. The dramatic anticipated water savings resulting from the Save A Buck program show that one of the best ways to meet this demand is for MWD and its member agencies to help businesses become more aware of water-saving technologies, and to provide the necessary financial incentives to encourage their implementation.

Other Inferences from the WUE Matrix

The other categories of Financial and Policy Initiatives, and Partnerships and Outreach, are important in strategizing, designing, and implementing WUE efforts. Each is a category that directly affects and influences the direction and development of future WUE Programs.

Financial and Policy Initiatives

Water Budgets and Allocated Tiered Water Rates offers individualized allocated water budgets for each water customer. This creates a structure that encourages people to stay within their water budget, and may be used at the discretion of local retail water agencies to penalize those who are careless or excessive with their water use. The money generated from overuse penalties could be a funding source to implement new local WUE programs. If passed, AB 2882 will support this strategy by allowing wholesale and retail water suppliers to adopt allocation-based conservation water pricing.

Partnerships and Outreach

Partnering and Outreach is an integral part in building consensus, sharing resources, and unifying the message for WUE efforts. There were numerous responses from WUE Pillar members on the ideas for how to partner with Resource Conservation Districts and Pollution Prevention/Water Quality efforts.

- ***Partner with Resource Conservation Districts***

  Conservation districts emerged during the 1930s as a way to prevent the soil erosion problems of the Dust Bowl from recurring. Formed as independent local liaisons between the Federal government and landowners, conservation districts have worked closely with the USDA Natural Resources Conservation Service (formerly the Soil Conservation Service).

  In the state of California, conservation districts are called Resource Conservation Districts (RCD), and are independent "special districts" organized under the state Public Resources Code, Division 9. Each RCD has a volunteer Board of Directors made up of five to nine district landowners who are elected locally or appointed. Currently, 103 RCDs in California work to address a wide variety of conservation issues including forest fuel management, water and air quality, wildlife habitat restoration, soil erosion control, and conservation education.

  Because RCDs are grassroots, nongovernmental organizations, they have no regulatory power and must meet their goals for the natural resources in their community through voluntary approaches, i.e., neighbors asking neighbors to cooperate. Opportunities exist for agencies in the watershed to work with local RCDs on cooperative efforts to improve the natural environment, in this case, through WUE.

- ***Partner with Pollution Prevention/Water Quality Efforts and Vector Control***

  A major source of water pollution is "non-point source" pollution, or pollution that comes from an indirect source. Storm runoff and excess irrigation are primary sources of non-point source water pollution. Irrigation runoff can contain fertilizers and pesticides that can harm habitat, flora, and fauna. Contamination of streams and rivers, as well as groundwater can result from storm and irrigation runoff if they carry pollution loads that are high. Reduction of non-point source water pollution is especially critical in areas that drain directly into the watershed. Reducing the use of irrigation and scheduling irrigation correctly to avoid runoff can accomplish this. Similarly, the majority of mosquito and vector activity is in and around storm drains, so reducing runoff will help alleviate this problem and reduce the threat from West Nile Virus. There also are opportunities to share public outreach messaging among the various regulating agencies.

- ***Partnership and Collaboration***

  Many agencies on their own have contributed to the current WUE programs and these efforts do not go unnoted. The existing programs are the foundation for our next steps, which include maintaining as well as expanding existing partnerships and collaborations with water wholesalers, sub-wholesalers, retailers, and municipalities.

  Another potential opportunity is to create new and innovative partnerships with customers that are large water users, such as schools, parks, businesses, irrigation companies, HOAs/property managers, gardeners, landscape architects, and contractors. Some of these partnerships could correspond with other CII programs.

  Collaborations with energy utilities could lead to improved outreach, cost-savings and opportunities for increased (combined) financial incentives that will further motivate participation. Energy utilities already are partnering with key water agencies, including MWDSC, on the pilot water-energy programs outlined in the California Public Utilities Commission's ruling regarding water-related energy use.

  Other possible partnerships and collaboration efforts include co-marketing between water agencies and product vendors. Examples include the WUE device certification with the US EPA's "WaterSense" certification and labeling program, or WUE device training sessions sponsored by water agencies and led by a representative from the device's manufacturer.

  The WUE Pillar also can support partnerships and collaboration among water agencies by serving as a forum to share ideas on what works or does not work for an agency. Collaboration between SAWPA member agencies in and outside of the MWDSC service area on WUE programs will allow those agencies and their customers outside of the MWDSC area to participate.

- ***Public Outreach: Emphasis on Outdoor Landscaping and Irrigation Efficiency***

  With up to 70% percent of household water consumption going toward outdoor use, there is a growing need to provide water efficient programs targeting outdoor landscaping. There are various ways to increase water efficiency of outdoor landscaping. The outdoor efficiency program topics identified by the WUE team include:

Marketing programs:

- Changing landscape design elements: increase pervious hard surfaces, pavers, and bioswales
- Creating sample landscape plan templates
- Using captured rainwater, recycled wastewater, graywater, or treated water for non-potable uses including irrigation
- Positioning water-efficient gardens as in style and "hip"
- Utilizing marketing suggestions from the WRI Landscape Water Use Efficiency statewide market survey: positives of water smart landscapes, the cost of doing nothing, children's involvement, and responsibility for the environment
- Targeting marketing efforts to various demographic communities

Technology/training programs:

- Advancing emerging technologies such as smart irrigation controllers and new irrigation device technology
- Creating a comprehensive package for consumers to promote use of smart irrigation controllers (e.g. rebates, stores, installers, training, and check-ups)
- Advocating use of appropriate/functional warm season turf throughout the region
- Developing a "one-stop shop" that offers accessible and comprehensive water-efficient landscape planning programs

- ***Public Outreach: Community-Based Social Marketing***

  Community-based social marketing is a behavior-change tool that can supplement traditional information-intensive marketing campaigns. Previously utilized as a strategy in health care initiatives such as smoking cessation, it now is being utilized for other causes, including natural resource management, to achieve the adoption of environmentally sustainable behaviors by the members of our communities.

  Community-based social marketing involves four steps: 1) identifying the barriers and benefits to a sustainable behavior through a combination of literature reviews, focus groups, and survey research; 2) developing a strategy to promote the sustainable behavior that utilizes "tools" that have been shown to be effective in removing barriers and changing behavior; 3) piloting the strategy; and 4) evaluating the strategy once it has been implemented across a community. These steps result in a community outreach campaign that will successfully foster the desired sustainable behavior, which in the WUE Pillar's case is water-efficient behavior.

  There are several typical reasons why people do not engage in a particular sustainable behavior. One reason is that people are unaware of the activity and/or its benefits. Another reason is that the activity may be perceived as having significant difficulties and barriers associated with adopting it. For example, people may believe that switching their traditional garden to a California-friendly landscape is a daunting task that requires expertise and money. A third reason why people do not engage in a sustainable activity is that they feel that there are no significant barriers that discourage their current behavior. For example, irrigation schedules are left the same throughout the entire year because it is easier to leave it alone rather than have to adjust it due to weather conditions or the time of year.

  To better influence what people do, community-based social marketing helps public outreach campaigns to identify perceived barriers and benefits to an action, and promote specific changes to overcome those obstacles. People naturally tend to gravitate to actions that have the most benefit and that have the fewest barriers to overcome. Additionally, perceived barriers and benefits vary from individuals and groups. What may work for one neighborhood may not work for another, or what may work for residents may not work for businesses. Behaviors also compete with each other; as one adopts a new behavior, the previous behavior is being rejected. For example, the behavior of capturing cold water in a bucket before the shower water gets warm replaces the behavior of letting the unused water run down the drain.

Because of this diversity of motivations, the perceived barriers and benefits to the desired sustainable behavior have to be understood so that the available behavior change tools can be prioritized by the benefits they offer and barriers they remove. From this analysis, effective community-based social marketing strategies can be developed. For future community-based social marketing efforts by the WUE Pillar, the WRI Landscape Water Use Efficiency Statewide Market Survey will be a good starting point as it identifies several residential and managed properties incentives and barriers to increased landscape WUE.

Once a sustainable behavior-specific marketing strategy has been developed, the piloting and post-pilot evaluation of the behavior change strategy ensure that a project is effective at achieving the desired result before it is implemented on a large scale. By careful research and planning, pilot testing, and pilot results evaluation, community-based social marketing strategies that promote sustainable behaviors can successfully become and remain a part of people's lifestyles.

Other WUE Strategies Discussed in WUE Meetings

The following is a brief summary of additional measures prioritized by the WUE Pillar that were not included in the Table of WUE Measures, but highly discussed in WUE meetings.

- ***Urban Water Management Plan***

  In the area of WUE planning, water agencies in California must perform certain minimum planning processes required by the California Water Code. The most informative of these planning tools is the UWMP. Agencies that either have more than 3,000 service connections or deliver more than 3,000 acre-feet annually must complete a UWMP at least every five years. The UWMP incorporates requirements for describing how the agency will implement WUE demand management measures, which are equivalent to the CUWCC BMPs. In the SAR Watershed, there are many overlapping water agency jurisdictions and their respective UWMPs, creating a large amount of information about WUE. BMP implementation information also is available, much of it from MWDSC.

- ***Evaporation and Transpiration Correlation***

  Significant water loss can be attributed to evaporation and transpiration. Evaporation accounts for surface water that enters the air as vapor due to the heat of the sun. Transpiration accounts for the use of water by plants. By promoting native and drought tolerant plant species instead of turf grass, transpiration is reduced. By planting more trees, the amount of shade area is increased, which reduces evaporation and the heat island effect.

  There will be opportunities for water agencies within a watershed to partner with other public and private entities that share the same goal of increasing the amount of drought-tolerant, native, and Mediterranean plants in the watershed. The goal of reducing evaporation and transpiration also should be incorporated into the plant palette idea, where landscape contractors can recommend a palette of plants that are water use efficient to a resident, business, or industry. Additional evaporation reductions can be accomplished by providing incentives or voucher programs for swimming pool and spa covers, and banning outdoor misting systems.

Collaboration and Integration with other OWOW Pillars

The nine other OWOW Pillars are developing programs, resources, and strategies for addressing challenges in their areas of expertise, similar to the WUE Pillar. By integrating strategies from multiple OWOW Pillars into planned water resource management programs, and by increasing program planning and implementation coordination among Pillars, efficiencies and benefits are generated that yield program results greater than those achieved through the efforts of a single agency or Pillar. Additionally, collaboration that produces consensus among the OWOW Pillars creates a stronger, more unified voice to communicate regional water management goals, strategies, and messages to stakeholders. Described below are the three reasons that collaboration and planning integration with other OWOW Pillars is crucial to the fulfillment of the WUE vision.

Leveraging Expertise

The WUE Pillar aims to maximize the benefits of the work of the other Pillars and water agencies by incorporating their expertise in future WUE programs. Among others, the Water Supply Reliability, Flood Risk Management, Climate Change, and Water and Land Use Pillars share common ground with the WUE Pillar. For example, WUE is a response to the region's dependence on imported water supplies, which is a water supply reliability and climate change concern, and WUE targets behaviors that create dry weather run-off that carries non-point source pollution. Collaboration and information sharing between these Pillars and the WUE Pillar will create consistency among programs and services, establishing a norm that is recognized within and beyond the region.

The more connections that can be made between Pillars in the design of a project, the more the project can be deemed valuable and successfully prioritized for funding and implementation due to its ability to provide multiple benefits. On another level, publicity and marketing strategies can be maximized through the dissemination and repetition of the message across different Pillars and diverse audiences.

Additionally, as WUE is a watershed-wide goal shared by many Pillar areas, the potential exists for the WUE Pillar to become a clearinghouse for WUE programs and resources, which could be made available through a Website for easy access. The WUE Pillar also could take on the role of a regional coordination planning body for WUE experts, including irrigation repair services, landscape design firms, and landscape contractors. Putting the public in touch with these experts through the clearinghouse would demonstrate a grassroots and social marketing approach to the implementation of WUE measures.

Leveraging Resources

Water resources are vital to the SAR Watershed, and resources including time and funding are vital to the successful implementation of WUE projects and programs. As the SAR Watershed's water resources cannot meet unlimited demands, and the WUE Pillar members' time and funding do not allow an unlimited number of WUE programs to be implemented, leveraging available resources to achieve the most benefit is critical.

In terms of water resources, the water agencies in the SAR Watershed currently rely on varying degrees of imported water supply to meet customer needs. Through the identification of existing local resources such as groundwater and recycled water, water agencies will be able to better

leverage water supply resources. One of those available local water supply resources is water saved through WUE measures.

Especially now, as the State Water Plan and the SB 7- Statewide Water Conservation in full swing along with current legislative initiatives of AB 1420 (access to water conservation funding), AB 1881 (water efficient landscapes and land use planning), focus on water efficiency, increased engagement by, and resources from the WUE Pillar will be necessary to meet these new requirements.

One way to leverage time and funding resources is to group together WUE projects and programs by similar geographic areas. By collaborating on work activities, timelines, and stakeholder outreach, the sponsors of these projects and programs can reduce project costs, lessen community impact by decreasing completion time for capital projects, and achieve greater success in community outreach and stakeholder behavior change for education and marketing programs.

Having multiple Pillars come together to combine various water management strategies within a single project or program is another way to leverage time and funding resources. For example, the Water Supply Reliability, Water Recycling, Flood Risk Management, Climate Change, Environmental Justice, and Water and Land Use Pillars could integrate WUE into all resource-based planning efforts (*i.e.*, treating WUE as a supply source and as a means to offset climate change impacts while mitigating land use impacts). WUE provides opportunities to increase demand for recycled water use. Landscape water conservation programs have a secondary benefit of reducing runoff and non-point source water pollution, as well as reducing the proliferation of vector-based diseases such as West Nile Virus.

As available staff and funding resources are not uniform among member agencies, leveraging resources and programs across geographical areas and Pillars also can address equity and fair distribution of resources while maximizing results. WUE programs and WUE ads can be spread across geographic areas and Pillars to leverage resources and maximize benefits. Using region-wide communications outlets obtains the greatest benefit for the funding resources available by allowing the ads' messages to reach the widest audience possible, and can result in earned media, better ad rates, and extra airtime.

Employing WUE staff expertise and funding resources on a regional basis using the IRWMP process ensures that smaller agencies and agencies outside of the MWDSC service area have access to the available resources. Pursuing regional implementation of programs will help to both leverage and balance resources, as agencies already implementing WUE will impart their expertise in the design and implementation of new regional WUE programs. These programs will then be available to the customers of smaller agencies, and regional programs will be able to employ new implementation formats and access new funding. The region's water agencies also would benefit from the more consistent message and improved reliability of regional WUE programs.
Leveraging the available resources to implement WUE programs that benefit those with sufficient means and those in need of resources is a proactive approach that will maximize the WUE benefits throughout the region. WUE also should be included in proactive emergency preparedness planning and preparation for disasters, as water saved through WUE can become the water that is available for future emergency use.

Leveraging Funds

Integration of water management strategies across geographies, within the project implementation process, and through partnerships between agencies can result in significant financial efficiencies. Collaborative projects that are widely supported can be more far-reaching and implemented more quickly, effectively, and efficiently than could be accomplished by one agency focused on a single water management strategy.

Spreading WUE funding throughout a watershed results in cost benefits through the integration of multiple strategies or messages and through regional marketing efficiencies. For example, Valley District and the Yucaipa Valley Water District (YVWD) are within the SAR Watershed, but are not MWDSC member agencies, making them ineligible for MWDSC conservation rebate funding. However, collaborative projects with regional benefits facilitated by the OWOW effort, such as a regional conservation incentive funding program that would overlap with efforts by MWDSC member agencies, SAWPA agencies, and Pillars, would be a way to enable Valley District, YVWD, and other agencies to receive funding and to maximize WUE benefits and results.

Funds also can be leveraged to achieve goals through regional partnerships and projects that use matching funds, such as MWDSC's conservation credits program. Created in 1988 and updated in 2005, this conservation credits program provides funds to MWDSC's member agencies to advance their individual demand management strategies. Additionally, Federal government funds could be used to leverage State and local funding.

Focusing in particular on the Water Supply Reliability, Climate Change, and Environmental Justice Pillars, SAR Watershed water agencies should incorporate WUE funding into their planning portfolios to ensure a constant funding stream for WUE programs and efficiency measure implementation. Agencies should institute an allocated budget-based tiered water rates structure whenever feasible to help generate the revenue streams necessary to implement successful landscape WUE programs, while at the same time pursuing MWDSC conservation incentives so that matching funds from State grants can be obtained.

Description of Data Collection and Compilation Process

Stakeholder Identification

The WUE Pillar is comprised of over 40 stakeholders from all three counties, consisting of WUE experts, consultants, business leaders, and other industry leaders. Members were solicited during several outreach events held by SAWPA in the early stages of the planning process. A fish bowl type public involvement approach (participants placed their business card in a "fish bowl" for each Pillar group of interest to them) was used to gather interest and collect contact information from potential participants. SAWPA also sent numerous email outreach blasts that invited and encouraged involvement and participation. Some members volunteered and others were assigned by their respective agencies.

Strategies Deployed to Involve and Motivate Stakeholders

Strategies used to involve and motivate the WUE members were establishing meeting dates early; creating an advisory committee within the larger pillar group; structuring meetings to constructively gather input; committing attendance for half-day brainstorming sessions; providing refreshments and lunch at workshops; making chapter drafts available electronically for review and comment, and continually reaching out to potential new participants.

Event Coordination

A chapter outline was developed by compiling input from a total of three large-scale meetings, PowerPoint presentations, and other resources, and organizing them into the categories developed by SAWPA. An interactive workshop was developed as a way to review the outline and gather more information. Participants were assigned to a group that worked on a particular section of the WUE Chapter. Within these groups, participants discussed and refined the key message of the section. Each group answered the question: "What should be the key message of this section of the WUE Chapter?" Participants were asked to develop key messages that relate to the mission statement of WUE discussed in the last meeting, and to determine if keywords, such as "future vision" and "proactive" needed to be part of the mission statement.

Another assignment for each group was to review a section of the WUE chapter. Participants read through their chapter section outline and discussed what information was missing or needed to be further developed. Each group thought about:

- What information is missing that is needed to support the section's key message?
- Can this section be organized or structured differently?
- Are there examples that can be placed in this section?
- Is there a program or resource that needs to be described in more detail in this section?
- What resources can be researched and cited?
- What supporting graphics/photos can communicate ideas in this chapter section?
- Are there statistics that need to be included in this chapter section? If so, where can this information be extrapolated?

Each group then presented their ideas of their key message and chapter section to the rest of the team. Afterwards, each participant was able to comment and add information to other sections of the chapter.

Additionally, two matrices were provided to the stakeholders: Table of WUE Measures, and Table of BMPs). These matrices will serve as comprehensive databases to summarize efforts in the SAWPA OWOW region. Participants were asked to fill out these matrices marking the existing and future efforts of their organization in terms of WUE and the CUWCC's 14 BMPs. With over 100 agencies listed in the matrix, these working databases identify and track areas of overlap, areas of collaboration, areas in need of development or improvement, and levels of prioritization.

Data Collection Methodology

Some of the SAWPA member agencies serve disadvantaged communities that have not yet had the opportunity to access grant funding to implement WUE programs. Other agencies have been promoting WUE for years, or have not begun at all. Thus, within the Santa Ana Region there are varying levels of familiarity with, and implementation of, WUE programs. It is this "uneven playing field" that the WUE Pillar has attempted to address by devising mechanisms to allow the Santa Ana Region as a whole to achieve water demand reduction. Key questions regarding implementation of WUE programs in the Santa Ana Region include:

- Should an approach to WUE be broad and non-specific so that agencies within the region have local flexibility, or should there be a list of specific measures and projects that have high potential for multiple regional benefits that are to be implemented by all agencies?
- If a conservation measure or project is locally cost-effective, should it be implemented regardless of the availability of grant funding?

Because each agency has its own set of ongoing circumstances, customers, and funding, agencies have differing preferences about the answers to these questions.
As a way to envision the greater picture of how to design a plan of action, the WUE Pillar members have expressed a desire to hold quarterly meetings to exchange information and ideas, partner by supporting each other's efforts, and coordinate with SAWPA staff. By coming together regularly, members can prioritize next steps, coordinate grant funding opportunities, and continually evaluate each WUE strategy to confirm its cost-effectiveness and benefits to the region.

To begin this collaborative effort of developing a plan, comprehensive databases were compiled to summarize two large efforts in the SAWPA OWOW region: 1) List of WUE measures: existing and potential new opportunities for WUE efforts, and 2) Table of BMPs: implementation coverage of the 14 CUWCC Best Management Practices (**Table 5.4-1**). With over 100 agencies listed, these working databases identify and track:

- Areas of overlap
- Areas of collaboration
- Areas in need of development or improvement
- Levels of prioritization

The WUE "opportunities" matrix identifies existing and potential new programs identified during the Pillar brainstorming effort. The programs are categorized as Regional Programs and Incentives, Landscape, CII, Financial and Policy Initiatives, and Partnerships and Outreach. Each SAWPA member agency has indicated which programs are of most interest to their service area.

The "Best Management Practices" matrix (**Table 5.4-2**) identifies the efforts of the SAWPA member agencies in satisfying the 14 BMPs listed in the CUWCC MOU. These data are summarized in **(Table 5.4-3**). Both of these Tables can be found in the Appendices.

The 2005 IRWMP demonstrates that water efficiency measures could have significant beneficial impacts on future water supplies in the region and how they are managed. As the major regional wholesalers, MWDSC and Valley District have compiled water demand and supply data. MWDSC also has provided water conservation savings data. The data is based on the 2005 UWMPs and the 2005 SAWPA IRWMP, as well as MWDSC's internal planning processes with data gathered from its member agencies. These datasets were discussed and analyzed in the WUE Pillar to determine the potential level of savings that will be targeted in the IRWMP.

One challenge is obtaining conservation savings data from those retail water suppliers within the Santa Ana Region that are not MWDSC member agencies or sub-agencies, or that have not signed the urban CUWCC MOU. Most of them likely will have supply and demand data, but they may not necessarily have conservation savings data. Agencies that have this full set of information should be contacted to make sure the data is integrated into the data set.

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Chapter 5.5 Land Use

Introduction

A compelling case for why water management agencies must work with local governments and other stakeholders to tackle the complex issues related to local land use was made in an editorial by DWR Director Lester Snow in April 2008. "The decisions we are making now…how efficiently we use water and where we build our new communities, will dictate how much flexibility we will have in the future and what the quality of life will be for the next generation of Californians." Moreover, Director Snow acknowledged that "Most land-use and water-use decisions in California are made at the local and regional levels, though rarely is such decision-making integrated." The result, Director Snow points out, is "Land-use planning that encourages low-density development greatly increases per-capita water demand. Such development patterns also inevitably lead to more dependence on automobiles, which are the largest source of climate-changing greenhouse gas emissions in California. The resulting climate changes will make it more difficult to maintain reliable water supplies. Low-density development imposes other costs as well, as it is generally more costly and difficult to provide flood protection for sprawling suburbs, and this growth reduces the availability of agricultural land. In all, such land uses threaten our water-supply reliability and are costly in many other ways. Land use and water planning must be better integrated to ensure that we make informed resource management decisions."

This chapter briefly examines the history of land use patterns and practices in the Santa Ana River Watershed (Watershed) and some of the lessons learned about the effect of land use decisions on water resources. An objective analysis of the strengths, threats and weaknesses of land use patterns and practices is followed by strategies that address land use and water management producing mutually beneficial and cost effective results. The chapter closes with suggestions of collaborative partnerships between regional water management agencies and local governments, and private sector developers and environmental organizations to address the sustainability of prior and future land use decisions. The authors of this chapter are confident that solutions to the challenges we face in the watershed are limited only by our resistance to solving complex problems working together.

Description of Historical and Current Conditions of Land Use

Historical documents about years of sustainable land use practices in the Watershed by native tribes are followed by an enormous body of knowledge about the settlement of the California missions that established the first significant rangelands in the region and also ventured into the first agricultural production. A steady wave of migration from other regions of the country as well as abroad continued until a tidal wave of migration during the construction of the railroads in the years between 1861 and 1900 that followed the path of available water supplies needed to operate the steam engines. The history of small towns that became respectably sized cities from the top to the bottom of the Watershed is linked to the arrival of thousands of permanent railroad jobs. Readily available water supplies then fueled the development of a vibrant agricultural community, including a large citrus industry, dependent on irrigation.

The Great Depression resulted in stagnant growth throughout the Watershed, but the next major tidal wave of migration was prompted by the bombing of Pearl Harbor that drove military installations and industrial war suppliers further inland. Residential and commercial development became robust from the top to the bottom of the Watershed when legions of soldiers returning from the Pacific of World War II relocated throughout the nation including southern California where they had trained or been stationed at military bases.

Demographic patterns clearly reflect an internal migration pattern from west to east in the Watershed that began when coastal property become too expensive for many prospective buyers, driving population further inland in search of affordable homes and land. The construction of the freeway system was enthusiastically welcomed in Riverside and San Bernardino Counties where the new link to robust job markets on the coast and in Los Angeles triggered the growth of suburbs that primarily served as bedroom communities for commuters.

Patterns also can be derived from a water supply perspective with land uses expanding from locations with access to surface water to places that could be served by gravity-fed irrigation ditches and canals. Land use intensified in areas where drilling a private well was affordable until the critical mass of urban and agriculture water users prompted the establishment of private water companies, irrigation districts, and municipal water districts that could tap the groundwater and build systems to deliver the water directly to customers.

Concerns over reliable water supplies to sustain future land uses led to decades of water rights disputes in the courts between downstream and upstream water agencies. By the time the State and Federal environmental protection regulations were established in the 1970's, consumptive land use patterns in the Watershed had decreased dramatically in the quality and quantity of open space, and surface waters and groundwater had been severely impaired by practices of the time.

Management of Land Resource

The sole authority of cities and counties to regulate land use in their own jurisdiction is deeply anchored in California history and cherished by local communities. The regional strength of local governments has been their focus on sustaining a robust economy through land use decisions that contribute to construction of infrastructure, and generating local government revenues that cover the costs of city and county services that protect the lives and property of their constituents.

Regional Strengths, Threats and Weaknesses of Land Use

Governor Davis signed the first legislation affecting the ability of local governments to make land use decisions related to water supply in 2003. SB 610/221 requires that water suppliers demonstrate in their Urban Water Management Plans (UWMPs) that sufficient water supply is available to meet project and cumulative demand over a 20-year horizon in normal or single-multiple dry years for projects of 500 units or equivalent water demand. More importantly, the legislation anchored the connection that does exist between land use and water supply planning that is fundamental to long-term sustainability as population continues to grow throughout the State.

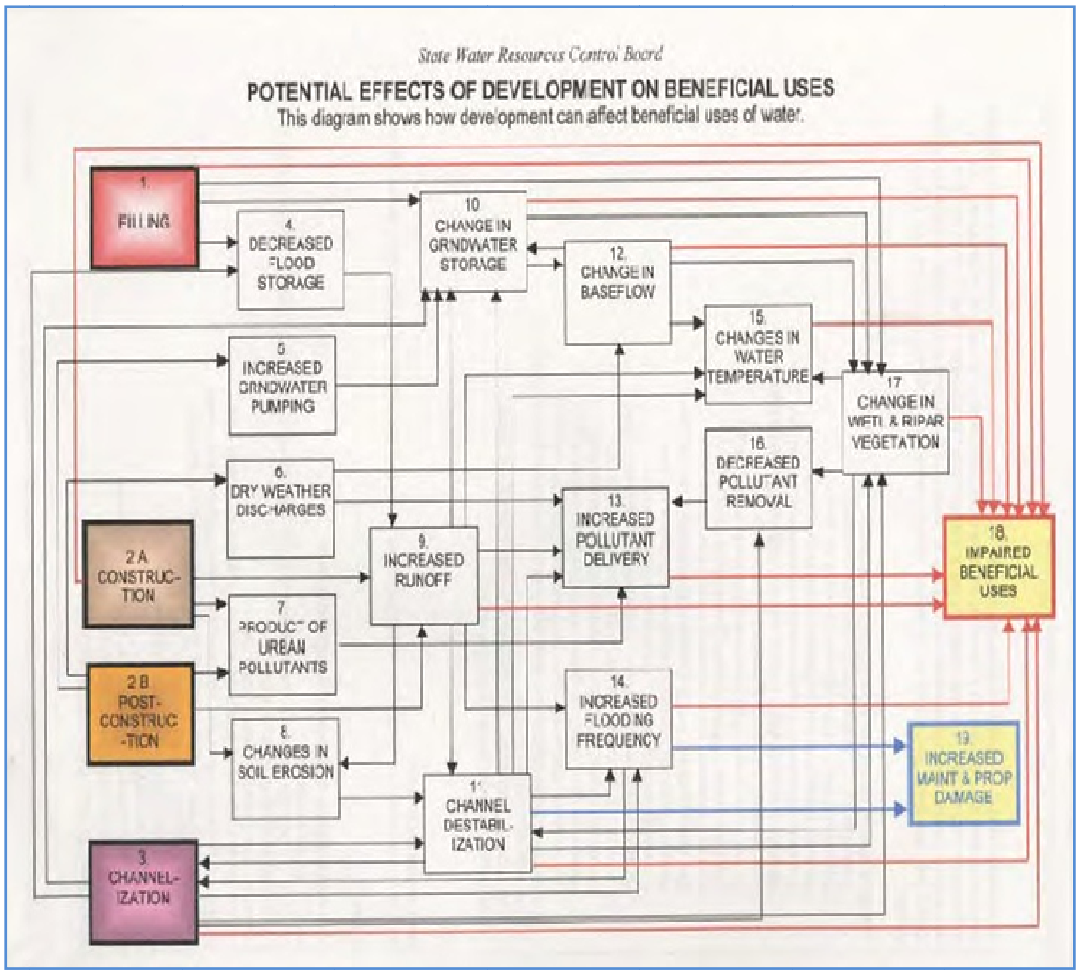
The increase in hard surfacing and flood control over decades of land use practices in the Watershed has changed stormwater runoff patterns resulting in a threat to the sustainability of regional groundwater basins losing historical recharge capacity. For example, the Chino Basin estimates that

over 40,000 acre-feet per year (AFY) of groundwater recharge have been lost on average since land use practices began increasing impervious surfaces.

Resource materials published by the California Land and Water Use Partnership have identified a sound correlation between impervious covers (IC) and threats to regional water supply sustainability. When IC exceeds 10% as it does in many of urban areas in the Watershed, the common signs are not only a reduced level of groundwater recharge, but also an increased size and frequency of one to two-year floods, decreased movement of groundwater to surface water, and increased contaminant run-off into surface water.

Figure 5.5-1, developed by the SWRCB, is included here to illustrate the potential effects of development on the beneficial uses of water from a science-based perspective. It is not difficult to find all of these effects in varying degrees throughout the developed Watershed.

Figure 5.5-1 Potential Effects of Development on Beneficial Uses



Drawing on the most recent land use maps available from the Southern California Association of Governments (SCAG), **Figure 5.5-2** reflects the collective outcome of land use planning and decisions in the Watershed that, over time, has shrunk the footprint of agriculture, open space and recreation, while the areas consumed by new residential, commercial, and industrial developments have expanded. **Figure 5.5-3** projects a population increase from 2000 to 2030 and pinpoints locations where future land use decisions will need to address a robust economy with new jobs and housing for residents, as well as a sustainable water supply over a long-term planning horizon.

Figure 5.5-2 Santa Ana River Watershed 2005 Landuse

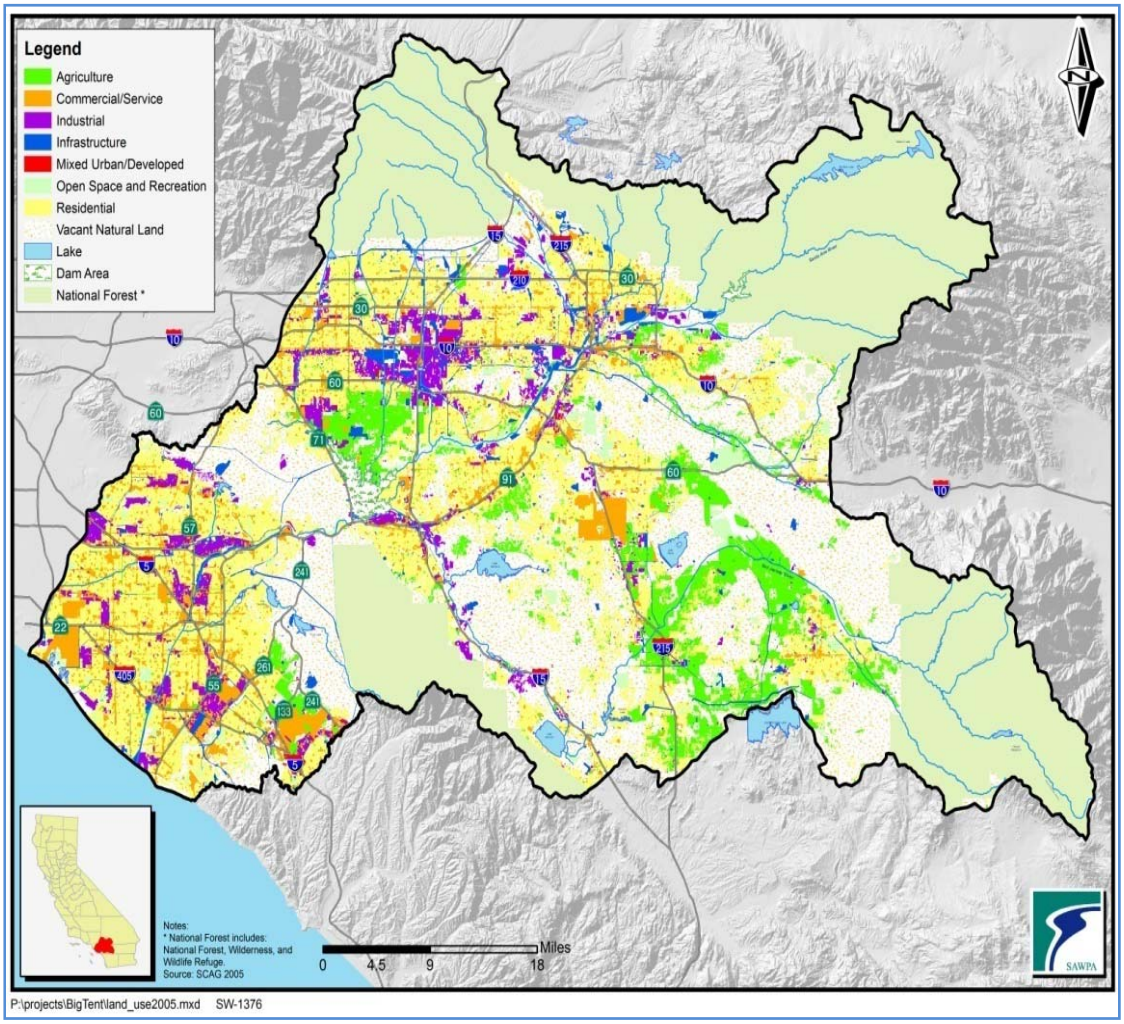
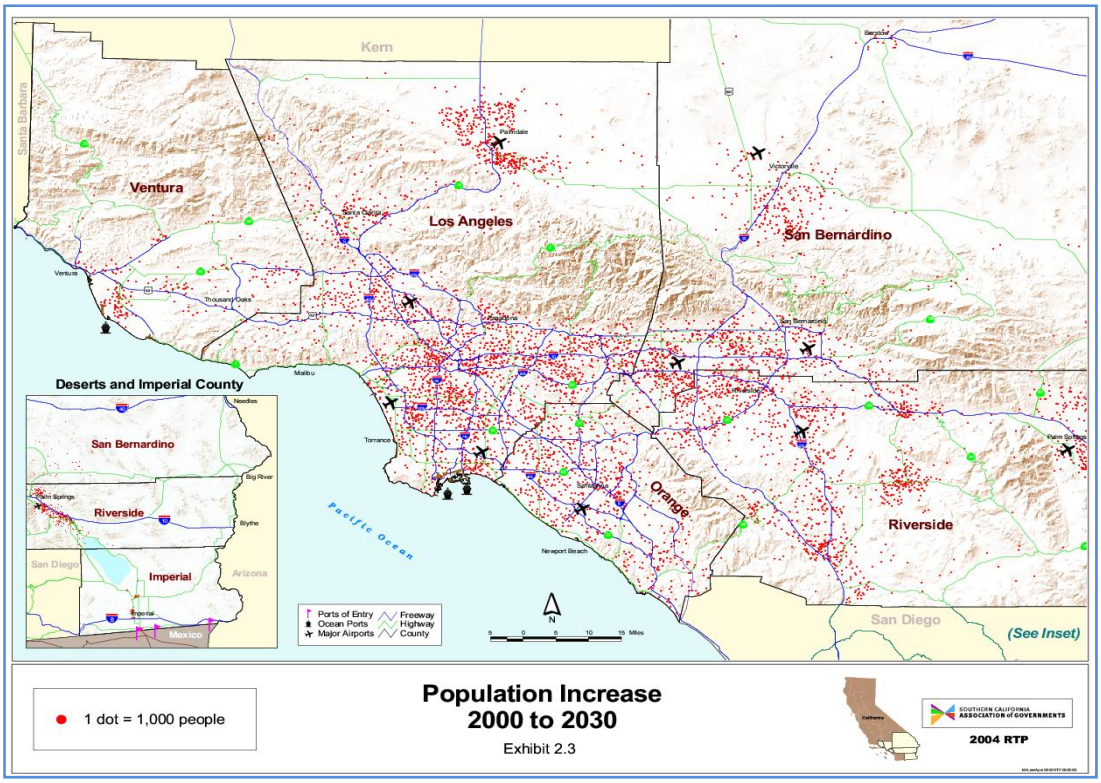


Figure 5.5-3 Projected Population Increase from 2000 to 2030



Identification and Implementation of Land Use Strategies

Regional Land Use Planning Reducing Low Density Development Patterns

The Compass Blueprint was developed by SCAG in companionship with the 2003 Regional Transportation Plan (RTP), and it continues as a companion to the proposed Final 2008 RTP. The RTP recognizes "The centrifugal force of growth that continues to push the development footprint of the urbanized area outward. At the same time, pushing back on dispersed development are natural barriers, financial constraints to pay for outward expansion, and public resistance to unsustainable 'leap frog' growth into green fields and sensitive habitat areas. Nearly all natural locations for urban development have been consumed, leaving us with hard choices about how we are to grow and change to meet the demands of the future."

The Compass Blueprint attempts to foster integrated land use and transportation planning in the local communities of the southern California region to accommodate the growth forecasted over the next 25 years in an environmentally sustainable manner. By encouraging local communities to focus on accommodating as much new growth as possible in existing and emerging centers along major transportation corridors, creating areas of mixed-use development and walkable communities around existing and planned mass transportation systems, the Compass Blueprint is aimed at reducing the quantity of low-density development that was presumed evitable for the inland areas of the Watershed.

By working with stakeholders in each county, the Compass Blueprint developed a series of maps (**Figure 5.5-4** to **Figure 5.5-6**) identifying 2% Strategy Opportunity Areas in each county. The maps point to modest changes in current land use and transportation trends on only 2% of the land area of the region. The Opportunity Areas are shown as colored areas within a blue perimeter line.

Figure 5.5-4 Opportunity Areas in San Bernardino County

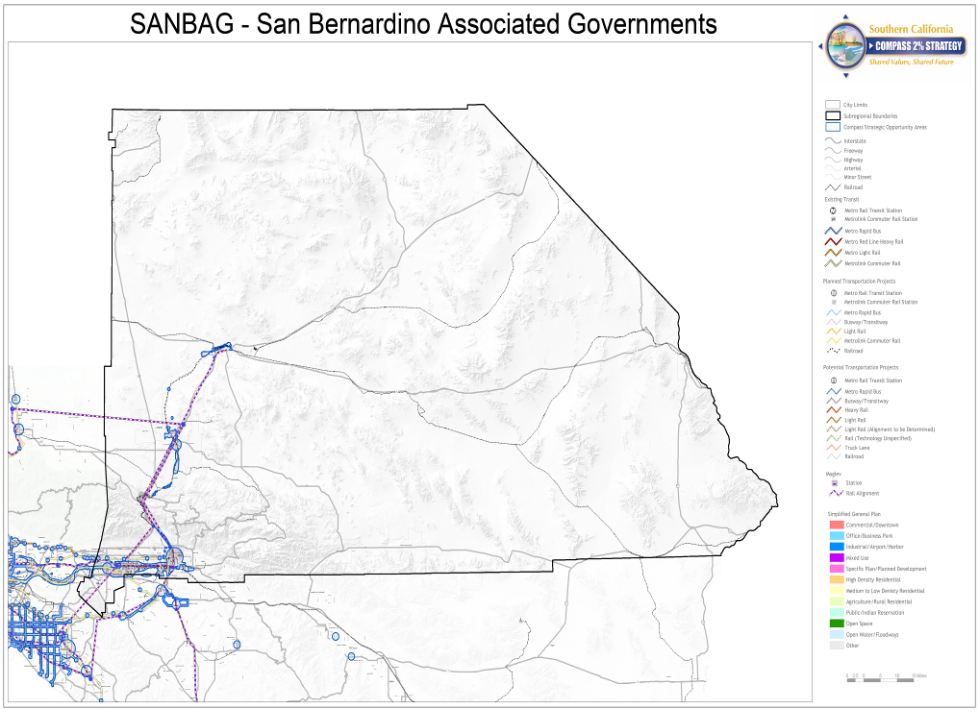
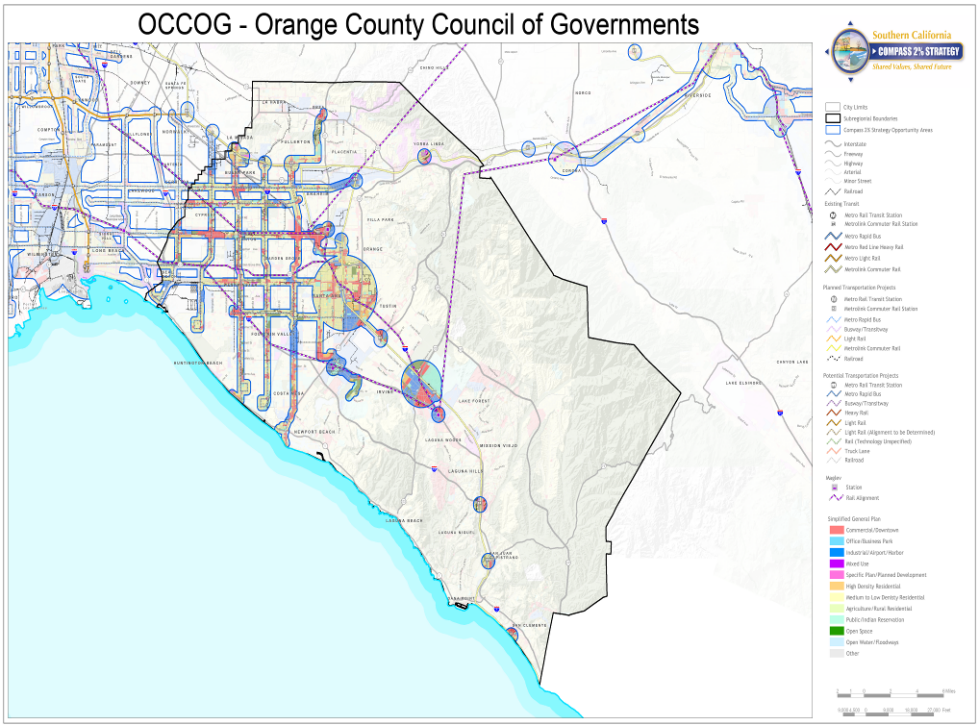


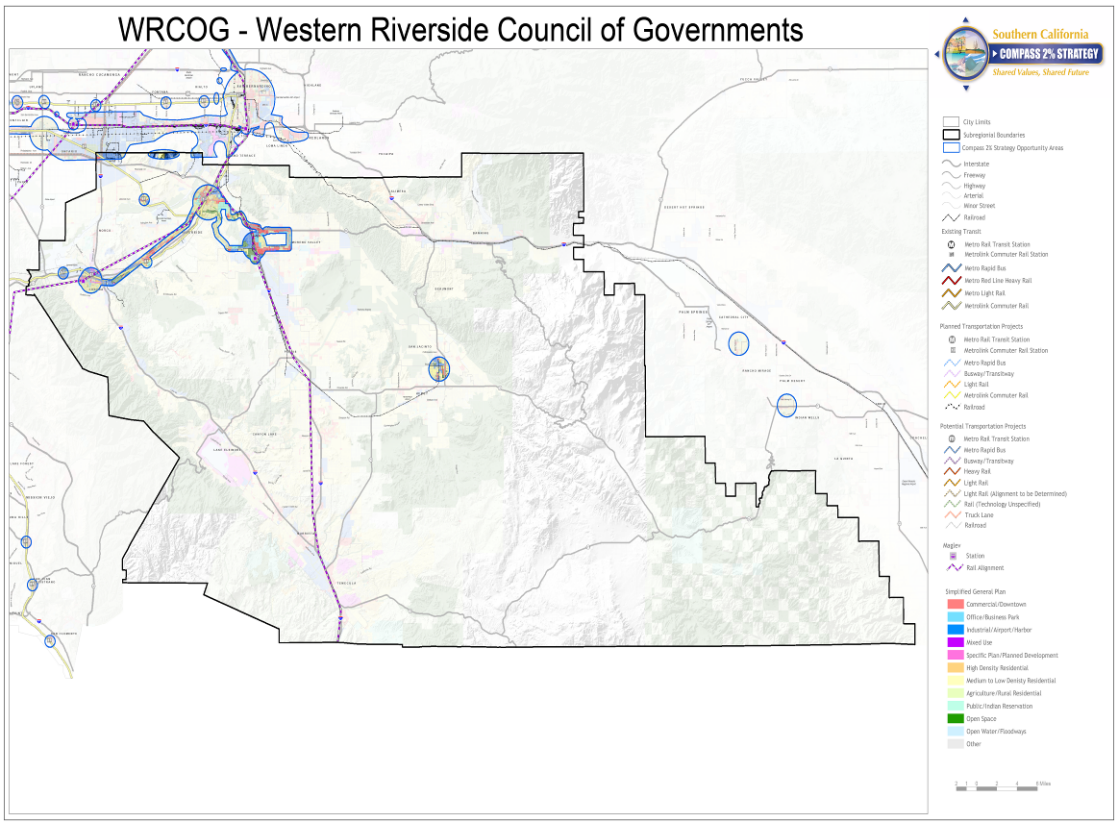
Figure 5.5-5 Opportunity Areas in Orange County



These maps were developed by the regional planning agencies that serve as Council of Governments for Orange, Riverside, and San Bernardino Counties with extensive public input. Efforts already are underway to reduce the quantity of low-density development in a number of the Opportunity Areas.

Higher density development that is compact, mixed use, walkable, and transit-oriented not only preserves open lands that absorb water to the maximum extent possible, but minimizes automobile-generated urban runoff pollutants that degrade both surface and ground water quality.

Figure 5.5-6 Opportunity Areas in Riverside County



Ahwahnee Water Principles for Resource Efficient Land Use

The SWRCB supported the Local Government Commission working in concert with elected officials and water leaders from throughout the State to develop the **Ahwahnee Water Principles for Resource Efficient Land Use** (Water Principles)**.** These complement the Ahwahnee Principles for Resource-Efficient Communities that were developed in 1991. The premise for the Water Principles is that "Cities and counties are facing major challenges with water contamination, stormwater runoff, flood damage liability, and concerns about whether or not there will be enough water for current residents, as well as for new development. These issues affect city and county budgets and their taxpayers. However, there are a number of actions that some cities and counties are taking that reduce costs and improve the stewardship of their water resources."

Figure 5.5-7 shows nine distinctly different water principles that cities and counties can implement through their authority to regulate land use. Five implementation principles provide steps for city and county officials to collaborate on to take advantage of the benefits and synergies of land use and water resource planning at a watershed level.

Figure 5.5-5 Ahwahnee Water Principles for Resource Efficient Land Use

Principle 1: Compact Community Design

- **Community design should be compact, mixed use, walkable and transit-oriented** so that automobile-generated urban runoff pollutants are minimized and the open lands that absorb water are preserved to the maximum extent possible.

Principle 2: Natural Infrastructure

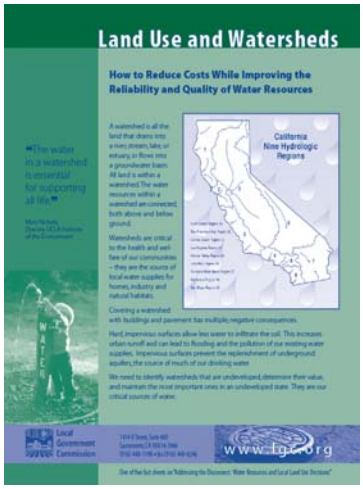
- Natural resources such as **wetlands, flood plains, recharge zones, riparian areas, open space, and native habitats should be identified, preserved and restored as valued assets** for flood protection, water quality improvement, groundwater recharge, habitat, and overall long-term water resource sustainability.

Principles 3-5: Sustainable Site Design

- **Incorporate water holding areas such as creek beds, recessed athletic fields, ponds, cisterns, and other features in the urban landscape** that serve to recharge groundwater, reduce runoff, improve water quality and decrease flooding.
- **Design all aspects of landscaping from the selection of plants to soil preparation and the installation of irrigation systems to reduce water demand**, retain runoff, decrease flooding, and recharge groundwater.
- **Permeable surfaces should be used for hardscape**. Impervious surfaces such as driveways, streets, and parking lots should be minimized so that land is available to absorb storm water, reduce polluted urban runoff, recharge groundwater and reduce flooding.
- **Dual plumbing that allows graywater from showers sinks and washers to be reused for landscape irrigation** should be included in the infrastructure of new development.

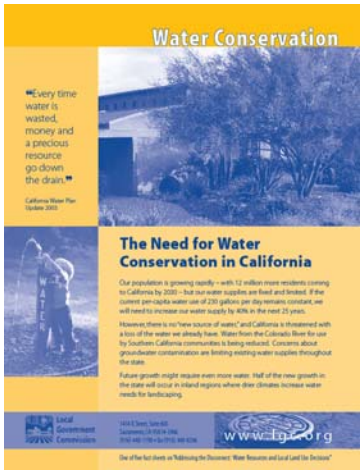
Principles 7-9: Efficient Water Use

- Community design **should maximize the use of recycled water** for appropriate applications including outdoor irrigation, toilet flushing, and commercial and industrial processes. Purple pipe should be installed in all new construction and remodeled buildings in anticipation of the future availability of recycled water.
- Urban water **conservation technologies such as low-flow toilets, efficient clothes washers, and more efficient water-using industrial equipment** should be incorporated in all new construction and retrofitted in remodeled buildings.
- **Ground water treatment and brackish water desalination** should be pursued when necessary to maximize locally available, drought-proof water supplies.



Implementation Principles

- Water supply agencies should be consulted early in the land use decision-making process regarding technology, demographics and growth projections.
- City and county officials, the watershed council, LAFCO, special districts and other stakeholders sharing watersheds should collaborate to take advantage of the benefits and synergies of water resource planning at a watershed level.
- The best, multi-benefit and integrated strategies and projects should be identified and implemented before less integrated proposals, unless urgency demands otherwise.
- From start to finish, projects and programs should involve the public, build relationships, and increase the sharing of and access to information.
- Plans, programs, projects and policies should be monitored and evaluated to determine if the expected results are achieved and to improve future practices.

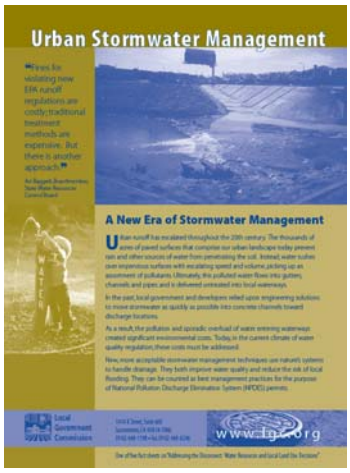


A series of Fact Sheets was developed to help local government officials understand that the concerns they face about having enough water for current residents, as well as for new development, are best addressed through actions by cities and counties to improve the stewardship and reliability of local water supplies. Copies of the Ahwahnee Water Principles and the Fact Sheets were distributed to every County Supervisor, Mayor and City Council Member in California. Regional Workshops were held throughout the State for elected officials, municipal staff, planning commissioners, and other stakeholders.

Low Impact Development

The **Low Impact Development (LID) Guidance and Training Program** is collaboration between the Southern California Stormwater Monitoring Coalition—a group comprised of San Bernardino,

Riverside, Orange, Ventura, Los Angeles and San Diego Counties, the Cities of Long Beach and Los Angeles, the three respective Regional Water Quality Control Boards, the U.S. EPA, Caltrans, and the California Stormwater Quality Association.

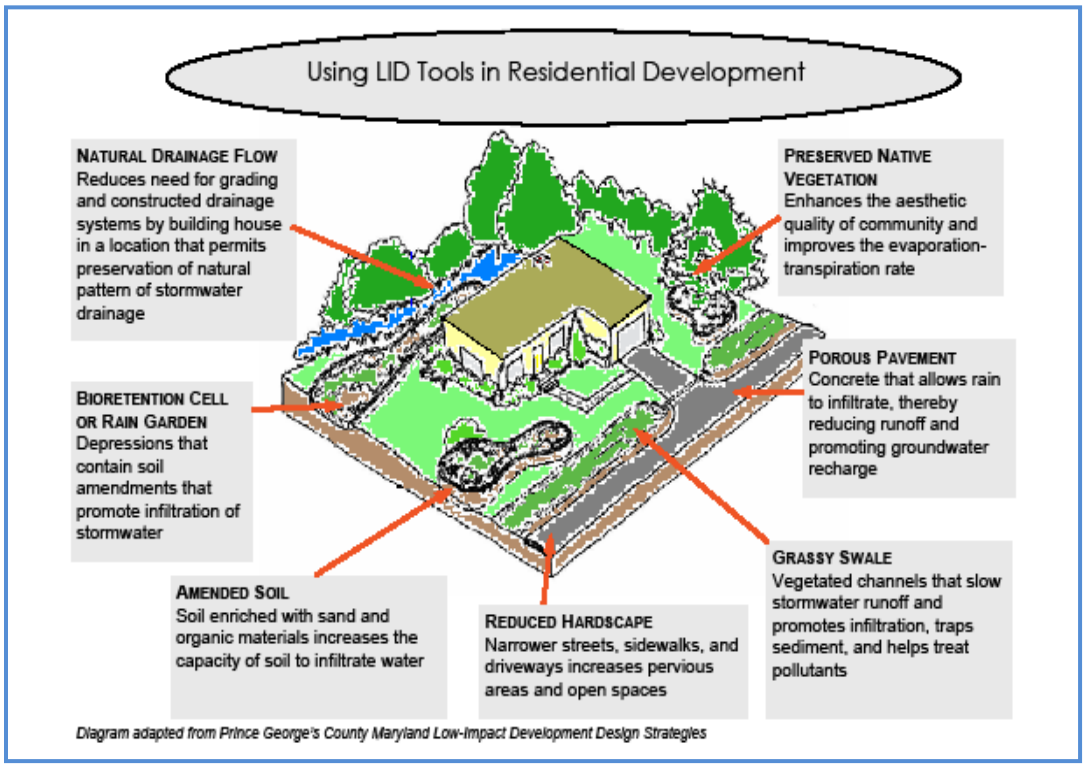


The potential of LID goes well beyond reducing the volume of polluted stormwater runoff. Stormwater runoff also can be understood as a lost resource in the semi-arid environment of southern California, where increasing demand for fresh water requires costly importation of water supplies to sustain ever-growing communities. The goal of LID is to mimic a site's pre-development hydrology, including runoff rates and volumes, by using design techniques that infiltrate, filter, store, evaporate, capture, and reuse runoff close to the source of rainfall (SWRCB). Through LID practices, both stormwater runoff rates and volume impacts can be managed more successfully than with conventional management practices.

LID also benefits water quality. Within the Watershed, the net increase in surface runoff for developed impervious area ranges from 9 inches to 18 inches during an average year, depending upon rainfall. Because stormwater runoff, both volume and rate, also is a major source of pollutant transport to coastal waters and other receiving water bodies, reducing runoff rate and volume reduces pollutant transport. Pollutants associated with stormwater include heavy metals, nutrients, pesticides, petroleum hydrocarbons, and others.

A LID Manual is being developed as a technical reference guide and describes the structural and non-structural Best Management Practices (BMPs) in sufficient detail to reduce the environmental impacts of land development or re-development at the project level. The Southern California LID Manual is designed to be incorporated as a component of the Stormwater BMP Manual(s) that have been developed and are maintained by the California Stormwater Quality Association (CASQA). **Figure 5.5-8** illustrates how LID Tools can be used in residential development.

Figure 5.5-8 Using LID Tools in Residential Development



Green Building Programs Linking Land Use and Water

The Leadership in Energy and Environmental Design (LEED®) is a Green Building Rating System™ that encourages sustainable green building and development practices through the creation and implementation of universally understood and accepted tools and performance criteria. Water agencies and local governments in the Watershed have completed public buildings earning LEED certification to demonstrate sustainable practices. More are anticipated.

There are over 60 local chapters of the U.S. Green Building Council (USGBC), including chapters in Orange County and the Inland Empire. The USGBC is committed to supporting Federal, State and local governments in their pursuit and development of green building programs and initiatives. The 2008 USGBC annual Greenbuild Conference welcomed nearly 30,000 attendees this past year for three days of outstanding educational sessions, renowned speakers, green building tours, seminars, and networking events.

An increasing number of California homebuilders are participating in the California Green Builder (CGB) program launched by the California Building Industry Association in 2005 with more than 1,800 homes completed and another 3,600 under construction or in the planning stage. Each one of these new homes save at least 20,000 gallons of water a year compared to typical homes.

Offsetting New Water Demand with Onsite and Offsite Conservation

The concept for offsetting impacts with onsite and offsite mitigation, also known as zero footprint, has been applied to air-quality and traffic-impact mitigation. As a water management strategy, it could be utilized in the Watershed to address the impact of water demand generated by new development

mitigated with conservation measures onsite and saving an equivalent amount of water within the existing water service area offsite.

The East Bay Municipal Water District formed a partnership with the developers of a new residential community of 1,400 homes to create a zero water footprint development in northern California. The onsite measures include high-efficiency toilets, washing machines, dishwashers, low-water-use landscaping with irrigation controllers, and water recycling. An agreement was reached for offsite conservation funded for the developers that will pay $6,000 per new home for new conservation projects within the existing service area. The offsite mitigation on a 2:1 rate provides a cushion in the event that water savings from specific measures are less than expected or not permanent.

Relation of Plan to Local Land Use and Water Planning

There are a variety of innovative collaborations that already exist between water supply agencies and other public agencies that are producing mutually-beneficial and cost-effective results. However, opportunities remain for water agencies to support programs that develop partnerships with local governments, developers and environmental organizations that will leverage funds, resources and expertise.

As previously described, the OWOW Plan was developed in an open, multi-jurisdictional and multi-disciplinary process in which the interests of all groups in the watershed were taken into consideration. The Steering Committee and the Pillars included representatives not only from water agencies, but from cities and counties, the development community, and a host of non-governmental organizations. The result is a plan that: (1) links the need for sufficient and clean water with land use, environmental protection, and the need for economic development; (2) as well as a plan that increases the level of understanding about the link between water resources and land use for both land use planning and water agencies. This understanding allows a perspective of land use planning that includes new development, open space for parks, recreation and environmental services, such as habitat and water filtration and natural treatment. Furthermore, it is anticipated that the OWOW process will strengthen the interactions between water agencies and land use planning entities into the future.

Incorporating water use considerations into land use planning will be required to meet the requirements on Senate Bill SB 7, passed in November 2009, which requires urban water agencies to reduce per capita consumption 20% by 2020. Considering that outdoor use (i.e. landscaping) accounts for at least half of typical water use, the way in which land is being used will have tremendous impact on future water conservation efforts.

The following sections describe ongoing efforts in the region to simultaneously address land use and water planning:

Working with Residential, Commercial and Industrial Developers

Water supply agencies have been investing resources to support landscape water use efficiency projects with homebuilders for some time. This is a strategy that has been employed successfully by Metropolitan Water District of Southern California (MWDSC) for a number of years.

In January 2010, Assembly bill AB1881 took effect, requiring local governments to adopt the State's Model Water Efficient Landscape Ordinance or equivalent, and requiring public and private development projects to submit water efficient landscape plans for areas equal or greater than 2,500 square feet. AB1881 will institutionalize at the State level the incorporation of water efficiency measures into new development.

In addition to the accomplishments to be provided by AB1881, it is time to invest with residential, commercial, and industrial developers to support other measures of critical importance from an integrated regional water management perspective, such as:

- Supporting LID site designs that move from a conventional concept of runoff as a waste needed to be disposed of as rapidly as possible, to viewing stormwater as a valuable resource to be captured for passive irrigation and groundwater recharge. Implementations of non-structural and structural LID techniques also reduce pollutant loads associated with stormwater, including heavy metals, nutrients, pesticides, TDS, petroleum hydrocarbons, and others.
- Reducing the quantity of impervious surfaces in new developments by installing green roofs and pervious pavement that is well suited for parking lots, sidewalks, plazas and other similar uses.

Working with Local Governments

Water supply agencies investing resources in water-efficient visible public landscaping projects with local governments is not new to the region. It has been employed by the MWDSC for a number of years and it continues to be expanded.

Unfortunately, these investments are far from sufficient to create the critical mass of water-use-efficient landscapes necessary to prompt the public toward a dramatic paradigm shift. Considerable investment is necessary to reduce unreasonable water waste and meet SB 7 requirement of 20% reduction in per capita water use by 2020.

Other detrimental land use practices present in visible public places also should be considered worthy of investment.

The outcome of investing resources in this manner offers the benefits of:

- Increasing the conservation of potable water supplies that are currently dedicated to irrigating public landscapes that lack water use efficiencies.
- Reducing the portfolio of negative images of public agencies wasting water.
- Educating the public using visible public places with signage that explains the smart controllers and irrigation systems that are supporting attractive water-use-efficient landscape designs that the public would find desirable in their own homes and businesses.
- Replacing impervious surfaces in public projects where flashy urban runoff is a chronic problem with attractive permeable paving illustrated with signage for the public.
- Preserving natural resources such as wetlands, flood plains, recharge zones, riparian areas, open space, and native habitats should be identified, preserved and restored as valued assets for flood protection, water quality improvement, groundwater recharge, habitat, and overall long-term water resource sustainability.

- Reducing development in high risk areas prone to wildfires and post-fire debris flows that reduce the efficiency of water supply programs when foreseeable disasters do occur.
- Replacing the aging septic systems in disadvantaged communities that are in close proximity to available sewer lines where residents have lacked the financial resources and political will.

Working with Environmental Organizations

Agencies in the Watershed have partnered with the environmental community in restoring over 3,000 acres of riparian habitat. These projects have increased surface water flow, replacing water hungry invasive species with native plants, and increased habitat suitability for endangered species living along river corridors. However, water supply agencies have insufficiently invested resources working with environmental organizations in low-income communities that disproportionately lack sufficient land surfaces for the capture of stormwater from urban runoff that also can serve as open space for recreation.

The outcome of investing resources in this manner offers the benefit of:

- Reducing the pollutant load associated with stormwater including heavy metals, nutrients, pesticides, TDS, petroleum hydrocarbons, and others.
- Serving the needs of Disadvantaged Communities

Conclusion

The way in which we manage water resources is inextricably linked to our land use patterns. Our current land use planning and practices have damaged and threaten to further damage our water-supply reliability, and are costly in many other ways, including habitat deterioration and high energy consumption for transport. This problem can be stopped and even reverted if local governments and their planning and water agencies, real estate developers, and the environmental community work together to fully incorporate water in the development process. No one agency can be successful working alone.

Working together, the Watershed can increase the understanding that unavoidable impacts do result from standard building practices. Embracing a sustainable development ethic steers the Watershed in a direction to meet human needs, while preserving the environment so that these needs can be met now, as well as in the indefinite future. Furthermore, ignoring the opportunities to curb the impacts of land use will result in only greater impacts tomorrow.

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Chapter 5.6 Flood Risk Management

(Flood Control & Stormwater Runoff)

Summary

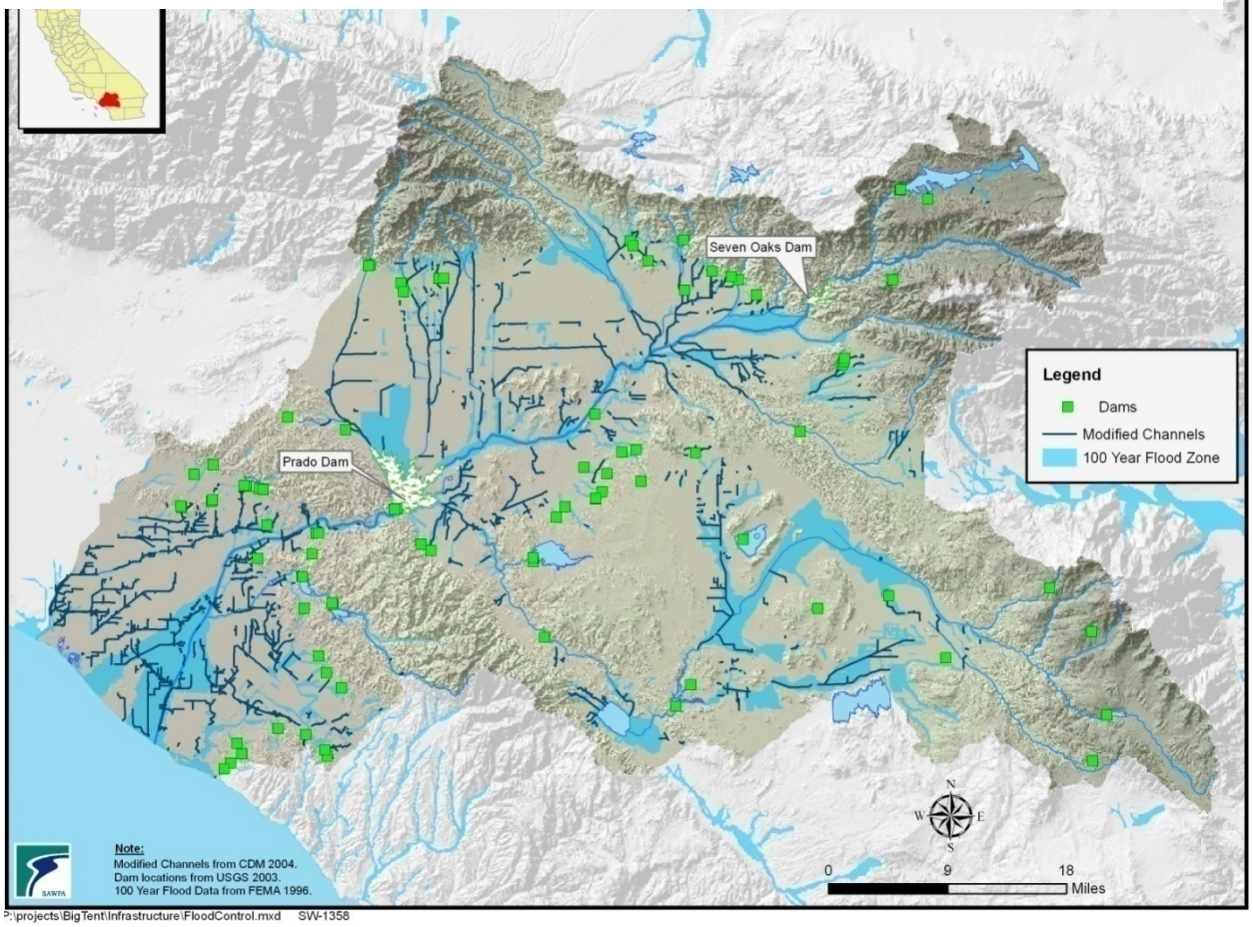
The Flood Control chapter describes the watershed physically, the way that a flood manager or flood control engineer would see it: catchment area, land uses, runoff volumes, and elevation differences or slopes. The chapter also describes the typical types of storms the region experiences, and the volumes and intensity of runoff these storms can produce. The chapter recounts the flood experience of the region and the strategies that have been used to respond to the risk of future flooding, including the ongoing Santa Ana River (SAR) Project. These strategies mainly have consisted of hardening and straightening the stream channels to maximize drainage efficiency and buffering peak flows by providing large flood storage facilities. In general, communities in the SAR Watershed have been effective at reducing flood damage risk, allowing the traditional California urban and suburban development to be maximized. However, some highly populated areas remain vulnerable to flooding even in fairly modest storms. In addition, the current principle strategies are expensive in terms of money, natural resources impacts, and lost water supply. Changing community values are forcing a re-evaluation of the traditional approach to managing flood risk, in effect changing the terms in the "cost-benefit" equation used for the past century.

There are two additional key issues that flood management must address in order to succeed. First, the basic goals of flood control efforts throughout the watershed need to be clarified and reaffirmed. Although there are few formalized rules, the most common planning and design guideline in the region is to design for the 100-year flood. How and why that level of protection became a community standard, and whether or not it is appropriate, is not free from doubt. There have been recent bills in the legislature proposing different standards, e.g. 200-year protection. This should be a watershed-scale community decision based on a balance of risks and economic and environmental costs. To facilitate such an agreement, we need a common vocabulary for the risks and costs associated with flooding and other competing issues, such as water supply and water quality. Additionally, the "100-year" standard is elusive because it is a statistical construct based on historical flows that were a product of past conditions in the watershed. Over time, both the physical conditions of the watershed and the climate itself change, and therefore the flows associated with a 100-year storm change. Thus, the standard that we use for flood risk management is not formally established, not easy to compare to or integrate with other community needs within the watershed, and of dubious predictive strength in any event. This OWOW process should produce more understandable and more universal metrics for the expression of risk, and use them to facilitate the establishment of a flood protection standard.

Second, the reality has been that very early land use decisions have preceded flood management strategies and have severely limited the alternatives that flood managers can consider. Once development has been allowed to encroach into a floodplain, regional storage and hardened, straightened, and levied channels may be the only feasible approaches. Ideally, it would be better to devise a flood management strategy during the original planning of the development of a region, so that flood risk management and other land and water needs could be optimized. Since that has

never been the practice in the region, and since the region is now highly urbanized, the Flood Risk Management Pillar and the Water and Land Use Pillar will need to collaborate to determine what, if any, new approaches would be productive going forward. **Figure 5.6-1** illustrates the built flood control systems, as well as the 100-year flood zones within the SAR Watershed.

Figure 5.6-1 Built Flood Control Systems and 100-Year Flood Zones in the Santa Ana River Watershed



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Introduction

A vision of flood risk management in 2030:

Each person in the watershed feels secure that there is a less than one in one hundred chance in any given year that their home will be flooded. No one in the watershed is killed by flood waters, and there is no uninsured property damage due to flooding. Stormwater is managed with the understanding that it is both a potential risk and a valuable resource.

Agencies throughout the watershed manage flood risk in balance with other community goals as part of a common management program. Investment in flood risk management is guided in this way to optimize risk reduction and avoid creating new problems or conflicts.

Stormwater conveyance facilities are used to achieve multiple benefits as much as possible, e.g., recreation, groundwater recharge, pollutant removal, habitat functionality, etc. This occurs because each of the municipal agencies in the watershed ensures that flood risk management strategies are considered early in the general plan process, and the costs and benefits of various strategies are fully described.

The objective of this OWOW planning process most directly relevant to flood risk management is the goal to "manage rainfall as a resource," with its sub-objectives of maximizing beneficial use of rainwater and providing appropriate flood control capacity and other community benefits. Although water is valuable and groundwater recharge is important, the prevailing view within the watershed has been that physical protection from flood damage was of paramount importance, and that efforts to capture and store flood water for beneficial use were generally infeasible, considering the volumes, intensity, and infrequency of such flows. The effect of this prevailing view was magnified by the fact that decisions about land development, water supply, and flood control were based on work done by separate agency staffs, often approved by separate governing boards, and on different timelines. The strategies available for flood risk reduction often have been constrained by development decisions that were made separately and earlier. Changing this trend in the future requires a conscious effort to integrate flood risk reduction into other community needs, both in terms of the weight given to flood risk concerns, and in terms of the timing of decision making.

The Santa Ana River Watershed from a Flood Manager's Perspective

The SAR drains approximately 2,450 square miles. Maximum elevations in the Watershed exceed 11,000 feet, and more than one-third of the watershed area lies within three steep mountain ranges. Most of the rest occurs in lower-sloped valleys formed by a series of broad alluvial fans that extend from the base of the mountain front. The SAR has an average gradient of about 240 feet/mile in the mountains and about 20 feet/mile near Prado Dam. The principal tributaries are significantly steeper.

The climate is generally mild, but both temperature and precipitation vary considerably with distance from the ocean and with elevation. Most precipitation falls as rain and occurs from December through March. Rainfall varies from ten inches/year in Riverside to about 45 inches/year in the higher mountains.

Winter storms usually move in from the Pacific Ocean bringing widespread rain, and snow at the higher elevations. Such storms often last for several days. More localized storms associated with frontal systems can occur at any time of the year. They are rare, but can produce high-intensity precipitation over a comparatively small area for up to six hours.

Stream flow is perennial in the canyons of the SAR and in the headwaters of most of its tributaries, but is generally ephemeral in most valley segments. Stream flow increases rapidly in response to

precipitation. High-intensity precipitation, especially following wildfire, may result in intense sediment-laden floods, with some debris load in the form of shrubs and trees.

The Watershed has experienced flooding on numerous occasions in the American era, including flood in 1825, 1862, 1884, 1914, 1916, 1927, 1938, 1965, 1969, 1983, and 1995. The critical event in flood management in the Watershed was the 1938 flood. In that event, Orange County experienced California's worst flooding of the 20th century. Anaheim experienced 15 feet of water in some places, and 182,000 acres were inundated. Dozens of people died. In Riverside and San Bernardino Counties, the 1938 flood made it painfully clear that the County governments did not have an adequate program of flood protection. San Bernardino County created its flood control district in 1939, and Riverside County followed the same course in 1944.

Prado Dam had been authorized in 1936, but was not completed until 1941. It was built primarily for downstream flood protection, and 92 percent of the Watershed lies above it. More recently, the dam also has become a vital component of the water supply management program in the region, and has allowed the creation of ecologically important habitat areas behind the dam. According to a mainstem report, when Prado Dam was built, it was to provide protection against flooding in a 200-year event. Because the area has become so heavily populated, that number has decreased to 70 years with downstream channel capacity reduced to approximately 50 years.

The Army Corps of Engineers (Corps) initiated the Santa Ana River Mainstem Project (SARP) in 1964. The Corps completed a survey report in 1975 and the Phase I General Design Memorandum (GDM) for the SARP in 1980. Construction of the SARP was authorized by Section 401(a) of the Water Resources Development Act of 1986. Construction of the SARP was initiated in 1989, and completion scheduled for 2010.

The SARP is located along a 75-mile reach of the SAR in Orange, Riverside and San Bernardino Counties. The plan for flood control improvements includes three principal features:

Lower river channel modification for flood control along the 30.5 miles of the SAR from Prado Dam to the Pacific Ocean.

Construction of Seven of Seven Oaks Dam (about 3.5 miles upstream of the existing Prado Dam) with a gross reservoir storage of 145,600 acre-feet (AF).

Enlargement of Prado Dam to increase reservoir storage capacity from 217,000 AF to 362,000 AF.

The Seven Oaks Dam Watershed comprises 177 square miles, excluding 32 square miles that is isolated by Baldwin Lake. The principal tributary within the Seven Oaks canyon area is Bear Creek, which drains 55 square miles, and has an average gradient of 460 feet/mile. The only existing structure that would affect flood flows in this sub-watershed is Big Bear Lake, which is a water conservation reservoir. It collects water from a 38-square-mile drainage area, and has a surcharge storage capacity of about 8600 AF between the top of the conservation pool and the top of the dam. Aside from Seven Oaks Dam, the only other major flood control dam above Prado Dam is San Antonio Dam.

The Lower SAR Basin from Prado Dam to the ocean comprises about 208 square miles, excluding the 19 square miles behind Carbon Canyon Dam. The river flows about 31 miles from Prado Dam through Santa Ana Canyon and seven Orange County cities before reaching the ocean. About 60 percent of the drainage area to this reach lies in the Santa Ana Mountains and Chino Hills, while most of the rest lies within the broad coastal plain. Of the numerous tributaries, the principal one is Santiago Creek, which drains about 102 square miles. The average gradient of the river mainstem from Prado Dam to the ocean is about 15 feet/mile.

Other smaller flood control improvements exist along Cucamonga, Deer, Lytle, and Cajon Creeks above Prado Dam, and Carbon Canyon Dam and Villa Park Dam in Orange County. These include channelization, debris basins, storm drains, levees, stone and wire-mesh fencing, stone walls or rip-rap along the banks of stream channels, concrete side slope protection, and drop structures. Other improvements not aimed mainly at flood control include spreading grounds, recharge basins, and water conservation reservoirs. There are more than 100 water conservation and recreational reservoirs in the basin, with storage volumes ranging from 5 AF to 182,000 AF in Lake Mathews. These improvements affect the regimen of lesser flood flows, but do not appreciably affect major flood flows. Lake Elsinore can have considerable influence on flood flows depending on its water surface elevation at the beginning of a storm.

By 1988, the Corps noted that the SAR was uncontrolled for much of its length in Riverside and San Bernardino Counties above Prado Dam. Flooding in 1969 had caused serious damage to sewage treatment plants, sewage lines, and bridges, and had flooded large areas of agricultural land and caused heavy bank erosion along most of the river. Below Prado Dam, the Corps calculated that downstream communities enjoyed about 70-year flood protection, while parts of the channel near Fountain Valley and Huntington Beach could not contain a 50-year flood. A 100-year flood would inundate over 160 square miles of urbanized land in Orange County.

The intent of the SARP was to provide the developed and developing areas in the Watershed with approximately 100-year flood protection through the end of the project life. While this system of infrastructure has been in development, the three counties that comprise the Watershed and the various cities within them, have overseen the growth of the region's population and its conversion, broadly speaking, from agriculture to an urban setting. The population of the three counties comprising the Watershed was less than 400,000 in 1940, and is now more than 7 million, most densely concentrated in the SAR Watershed.

In addition to the mainstem of the SAR, the regional flood control agencies each have extensive plans governing flood management for tributaries. For example, the Upper SAR Watershed is contained within San Bernardino County Flood Control District's (SBCFCD) jurisdiction. There are approximately seven major and three minor mainline flood control systems draining directly into the SAR from San Bernardino County. In addition, two systems flow directly into Prado Flood Control Basin which connects to the SAR. Of these 12 mainline systems, eight are built to their ultimate capacity. The remaining ones are in an interim condition and need upgrading. Many of the regional subsystems that feed these main lines are in interim condition; a few others are merely proposed facilities.

Though most concrete structures typically are designed to have a 50 year lifespan, SBCFCD has a number of facilities that are older than 50 years and still function well. Many of the SBCFCD's facilities were built by the Corps in the 30s, 40s, 50s, 60s and 70s. Most of those facilities still are considered to be stable and secure structures with little or no repair requirements.

From SBCFCD's perspective, the majority of the mainline system is built out to ultimate, but the interim facilities operating within our jurisdiction are in need of improvements. The regional interim subsystems consist of rail and wire revetment or simple rock slope protection. These facilities experience erosion and undercutting on a regular basis. Also, these interim systems do not provide the ultimate capacities and as communities develop, increasing runoff volumes further compromise those capacities. In conclusion, although the mainline systems are complete, the regional subsystems are acceptable at best, and the flood control system as a whole is in need of improvements.

The Traditional Way of Thinking about Flood Protection in Southern California

Flood protection agencies, including the Corps, county flood control districts, and cities are charged with ensuring that floodwaters do not endanger life or property. Historically, efforts to deal with flooding in the region focused on reducing the threat to properties from floodwaters and on damage control. These strategies mainly have consisted of hardening and straightening the stream channels to maximize drainage efficiency, and buffering peak flows by providing large flood storage facilities.

In many ways, these strategies have been a great success; many people and highly valuable economic assets are now protected from a certain level of flooding. A number of significant issues have arisen, however, that warrant consideration in a discussion about a going-forward strategy.

The management of flood risk has been profoundly affected by the sequence of decision-making and the interests of the early decision makers. A typical conversation today about reforming our approach to flood risk management compares the various costs of our traditional strategies against the alternative "softer" approaches of wider floodways, restricted development in floodways, restoration of wetlands, and so forth. The reality, however, is that much of the land use and development in the SAR Watershed preceded systematic flood control planning and implementation. This history of limitations is not unique to this Watershed.

Typically in southern California, the early European settlers established themselves near sources of water. Because of the climate and terrain, the places where water tended to be readily available were lower, flatter areas near streams, where stream flow could be diverted or shallow wells could produce groundwater. Often, stream beds were attractive for land development because of accessibility. Immigrants from wetter climates did not think of the dry stream beds as water bodies. Given the semi-arid climate and the braided-channel form of many of the local rivers, it might be years between rain events that actually produced any significant flow in some of the streambeds. As the population grew very rapidly between the infrequent but significant storms, only a diminishing percentage of the residents had any concept of the physical floodplain for the streams they lived near.

Eventually, rain fell and the rivers flowed. The resulting damage to property that had been developed in the floodplains prompted initiatives to protect valuable property from flood damage. The available flood management solutions where thus entirely reactive to then-existing development, even though not nearly as dense as development was to become in the future. The alternatives available to flood managers were constrained by existing development and the expense of acquiring urbanizing land for flood control right=of-way. The only feasible solution tended to be to channelize the streams, which increase velocities, so that more flow could be carried in the same narrow channels. To maximize velocity and to avoid erosion, the channels often needed to be engineered with rock or concrete lining.

This approach**,** while effective at managing flood risk, created other environmental, fiscal, and management issues, which must be addressed as we plan for the future. Any opportunity to change the direction of flood management strategy immediately encounters the constraint of available land and the cost of acquiring additional land. It is ironic and true that the land that is too dear now to be acquired reasonably for flood management only has become valuable because of the promise of flood protection.

There already have been some efforts toward more holistic approaches to flood risk management within the Watershed. For example, the San Jacinto River Watershed Council (SJRWC) has led a stakeholder group to develop an Integrated Regional Water Management Plan (IRWMP) for that 770-square-mile sub-watershed. Like all IRWMPs, it addresses a number of water resources issues in an integrated framework, including water supply, water quality, drought-proofing ,and critical habitat protection. The plan also addresses flood risk concerns, and recognizing that the issue is risk management and not purely a matter of engineering, the SJRWC approach frames the issue as "provid[ing] flood protection to existing disadvantaged communities." In that group's view, assisting disadvantaged communities is a particularly important risk to be mitigated, considering all of the needs within the watershed. The plan acknowledges a number of alternative strategies to flood risk management instead of channelization. It remains to be seen how well the plan is implemented and whether or not it is detailed enough to provide decisive support for the innovative approaches is mentions.

Challenges for the Future

Watershed Coordination

For more creative approaches to flood risk management both to flourish and to improve upon the results of traditional approaches, planning and implementation needs to be coordinated at the watershed scale. The three county flood control districts already have developed good working relationships and they coordinate more effectively than, for example, the various land use planning agencies within the Watershed. To firmly integrate flood risk management with other water resources goals, however, will require a quantum leap in the level of coordination and communication between agencies and stakeholders. The Watershed truly needs a culture of communication, where the sharing of information and strategies, and group discussion of costs and benefits, is the norm. In particular, the three county flood control districts should coordinate even more than they do now, and they should develop standard approaches to coordinating with the major land use planning agencies in the watershed, as well as the water districts.

A significant challenge and opportunity for the future is the improvement of risk assessment methods, metrics, and messages. This will be discussed in more detail below, but it can be noted here that this is one kind of action that should be standardized throughout the Watershed to get the most benefit. All agencies and the general public will benefit from clarity and commonality in the way risks are assessed, quantified, and described.

The watershed approach also always raises issues of working or contributing to work that is physically outside of an agency's jurisdiction. This is true for all sorts of water resources efforts that can be the focus of the watershed approach, including flood risk management. The issue cannot be avoided and must be addressed so that resources can be directed at the watershed scale to the most important issues, and with the greatest integration and synergy.

A final example of an aspect of planning and design that relates to stormwater management that would be greatly improved by watershed-scale coordination is the adoption of data standards. For planners, engineers, and managers to collaborate routinely across disciplines and across jurisdictional lines, they need to use the same data, or at least the same kinds of data, as much as possible. This can mean standard protocols for topographic data, hydrologic calculations, rainfall measurement, and quality assurance and quality control for hydrologic data. It is a necessary part of establishing a common language and a common understanding within the watershed.

Water Conservation

The OWOW Steering Committee adopted a sub-objective of maximizing the beneficial use of rainwater. Our historic strategies for flood risk reduction have been directly opposed to this goal. The hardened channels that sped storm water away also prevented the water from replenishing groundwater basins. Even where storage has been used to buffer peak flows, the storage facilities are designed and operated for flood control capacity, and do not provide significant water supply benefit. Soon after flood control projects were implemented, groundwater sources usually experienced shortages, and water importation became a necessity.

Today we face an ever increasing need to be as efficient as possible with our water supply. We have made significant improvements in our approach, by using our facilities on the SAR to increase groundwater recharge, especially in the lower SAR. We have pioneered the reoperation of Prado Dam and the use of Seven Oaks Dam to allow more use of storage capacity for water conservation, without unacceptably diminishing flood protection.

The challenge for the future is to find additional ways to modify our infrastructure, or at least build new parts of the system differently, to provide flood protection but still capture our local water, particularly in the Inland Empire (water captured in the upper watershed is likely to be available for use two or more times before it flows to the ocean).

Stormwater Quality Management and Flood Risk Management

The area within the watershed is regulated by three area-wide municipal stormwater permits, all of which are in the process of being renewed. The existing stormwater quality programs in each county include the use of site design features and flow-reduction management practices in

connection with new development. These elements of the stormwater quality programs are certainly going to be increased in the current round of permit renewals. The new permits will include express requirements to limit the projects change of the hydrograph for runoff from the site, mainly by using "low impact development" (LID) design concepts. These include minimizing impervious surface area, including pervious areas to interrupt flows across impervious areas, maximizing the use of groundwater infiltration basins, and so forth.

It is important to note that these management practices are intended to prevent or minimize water pollution and the deleterious effects on water bodies from the change in flow characteristics resulting from development. The LID concepts and other methods used to avoid changes to the hydrograph will not, however, address flood management issues. As a practical matter, once even natural areas are saturated by the first rains of a big storm or a series of storms, the runoff characteristics of the site become very much the same as that from a traditional development with many impervious surfaces. In any event, it is almost certain that the new permits will mandate certain LID measures and other control measures that are sized to address relatively small and frequent rain events, but not the large events for which flood conveyance facilities have to be sized.

Ecological Impacts

Our flood control system has had dramatic effects on the environment within the Watershed. Natural floodplains perform ecological functions as habitat, water pollutant removal, and groundwater recharge, as well as slowing flows and thereby dampening flood peaks downstream.

Our extensive system of improved channels unquestionably has a significant effect on the region's riparian and wetland habitats, on water quality in the streams and at the beach, and on the aesthetics of our communities.

Channel improvements for flood conveyance and the construction of dams for flood detention have a direct effect on riparian and wetland habitats. New projects of this type have become increasingly unacceptable to the public, and when approved, incur major costs for environmental mitigation. Flood control strategies in new developing areas may well be changed just because of these habitat concerns. Whether retrofitting of existing channelized reaches will ever be found to be feasible is a challenge for the future. The expense—especially of land acquisition—would be great, but the benefit to regional habitat vitality and sustainability also would be significant. An important goal should be to maximize marginal opportunities for gains in habitat functioning within existing rights of way.

A closely related challenge is the regulatory burden on maintenance of flood conveyance channels and basins. Vegetation management such as mowing, sediment removal, and other maintenance activities are often subjected to permitting and mitigation requirements in the name of protecting habitat. The imposition of stricter environmental regulations on existing facilities represents a new cost without increase in flood protection, and often without real habitat benefits either. In fact, regulatory attempts to benefit habitat in man-made or highly modified channels likely will increase flood risk, defeating the goals of the flood management project. In addition, the difficulties associated with habitat regulations are a very real disincentive to any attempts at habitat restoration within existing flood control facilities, illustrating the rubric that no good deed goes

unpunished. A goal of this regional planning effort should be to develop a regional consensus on habitat restoration projects and how to keep environmental regulations from defeating them.

Money and Advocacy

Historically, both flood control projects and the often related water supply projects were expensive. The public investment needed for projects of that sort was more palatable if it were spread over a large population. Thus, the idea became ingrained in our regional culture that property protection depended on infrastructure improvements, which depended on growth to be affordable. A challenge for the future is for the Watershed to break the habit of relying on future development to fund infrastructure.

In addition, the evaluation of new flood risk management strategies will take place largely in the setting of an already built environment. No new flood management strategy will achieve a pronounced effect on the Watershed unless it can address both new development and retrofitting in existing developed areas. It will be important to identify incentives for flood management agencies to view programmed repair and replacement projects as significant opportunities to implement new approaches. Changing to a new approach, for example, deciding to widen a right of way and channel to incorporate softer features with more natural functions, is unlikely ever to be found an appropriate investment if it only is evaluated on a project by project or reach by reach basis. Innovative retrofitting projects will make more sense if they are part of a larger plan that is being patiently but consistently implemented.

Flood control infrastructure construction in this watershed often has depended on State and Federal subsidies. This approach necessitates a sustained commitment to advocacy in Sacramento and Washington, DC, that is itself expensive and that has not always been well coordinated. Within the Watershed, different agencies and stakeholders advocate different priorities to State and Federal officials regarding water projects of all types, including flood control projects. The Watershed as a whole, therefore, misses an opportunity to be much more forceful and persuasive in seeking State and Federal funds. A comprehensive, watershed-wide plan for flood management, integrated with other water resources programs, would be the foundation for focused advocacy efforts of all stakeholders and the entire delegation of legislators in the Watershed.

Decision-making

The common perception in the community is that the flood program managers are responsible for achieving their flood control mission and for the economic and environmental impacts of those actions. But this has not been true, practically speaking, in the history of the region, where flood management alternatives have been constrained by land development decisions that occur first.

From a land use perspective, the three counties and the cities all have adopted General Plans, which are intended to guide planning and development. In the past, General Plans often made little mention of water supply, and flood control discussion focused on the need to make improvements to contain flood flows. The Riverside County General Plan reflects a more modern sensibility, with a balanced statement of the tradeoffs involved in addressing flood protection, as shown in the following excerpts.

Since 1965, 11 Gubernatorial and Presidential flood disaster declarations have been declared for Riverside County. State law generally makes local government agencies responsible for flood control in California.

Riverside County has experienced severe flooding many times throughout its history, resulting in the loss of lives and millions of dollars in property damage. Floods are caused by rivers and creeks overrunning their banks, and most property damage has occurred where development has been allowed without regard for flood hazard. If urban development continues to encroach onto the floodplains without major structural improvements, Riverside County will face an ever-increasing flood hazard, and potential losses will escalate.

The tremendous capital investments made in dikes, channels, levees, and dams over the last half century have not eliminated all flood hazards, and in some instances, the protective facilities may be unable to accommodate the 100-year flood. In recent years, the idea has become increasingly accepted that, while it is essential to protect existing development, the provision of massive flood control facilities merely to permit new development over major floodplains may be unwise. It is often more effective and less costly to locate development outside of hazard areas than to attempt to control the hazard itself.

Furthermore, consistent with the intent and policies of the Multipurpose Open Space Element, the Safety Element recognizes the need to protect watercourses in their natural state. Flood and inundation policies limit the alteration of floodways and channelization when alternative methods of flood control are not technically feasible.

Policies:

S 4.4 prohibits alteration of floodways and channelization unless alternative methods of flood control are not technically feasible or unless alternative methods are utilized to the maximum extent practicable. The intent is to balance the need for protection with prudent land use solutions, recreation needs, habitat requirements, and as applicable, to provide incentives for natural watercourse preservation, including density transfer programs as may be adopted (AI 25, 60).

Risk Assessment

Recent environmental legislation and improved understanding and analysis of flood hazards in arid environments have resulted in new approaches to flood hazard mitigation implementation. Nationwide, there is a move to leave nature in charge of flood control. The advantages include lower cost, preservation of wildlife habitat, and improved recreation potential. However, this type of flood mitigation is difficult to implement in areas where development already has occurred, as well as in regions susceptible to sheet flow. Where water spreads across broad areas, mitigation without channels or culverts is more difficult. Flood control structures often have been built piecemeal over the years, and new development may funnel water into older systems with insufficient capacity. These issues have been mitigated in recent years by the preparation of Master Plans by local public works agencies.

The communities within the watershed have invested enormous resources in creating the existing built environment, including urban development, roadways, channel improvements, pipelines,

treatment plants, basins, dams, and levees. It is vitally important that decisions going forward favor multiple benefit projects, but also that we maximize the use that can be made of our existing infrastructure to achieve more benefits. In the past, multiple benefit projects were not emphasized because flood control, water supply, and development decisions were handled by different governmental entities at different times. This planning effort aims to reach agreement on a governmental decision-making process that naturally encourages multiple benefit projects and watershed scale master planning of facilities and strategies.

Quantification of Risk

The Steering Committee adopted a sub-objective of providing appropriate flood control capacity and other benefits to the community. Determining what flood control capacity is appropriate is no easy task. Decisions about flood management were, and are, driven by flood risk, which is a commonly misunderstood concept. Early in the development history of the watershed, flood protection decisions were made based on local notions of what was reasonably or adequately safe. Over time, a community standard has evolved of planning to provide protection from the 100-year flood. This has become somewhat formalized now, driven largely by the Federal government's use of the 100-year probability threshold for insurance and subsidy programs. In theory, at least, a local community should make its own decision about the level of flood protection that is adequate for its local circumstances. But that does not happen in practice, and essentially all communities in California, including the SAR Watershed, default to using the 100-year protection standard for planning purposes. This should not be accepted as a given; however, it is proven by the fact that there has been advocacy in Sacramento recently about creating a statewide standard for a higher level of protection, meaning 200-year or even 500-year protection.

The 100-year flood standard does not imply a frequency of occurrence, but denotes a likelihood of occurrence in any given year. It is based on hydrology, and therefore on the information about rainfall and stream flow that we have collected in the past. Our period of record for rainfall and flow information is relatively short in southern California, and for both flood and water supply purposes, we are beginning to see the problems that might arise from relying on a dataset that may not accurately represent a very long-term condition. Moreover, the weather itself is changing with time due to global climate change, whether human induced or natural. This means that the likelihood of a particular storm is a moving target, making it problematic as a design standard. Additionally, the stream flow experienced in a 100-year event at a given point along a channel is affected, often dramatically, by changes in upstream land use.

The Corps has noted, regarding the SAR Watershed, that while the mountainous areas of the Watershed remain largely undeveloped, the valley areas are approaching complete urbanization. Urbanization in the valley areas of the SAR Basin has tended to make the basin more responsive to rainfall. Hence, the same rainfall occurring over an urbanized segment of the basin will result in earlier and higher peak discharges, with greater volume than had it occurred over a natural basin without urbanization.

The SARP is designed to provide well over 100-year protection to Orange County through the life of the project. The reality is that no one really knows where that massive investment will leave Orange

County, because the development that actually has occurred upstream is almost certainly different from the assumptions in the original SARP design. The same uncertainty affects flood management decisions in the upper watershed, albeit with less land area above them. Climate change will affect flood protection throughout the Watershed.

Flood risk is documented in FEMA flood insurance rate maps, and the maps are used to determine who can, or who must, obtain flood insurance, and who can receive certain government services. However, the FEMA maps are inaccurate for the reasons discussed here, and are generally out of date, meaning that insurance premiums are assessed inappropriately.

Another consequence of the uncertainties in determining flood risk is that the benefit-cost calculations done to determine the feasibility of flood control projects or to determine whether or not Federal subsidies will be available, are highly imperfect.

The uncertainty in the degree of flood protection provided can be reduced by having strong, clear policies in General Plans, and by favoring flood management strategies that are not as sensitive to changes in upstream conditions. The uncertainty can never be eliminated; however, in any event, the whole notion of flood risk is a statistical construct, never a guarantee. What is more important is for the risks to be articulated understandably.

First, it is important to express flood risk in a way that makes it relatively easy for elected officials to compare that risk to other needs faced by the community, or even other water resources needs. There is no widely used metric for a similar statistical analysis of the risk of water shortage, or of poor water quality, or of the risk of habitat loss, or species impacts, for example. Moreover, flood managers do not provide elected officials with comparative evaluations of flood damage risk and the impacts of crime, traffic, poverty, or earthquake.

Second, it is important for the public to understand more readily what 100-year flood protection means. Currently, the only significance of the term to the average citizen is whether flood insurance premiums are required, and whether the local flood manager is doing his or her job well.

Conclusion

Regional flood protection professionals have faced a series of increasingly difficult challenges. The costs associated with acquiring rights of way and constructing infrastructure have climbed steadily over the years, while dedicated funds for flood control infrastructure have not kept pace. Environmental review processes and budgetary controls have become more complicated so that the development, funding, design, and permitting of projects have become a cumbersome process that can take decades. Environmental regulations related to water quality and habitat have seriously affected the financial and technical capabilities of regional flood agencies to operate and maintain their systems.

More recently, professionals from many disciplines that relate to water resources and urban policy have begun to see that flood management cannot be managed separately from other important decisions about land use, water supply, environmental risks, public safety, and quality of life within the urban landscape. However, the legal and bureaucratic processes through which urban

government takes place have not changed, and flood management decisions still are not integrated with land use decisions, water supply decisions, and the like.

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Chapter 5.7 Environment & Habitat Enhancement

Introduction

The OWOW program is a holistic planning effort that considers the various individual elements of a Watershed plan and how those elements can interact synergistically to optimize the overall wellbeing of the Watershed and its inhabitants. One of the ten planning elements, or Pillars, identified under the OWOW plan is Environmental and Habitat Enhancement, alternately referred to as the Environment/Habitat Pillar. The purpose of this chapter is to identify the scope of the Environment/Habitat Pillar and describe the current condition of and strategies used to manage water-oriented biological resources within the Watershed.

On a macro level, this chapter attempts to catalog the locations of many water-oriented habitats within the Watershed. While there are several types of habitat within the Watershed boundary that are not directly water-oriented (e.g., chaparral, pine forest, oak woodland, grassland), the primary focus is on water-oriented habitat types (e.g., alluvial fans, riparian woodland, emergent wetlands, vernal pools, lakes, streams, estuaries, tidelands, open ocean). These water-oriented habitats tend to show up on maps as the "corridors" that connect the larger, non-water-oriented habitats. Water-oriented habitats locations that are candidates for protection or enhancement are of particular interest.

It should be noted that this chapter uses broad, generic categories of habitat type in order to be understandable to scientists and non-scientists alike. While some scientists may find these categories to be imprecise, or even at times a bit inaccurate, the intent is to persuasively convey the importance of habitats in the overall health of any watershed planning effort. For a more detailed, scientific description of various locations, the reader can refer to the appendices or other references cited by the chapter.

Further, two terms of special importance to watershed planning are riparian areas and wetlands. These terms sometimes are used interchangeably, adding to the confusion associated with categorizing water-oriented habitat types. In order to differentiate these terms, but at the risk of adding to the confusion, the terms will be used in this chapter as described by the U.S. Environmental Protection Agency (EPA) in several of its guidelines and regulations.

According to EPA, ***riparian areas*** are defined as:

> A vegetated ecosystem along a water body through which energy, materials, and water pass. Riparian areas characteristically have a high water table and are subject to periodic flooding and influence from the adjacent water body. These systems encompass wetlands, uplands, or some combination of these two landforms. They will not, in all cases, have all the characteristics necessary for them to also be classified as wetlands.

> For the purposes of this chapter, riparian areas generally are somewhat linear in shape, along water courses, or occupy the "bathtub ring" (lacustrine zone) around water impoundments. They are more characterized by trees and shrubs that tolerate periodic flooding than they are by emergent vegetation such as cattails and bulrush.

According to EPA, ***wetlands*** are defined as:

> Those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Thus, wetlands usually are considered a subset of riparian areas. However, for the purposes of this chapter, they are being considered separately, with a separate chapter dedicated specifically to them. Further, for this chapter, wetlands are generally considered to be more "two dimensional" in shape than other riparian areas, whether they are extensive flat, marshy areas or small debris basins associated with flood control works. They are characterized by a dominance of emergent vegetation such as cattails and bulrush rather than by trees and shrubs.

The chapter cites many references for information included within. In some cases, the online encyclopedia, www.Wikipedia.com, is cited as an information source. While this reference usually is not used for scientific writings, it was included as a reference for this chapter because it provides ready access to readers that are interested in learning more about specific locations. Readers are cautioned that the information on Wikipedia may not have been fully reviewed by peer experts and authors that may or may not have been authenticated as knowledgeable on the particular topic presented.

Legal and Regulatory Framework for Potential Environmental and Habitat Enhancement Projects

This chapter summarizes the Federal and State regulations and associated permits that may be necessary for the implementation of projects focusing on the enhancement of the SAR and adjacent wetland, riparian, and upland habitat. It is important to note that every project is different and will be subject to a different set of permitting procedures. Therefore, the information provided here is general and is intended to alert project proponents to various regulations and permits that may be applicable to their project. It serves as a starting point for those considering the aforementioned types of habitat improvement projects. Additional information on specific permitting requirements may be obtained from the agency responsible for issuing the permit.

The following are summaries of legal requirements for environmental and habitat enhancement projects. **Appendix A** contains a list of agencies that should be consulted early in the conceptual or visioning phase of a project to address project needs and requirements. These agencies also can be effective partners in the design and construction of a successful multi-benefit project.

Clean Water Act

The Clean Water Act of 1972 (CWA) establishes the basic structure for regulating discharges of pollutants into the waters of the United States. The Clean Water Act is administered primarily by EPA and the Corps. In California, discharge permits under the CWA are issued by the SWRCB. The CWA contains various regulatory requirements, including permitting requirements, pertaining to activities that have the potential to result in the discharge of pollutants into the U.S. See below for a discussion of the relevant sections.

Waste treatment systems designed to meet the regulations of the CWA are not, by definition, considered waters of the U.S. In general, treatment wetlands systems constructed in upland areas are not considered waters of the U.S. and are not subject to CWA regulations. However, if a wetland treatment system itself is not considered a water of the U.S., but discharges into a water of the U.S., then a discharge permit under CWA Section 402 is required. If a treatment wetland system is constructed in an existing water of the U.S., then the area will remain a water of the U.S. and one or more of the following sections may be applicable (EPA, 2000).

Section 303 Water Quality Standards

Under Section 303 of the CWA, states and tribes are required to develop water quality standards for waters of the U.S. These standards must include the following three components (EPA, 2000):

- Environmental Program Plan.
- Designated Uses: Each body of water is given a "designated use", or environmental goals such as recreation or agricultural supply. Each state or tribe is then responsible to maintain these uses.
- Water Quality Criteria: Criteria established to support and protect the designated uses of each water body.
- Antidegradation Policy: All states are required to have an antidegradation policy and an implementation plan to maintain the level of water quality necessary to protect existing in-stream water uses.

Permits issued to dischargers to waters of the U.S. must ensure that discharges will not violate or contribute to a violation of water quality criteria or impair the designated uses in receiving and downstream waters.

Section 401 Certification

Projects that could potentially discharge to a water of the U.S. require certification. Applications need to certify that the activity will not violate any water quality standards or other State or Tribal requirements (EPA 2000).

Section 402 NPDES

Section 402 of the CWA regulates the discharge from point sources into waters of the U.S. As construction and operation of a treatment wetland may result in a discharge into waters of the U.S., these projects may require an NPDES permit. If construction of a treatment wetland disturbs one acre or more, an NDPES permit for stormwater discharge from the construction activity is required. This requirement applies to all construction projects.

Section 404

Section 404 of the CWA makes it unlawful to discharge dredged or fill material into waters of the U.S. (including wetlands) without obtaining a permit from the U.S. Army Corps of Engineers. If wetland construction activities involve the discharge of dredged (excavated materials) or fill materials (*i.e.*, material used to replace an aquatic area with dry land or to change the bottom elevation of a body of water), authorization must be obtained and may include mitigation for wetland impacts. Additionally, subsequent maintenance activities also may require a permit.

There are two basic types of Section 404 permits issued by the Corps, individual and general. An individual permit is usually required for potentially significant impacts. However, for most discharges that will have only minimal adverse effects, the Corps often grants general permits. These may be issued on a nationwide, regional, or statewide basis for particular categories of activities (e.g., minor road crossings, utility line backfill and bedding) in order to expedite the permitting process.

"Navigable waters" of the U.S. are those subject to the ebb and flow of the tide shoreward to the mean high water mark and/or presently used, or have been used in the past, or are susceptible for use to transport interstate or foreign commerce. The term includes coastal and inland waters, lakes, rivers, and streams that are navigable; and the territorial seas.

Section 10 of the Rivers and Harbors Act

Under Section 10 of the Rivers and Harbors Act (33 U.S.C. 401 et seq.), projects that involve any obstruction to the navigable capacity of any water of the U.S. require authorization from the Corps. "Obstruction" includes the construction of any structure in or over navigable water, excavation/ dredging, or deposition of material or any obstruction or alteration in any navigable water of the U.S. Projects outside the limits defined for navigable waters of the U.S. require a Section 10 permit if the structure or work affects the course, location, condition, or capacity of the water body. There is an overlap of Section 10 and CWA Section 404 for some activities involving wetlands, and permits for activities regulated under both are processed simultaneously by the Corps.

Coastal Zone Management Act

The Coastal Zone Management Act was created to address overdevelopment along the nation's coast and to actively involve states in the coastal preservation process. It establishes a program based on land development controls within coastal zones, and incorporates the development of programs for comprehensive state management. The Coastal Zone Management Act also requires that activities conducted by Federal agencies conform to the maximum extent practicable with a state's coastal zone management program.

Under the Coastal Zone Management Act, states may review Federal actions. These include activities conducted by parties authorized by Federal licenses and permits, such as CWA Section 404 permits. A certification of consistency with the California Coastal Management Program must be included with the application for Section 404 and Section 10 permits, and the Corps may not issue a permit until the California Coastal Commission reviews and concurs with the certification of consistency.

California Coastal Act

The California Coastal Act is California's coastal zone management program that was created to provide long-term protection to California's coastline. The California Coastal Act is used to make decisions on permit applications, Federal consistency reviews (as set forth in the Coastal Zone Management Act), and local coastal programs. Almost all development within the coastal zone requires a coastal development permit from either the Coastal Commission or a local government with a certified Local Coastal Program. The "coastal zone" generally is defined under the California Coastal Act as the area that extends three miles seaward and roughly 1,000 yards inland. In generally undeveloped areas, the coastal zone extends to a maximum of five miles inland, and in developed urban areas, the coastal zone extends substantially less than 1,000 yards inland .

Under the California Coastal Act, wetlands are defined as lands within the coastal zone that may be covered periodically or permanently with shallow water, including saltwater marshes, swamps, mudflats, and fens. Development in coastal zone wetlands is limited to eight allowable uses as set forth in Section 30233.

Guidelines: The California Environmental Quality Act and the National Environmental Policy Act

The California Environmental Quality Act (CEQA) is a statute that requires the State and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. The impetus for CEQA can be traced to the passage of the first Federal Environmental Protection Statute in 1969, the National Environmental Policy Act (NEPA). In response to this law, the California State Assembly created the Assembly Select Committee on Environmental Quality to study the possibility of supplementing NEPA through state law. In 1970, this legislative committee issued a report entitled, *The Environmental Bill of Rights*, which called for a California counterpart to NEPA. Later that year, acting on the recommendations of the select committee, the legislature passed, and then Governor Reagan signed, the CEQA statute. CEQA is a self-executing statute. Public agencies are entrusted with compliance with CEQA and its provisions are enforced, as necessary, by the public through litigation and the threat thereof. While the California Resources Agency is charged with the adoption of CEQA Guidelines, and may often assist public agencies in the interpretation of CEQA, it is each public agency's duty to determine what is and is not subject to CEQA. As such, the California Resources Agency does not review the facts and exercise of discretion by public agencies in individual situations. In sum, the California Resources Agency does not enforce CEQA, nor does it review for compliance with the many state and local agency actions which are subject to CEQA.

A public agency must comply with CEQA when it undertakes an activity defined by CEQA as a "project". A project can be defined as an activity undertaken by a public agency or a private activity which must receive some discretionary approval (meaning that the agency has the authority to deny the requested permit or approval) from a government agency which may cause either a direct physical change in the environment or a reasonably foreseeable indirect change in the environment.

Many wetland projects may trigger a "significant effect" as defined by CEQA. According to CEQA Guidelines (Office of Planning and Research 2004), significant effects related to wetland projects may include, but not be limited to, those that may:

- Have a substantial adverse effect, either directly or through habitat modifications, on any candidate, sensitive or special status species, as identified by local or regional plans, policies, or regulations, or by CDFG or USFWS
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified by local or regional plans, policies, regulations, or by CDFG or USFWS
- Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the CWA (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species with established native resident or migratory wildlife corridors, or with the use of native wildlife nursery sites
- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance
- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan

Project proponents are encouraged to consult early with regulatory specialists and environmental planners with strong experience in wetland project implementation.

NEPA: Purpose of the National Environmental Policy Act Sec. 2 [42 USC § 4321].

The purposes of NEPA are to: 1) declare a national policy which will encourage productive and enjoyable harmony between man and his environment; 2) promote efforts which will prevent or eliminate damage to the environment and biosphere, and stimulate the health and welfare of man; 3) enrich the understanding of the ecological systems and natural resources important to the Nation; and 4) establish a Council on Environmental Quality.

Certain projects also may be subject to NEPA review. The intent and process of NEPA is similar to CEQA. A project is subject to NEPA when one of the following occurs:

- Project requires a federal permit or entitlement
- Is jointly carried out by a federal agency
- Will be federally funded
- Will occur on federal land

Joint CEQA/NEPA documents are often used by agencies to address environmental effects of wetland projects. Project proponents are encouraged to consult early with appropriate agencies to determine the appropriate regulatory path for each wetland project.

California Fish and Game Code 1600-1607

The Lake and Streambed Alteration Program (Section 1600-1607 of the CDFG Code) requires that CDFG be notified before beginning any proposed projects that will substantially divert or obstruct natural flow; substantially change the bed, channel, or bank of any river, stream, or lake; or use materials from a streambed. Notification is generally required for any project that will take place in or in the vicinity of a river, stream, lake, or their tributaries. If CDFG determines that a project may substantially adversely affect existing fish or wildlife resources, the project may not be started until

CDFG develops a Draft Lake or Streambed Alteration Agreement. CEQA review is required prior to the development of the draft Agreement.

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act establishes the SWRCB and the RWQCBs as the state agencies that have primary control over water quality in California. The RWQCBs' primary role is to enforce the CWA, and therefore, have regulatory authority over the development activities affecting the water quality of navigable water and wetlands. The RWQCBs regulate all pollutant or nuisance discharges that could potentially affect either surface water or groundwater. Any proposed project that that will discharge waste is required to file a report of waste discharge with the appropriate RWQCB. Project proponents should contact the appropriate RWQCB before proceeding with any action that may result in a discharge to waters of the State (California Resources Agency 98). Unlike waters of the U.S., waters of the State include groundwater.

Vector Control

One potential undesirable attribute of wetland projects, if not addressed properly, is that they can become breeding grounds for mosquitoes that can serve as vectors for diseases harmful to humans such as West Nile virus, malaria, and encephalitis (MVCAC 2004).

The California Department of Health Services (DHS) has the authority to abate public nuisances, and has determined that water supports a breeding population of mosquitoes constitutes a public nuisance. DHS and other local vector control agencies have the authority to take necessary actions up to a legal notice to abate a public nuisance (DHS 01). As such, it is important to plan for vector control in wetland projects.

The Mosquito and Vector Control Association of California, established in 1951, is a non-profit association. They provide public information, mosquito and vector-borne disease surveillance, and advocate environmentally-friendly methods for vector control. They "support the sensible development of wetlands when they include best management practices for the control of mosquitoes", and advocate planning for mosquito control at during the early phases of a project (MVCAC 2004). In general, mosquito control in a wetland project is best handled through early planning and most importantly, the creation of long-term maintenance agreements that include vector monitoring and control as part of the projects operation and maintenance plan.

Other Relevant Federal and State Laws and Regulations

The following is a list of other relevant Federal and State regulations that may apply to a wetland project and should be considered:

Endangered Species Act: Provides a mechanism for the protection and recovery of species threatened with extinction. It prohibits unauthorized acquisition, possession, sale, and transport of federally-listed threatened and endangered species.

Information regarding the location of threatened or endangered species habitat can be obtained from the USFWS and the National Marine Fisheries Service (EPA 2000). Additionally, Section 404 permits

help protect endangered species by regulating projects that include the discharge of dredging or fill materials.

National Wild and Scenic Rivers Act: Selects certain rivers that possess outstanding values and preserves them and their surrounding environment for the enjoyment of present and future generations. Designated rivers are protected from federally-supported dam building and other federally authorized structural changes that would adversely affect the river's values.

National Historic Preservation Act: Preserves significant historic features and establishes a National Register of Historic Places, which is an inventory of the United States' historic resources that includes buildings, structures, objects, sites, districts, and archeological resources. Section 106 of the National Historic Preservation Act requires that a Federal agency involved in a proposed project must confer with the State Historic Preservation Officer and the National Historic Preservation Act to determine if the project will impact a significant historic feature.

Migratory Bird Treaty Act: Implements four international treaties and establishes federal responsibility for protecting and managing migratory and non-game birds. The Migratory Bird Treaty Act makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued by the USFWS.

The Fish and Wildlife Coordination Act: Requires that all Federal agencies consult with the USFWS, the National Marine Fisheries Service, and State wildlife agencies (e.g., CDFG) for projects that could affect, control, or modify any stream or body of water.

Estuary Management Plans CWA Section 320: Provides means for states to nominate estuaries within, or partially within, its borders as an estuary of national significant. The state also may request a management conference to develop a comprehensive management plan for the estuary.

Magnuson-Stevens Fishery Conservation and Management Act: Provides for the designation of "essential fish habitat" for managed fish and shellfish, and requires Federal agencies to consult with the National Marine Fisheries Service on any federal action or federally authorized action that may adversely affect the essential fish habitat.

California Endangered Species Act: The current version of the California Endangered Species Act, enacted in 1984, is generally parallel to the Federal Endangered Species Act. The CDFG and the Fish and Game Commission are responsible for the implementation of the California Endangered Species Act. State lead agencies are required to consult with CDFG to ensure that a proposed project is not likely to jeopardize the continued existence of any California-listed endangered or threatened species, or result in destruction or adverse modification of essential habitat.

The Natural Community Conservation Planning Act: Added to California Endangered Species Act in 1991, the Natural Community Conservation Planning Act provides for voluntary cooperation among CDFG, landowners, and other interested parties to develop natural community conservation plans which provide for coordination to protect listed species or species that are not yet listed. The primary purpose of the Natural Community Conservation Planning Act is to preserve species and their habitats, while allowing reasonable and appropriate development to occur.

The California State Coastal Commission: Although it has no regulatory function, the California State Coastal Commission is a State agency actively involved in the protection and enhancement of coastal wetlands. A primary purpose of the California State Coastal Commission is to resolve coastal land use conflicts in order to protect coastal resources and expedite environmentally sound development.

Food, Agriculture, Conservation, and Trade Act: The "Swampbuster" provision removes a farmer's eligibility from all government price and income support programs for violations of the Food, Agriculture, Conservation, and Trade Act including draining, dredging, filling, leveling or otherwise altering a wetland.

Non-point Source: Sources of pollution not defined by statute as point sources. Non-point source pollution results from the transport of pollutants into receiving waters via overland flow runoff within a drainage basin. Because non-point source pollution is diffuse, its specific sources can be difficult to identify.

Point Source: Any discernible, confined, and discrete conveyance including, but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel, or other floating craft from which pollutants are or may be discharged. This term does not include return flows from irrigated agricultural or agricultural runoff. (40 CFR§ 122.2)

Non-point Source Management Programs under CWA Section 319: Provides for the assessment of water bodies that cannot be expected to meet water quality standards without actions to control non-point sources of pollution and the preparation of management programs for controlling pollution and water quality from non-point sources. It emphasizes a watershed-based approach which may include protection and/or restoration of wetlands and riparian areas.

California Non-point Source Program: Established under the framework CWA Section 319, the California Non-point Source Program is a comprehensive statewide effort aimed to reduce and prevent non-point source pollution under the authority of the California State Coastal Commission and the RWQCBs. The Program identifies non-point source management measures to be implemented by 2013.

3.0 Existing Regional Management Plans

Upper Santa Ana River Wash Land Management and Habitat Conservation Plan

The project is located in the eastern valley portion of San Bernardino County, mostly within the Cities of Highland and Redlands, but also partially within County jurisdiction. The plan area is bounded by Greenspot Road to the north and east, Alabama street to the west and the SAR Wash to the south.

The purpose of the proposed project is to allow the continued use of land and mineral resources while maintaining the biological and hydrological resources of the planning area in an environmentally sensitive manner. The Wash Plan is intended to coordinate and manage the present and future activities in the Wash which are part of multiple jurisdictions, each with different needs. The goal of the project is to balance the ground-disturbing activities of aggregate mining, recreational activities, water conservation, and other public services with quality, natural habitat for endangered, threatened, and sensitive species (San Bernardino Valley, 2007).

Western Riverside County Multiple Species Habitat Conservation Plan

The Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP) is a comprehensive, multi-jurisdictional Habitat Conservation Plan (HCP) focusing on the conservation of species and their associated habitats in Western Riverside County. The MSHCP is one of several large, multi-jurisdictional habitat-planning efforts in southern California with the overall goal of maintaining biological and ecological diversity within a rapidly urbanizing region. Large-scale HCP planning efforts have been completed in San Diego and Orange Counties, and a similar effort is underway in the Coachella Valley. The MSHCP will allow Riverside County and its cities to better control local land use decisions and maintain a strong economic climate in the region while addressing the requirements of the State and Federal Endangered Species Acts.

Riverside County's population in 2000 was approximately 1.5 million people. Its population is expected to double by 2020, to reach approximately 3.5 million by 2030, and to be approximately 4.5 million by 2040, according to forecasts by SCAG. This is nearly a 400% increase over the next 40 years. Most of southern California's growth over the next 40 years is expected to occur in the Inland Empire (San Bernardino and Riverside Counties) (SCAG 2001). Accommodating an increase in population of this magnitude will involve urbanizing thousands of acres of undeveloped land and result in significant conflicts with regulations protecting species and their habitats. Conflicts and delays will escalate costs for all development projects, uncoordinated mitigation efforts will fragment habitats, the region will miss opportunities to improve the quality of life, and economic development opportunities for the current and future residents of Riverside County also will not be realized.

The MSHCP plan area encompasses approximately 1.26 million acres (1,966 square miles); it includes all unincorporated Riverside County land west of the crest of the San Jacinto Mountains to the Orange County line, as well as the jurisdictional areas of the Cities of Temecula, Murrieta, Lake Elsinore, Canyon Lake, Norco, Corona, Riverside, Moreno Valley, Banning, Beaumont, Calimesa, Perris, Hemet, and San Jacinto. This HCP is one of the largest plans ever attempted. It covers multiple species and multiple habitats within a diverse landscape, from urban centers to undeveloped foothills and montane forests, all under multiple jurisdictions. It extends across many bioregions as well, including the Santa Ana Mountains, Riverside Lowlands, San Jacinto Foothills, San Jacinto Mountains, Agua Tibia Mountains, Desert Transition, and San Bernardino Mountains. It will provide a coordinated MSHCP Conservation Area and implementation program to preserve biological diversity and maintain the region's quality of life.

Existing Reserves within the Western Riverside County MSHCP

Box Springs Reserve	Prado Basin
Bureau of Land Management Lands	Riverside County Flood Control & Water
Cleveland National Forest	Conservation District Lands
Emerson Oaks Reserve	San Bernardino National Forest
Harford Springs Reserve	San Diego Gas and Electric Lands
Kabian Park	San Jacinto Wildlife Refuge
Lake Mathews-Estelle Mountain Reserve	San Timoteo Creek State Park
Lake Perris Recreation Area	Santa Margarita Ecological Reserve
Lake Skinner Recreation Area	Santa Rosa Plateau Nature Reserve
March Air Reserve Base Reserve Lands	Southern California Edison Lands
Metropolitan Water District Lands	Southwestern Riverside County Multi Species
Motte Rimrock Reserve	Reserve
Mount San Jacinto Wilderness State Park	Sycamore Canyon Wilderness Park
Norton Younglove Reserve	UC James San Jacinto Mountain Reserve
Orange County Water District Lands	

Orange County Natural Communities Conservation Plan

The purpose of this project is to create a sub-regional multi-habitat-based HCP that balances resource protection with reasonable economic growth.

This was a chance to preserve coastal sage scrub and oak woodland habitats that have nearly disappeared from southern California. The remote canyons of the 13,000-acre northern boundary, east of the City of Orange, are notable for "The Sinks" area of Limestone Canyon, a huge, steep-walled sandstone ravine that resembles a mini-Grand Canyon. The land harbors some of Orange County's richest oak and sycamore woodlands, as well as streams and springs laced with blackberries and monkey flowers and shared by animals of all sizes – from mountain lions to rare lizards. The ranch's 12,000-acre Weir, Gypsum and Fremont Canyons, adjacent to Cleveland National Forest, are home to many native animals and plants. These include the rare Tecate cypress, found only in three other areas of California. The 14,000-acre southern boundary, with its hills, meadows, wooded canyons and sweeping views of the Pacific, connects Crystal Cove State Park and the Laguna Coast Wilderness Park. The Irvine Ranch Wildlands and Parks are home to bobcats, red-tailed hawks, coyotes, mule deer, meadowlarks, and an abundance of other wildlife (Nature Conservancy, 2008).

The Irvine Ranch Conservancy was established in 2005. It is a non-profit, non-advocacy organization, created to help care for the 50,000 acres of permanently protected wildlands and parks on the historic Irvine Ranch. The organization works with its partners to enhance the public's appreciation, understanding and connection to the land, while helping other landowners and managers with all aspects of stewardship. The Irvine Ranch Conservancy contributes its resources, expertise and energy to achieve the best possible balance of preservation and public participation. Nearly 50,000 acres of wildlands and parks have been designated as permanent open space on The Irvine Ranch. However, protecting the land is only the first step. Mediterranean ecosystems like these need extremely attentive stewardship. The rare plants, animals, and habitats found here are adapted to specialized conditions

and need our long-term management to survive. The mission of the Irvine Ranch Conservancy is to make sure that these lands are cared for and enjoyed to the highest possible standards.

The wildlands of the North Ranch are connected to the Cleveland National Forest and are one of the few places where natural habitat ranges relatively unbroken from lowland scrub, grassland and oak woodlands up to higher altitude montane chaparral and conifers. The Venturan and Diegan associations of coastal sage scrub and native grasslands of southern California are all critically endangered and the Irvine Ranch Wildlands and Parks and adjacent wildlands offer one of the last, best places to protect these ecosystems and many of the species associated with them.

This area also is sufficiently large and continuous to support native ecosystems that still benefit from the presence of large predators such as mountain lion, coyote, golden eagle, and bobcat. Their ecological role as top carnivores helps maintain a healthy and resilient ecosystem. The wildlands are some of the last and most extensive lower elevation habitat for these important predators. For all of these reasons, The Irvine Ranch Wildlands and Parks has been identified by The Nature Conservancy as one of the top 50 priority conservation landscapes in California.

Not only are these natural areas a globally important conservation priority, they are remarkably close to one of the world's largest urban regions. This offers an unparalleled opportunity for people to experience and enjoy these extraordinary native ecosystems in their own backyard, while enhancing understanding and support for their protection and stewardship (Irvine Ranch Conservancy, 2008).

Existing Conservation Plans
Western Riverside County MSHCP

PLAN	AGENCY	ACRES	STATUS
WRC MSHCP	WRC RCA		Underway
Cleveland NF	USFS		Completed
San Bernardino NF	USFS		Completed
Prado Basin	OCWD		Completed
Bureau of Land Management Lands	BLM		Fluctuates
Lake Perris SRA	CA State Parks		Completed
San Jacinto WR	CA State Parks		Underway
San Timoteo Creek SP	CA State Parks		Underway
Mt San Jacinto Wilderness SP	CA State Parks	10,000	Completed
Santa Margarita Ecological Reserve			Completed
Santa Rosa Plateau Nature Reserve		8,300	Completed
Motte Rimrock Reserve	UC NRS		Completed
Box Springs Reserve	UC NRS	1,155	Completed
Emerson Oaks Reserve	UC NRS		Completed
James San Jacinto Mountain Reserve	UC NRS	160	Completed
Kabian Park	RC Parks	640	Completed
Norton Younglove/De Anza Reserve			Completed
Harford Springs Reserve	RC		Completed
Lake Skinner Recreation Area	RC Parks		Completed

Lake Mathews-Estelle Mountain Reserve	MWD		Completed
SW Riverside County Multi Species Reserve	RCHCA		Completed
Metropolitan Water District Lands	MWD		Completed
March ARB Reserve Lands	USAF		Completed
Southern California Edison Lands	SCE		Completed
San Diego Gas and Electric Lands	SDGE		Completed
	Total Acres:	500,000	

San Bernardino County MSHCP

PLAN	AGENCY	ACRES	STATUS
San Bernardino National Forest	USFS		
San Bernardino County MSHCP	SB County		Hiatus
Upper Santa Ana River Land Management & Habitat Conservation Plan	SBVWCD		Underway
	Total Acres:		

Orange County MSHCP

PLAN	AGENCY	ACRES	STATUS
Cleveland National Forest	USFS		Completed
Irvine Ranch Wildlands	Nature Conservancy	50,000	Underway
Irvine Open Space Preserve - South	City of Irvine	4,000	Underway
	Total Acres:		

Current Issues, Challenges and Potential Approaches

While most of the Watershed can be described as semi-arid to arid coastal plain, historically, water has played a critical role in supporting a rich diversity of seasonal and year-round wildlife. Expansive seasonal and permanent wetlands, estuaries, ephemeral and perennial streams, vernal pools, and natural lakes all provided life-giving water to thousands of square miles of land inhabited by many species of plants and animals.

As the Watershed has been developed over the last two centuries, many water-oriented habitats have been altered by man. Where water-oriented habitats have been reduced, the flora and fauna have adapted, moved, or disappeared. Through the OWOW process, stakeholders will investigate how to successfully manage water-oriented habitats while ensuring adequate public water supply, protecting water quality, and providing housing and commerce for a growing population.

The purpose of this chapter is to identify the issues and challenges related to the successful management of water-oriented habitat. The following is a list of issues/challenges, followed by a brief discussion of potential approaches to address them.

Pollutant Trading Programs

Constructed wetlands can be used to remove pollutants from surface runoff using natural processes. Formal pollutant trading programs provide the mechanism to pool funding from multiple, smaller sources to construct wetlands that would create habitat and increase the pollutant removal benefit.

Potential Approach:

- Develop formal pollutant trading programs that facilitate pooling of funds to construct wetlands

Innovative Conservation Arrangements

Over the last few decades, development interests, regulators and environmental groups have worked together to encourage habitat conservation and enhancement while allowing for reasonable land development. Such efforts include Natural Community Conservation Plans and HCPs. These programs have provided large conservation areas to accommodate large developments, but have taken years and large financial commitments to develop and implement.

Other programs include the Federal Safe Harbor Policy, which protects the ability of landowners to use their land responsibly in exchange for the setting aside of large land parcels for conservation of specific threatened or endangered species.

Potential Approaches:

- Facilitate legislation to simplify landowner habitat conservation programs.
- Develop an inventory of existing mitigation lands.
- Develop a Watershed-wide, water-oriented habitat conservation program.
- Create mitigation banks to "pool" smaller mitigation requirements to enable the creation of larger, more beneficial habitat mitigation projects.
- Work with private landowners to manage habitat more effectively, provide "assistance agreements" that help those landowners manage their lands partnership, and management education.
- Build on successes of the Western Riverside County MSHCP and other similar efforts to expand conservation opportunities.

Multi-Purpose Publicly Owned Lands

There is a significant amount of land across the Watershed that is owned by federal, state, and local governments for purposes other than water-oriented habitat conservation. In many cases, these lands currently are left unmanaged or are managed in a manner that discourages the development of habitat. In many cases, unused portions of public lands could be set aside for habitat enhancement without impacting the landowner's primary purpose. An example might be flood control channels and basins that could provide habitat while still providing critical flood protection.

Potential Approaches:

- Develop a public land database as a first step toward a more comprehensive, coordinated management plan.

- Develop a regional plan for public land use.
- Develop regional "safe harbor" type agreements that allow for short- or long-term management of public lands for multiple uses including habitat conservation.
- Coordinate wildlife management with local parks departments.
- Provide expert assistance to public agency landowners to help them better understand how they can manage their lands for multiple purposes, especially short- or long-term habitat enhancement.
- Partner with public utilities in utility corridors.

Economic Development

The region's favorable climate and historically high employment rate make the region prime for development and urban growth, and it is expected to remain so in the future. This produces a great deal of pressure on water-oriented habitat. To address these pressures, this plan recommends that the development community consider water-oriented habitats early in the development planning process. Potential Approaches:

- Analyze the economic value of environmental and habitat enhancement to new and existing communities
- Identify early what general and specific areas should be preserved at full build-out of the Watershed rather than identifying them after landowners have prepared development plans (the latter approach can result in inequitable, piecemeal conservation efforts)
- Incorporate water-oriented habitat conservation into land use planning in a manner that provides a return on investment while protecting the environment
- Modify the state tax structure to encourage conservation
- Facilitate cooperation among regulators and private landowners to prioritize lands that could be purchased and set aside as public lands
- Identify funding sources for such purchases or facilitate development agreements that transfer such lands to public agencies for future management
- Consider the natural configuration of water-oriented habitat that does not recognize political jurisdictional boundaries. A regional coordination effort is needed to provide consistent planning and regulation across multiple jurisdictions

Private and Public Funding

Despite significant bond funding in recent years, there still is a shortage of funding available in both the private and public sectors to purchase, operate, and maintain valuable habitat areas.

Potential Approaches:

- Research and develop innovative funding arrangements to buy high priority, water-oriented conservation lands, construct needed improvements for appropriate public access, and fund on-going operation and maintenance of those lands
- Develop an in-lieu funding program or habitat bank for water-oriented habitats throughout the Watershed

Connection Between People and Local/Regional Habitats

As development moves into the arroyos and hillsides of the Watershed, more people are living closer to valuable habitat. Unfortunately, not enough emphasis has been placed on developing a land ethic across the Watershed, even among those residents who live directly adjacent to some of the Watershed's richest habitats. There is a great deal of potential to improve the connection between people and local habitats. For instance, along the northeastern slope of the Santa Ana Mountains, stewardship groups could be formed among residents to care for the habitat and wildlife in the local canyons and forest water courses.

Some of the Watershed's high quality, water-oriented habitats are near disadvantaged communities, where historically, little attention has been paid to stewardship of the local resources. Developing local "ownership" of these habitats could benefit both the habitat and the community.
Potential Approaches:

- Develop a social marketing campaign, including opinion surveys to determine how to best enhance the people/habitat connection.
- Develop community "ownership" of local water courses and wetlands by forming wetland societies or stewardship/"friend" groups.
- Create educational centers near water-oriented habitat areas.
- Provide educational tours of both local and regional water-oriented habitat areas.
- Sponsor conferences that include outdoor seminars.
- Produce/distribute wildlife habitat maps and make them available on-location and on the Internet.
- Increase citizen science opportunities/involvement.

Comprehensive Habitat Management

Without a comprehensive, regional plan for water-oriented habitat conservation, independent efforts by various planners, regulators, and landowners can lead to fragmented habitat areas and fragmented management of those areas. In addition, a parcel-by-parcel, or piecemeal planning approach can lead to inconsistent, inequitable regulation of land development and unnecessary costs and delays. Broader planning and management approaches would benefit both the environment and development.

In general, the larger a habitat area, the healthier it is, with ample breeding, feeding, and shelter opportunities for its inhabitants. Fragmented, small habitat areas can pose a threat to species diversity and the overall health of ecosystems. Habitat fragmentation is frequently caused when native vegetation is cleared for activities such as agriculture or urbanization. Habitats, which were once continuous, become divided into separate fragments or islands. When habitat is fragmented, plants and animals lose their protective buffers around the fringes and access to each other, food, and water. Eventually the fragments become unable to support their natural diversity and species disappear.

Fragmented management refers to piecemeal approaches to conservation and restoration of water-oriented habitat. When management is approached in a collective, comprehensive manner, overall costs can be reduced, funding can be pooled, and wasteful or harmful practices can be minimized or eliminated. When management is fragmented, there is a potential for duplication of effort, conflicting practices, and excessive costs.

Large conservation groups do not generally operate within the region; however, Santa Ana Watershed Association (SAWA) and the Riverside Land Conservancy have active habitat programs. There also are numerous "friends" groups throughout the Watershed providing area-focused land conservation.

Potential Approaches:

- Develop a map of the Watershed reflecting all the water-oriented habitat areas as described in this chapter.
- Develop a landownership database along riparian corridors.
- Work with landowners to manage habitat more effectively and provide "assistance agreements"
- Develop an urban habitat management model that softens/blurs the transition from urban development to surrounding habitat areas, and allows urban gardens and green space to be used safely/responsibly by wildlife based in the habitat areas.
- Partner with transportation agencies to minimize fragmentation and incorporate wildlife crossings.
- Incorporate vector control efforts into habitat management efforts to avoid conflicting activities.
- Consolidate the various "vision plans" by various agencies regarding water-oriented habitat conservation.

Evaluation of Hardened and Buried Water Courses

Many water courses throughout the Watershed have been hardened or contained in pipelines to protect urban development. Unfortunately, while such efforts improve the efficiency and safety of the water courses, it tends to eliminate critical wildlife connectivity between habitat areas. Not all flood control facilities are in areas where softer, above ground designs would be beneficial or necessary for habitat conservation. A prioritization process could identify where such designs would be of the highest value to habitat conservation.

Potential Approaches:

- Include flood control officials in any regional habitat conservation planning.
- Coordinate flood control management efforts with habitat conservation efforts to recognize/enhance the use of channels/basins by wildlife for connectivity among habitat areas.
- Identify and fund efforts to "daylight" or soften specific existing hardened channels and pipelines.

Invasive Species

One component of integrated programs to rehabilitate and improve the Watershed, is the removal of exotic and invasive plant species within the Watershed, primarily giant reed or wild cane (*Arundo donax*). SAWA, the Riverside County Parks and Open-Space District, RCFCWCD, OCWD, the Orange County RDMD, and the Orange County Conservation Corps, collectively known as "Team Arundo", participated in a comprehensive Arundo Removal Program (ARP). The ARP will remove Arundo and other invasive species, thereby helping to achieve the following goals:

- Remove non-native plants and create new open space and wetlands.
- Conserve water, use water efficiently, and capture and manage stormwater.

- Plan and implement a flood control program to protect agricultural operations and adjacent property, and to assist in abating the effects of waste discharges into waters of the State.

In addition to Arundo, team members may remove other invasive species while undertaking Arundo removal activities. These species include, but are not limited to, castor bean (*Ricinus communis*), artichoke thistle (*Cynara cardunculus*), tree or wild tobacco (*Nicotiana glauca*), tamarisk or saltcedar (*Tamarix* sp.), tall whitetop (*Lepidium latifolium*), and tree of heaven (*Ailanthus altissima*). These species disrupt natural ecosystems by competing with native flora for limited resources and generally providing poor quality habitat for native fauna. Removing any exotic species, including Arundo and other species, must follow applicable permit conditions.

Currently, more than 95% of the historic riparian habitat in the southern part of California has been lost to agriculture, development, flood control, and other human-related impacts (Zembal and Hoffman 2000). However, the greatest threat to the remaining riparian corridors is the invasion of exotic plant species, primarily Arundo. As a result of past and present introductions, its ability to colonize new areas relatively easily, and its ability to outcompete native species, Arundo has infested nearly every drainage system in the southwestern United States (Brotherson and Field 1987).

Because this exotic plant alters ecosystem dynamics and interrupts and redirects succession, the removal of Arundo from the Watershed offers numerous direct and indirect benefits to landowners, land managers, public agencies, and other Watershed residents. These benefits include reduction in risk of flooding and fire, improvements in water quality, increased water conservation, and restoration of habitat for native species, including several threatened and endangered species.

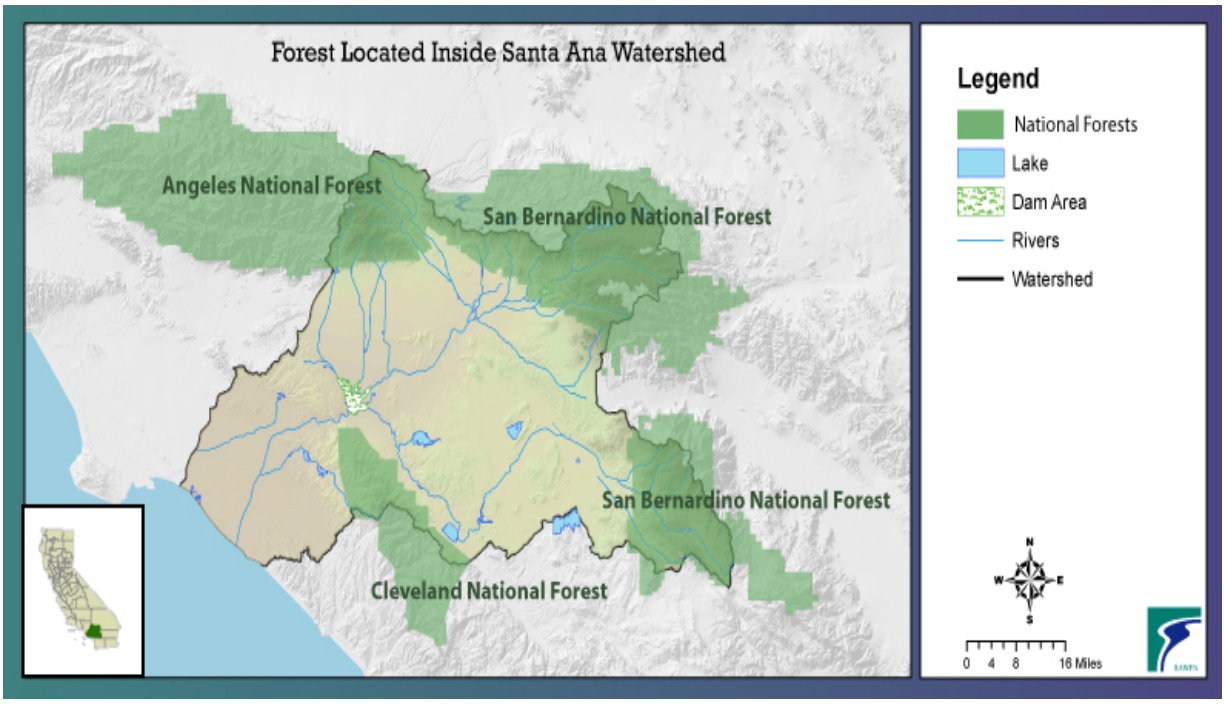
This Team Arundo approach to habitat management and restoration has been dependent upon a large upstream seed bank that re-seeds areas where non-native plants are removed, and replaces the invasive, non-native plants with stands of riparian vegetation. These areas have provided excellent habitat for the native species using the river corridors. As natural lands are restored, it becomes important to balance their value as habitat resources with the important recreation benefit they provide.

Wildfires and Forest Planning

Wildfires are an important habitat and public safety issue throughout the Watershed.

There are five national forests located in southern California and three of them are located in and around the Watershed (**Figure 5.7-1**). Angeles National Forest covers over 650,000 acres and is located northwest of the Watershed; Cleveland National Forest is located in the southern area of the Watershed and covers 460,000 acres; and San Bernardino National Forest, located in the northern and eastern areas of the Watershed, covers over 670,000 acres.

Figure 5.7-1 National Forests located in and around the Watershed



National forests provide habitat and a safe haven for threatened and endangered plants and animals, as well as provide people with opportunities for recreation in a natural environment. Forests also are a major source of water. In fact, many of California's National Forests were created specifically to safeguard and preserve water supplies essential to life in California's semi-arid climate. The Watershed receives the majority of its water from rainfall in and around the San Bernardino, San Gorgonio, and the San Jacinto Mountain's forest areas. Rainfall in these areas provides surface water and groundwater recharge throughout the region.

Along with the benefits that come from being near forests, the Watershed's proximity to three national forests also yields additional responsibilities. Proper forest planning is essential to maintaining the Watershed's water supply and water quality. Wildfires are always a threat, and the resulting physical, chemical and biological impacts on the Watershed will continue to be experienced for years after a fire.

The wildfires that were a natural part of California's historic landscape cleared the forest floor of debris and small trees. Historically, forest fires were generally low-intensity affairs. Fires might cover large areas, but flames stayed close to the ground with relatively modest temperatures. Today's infernos sometimes tower hundreds of feet above the ground and reach 3,000°F, hot enough to melt metal. They can travel 20 miles in a day and sterilize soils. However, it is the unnatural number of trees, not the amount of precipitation that is at the root of the problem. With 50-70 trees per acre, as was historically natural for much of California, forests could survive limited droughts relatively unharmed. However, with five to 30 times that amount of trees, even relatively wet years may not provide sufficient moisture for the trees.

Water also is the key to a tree's ability to survive bark beetle attacks. When a tree has sufficient moisture available, it can "pitch out" beetles by blocking the holes they bore into the tree with sap. Moisture-stressed trees, however, cannot. They succumb to insect infestation and become fire hazards.

Over the last several years, the Watershed has experienced drought conditions due to significantly decreased rainfall. This, combined with an infestation of bark beetles, has resulted in the large-scale mortality of trees, creating an enormous source of combustible material. Fuel loads in the San Bernardino National Forest and adjoining areas are extraordinarily high due to forest and private property management practices in these urban forest areas.

In 2003 and in 2007, the Watershed experienced major wildfires. There were three large fires in 2003 (**Figure 5.7-2**). The "Padua" fire burned 10,810 acres, the "Grand Prix" fire burned 49,184 acres, and the "Old Fire" burned 93,119 acres. In 2007 there were six wildfires (**Figure 5.7-3**). The "Slide" fire burned 12,759 acres, the "Cajon" fire burned 104 acres, the "Grass Valley" fire burned 1,242 acres, the "Santiago" fire burned 28,410 acres, the "Rosa" fire burned 409 acres, and the "Roca" fire burned 270 acres.

Figure 5.7-2 Location of 2003 Wildfires in the Watershed

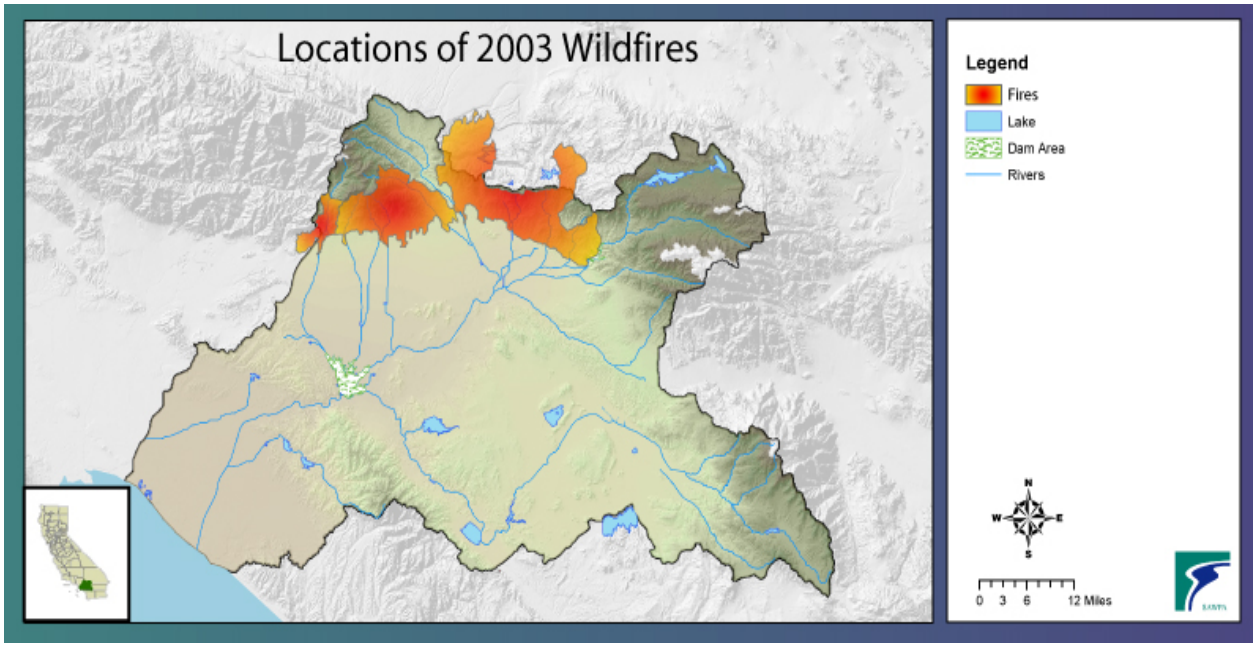
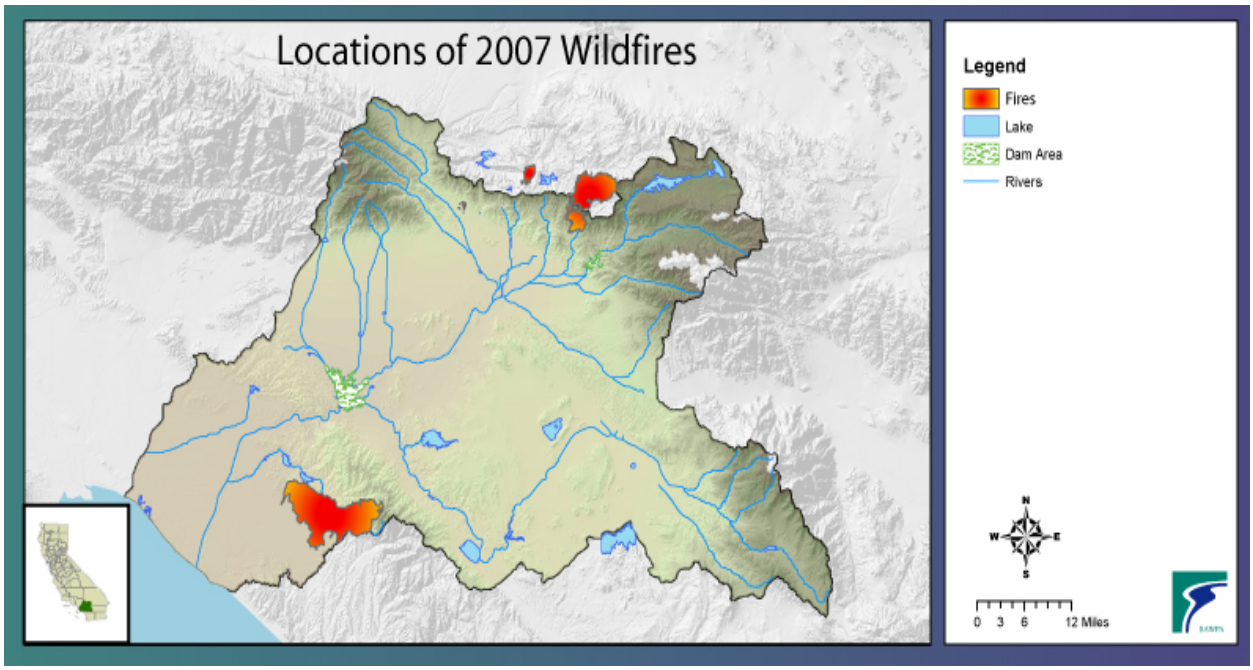


Figure 5.7-3 Location of 2007 Wildfires in the Watershed



For the first time, SAWPA developed a fire impact cost estimate to determine the cost of mitigating the long-term and short-term effects caused by 2003 wildfires. The costs of mitigating the effects of these three fires were estimated to be around $450 million (for a summary of the costs, (**Figure 5.7-4**).

Figure 5.7-4 Fire Impact Cost Estimates based on 2003 Fires

Impact Type	Total Cost	First Year
Sediment Removal (5 years)	$ 125,250,000	$ 12,525,000
Flood Control Improvements (56 basins)	$ 56,000,000	$ 5,600,000
Basin Percolation Restoration (25 basins)	$ 6,250,000	$ 1,250,000
Habitat Restoration (7,500 acres)	$ 15,000,000	$ 1,500,000
Toxic or Radiological Treatment	$ 13,000,000	$ 500,000
Inorganic Salt Removal (Capital and 20 yrs Op)	$ 182,000,000	$ 18,200,000
River and Basin Quality Monitoring	$ 8,850,000	$ 1,770,000
Water Supply Emergency	$ 35,350,000	$ 3,535,000
Wetland Restoration (2,500 acres)	$ 5,000,000	$ 500,000
TOTAL	**$ 446,700,000**	**$ 45,380,000**

Wildfires have a direct impact on the habitat of plants and animals. The 2003 fires affected the habitat of 16 species federally listed as threatened or endangered, as well as other sensitive and watch-list species. Most of the habitat that burned in these fires was chaparral, a habitat where periodic fires are an important ecological component. However, there are post-fire concerns about several species that depend on riparian or alluvial fan scrub habitats. Federally-listed species such as San Bernardino kangaroo rat, Santa Ana woolly-star, slender-horned spineflower, and California gnatcatcher are at post-fire risk if flood control measures outside national forest lands are not properly planned and the effects mitigated.

Besides causing physical damage to habitat, wildfires in national forests and the surrounding wildlands have a significant impact on the water in the SAR and other areas far from the burn sites. Serious water supply and water quality problems will likely begin during the winter following a fire event. Stormwater runoff from burned areas could contain high concentrations of manganese, lead, phosphorus, mercury, total organic carbon, and uranium, as shown in **Figure 5.7-5**. This degraded runoff will have significant downstream impacts.

Figure 5.7-5 Biological, Chemical and Physical Impacts on the Watershed from Wildfires

Potential Biological Impacts	Potential Chemical Impacts	Potential Physical Impacts
Plants	Increase in Total Dissolved Solids or Salts	Decreased Groundwater Recharge
Santa Ana River Wooly-Star	Increase in Nutrients, Nitrates and Phosphates	Sediment Loads 30 to 50 Times Above Average
Slender Horned Spineflower	Increase in Organics, Including Toxic Organics and Carcinogenic Compounds	Increased Total Runoff
Fish	Increased Water Turbidity	
Santa Ana Sucker	Transport of Uranium and Radiological Progeny Downstream	
Arroyo Chub	Decreased Dissolved Oxygen Content	
Santa Ana Speckled Dace		
Three Spineed Stickleback		
Amphibians		
Arroyo Toad		
Yellow Legged Frog		
Birds		
Least Bells Vireo		
Southwestern Willow Flycatcher		
California Gnatcatcher		
Mammal		
San Bernardino Kangaroo Rat		

A single storm event could result in approximately 20,000 AF of sediment laden runoff that would flow down the SAR and its tributary streams, filling the recharge basins with debris and silt, and decreasing the rate of percolation. Increased nutrients in the runoff could promote the growth of algae and other vegetation that also may result in the clogging of the recharge basin substrate. These recharge basins play a major role in refilling the groundwater basin in this region. Reducing the rate of percolation decreases the amount of groundwater recharge. Increased basin maintenance and basin cleaning machines, developed and operated by OCWD, will be necessary to restore groundwater recharge rates. Increased silt also will have a negative impact on water quality. Currently, OCWD owns and operates 2,150 acres of wetlands for natural nitrate purification. Over 90% of the nitrate removal is accomplished through de-nitrification processes that occur in the bottom of the wetland substrate.

Under storm runoff conditions, the silt coming into the wetlands from the upstream tributaries likely will result in severe clogging, and reduce the effectiveness of the natural nitrate removal process. Wetland restoration will be required to repair damage caused by runoff from burn areas.

In addition to silting impacts, the runoff will contain increased levels of TDS, turbidity and nutrients such as nitrates from the burned area. Salt levels in runoff water are assumed to increase five-fold after a fire. For example, after the "Old Fire", 135,000 tons of salt was expected to infiltrate the groundwater basin and degrade groundwater quality for up to ten years following the fire. With larger storm runoff events, the salt infiltration quantities are likely to be even greater. Without some means of off-setting the increased salt loads in the groundwater basins, local water and wastewater agencies will be unable to meet California State and Federally mandated water quality regulations necessary to protect downstream beneficial uses. Existing desalination facilities likely will need to be expanded, and new facilities may need to be built depending levels.

Another source of concern is the high level of ash, both coarse and fine, that will enter the surface water supply system. Estimates indicate that possibly as much as 10,000,000 cubic yards of ash could enter the Watershed during storm events. Elevated levels of ash will persist for several years after the fire. Elements of the ash will be moved directly from the burn surfaces by storm runoff and will be incorporated into surface water flows. Furthermore, the high ash content of the first stormwater runoff event could affect the net oxygen availability in streams and wetlands.

In the Upper Watershed, clay and ash could mix and be deposited in rivers, streams and recharge basins. There are historical and current references to the use of baked clay and wood ash to form a material similar to Portland cement. Clay-ash slurry settling in low points in the upper Watershed may form hardened impermeable deposits. The removal of these deposits would require repeated maintenance activities.

There also are several other water quality parameters that could impact Watershed water supplies. These include uranium and its radiological progeny, toxic organics, and carcinogenic compounds. Some of the expected organic and carcinogenic compounds may be removed by desalination facilities. However, for uranium, radon and radiological progeny removal, there are no regional facilities that have been constructed. New facilities may need to be constructed depending on the results of monitoring and water quality measurements made in the storm runoff and burn areas.

Wildfires also can cause a significant, immediate change to the soil chemistry of the Watershed and could result in direct impacts on drinking water reservoirs. The abundant carbon left over from burned vegetation competes for oxygen with stable, oxidized metal compounds. During rainfall events, these metals dissolve and can be conveyed into mountain streams and receiving waters. Recent research on the effects of wildfires on drinking water quality has demonstrated that post-fire watershed runoff could contain spikes in the concentrations of manganese, phosphorous, lead, mercury, nitrate, total organic carbon, aluminum, barium, cobalt, copper, niobium, zinc, and uranium (Wildland Fire Impacts on Watershed, Geological Society of America, 2003).

Wildfires also have an impact on flood control. The Watershed's close proximity to both the ocean and the mountains at times brings heavy storms, which are problematic from a flood control standpoint. Many of the SAR's tributaries are dry throughout most of the year, but can quickly become raging torrents. The burned areas of the Watershed reveal exposed hillsides of rock; sand and debris; parched chaparral; and dead trees with a high potential for severe erosion, flooding, and mudslides.

As rainfall starts to saturate the burned portion of the Watershed, intense storms can result in rapid erosion and slope failures. This can lead to debris flows and rapidly moving flood events that carry a large concentration of soil, rock, and organic debris. In general, a fire causes an increase in the amount of sediment delivered by the Watershed to downstream areas. The increased volume of sediment could be 30 to 50 times the average amount.

Leaving forests alone is not a sustainable approach to managing natural resources. People are dying in high intensity wildfires, biodiversity is suffering, and the situation is getting worse as an increasing population puts more demands on forests.

Restoration forestry, on the other hand, is a real-world solution for addressing the forest health and wildfire crisis California is facing. Restoration forestry is a comprehensive plan that could:

- Restore natural forest conditions to California's landscape
- Reduce the threat of catastrophic wildfire
- Enhance biodiversity
- Protect water and air quality
- Pay for itself
- Encourage use of renewable resources
- Save taxpayers millions of dollars (Bonnicksen, Protecting Communities and Saving Forests, 2008)

During the first half of 2009, SAWPA staff provided information to the United Dates Department of Agriculture (USDA) Forest Service, Pacific Southwest Region, for an assessment of potential ecological restoration and ecosystem services strategies to assist in the Forest Service efforts in the restoration of California national forests. The Forest Service developed a strategy document called "Leadership Intent for Ecological Restoration" outlining the vision for the region and layout specific restoration strategies and expected benefits.

The goal of the Forest Service, Region 5, is to retain and reestablish ecological resilience on forest lands to achieve a sustainable management of forests to provide environmental services, including air and water purification, flood and climate regulation, biodiversity, scenic landscapes, wildlife habitat and carbon sequestration and storage. Work will be focuses on three influences: climate change and shifting hydrological patterns, overly dense forests, and rapid population increase.

The Forest Service estimates that by approximately 2050, the ability of national forests to sequester carbon and deliver ecosystem services will start to collapse. This will result in the loss of the ecosystem services mentioned above, many of which are directly related to water supply, both in terms of quantity and quality.

An environmental restoration program of unprecedented scale and with the collaboration of different ownerships and jurisdictions is required. Activities to be performed as part of this program need to include, among other, management of vegetation, wildlife, water, wildland fires, and recreation. Activities include meadow and riparian restoration, invasive species eradication, wildlife and fish habitat improvements, and landscape restoration.

Lakes

Current Conditions

This section discusses lakes within the Watershed, from the headwaters in the San Bernardino Mountains, through the basin and the SJR Watershed to the SAR's terminus in Orange County. These include a number of natural sumps and large, man-made lakes formed by dams. Excluded from this discussion are small private lakes disconnected from the Watershed, and have not been assigned beneficial uses by the Regional Board, for example golf course or park lakes.

San Bernardino Mountains Lakes

Erwin Lake

Erwin Lake is relatively small and only a couple feet deep. It is located off Highway 38 near the community of Sugar Loaf. Erwin Lake is fed by a spring and surrounding creeks. If Erwin Lake overflowed, it would connect with Baldwin Lake to the north. Noting Baldwin Lake's endangered species and importance as an ecological reserve, it would be beneficial to study Erwin Lake further. Two additional lakes that are far smaller in size with very little known about them include Lake Williams (a.k.a. Deadmans Lake) and Oakes Lake, both south of Erwin Lake and east of Highway 38. In the rare event of an overflow, these two sumps would ultimately connect with Baldwin Lake.

Baldwin Lake

Directly north of Erwin Lake is the much-larger Baldwin Lake that is characterized by mountain meadowland and a plain of pebble-size quartz rocks – remnants of the ice age lake that formed this natural depression. Called the "original" Big Bear Lake, Baldwin Lake is located at the very top of the Watershed. The lake can fill to 1,400 acres with a maximum depth of approximately 10 feet in wet years (CDFG, 1995). The lake is usually dry in spring or summer and has no natural outlet.

The combination of unique soils, harsh growing conditions, and isolation from other similar areas has created a plant community found nowhere else in the world (Flannery, 2001). In spring, Baldwin Lake displays wildflowers such as Douglas' violets (*Viola douglasii*), Parish's rock-cress (*Arabis parishii*), ash-grey Indian paintbrush (*Castilleja cinerea*), slender-petaled mustard (*Thelypodium stenopetalum*) and Kennedy's buckwheat (*Eriogonum kennedyi var austromontanum*). Both the ash-grey Indian paintbrush and Kennedy's buckwheat are listed as threatened, and the slender-petaled mustard is endangered on both state and federal lists. The ash-grey Indian paintbrush and the slender-petaled mustard are endemic to the San Bernardino Mountains.

When the lake is full, it supports populations of the unarmored three-spine stickleback (*Gastereosteus aculeatus williamsoni*), which is both federally and state listed as endangered. CDFG operates the Baldwin Lake Ecological Reserve on the north shore of the lake (Flannery, Meyer, Sudduth, 2001). A local non-profit organization, Natural Heritage Foundation, is looking to develop a waterfowl viewing platform and visitor center.

Big Bear Lake

Big Bear Lake, located downstream from Baldwin Lake, is a man-made reservoir that was dammed for the first time in 1884, and then again in 1912 when the current dam was built about 100 yards downstream of the original dam, tripling the lake volume to 73,000 AF. The lake is managed by Big

Bear Municipal Water District (BBMWD) for the purposes of recreation, water supply for downstream users, and wildlife. BBMWD also releases lake water to support the trout fishery in Bear Creek located below the dam.

Nine types of aquatic plant species have been identified in the lake. Of these, two invasive species have become problematic; Eurasian watermilfoil (*Myriophyllum spicatum*) and coontail (*Ceratophyllum demersum*). These species crowd out the native species that provide habitat for fish and waterfowl. Also, they can release high levels of phosphate resulting in algae blooms during the summer months. Other aquatic plants include smartweed, curlyleaf pondweed, American waterweed, sago pondweed, leafy pondweed, Widgeon grass, and spikerush.

Fish present in the lake include black crappie, blue catfish, bluegill, carp, channel catfish, largemouth bass, rainbow trout, and smallmouth bass. Recreational fishing is important to the economy in the Big Bear Valley, so game fish are regularly stocked.

Adjacent to the lake is Stanfield Marsh, a 145-acre wildlife preserve established in 1982. Since 1993, efforts have been underway to re-create a working wetland and marsh environment. It is located at the most easterly end of the lake, separated by a highway bridge, but water flows between the two water bodies through culverts. The purpose of the marsh is to provide year-round habitat for native plant species, waterfowl, and aquatic species through permanent wet basins and permanently dry loafing islands. Public walkways and interpretive signs are planned.

Jenks Lake

Located in Barton Flats along Highway 38 in the San Bernardino Mountains, Jenks Lake is a 10-acre public lake that is regularly stocked for recreational fishing by CDFG. The lake is fed by Frog Creek and maintains several fish species including bass, bluegill and rainbow trout. There is a picnic area and lake platform. When the lake overflows, it flows into Barton Creek that connects with the SAR upstream of Seven Oaks Dam (Reach 6).

San Jacinto River Watershed

Lake Perris

Lake Perris was constructed in 1974 as the last drinking water reservoir in the SWP, and is managed by DWR. It is surrounded by the Lake Perris State Recreation Area, an area managed by the California State Parks Department. The surface area of the lake is roughly 2,000 acres and the State Recreation Area covers more than 6,000 acres of open space. For the most part, the environment within the lake is constructed and managed to support recreational interests; however, the environment around the lake provides an important open space area for local native species of plants and animals.

Lake Perris provides an important stop-over point for migratory birds. The State Park preserves open space for wildlife like mule deer, roadrunners, bobcats, coyotes, long-tailed weasels, skunks, badgers, cotton tail rabbits, jack rabbits, quail, gopher snakes, rattlesnakes, lizards, and rodents.

Fishing, boating, and swimming provide the major recreational attraction for Lake Perris. Largemouth bass, spotted bass (rare), catchable trout (stocked by CDFG), rainbow trout, channel catfish, bull catfish, red ear sunfish, green sunfish, and Florida bluegill are caught in the lake. In addition, small

shrimp that arrived from San Francisco via the California Aqueduct and crawdads are present (Rocky Mountain Recreation, 2006; Lake Perris State Recreation Area, 2008; and Lake Perris Dam Project, 2008).

Lake Hemet (Hemet Reservoir)

In 1895, the Great Hemet Dam was completed on the San Jacinto River for the purpose of providing a reliable water supply to the San Jacinto Valley. It is located in the San Jacinto Mountains with a capacity of 8,100 AF, and managed by the Lake Hemet Municipal Water District. Hurkey Creek, Apple Canyon Creek and Garner Valley Wash drain into Lake Hemet from the San Jacinto Wilderness Area. The reservoir provides water to the Cities of Hemet and San Jacinto, and the community of Garner Valley. The reservoir is not connected to the SWP or MWD.

Fishing is one of the primary recreational attractions of the reservoir; and it is stocked with rainbow trout, channel catfish, bluegill, and largemouth bass. Activities such as camping, hiking, and wildlife viewing are available (Lake Hemet, 2008; Hemet History, 2008; and Hemet Museum, 2008).

Lake Fulmor

Lake Fulmor is a naturally-formed, three-acre mountain lake fed by Indian Creek which flows out of Hall Canyon. It is easily accessible along the Banning Idyllwild Panoramic Highway (Highway 243). It is enjoyed year-round for picnicking and fishing; stocked trout, largemouth bass, bluegill, and catfish are present. From Lake Fulmor, Indian Creek flows westerly and joins the SJR near Valle Vista.

Mystic Lake

Like Erwin Lake, Lake Fulmor, Jenks Lake, and Baldwin Lake, Mystic Lake is a natural, ephemeral lake that is fed mainly by the SJR. It fills during the rainy season and often dries up in summer. The lake soil is characteristically alkaline and supports many unique and isolated plant species. The most notable plant is the San Jacinto Valley crownscale (*Atriplex coronata var. notatior*) that is endemic and federally endangered. In the early 1990s, one of the largest known concentrations of this species was along the margin of Mystic Lake. However, the lake was full during the wet years of 1993 and 1994, and the species has not been noted since (Fred Roberts, personal communication, 04-25-08).

Other species known to occur or likely to occur within the Mystic Lake Basin, which have adapted to the alkaline conditions include: navarretia (*Navarretia fossalis*), federally listed as threatened; thread-leaved brodiaea (*Brodiaea filifolia*), federally listed as threatened and state listed as endangered; Coulter's goldfields (*Lasthenia glabrata ssp. coulteri*), identified by the California Native Plant Society as “seriously endangered in California”; Davidson's saltscale (*Atriplex serenana var. davidsonii*), identified by the California Native Plant Society as “fairly endangered in California”; Parish’s brittlescale (*Atriplex parishii*), identified by the California Native Plant Society as “seriously endangered in California”; smooth tarplant (*Centromadia pungens ssp. laevis*), identified by the California Native Plant Society as “seriously endangered in California”; mud nama (*Nama stenocarpum*), identified by the California Native Plant Society as “fairly endangered in California”; and Wright's trichocoronis (*Trichocoronis wrightii var. wrightii*), identified by the California Native Plant Society as “seriously endangered in California”.

Evidence suggests that the San Jacinto Valley contains the world's largest concentration of Coulter's goldfields, and Mystic Lake has the only known population of mud nama in Riverside County. Parish's brittlescale is the most endangered saltbush in southern California. Prior to its rediscovery near Hemet in 1993, it had last been seen in 1974 near Mystic Lake (near Lakeview).

Mystic Lake has long provided an important stop-over point for migratory birds, and an important watering hole for animals in the valley. In 1774, Spanish explorer Juan Bautista de Anza described the lake's size and waterfowl as, "several leagues in circumference and as full of white geese as water". It is part of, and located adjacent to the 9,000-acre San Jacinto Wildlife Area managed by CDFG. The area includes an active duck hunting area.

The lake is steadily sinking and increasing its holding capacity due to valley subsidence and the decreasing amount of silt deposition.

Canyon Lake (Railroad Canyon reservoir)

After the SJR flows from Lake Hemet through Mystic Lake, it flows south through Railroad Canyon Reservoir; named for the California Southern Railroad line that was built through the canyon in 1882. This line was repeatedly washed out by the river before it was abandoned. Later, a water company bought the land rights and built the dam in 1929 to supply water for the Temescal Valley. The Canyon Lake reservoir is fed mainly by the SJR and Salt Creek, and has a capacity of 11,900 AF. The lake is designated as a municipal drinking water supply, and water volume and quality are managed by Elsinore Valley Municipal Water District (EVMWD). The City of Canyon Lake and the Canyon Lake Property Owner's Association are largely responsible for the quality of runoff that enters the lake from the surrounding community. The environment surrounding Canyon Lake is almost completely urbanized, and the environment within the lake is highly monitored and controlled for the dual beneficial uses of recreation and municipal supply.

Fishing has been a recreational attraction to the lake, and anecdotal evidence suggests bass and trout are present.

Lake Elsinore

Lake Elsinore is located in a rapidly urbanizing landscape, just 60 miles southeast of the City of Los Angeles, and 22 miles south of the City of Riverside. This large, shallow, natural Lake is the terminus of the SJR. As a terminal basin, Lake Elsinore is subject to highly variable hydrological conditions that influence the physical-chemical environment of the lake which, in turn, influences the aquatic biological resources (e.g., fish, zooplankton, phytoplankton, benthic invertebrates) that can be supported by the Lake. Over the past 120 years, Lake Elsinore has experienced wet periods during which the Lake has overflowed to Warm Springs Creek, as well as dry periods when the Lake has dried up completely. As settlement in the region increased, Lake Elsinore and the many hot springs around the Lake became popular recreation destinations. During the heyday of initial settlement in the region and recreational development at Lake Elsinore, Federal and State agencies, as well as private groups stocked a wide variety of fish species in the lake with the goal of drawing people to Lake Elsinore by providing recreational fishing opportunities.

Currently, little resembling a native plant community remains around the shoreline of Lake Elsinore. While the native willow (*Salix gooddingii*), cattail (*Typha latifolia*), and tule (*Scipus actutus*) remain in suitable habitats scattered around the Lake, most of the lakeshore vegetation does not consist of true riparian species, but rather, non-native, early serial stage colonizers that can grow on the exposed lakeshore as the water level recedes. A typical example of this community may be found at the Four Corners area. While a few willows remain in this area, most of the lakeshore plant community consists of mustard (*Brassica camestris*), bermuda grass (*Cynodon dactylon*), castor bean (*Ricinus communus*), filaree (*Erodium* sp.), wild radish (*Raphanus sativus*), jimsonweed (*Datura stramonium*), wild oats (*Avena* sp.), dock (*Rumex* sp.), and tamarisk (*Tamarix* sp.).

Lake Elsinore currently does not support any species of floating or submerged, rooted aquatic macrophyte. The absence of a floating or submerged aquatic macrophyte community is a consequence of: 1) the variable water level from year-to-year and even seasonally within a year; 2) limited suitable shoreline sediments for rooting; 3) shading of light by the dense algal populations; 4) turbidity caused by several mechanisms; and 5) the constant foraging of the common carp across the bottom. In the absence of a relatively stable lake level, aquatic plants cannot become established and persist. While Lake Elsinore is a highly alkaline lake (pH typically >9), there are numerous aquatic plant species that can grow in alkaline waters. Even though the lake has dried up completely in the past, it is likely that waterfowl have served, and continue to serve, as a vector for the introduction of aquatic plants to the lake.

Other Inland Lakes

Lee Lake (Corona Lake)

Lee Lake is an artificial reservoir located in Corona, approximately eight miles north of Lake Elsinore, managed by the Lee Lake Water District. Formed in the mid-1940s, its purpose has evolved from primarily flood control and irrigation of orange, grapefruit, lemon, and lime groves to fishing and general agricultural customers. Potable and non-potable water is provided to more than 2,000 retail customers. The Lake covers about 56 surface acres and is up to 28 feet deep. Since 1983, a fishing concession has operated at the site. The lake has been stocked with trout, carp, shad, bass, and catfish. Much of the water supply in Lee Lake comes from the Mills Treatment Plant in Riverside. Temescal Wash and overflows from Lake Elsinore also supply water to the Lake.

Most of the area surrounding the Lake is altered for parking, picnicking, boat loading, and fishing. However, on the easterly side is linked to coastal sage scrub. One should expect typical flora and fauna here, but it is unlikely the Lake is frequented by wild animals due to a constant human presence (Kelly, 2007; Romo, 2005; and MWH, 2006).

Lake Mathews

Lake Mathews was created to serve as the western terminus of the CRA and provides drinking water supply for MWD. It was formed by constructing the Cajalco Dam on Cajalco Creek, which flows from Mead Valley to the east to the Elsinore Valley to the west. The Lake and the 4,000 acres surrounding it are part of a State Ecological Reserve and public access is prohibited.

Mockingbird Reservoir (Gage Canal Basin)

Mockingbird reservoir is a man-made reservoir for collecting flood waters from Mockingbird Canyon, an eight-mile drainage starting near Lake Mathews and its tributaries. The canyon and creek were

dammed around 1913 by the Gage Canal Company, which delivers water to farms along Riverside's southern boundary including the California Citrus State Historic Park, located north of the dam.

The canyon contains healthy stands of typical riparian trees and shrubs, but also was plagued with stands of giant cane (*Arundo donax*). Intensive efforts to remove 170 acres of this fast-growing, water-consuming bamboo-like plant occurred in 2003, with on-going management continuing today. SAWA, a non-profit organization, is conducting on-going monitoring for increases in threatened native animal species as a result of removing giant cane and other invasive plants.

The federally endangered least Bell's vireo (*Vireo belli pusillus*) and the California gnatcatcher (*Polioptila californica*) are known to occur in the canyon (Fishing Works, 2008 and SAWA, 2005).

Prado Park Lake (El Prado Lake)

Prado Park Lake serves as the terminus of the Chino Creek Watershed, a 6,500-acre area that drains agricultural, dairy, urban and suburban properties. Also, the Lake receives treated wastewater outflow from IEUA's Regional Plant 1. The 56-acre Lake outlets to the Prado Wetlands behind Prado Dam.

CDFG stocks the lake with trout and catfish; largemouth bass, carp, and bluegill also are present. The Lake is surrounded by a San Bernardino County park that provides camping, fishing, boating, picnicking, hiking, horseback riding, playing fields, a dog training facility, a golf course, and an Olympic shooting range.

Much of the Chino Creek Watershed, including Prado Park Lake, is listed on the 303(d) list for pathogens. The Regional Board is in the process of developing a TMDL for the middle SAR, an area that includes Prado Park Lake (Prado Regional Park, 2008 and Press Enterprise, 2003). Water quality is monitored jointly by OCWD, IEUA, and the surrounding Cities of Chino and Chino Hills.

Lake Norconian

Lake Norconian, a 60-acre man-made lake, was constructed in 1928 as part of the Norconian Resort. The resort was popular by those visiting for the mineral hot springs. In the 1930s, the resort was converted into a naval hospital, and then into a naval weapons testing site and the California Men's Rehabilitation Center, part of the California prison system. Although the resort hotel is now abandoned, the Lake and grounds are maintained by the Navy. The Norco Regional Conservancy is a non-profit organization with two specific projects, one being the Lake Norconian Club Foundation, who is working to get the property renovated and keep it from being demolished.

Lake Evans (Fairmount Park)

Lake Evans in downtown Riverside is the man-made terminus of Springbrook Wash. The wash begins to the east in the Box Springs Mountains. Lake Evans has an outfall directly into the SAR. The Lake is surrounded by Fairmount Park and split by roads into three lakes; two small and one large. The Lake and adjoining park was designed by park designer F.L. Olmsted. The Lake was an early multi-benefit project, developed for a dual purpose of flood retention and the provision of recreational amenities. Recently, the Lake was dredged to improve water quality. The Lake and surrounding park is owned and managed by the City of Riverside through the Parks, Recreation and Community Service Department.

Lower Santa Ana River Watershed Lakes

Anaheim Lake

Anaheim Lake is a key component of north Orange County's water supply system serving as a groundwater recharge facility. The Lake is located in the City of Anaheim and covers approximately 75 acres. Anaheim Lake was originally opened in 1969 for recreational fishing and quickly became one of the most popular fishing spots in all of southern California. Anaheim Lake is owned and managed by OCWD as a groundwater recharge facility.

Irvine Lake

Irvine Lake is located within the Santiago Creek Watershed in the west-facing foothills of the Santa Ana Mountains. The Lake was created when the Santiago Dam was constructed in 1931 to create a reservoir for local agricultural use. Irvine Lake captures runoff from a 63 square mile watershed and also is used to store untreated imported water from MWD. The 25,000 AF Lake is an important regional water storage facility, as well as a recreational amenity offering boating and fishing.

Irvine Lake covers approximately 580 acres and is primarily surrounded by lands within the Nature Reserve of Orange County, a permanently protected 38,000-acre reserve system. It is located adjacent to the Cleveland National Forest. Surrounding habitat includes typical riparian species, native and exotic grassland, and small areas of oak woodland habitat. This area is impacted by recreational use, wildfires that occur too frequently to allow native plant communities and animal populations to reestablish, and exotics and invasive plants that are difficult to eradicate (IRWD, 2008 and Irvine Lake, 2008).

Peters Canyon Reservoir

Peters Canyon Reservoir is located in Peters Canyon Regional Park (354 total acres) in the City of Orange, which is within the permanently protected lands of the Nature Reserve of Orange County. A wildlife undercrossing allows for connectivity between the park and conservancy lands on the eastern side of the transportation corridor. The reservoir is owned by the County of Orange, and is currently operated by the Orange County Flood Control District to provide runoff storage and flood control for the communities surrounding the reservoir. Irvine Ranch Water District (IRWD) is evaluating the use of the reservoir for recycled water storage. Outflows from the reservoir to Peters Canyon Wash occur infrequently and are regulated by the County. Stormwater exits the reservoir through an outlet pipe to Handy Creek. Water levels can be lowered in case of emergency related to the integrity of the dam, or as a vector control mechanism.

The surrounding publicly accessible park offers a variety of trails; public amenities; and recreation opportunities for hikers, mountain bikers, and equestrians. It is surrounded by development and a major arterial roadway. Recreation activities in the reservoir are prohibited.

Surrounding the open water reservoir is a narrow band of freshwater marsh dominated by cattail (*Typha* sp.) and rushes (*Scirpus* sp. and *Juncus* sp.). Mule fat (*Baccharis salicifolia*) scrub communities, which includes sweet fennel, saltgrass (*Distichlis spicata*), and western ragweed (*Ambrosia psilostachya*) buffer the freshwater marsh habitat. Peters Canyon Regional Park supports a variety of vegetation communities and land covers, including coastal sage scrub, riparian, freshwater marsh, and grasslands. A black willow (*Salix gooddingii*) riparian forest community is present amongst mule fat, poison oak (*Toxicodendron diversilobum*), mugwort (*Artemisia douglasiana*), and nutsedge (*Cyperus* sp.).

The upper Peters Canyon area is 55 acres of abandoned agricultural operations containing non-native grassland and some habitat restoration of coastal sage scrub. It also is a source of sediment deposition in the reservoir.

Syphon Canyon Reservoir

The Syphon Canyon Reservoir, was created by the impoundment of an unnamed drainage in the Santa Ana Mountains near the southern edge of Loma Ridge between Hicks and Bee Canyons in the City of Irvine, and was used for recreational fishing. IRWD is evaluating the conversion of the reservoir to recycled water storage. Aquatic recreation activities are now prohibited within the storage reservoir. The reservoir continues to provide irrigation water storage for agricultural uses. The Syphon Canyon Dam is located at the southern side of the reservoir and controls outflows from the reservoir to downstream agricultural lands.

The surface area is approximately 65 acres, and when constructed, had a capacity of 1,090 AF (DSOD, 2008). The catchment area draining to Syphon Canyon Reservoir is approximately 186 acres (DSOD, 2008). This area includes open space area directly surrounding the reservoir, between Bee Canyon and the Eastern Transportation Corridor. Like Peters Canyon Reservoir and Irvine Lake, Syphon Canyon Reservoir is within the permanently protected lands of the Nature Reserve of Orange County. Previous land use of the area was citrus orchards.

The surrounding open space covers approximately 27 acres and the topography ranges from gentle slopes to steep, south-facing slopes located immediately west of the reservoir. Syphon Canyon Reservoir supports upland and riparian vegetation communities and land covers. The vegetation communities have developed as a result of habitat restoration activities as part of the Foothill (241) and Eastern (241, 261 & 133) Toll Roads mitigation. A coastal sage scrub community dominated by California sagebrush, California buckwheat, white sage (*Salvia apiana*), black sage (*Salvia mellifera*), bush sunflower, and prickly pear cactus surrounds the open water reservoir. Immediately adjacent to the open water reservoir is most likely a narrow band of freshwater marsh similar to that found at Peters Canyon Reservoir. A small riparian community dominated by willows and mule fat occurs in the northeastern portion of the study area (Dudek, 2008).

Laguna Lake

Laguna Lake is located at Laguna Park within the City of Fullerton, and is the only public lake in the city. Laguna Lake is now open to the public and is being stocked for fishing. The Lake restoration and trail improvements recently have been completed. Trail improvements also were completed, which included new fencing, trees benches, and tables. The Lake is now stocked on a regular basis by CDFG. Cormorants have been spotted near the lake.

Laguna Lake Park opened in 1952 and provides recreational services to the public such as fishing, biking, and hiking. By the mid-1990s, the Lake, originally up to 11 feet deep, had decreased to five feet as the result of sedimentation. The purpose of the Lake restoration was to protect the coastal water quality from the toxic sediment that has accumulated in the lake, which drains to the ocean after storms. This renovation also included vegetation management and the construction of a new aeration system to protect water quality.

Rattlesnake Reservoir

Rattlesnake Reservoir is an open reservoir, roughly 3,200 feet long and up to 1,600 feet wide within IRWD's non-potable water system. It is located in the San Diego Creek Watershed in the foothills of the

Santa Ana Mountains, south of Loma Ridge. It was originally constructed for agricultural irrigation and receives winter flows from Rattlesnake Creek. The eastern edge of the reservoir lies within the Nature Reserve of Orange County.

Vegetation immediately adjacent to the reservoir consists of herbaceous riparian vegetation and wetland species adapted to the fluctuating shoreline such as California rush (*Scirpus californicus*), southern cattail (*Typha* domingensis), rabbitfoot grass (*Polypogon monspeliensis*), great-water speedwell (*Veronica anagallis-aquatica*), hairy willow-herb (*Epilobium ciliatum*), bristly ox-tongue (*Picris echioides*), willow smartweed (*Polygonum lapathifolium*), cocklebur (*Xanthium strumarium*), nutsedges (*Cyperus* sp.), spikerush (*Eleocharis* sp.), and duckweed (*Lemna* sp.).

Beyond this initial zone lies an extensive area of willow riparian scrub, particularly along the northern and eastern ends of the reservoir. The willow riparian scrub is dominated by arroyo willow (*Salix lasiolepis*) and black willow (*Salix gooddingii*) with lesser amounts of mulefat (*Baccharis salicifolius*). Understory species included those also found in the herbaceous riparian habitats.

Hillsides in the vicinity of the reservoir support either coastal sage scrub or avocado orchards. The coastal sage scrub is dominated by California sagebrush (*Artemisia californica*), bush buckwheat (*Eriogonum fasciculatum*), black sage (*Salvia mellifera*), white sage (*Salvia apiana*), coast prickly pear cactus (*Opuntia littoralis*), and coastal cholla (*Opuntia prolifera*).

Sand Canyon Reservoir

Sand Canyon Reservoir, an open reservoir in the San Joaquin Hills of the San Diego Creek Watershed, is used to store recycled water for IRWD's service area. It is approximately 1.1 miles long and up to 600 feet wide.

Vegetation immediately adjacent the reservoir consists of herbaceous riparian vegetation and wetland species adapted to the fluctuating shoreline such as California rush (*Scirpus californicus*), southern cattail (*Typha* domingensis), rabbitfoot grass (*Polypogon monspeliensis*), great-water speedwell (*Veronica anagallis-aquatica*), hairy willow-herb (*Epilobium ciliatum*), bristly ox-tongue (*Picris echioides*), willow smartweed (*Polygonum lapathifolium*), cocklebur (*Xanthium strumarium*), nutsedges (*Cyperus* sp.), spikerush (*Eleocharis* sp.), and duckweed (*Lemna* sp.).

Willow riparian scrub can be found along the corridors, particularly along the upstream end of the reservoir and downstream of the spillway. The willow riparian scrub is dominated by arroyo willow (*Salix lasiolepis*) and black willow (*Salix gooddingii*) with lesser amounts of mulefat (*Baccharis salicifolius*). Understory species included those also found in the herbaceous riparian habitats.

Riparian

Current Conditions

Santa Ana River, Reaches Five and Six

The upper most reach of the SAR, Reach Six, extends 18 miles from the headwaters of the river below Big Bear Lake Dam to the Seven Oaks Dam (EPA, 2004). The water quality in this reach tends to be of higher quality than other river reaches, as it receives a substantial amount of water from mountain snowmelt and runoff from the least developed region in the Watershed. Impaired water bodies do contribute to this reach including Big Bear Lake and Knickerbocker, Summit, and Rathbun Creeks. However, according to the 2004 National Assessment Database, categories such as wildlife habitat and

drinking water supply potential remain listed as non-threatened (EPA, 2004). Predominant species in Reach Six include both the lodgepole pine (*Pinus contorta*) and yellowpine (*Pinus echinata*); the yellow pine forest contains Jeffrey pine (*Pinus jeffreyi*), Ponderosa pine (*Pinus ponderosa*), black oak (*Quercus kelloggii*), and a variety of willows (*Salix spp.*).

Reach Five of the SAR extends 51.6 miles from the Seven Oaks Dam to the San Jacinto Fault line, which is marked by the Bunker Hill Dam. The water quality of Reach Five is currently lower than that of Reach Six. According to EPA, water recreation, wildlife habitat, and overall use of the water body are considered "threatened" in the reach (EPA, 2004). One of the reasons for lower water quality likely is that several tributaries to Reach Five are considered impaired including Mountain Home Creek, Mill Creek, and Lytle Creek. In addition to impaired streams, land surrounding this reach also has experienced two rounds of recent major wildfires, one occurring in 2003 and the other in 2007.

The prevalent habitat along this reach is fire and flood adapted. However, this pattern has been disrupted by urban development in the valley region. Pollution caused by runoff after fires can have devastating effects on populations of threatened and endangered species and sources of drinking water located downstream in the Watershed. The Santa Ana speckled dace, the California Mountain yellow-legged frog, and the Santa Ana sucker all likely have been impacted by fire in the San Bernardino Mountains. In addition to fire damage, Reach Five also has experienced runoff pollution as a result of human activities including direct dumping of trash in these rural areas. The hydrology has been altered and increased runoff also has occurred due to the increase in the percentage of pervious surfaces in this urban/suburban area.

This reach tends to be dry most of the year, only flowing during stormflows. The channel is largely operated as a flood control facility. The extreme lower end of this reach is wetted by rising groundwater and intermittently, San Timoteo Creek flows (City of Colton). The vegetation of Reaches Five and Six include coastal sage scrub, chamise chaparral (dominated by *Adenostoma fasciculatum*), mixed and semi-desert chaparral, conifer woodland forest, pinyon-juniper forest, and a very small percent of riparian habitat. According to the California Rare Plant Society, there are over 20 species of rare plants in this area including Mount Gleason paintbrush (*Castilleja gleasonii*) and lemon lily (*Lilium parryi*).

Santa Ana River, Reach Four

Reach Four of the SAR begins at the Bunker Hill Dam, extending to Mission Boulevard Bridge in Riverside. The Bridge marks the upstream limit of rising water induced by the flow constriction in the Riverside Narrows. Until about 1985, the reach was mostly dry. Flows are now perennial because of discharges from local POTWs. Much of this reach also is operated as a flood control facility. Reach Four is home to several threatened and endangered species including the southwestern willow flycatcher (*Empidonax traillii extimus*) and the Santa Ana Sucker (*Catostomus santaanae)*. Reach Four currently also has been designated by USFWS as critical habitat for the southwestern willow flycatcher (Anderson, 2006). Finally, the Santa Ana woolly-star (*Eriastrum hooveri*) also is found in this reach, and it is dependent upon adequate scour by stormflow.
The vegetation of Reach Four is a mix of species including alluvial sage scrub. This includes the presence of juniper (*Juniperus communis*), cottonwood (*Populous fremontii*), buckwheat (*Eriogonum annuum*), yucca (*Yucca schidigera*), mulefat (*Baccharis salicifolia)*, and California wild rose (*Rosa californica*).

Reach Three and Chino Basin Surface Water Bodies

Reach Three of the SAR begins at the Mission Boulevard Bridge in Riverside and extends to Prado Dam in Corona. In the Riverside Narrows, rising water increase flows in the SAR. Several small tributaries (Sunnyslope Channel, Tequesquite Arroyo, and Anza Park Drain) can provide important places of refuge for native fish. Other important tributaries of Reach Three include Temescal, Chino, Mill, and Cucamonga Creeks. The water contained within and contributing to this portion of the SAR including Chino Basin, Chino Creek, Mill Creek, and the rest of Reach Three is classified as impaired. This impairment may be the result of the land use surrounding this portion of the river. At one time, land surrounding this Reach contained the highest concentration of dairy animals in the world (SWRCB Fact Sheet). There still are significant numbers of dairy animals in this area, but a number of programs and projects have been implemented to reduce agricultural runoff from reaching surface waters.

Reach Three is home to a variety of vegetation communities, including riparian woodlands, grasslands, coastal sage scrub, and southern oak woodlands; of these, the two latter communities are considered "sensitive" habitat. Reach Three also houses several sensitive species of fauna including the Arroyo chub, currently listed as a "species of concern" in the State of California. The Reach Three region also contains a unique geologic formation known as the Delhi Sands. The Delhi Sands is the largest remaining sand dune system within the Los Angeles Region. This formation hosts several rare flowers, pocket mice, butterflies, and an isolated population of the federally-endangered Delhi Sands flower-loving fly (*Raphiomidas terminatus abdominalis*).

San Jacinto River

Surface water in this reach is supplied from groundwater, imported water, surface water, and recycled water sources. Major issues along the SJR include groundwater salinity and reliance on imported water supplies, especially because groundwater supply is threatened by high TDS and nitrate concentrations. The largest problem identified in groundwater pollution of the SJR Watershed is the effect of dairies in the region (SAIWP, 2005). Failed, leaking, or abandoned septic tanks also have been identified as a source of pathogen pollution.

Like the Chino Basin and Reach Three, water bodies are impacted by animal feeding operations in the area. The land use in the immediate area of the San Jacinto Basin contains 50,000 dairy animals generating manure, waste water, and stormwater runoff.

Significant portions of the San Jacinto Basin are devoted to agricultural cropland and grassland, consisting of predominantly winter annual grasses, forbes, and subshrubs. Foothill vegetation consists mostly of evergreen species well adapted to withstand drought. Chaparral vegetation is dominated by chamise (*Adenostoma fasciculatum*) and scrub oak (*Quercus dumosa*). Coastal sage scrub type vegetation dominates the Santa Ana Mountain Range. Canyons and riparian sites produce oak (*Quercus spp.*), and cottonwood (*Populous fremontii*) trees. Above 5,000 foot elevation, the mountains are dominated by stands of Jeffery (*Pinus jeffreyi*) and Ponderosa pine (*Pinus ponderosa*) trees.

Santa Ana River, Reaches 2 & 1, and Santiago Creek Watershed

Reach Two carries all the upstream flows from Prado Dam through the Santa Ana Canyon to Orange County, where as much of the water as possible is recharged into the Orange County Groundwater Basin. The downstream end of the forebay/recharge area and, therefore, the ordinary limit of non-storm surface flows, occurs at 17th Street in Santa Ana. Reach One is primarily a dry flood control facility. This reach extends from 17th Street to the tidal prism at the ocean.
The adjoining Santiago Creek Watershed encompasses 100.6 square miles. There are many challenges to maintenance of water quality in the riparian environment of this Watershed including urbanization, human activities, and more recently, the Santiago Canyon wildfires of 2007. The vegetation of Santiago Creek includes communities such as riparian and coastal sage scrub populated with chamise (*Adenostoma fasciculatum*), lemonade berry (*Rhys integrifolia*), Monkeyflower (*Mimulus flemingii*), and Matilija Poppy (*Romneya coulterii)*.

Coyote/Carbon Canyon Creek Watershed

The Coyote/Carbon Creek Watershed is located primarily in Orange County and Los Angeles County, with a small portion in San Bernardino County. The watershed drains approximately 165 square miles of densely urbanized residential, commercial, and industrial development, and includes some areas of open space and natural lands. Near the northern border of the City of Anaheim, the Carbon Canyon Channel branches off Carbon Creek and drains to the SAR on the south (County of Orange, 1989). The flows above Carbon Canyon Dam and releases from Carbon Canyon Dam drain to Carbon Canyon Channel and the SAR.

The habitat within this heavily urbanized and developed area is limited to landscaped parks and golf courses, residential neighborhoods, transportation corridors, and flood control channels. Drainage channels generally consist of concrete-lined or otherwise concrete-armored conveyance facilities with limited aquatic or riparian (streamside) habitat. Within the Watershed; however, some areas of open space and natural lands persist. These areas include some relatively natural stream channels with intact riparian vegetation and diverse aquatic habitat, and open hillsides with remnant native plant communities. The Watershed area includes coastal sage scrub, coast live oak woodland, native grasslands, coastal dunes and salt marsh, California walnut woodlands, and riparian woodlands. The most extensive of these remnant habitats are present in Tonner Canyon, Brea Canyon, Carbon Canyon, and open areas extending west to the Whittier Hills.

San Diego Creek and Newport Bay

San Diego Creek and the Upper Newport Bay Ecological Reserve are two major waters listed as impaired due to water quality impacts from nutrients. Nutrient loads from the agricultural, residential, and commercial land uses, as well as from point source discharges flow from upper San Diego Creek into the lower Creek and upper Newport Bay. The nutrient-laden loads cause algal blooms and eutrophic conditions in poorly flushed areas of the watershed.

The San Diego Creek Watershed is 122 square miles with over 380 linear miles of ephemeral, intermittent, and perennial streambed. Riparian habitat can be found along portions of the major stream systems including San Diego Creek, Serrano Creek, Borrego Canyon Wash, Peters Canyon Wash, and Hicks Canyon Wash.

Over the past 50 years the watershed has transitioned from an agricultural area to a developed urban area. Once-stable channels have significantly eroded. More severe winter storm seasons, such as the El Niño winter of 1997-98, have impacted channel stability. In that year alone, several hundred thousand cubic yards of material deposited in the bay, and watershed channel basins were filled to capacity. Channel erosion, including incising and loss of bank slopes, were clearly evident along Serrano Creek and other tributaries to the bay (SD/NBWSP, 1999).

Newport Bay is mainly fed by San Diego Creek and Bonita Creek. San Diego Creek alone accounts for about 80% of the Newport Bay Watershed area and is responsible for over 90% of the sediment delivered to the Bay. Newport Bay is home to several distinctive vegetation communities including low marsh, middle marsh, high marsh, upland, riparian, and freshwater marshes; and salt panne habitats populated by species including cordgrass (*Spartina foliosa*), pickleweed (*Salicornia virginica*), marsh jaumea (*Jaumea carnosa*), and turtleweed (*Batis maritime).*

Current Management Strategies

	Santa Ana River Watershed-wide plans	Upper Santa Ana River Watershed (Big Bear Lake headwaters to Prado Dam)	Lower Santa Ana River Watershed (Prado Dam to Ocean)	Chino Basin and surface water bodies	San Jacinto River Watershed	Coyote/ Carbon Canyon Creek	Santiago Creek and Newport Bay
Watershed/ Area Management Plans	Santa Ana River Basin Water Quality Control Plan; Watershed Management Initiative	The Upper Santa Ana Wash Plan; The Upper Santa Ana Integrated Regional Water Management Plan		OBMP; Chino Basin Maximum Benefit Plan;	San Jacinto Mountain Communities Coordinated Resource Management Plan; SJR Watershed management plan	Coyote Creek Watershed Management Plan	Santiago Creek Watershed Special Area Management Plan; Newport Bay/San Diego Creek Watershed Management Plan
Federal/State/ County Efforts	Riverside County MSHCP(RCIP); Santa Ana River Basin Plan (SWRCB)				San Jacinto Groundwater Management Plan		
Specific Water Use Strategies				Recycled Water Program (IEUA); Regional Urban Water Management Plan (IEUA); Chino Basin Desalter Authority			
Special District/Non-Profit Efforts	IE Sustainable Watershed Program (California Resource Connections)	Inland Empire RCD arundo removal; SAWA arundo removal/least Bell's vireo monitoring	Riverside-Corona RCD arundo removal/Land use learning center; SAWA arundo removal/least Bell's vireo monitoring		SJBRCD arundo removal		The Santiago Creek Watershed Preservation and Restoration Project; Upper Newport Bay Project

Coastal Marshes, Estuaries and Open Ocean

The SAR Region, with 18 miles of coastline, includes significant coastal habitat areas within bays, estuaries, and the open ocean. This includes a national wildlife refuge, two state ecological reserves, and two areas of special biological significance (ASBS). These habitat areas have regional, statewide and national significance as they provide habitat for threatened and endangered species, as well as critical habitat for migratory species along the Pacific Flyway. They also support commercial and recreational fisheries that provide a high-quality food source, enhanced recreational opportunities, and economic value to coastal communities.

The State has afforded special protection to marine and estuarine areas through the Marine Managed Areas Improvement Act, the Marine Life Protection Act, and the California Ocean Plan, among others. The five classifications of Marine Managed Areas are defined in the Public Resources Code (Section 36700); Marine Protected Areas are a subset of Marine Managed Areas and have specific regulations that limit the take of living resources. Within this region, there are five geographic areas designated as Marine Managed Areas with further protection as Marine Protected Areas:

- Bolsa Chica State Ecological Reserve
- Upper Newport Bay State Ecological Reserve
- Robert E. Badham ASBS
- Crystal Cove State Marine Conservation Area
- Irvine Coast ASBS

In addition, the coastal area includes the 920-acre Seal Beach National Wildlife Refuge and the 25-acre Talbert Marsh near the mouth of the SAR.

Marine habitat is affected by natural and human-caused factors including shifts in oceanographic conditions and human activities. Climate patterns, such as short-term conditions associated with El Niño, La Niña, and long-term climate changes impact habitat and the presence of species.

Growth and development within the Watersheds also has influenced coastal ecosystems, primarily due to water quality and recreational uses. Most of these coastal habitat areas are receiving waters for runoff from the developed areas; as a result, they are impacted by pollutants and sediment.

The open ocean section, also known as the pelagic zone, extends 12 nautical miles from the shore. This zone has a rich and varied habitat that supports a diversity of marine life.

Current Conditions

Seal Beach National Wildlife Refuge

The 965-acre Seal Beach National Wildlife Refuge is located on the Seal Beach Naval Weapons Station in Orange County within the Anaheim Bay-Huntington Harbor Watershed. Formed through a partnership between the USFWS and the Department of the Navy, this refuge was established to protect the endangered California least tern, light-footed clapper rail, and to provide quality habitat for California brown pelican, Peregrine falcon, and Belding's savannah sparrow. The purpose of Seal Beach National Wildlife Refuge is to provide for the conservation, protection, and propagation of native species of fish and wildlife including migratory birds that are threatened with extinction.

About 740 acres of the Refuge are subject to regular, unobstructed tidal influence supporting 565 acres of salt marsh vegetation, 60 acres of intertidal mudflats, and 115 acres of tidal channels and open water. Another 160 acres of the Refuge have been restored, providing a combination of coastal salt marsh, mudflat, open water, and upland habitats.

The restored coastal wetland areas, which experience some degree of tidal muting, support a diverse array of marine and avian species. The remaining portions of the Refuge (about 65 acres) consist of uplands, developed areas, and roads. A few of the Refuge's upland areas are considered potential sites for salt marsh restoration, while other areas may provide opportunities for restoring native wetland/upland transition areas that would benefit a variety of bird and sensitive plant species.

The extensive sub-tidal habitat on the Refuge supports a diverse array of fish, benthic invertebrates, and other marine organisms. These species provide important food sources for migratory birds and marine organisms including species important to commercial and recreational fishing interests.

The Refuge supports three federally listed species including the endangered California brown pelican, light-footed clapper rail, and California least tern. Clapper rails and least terns, as well as the state listed endangered Belding's savannah sparrow, nest and raise their young within the boundaries of the Refuge.

Bolsa Bay

The Bolsa Bay encompasses approximately 1,600 acres including the Bolsa Chica lowlands with a 1,350 acre State Ecological Reserve. The Ecological Reserve extends along the east side of Pacific Coast Highway in the City of Huntington Beach from Warner Avenue to Seapoint Avenue. This area is designated as a State Marine Park, and therefore, is a Marine Protected Area.

The Bolsa Chica lowlands receive tidal influence from the Pacific Ocean through a direct connection to the Pacific Ocean that was re-established in 2006. There were two existing nesting areas within the State Ecological Reserve; as part of the restoration, three additional nesting areas were created on 20 acres within the site to establish additional habitat for threatened and endangered species. The special status species that are present include the Federal and State listed endangered California least tern (*Sterna antillarum browni*) and light-footed clapper rail (*Rallus longirostris levipes*), federal threatened western snowy plover (*Charadrius alexandrinus nivosus*), and the state endangered Belding's savannah sparrow (*Passerculus sandwichensis beldingi*). Cordgrass habitat is being established to support the clapper rail population.

Huntington Beach Wetlands

The Huntington Beach Wetlands are located in the city of Huntington Beach between the SAR and Beach Boulevard along the eastern side of Pacific Coast Highway. The wetland area is divided into six parcels by Southern California Edison power plant, mobile home sites, roadways, and flood control levees. This includes the 25-acre Talbert Marsh located adjacent to the SAR. The Talbert flood control channel was reconfigured to flow through this restored marsh. It is the only area within the Huntington Beach wetlands that has been restored. The remaining five parcels of degraded marsh and uplands are designated as coastal conservation, coastal zone, and floodplain. The Huntington Beach flood control channel is leveed adjacent to these five sites. At this point, only the Talbert Marsh has

been restored to full tidal action. The wetlands characteristics of the remaining unrestored marsh areas are maintained through fluctuations in the local water table, direct precipitation, and limited urban runoff.

Tidal action was restored to Talbert Marsh in 1989. This restoration project included relocation of the Talbert Channel ocean outlets, development of intertidal mud-flats, and refuge islands. Numerous other studies have been completed on part or all of the various six sites to determine the potential for restoration, with limited results.

Within Talbert Marsh, habitat is primarily salt marsh with brackish/freshwater conditions, mudflats, and some open water areas. Cordgrass is present. Beneficial uses include REC1, REC2, BIOl, Wild, Rare, MAR, and EST.

Newport Bay

Newport Bay is comprised of lower and upper Newport Bay. Lower Newport Bay is surrounded by development, and is used primarily for recreational boating. Upper Newport Bay begins at the Pacific Coast Highway Bridge and extends inland to the mouth of the San Diego Creek. The upper Bay is surrounded by high bluffs and contains a State Ecological Reserve, as well as a nature reserve. The upper Bay is primarily a salt marsh with freshwater inflows from San Diego Creek, the Santa Ana-Delhi Channel, local springs, and local area drainage. The salt marsh habitat is directly influenced by the tides. The low marsh areas are dominated by cordgrass. The middle marsh ecological community is dominated by common pickleweed, while the high marsh areas support diverse plant communities. Other habitats include open water, transitional/coastal dune, riparian/freshwater marsh, and upland vegetation.

Upper Newport Bay supports diverse habitat. Open water is used by a variety of fish, and others use the mudflats during high tide. Fish-eating birds, including the State and Federally endangered brown pelican and California least tern, forage in the bay. Intertidal areas of mudflats and low marsh serve as nursery areas for fish and forage for shorebirds including the federally threatened western snowy plover. The salt marsh provides nesting habitat for birds such as the state endangered Belding's savannah sparrow and state and federally endangered light-footed clapper rail. The upper Bay provides critical habitat for migratory species of the Pacific Flyway, and is home to the largest single population of light-footed clapper rails. Salt marsh bird's beak, a Federally endangered plant, thrives in the upper Bay's marsh areas (Corps, Upper Newport Bay Ecosystem Restoration Feasibility Study Draft EIR/EIS, May 2000).

Current Management Strategies

Current management strategies for the coastal habitat areas include planning and project implementation using the applicable regulatory context as a guide. As described above, there are numerous planning efforts underway to address resource management and protection.

- The USFWS is currently developing a Comprehensive Conservation Plan for the Seal Beach National Wildlife Refuge. A Comprehensive Conservation Plan provides a clear vision of the desired future conditions for the Refuge, and is used to ensure consistent management of the Refuge over a 15-year period. The Seal Beach National Wildlife Refuge Comprehensive Conservation Plan is expected to be complete in 2009

- In conjunction with the Bolsa Chica Lowland Restoration Project completed in 2006, the USFWS is conducting beach monitoring to ensure that the beach area ultimately reaches stabilization following the creation of the inlet. In addition, a long-term ecological monitoring program is being conducted to document the habitat improvements for fish and wildlife, the success of re-vegetation efforts, and the use of the site by endangered species. The ecological monitoring objectives are:
    - Facilitate evaluation of the effectiveness of the restoration to provide habitat for fish and wildlife
    - Document changes in the ecology of the wetlands environment over time
    - Provide timely identification of any problems with the physical, or biological development of the restored area
    - Assist in providing a technical basis for resource management of the restored wetland by documenting maintenance needs and enhancement opportunities
- The Talbert Marsh is managed by the Huntington Beach Wetlands Conservancy, a non-profit organization that works with local, State and Federal agencies to acquire, restore, and manage coastal wetlands in Orange County. Talbert Marsh is one of the most successful saltwater marsh restoration projects in the state

Constructed Wetlands

Current Conditions

Constructed wetlands have a wide range of benefits. They protect surface waters. Constructed wetlands designed to treat secondary effluent will directly affect the reclaimed water supply. If water produced from the wetlands is of suitable quality to be recharged into groundwater aquifers, diminishing groundwater resources can be supplemented, or in some areas, reclaimed water can be recharged as part of a groundwater remediation program. Located along the Pacific Flyway, the critical migratory corridor connecting Alaska and Canada to Latin America, southern California wetlands provide vital habitat for migratory waterfowl. Opportunities for wildlife enhancement were considered in the construction/preservation of many of the following wetlands with environmental features that increase habitat diversity and wildlife productivity.

Prado Wetlands

Within the 2,150 acres of land owned by the OCWD in Prado Basin, 465 acres have been modified into treatment wetlands that include a network of 50 shallow ponds. In the 1970s, irrigated agriculture fields were turned into ponds for duck hunting and later re-constructed as permanent ponds to maximize nitrate removal. The wetland system contributes significant habitat diversity to the Prado Basin, as well. They are a mix of open water, fresh water marsh, and woodland habitats that harbor significant populations of birds, particularly waterfowl.

San Jacinto Wetlands

The Hemet/San Jacinto Multi-purpose Constructed Wetlands was designed to focus on reclaimed water treatment, migratory, and resident waterfowl and shorebird habitat enhancement, wildlife diversity, and public education, as well as recreation opportunities. A cooperative effort by USBOR, the

National Biologic Service, and EMWD, the one million gallon per day system occupies about 26 acres of the 50-acre site. The design is a three phase (marsh/pond/marsh) integrated system consisting of five separate wetlands treatment units, a combined open water and marsh habitat area, and a final polishing wetlands. Secondary reclaimed water from the Hemet/San Jacinto Waste Water Plant is distributed to the five wetland treatment units, and is recombined in the central area to flow through the open pond prior to flowing through the final wetland, which combines all flows to remove biological input produced in the open water area. From the air, the system is "amoeba-shaped", and on the ground, the curved lines give the appearance of a natural system.

Stanfield Marsh

BBMWD designated the 145-acre Stanfield Marsh as a wildlife preserve in 1982. The Marsh is located at the east end of Big Bear Lake, and is separated from the main body of the Lake by the Stanfield Cutoff highway bridge. The water flows back and forth between the two bodies of water through a permeable structure under the bridge and three culvert pipes.

In 1993, a joint project with the Natural Heritage Foundation, Inc. was approved in which very specific objectives were established for improvements. The adopted wetlands enhancement project has the goal of restoring some wetlands' function and values while enhancing existing functions and uses.

Because the Marsh is subject to extreme variations in water levels and during dry cycles is devoid of water, dredging to create permanently wet basins is needed to protect the wildlife in the area during those dry cycles.

Gunnerson Pond

Gunnerson Pond is a 60-acre site located on the west edge of the Temescal Creek Floodplain one mile below Lake Elsinore, adjacent to Highway 74. The site was a Corps 1135 restoration project that restored pond and freshwater marsh habitat to an area of the floodplain that once held a private residence whose property was regularly flooded during high water events. The project was authorized under Assembly Bill 1389 in 1999 for enhanced flood control and wildlife benefits. Riverside County asserted that the Gunnerson Pond project was necessary to restore 60 acres of degraded riparian and wetland area to be used for habitat for migratory waterfowl including the endangered least Bell's vireo. The pond also serves as an overflow basin to prevent floods.

San Joaquin Freshwater Marsh Reserve

The San Joaquin Freshwater Marsh Reserve represents one of the last remnants of freshwater wetlands that once covered much of Orange County's flood plain and is located adjacent to the University of California, Irvine campus. Located in an ancient river-cut channel at the head of Newport Bay, the Reserve supports a variety of wetland habitats including freshwater marshlands, shallow ponds, and channels confined by earthen dikes. Dry upland habitats with a remnant coastal sage scrub community are found on the margins of the reserve. The marsh is a critical stopping place for 100 migratory bird species using the Pacific Flyway. Altogether, more than 200 bird species (20 nesting) have been sighted in the reserve including two resident endangered bird species, the light-footed clapper rail and the California least tern. The marsh is located within a ten-minute walk from UC Irvine, making it convenient for day use by faculty and numerous students.

San Diego Creek Natural Treatment System

The County of Orange, cities, and IRWD are taking IRWD's successful wetlands restoration program at the San Joaquin Marsh and extending it throughout the watershed. The natural treatment system is a cost-effective, environmentally sound alternative for handling dry weather runoff. In very simple terms, it will work much like the San Joaquin Marsh with smaller, man-made wetlands placed strategically in many areas throughout the watershed. Low-flow, natural, and urban runoff, as well as smaller stormflows will be diverted into man-made wetlands throughout the San Diego Creek Watershed where contaminants will be removed and prevented from reaching the upper Newport Bay. At the same time, the system will provide a natural resource, riparian habitat, wildlife, and water quality benefits throughout the Watershed.

Lake Elsinore Back Basin

Lake Elsinore sits at the bottom of a 720 square mile watershed, the area that drains into the Lake. The Watershed begins up in San Jacinto Mountains, in the Idyllwild area near Lake Hemet. Runoff, from as far away as Moreno Valley, San Jacinto, Hemet, Perris and Canyon Lake, contribute to flows that occasionally reach Lake Elsinore in very wet years. Normal rainfall in the watershed is about 11 inches per year and does not result in Canyon Lake Dam spilling. Only about one in six years does Canyon Lake Dam spill to Lake Elsinore, which often correlates to El Niño conditions; only one in 15 years results in receiving enough water to offset evaporation (15,000 AF). The Lake Elsinore Back Basin Wetland area comprises approximately 360 acres and includes the old SJR channel. There is a 48-inch conduit for fish passage, and the basin is closed at 1,243-feet elevation to retain flood storage and maintain habitat. The Old San Jacinto Riverbed was to be restored to native riparian habitat with the Cereal Street wells plumbed to the head of the old channel and a 24-inch conduit connecting the inlet channel to the historic SJR channel as an option to maintain the riparian habitat.

Shay Meadows

Shay Meadows is a 30-acre wetland on the edge of Baldwin Lake. The creation of the Big Bear Lake reservoir in 1911 resulted in the inundation of nearly 3,000 acres of meadows and wetlands, nearly half of the total regional acreage. Subsequent urbanization around Big Bear Lake's and Baldwin Lake's shores has reduced much of the remaining meadow habitat.

The drying clay soils create a saline situation, as indicated by associated halophytic species such as salt grass (*Distichlis spicata*) and *Atriplex* species. Other associated endemic species include *Castilleja cinera, Ivesia argyrocoma, Orthocarpus lasiorhynchus, Perideridia parishii, Poa atropurpurea, Haplopappas uniflora* subsp. *gossypina, Senecio bernardinus*, and *Taraxacum californicum*.

Surrounding dominant forest types include pinyon pine (*Pinus monophylla*) and western juniper (*Juniperus occidentalis*), Jeffrey pine (*Pinus jeffreyi*), and lodgepole pine (*P. contorta* var. *murrayana*) at Bluff Lake.

Vernal Pools

Vernal Pools or hog-wallows are generally small, rain-filled depressions that retain very local drainage for a prolonged period of time due to underlying hardpan, particularly heavy clay soils. The annual size and longevity of a pool varies with annual rainfall amounts and climatic conditions responsible for

evaporative rates. These seasonal wetlands fill up with rainwater and are generally dry before summer. Many vernal pool associated species are endangered.

There are vernally moist soils along SJR and Mystic Lake that support an endangered alkaline endemic plant, San Jacinto Valley Crown-scale (*Atriplex coronata* var. *notatior*). This species also is found in the upper Salt Creek vernal pool complex encompassing approximately 1,200 acres above Railroad Canyon Reservoir in the west Hemet area. A 40-acre upper Salt Creek Wetland Preserve was purchased and preserved on the west side of this complex. The preserve was established to protect native species in perpetuity to offset impacts associated with the Eastside Pipeline Project.

Alkali vernal wetlands are found mainly along the SJR between Mystic Lake and the City of Perris and in the upper Salt Creek drainage. The community is unique consisting of alkali scrub, playa, annual grasslands, and vernal pools. Over 200 vernal pools have been identified in the vicinity of Hemet alone. Here are the largest remaining populations of extremely rare plants such as the little mouse-tail, Coulter's seaside daisy, Parish's saltbush, and the threatened spreading navarretia. Once occupying approximately 32,000 acres in this area, alkali vernal wetlands occur today on no more than 7,000 acres.

One small remnant pool on the Pechanga Indian Reservation is home to endangered Riverside fairy-shrimp.

The region's largest concentration of vernal pool habitat, located at Skunk Hollow and on the Santa Rosa Plateau, are just south of the Watershed located in the drainage of the Santa Margarita River. Skunk Hollow is part of a preserve and wetland mitigation bank located in the unincorporated area of French Valley, Riverside County and consists of 138 acres of annual grassland, coastal sage scrub and vernal pool. The pool reaches a maximum size of 32 acres and is home to four listed species: the Riverside fairy shrimp (*Streptocephalus wootoni*), vernal pool fairy shrimp (*Branchinecta lynchi*), California orcutt-grass (*Orcuttia californica*), and San Diego ambrosia (*Ambrosia pumila*). The preserve also acts as a dispersal corridor for the California gnatcatcher (*Polioptila californica*) and *Quino checkerspot* butterfly (*Euphydryas editha quino*).

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Section 401 http://www4.law.cornell.edu/uscode/33/401.html

Section 1451 http://www4.law.cornell.edu/uscode/16/1451.html

Appendix A

Sources for Further Information

U.S. Army Corps of Engineers
Los Angeles District
911 Wilshire Boulevard
Los Angeles, CA 90053-2325
(213) 452-3406 or
(213) 452-3921
http://www.usace.army.mil/

Rivers and Harbor Act information can be found at:
http://ceres.ca.gov/wetlands/permitting/RHA_summary.html
http://www4.law.cornell.edu/uscode/33/401.html

Coastal Zone Management Act (CZMA)
http://ceres.ca.gov/wetlands/permitting/CZMA_summary.html
http://www4.law.cornell.edu/uscode/16/1451.html

Environmental Protection Agency
Region 9 (AZ, CA, HI, NV)
75 Hawthorne Street
San Francisco, CA 94105
(415) 947-8000 or
(866) EPA-WEST
http://www.epa.gov/

Clean Water Act websites include:
http://ceres.ca.gov/wetlands/permitting/sec404_descrip.html
http://www4.law.cornell.edu/uscode/33/1344.html

Environmental Quality
http://ceres.ca.gov/topic/env_law/ceqa/flowchart/index.html

U.S. Department of Fish and Wildlife
Carlsbad Office
6010 Hidden Valley Road
Carlsbad, CA 92009
(760)-431-9440
http://www.fws.gov/

National Marine Fisheries Service
Southwest Regional Office
501 West Ocean Boulevard
Long Beach, CA 90802
(562) 980-4000
http://www.nmfs.noaa.gov/

California Fish and Game
South Coast Regional Office
4949 Viewridge Avenue
San Diego, CA 92123
(858) 467-4201
http://www.dfg.ca.gov/

California Fish and Game Code 1600-1607
http://ceres.ca.gov/wetlands/permitting/DFG_summary.html
http://www.dfg.ca.gov/1600/1600code.html

California Coastal Commission
South Coast District Office
200 Oceangate, 10th Floor
Long Beach, CA 90802-4416
(562) 590-5071
http://www.coastal.ca.gov/

California Coastal Act (CCA)
http://ceres.ca.gov/wetlands/permitting/cca_summary.html
http://ceres.ca.gov/wetlands/permitting/tbl_cntnts_cca.html

California Coastal Conservancy
11th Floor, 1330 Broadway
Oakland, CA 94612
(510) 286-1015
http://www.coastalconservancy.ca.gov/

Mosquito and Vector Control
Association of California
660 J Street, Suite 480
Sacramento, CA 95814
(916) 440-0826
http://www.mvcac.org/

Santa Ana Regional Water Quality Control Board
3737 Main St., Suite 500
Riverside, CA 92501
(909) 782-4130
http://www.swrcb.ca.gov/

Porter-Cologne Water Quality Control Act
http://ceres.ca.gov/wetlands/permitting/Porter_summary.html
http://ceres.ca.gov/wetlands/permitting/tbl_cntnts_porter.html

Appendix B

Contributors

The following stakeholders provided data and information, wrote, reviewed and commented upon the text, and/or provided ideas and concepts for the development of the One Water One Watershed Water Environmental and Habitat Enhancement Pillar.

Autumn	Dewoody	Inland Empire Waterkeeper
Beatrice	Musacchia	OC Watersheds
Dick	Zembal	Orange County Water District
Jean	Watt	Friends of Harbors, Beaches and Parks (Orange County)
Jeff	Beehler	Santa Ana Watershed Project Authority
Jennifer	Ares	East Valley Resource Conservation District
Mandy	Parkes	Santa Ana Watershed Association
Natalie	Likens	Irvine Ranch Water District
Norris	Brandt	Elsinore Valley Municipal Water District
Pat	Boldt	San Jacinto River Watershed Council
Peter	Kiriakos	Sierra Club
Rene	Latu	Santa Ana Watershed Association
Ron	Baxter	Riverside County Parks and Recreation Department

Chapter 5.8 Parks, Recreation, & Open Space

Most park and open space areas are local amenities. The implementation of projects to develop parkland or obtain open space areas then becomes a local decision intended to serve a focused, local population, often residing within a few miles of a given developed park or open space area. On the other hand, regional parks and open space areas tend to be larger, and serve a population coming miles away from the community where the facility is located. These facilities often provide more diverse amenities than those found in locally operated park facilities, and are managed to attract visitors from a wider area. Visitors come from within the Santa Ana River Watershed (Watershed) or from adjoining areas. The diversity of available facilities may enhance the region's attractiveness to visitors and thereby provide economic growth through increased tourism. Most notably, parkland containing exceptional natural resources may attract eco-tourists looking for an opportunity to experience outdoor activities unavailable in the area in which they live. The wide variety of topography and natural resources within the Watershed provides excellent opportunities for the development of this type of tourism.

Regional park facilities also may serve an important role in the continued economic development of the region. Businesses interested in attracting highly skilled workers often use the proximity to well developed recreational resources in attracting and retaining talent. Among the amenities often considered by skilled professionals are culture and the arts, nightlife, and the availability of outdoor recreation opportunities. From the ocean to the mountains, the Watershed provides numerous opportunities for such a population.

Running through the Watershed is the Santa Ana River Trail and Parkway (SART), a regional recreational amenity linking open space areas throughout the Watershed. Models such as the SART also could be developed in other parts of the Watershed, such as in San Timoteo Canyon, along Lytle Creek, and within the San Jacinto Watershed. Completion of these linear park amenities and their connection with the existing trail backbone would create a world-class recreation system available to millions of residents and visitors. Trail and park amenities linked to the waterways within the Watershed are the focus of the following discussion.

Summary

The Parks, Recreation and Open Space Pillar brought together park, recreation, and open space advocates from the three counties, including cities, other governmental agencies, and citizens who are interested in public access relative to water resources in the Watershed. This group focused attention on the larger "picture" of opportunities. However, they consider the development of the SART as a model for the development of additional regional amenities where close cooperation across many areas and jurisdictions is necessary.

The general findings included a survey of current regional park and open space offerings and conditions. While there have been many accomplishments, especially with regard to river access, more planning, management, and coordination need to occur and be sustained. Urban development patterns, high land prices, and low availability of land for recreation make expansion of opportunities difficult. Also, new parks or trails may impact habitat with limited land remaining for public access and recreation.

Possible future threats include uneven funding for new trails and parks within the Watershed, a shortage of on-going maintenance funds, and maintaining a high level of security and care for the parks and trails.

Strategies for addressing existing threats include: 1) seeking more stable funding through assessments; 2) increased public awareness of park, recreation and open space issues; 3) development of a plan to leverage existing resources and expertise; 4) forging and maintaining partnerships; 5) improving mapping of resources; 6) curtailing vandalism by increased patrol presence; and 7) ensuring regional park master plans include proper trail and open space protections. The most important regional strategy is to fund and complete the SART. It's also imperative to help local agencies find support for their recreation needs radiating from the SART backbone. The model developed on the Mainstem of the Santa Ana River (SAR) to develop the SART can be adapted to tributaries such as San Timoteo Creek and the San Jacinto River.

Current Conditions

Description of Resource (or Management of Resource) Include Geographic Patterns

The SAR stretches approximately 100 miles from the crest of the San Bernardino Mountains to the coast of the Pacific Ocean. It is uniquely southern Californian in its beauty, hydrology, and utility. Dry in locations at certain times of the year and intermittent along its course, it long has been the focus of passionate citizens eager to see its potential realized as a destination for recreation, commerce, and the conservation of natural and scenic beauty.

The Watershed drains 1,082,540 acres from its headwaters in the San Bernardino Mountains to its terminus in the Pacific Ocean. Elevations range from 11,502 feet on the top of San Gorgonio Peak to sea level at the river's end at Huntington Beach. The river is narrow and constrained in its upper reaches and naturally would form a delta in the lower portions of the valleys. However, flood control measures and dam construction have altered the natural hydrology and geography of the river. The river is interrupted by two major dams and contains numerous areas constrained by concrete flood control improvements.

On a glorious winter's day, the Watershed is arguably one of the most beautiful places on earth. Snow-capped peaks and azure skies provide the backdrop for velvety-green foothills and citrus groves laden with orange and yellow fruits. Much of this region is still wild and provides a refuge for those plants and animals that thrive in such unaltered conditions. The Watershed with its unique location between desert, mountains, and sea, encompasses a complex blend of terrain, climates, and habitats, and consequently contains a wealth of outdoor recreational opportunities.

Current recreation opportunities in the Watershed include bicycling, hiking, walking, rock climbing, geocaching, bird watching, horseback riding, and organized team and individual sports. The availability and level of participation in such activities is dictated by terrain, the location within the Watershed, and degree of urbanization. For example, approximately 20% of the Watershed is within the San Bernardino National Forest. Recreational opportunities in this area are much different than in highly urbanized areas such as the cities of San Bernardino and Huntington Beach. In the upper Watershed, hiking, rock climbing, and mountain biking are very popular on national forest lands. In the lower, more urbanized areas in the Watershed, jogging and cycling are more common as well as organized sports such as soccer and baseball. Sports fields are located adjacent to the river along its length.

The centerpiece of recreation in the Watershed is the SART, a 100-mile long trail currently under development, extending from the crest of the San Bernardino Mountains to the coast of the Pacific Ocean. The trail runs through three counties, 15 cities, and multiple special jurisdictions. The trail is approximately 65% complete with plans to complete the remaining portions over the next five years (**Table 5.8-1**).

Table 5.8-1 Status of Santa Ana River Trail and Parkway (by County)

County	Completed (miles)	In Construction (miles*)	Planned (miles*)
San Bernardino	7	0	14.0
Riverside	12	0	21.0
Orange	24	0	4.5
Total Miles	**43**	**0**	**39.5**
*Mileages are approximate and do not include earthen trail in San Bernardino National Forest.			

The SART, shown below in **Figure 5.8-1**, is a common thread through each county, and **Figure 5.8-2** lists the recreational opportunities available in the Watershed. **Table 5.8-2** describes each county's unique set of recreational resources.

Figure 5.8-1 Santa Ana River Trail Parkway

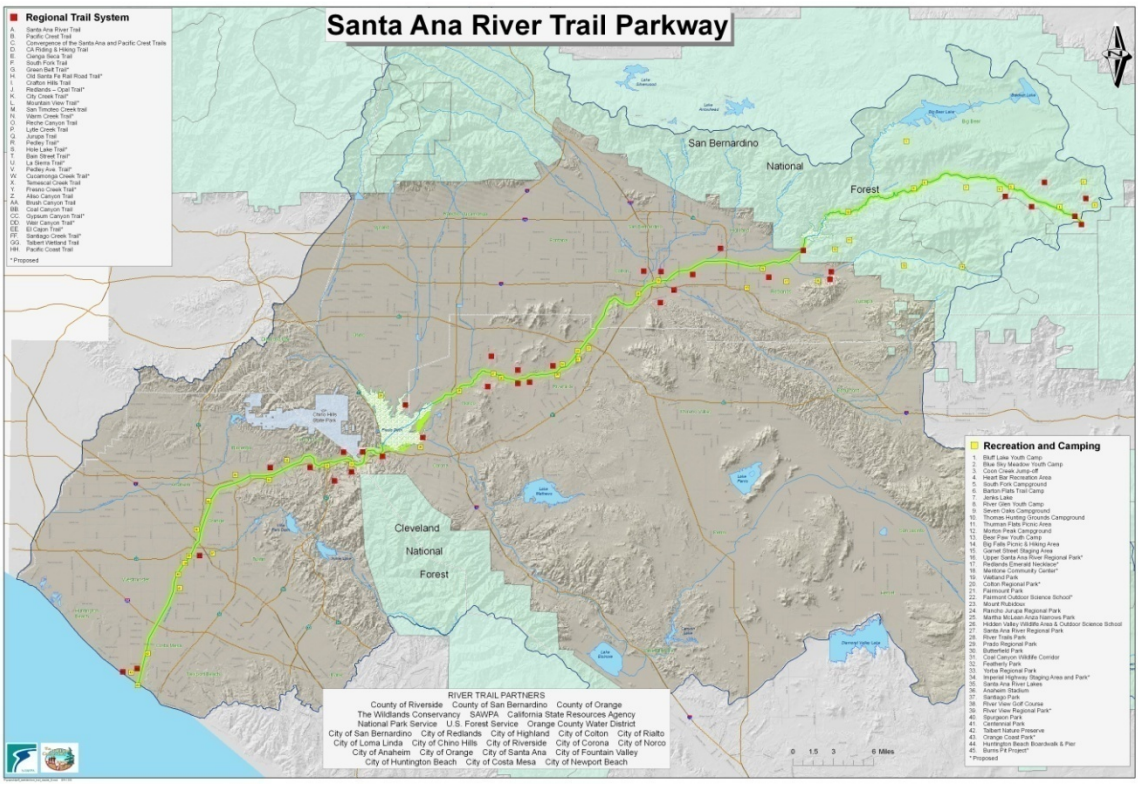

Figure 5.8-2 Recreational Opportunities within the Watershed

Table 5.8-2 Regional Recreational Resources by County

County	Name and Location of Recreational Resource	Description of Resource and Available Activities
San Bernardino County	San Bernardino National Forest	Approximately 672,000 acres 352 miles of trails Camping, fishing, hiking, equestrian, skiing, outdoor education, biking, target shooting and motorized sports
	Chino Hills State Park Chino Hills	6,000 acre park Mostly open space Hiking, bird watching, mountain biking
	Wildwood Canyon State Park Yucaipa	Under development 1,200 acres currently; plans to expand to 5,000 acres and to develop trails and campgrounds
	County Parks: Glen Helen, Prado Basin, Cucamonga Guasti, Lake Gregory, and Yucaipa	Approximately 4,500 acres total Camping, fishing, swimming and general day use
	City Parks: Cities of Chino, Chino Hills, Redlands, San Bernardino, Colton, Highland and Loma Linda	Various locations, facilities and acreages with mostly urban uses
	Rails to Trails Upland and Fontana	
	Wildlands Conservancy Los Rios Rancho, Oak Glen	6,000 acres of open space with hiking and outdoor educational facilities
Riverside County	County Parks: Hidden Valley Wildlife Area, Martha McLean-Anza Narrows, Rancho Jurupa, and Louis Rubidoux Nature Center	Hiking, bird watching, equestrian, camping, and outdoor education
	City Parks: Norco River Trails, Mt. Rubidoux Park, Fairmount Park, and Butterfield	Various locations, facilities and acreages with mostly urban uses

Table 5.8-2 Regional Recreational Resources by County (continued…)

County	Name and Location of Recreational Resource	Description of Resource and Available Activities
Orange County	County Parks: 3 regional parks along SART	
	City Parks: 9 City parks along SART	
	Burris Basin currently under development	
	Existing equestrian facilities: Rancho Del Rio and Singletree Farms	
	SART bikeway: 27 miles complete Riding and hiking trail: 23 miles complete	
	Talbert Marsh	Multi-purpose trail on 25 acres. Bird watching
	Upper Newport Bay State Ecological Reserve/Interpretive Center	Bird watching, outdoor education, biking, and walking
	Irvine Ranch Wildlands and Parks	Hiking, equestrian, outdoor education, and mountain biking
	Bolsa Chica Ecological Reserve Bolsa Chica State Beach	300 acres Outdoor education, hiking, biking, bird watching, and camping

Regional Strengths, Threats, and Weaknesses

Physical

One of the great strengths of the region is that each county is geographically distinct, providing a variety of recreational opportunities. However, this diversity in topography also creates some threats and challenges. The biggest threat to recreation in the region is arguably patterns of urban development. The upper portion of the Watershed, in San Bernardino County, is mountainous and relatively less populated than other areas in the Watershed. The lower valleys are more urban with a discernible pattern of higher density near the coast. However, recently, relatively lower land values inland have resulted in increasing urbanization in these areas. Open space is being converted at a rapid pace, reducing opportunities to establish large parks and natural recreational amenities. The result most likely will be the development of more urban parks, which will support more urban recreational activities.

The upper portion of the Watershed being mountainous, results in a diversity of activities associated with forested environments. These include skiing, camping, hiking, rock climbing, and fishing. The middle portion of the Watershed is relatively flat, valley terrain and is more densely urbanized. Activities in these areas include walking, jogging, bike riding, and horseback riding. Also, activities associated with more urban environments such as organized team sports played on developed fields, are more common in these areas.

The proximity of the ocean in the lower parts of the Watershed is a draw for outdoor recreation in Orange County. The beach provides recreational opportunities found nowhere else in the Watershed. This is a strength, in that unique activities are available, but also a weakness in that the area is heavily used and requires additional maintenance and management. Facilities require greater upkeep and the potential for conflicts among users is higher here than elsewhere.

The presence of the Prado Dam in the center of the Watershed also creates some unique challenges and opportunities. The area behind the dam is a largely undisturbed wetland, habitat to a number of threatened and endangered bird species. Bird watching is popular in this area, but access is challenging. Additionally, the river below the dam has water year round, providing recreational opportunities such as boating and fishing. The river upstream of the dam is more intermittent and does not offer these same opportunities in the same way.

The presence of the SART and various state and regional parks adjacent to the river along its course, provide a ready-made infrastructure on which to build future trail linkages. There are few recreational trails adjacent to water in Riverside and San Bernardino counties, but opportunities exist to develop recreational amenities at flood control facilities.

Institutional

All counties and cities in the Watershed have some type of park and recreation management agency in place. These agencies provide an existing framework from which to plan and implement future projects. Several working groups currently exist to address specific issues that also provide forums from which to collaborate. Additionally, many agencies have developed management plans for various parks and resources under their purview. For example, most cities have master plans that reference recreation along the river. A major institutional strength is that most of the agencies currently cooperate and maintain good working relationships with each other as they endeavor to build trails.

Most all of the cities in the watershed have completed or are in the process of completing some type of vision document for the Santa Ana River Trail within their jurisdictions. Sponsored mainly by the Wildlands Conservancy, these “blue ribbon” committees have assembled stakeholders in each city to craft a vision for recreation adjacent to the river. Each city will have a document that can be used to guide future recreational development.

Private institutions, such as the Wildlands Conservancy, located in San Bernardino County, provide key private support and involvement. Wildlands Conservancy has provided critical and substantial funding and works effectively with government agencies to further outdoor recreational and educational programs. Other groups, such as the Crafton Hills, Yucaipa Valley, San Bernardino Mountain, and Riverside land conservancies are working with their own contacts and partners to acquire lands, build connecting trails, and encourage elected officials to make recreation and open space a priority.

The SART Partnership, a relatively new collaboration between public and private entities on the Watershed also has been effective in bringing about funding and planning in the Watershed. In 2006, the three counties, SAWPA, and the Wildlands Conservancy signed a Memorandum of Understanding to form the SART Collaborative Partnership. This group brings political will to bear and directs the agencies under its umbrella to coordinate, find funding, and leverage resources to finish building the SART. This group has developed the first regionally adopted plan for completing the unfinished segments of the trail.

Many of the group's participants felt that lack of funding to implement management plans was a widespread problem. Much of the funding focused on non-native species removal, such as Arundo donax. The group also expressed that funding was available for new park development, but not for maintenance and operations. Many expressed the need for acquiring lands to expand or build new facilities.

Identification and Implementation of Strategies to Improve Resources

More collaboration is needed in all counties. Some strategies include reaching out to businesses and partnering with them to make trails their "front yard" and encourage them to take care of them. Businesses also should be courted to provide more services along the trails. Working with entities such as business councils, developers, and chambers of commerce will bring in new partners. Additionally, all participants voiced the need to work cooperatively to provide more trail linkages, staging areas, and access points including more links, loops, and crossings.

Security is a concern and is more problematic in some areas than others.

There are various strategies that the group developed to improve recreational resources in the Watershed is listed in **Table 5.8-3**.

Additionally, these strategies led to the identification of specific projects. **Table 5.8-4** lists those projects that were identified as priorities in the workshop for each county.

Table 5.8-3 Description of County Strategies to Improve Recreational Resources in the

County	Strategy	Description
San Bernardino County	Park and open-space assessment	Need to assess parks and trails for new growth and use.
	Facility expansion	Use existing easements or acquire new lands for new facilities. Provide linkages to other trails and connections. Use other agencies' facilities (e.g., flood control) to provide recreational opportunities.
	Public relations and education effort	Develop marketing campaign to identify various resources within watershed. Host celebrations for agencies to share vision and progress. Develop a watershed "phone book" and update it annually.
	Partnerships	Develop and exercise more collaborative partnerships (e.g., transportation agencies, developers, and land-use agencies).
Riverside County	Interagency coordination	Establish a centralized clearinghouse for information to prevent duplicity, identify common agendas, and integrate watershed, recreation, planning and wildlife needs. Water districts and park agencies should partner. Water facilities should be used for recreation.
	State and Federal support	Hire regulatory lobbyist to influence State and Federal regulation development.
	Public involvement	Establish "adopt-a" programs for trails and open space. Create a website for the integrated effort. Create and tend volunteer forces.
	Funding	Develop new funding sources. Provide more funds for operations and maintenance. Partner with other agencies to pursue grant opportunities.
	Mapping	Map all existing regional and community trails in unincorporated areas.
	Illegal activity control	Develop and fund programs to control for vandalism, illegal dumping, and graffiti.
Orange County	Support from leaders	Get commitment from decision-makers and staff at all levels. Get partners (e.g., railroad, transportation, parks) to agree on priorities.
	Development	Engage business councils and tourism groups to assist. Engage development and redevelopment agencies in all counties.

Table 5.8-4 Project Identification by County

County	Project Name	Description
San Bernardino County	Pine Avenue Corridor	Develop wildlife corridor and trail connections at Pine Avenue.
	Regional Park	Develop a regional park and master plan with wildlife corridors.
	Upper Santa Ana River Wash	Develop a park and trail for recreation in the Upper Santa Ana River Wash.
	San Timoteo Park	Acquire lands and complete park in San Timoteo Canyon.
Riverside County	Santa Ana River Trail	Complete the SART (include signage, linkages, and staging areas).
	Louis Rubidoux Nature Center	Update nature center.
	Regional trail linkages	Improve regional trail linkages throughout county to connect to SART.
	Riverside Canal Trail	Convert existing easement along Gage Canal to horse, bike, and pedestrian trail.
Orange County	Santa Ana River Trail	Complete gaps in bikeway, riding, and hiking trail.
	Burris Basin	Provide funding for development of park.
	Le Bard Park Access ramp	Provide ADA access ramp at OC River Park/LeBard Park.
	Trail linkages	Develop better connections to Chino Hills State Park from Green River Golf Course.
	Anaheim Lakes	Improvements at Anaheim Lakes.
	Platinum Triangle and Anaheim Regional Transit Center	Improve economic development at the Platinum Triangle and provide linkages from the Anaheim Regional Transit Center commuter hub.
	Orange Coast River Park	Multi-use river parkway at mouth of SAR.

Collaboration and Integration with other One Water One Watershed Pillars

Leveraging Funds

Parks, recreation, and open-space development are most often logically linked with species and habitat protection. Frequently, habitat preservation results in the availability of open space for recreation. Additionally, outdoor recreation programs offer opportunities to educate the public about threats to our environment, water quality, and quality of life. Preservation of open space often results in improved water quality because of the ability to control inputs and access. Therefore, programs that address water quality, species and habitat protections, and quality of life ideally should include funding for recreation. Economic development plans also should always address trails, open space and linkages, as entitlements can result in the dedication of open space. Climate change should include funding for trail and open-space development. Trail usage can result in a reduction of greenhouse gas emissions and open-space areas can result in reduction of carbon dioxide.

Leveraging Resources

Water quality and water supply programs identify the development of facilities such as above ground storage and treatment wetlands. These areas provide ideal opportunities for recreation and education. Additionally, linear water features such as canals can be used for recreational trails and provides linkages to other trails. Habitat reserves and related facilities present ideal opportunities for trail and outdoor recreation programs. Also, open-space areas are permeable, allowing groundwater recharge, enhancing water supplies. The establishment of trails also provides for alternative commuting, reducing greenhouse gas emissions.

Leveraging Expertise

Outdoor recreation planners are able to assess open space and park needs and assist in identifying the most critical trail linkage needs. Other experts can use this information as they plan for open-space development. Biologists can identify needs for habitat protections and work with park planners to develop outdoor educational programs. Likewise, water conservationists can work with park planners to develop outdoor educational programs to reduce water use through xeric landscaping and other methods. Park and open-space planners and managers provide expertise in education and interpretation and can assist in developing materials for other pillars.

Description of Data Collection Process

Many groups have worked to provide recreational opportunities in the Watershed over the years, but recently local leaders realized that a regional approach is necessary to achieve a unified vision. A regional approach would allow neighboring counties and cities to share resources and ideas and develop a common vision for the entire trail system. Several recent efforts, such as the development of integrated regional watershed management plans, have focused on cooperation and regional planning. SAWPA's *One Water One Watershed* effort is one such effort.

Over the course of several months in the summer of 2007, SAWPA convened large groups of stakeholders to develop an integrated plan for watershed management in the Watershed. SAWPA divided the effort into ten main subject areas or "pillars." This report documents the efforts of one such pillar: The Parks, Recreation, and Open-Space group.

The Parks, Recreation, and Open-Space group was organized and convened by the Riverside County Parks and Open-Space District and led by Paul Frandsen, former General Manager. Three main groups were targeted for participation in the effort: 1) the SART Technical Advisory Group; 2) respondents from SAWPA's offer to participate in the effort; and 3) personal invitations to interested individuals, interest groups, and other local, state, and federal agencies known to be stakeholders in the Watershed (see attached list of participants).

The group held a one-day focus workshop. Participants were divided into the three counties (Orange, Riverside, and San Bernardino) and identified a vision for recreation in the Watershed. The group identified the assets and challenges currently in place that make the Watershed such a unique and valuable place to recreate. This list was used to identify a strategy for development of future opportunities.

Each group was asked to identify existing amenities, projects under development, challenges to implementing such projects, and plans in place to manage existing programs. This information was recorded on flip charts for each county. A plenary session with all groups followed. A summary of the meeting was distributed to all participants and comments were received. The results of those efforts are included here.

Conclusion

The Watershed is a stunning location with a wide variety of scenery and natural resources. It is a unique location, situated between the desert, mountains, and the sea. The Watershed combines a complex arrangement of terrain, climates, and habitats that extend from the San Bernardino Mountains down to the Pacific Ocean.

Taking advantage of the Watershed's beautiful landscape, the SART links open space areas throughout the Watershed. Building the SART has been a highly successful collaborative effort and should be used as a model for other recreation projects in the future. The SART's achievements only could have been accomplished through a variety of partnerships, combining the expertise and resources of multiple counties, cities and other groups.

The SART is only a single project; much more work within the Watershed still needs to be done. Future projects should include a San Timoteo Canyon Trail, Lytle Creek Trail and San Jacinto Trail, as well as linkages between a multitude of Orange County trails.

Future projects should involve collaborations between public and private entities to bring about funding and planning in the Watershed, similar to what the SART Partnership accomplished. This system would allow the group to organize, find funding, and leverage resources to complete the project.

References

One Water One Watershed Pillar 8
Parks, Recreation & Open Space
June 28, 2007
Report of Public Process
Riverside County Regional Park & Open-Space District
Carriage House
4600 Crestmore Road
Riverside, CA 92509-6858

San Bernardino County

1) ***Current Conditions***
   - ***a)*** *Parks:*
     - i) Chino Hills State Parks: Chino Hills State Park, 6,000 acres in all three counties, mostly open space but few facilities
     - ii) Wildwood Canyon State Park in Yucaipa, 1,200 acres in state ownership with a goal for a total of +/- 5,000 acres, land banked facility, rich in potential for camping and trails
     - iii) Glen Helen, Prado, Cuc-Guasti, Yucaipa County Parks, 4-4,500 acres, camping, fishing, day use
     - iv) Special Districts and cities have other parks

   - ***b)*** *Recreation/Trails*
     - i) SART&P: 6-8 miles open with a potential for 18 miles
     - ii) San Timoteo
     - iii) San Antonia Heights
     - iv) City of Redlands-Emerald Necklace
     - v) Rails to Trails in Upland and Fontana
     - vi) SH 71 Wildlife corridor at Pine Ave

   - ***c)*** *Open Space*
     - i) Crafton Hills Conservancy
     - ii) Yucaipa Valley Conservancy
     - iii) The Wildands Conservancy, Oak Glen, 6,000 acres
     - iv) San Bernardino Mountain Conservancy
     - v) Flood control property

2) ***Management Strategies:***
   - ***a)*** *Parks/Trails:*
     - i) Potential partnerships
     - ii) Need assessments for new growth in parks and trails
     - iii) Blue Ribbon Committees
     - iv) SART & Partnership
     - v) Specific Plans
   - ***b)*** *Open Space:*
     - i) Additional acquisition needed

3) ***Problem Identification:***
   - **a)** Need acquisition for new or expanded facilities
   - **b)** Use Edison easements, new/existing corridors
   - **c)** O&M funding
   - **d)** Communication between all agencies and private sector
   - **e)** One voice for a commitment to meeting the needs for parks, trails, and open space
   - **f)** Connections for continuous trail corridors
   - **g)** Pine Ave trail connections

h) Rail Road, Glen Helen and SAR
i) Land Use Dept: coordination with all parties
j) New development connections and dealing with O&M
k) Illegal dumping and vandalism

4) Strategies for the Future:
a) Education and awareness
b) Provide public voice for a marketing campaign to tell the story of what the watershed has to offer
c) Conduct more interpretive programs
d) Host more celebrations for agencies to share vision and progress of the project
e) Develop a watershed 'phone book' and update it annually

5) Opportunities for Collaboration and a Unified Vision:
a) SART&P partnerships
b) Cities, counties work with developers for parks, trails, and open space
c) Host special events: Earth day for example
d) Be aware of cities general plans
e) Conduct ongoing media efforts
f) Collaboration with transportation agencies and flood districts

6) Projects:
a) Pine Avenue wildlife corridor and trail connections
b) Develop a regional park and trail master plan with wildlife corridors
c) Identifying needs/areas to meet standards of per capita needs as it relates to parks, trails, and open space
d) Upper SAR wash development of park and trail for recreation
e) San Timoteo Trail

Riverside County, Team A

1) ***Current Conditions***:
a) SAR Trail is not complete
b) Rancho Jurupa-Master Plan done but lacks full funding
c) Martha McLean park-complete
d) Hidden Valley-complete
e) Prado reach of river trail, on-going development with restrictions
f) Open Bottom of riverbed, flood impacted with Arundo
g) Chino Hills State Park: significant riparian area

2) ***Management Strategies:***
   - **a)** SART: multi-agency effort with cities, counties, and state and federal government.

3) ***Problem Identification:***
   - **a)** Jurisdictional concerns
   - **b)** Perceived lack of coordination
   - **c)** No integrated master plan
   - **d)** Changing regulatory environment
   - **e)** Illegal dumping enforcement, vandalism, graffiti on SAR Trail

4) ***Strategies for the Future:***
   - **a)** Interagency coordination
   - **b)** Adequate Enforcement
   - **c)** "Adopt-A" programs
   - **d)** Education-public (i.e. signage)
   - **e)** One Water website
   - **f)** Expanded access
   - **g)** Identify future needs-bring together multi-agency partners
   - **h)** Develop a capital improvement plan

5) ***Opportunities for Collaboration and a Unified Vision:***
   - **a)** Centralized Clearing house
     - i) prevents duplicity
     - ii) identify common agendas
     - iii) include watershed, recreation, planning, and wildlife needs
   - **b)** Dialog between Water Districts and Park agencies
   - **c)** Create habitat/recreation in wetlands vs. retention basins.
   - **d)** Riverside County to take the lead with Flood Control involvement
   - **e)** Have regulatory lobbyists
   - **f)** Create MOUs and other agreements

6) ***Projects:***
   - **a)** Complete the river trail
     - i) be aware of signage
     - ii) crossovers where appropriate
     - iii) be aware of connectivity and staging areas
     - iv) link to transportation corridors
     - v) update Louis Rubidoux Education Center
   - **b)** Development of recreation areas with water activities

Riverside County, Team B

1) ***Current Conditions:***
   - **a)** Many operators and agencies dealing with parks and recreations: cities, counties, and special districts
   - **b)** Coordination among groups needs improvements
   - **c)** Underserved regional parks and community parks (sports fields needed)
   - **d)** Few recreation trails near water sources, but have done some on Flood District property
   - **e)** Regional trails mostly unbuilt
   - **f)** The status of community trails varies widely among jurisdictions
   - **g)** Poor regional-local trail connections
   - **h)** Nations most aggressive habitat plan
   - **i)** Opportunities exist to link trails, recreation, and water bodies
   - **j)** Funding available for trail design and construction but not maintenance
   - **k)** Lack of funding for new parks
   - **l)** Narrow vision regarding parks and trails
   - **m)** Need partnerships with water agencies
   - **n)** Inventory of existing parks along the River: Prado Basin Park, Santa Ana River Regional Park (which includes the Hidden Valley Wildlife Area), Martha McLean/Anza Narrows Park, Norco River Trails Park. Mt. Rubidoux Park, Fairmount Park

2) ***Management Strategies:***
   - **a)** Streambed management oriented to removal of exotics
   - **b)** SAR Mitigation bank
   - **c)** MSHCP actions in SAR, San Jacinto River
   - **d)** The SAR TAC is now working to develop management strategies for the SAR Trail

3) ***Problem Identification:***
   - **a)** Multiple agencies
   - **b)** Lack of funding for maintenance
   - **c)** Underserved populations
   - **d)** Better coordination needed among players
   - **e)** Lack of funding for new parks
   - **f)** Incomplete trail network

4) ***Strategies for the Future:***
   - **a)** Expand the vision
   - **b)** Develop new funding sources
   - **c)** Develop better coordination with water agencies
   - **d)** Better utilization of water agency facilities
   - **e)** Better utilization of volunteer organizations
   - **f)** Develop new trails in MSHCP reserves
   - **g)** Focus on San Jacinto River opportunities
   - **h)** Increase PR regarding benefits of recreation

i) Non-motorized thoroughfares are essential components of local circulation elements and reduce greenhouse gas emissions
j) Mapping all existing regional and community trails in unincorporated areas
k) Researching all approved developments having trail conditions
l) Aggressive pursuit of grant opportunities for trail projects

5) Opportunities for Collaboration and a Unified Vision:

a) SAR MOU
b) Use reclaimed water at parks
c) Work with water districts and flood control agencies to use facilities for trails
d) Enhance public education
e) Have recreation facility part of every new water/flood structure if possible
f) Improve connections with schools
g) Improve working relationship with state and federal partners
h) Develop joint-use agreements with schools for community use
i) Expand the vision
j) Ensure trail connectivity
k) Trail planning with USFS and CAL State Parks

6) Project Identification:

a) Lake Elsinore project: connecting trails with the county system
b) Santa Ana River Trail
c) Prado easement
d) Corona-Norco reach
e) West of Prado dam to OC line
f) San Jacinto to River Parkway, state wildlife area and Mystic Lake
g) Salt Creek Trail
h) Temescal Trail
i) Riverside Canal trail
j) Whitewater river trail
k) Regional Parks:
  i) Lakeview Nuevo
  ii) Menifee
  iii) French Valley

Orange County:

1) ***Current Conditions:***
   a) Half of the SAR is paved from 17th Street to below MacArthur
      i) 1/3 concrete sides and bottoms
      ii) ½ concrete bottom
      iii) Top useable space is on levees and only width of levee is useable and only about ½ is on both sides of river
   b) Imperial Highway
      i) Above Imperial Highway: nice, green aesthetics
      ii) Below: more industrial
   c) Levees are narrow in most places; abuts development, limits options (would require acquisition beyond levees)
   d) Bikeway is completed for about 27 miles from OC line (east) to the ocean (HB)
   e) Riding and hiking trail almost complete with approximately 3-4 to do landscaping with drought resistant 2/3 of both sides of river
   f) Number of basins are options for recreation-Burris Pit for example 500k users/year throughout OC
   g) Stables such as Rancho Del Rio and Single tree farms-maybe be threatened by development
   h) Nine city parks, Anaheim has 3 and with Burris Pit, this would make four HB has 5 access points and 3 regional parks along river

2) ***Management Strategies:***
   a) Most cities have some kind of master plan that references recreation along the river
   b) County has Master Plan of bikeways and riding trails
   c) OCTA has a master plan for bikeways
   d) Citizen's Regional Recreational Trails Advisory Committee: gives feedback; assists county in implementing trails
   e) Maintenance is shared between county, cities, Water District and Flood Control District and volunteer groups
   f) SAR Trail and Parkway Partnership provides forum for regional coordination
   g) SAR touches four supervisorial districts

3) ***Problem Identification:***
   a) Money (lack thereof)
   b) Identifying funding opportunities and ability to collaborate
   c) BNSF: trail is close to the railroad and more collaboration is needed
   d) There are gaps in the trail
   e) Substandard sections of the bikeway
   f) Homeless issues
   g) Lacking linkages to open spaces
   h) Inadequate access
   i) Build out next to trails
   j) Lack of staging areas
   k) Security

l) Loops, links and crossings
m) Appropriate staffing for O&M and design
n) Graffiti and vandalism a serious problem
o) Illegal dumping
p) Theft (copper 'mining')

4) ***Strategies for the Future:***
a) Commitment by decision makers and staff at all levels
b) Priority setting and collaboration and integration of all players: private, RR, CALTRANS, State Parks and locals
c) Business council, tourism, developers
d) Redevelopment

5) ***Opportunities for Collaboration and a Unified Vision:***
a) Reaching out to businesses
b) Make the trail the businesses 'front yard'
c) Develop businesses along the trail to serve users
d) Embracing the beauty and value of natural aspects of the river
e) Opportunities include: planning, design and O&M
f) Unified vision
g) Uniform signage

6) ***Projects:***
a) Burris Pits: includes water retention, flood control, habitat, recreation, water quality, water recharge, and transportation
b) Singletree Farms: acquire, provides for equestrian needs
c) ADA access ramp LeBard Park OC River Park
d) Improve linkages: gap in riding/hiking trail at Weir Canyon to Co. Line
e) Bikeway gap from Coal Canyon to County line
f) Connection from Green River Golf Course to Chino Hills
g) Economic development at Platinum Triangle
h) Anaheim Regional Transit Center (Commuter hub)
i) Improve 15 undercrossings from HB to Yorba Linda
j) Improve Anaheim Lakes at the 91 and 55 freeways, redevelopment, hotels and mixed use
k) Imperial Highway. CALTRANS and OCWD

List of Contributors

Participants from the meeting June 28, 2007:

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Chapter 5.9 Climate Change

This IRWMP complies with all climate change standard requirements established in the Proposition 84 Guidelines. As of the publishing date, the IRWMP Climate Change Handbook to be developed by the State of California DWR in conjunction with US EPA Region 9, USACE and Resources Legacy Fund was under development, and as such, is anticipated to further improve some of the quantitative tools used for the analysis of climate change vulnerabilities. The evolving nature of the OWOW Plan will allow SAWPA and its stakeholders to update the Plan in the future to strengthen the analysis of climate change implications and strategies for the watershed.

Climate change is already having a profound impact on the State of California and on the Watershed. Warmer temperatures, altered patterns of precipitation and runoff, and rising sea levels are increasingly compromising water and environmental resources and, in turn, the sustainability of our communities. Adapting the State's infrastructure to respond to climate change presents one of the most significant challenges of this century. Impacts and vulnerability will vary by region, as will the resources available to respond to climate change. Regional solutions, such as proposed through OWOW and associated integrated solutions, are vital to the future of the Watershed.

Current Conditions

There is broad scientific agreement that climate change is occurring and that emissions of heat-trapping pollution are the primary cause. The United Nations Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report in 2007 estimated that the rate of warming is averaging 1.3 degrees Fahrenheit over the past century. The report also confirmed that "11 of the last 12 years (1995 to 2006) rank among the twelve warmest years since 1850."[i] IPCC predicts the project rate of warming over the 21st century will increase and could peak at 11.5 degrees Fahrenheit above 1990 levels. Global warming and its probable consequent changes in precipitation, storm intensity, increased evaporation and transpiration, greater risk of fires and floods, and a rise in sea level pose a significant danger to the world's environment, health and economy.

The IPCC has identified three major components of a changing climate that will have the most serious impact on communities: 1) increased temperature; 2) more variable precipitation, and; 3) a rising sea level. Each of these components likely will have a significant impact on the Watershed.

Climate Change Projections for the Watershed

Climate change-related impacts already have taken place in California, and are having an effect on the Watershed. According to DWR, historic hydrologic patterns can no longer be relied upon to forecast the water future. As such, the reliability of the system of imported water that provides significant supply to the region has been lessened. Precipitation and associated runoff patterns are changing, increasing the uncertainty for water supply and quality, flood management, and ecosystem functions. The average early snowpack in the Sierra Nevada has decreased by about ten percent during the last century, representing a loss of 1.5 million AF of snowpack storage.[ii] During the same period, the sea level rose seven inches along California's coast. The State's temperature

also has risen 1 degree Fahrenheit. Most of the increased temperature readings are at night and during the winter season, with higher elevations showing the greatest increase. Rainfall has become increasingly variable, with southern California experiencing both its driest and wettest years on record within the past decade.

However, projections about future impacts of climate change on the Watershed region remain, like all projections, uncertain. Current temperature and precipitation forecasts are derived from large scale atmosphere-ocean general circulation models that are not easily applied to discrete geographic regions such as the Watershed. More than 20 of these models exist worldwide, and most give quantitatively different forecasts for southern California.[iii] There is value in using predictive models to develop scenarios that aid in planning for the future. Impacts of climate change are likely to occur, and there are risks associated with not planning for future impacts because predictive models are imprecise.

Methodology

With the assistance of the RAND Corporation, an evaluation of the key climate change drivers and the Watershed's vulnerabilities were developed. In 2006, the RAND Corporation partnered with the National Science Foundation to prepare and evaluate case studies addressing water management decision making under conditions of abrupt climate change.

Weather projections for the Watershed region, reflective of climate changes predicted by the scientific community's global climate models, were developed. These data were then used with a water management model to evaluate how various water management scenarios for the region would perform under different scenarios of climate and other management options.

The probable scenarios affecting water supplies in the Watershed included increased temperature, but variable precipitation levels. It also was recognized that the statewide climate trends likely would result in reduced snowpack and runoff amounts, in turn, reducing the amount of water that was likely to be available for imports into the region.

The baseline case for water management was IEUA's 2005 Urban Water Management Plan (UWMP). This plan emphasizes development of local supplies and a reduced dependence on imported water supplies. Under base year conditions, approximately 70% of the water supplies are from local sources (e.g., groundwater, recycled water, and desalted groundwater supplies). These ratios of potential water supply sources are relatively common throughout the Watershed, but some regions are more dependent on imported water and a few, less so. However, the UWMP projects the ability to meet nearly 80% of the service area water demands by 2025.

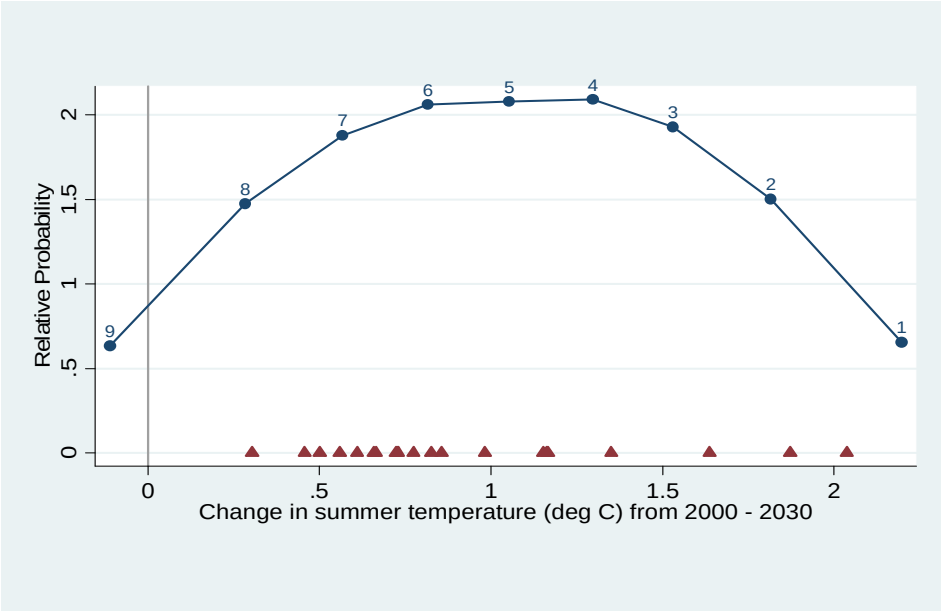
The RAND study showed that the 2005 UWMP performs well under many potential climate change scenarios. However, significant risks to water supply exist if nothing more is done now or in the future to develop additional local supplies. The core vulnerability in the UWMP was the region's continued reliance on imported water supplies, when climate change scenarios showed that imported supplies were severely impacted by declines in precipitation statewide. The most cost-effective scenarios were those which included significant improvements in local water use efficiency along with the development of additional conjunctive use and recycled water programs.

Using the large-scale models to run thousands of possible scenarios, RAND generated probabilistic forecasts for southern California which was the smallest geographic scale to which these probabilistic models can be applied. Based on these model projections, RAND concluded the following regional impacts were likely to occur within the Watershed over the next 30 years.

Temperature

Figure 5.9-1 shows that average summertime temperatures are likely to increase between 0.1 degree and 2.1 degree Celsius. The RAND temperature forecast for southern California, including the Watershed region, is consistent with the IPCC 2007 report that projects warmer temperatures for the western states. It is important to note that the increase in peak summer temperature predicted for the region will intensify heat island effects from the watershed's existing extensive urban development.

Figure 5.9-1 Average summertime temperature changes

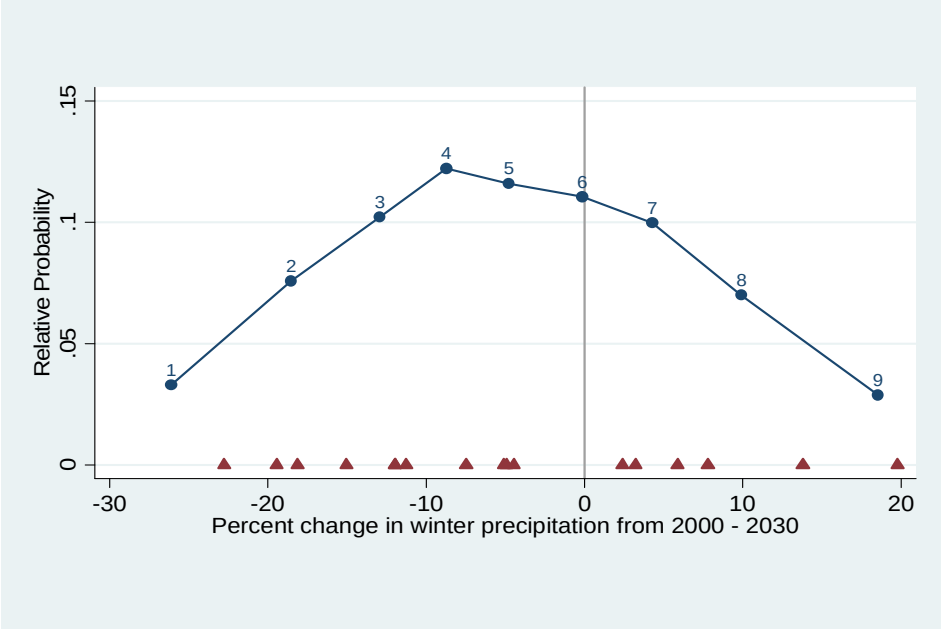


Rainfall

Figure 5.9-2 shows that average wintertime precipitation within the Watershed is likely to be exceedingly variable, ranging from a probable 19% decrease in rainfall (drier) to a possible 8% increase (wetter).

The RAND precipitation forecast suggests that rainfall that will occur in the Watershed region is still very uncertain, but certainly variable. There are many possible changes to the Watershed's precipitation patterns, including a shift to summer monsoon-type (hotter, muggier) weather events. The modeling underscores greater variability of precipitation combined with an expected greater intensity of precipitation events. Dry periods are predicted to last longer and rain storms, when they do occur, will be more powerful. The past three years of precipitation can provide an excellent example of highly variable rainfall patterns as the Watershed had the wettest (2005) and driest (2007) years ever recorded.

Figure 5.9-2 Average wintertime precipitation within the Watershed



Sea Level Rise

RAND recognized that sea level rises associated with increased temperature scenarios shown in the models would increase sea level along the Orange County Coast between 22 and 35 inches.

Actual sea level rises have varied among locations. However, over the past 100 years, sea levels already have risen about seven inches along the California coast. If greenhouse gases and temperatures continue to rise, the ocean could rise an additional 22 to 35 inches by the end of the century. There are implications for coast development and for the provision of groundwater from coastal aquifers.[iv]

Implications of Climate Change for the Watershed

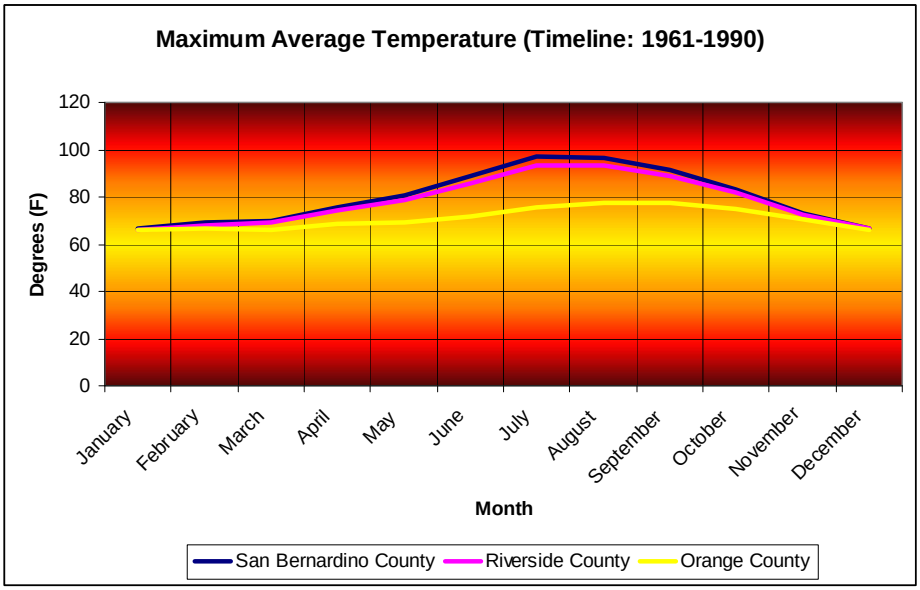
Warmer Temperatures

Increased Evaporation and Transpiration, Increased Water Needs

Overall, higher temperatures will increase levels of evaporation and transpiration, which in turn, increases water demand, primarily for outdoor irrigation. As needs for irrigation water increase, there also may be increasing needs for environmental water, and a greater potential for conflict and competition between these uses.

Figure 5.9-3 shows the maximum average temperatures for San Bernardino County, Riverside County, and Orange County from the 1960s through the 1990s.[v]

Figure 5.9-3 Maximum average temperature in Watershed region



Heat waves are likely to be longer, hotter and more frequent; intensifying wildfire risks and increasing summer peak energy demands

The RAND prediction that summer peak temperatures will increase in the Watershed is a major impact, as it exacerbates a heat island effect that already takes place in developed areas that have minimal vegetation (roof tops, roads) to reduce the concentrated heat. The higher temperatures will exacerbate wildfire concerns by drying out vegetation earlier in the year and increase the potential for extreme wildfire events, especially during annual Santa Ana wind conditions.

Rising temperatures will cause an increase in energy demand, particularly electric cooling demand. However, reduced energy supply reliability is a likely result of the rise in temperature. The lack of snow pack, which usually leads to lower reservoir levels, may reduce hydroelectric power production.

Air quality will be diminished, especially during summer peak temperatures

Southern California already has poor air quality, especially during hot summer months when smog, ozone, and other air pollutants tend to concentrate. The expected increase in summer peak temperatures due to climate change will intensify these problems and create a larger impact on sensitive populations (e.g., young, elderly, and poor) within the Watershed.

Temperature of interior stream, ponds and lakes will increase, creating water quality problems and causing environmental stress for Watershed biota.

Increased temperature can impact water quality several ways. First, warmer water is unable to hold as much dissolved oxygen (DO) as cooler water. This DO is essential for fish and macro-invertebrates that do not breathe at the surface of the water. At times when DO levels decrease, native fish congregate in the deeper cooler areas of a lake or stream. In these areas, they are more

susceptible to imported predators such as bass. Where areas of cooler water are not available, the fish become physiologically stressed resulting in reduced survival and decreased fecundity. Increases in water temperature also increase the growth of algae. While algal growth is natural in healthy ecosystems, excessive growth can further decrease DO and produce serious water quality impacts.

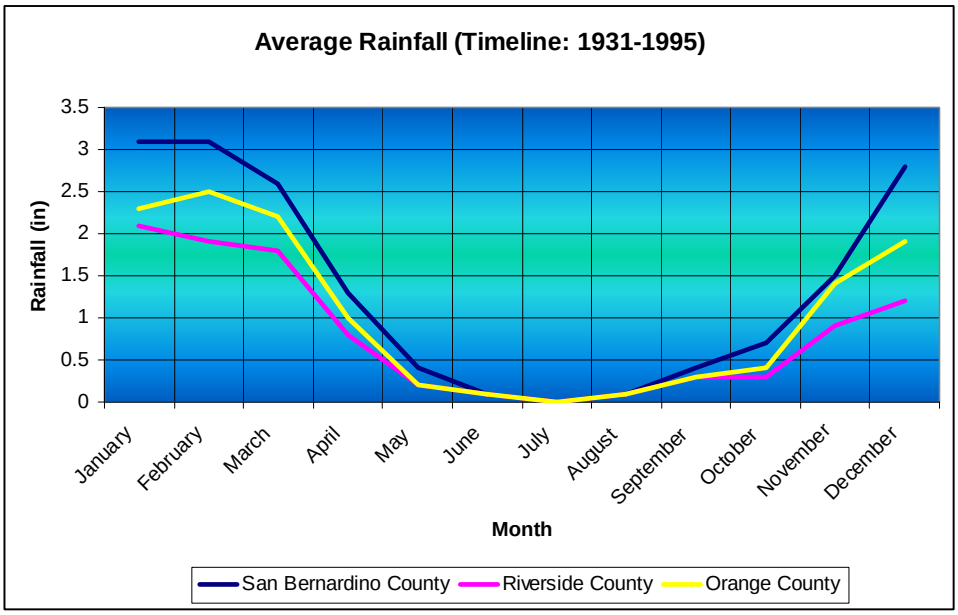
Statewide increase in temperature impacts available imported water supplies

A significant portion of the water currently used within the Watershed is imported into the region either from the Colorado River or from northern California via the SWP. The greatest volume of water imported into the region arrives from northern California, and those deliveries are dependent of the snowpack in the Sierra Nevada Mountains. Decreased snowfall related to climate change or a change from snow to rain, which often flows down the mountains too rapidly to collect, can have significant impacts on the availability of water in southern California.

In the northern part of the State, since rainfall occurs over a short seasonal interval, California's water infrastructure is dependent on the build-up of snow in the mountains of the Sierra Nevadas. Snow acts as a natural reservoir by releasing water into streams and man-made reservoirs after winter and early spring rains and snowfall have ceased.

Warmer temperatures may cause rivers to carry a heavier flow during wet months, possibly triggering floods. During summer months, river flows would be reduced, resulting in water shortages that could affect agricultural areas. **Figure 5.9-4** depicts the average rainfall, in inches, for San Bernardino, Riverside, and Orange Counties during 1931-1995.

Figure 5.9-4 Average rainfall for San Bernardino, Riverside & Orange Counties during 1931-1995

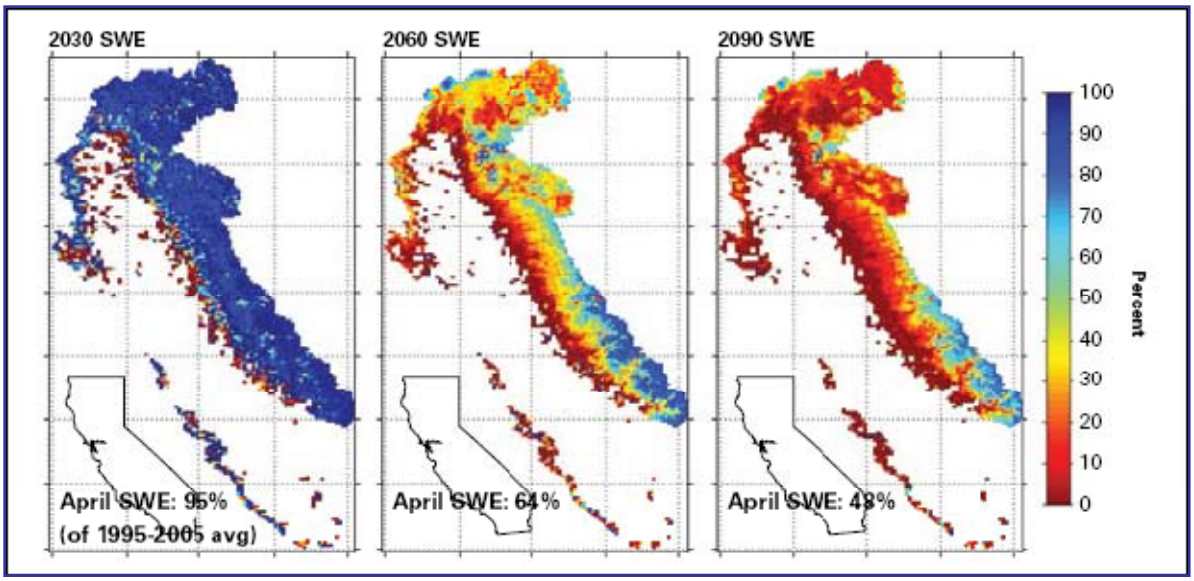


Snowpack and Streamflows

"In the West, streamflow is often strongly influenced by runoff from melting winter snowpacks. Streamflow is characterized by timing, magnitude, frequency, and duration of water flows, all of which are affected by climate change…Recent studies indicate that changes have already occurred in snowmelt and spring runoff throughout the western region of North America." (NRDC)

No matter what amount of precipitation California ends up with, an increase in temperature will result in a reduction in snowpack. This, in turn, will adversely affect the runoff that the California water supply has become so dependent upon. One study projected that snow levels will retreat 500 feet in elevation in California for every rise of one degree Celsius.[vi] The United States Geological Survey (USGS) has observed "that flows in many western streams arrive a week to almost three weeks earlier than they did in the middle of the 20th Century."[vii] For example, (**Figure 5.9-5**) one study shows that the Sacramento and San Joaquin Rivers have declining flows during the critical April to July period, over the last century. Any and all of these changes will affect the water supply, flood control management, and could cause major erosion which would lead to fires and major health hazards.[viii]

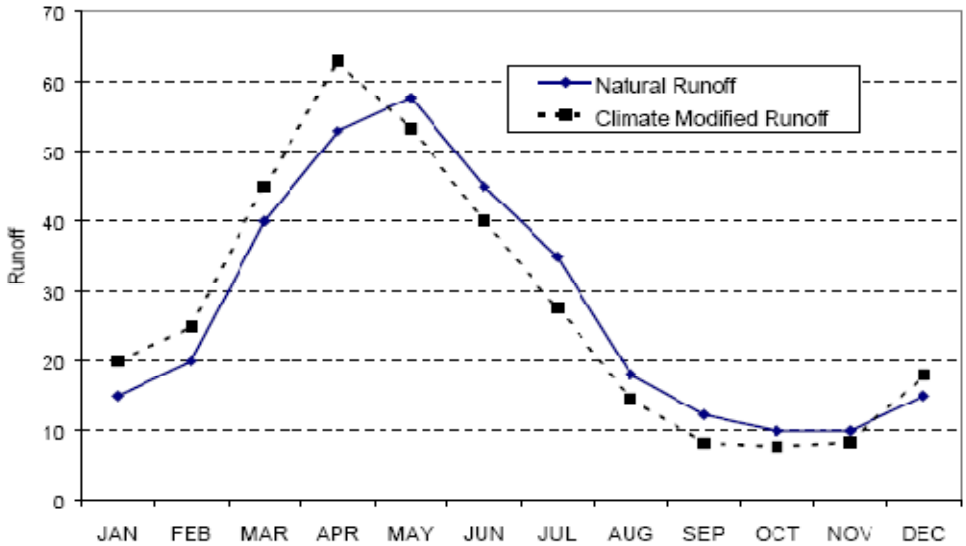
Figure 5.9-5 Evolution of average annual snow water equivalent as a percentage of average 1995-2005 values



Source: Knowles, N. and Dan Cayan. Potential effects of global warming on the Sacramento/San Joaquin Watershed and the San Francisco estuary. September 28, 2002. Geophysical Research Letters. Vol. 29, No. 18.

A study by the Pacific Institute showed that rising temperatures will affect snowfall patterns, as well as the timing and rate of snowmelt. **Figure 5.9-6** shows hypothetical changes in hydrographs that can be expected with changing snow dynamics in the Sierra Nevada.

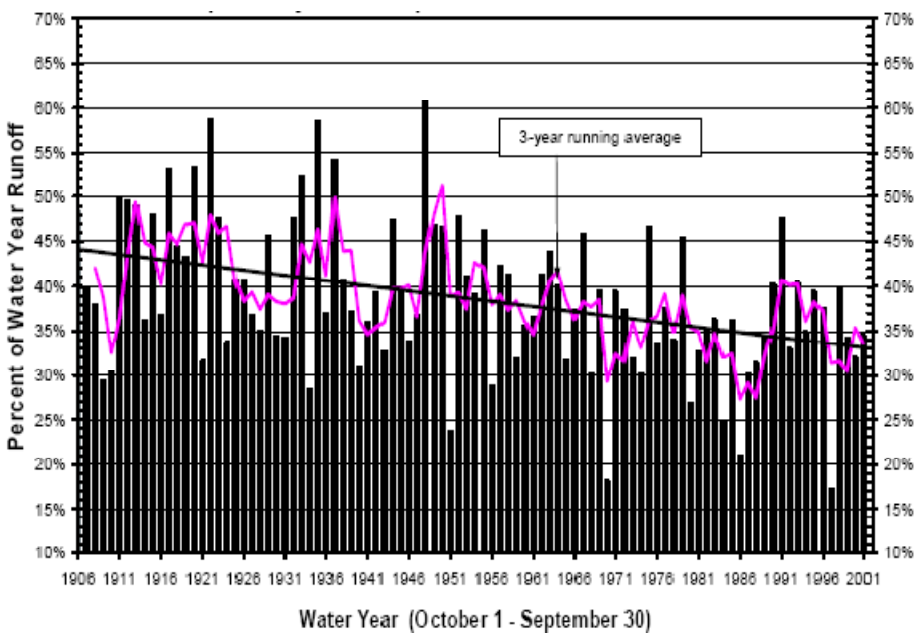
Figure 5.9-6 Hypothetical natural and modified average hydrograph for basins with snowfall and snowmelt in the Sierra Nevada



Warming-induced change in the timing of streamflow, including both the intensity and timing of peak flows, is quickly becoming a reality. As temperatures rise, a declining proportion of total precipitation falls as snow, more winter runoff occurs, and remaining snow melts sooner and faster in spring (see, for example, Gleick, 1986, 1987a,b; Lettenmaier and Gan, 1990; Nash and Gleick, 1991b; Miller *et al.,* 1999; Knowles and Cayan, 2002; VanRheenen *et al.*, in press). In some basins, spring peak runoff may increase; in others, runoff volumes may significantly shift to winter months. Shifts in runoff timing in snowmelt-fed basins are consistent in all studies that considered daily or monthly runoff. These studies show with very high confidence that increases in winter runoff, decreases in spring and summer runoff, and higher peak flows will occur in such basins as temperatures and hence, both snowline and melt rates, rise.

Figure 5.9-7 depicts the historical trend in seasonal runoff for the Sacramento River. The decreasing percentage of runoff indicates an earlier melting seasonal snowpack.

Figure 5.9-7 Sacramento River runoff in percent of Water Year runoff



Increased flood risk and reduced ability for groundwater replenishment

As temperatures warm, more rain than snow falls at higher elevations. In areas that do have snowpack, melting occurs sooner. In the Watershed, this would increase peak flows after winter storms making rainfall more difficult to capture. This scenario could be more severe in El Niño years, which generally feature warmer winters and produce higher amounts of precipitation. Further, climate model studies performed in the last few years indicate that additional levels of carbon dioxide will lead to fewer, but more potent storms as has been the case in the last 50 years.[ix] These intensified storms produce intense run-off (flash-flood type storms) that do not have the necessary time for groundwater replenishment. Intensifying storms combined with the booming population growth in the Watershed region (increased paved land) will only reduce groundwater replenishment even more.

Increased risk to local supplies

Local water supplies are much more reliable than imported supplies, but also will be affected by a changing climate. Increased temperatures, uncertain precipitation patterns, reduced groundwater replenishment, and possible sea-water intrusion are all realistic scenarios that may decrease the reliability of local resources. Local water supplies may consist of surface water, groundwater, recycled water, and desalinated water.

The reliability of surface water can be affected by increased evaporation, changes in precipitation, changes in stormwater run-off, and degrading water quality. These issues also may have a direct impact on groundwater supplies. Rising sea level associated with climate change may increase salt water intrusion into the Orange County groundwater basins, necessitating expensive measures to protect the basins. Continuous replenishment of groundwater is necessary to keep that barrier between the sea water and the coast's fresh water aquifers.

Decreased water quality

Water quality depends on a wide range of variables, including temperature, flow, run-off rates and timing, and the ability of watersheds to assimilate pollutants. Changes in stormflows will have direct water quality impacts. Higher winter flows could reduce pollutant concentrations or increase erosion of land surfaces and stream channels, leading to higher sediment, chemical, and nutrient loads in rivers. Lower summer flows could reduce DO concentrations, reduce dilution of pollutants, and increase zones with high temperatures (Eheart *et al.*, 1999).

Increased wildfire risk

Ecosystems in the West are dependent upon fire to maintain the region's unique ecology. However, a study conducted by the American Water Works Association (AWWA) emphasized that whether or not fire is an ecological benefit or a threat to society, it has a serious impact on water supply in terms of both reduced water quality and possible storage capacity, due to sedimentation.[x] Recent research at Scripps Institute suggests that there are two primary ways that climate change will increase fire risk. The first is varying periods of increased precipitation followed by sustained drought creates high fire-risk fire conditions. And second, higher temperatures reduce moisture

levels in soils drying vegetation and creating increased fire risk. A combination of bark beetle infestation and a prolonged drought resulted in extremely severe fire conditions in 2003. According to historical tree-ring analysis, patterns of one or more wet El Niño years followed by a dry La Niña year produces a higher risk of wildfires, in the southwest.[xi]

Management Strategies for a Changing Climate

In order to mitigate green house gas emissions and increase the watershed's ability to adapt to climate change, several strategies and adaptation actions that water managers can take were developed.

Understand that the Past is Not the Future: Resource management planners, including water agencies, have traditionally planned for the future assuming that historical weather patterns will persist without change into the future. Planning within the Watershed must include consideration of the potential impacts of climate change, such as reduced precipitation, more intense storm patterns, increased flooding, reduced snow pack decreasing the reliability of imported water, greater evaporation of surface water, sea level rise and associated impacts on coastal groundwater basins, and increased stress on natural habitats.

Develop Watershed-wide Programs: Time, money and water can be saved through coordinated program implementation within the Watershed. Changing management strategies to meet a changing climate will require that all interests work together to ensure that there are no unintended consequences of our actions. Already, such work has been done in developing regional water management plans and in the development of Basin Plans that feature salt and nitrogen management. The OWOW process continues this effort and considers all stakeholder communities dependent on water.

Incorporate Climate Considerations into Land Use Planning: The development of Smart Growth Communities, the implementation of LID, and improved water efficiency standards will play a significant role in helping the Watershed to adapt to climate change impacts.

Factor in Flood and Fire Management in Planning Decisions: The steep mountains and alluvial flood plans of the Watershed, combined with its historical proclivity towards intense storm events, makes the region more vulnerable to climate changed induced flooding and fires, as the intensity of flood and fire events may increase further.

Protect and Restore Aquatic Ecosystems: The Watershed has a rich array of biological resources that are critical to the quality of life in the region. Healthy ecosystems are more resistant to climate impacts, and enhancement of these systems provides other benefits including water quality, recreation, and flood protection.

Make Water Use Efficiency and Local Water Supply Development a Top Priority: Increased investment in water use efficiency, recycled water, stormwater capture, and groundwater storage

are vital to the long-term reliability of water supplies for the Watershed. Imported water supplies are likely to become much less reliable in the future.

Promote Investment in Renewable Energy, Building Efficiency, and Vehicle Efficiency: Transportation, power generation, and heating are primary sources of controllable carbon emissions, and constitute early implementation opportunities for the reduction of greenhouse gases. Wind and solar energy could both become significant sources of renewable energy within the Watershed and numerous projects already are underway. The U.S. Green Building Council has implemented a LEED certification program for green buildings where significant energy savings can be found. There have been several significant LEED projects within the Watershed, but the region lags behind in the implementation of LEED projects. Encouragement of LEED building would result in significant energy savings and an associated reduction in carbon emissions.

Recognize the Energy Intensity of Water Supplies: Development of local supplies is acknowledged by the California Air Resources Board as a core adaptation strategy, as well as a way to reduce greenhouse gas emissions under California's Assembly Bill 32 Scoping Plan. A 2008 Study completed by the California Sustainability Alliance on recycled water estimates that energy savings from the use of 100,000 AFY of currently unused tertiary treated recycled water within the Watershed over the next five years would reduce energy usage by 340,000 MWh/year and achieve an annual reduction of 129,000 tons of carbon dioxide.

In 2006, the California Energy Commission released a report, Refining Estimates of Water Related Energy Use in California, in which they concluded that water supply/conveyance is the most energy intensive source of water, with imported water supplies in southern California requiring almost five times the energy than water supplied to northern California (average 3200 kWh/AF in southern California versus 700 KWh/AF in northern California). Clearly, development of local supply could yield enormous carbon savings.

The California Governor recently issued an Executive Order calling for a 25% reduction in greenhouse gas emissions (from 1990 levels) by 2020. In the same year, the California legislature passed Assembly Bill 32, the Global Warming Solutions Act, which provides for the development of mandatory reporting requirements, greenhouse gas emission targets, and a cap and trade system for achieving the Governor's greenhouse gas emissions goal. The California Air Resources Board is responsible for the development of an implementation plan and adoption of regulatory requirements that will achieve the greenhouse gas reduction goal. In December 2008, the Air Resources Board adopted a scoping plan that lays out the programs that will become requirements statewide.

With emissions currently at 492 metric tons of greenhouse gases annually, California is the second largest emitter in the United States and about the twelfth largest in the world. Reducing California's "carbon footprint" to meet the Assembly Bill 32 goals will require approximately a 29% cut in emissions below the 2020 levels the state's current trajectory would produce.

Increase Public Education: An understanding of the impacts of climate change on the Watershed and California is critical to making the informed choices for water management, land use, ecosystem protection, and infrastructure investments.

Perform Carbon Footprint Assessment and Use the Tool to Identify Additional Opportunities for Reducing Carbon Emissions: A carbon footprint is a measure of the impact human activities have on the environment in terms of the amount of green house gases produced, measured in units of carbon dioxide. The measure is usually expressed as tons of carbon dioxide equivalent. Carbon dioxide accounts for about 84% of human-caused greenhouse gas emissions in California, with methane, nitrous oxide, hydroflorocarbons, sulfur hexafluoride, and perflorocarbons contributing the remainder of the gases.

The California Climate Action Registry provides criteria for measuring carbon emissions from water, wastewater, local government, industry, and other sectors. Carbon emission accounting is expected to be one of the primary tools that the State of California will use to measure progress towards its greenhouse gas emission reduction goals. **(Annual Emissions Report)**. This Report can be found in the Appendices.

EMWD recently has completed an excellent carbon footprint analysis for their facilities that can be a model for others to complete a similar analysis.

Current Implementation

Recognizing the importance of climate change to IRWM planning, assessment and implementation of the plan, climate change was included among the criteria approved by the OWOW Steering Committee for priority ranking of projects submitted to implement the OWOW plan and in the Call for Projects information form. The Call for Projects information form included a requirement that all projects provide data to describe how effectively the proposed project would reduce greenhouse gas emissions from water management activities. The projects were then given a performance measure to determine how effectively this criteria was addressed which in turn was used as part of the criteria to rank projects.

To assure that climate change implementation is addressed, the project proponent for all projects funded under the Prop 84 IRWM Implementation grant program as well as other projects funded by this process will be required to track the effectiveness and performance of the project greenhouse gas emissions during and after implementation or construction.

As a part of climate action registration, SAWPA has joined the California Climate Action Registry (CCAR) which is now operated by the non-profit national organization, Climate Action Registry (CAR). Further, we have encouraged all our partner agencies to do the same in the Santa Ana River watershed.

To stay current with developments, SAWPA has closely tracked the developments under State legislation dealing with climate change as it relates to IRWM planning efforts. Staff has analyzed the legislation and policy context of Executive Order S-3-05 and the California Global Warming Solutions Act of 2006 (AB 32), Senate Bill 97, and EO S-13-18. Further, the following publications

and presentation on Climate Change have been thoroughly reviewed and monitored as they have been developed.

- The Climate Change Scoping Plan, California Air Resources Board, 2008
- DWR White Paper, Managing an Uncertain Future: Climate Change Adaption Strategies for California's Water (2008)
- California Climate Adaptation Strategy, California Natural Resources Agency, Dec. 2009
- DWR Power Point Presentations, July 2010, Climate Change Handbook, Incorporating Climate Change into Integrated Regional Water Management Plans, CDM, sponsored by US EPA Region 9, DWR, Resources Legacy Fund, USACE
- IRWM Planning- Climate Change Document Clearinghouse for IRWM Plan support

Next Steps

It is recognized that the tools to mitigate and adapt to climate change impacts are still evolving and will be applied to the region as they develop. Future updates to the OWOW plan will require the application of lessons learned from the latest Climate Change science, the yet to be published Climate Change Handbook, further application of quantitative tools for vulnerability analysis and more detailed and comprehensive assessment of greenhouse emissions in a quantitative fashion from the entire water resource industry in the region. Despite the needs for the future, it is believed that this region has taken the most progressive steps in climate change impacts, mitigation and adaptation within any IRWM plan across the State.

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[i] IPCC see Wilkinson paper

[ii] DWR Report

[iii] Page 10 of Grove Study

[iv] http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2006/08/01/WARMING.TMP

[v] http://www.worldclimate.com/

[vi] Roos, Maurice, 2005. "Accounting for Climate Change" in *California Water Plan Update 2005,* Vol. 4, Reference Guide, Public Review Draft, California Department of Water Resources, p.5.

[vii] USGS, National Streamflow Information Program, March 2005, "Changes in Streamflow Timing in the Western United States in Recent Decades." Fact Sheet, 2005-3018.

[viii] Dettinger, Michael D., and Dan R. Cayan, 1994. Large-scale atmospheric forcing of recent trends toward early snowmelt runoff in California. *Journal of Climate 8: 606-23.*

[ix] http://earthobservatory.nasa.gov/Newsroom/NasaNews/2006/2006030921864.html

[x] Miller, Kathleen, and David Yates, 2005. *Climate Change and Water Resources: A Primer for Municipal Water Providers.* AWWA Research Foundation and University Corporation for Atmospheric Research. http://www.awwarf.org/research/TopicsAndProjects/projectSnapshot.aspx?pn=2973.

[xi] Swetnam, T.W. and J.L. Betancourt, 1998. "Mesoscale Disturbance and Ecological Response to Decadal Climatic Variability in the American Southwest." *Journal of Climate* 11, 3128-3147; Swetnam, T.W. and J.L. Betancourt, 1990. Fire-Southern Oscillation Relations in the Southwestern United States. *Science* 249, 1017-1020.

Chapter 5.10 Environmental Justice

Introduction

The United States Environmental Protection Agency (U.S. EPA) recognizes the disproportionate impact that disadvantaged and minority communities face throughout the United States. Disadvantaged and minority communities are disproportionately affected by environmental pollutants which are emitted by various sources. Because these disadvantaged and minority communities are concentrated in areas where the sources of pollution are situated, the communities often times endure conditions that are unknown by more affluent communities.

Environmental justice and providing support to disadvantaged communities are concerns of the One Water One Watershed (OWOW) process. The Santa Ana River Watershed Project Authority (SAWPA) has produced this report in order to present the concerns that local disadvantaged and minority communities in the Santa Ana River (SAR) Watershed region share. The findings were produced over a two month time period using a combination of personal interviews, as well as community forums with residents of disadvantaged and minority communities in the three counties that comprise the SAR Watershed: San Bernardino, Orange and Riverside.

Background

Disadvantaged Communities

The SAR Watershed contains one of the fastest growing regions in California and also some of the State's poorest residents. In 2000, the per capita income of portions of the Inland Empire was about 25% below the State average (Schreiber, 2003). **Figure 5.10-1** depicts watershed income in the SAR Watershed by census tract, based on 2007 incomes as collected by the Claritas division of Nielson Company in 2008. This disparity in income is exacerbated by the recent economic downturn which has had a detrimental effect on the region in general and specifically impacted laborers in disadvantaged communities with limited job skills.

The State of California defines a Disadvantaged Census Tract as a census tract with a household income less than 80% of the California State median household income. They also define a Severely Disadvantaged Census Tract as a census tract with a household income less than 60% of the California State median household income. In 2007 the California median household income was $58,361 as reported by the U.S. Census Bureau (USCB, 2007). Approximately 69% of the cities/communities within the watershed are therefore considered disadvantaged or contain disadvantaged communities (**Figure 5.10-2** and **Table 5.10-1**). In terms of watershed population, 1.4 million of the 5.4 million residents are considered disadvantaged, approximately 26% of the total SAR Watershed population.

Figure 5.10-1 Watershed Income in the Santa Ana River

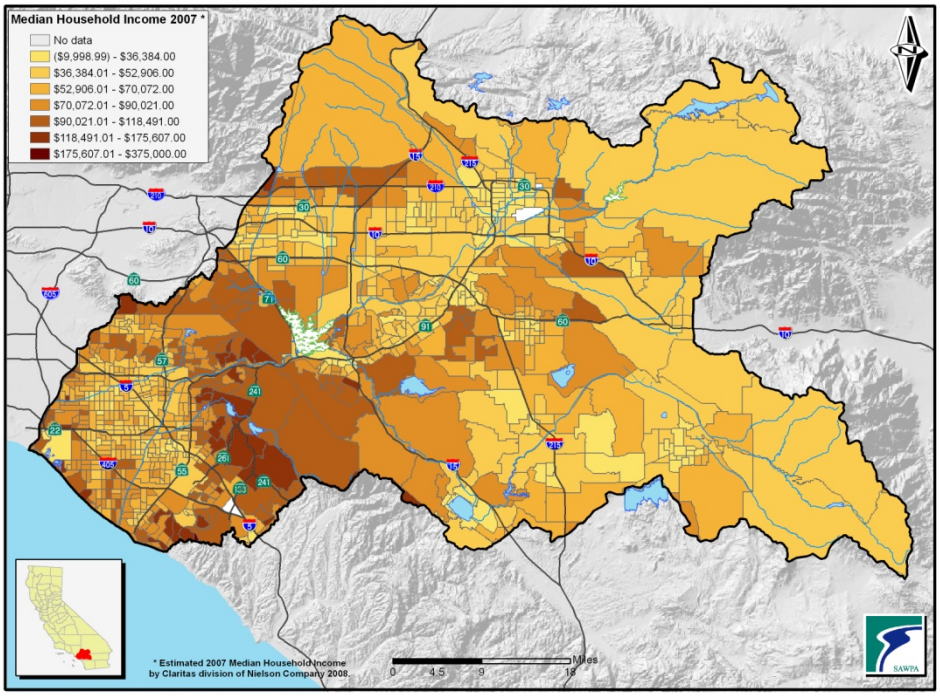

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Figure 5.10-2 Disadvantaged Communities in the Santa Ana River

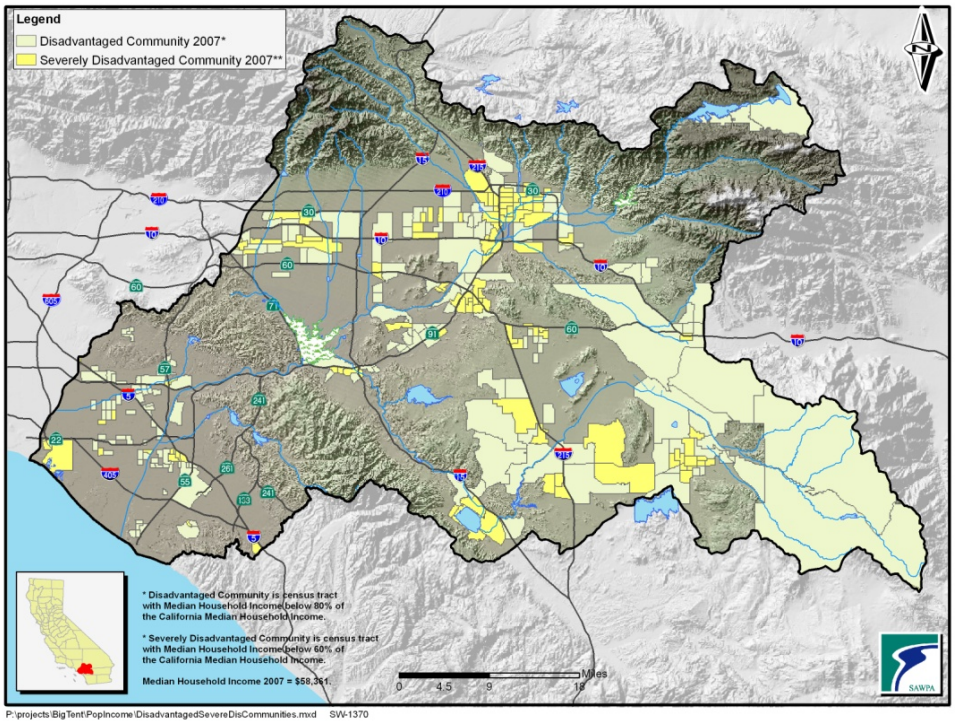

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Table 5.10-1 Disadvantaged or Partially Disadvantaged Communities

Anaheim	Garden Grove	Long Beach	Riverside
Banning	Glen Avon	Los Alamitos	Romoland
Beaumont	Grand Terrace	March AFB	Rubidoux
Big Bear City	Hemet	Mira Loma	San Jacinto
Big Bear Lake	Highgrove	Montclair	Santa Ana
Bloomington	Highland	Moreno Valley	Seal Beach
Buena Park	Home Gardens	Muscoy	Sedco Hills
Calimesa	Homeland	Newport Beach	Stanton
Cherry Valley	Huntington Beach	Norco	Sun City
Chino	Idyllwild-Pine Cove	Nuevo	Sunnyslope
Claremont	Irvine	Ontario	Upland
Colton	La Habra	Orange	Valle Vista
Corona	La Mirada	Placentia	Westminster
Costa Mesa	La Palma	Pomona	Wildomar
East Hemet	Laguna Hills	Quail Valley	Winchester
El Toro	Lake Elsinore	Rancho Cucamonga	Woodcrest
Fontana	Lakeland Village	Redlands	Yucaipa
Fullerton	Loma Linda	Rialto	

Environmental Justice

The U.S. EPA defines environmental justice as the fair treatment of all races, cultures, and incomes with respect to the development, implementation, and enforcement of environmental laws and policies, and their meaningful involvement in the decision making process of the government.

In order to achieve this objective, it is important to conduct the OWOW process in a manner that ensures all programs, policies, and activities will treat SAR Watershed residents, including minority populations and/or low income populations, fairly. This includes the need for equal enforcement of environmental laws across ethnic and income boundaries.

In order to meet the above objective, all studies conducted and data collected must adequately characterize and address the needs of the communities within the SAR Watershed. Perhaps the greatest challenge is to ensure that members of all communities are involved in the development of plans, including the OWOW Plan, and that all communities have input on water issues important to them.

Challenges

Several environmental justice issues within the SAR Watershed were identified early in the OWOW process. First, direct community impacts from groundwater contamination from industrial operations have occurred primarily in the upper watershed. This sort of contamination should be addressed as a local issue before contaminant plumes spread and the issue becomes regional in nature. Addressing such issues early not only protects water supply the community living in the area of contamination, it also provides cost savings by avoiding cost of regional cleanup efforts.

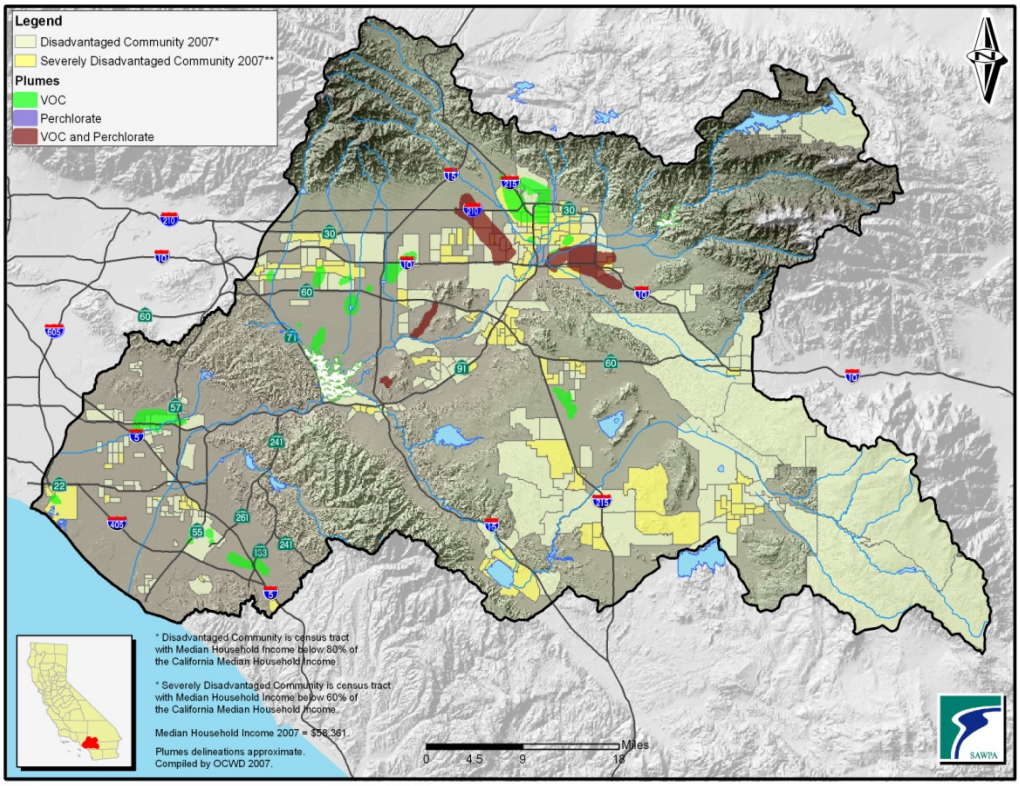
Similar issues arise in areas where groundwater and surface waters are impacted by leaking septic systems located in some high density, lower income communities where sewer services are not available. Here again, regional water quality issues can be avoided through implementation of projects to correct an environmental justice issue.

Some lower income areas of the Watershed are served by small water companies lacking resources to upgrade infrastructure and provide up-to-date treatment technologies for waste. In these areas the community lacks the resources and, in some cases, the expertise to upgrade systems. Disadvantaged areas located within larger districts with greater resources are not impacted in this way.

Finally, communication continues to be an environmental justice issue. Language barriers and a reliance on "word of mouth" communications limit communication avenues available to provide reliable, factual information to a community. In addition, the lower educational level of the community can result in difficulty interpreting the technical information needed to make informed decisions about water. Unfortunately, this issue has resulted in limited involvement from these communities in public discourse and in some cases, resulted in serious misinterpretation of information provided to the community.

Figure 5.10-3 depicts the various plumes (volatile organic compounds (VOC), perchlorate, and VOC and perchlorate) in disadvantaged communities.

Figure 5.10-3 Disadvantaged Communities and Plumes



Methodology

As part of the planning process, it became apparent that in order of fulfill the goal of direct involvement of the environmental justice community, it would be necessary to go directly to communities within disadvantaged census tracts and engage residents directly. It appeared implausible that adequate, unbiased information could be collected from meetings structured like those in the usual water resources planning process. It also became apparent that outreach would need to be conducted in a bilingual setting, as many residents were Spanish speaking and uncomfortable providing information in English.

In order to get the widest possible assessment of the concerns of the residents of minority and/or low income communities in the three counties, a series of one-on-one interviews and community group meetings were held over a period of two months in September and October of 2008. The interviews were conducted in English and Spanish in the cities of Colton and Rialto in San Bernardino County, Lake Elsinore and Pedley in Riverside County, and Santa Ana in Orange County. A standard set of questions was used to establish whether or not the residents of these communities had concerns with the water quality. The residents also were questioned about their understanding of the concept of environmental justice and their perception of the water quality in the SAR. When the survey was written, Lake Elsinore was not included in the questionnaire. Once the field work commenced in Lake Elsinore, the Lake became a topic of which the residents wanted to address without prompting.

It was apparent from the response to the questions about environmental justice and the SAR that neither concept is readily familiar to the residents of the disadvantaged and minority communities where the field work was conducted. In order to establish a base line opinion, a focus group was held at a community meeting in Santa Ana which was mostly attended by Anglo members of the community who were more affluent than the residents of the Barrio Logan area of Santa Ana who had initially been surveyed. A similar approached was used in the City of Colton because of the serious concerns about water quality in the disadvantaged and minority communities of that city. Many residents did not want to say their last names and in some instances they did not want to identify themselves, although they readily gave their opinions on their concerns with the water quality.

Findings

There is a widespread fear in minority and disadvantaged communities that the water is contaminated. During the course of the project, it became apparent early on that these communities are fearful of the water quality and are relying on water stores to obtain water for drinking and cooking. Because of the fear over water quality in disadvantaged and minority communities, there is a proliferation of water stores in these communities. Often times these water stores are chains which are located in three counties where the watershed is located. The Regional Water Quality Control Boards do not have jurisdiction over the water stores. The agency that oversees these water stores is the Food and Drug Administration because the water they sell is classified as “bottled water”. It is not unusual to see residents of the communities where this project focused purchasing

a daily supply of water from the water stores. Too often the elderly residents of these communities carry their daily water supply on their own with great difficulty. Many of these elderly residents carry the five gallon water bottles in grocery carts. One senior complex in Rialto is a multi-story building. The author of this report personally accompanied one elderly resident to the water store and carried the bottles back to her apartment complex. The bottles are extremely heavy and burdensome to carry. It is troubling that the residents of these communities are so fearful of the water quality that they must shoulder such enormous burdens.

Although the Watershed has eight Superfund sites, only one resident knew about a Superfund site that exists in the area in which he lived. This resident is English speaking and the Superfund site was Stringfellow, which has a high name recognition factor. None of the Spanish speaking residents knew what the term "Superfund site" meant.

The findings below are categorized by the three counties that are within the SAR Watershed. The findings are a summary of the data that was collected in the interview process that occurred during the months of September and October of 2008. The interviews were conducted in both English and Spanish. The discussion on Quail Valley was taken from the Quail Valley Water Quality Improvement Project report prepared by SAWPA on December 2009.

County of Riverside

Community of Pedley

There is a deep concern in the area of Pedley about water quality. The community is where the Stringfellow Superfund site is located. In the conversations with residents, only one person knew about Stringfellow. The Spanish speaking residents did not know what Stringfellow is or where it is located. Bill Griffith is a long time resident of Pedley. When asked if he drinks the tap water, he replied that he never drinks the tap water. When asked why, he replied, "It's nasty stuff." Griffith said he buys bottled water. He is in a motorized wheelchair and is very knowledgeable about the area. He knows about Stringfellow as he has lived in the area for many years. Griffith spoke freely about his concerns with the water quality in his neighborhood. He currently lives in the area near the intersection of 63rd Avenue and Pedley. He also was concerned about the former U.S. Pipe Company that is located at the corner of Clay Street and Limonite, and wondered what contaminants were left behind by the company, and if perhaps the company's activities had contaminated the groundwater. Griffith did not know the term "Environmental Justice" but did echo the concerns that the environmental justice movement has in the area. Griffith did not feel that the SAR was polluted and he would allow his children to play in the river.

The concern with the drinking water was affirmed by another resident of the area. This interview was conducted in Spanish. The resident's name is Josephine. Josephine said she didn't like the flavor of the water so she bought bottled water from the grocery store. When asked about the water quality of the SAR, she immediately said she thought it was contaminated. The resident said that, in addition to her concerns about water quality, she was concerned about the illegal dumping in her neighborhood. Items dumped supposedly included motor oil so she was concerned about the effects on the water supply. When asked if the county tried to respond to her concerns, she said

they did the best that they could but the quality of the drinking supply was still a problem because of the remote location of her home. Josephine did not know the term "Environmental Justice." She was concerned that the SAR was contaminated and would not let her children play in the river. Josephine said that her neighbors were all concerned about the water quality and purchased their water as well. It is apparent that given the isolation of the area, the residents do not feel they have any recourse but to purchase water rather than drink from a water source they do not trust to be safe.

Lake Elsinore

The Riverside County Housing Authority runs several housing projects in the Lake Elsinore area. Unlike their Los Angeles County counterparts, the housing projects are former apartment complexes which were bought by the Riverside Housing Authority for the purpose of using them as housing projects. The two apartment complexes which were part of this field work are located in single family neighborhoods and do not have any signs that they are subsidized housing. Both complexes are near Lake Elsinore. The first complex, Fairview, is located directly across from Lake Elsinore. Most of the residents were single women with young children. One resident named Lucia said that she did not drink the tap water "because it smells musty." When asked to elaborate, she said she couldn't but reiterated that the water smelled bad. She said she bought her water from the local water store, Agua Pura (pure water). Lucia said that she heard that the lake was contaminated and that was where they got their drinking water from. After further prompting, she said that the water smelled stagnant. Lucia had never heard the word "Environmental Justice" and had no idea what it meant. Lucia said that her neighbors were also worried about the Lake, as well as the contamination that they had heard about.

Another young mother with a small baby who did not want to give her name stated that she did not trust the tap water. She could not articulate why she didn't trust the water when questioned. She was unable to complete the interview because of her baby.

The second housing project is located on Broadway, and produced the only two persons during the entire two-month interview period who stated that they were not concerned about the water quality. Pauline said they had water delivered to their home "out of habit." She said that if she runs out of bottled water, she will drink the tap water. She said she didn't have any concerns about the quality of the area's tap water. When asked about the lake, she said that she didn't think the lake was contaminated. Maria also is a resident of the Broadway complex, and she also had water delivered to her home because she liked the taste better. When asked about the lake, she said she didn't think it was contaminated and admitted that she didn't know about the SAR. When asked if she has any concerns about the tap water she replied, "No I will drink it." Maria did not feel she had any water quality issues she wanted to address. She didn't know what the term "Environmental Justice" meant. Another interview that went against the usual pattern produced by the field work was conducted in English with a young man in his early twenties who is a resident of the Broadway complex. The young man, Chris, said he only drinks bottled water. He buys water bottles from the grocery store and doesn't patronize the water stores in Lake Elsinore. When asked why he doesn't drink the water from the tap, he replied, "no way, it's lake water." Chris is concerned that the lake is

contaminated. He also said that the City's water pipes are rusty because the area is old. He pointed out that the newer areas such as Murrieta do not have rusty pipes, so he would drink the water in that area. Chris also said that he thinks the water is dirty because the lake is dirty. When asked if his concerns were being addressed by the officials, he replied, "I don't know, probably not." Chris was not aware of the SAR (although he knew of the Colorado River) or the term "Environmental Justice".

Steve also is a resident of the Broadway complex. He was surrounded by his children when he was interviewed. Steve said he purchases bottled water from the water store because he doesn't think the tap water is good, "it's contaminated." Many of his responses were prompted by his children. In spite of the fact that Lake Elsinore is widely used for recreation, when asked about the Lake, he immediately replied that it was contaminated and he doesn't allow his children to play in the Lake. When asked about his concerns with the tap water, he reiterated that he feels the water is contaminated. Steve doesn't think that the issue is being addressed and didn't know how it could be better addressed. The term "Environmental Justice" was not recognizable to Steve or his children.

Rudy was interviewed at the DeJong Dairy in Lake Elsinore. He said he didn't buy bottled water but had a filtration system at his house. He said he bought the filtration system because he is "somewhat" concerned about the runoff into the lake. He thinks there is contamination in the Lake from the water run-off. Rudy said he thinks the officials are addressing the issue and does not believe he has anything to contribute "because they know more about it than I do." When asked what should be done to address the concerns he has heard about, he replied "the City should talk to us." Rudy did not know the term "Environmental Justice". Rudy's girlfriend Irene echoed his comments.

Another couple, who were interviewed together and wanted the husband to be the spokesperson, were Francisco and Connie. The couple had just bought water from a water store in Lake Elsinore. They were carrying the five gallon bottle in a baby carriage. When asked why they bought water from the water store, Francisco replied in Spanish, "Because the water is contaminated." When asked why he thought the water was contaminated, Francisco replied "because it comes from the Lake and the Lake is contaminated." Both Francisco and Connie said the water "smells bad." When asked if they would let their children play in the Lake, both immediately replied, "No." When asked what could be done to address their concerns, Francisco said he would like someone to talk to him about the water. Neither one had heard the term "Environmental Justice".

Quail Valley

Information for the preparation of this section is taken from *Quail Valley Water Quality Improvement Project* (SAWPA, December 2009). Quail Valley is located within the City of Menifee in western Riverside County. According to the 2000 Census, Quail Valley had a population of 1,639, but more recent estimates put it at 4,400 residents in approximately 1,400 homes. Many of these homes are mobile homes located in small lots that rely on septic tanks for wastewater disposal. Although Quail Valley is not officially considered a disadvantaged community based on California State Median Household Income, as this classification is granted at the census tract level, it is

evident that this community is indeed disadvantaged. In particular, the area known as "The Grid" shows characteristics of a disadvantaged community.

Many of the septic tanks in the community have a history of malfunctioning, as evidenced during the 2004-05 rainy season, when many of the septic tanks of people surveyed overflowed. It is believed that the problems arise partly due to the percolation characteristics of the sites, the irregular topography of the area with high groundwater levels, and the high density of housing units. Many of the septic tank failures occur in the Grid.

According to the Santa Ana Regional Water Quality Control Board, there are approximately 1,100 septic tanks in Quail Valley, and as many as 3,900 additional lots available for development. A survey conducted in March 2005 by the Riverside County Environmental Health Department concluded that 27% of residents interviewed have grey water discharges, 28% said they have experienced problems with their septic systems, and 10% were observed having sewage discharge.

Although there is no quantifiable evidence, it is generally believed that septic tanks in the area are partly responsible for water quality impairments in Canyon Lake, which is in the Regional Board's list of impaired waters for nutrients, and has a TMDL plan in place.

A moratorium was in place in 2006, banning the construction of new housing units or remodeling of existing units until a formal sewer system is in place. This moratorium limits what is perceived as a high potential for development in the area and adversely impacts economic development.

In March 2009, the City of Menifee formed the Quail Valley Task Force to address the problems associated with failing septic tanks. The Task Force was formed with members from Eastern Municipal Water District, Elsinore Valley Municipal Water District, the City of Menifee, the City of Canyon Lake, and the City of Riverside. In addition, the Quail Valley Sewer Improvements Alternatives Study was conducted in 2005, as commissioned by Eastern Municipal Water District to analyze the problem and identify potential solutions.

The Task Force decided to concentrate on Subarea 9 for the first phase of a Quail Valley Sewer Project. Subarea 9 is the southern portion of Quail Valley and is believed to be a contributor to some of the impairment in water quality in Canyon Lake. It is also believed that installing a sewer system along Vista Way in subarea 9 is most feasible due to topography and to the fact that there are many lots that could be developed if the sewer system were built, thus stimulating the local economy.

The study and work performed by SAWPA identified the following challenges in addressing the septic tanks problem.

- The topography of the area is hilly, which makes the construction of a sewer system more expensive.
- The small size of the lots and narrow streets make the construction of the sewer system difficult and expensive.
- Construction costs and funding challenges due to the recent downturn in the economy and the low income of residents of the area affect the financial feasibility of the project.

Preliminarily estimations are that the sewer system would have a capital cost of approximately $70 million.
- Although 80% of residents surveyed indicated that they would be willing to connect to the sewer system, hook-up fees may limit the feasibility to do so.
- The belief by some people that the authorities only have an interest in sewer Area 9, which is the area closest to Canyon Lake.

An implementation strategy for Quail Valley is laid out in the SAWPA report, consisting of the following seven strategies:

- Strategy 1 – Develop a plan to lift the moratorium or sewer the area.
- Strategy 2 – Develop a phased approach to sewer the area considering technical complexity and funding availability, including an emphasis on securing funding from several sources.
- Strategy 3 – Address additional sewer needs within Quail Valley, including provisions for "over-sizing" of sewers to accommodate future needs.
- Strategy 4 – Communicate with the residents of Quail Valley addressing the concerns and viewpoints of both the English-speaking and the Spanish-speaking members of the community.
- Strategy 5 – Concentrate on moving forward with providing sewer to Area 9 within the context of a larger Quail Valley Project.
- Strategy 6 – Develop and implement an interim plan to assist residents during rain events.
- Strategy 7 – Sign an MOU among the members of the Task Force to continue to work toward the resolution of issues and help assure residents that the Quail Valley Project will not end with the sewering of Area 9.

Beaumont Cherry Valley

The community of Cherry Valley is an unincorporated area of Riverside County, next to the City of Beaumont, with an area of approximately 8.24 square miles. The population of the community was estimated at 5,945 in 1990 and 5,891 in 2000. The ultimate built-out population is estimated at approximately 24,700. The Beaumont-Cherry Valley Water District (BCVWD), which provides potable water service to the City of Beaumont and Cherry Valley, in its 2005 Urban Water Management Plan, estimates the following population growth:

Year	2000	2005	2010	2015	2020	2025	2030
Population	5,891	6,981	7,936	9,610	11,159	12,559	13,870

The median household income of the community in 2000 was $39,199, or 83% of the State average household income of $47,493. This puts the community slightly above the threshold to be considered a disadvantaged community by the State: 80% of the median state household income. However, similar to Quail Valley, some areas of the community are believed to fall under the 80% threshold.

The potable water supply from BCVWD is from local groundwater wells. While formal potable water service is provided by BCVWD, residents of Cherry Valley rely on septic tanks, or on-site waste disposal systems, for wastewater disposal and treatment prior to effluent discharge to groundwater.

According to the Water Quality Impacts from On-site Waste Disposal Systems in the Cherry Valley Community of Interest (Wildermuth Environmental Inc 2007), groundwater quality has been impacted by septic tank discharges. According to this report:

- Several production wells have been negatively impacted and nitrate concentrations are increasing at BCVWD and other retailer's wells.
- Several wells within and down-gradient of Cherry Valley have nitrate concentrations that are near or exceed the MCL of 10 mg/L.
- Water produced from these wells have a nitrogen isotopic signature that is consistent with discharges from septic tanks.

Based on the conclusions of the WEI study report, on July 17, 2007 the County of Riverside Board of Supervisors issued a prohibition on the use of on-site waste disposal systems in the Cherry Valley Community of Interest. Based on resident concerns with the prohibition, on April 29, 2008, County of Riverside Supervisor Ashley established the Groundwater Quality Evaluation Committee for the Beaumont/Cherry Valley Area (Committee). The Committee members included interested local residents and technical experts in the field of water quality. The technical experts were non-voting members and provided only technical assistance to the local residents. The Committee was tasked with reviewing technical data presented by Federal, State, and regional experts and making recommendations to the Riverside County Board of Supervisors, the cities of Beaumont, and Banning, and the Board of the BCVWD regarding the on-going concerns about groundwater quality in the Beaumont Groundwater Management Zone (GMZ). Regional Board staff and SAWPA served as technical experts on the Committee. The Committee completed its Final Report and Recommendations on June 15, 2009, but unfortunately removed the input of the several technical experts on the panel.

On July 10, 2009, the Riverside County Board of Supervisors accepted the Committee report and recommendations, but chose not to change its position on the septic system ban. On August 28, 2009, a report of the County actions and report findings were shared with the Regional Board. The Regional Board staff recommended further analysis be conducted, possibly under a SAWPA Task Force format, to ensure the protection of water quality and beneficial uses in the Beaumont GMZ. Furthermore, the Regional Board suggested additional regulatory actions if the County prohibition were to be repealed in the future, such as a prohibition on future waste discharges from septic systems to the Beaumont GMZ, and a cease and desist order with a compliance schedule to residents in Cherry Valley who dispose of wastewater to septic systems.

County of San Bernardino

City of Colton

The residents of the northern portion of the City of Colton are deeply concerned about their water quality. One resident, a young mother of a two year old child, said that she buys water from the store because the water that comes from the tap is yellow. When asked if she has ever complained to the City about the water quality, she says that she doesn't feel it will do any good so she stays silent. Every day, she and her husband go to the water store for their daily supply of water for drinking and cooking. This resident says that in addition to the water discoloration, the taste of the water is an issue.

A group of parents whose children attend an elementary school in northern Colton were queried about their water quality concerns and the following are their responses. One resident of the north side of Colton also expressed reservations about the quality of the tap water. When asked about water quality concerns with regard to the SAR, this resident, who is an undocumented worker and did not want her name to be revealed, replied that she never goes near the river so it is not a concern. This resident says that the tap water in her home is brown. She blames the brown discoloration on the rusty city pipes that deliver water to her home. She said that her entire neighborhood has rusty water. Although she lives in a disadvantaged community, she is not aware of the term "Environmental Justice." When asked if she would allow her children to play in the SAR, she replied, "No, it's polluted."

Camela, a resident who lives in northern Colton also stated that the water tastes bad. Because of the taste, she buys water from the store. Camela said she has not seen brown water coming from her tap, but at the same time said she buys bottled water because the tap water "is dirty." She feels that the pipes that bring water to her home need to be replaced. Like her neighbors, Camela feels it is useless to complain so she stays silent. Again, the term "Environmental Justice" is an unknown term in this community.

Sonny is a long time resident of Colton. He lives in south Colton. He is a Latino who lives in a primarily Anglo area of Colton. He says he doesn't see any brown water and has never had a concern about his drinking water. He admits that he never worries about the water quality but realizes that there are water problems in other parts of the city. As for the City's response to the citizen's concerns, he feels the city is responsive. "The City is going about flushing the pipes." When asked whether or not he knew what "Environmental Justice" is, he replied, "No." In spite of everything, Sonny buys bottled water because "it tastes better."

One of Sonny's neighbors is an older couple who reaffirmed that they do not have any concerns with their water quality. They routinely use the tap water for cooking and drinking. When asked whether or not they knew what the term "Environmental Justice" means, neither one could define the term.

Dave is another long time resident of south Colton. He and his wife Barbara stated that they drink the tap water readily and do not feel the water is contaminated. They pointed out that the southern part of Colton obtains their water from a different water source than the northern part of the city. Barbara believes that this may be a reason why they have never had an issue with the water quality in Colton.

City of Rialto

An informal focus group was conducted at the Senior Center in the City of Rialto. The interviews were conducted in Spanish with a group of Latino senior citizens. Each of the persons interviewed stated that they buy their water from water stores in Rialto because they are fearful of the pollution in the water. The group stated that the City of Rialto advised them not to drink the water.

Teresa is an elderly Latino woman who lives in a senior complex in Rialto. In spite of having arthritis in her hands which impedes her ability to grasp, she buys her water daily from a local water store called *Agua Pura* (pure water). The water store is in a minority neighborhood and has a brisk stream of customers buying water. It is not uncommon to see pedestrians walking from the water stores with large containers of water for their daily consumption. When asked how the City conveyed the message of not using the water, Teresa replied, "Through television commercials and in the newspaper." When asked when this was done, she replied, "It's been a while; it's been the last year or so."

An Internet search revealed a great deal of press on the perchlorate issue in the City of Rialto. The large number of press stories could have added to the perception that there is a serious problem with water quality in the City. Nevertheless, the City of Rialto stated that the tap water is safe to drink. Rialto Councilmember Joe Baca, Jr. noted that the City has sent mailers to residents explaining that the water is safe to drink. Nevertheless, the residents interpreted this mailer as stating that the water was unsafe to drink. Councilmember Baca said the City is aware of the problem and is working on ensuring the residents understand the water is safe to drink.

County of Orange

City of Santa Ana

The Barrio Logan area of Santa Ana sits in the shadow of the Ward Disposal and has been a source of concern for the residents for many years. The City of Santa Ana's Code Enforcement Department has tried repeatedly to respond to concerns by the neighbors, but is limited in what the department can do. The residents in this minority and mix-zoning disadvantaged community also are leery of the water quality. "I don't drink the water from the tap because it tastes bad," said a resident of a home next to the Ward facility who identified himself as "Salinas." When asked if he used tap water, he said he didn't because of fear of the water being contaminated. When asked why he thought the water was contaminated, he replied that it had "been on the news." This resident is a patron of the local water store.

Another resident of Barrio Logan echoed a similar concern. Juanita was interviewed at a park in the Barrio Logan area where she was watching her children play. When asked if she drank tap water she replied, "No, it doesn't taste good." When asked from where she obtained her water, she stated that she went to the water store to buy water. Juanita said she had heard that the water was contaminated so she was not going to take chances. Juanita said that it was "cheaper to buy water at the water store than to pay a doctor bill." It is evident from this conversation that this resident is extremely fearful of the water quality in the area.

During the same interview period, another woman was approached about her thoughts on water quality. Although she was in Santa Ana at the time of the interview, she said she was a resident of Corona. When asked if she used tap water, Veronica replied, "No, it tastes bad." When asked to elaborate, she said, "There are too many chemicals in the water; it leaves a bad taste." When asked about the SAR, Veronica stated that she was familiar with the SAR but she would not let her kids play in the water because of fear of contamination. When asked where she bought her water from, she replied, *Agua Pura. Agua Pura* is the same water store where the residents of Rialto and Lake Elsinore buy their water.

The Communications Linkage Forum (Comm Link) was created in 1989 in the City of Santa Ana in order to foster communications between the community and city leaders. The membership consists mostly of older long time residents of Santa Ana. The majority of the members of this group are not members of minority and disadvantaged communities. At the group's October meeting, the question was posed as to where they obtain their drinking water. The majority stated that they drink the tap water. The group included an official from the City's Water Resources division. None of the residents polled at the meeting had any concerns about water quality. None of these residents patronized the water stores.

The City of Santa Ana was chosen for targeted outreach to the disadvantaged community because it is located in two of the three WMAs. This outreach specifically targeted the 92701 zip code of Santa Ana because in this area there is only one half of an acre of open space for every thousand residents. In addition, it has the second highest child obesity rate in California with cities of population over 100,000. The City of Santa Ana has neighborhood associations that are officially recognized by the City as citizen participation groups. These neighborhood associations groups hold monthly or quarterly meetings to address the particular needs of their neighborhood.

Targeted outreach efforts began in the Lyon Street Neighborhood Association located in the City of Santa Ana. Residents in this neighborhood identified their main concern to be the lack of parks in their community. There was genuine interest from the Lyon Street neighborhood group to participate in the IRWMP process but there were other priorities that took precedence such as employment, housing, traffic safety and education. Though the stakeholders identified were unable to participate engaging in this neighborhood forum was a success because a community need was identified. The County of Orange realized that this type of targeted outreach efforts would help to involve other disadvantaged communities.

Armed with this new insight an outreach plan was developed and implemented to ensure that these targeted stakeholders would get involved and stay involved. The County researched other IRWM groups who were successfully outreaching to disadvantaged communities by in the State. County staff then identified and contacted organizations that were already engaged in this type of targeted outreach in other parts of the State of California. They included Environmental Justice Coalition, Urban Semillas, San Gabriel and Lower Los Angeles Rivers and Mountains Conservancy, and Los Angeles County Department of Public Works. Staff gathered information from these organizations to determine the methods that were being using to conduct this targeted outreach. This research proved that successful outreach was tied to partnering with existing community outreach groups. Community groups are an important connection because the members are a part of the community and understand the needs.

Latino Health Access

The first community group that the County began targeted outreach with is Latino Health Access. Latino Heath Access (LHA) is a nonprofit organization founded in 1993 to help meet the multiple health needs of the Latino community. LHA assists in improving the quality of health and life of uninsured, under-served people by providing them with quality preventive care services and educational programs. LHA emphasizes full patient participation in health-related decisions. LHA lacks a direct connection to water resource issues but their in-depth community involvement, specifically through a program known as "Pasa La Voz", translated in to English means "Pass on the Voice". This program focuses on civic engagement and increased political participation by actively involving community members to help them become a valuable networking resource.

On February 7, 2009, County of Orange staff provided an informational presentation at an all day workshop with members of the community park board. This presentation was conducted in Spanish and included information on Measure M2 and Proposition 84 IRWM grant opportunities, examples of regional water projects completed in other DAC areas of California and fund raising ideas. A brain storming session ensued where community outreach opportunities were discussed.

As a result of the County's targeted outreach, LHA submitted a project for inclusion in the Phase III Central Orange County IRWMP. The project involves the development of a pocket park in the 92701 zip code of Santa Ana, the most park-poor area of the city. The park will include a basketball court, a playground, community center with a multi-purpose room, full industrial kitchen, small office space and a walking path. Located two blocks from downtown Santa Ana and next to Spectrum condominiums, the LHA Park and Community Center will be walking distance for most residents. In addition, LHA plans to offer nutrition and physical activity, English as a Second Language, and mental health support programs at the Center. The Community Center will be seeking Silver Certification under the Leadership in Energy and Environmental Design (LEED) Green Building Rating System, which means that the construction will have to include water-use efficiency among other environmentally-responsible measures.

On April 11, 2009 County of Orange staff participated in a site cleanup event and brought in kind assistance in the forms of tools such as shovels, rakes, hoes and trash bags. About 20 volunteers showed up to help with the cleanup. Previous efforts were made to clean up but were not successful due to the lack of tools. Support for this project has continued by offering in-kind services, such as assistance from County of Orange LEED certified staff and support for local fundraising events. The development of this pocket park will help fulfill the need of a park that was originally identified by the Lyon Street neighborhood.

La Habra High School Watershed Event

OC Watersheds staff worked with the National Hispanic Environmental Council and U.S. Fish and Wildlife Service and the City of La Habra to conduct targeted outreach with two AP Environmental Science classes at La Habra High School. The outreach was a two day watershed event that was held on May 21 and 22, 2009. This two day event started with speakers coming to the AP Environmental Science classrooms at La Habra high school to provide information to the students about their watershed, water supply and water quality. Lunch was sponsored by the City of La Habra and Waste Management to give the students' additional time to participate in the event. The second day

included a field trip where students walked to Coyote Creek and conducted water quality and habitat monitoring. Information was provided to the students about the types of pollutants that were being tested as well as what affects these pollutants can have on water quality. Habitat monitoring studied what types of birds and other animals were using the area for habitat. After the monitoring the students wanted to make a difference so they made the extra effort to remove trash and debris that was in Coyote Creek channel. The students removed a large amount of trash and debris that had collected in the creek. The watershed event was very successful because the students gained valuable information and experience in the environment and helped to clean up their watershed. Over fifty students participated in this two day event.

A grant was submitted and approved by the US Fish & Wildlife Service for water quality monitoring supplies. This targeted outreach has developed into yearly Water Quality monitoring efforts by La Habra high school AP Environmental science students. In October 2009 program implementation began with County of Orange staff providing water quality monitoring training to the students. Training involved the use of the mobile lab where students performed water quality tests for nitrates, phosphorous, dissolved oxygen and pH. This grant has helped to expand these efforts by incorporating a second high school to begin water quality monitoring.

Conclusion

The SAR Watershed includes one of the fastest growing populations in California. The Inland Empire is growing at a phenomenal rate and will only continue to expand. Because there are so many disadvantaged and minority communities in the SAR Watershed, it is important that Environmental Justice be of prime importance in any discussion of water supply and reliability in the Watershed. There is a wide perception among residents of disadvantaged and minority communities that the water is contaminated. In the two month time period spent in the disadvantaged communities of Riverside, San Bernardino and Orange Counties, it is apparent that that these communities are going to great lengths, both physically and economically, to avoid using tap water. Whether it is an elderly woman in Rialto carting heavy bottles of water home, or a young mother with small children who also lugs heavy bottles of water home, the reality is the same: people are afraid that the water is contaminated. There must be a serious effort to communicate with the residents of these communities about the water supply and reliability. The disadvantaged and minority communities have a feeling of disconnect from the agencies that have jurisdiction over their water supply. The residents need to be assured that the water supply is not contaminated. There is a grave distrust of the water quality in these areas by the residents, and this has to be countered. Although public officials state that that there is nothing wrong with the water quality, the residents are not aware of this message. Too often, these residents are situated in communities that are isolated. For example, the area surveyed in Pedley was in an isolated rural neighborhood where persistent dumping onto the ground is the norm. The residents believe, and rightly so, that this will contaminate the ground water and feel powerless to stop the dumping of oil and other hazardous materials in their neighborhoods. There is also a fear of what contaminants are left behind by industrial plants that are no longer functioning. Although millions of dollars have been spent cleaning up Superfund sites in the Watershed, there is still the persistent idea that there is contamination in the water supply. The residents of the disadvantaged and minority communities often times only speak Spanish, so an effort should be made to speak Spanish to these communities.

In 2007, SAWPA initiated the OWOW project in order to pool all of the resources in the SAR Watershed to ensure that the water supply is protected. A network of nearly 100 Federal, State, and local agencies along with the private sector is in the process of producing a long range planning document that will give the region a unique and comprehensive approach to Watershed management. With so many agencies and stakeholders involved, it is only right that the disadvantaged and minority communities which are so isolated and distrustful of their water quality, be brought into the process. OWOW is comprised of various pillars such as Flood Risk Management and Water Quality Improvement. The Environmental Justice pillar is an equally important pillar that must be nurtured in order to allow these disadvantaged and minority communities to begin to participate in the process of creating the long range planning document, which will give us the blueprint for watershed management for many years to come.

The results of this interview study reinforce the need for a careful, coordinated public information program in service to the Environmental Justice community. Many of the resident's concerns are based on misinformation, but nonetheless, they are concerns. Carefully planned, well-executed public information programs have not reached the entire community, and it would be beneficial to convene a number of roundtable discussions among public education professionals from throughout the Santa Ana River Watershed to develop a strategy that reaches all communities.

There are legitimate water quality issues that impact low income communities throughout the Watershed. These issues need resolution. However, some of the issues involving perception of unsafe water where water supplies are clearly safe for public consumption identify another problem. Spending scarce family resources to protect families from a perceived risk appears to be a major Environmental Justice issue. The solution to this issue is to ensure that all communities have the information they need to make informed decisions.

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Chapter 6 Regional Goals & Objectives

In order to guide the development of the OWOW Plan, the Steering Committee and the Pillar Leader group convened to establish the goals and objectives for the Watershed that would allow a holistic approach to resource management.

A two-day eco-charrette was hosted by Stantec Consulting on July 16, 2007 and on July 17, 2007. This event provided an interactive and thought-provoking forum to discuss ideas and priorities in the pursuit of sustainable water resources and to discuss and take a first step toward developing goals and objectives for the Watershed. Stantec staff conducted a thoughtful and meaningful discussion regarding the values and principles that would be used as guiding principles for the Pillars to follow in the development the OWOW IRWMP. The eco-charette format is based on developing consensus of the OWOW leadership values, challenges, and strategies via group input and voting mechanisms to refine and enhance the overall vision of the group.

Through extensive discussion and collaboration among the OWOW Steering Committee and Pillar Leaders on issues pertaining to values, challenges, and strategies, they were able to prioritize each issue. Listed below is a summary of the issues obtaining the most "votes" at the eco-charrettes.

Values

- Sustainability
- Comprehensive Water Strategy
- Smart Growth/Urban Centers Communities
- Maintain Quality of Life

Challenges

- Benchmark Data
- High Impact Development/Heavy Footprint
- Economics/Cost of Change

Strategies

- Improved Social Marketing
- Advocacy for a Sustainable Watershed
- Increase Recycled Water Usage
- Massive Reduction of Urban Runoff by 2030
- Maximize Utilization of Stormwater for Supply
- Green Building/LID
- Reduction of Turf and Water Guzzling Plants

In addition, using the Pillar Leaders' input from the July 16, 2007 eco-charrette, the Steering Committee developed three statements to help each Pillar prepare their respective group's report. These three statements are:

- Balance Environment and Economics
- Plan for Severe Reduction of Imported Water Scenario
- Consider Climate Change

The Steering Committee conveyed a sense of urgency that moderately aggressive to aggressive planning was needed. Furthermore, they were effective in conveying direction to produce a plan that is more aggressive in taking steps to plan for major changes in how developing, protecting, and conserving water is approached. At the end of the eco-charrette, the general direction was as follows:

- There was a shared understanding that all water within the Santa Ana River Watershed is a precious resource. Climate change, continuing Colorado River drought, questions about the San Joaquin Bay Delta's vulnerability and its ability to deliver water to southern California, and changes to the hydrologic cycle as the result of our very own successful growth and development will stress our ability to provide sufficient water to supply to our Watershed for economic and environmental sustainability.
- There was an expressed commitment to invest time and resources for high quality planning, both long-range and short-range, to ensure the best possible outcome and to achieve the stated mission of making the Santa Ana River Watershed drought-proofed, salt-balanced, and to continue its economic and environmental vitality.
- While major paradigm changes are being considered, the quality of life of the residents must be protected and the economic impact of a recommended change must be understood before implementation.
- The group indicated through voting that, in order to meet these challenges, the leadership in the watershed would need to consider significant review of current practices and expectations. The best solutions would likely engender new ways of thinking about water use and the value of water.
- There was acknowledgment that while many advances would need to be made in conservation and water use efficiency, the planning process should consider if agricultural water conservation measures could free up water for urban use or if water could be purchased from agriculture for urban use.
- There was a commitment to employ emerging technologies to further urban water efficiencies and to develop new water supplies.

Generally, the consensus was that the OWOW effort would need to be bold and innovative to meet the watershed's vision.

There also was interest in matching the quality of water delivered to the water quality needed for a specific purpose. For example, highly treated drinking water is not needed for agriculture or landscaping use. Steering Committee members discussed the impacts of land use decisions on water quality and the quantity of water available. There was a desire for better communication and coordination between the water industry and those charged with land use planning. Furthermore, Steering Committee members also discussed how much public open space is dedicated to grass and how much of residential personal outdoor space can be maintained in grass verses other plantings that would be less water dependent. They acknowledged the need for grass play areas while seeing opportunities for water savings by replacing grass with drought tolerant plantings in other areas. The Steering Committee suggested that the price paid for water by the consumer versus the actual cost of water, including environmental, wheeling, and infrastructure replacement costs be reconciled.

In addition to the two-day eco-charette, the Steering Committee, as well as the Pillar leaders, met on several occasions to review and enhance these goals and objectives. Draft goals and objectives were developed based on the eco-charrette exercises. A draft set of Goals and Objectives was presented to the Steering Committee for comment. The Pillar Leaders then prepared a draft final set of goals and objectives. These were presented for comment at a public meeting held at the California Citrus State Historic Park on October 31, 2007. Email notices allowed public on the mailing list to participate electronically in the comment process. Stantec Consultants collected the comments and provided them to the Pillar leaders for consideration. After final revision, the goals and objectives were adopted by the Steering Committee. The final product of their efforts is shown below in **Table 6-1**, which summarizes the objectives and sub-objectives developed in consensus by the group.

Table 6-1 Objectives Adopted by the Steering Committee

Objectives	Sub-objectives
Provide reliable water supply	Reduce dependency on imported water Meet current and future water demands during all hydrologic conditions Meet water demands during emergency or catastrophic conditions Maximize water use efficiency (conservation) Increase use of recycled water
Preserve and enhance the environment	Protect and enhance the ecological function of open-space Protect and enhance water-related habits Reduce or eliminate invasive riparian and aquatic species Protect sensitive marine and estuarine environments Consider ecological functionality in new development
Promote sustainable water solutions	Promote strategies that link land and water use Reduce greenhouse gas emissions Reduce energy consumption and promote urban greening projects Develop partnerships for planning and implementation of economically, environmentally, and socially sustainable watershed projects
Ensure high quality water for all users	Attain water quality standards in fresh and marine environments Match water quality with intended uses Protect and improve source water Manage salinity
Provide economically effective solutions	Leverage existing financial and infrastructure assets Minimize capital, O&M, and life-cycle cost Promote aggressive pursuit of grants and loans Pursue innovative, non-traditional revenue-generating concepts
Improve regional integration and coordination	Engage stakeholders in planning and implementation of watershed projects Increase communication and coordination Search for projects that meet multiple goals across geographic and water resource services
Manage rainfall as a resource	Provide appropriate flood control capacity and other benefits to the community Maximize beneficial use of rain water
Preserve open-space and recreational opportunities	Increase opportunities for recreation and open-space Provide useable open-space for all residents of the watershed
Maintain quality of life	Balance quality of life, and social, environmental and economic impacts when implementing projects Consider the needs of disadvantaged communities

The objectives established by the Steering Committee address the overarching goals established by DWR Proposition 84 Guidelines, including requirements of CWC§10540(C), as summarized in **Table 6-2**.

Table 6-2 Objectives and Goals set by the Steering Committee

CWC§10540(C) Objectives	Corresponding OWOW Plan Objective
Protection and improvement of water supply reliability, including identification of feasible agricultural and urban water use efficiency strategies	Provide reliable water supply Promote sustainable water solutions Provide economically effectives solutions Improve regional integration and coordination Manage rainfall as a resource
Identification and consideration of the drinking water quality of communities within the area of the Plan	Ensure high quality water for all users
Protection and improvement of water quality within the area of the Plan consistent with relevant basin plan	Ensure high quality water for all users
Identification of any significant threats to groundwater resources from overdrafting	Provide reliable water supply Promote sustainable water solutions Manage rainfall as a resource
Protection, restoration, and improvement of stewardship of aquatic, riparian, and watershed resources within the region	Preserve and enhance the environment Promote sustainable water solutions Improve regional integration and coordination Preserve open-space and recreational opportunities
Protection of groundwater resources from contamination	Ensure high quality water for all users Promote sustainable water solutions
Identification and consideration of water-related needs of disadvantaged communities in the area within boundaries of the Plan	Provide reliable water supply Provide economically effectives solutions Improve regional integration and coordination Maintain quality of life

During subsequent meetings and workshops, the Steering Committee and the Pillar Groups identified Strategies to meet the objectives, and targets to measure the extent to which the objectives are being met. As shown in **Table 6-3** below, there is a strong correlation between objectives, strategies, and targets.

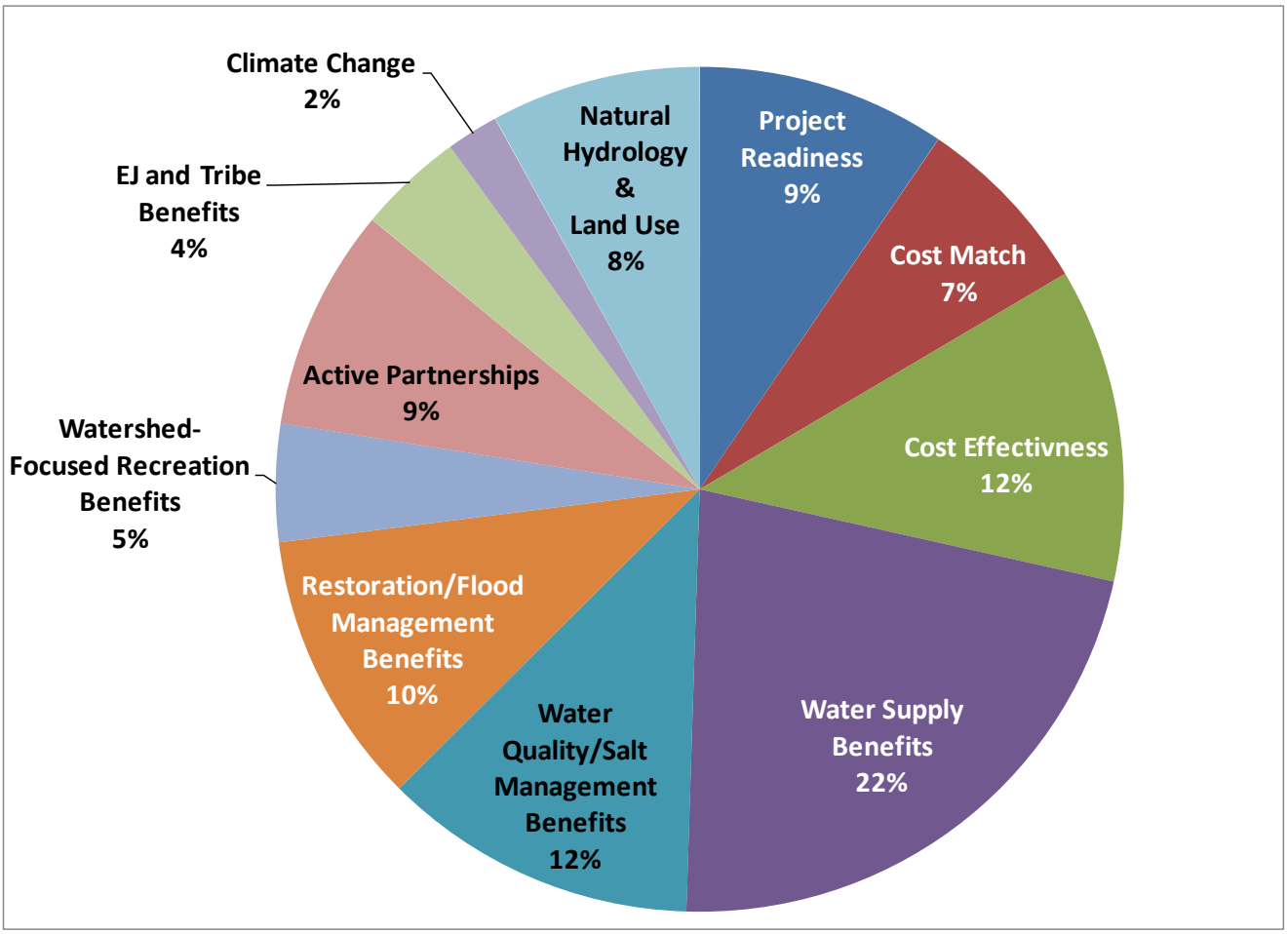
Table 6-3 Objectives, Strategies, and Targets Identified

Goals & objectives	Strategies	Targets
Provide reliable water supply Promote sustainable water solutions Use rainfall as a resource	Increase storage Reduce demand Desalinate groundwater Recycle water Consider stormwater as water supply Value water differently	Recycle and reuse 100% of wastewater Store water to account for half of watershed demand for 3 years Reuse all of Santa Ana River flow at least once Reduce potable water use by 20% Capture and recharge 80% of rainfall
Preserve and enhance the environment	Maximize preservation and use of native plants	Fill gaps in riparian corridors to provide wetlands and linkages between open space and natural habitat Meet California Flood SAFE goals & construct soft bottom flood systems
Ensure high quality water	Develop risk-based WQ improvements	Meet WQ standards Remove salt from watershed to improve salt balance
Provide recreational opportunities		Complete the SAR Trail and connect all tributary corridors to
		Assure adequate water supply and safe wastewater treatment and disposal
		Reduce GHG emissions from water mgmt activities
	Incorporate integrated water planning in General Plans Manage public property for more than one use	Increase resource efficient land use
Provide economically effective solutions		
Improve regional integration & coordination		
	Create watershed governance Implement watershed-wide education programs	

Finally, in order to prioritize projects based on the degree to which they meet the Plan goals and objectives, SAWPA staff and consultants developed Evaluation Criteria. Evaluation criteria are considered more implementable and quantifiable than the overarching goals and objectives of the Plan, and thus are useful for the ranking of projects and to monitor the performance of projects upon implementation (the project ranking process is explained in more detail in Chapter 7).

The Steering Committee assigned a weight of importance to each criterion by using a dot-voting exercise. The exercise consisted in giving each Steering Committee member a set number of votes (dots) to be allocated among the 11 criteria based on its importance as perceived by the individual Steering Committee member. The final weight or relative importance of each criterion was established based on the total number of votes allocated to it by the Steering Committee. **Figure 6-1** summarizes the results of the weighting exercise.

Figure 6-1 Relative Importance of Objectives



A Performance measure was created for each criterion and sub-criterion to quantitatively determine the degree to which the latter are being met by each project. In some cases, more than one performance measure was established for a criterion to increase the specificity of the measurements (See **Table 6-4** below).

Table 6-4 Evaluation Criteria

Project evaluation criteria	Performance measures
1. Provide water supply benefits	a. Reduction in imported water (in acre-feet per year) from conservation, recycling, desalination, storage, transfers, groundwater recharge/storage/conjunctive management, and/or other sources of new water b. Percent of project area implementing water use efficiency
2. Provide restoration and flood management benefits	Number of acres of new or restored habitat or flood plain protected
3. Provide water quality and salt management benefits	a. Volume of water treated (acre-feet/year or mgd) b. mass of salt or contaminants removed (tons/year).
4. Provide recreational benefits	Acres of open space/parks created
5. Provide benefits and avoid adverse impacts to disadvantaged communities and Native American tribes	a. Benefits to disadvantaged communities (Yes/No)b. Benefits to Native American tribes (Yes/No)
6. Reduce greenhouse gas emissions from water management activities	GHG Score: 0 = no information 3 = narrative description only 4 = numeric estimate without specific actions 5 = numeric estimate with specific actions
7. Increase resource-efficient land use and reduce impact on natural hydrology	a. Uses LID or other resource-efficient land use (Yes/No) b. Adversely impacts or changes natural hydrology (Negative impacts/No impacts/Positive impacts)
8. Cost match	Percent of project cost funded and secured from other sources
9. Cost effectiveness	A standardized per unit cost indicator (e.g., $/AF or $/acres of habitat)
10. Project readiness	Project readiness score: 1 = Planning studies completed 2 = Conceptual design (15%) completed 3 = Preliminary design (30%) completed 4 = Final design (100%) completed 5 = Project ready for construction bids (permits secured)
11. Increase active participation	Partnership Score: 1 = No or limited partnership 3 = Coordination with others 5 = Cost-share or in-kind funding partner

The graph below illustrates the relationship between goals and objectives, strategies, targets and evaluation criteria.

Chapter 7 further describes the project ranking method based on objectives achievement as indicated by the performance measures described above.

Guiding principles

1. View our actions as part of a watershed systems
2. Avoid transferring our problems to others or the environment
3. Work collaboratively

Goals and objectives (SteerCo)	Strategies (SteerCo)	Targets (Pillars)	Evaluation criteria (Staff)
1. Reliable water supply 2. Preserve/enhance the environment 3. Promote sustainable water solutions 4. Ensure high quality water 5. Provide economically effective solutions 6. Improve regional integration & coordination 7. Use rainfall as a resource 8. Provide recreational opportunities 9. Maintain quality of life	1. Increase storage 2. Reduce demand 3. Desalinate groundwater 4. Recycle water 5. Maximize preservation and use of native plants 6. Develop risk-based WQ improvements 7. Consider stormwater as water supply 8. Value water differently 9. Incorporate integrated water planning in General Plans 10. Manage public property for more than one use 11. Create watershed governance 12. Implement watershed-wide education programs	1. Recycle and reuse 100% of wastewater 2. Store water to account for ½ of demand 3. Reuse all Santa Ana River flow at least once 4. Remove all salt necessary for reuse 5. Reduce potable water use by 20% 6. Fill gaps in riparian corridors to provide wetlands and linkages 7. Meet California FloodSAFE goals & construct soft bottom flood 8. Meet WQ standards 9. Capture and recharge 80% of rainfall 10. Connect all tributary corridors to the SAR Trail 11. Assure adequate water supply and safe wastewater treatmentt 12. Reduce GHG emissions 13. Increase resource efficient land use	1. Provide water supply benefits 2. Provide restoration and flood management benefits 3. Provide water quality and salt management benefits 4. Provide recreational benefits 5. Provide benefits and avoid adverse impacts to disadvantaged communities and Native American tribes 6. Reduce greenhouse gas emissions from water management activities 7. Increase resource-efficient land use and reduce impact on natural hydrology 8. Cost match 9. Cost effectiveness 10. Project readiness 11. Increase active participation

Chapter 7 Project Evaluation & Prioritization

Project Prioritization Criteria

Candidate projects included in the OWOW Plan were evaluated and prioritized based on the degree to which they comply with Evaluation Criteria developed by SAWPA staff. These were based on the goals and objectives, strategies and targets established by the Steering Committee and the Pillars. The achievement of goals and objectives by a project is directly related to the projects ability to obtain Proposition 84, Chapter 2 funding. Chapter 6 described the process followed to develop and weight the criteria.

Evaluation criteria were the basis for ranking projects in a reproducible way, using numerical scores for quantitative and qualitative criteria, and applying a consistent scoring and ranking process, described below. A performance measure was created for each criterion to numerically establish the degree to which a project meets each criterion. In some cases, more than one performance measure was used for a given criterion.

The evaluation criteria and performance measures for project prioritization had the following attributes:

Non-redundant: each criterion needs to measure something not measured by others to avoid a bias decision.

Specific: each criterion is described in detail, clearly specifying what is being measured and the rationale for it.

Relevant: criteria and, particularly, performance measures need to help discriminate between "better" and "worse" projects in terms of matching with goals and objectives. If a performance measure value does not vary between projects (if the score for all projects is the same for a given performance measure) the performance measure is unnecessary or inadequate.

Table 7-1 below presents the description of all criteria and their respective performance measures.

Table 7-1 Ranking Criteria and Performance Measures

Project evaluation criteria	Criteria Weights	Performance measures	Performance Measure Units	Performance Measure Weights
1. Provide water supply benefits	22%	Reduction in imported water use from recycling, desalination, storm water use, water transfers, surface water storage, groundwater storage and/or any other new source of water	AFY	90%
		Percentage of project area implementing water use efficiency or conservation best management practices	%	10%
2. Provide restoration and flood management benefits	10%	New or restored habitat area, and flood plain protected	Acres	100%
3. Provide water quality and salt management benefits	12%	Volume of water treated	mgd	50%
		Salt or contaminants removed	Tons/year	50%
4. Provide recreational benefits	5%	Area of open space and parks created	Acres	100%
5. Provide benefits and avoid adverse impacts to disadvantaged communities and Native American tribes	4%	Percentage of project benefitting disadvantaged communities	%	50%
		Percentage of project benefitting Native American tribes	%	50%
6. Reduce greenhouse gas emissions from water management activities	2%	Numeric estimates of reductions on greenhouse gas, and actions or project features to accomplish those reductions	1 to 5 Qualitative Score	100%
7. Increase resource-efficient land use and reduce impact on natural hydrology	8%	Percentage of project using Low Impact Development or other resource-efficient land use	%	50%
		Impacts or changes to natural hydrology	1 to 5 Qualitative Score	50%
8. Cost match	7%	Percent of project cost funded and secured from non-state funding	%	100%
9. Cost effectiveness	12%	Standardized unit cost indicator measuring cost per unit of benefit	$/[unit of benefit]; for example, $/AFY, $/mgd, $/acre	100%
10. Project readiness	9%	Phase of project development	1 to 5 Qualitative Score	100%
11. Increase active participation	9%	Number of Partners	1 to 5 Qualitative Score	50%
		Partners Role or level of participation	1 to 5 Qualitative Score	50%

Project Prioritization Process

SAWPA received candidate projects from agencies in the Watershed for inclusion in the OWOW plan and potential Proposition 84 funding. All projects were evaluated by SAWPA staff to determine their eligibility to be part of the OWOW Plan. Additionally, since the projects received were in different stages of development, projects in advanced stages of development were given priority to receive Proposition 84 funding. It is important to reiterate that ranking is based on self-reported project data.

Project Scoring

The first step of the prioritization process was to score each project. Project sponsors provided a project nomination form with information about each project (**Project Form**). Scoring is the process by which the information provided by the project sponsors is converted to a numerical value for each sub-criterion using the performance measures presented in **Table 7-1** above. In many instances, the information provided in the nomination forms need to be processed or combined to establish the numerical value of each performance measure. Relevant methodological notes on the scoring of each performance measures are presented below. The Project Form may be found in the Appendices.

Provide water supply benefits - Reduction in imported water use from recycling, desalination, storm water use, water transfers, surface water storage, groundwater storage and/or any other new source of water:

The score for this performance measure was calculated by adding the yearly supply benefits from every source in the nomination form: recycling, ocean desalination, brackish groundwater desalination, storm water beneficially used, water transfers, operational efficiencies and other new sources of water (such as rainwater capture). The great majority of projects provide only one of the sources mentioned, but in some cases more than one source existed. Two additional sources of supply possible are surface and groundwater storage (including conjunctive use of groundwater basins). The project nomination forms included information on the storage and/or recharge capacity developed. For storage-related projects, the supply benefit as an annual volume in AFY was assumed to be one third of the storage reported. This assumption was applied for all projects.

Provide water supply benefits - Percentage of project area implementing water use efficiency or conservation best management practices:

The score for this performance measure was simply taken from the project nomination forms, as the value reported by the sponsor.

Provide restoration and flood management benefit - New or restored habitat area, and flood plain protected:

The score for this performance measure was estimated by adding the values of acreage reported in the nomination forms, for habitat created or restored and for floodplain area protected.

Provide water quality and salt management benefits - Volume of water treated:

The score was calculated as the sum of flows treated under the categories of wastewater treatment, well head treatment for remediation, and stormwater treatment. Water treatment for drinking water standards for subsequent distribution was not counted under this measure to avoid redundancy with the water supply score.

Provide water quality and salt management benefits – Salt or contaminants removed:

The score was obtained directly from the project nomination forms when the value reported corresponded to salt removal, given the rationale for the salt management objective. Other contaminant removal estimates were not counted to avoid redundancy with the volume of water treated reported.

Provide recreational benefits – Area of open space and parks created:

The score was obtained directly from the project nomination forms.

Provide benefits and avoid adverse impacts to disadvantaged communities and Native American tribes - Percentage of project benefitting disadvantaged communities:

The score was obtained directly from the project nomination forms.

Provide benefits and avoid adverse impacts to disadvantaged communities and Native American tribes - Percentage of project benefitting Native American tribes:

The score was obtained directly from the project nomination forms.

Reduce greenhouse gas emissions from water management activities - Numeric estimates of reductions on greenhouse gas, and actions or project features to accomplish those reductions:

A scale of 1 to 5 was developed as a qualitative score. The rationale for this scale was that, while the methodology to estimate reductions in GHG emissions is significantly well established, the assumptions about direct versus indirect benefits from a project can vary widely. In some cases, project estimates can include a number of externalities and count them as reductions associated with the project. In other cases, the values reported constitute only direct reductions from a project (such as a more efficient pump engine requiring less energy). Given the potential inconsistencies with the values reported in the project nomination forms, the scale established for this score was a combination of the estimates and the actions and considerations supporting those estimates. The scale developed was:

1 = no information
3 = narrative description only
4 = numeric estimate without specific actions

5 = numeric estimate with specific actions, with 5 being the highest score. The sensitivity of the ranking to this performance measure was tested after the ranking was completed, and the ranking did not show to be sensitive to this qualitative score.

Increase resource-efficient land use and reduce impact on natural hydrology - Percentage of project using Low Impact Development or other resource-efficient land use:

The score was obtained directly from the project nomination forms.

Increase resource-efficient land use and reduce impact on natural hydrology - Impacts or changes to natural hydrology:

A scale of 1 to 5 was developed as a qualitative score:

1 = Negative impacts
3 = No impacts
5 = Positive impacts

Cost Match - Percent of project cost funded and secured from non-state funding:

The score was obtained directly from the project nomination forms.

Cost Effectiveness - Standardized unit cost indicator measuring cost per unit of benefit:

Projects of different types provide benefits that are measured in varying units. For water supply projects, the units used in the supply performance measure are AFY. For water quality projects, the units of the water treated are in mgd, while the units of salt removal are in tons/year. Cost effectiveness was therefore measured as:

- $/AFY of water supply benefits, i.e., total project cost/ water supply benefits (in AFY)
- $/mgd of water treated, i.e., total project cost/ water treated (in mgd)
- $/acres of habitat restored and open space created, i.e., total project cost/ open space created and habitat restored (in acres)
- $/(tons/year) of salt removed, i.e., total project cost/ salt removed (in tons/year)

To be able to perform the ranking as described in the next section, a score with the same units is necessary for a given performance measure, which required the normalization of cost effectiveness scores by project category. For example, projects providing water supply benefits were scored in $/AFY, but the score then was normalized to a unit-less score between 1 and 5. Projects providing water quality benefits were scored in $/mgd, but the score then was normalized to a unit-less score between 1 and 5. Once all cost effectiveness scores were normalized, the score of 1 to 5 can be used for ranking. The process and need for *normalization* are explained in a section below in this chapter.

Project Readiness - Phase of project development:

The following scale of 1 to 5 was developed to score the projects:

1 = Planning studies completed
2 = Conceptual design (15%) completed
3 = Preliminary design (30%) completed
4 = Final design (100%) completed
5 = Project ready for construction bids (permits secured)

Increase Active Participation - Number of Partners:

The following 1 to 5 scale was developed for this performance measure based on number of partners:

1 = None
3 = One
5 = Multiple

Increase Active Participation - Partners role or level of participation:

The following 1 to 5 scale was developed for this performance measure:

1 = No or limited partnership
3 = Coordination with others
5 = Cost-share or in-kind funding partner

OWOW Project Ranking

The project scores for each performance measure were used for the ranking of the projects using a multi-criteria ranking method. The method is known as Multi-Attribute Rating Technique (MART). The method consists of applying the weights for each criterion to the criteria scores, and adding the weighted criteria scores to obtain an overall weighted and final score to use in ranking. For the ranking process, the commercial software used was developed by Infoharvest, Inc., called Criterium Decision Plus (CDP). CDP uses MART for ranking projects or planning alternatives.

One of the steps in the MART consists of normalizing the scores. The *normalization* of a score is necessary to eliminate the units of the scores and to be able to add, average, or compare scores from different performance measures. *Normalization* basically means converting any dimensional or dimensionless quantity to a common scale.

Normalization of scores was done at two levels in this prioritization process. The first level of normalization was done within the scoring (i.e., before the application of CDP) where a criterion required addition or averaging of performance measures. The following performance measures were normalized to a scale of 1-5:

For the criterion "Provide water quality and salt management benefits" the performance measures:

- Flows treated [mgd]
- Salt or contaminant removed [tons/year]

Once these two performance measures were normalized, they were combined in a composite score of 1-5 to be used for prioritization.

For the criterion "Cost effectiveness" the performance measures:

- Unit cost of water supply benefits [$/AFY]
- Unit cost of water treated [$/mgd]
- Unit cost of habitat restored and/or open space created [$/AF]
- Unit cost of salt/contaminant removed [$/(tons/year)]

The normalized scores in the scale of 1 to 5 then were combined in an average as a composite score of cost effectiveness to be used in prioritization.

The second case in which *normalization* was conducted was within the ranking process, for all of the scores. This step always is performed in MART and it's a step performed within CDP. CDP normalizes all scores using a scale of 0 to 1.

In addition to the normalization score in CDP, there are five other basic steps in MART (Figure 7-1). The first step is the scoring of the project against each sub-criteria as described in the earlier sections. In the example described in Figure 7-1, the project has a score of 12 acres (raw performance measure) for recreational benefits. As different criteria have different units of measurement (for example restoration and flood management benefits are measured in acres, water supply benefits are measured in AFY, etc.) normalization is used, as mentioned above. In the example depicted in Figure 7-1, the recreational benefits score is converted with a scale between 0 and 1, using a linear scale. The raw performance of 12 acres translates into a normalized score of 0.34 (where the score of 0 indicates the worst performance, i.e. no acres for open space, and the score of 1.0 indicates the best performance, i.e. largest recreational and open space area provided by any project).

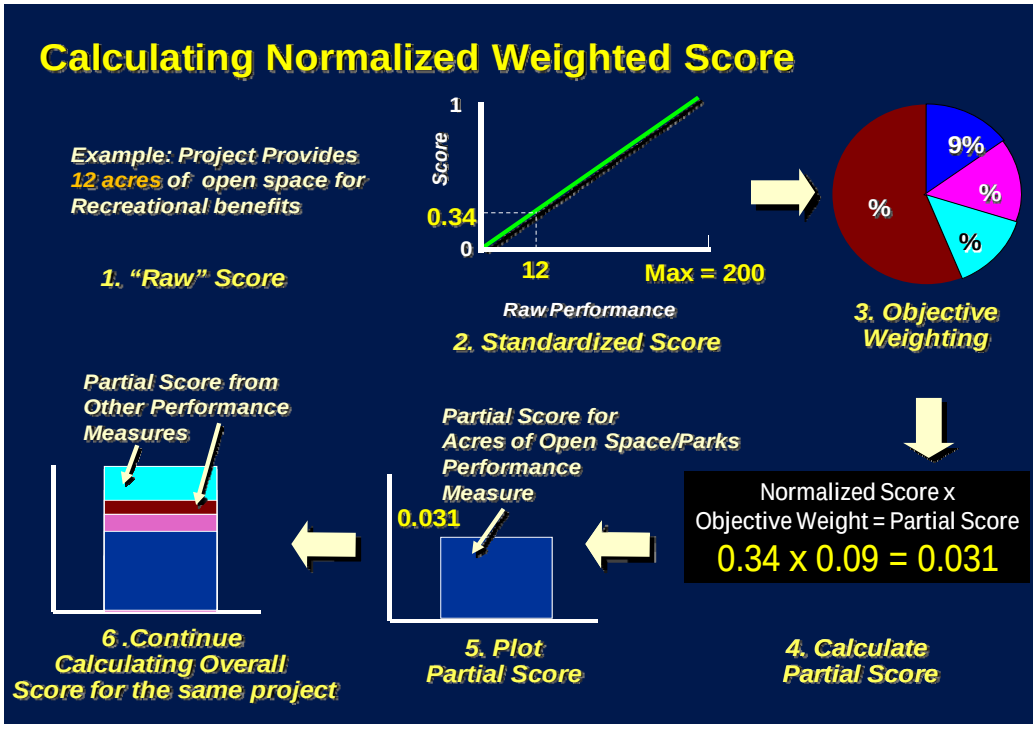
Step 3 on Figure 7-1 shows the weighting of the criteria. The process of weighting the criteria was described in Chapter 6. In Step 4 in Figure 7-1, the normalized score is multiplied by the weight of the criterion. In the example in Figure 7-1, the open space criterion received a weight of 9 percent (out of a possible 100 percent). The normalized score (0.34) is multiplied by its weight of 9 percent in order to get a partial score of 0.031 for the project.

The partial score of 0.031 then is plotted on a graph for that project [Step 5 in Figure 7-1]. This procedure is repeated for all of the other criteria (or performance measures) for the same project until a total decision score for the alternative is calculated [Step 6 in Figure 7-1].

Finally, after all projects receive a total score, they can be compared to the rest of the projects and ranked according to the overall CDP score, also called *decision score*.

Figure 7-1 shows the example of a linear scale for normalization of scores in Step 2. In the process of normalizing scores for the OWOW projects, however, some of the normalization scales were defined as non-linear scales. This was necessary to avoid an effect called "shadowing" by which a few projects with significantly higher raw scores can generate low scores for the rest of the projects when a linear scale is used. For example, in a situation in which 95 percent of projects have benefits under 100 acres, but one or two percent of projects have benefits over 5,000 acres, a linear scale could result in the lowest score for the 95 percent of projects under 100 acres. The shadowing of those high performing projects could render the performance measure irrelevant since the normalized score would not serve as a discriminator for 95 percent of projects.

Figure 7-1 Multi-Attribute Rating Technique to Rank Any Type of Alternatives or Projects



In the OWOW ranking process, the scales for water supply, water quality, restoration and flood protection, and open space and recreation required non-linear normalization scales. The cost effectiveness scales for these benefits also required a non-linear normalization score.

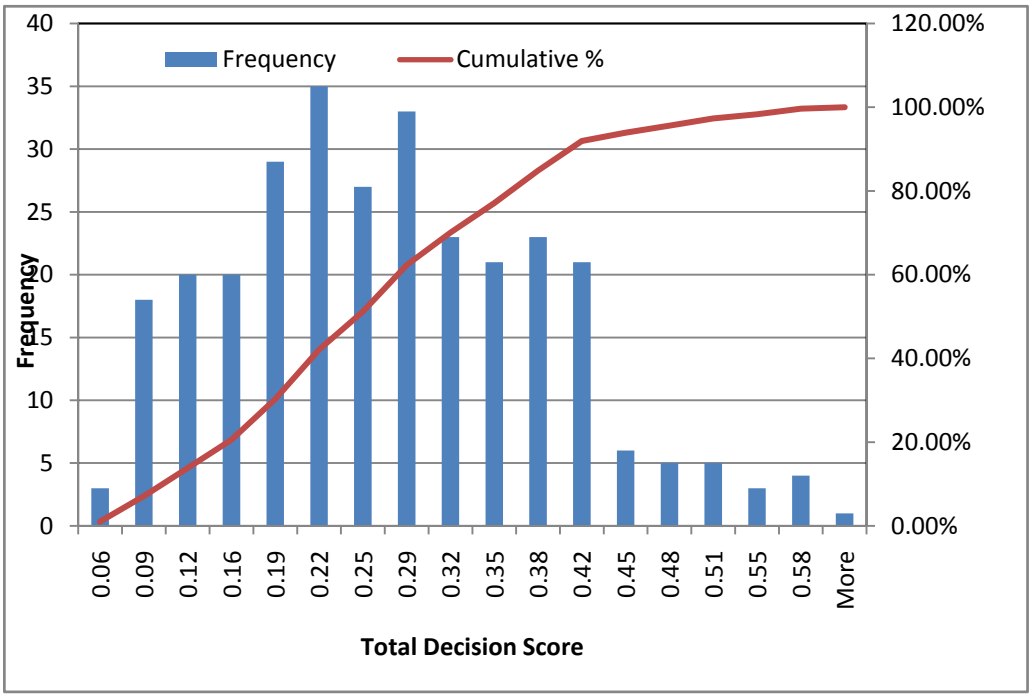
Project Prioritization Results

All 297 projects included in the OWOW plan were ranked using MART with the criteria weights established by the Steering Committee as explained in Chapter 6. The complete ranked list of projects is presented in **Appendix H**.

Figure 7-2 presents the spread of decision scores (ranking scores) in a histogram (and a cumulative histogram). The figure shows an inflection point around 90 percent of projects. This means that about ten percent of the projects (between 25 and 20 projects) distinguish from the rest obtaining scores that would indicate that they provide more benefits and/or perform significantly better than the rest of the projects for most of the criteria.

In order to test the robustness of the ranking method used (including the qualitative scales and the non-linear normalization scales), a series of sensitivity analyses were run on the model. Additionally the sensitivity of the ranking to the weights of the sub criteria also was tested. Results of the sensitivity analysis showed that the ranking is not sensitive to the qualitative scales (such as the greenhouse gas scale of 1 to 5). The model is not sensitive to the actual shape of the non-linear scales used for normalization of some criteria, as long as the scale remains non linear (to avoid the "shadowing" effect). Similarly, the ranking generally is not sensitive to reasonable changes in the weights of the criteria (changes of ten percentage points). The ranking, however, does show a sensitivity to the actual raw scores (numbers reported in the project nomination forms) mainly for water supply and water quality benefits. For a ranking of projects to determine the actual Proposition 84 funding, the information provided in the nomination form would have to be vetted to avoid biases in decision scores due to inaccurate information.

Figure 7-2 Distribution of Total Decision Scores for all OWOW



The final prioritized OWOW project implementation list is presented in Appendix H. Projects are ranked from highest CDP decision score to lowest CDP decision score. Scores range from about 0.06 for the lowest ranked projects to above 0.60 for the highest ranked projects (shown in **Figure 7-2**). The "perfect" theoretical score is 1.0. The results of the ranking with the highest ranked project around 0.61 are not unexpected given the great number and diversity of sub-criteria. Generally, in any multi-criteria ranking process, the greater the number of criteria, the lower the decision scores tend to be, as it becomes increasingly less likely that the best project will score well for all criteria.

Chapter 8 Benefits of Sustainable Solutions

With the development of integrated watershed planning, multi-benefit, multi-purpose projects have moved to the forefront and have become one of the primary goals of the OWOW process. The idea of meeting a number of community needs with a single project is not new; however, specialization within agencies that deal with water has often moved these project types to the backburner. Efforts primarily have focused on single purpose projects, and the additional effort required to develop multi-objective solutions has made true multi-benefit projects relatively uncommon. In California, there has been an effort to incentivize collaborative planning through IRWM Planning and associated funding sources.

This reliance on single purpose projects is not unique to water. An interesting analogy can be drawn with the field of public health. Infectious diseases that plague much of the world can be treated by eliminating the infectious agent or interrupting the transmission of the pathogen. Public health programs traditionally focus on both approaches and use a team of physicians, sanitary engineers, and others professionals to address problems, often with great result. The development of more specialization in public health practice, in many cases, has been correlated with the resurgence of some diseases, such as malaria. Recently, scientists have become concerned that the "Balkanization of Science" has resulted in specialists with narrow training focusing only on a single aspect of a broader problem. Often, effective solutions are missed by this approach (Moore, 2008). Similar statements could be made about water management. If water is considered, in the broadest sense, as a resource that benefits a wide group of interests, including those represented by the ten Pillar groups of the OWOW process, the projects that address as many of those interests as possible should be encouraged.

Some of the earliest multi-benefit water projects were done through a partnership between those interested in flood and groundwater management. Spreading grounds along the front slopes of local mountains have attenuated flood flows and recharged groundwater basins for nearly 100 years. OCWD partnered early with Orange County Flood Control District to provide recharge basins within flood control basins. More recently, IEUA has worked with San Bernardino County Flood Control to modify the operation of the flood control system to maximize recharge opportunities. IRWD has partnered with the Orange County Flood Control District to store recycled water in some flood basins. All of these projects primarily were facilitated by operational changes rather than the construction of new infrastructure, although in some cases the flood system was upgraded. Operational changes could occur only when both parties understood the needs and assets of the other.

The development of multi-benefit projects will remain challenging and require sustained effort by agencies that manage water. In the Watershed alone, there are approximately 100 agencies that manage water in some way. This situation is not unique to this Watershed. The Federal government has 12 Federal agencies and eight separate committees all doing water-related work (Udall and Averyt, 2009). Agencies need to prioritize collaborative projects and provide the staff resources to ensure that such projects are developed.

The purpose of integrated watershed planning is to consider other disciplines or functional areas when planning and implementing projects. Benefits of this approach far exceed the immediate benefit of reducing controversy surrounding a particular project. Pillar leaders developed a list of potential benefits in a workshop to identify incentives associated with the development of multi-benefit programs and projects. They are listed below:

Solving problems using a multi-benefit approach prevents the creation of other problems. Often when a single-function project is developed, it has an impact on other water-related areas, often unanticipated. The truth of this statement is often born out in a CEQA or NEPA analysis, where numerous problem areas can be identified.

Multi-benefit problem solving results in no missed opportunities. In a multi-benefit type of approach, a careful exploration of all aspects of a particular project often results in the identification of incremental project changes that can result in large benefits in other areas.

Cost and resource savings for the public can be achieved. When a multi-benefit project is developed, the cost of providing each benefit is often less than providing similar benefits to the public using two or more separate projects. As land and other public resources become scarce, these types of projects are more likely to be undertaken and provide more public benefit.

Developing projects that provide multiple benefits develops trust. As groups develop multi-benefit projects, trust is developed among different constituencies, each interested in a different aspect of water. These groups are more likely to work toward similar solutions in the future if they have successfully developed multi-benefit projects.

Multi-benefit projects are focused on building successful projects, not dispute resolutions. Groups focused on problem solving rather than dispute resolution or litigation save public resources and implement solutions to regional problems faster than they would had they disputed each other's single-function project.

Development of multi-purpose projects can develop better communication. Through the development of a project, groups that span geography or area of interest develop better communication and trust.

Multi-purpose projects often have diverse sources of funding. As multi-benefit projects are developed, multiple State and Federal funding sources become available providing cost share opportunities, and increasing the probability that a specific project would move forward.

Development of multi-function projects allows sharing of human resources. Each agency or constituency interested in developing a project has access to individuals with unique abilities and perspectives. Teams formed from diverse groups often develop unique solutions to problems.

Pillar leaders met several times to develop matrices that demonstrated the potential benefits of multi-benefit projects undertaken between Pillars. In other words, how would a multi-benefit project conducted by one Pillar group benefit another group? The purpose of this exercise was to

encourage Pillar leaders to begin to focus on how implementing projects to benefit their constituency can be designed to benefit others.

Drafts of these matrices were taken to three public workshops held in Orange, Riverside, and San Bernardino Counties. At these sessions, stakeholders were invited to comment on the work of the Pillar leaders, as well as suggest their own benefits. Again, the primary purpose of these workshops was to encourage discussion around the concept of designing projects for more than one purpose. As the Pillar leaders completed their final drafts, they developed a list of project types that would benefit more than one Pillar and were worthy of further consideration.

The following tables summarize the efforts of the Pillar leaders and the Watershed stakeholders to catalog the possible benefits to other Pillars by well designed projects. A project that fulfills a particular Watershed need can be designed to provide other benefits to all other Pillar groups. Maximizing these benefits provides for better projects and better use of public money.

Benefits of Multi-Purpose Projects

- Water use efficiency projects increase water supply reliability
- Integrated flood management projects also supply groundwater recharge and provide
- Surface storage provides opportunities for local recreation
- Improving water quality of "tainted" local supplies increases reliability

Water Supply Reliability

Pillar	Benefit to Other Pillars
Climate Change	• Reduces the carbon footprint associated with importing water. • Accommodates for drought and less frequent rainfall.
Environmental Enhancement and Habitat	• Quantifies environmental and habitat needs. • Provides water supply for riparian and aquatic habitat.
Environmental Justice	• Provides reliable high quality drinking water supply for all residents. • Constructs infrastructure improvements supporting disadvantaged communities.
Flood Control and Stormwater Management	• Allows cost sharing partnerships to enhance and improve the capability of flood control infrastructure to capture and infiltrate storm flows.
Parks, Recreation, and Open-Space	• Surface storage provides opportunities for local recreation. • Expands and enhances opportunities for recreational boating and sport fishing. • Increases the economic value of local recreational opportunities. • Water utility easements provide trail opportunities.
Water and Land Use	• Supports smart growth enhancing quality of life. • Allows sustainable growth. • Incentive for high quality industrial and commercial development. • Enhances property values. • Improves public's perception of community.
Water Quality Improvement	• Lowers the concentrations of imported salt in local surface and groundwater supplies. • Provides mechanism to lower the concentration of industrial pollutants in local surface and groundwater supplies. • Provides high quality supply to clean up contaminated groundwater basins.
Water Recycling	• Promotes appropriate use of recycled water.
Water Use Efficiency	• Provides business opportunities for green products and water saving devices. • Promotes changes in water usage. • Encourages transition of landscaping to native plant types.

Water Quality Improvement

Pillar	Benefit to Other Pillars
Climate Change	• Offsets climate changes stress on water supply by expanding usable local surface and groundwater resources. • Reduces the carbon footprint associated with transporting and processing water. • Reduces the amount of salt and other contaminants entering local surface and groundwater supplies.
Environmental Enhancement and Habitat	• Improves quality of local water resources that support wildlife habitat. • Reduces the input of nutrients which promote eutrophication. • Promotes greater biodiversity. • Use of natural treatment systems provides incentive for restoration and construction of habitat. • Supports and protects areas of biological significance including habitat for threatened and endangered species.
Environmental Justice	• Provides high quality drinking water for disadvantaged communities. • Reduces the perceived need for bottled water. • Improves public health. • Expands and enhances recreational opportunities. • Improves the public's perception of community. • Enhances value of property. • Expands water supply for local communities. • Extends life of fixtures and appliances • Reduces operation and maintenance costs.
Flood Control and Stormwater Management	• Strategies that promote infiltration, such as Low Impact Development (LID) help to reduces peak flows and risk of flooding. • Extends the life of existing infrastructure. • Reduces operation and maintenance costs.
Parks, Recreation, and Open-Space	• Expands and enhances recreational opportunities. • Increases the economic value of local recreational opportunities. • Improves the aesthetics of local lakes and streams. • Promotes tourism. • Reduces risks to public health.
Water and Land Use	• Attracts high quality industrial developments. • Improves the public's perception of community. • Enhances value of property. • Reduces operation and maintenance costs.
Water Recycling	• Expands opportunities for water recycling. • Reduces operation and maintenance costs. • Extends the life of equipment. • Improves the efficiency of membranes and filters.
Water Supply Reliability	• Expands local surface and groundwater supplies. • Reduces the amount of salt and other contaminants entering local surface and groundwater supplies. • Reduces operation and maintenance costs.
Water Use Efficiency	• Expands the range of available technologies. • Extends the life of fixtures and appliances. • Reduces operation and maintenance costs. • Reduces the perceived need for water softeners.

Water Recycling

Pillar	Benefit to Other Pillars
• Climate Change	• Offsets carbon footprint associated with imported water. • Reduces dependence on outside water sources facing reduced rainful and snow pack. • Stretches local sources of supply stressed by changes in the local climate.
• Environmental Enhancement and Habitat	• Provides source water for riparian habitat and environmental enhancement. • Provides reliable source for stabilization of lake levels and restoration of local rivers and streams. • Supports and protects areas of biological significance including habitat for threatened and endangered species.
• Environmental Justice	• Stretches local water resources to meet public demand. • Frees up potable supply for public consumption.
• Flood Control and Stormwater Management	• Reduced operation and maintenance costs through reduced discharges to flood control system.
• Parks, Recreation, and Open-Space	• Provides economical water source to support recreational activities. • Improves esthetics through stabilization of lake levels and stream flow. • Provides a reliable long term lower cost alternative for irrigation needs of parks and golf courses. • Provides source water for esthetic features such as fountains and ornamental ponds.
• Water and Land Use	• Provides a reliable lower cost alternative for landscape irrigation. • Provides a reliable source of supply to support growth and development. • Reduces demand for potable water. • Provides incentive for replacing septic systems with sewer systems. • Provides alternative water source for toilet flushing in commercial and residential development. • Provides alternative supply for industrial and commercial use fostering sustainable economic growth, and local job opportunities.
• Water Quality Improvement	• Reduces the amount of salt and other contaminants entering local surface and groundwater supplies. • Injection into barrier wells prevents ocean water intrusion into coastal groundwater basins.
• Water Supply Reliability	• Helps to drought-proof the region. • Reliable source for groundwater recharge. • Provides a direct local supply to users. • Expands available water sources. • Provides reliable source of supply for industrial use and irrigation. • Reduces the need for imported water. • Reduces demands on potable water supply.
• Water Use Efficiency	• Substitutes recycled water for potable water. • Stretches the local water supply. • Recycled water projects focus public attention on water conservation.

Water Use Efficiency

Pillar	Benefit to Other Pillars
Climate Change	• Reduces carbon footprint associated with transporting and processing water. • Reduces carbon footprint associated with water use and consumption.
Environmental Enhancement and Habitat	• Provides opportunity for conservation of local surface and groundwater flows. • Reduces poor quality urban runoff from reaching natural systems. • Encourages planting of native plant species. • Reduces standing plant biomass associated with fire threat in the riverbed.
Environmental Justice	• Provides conservation of local surface and groundwater resources. • Insures baseline water supply through tiered water rates. • Provides funding programs for upgrading inefficient fixtures and appliances.
Flood Control and Stormwater Management	• Reduces volume of poor quality runoff from suburban and urban development entering flood control system.
Parks, Recreation, and Open-Space	• Encourages maintenance of open spaces and corridors for trails. • Encourages efficient use of turf and the planting of native species in local parks. • Provide educational opportunities through signage and demonstration projects to educate public about water efficiency landscaping and irrigation..
Water and Land Use	• Increase reliability of water supply to sustain development. • Reduces the per capita water demand to sustain development.
Water Quality Improvement	• Reduces volume of poor quality runoff from suburban and urban development. • Reduces salt imported to region.
Water Recycling	• Encourages water recycling and opportunities for alternate technologies (i.e., grey water systems, cisterns for roof runoff). • Provides alternative supply for landscape use. • Provides alternative supply for commercial and industrial uses.
Water Supply Reliability	• Increase reliability of local water supply. • Increases the flexibility of the local water supply. • Reduces stress on existing infrastructure.

Water and Land Use

Pillar	Benefit to Other Pillars
Climate Change	• Smart growth through higher density development reduces the carbon footprint associated with transporting and processing water. • Provides better local job to housing ratio reducing the carbon footprint associated with commuting.
Environmental Enhancement and Habitat	• Preserves and improves habitat. • Helps improves watershed functionality. • Integrates habitat into a built environment. • Enhances habitat connectivity and quality of life. • Redevelopment and retrofitting provides opportunities for habitat restoration
Environmental Justice	• Redevelopment and retrofitting improves the quality of housing. • Improves quality of life. • Sewer systems protect groundwater quality, reducing the risk of contamination associated with septic system failure.
Flood Control and Stormwater Management	• Promote natural groundwater recharge to reduce stormflow. • Improves quality of stormwater runoff. • Reduces risk of local flooding. • Avoided flood control infrastructure costs. • Provides opportunities for public-private partnerships. • Reduces cost of regulatory compliance.
Parks, Recreation, and Open-Space	• Creates local recreation opportunities and reduces travel costs. • Increases opportunities for local tourism. • Improves community aesthetics. • Provides more open space.
Water Quality Improvement	• Strategies linking water and land use improve surface and groundwater quality. • Reduces nuisance flow from urban development into surface waters. • Reduces cost of regulatory compliance.
Water Recycling	• Integration of recycled water into new development promotes sustainable growth. • Higher density development reduces the cost of recycled water infrastructure. • Sustainable development provides market for recycled water. • Provides prescriptive measures for the use of recycled water for irrigation and other non-potables uses.
Water Supply Reliability	• More open space promotes groundwater recharge. • Decreases per-capita water use • Enhances local supply reliability.
Water Use Efficiency	• Promotes the efficient use of water. • Provides prescriptive measures for the efficient use of water. • Provides market for green products and water saving devices.

Flood Control and Stormwater Management

Pillar	Benefit to Other Pillars
Climate Change	• Large recharge basins may help reduce the heat island effect. • Increased groundwater recharge reduces the need for more energy intensive imported water.
Environmental Enhancement and Habitat	• Channels provide corridors between open spaces. • Provides more opportunities for wetland construction. • Connects isolated biological communities. • Non-structural flood control channels provide habitat. • Serves as a multi-purpose source of funding for habitat projects. • Prevents channel erosion. • Expands habitat. • Easements provide fire breaks and emergency access.
Environmental Justice	• Protects lives and property. • Reduces flood insurance costs. • Provides improved water quality for recreation. • Better understanding of risk improvs safety and water quality
Parks, Recreation, and Open-Space	• Easements provide trail opportunities. • Provides additional land for parks during dry season. • Prevents erosion of parks. • Promotes multi-agency projects provide opportunities to expand parks system.
Water and Land Use	• Protects lives and property. • Reduces the need for flood insurance. • Integrated flood strategies enhance the value of developed property. • Reduced risk to infrastructure from debris dams associated entering flood control system.
Water Quality Improvement	• Integrated flood strategies improve the quality of surface water, ocean water, and groundwater. • Supports regulatory compliance and reduces compliance cost. • Reduce the flow of poor quality runoff from urban development
Water Recycling	• Provides additional conveyance opportunities. • Provides facilities to recharge recycled water. • High quality storwater dilutes the salt of recycled water and imported water recharge.
Water Supply Reliability	• Increases opportunities for groundwater recharge. • Provides temporary storage for other uses. • Provides additional conveyance opportunities. • Increases available local water supply. • High quality storwater dilutes the salt of recycled water and imported water recharge
Water Use Efficiency	• Expanded local recharge reduces the need for irrigation.

Environmental Enhancement and Habitat

Pillar	Benefit to Other Pillars
Climate Change	• Provides compliance opportunities for carbon offsets. • Reduces heat island effect. • Provides real carbon reduction with vegetated "carbon sinks". • Improved air quality.
Environmental Justice	• Increases available open space. • Environmental services are an important link to public health – clean air, natural treatment of water. • Improves quality of life. • Creation of habitat mitigates urban impacts
Flood Control and Stormwater Management	• Provide opportunities for retention, detention, and local flood control. • Improves stormwater quality. • Treats urban nuisance flows. • Provides additional flood control system capacity.
Parks, Recreation, and Open-Space	• Provides recreational opportunities. • Provides environmental education opportunities through signage and interpretive centers.
Water and Land Use	• Increases value of properties adjacent to habitat areas. • Promotes groundwater recharge. • Protects property from local flood impacts. • Redevelopment strategy for blighted areas. • Promotes consistency with General Plan.
Water Quality Improvement	• Provides large permeable area for stormwater infiltration. • Wetlands provide enhanced water quality. • Provide erosion control and reduce accompanying sediment load.
Water Recycling	• Provides a market for recycled water. • Treatment wetlands reduce recycling costs.
Water Supply Reliability	• Increases groundwater recharge for local supply. • Provides large permeable area for stormwater infiltration. • Arundo removal provides additional surface flow.
Water Use Efficiency	• Natural habitat reduces demand as it is sustained by rain only. • Promotes removal of water-guzzling exotic plants.

Parks, Recreation, and Open-Space

Pillar	Benefit to Other Pillars
Climate Change	• Reduces heat island effect. • Provides opportunities for carbon offsets. • increases opportunities for local outdoor recreation reducing travel. • Provides real carbon reduction with vegetated "carbon sinks". • Green spaces improve air quality.
Environmental Enhancement and Habitat	• Parkland provides opportunity for habitat. • Trails and linear parks provide corridor function. • Provide opportunities for environmental education through signage and interpretive centers. • Removal of invasive species provides additional surface flows.
Environmental Justice	• Provides low or no cost recreational opportunities. • Provides a public health benefit. • Provide job opportunities. • Provide opportunities for environmental education through signage and interpretive centers.
Flood Control and Stormwater Management	• Provides opportunities for retention or detention basins. • Provide flood buffer for private property. • Provide additional flood control system capacity. • Parkland buffers improve stormwater quality. • Provide natural treatment of urban nuisance flows.
Water and Land Use	• Increases park-land to housing ratio. • Helps increase property values. • Promotes opportunities for clustering and high-density housing. • Promotes groundwater recharge. • Parks reduce stormwater impacts to urbanized areas
Water Quality Improvement	• Provides large permeable area for stormwater infiltration improving groundwater quality. • Parks with wetland features provide enhanced surface water quality. • Provide erosion control and reduce accompanying sediment load. • Provide opportunities for environmental education through signage and interpretive centers.. • Supports regulatory compliance.
Water Recycling	• Provides market for recycled water.
Water Supply Reliability	• Provides location for groundwater recharge facilities. • Provides opportunities for dual use facilities (i.e., buried reservoirs and wells). • Provides large permeable area for stormwater infiltration.
Water Use Efficiency	• Provides opportunities for use of non-invasive and native species to maximize Water Use Efficiency • Promotes native vegetation as an alternative for residential landscaping. • Reduces the need for residential turf. • Efficient irrigation systems in parks reduce water usage.

Climate Change

Pillar	Benefit to Other Pillars
Environmental Enhancement and Habitat	• Increases stormwater capture. • Increases recharge capacity. • Increases LID opportunities minimizing impacts to habitat. • Reduces greenhouse gas emissions. • Promotes removal of invasive species. • Increase California-friendly planting opportunitie • Increases fixed carbon.
Environmental Justice	• Increases fixed carbon. • Benefits public health. • Increases funding opportunities for community enhancement. • Increases stability of utility rates.
Flood Control and Stormwater Management	• Increases stormwater capture and storage capacity. • Increases recharge opportunities. • Decrease chances of threatening floods.
Parks, Recreation, and Open-Space	• Reduction of greenhouse gas emissions. • Reduce heat island effect. • Increases fixed carbon. • Increases recharge capacity • Low impact development increases opportunity for parkland. • Promotes recycled water use. • Trails usage encourages non-gasoline modes of transportation.
Water and Land Use	• Encourages usage of low water landscaping. • Encourages low impact development. • More opportunity to designate open space and recharge-type land uses. • Promotes efficient energy use. • Accommodates sustainable growth.
Water Quality Improvement	• Provides cheaper, natural treatment for surface water and groundwater recharge. • More stable snow-pack reduces early seasonal run-off.
Water Recycling	• Provides markets for recycled water. • Promotes water recycling.
Water Supply Reliability	• Increases groundwater supply and recharge opportunities. • Local supply development reduces demand on imported water. • Expands local water supplies.
Water Use Efficiency	• Promotes the efficient allocation of water resources. • Promotes efficient water practices • Encourages appropriate water source for appropriate use. • Provides for more rebate program opportunities.

Environmental Justice

Pillar	Benefit to Other Pillars
Climate Change	• Urban greening reduces heat island effect. • Improvements to infrastructure are more energy efficient.
Environmental Enhancement and Habitat	• Brownfield and other redevelopment improves habitat quality.
Flood Control and Stormwater Management	• Improves nuisance water quality. • Reduces septic flow into surface water and improves surface water quality.
Parks, Recreation, and Open-Space	• Provides mechanism for open space development. • Community involvement reduces operation and maintenance costs. • Promotes use of local amenities.
Water and Land Use	• Promotes sense of well being within community. • Allows redevelopment of outdated community infrastructure. • Improved community planning • Upgrades community amenities.
Water Quality Improvement	• Early intervention prevents regional water quality problems from developing. • Prevents groundwater contamination. • Lowers public health costs. • Focus public scrutiny on local water quality issues. • Reduces surface water and ocean water impacts.
Water Recycling	• Provides new water for recycling. • Prescribes recycled water for landscaping. • Maintains water quality for future use.
Water Supply Reliability	• Expands local water portfolio. • Increases water supply redundancy.
Water Use Efficiency	• Infrastructure upgrades available to all communities. • Decreases operation and maintenance costs for utilities and consumers.

The anticipated benefit of each project for each of the Plan objectives was provided by project proponents in their applications. This information was used to rank projects, as explained in Chapter 7. The expected impact and benefit will be further detailed during the different project development phases (i.e. planning, design, CEQA). The realized benefit of the projects, both at the watershed aggregated level and at the individual project level, will be monitored as projects are implemented, as detailed in Chapter 9.

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Chapter 9 Strategy Implementation

Data Management

Managing water resources data at a watershed-wide level in a centralized and consistent manner, and providing access to this information to key stakeholders and the public at large is key for the implementation, monitoring and updating of the OWOW Plan. Properly managed data helps SAWPA and other agencies and stakeholders in the watershed to identify water quantity and quality issues, assess and develop potential solutions, quantify the anticipated impacts of these solutions, and measure the extent to which anticipated impacts materialize. In addition, having a single depository of data with a consistent format allows the sharing of information among stakeholders, and the integration of watershed data with other databases at the State level.

SAWPA already provides tools for the watershed that facilitate the management, dissemination and integration of data. The emphasis of tool development has been the use of electronic reporting into an easily queried database. These tools can be further enhanced in the context of the OWOW Plan, and become a source of data for future studies and for the monitoring of the impact of the plan and specific projects in reaching the plan objectives. However it should be noted that any project list of projects is dynamic. Projects are continuously refined and redefined between inception and implementation. The list reflects a response to conditions at a particular time. As the OWOW process encourages collaboration and the development of multi-benefit, multi-purpose projects, a project list also can serve as a tool to identify new partners or project synergies. To remain as viable planning tools and be relevant to available funding sources, project lists should be updated regularly. Using the electronic data submission format from the first round of project submittals, it is possible to regularly update project information. With this information, the Steering Committee can track the Watershed's progress in meeting OWOW goals. They also can be responsive to other regional planning opportunities.

One such tool is the Santa Ana Watershed Data Management System (SAW DMS), developed by SAWPA under contract with the State Water Resources Control Board. SAW DMS is a watershed-wide data management structure that supports programs and research that evaluate and promote the health of water quality in the watershed. The database incorporates data from existing systems as well as data not currently managed as part of a larger system. The project also includes a Web portal whereby users can access the data via the Internet.

The database manages data associated with watershed-wide Ambient Groundwater Recalculation (AWQ). This data includes well information (location and construction), groundwater level, and groundwater quality. A custom data portal application (GIS Data Query Tool) allows users to access and download the data from a Web portal on the SAWPA Website. The database and Web portal were installed on the SAWPA computer network in August 2005.

In addition, SAW DMS includes data for the Santa Ana River Annual Water Quality Report (SAR) and data for TMDL efforts in the San Jacinto and the middle Santa Ana River. Data update processes were made more efficient through the development of standard data exchange templates, or Electronic Data Deliverable (EDD) templates, and coordination with agencies to provide data using

these templates. Data loading and quality control tools were then built to efficiently load data into SAW DMS using the EDDs. Reporting and query tools were developed to streamline reporting tasks for the AWQ and SAR projects. The Web portal developed in Phase I also was expanded to include additional data content, and the GIS Data Query Tool was enhanced based on user comments. Data in SAW DMS

is in a format compatible with the State Surface Water Ambient Monitoring Program (SWAMP).

SAWPA will continue improving its database in terms of types of data to be included, ease of uses, accessibility, and compatibility with other relevant databases in the State.

Plan Performance and Monitoring

SAWPA will develop a plan to monitor the implementation of the OWOW Plan and the specific projects herein included. The monitoring will take place at two levels, plan and project, to:

- Ensure progress is being made toward meeting the objectives of the Plan.
- Ensure specific projects identified in the Plan are being implemented as planned in terms of schedule, budget, and technical specifications.
- Identify potential necessary modifications to the Plan or to specific projects, in order to more efficiently and effective accomplish the goals and objectives of the Plan.
- Provide transparency and accountability regarding the disbursement and use of funds for project implementation.

The project sponsor will be responsible for providing the information necessary to conduct the monitoring and collaborate with SAWPA and other stakeholders in the Watershed in the identification of adaptive measures.

Program management and project administration will be performed by SAWPA, upon receipt of funding, following a process similar to the one used for projects funded through Propositions 13 and 50. Through this process, SAWPA expects to achieve, as a minimum, the same level of success in implementing projects to further the goals of the OWOW Plan. As with SAWPA's past efforts, this process consists of measures to ensure consistency in the review, preparation, and submission of all documentation pertaining to grant funded projects, and to meet the objectives of the California Department of Water Resources (DWR) and State Water Resources Control Board (SWRCB), as well as the goals of the OWOW Plan.

SAWPA will serve as administrator for agreements between State Agencies and SAWPA, as well as program manager for the various programmatic requirements and related activities required through these agreements. SAWPA's authority and administrative policy to serve as program manager for such agreements was granted by the SAWPA Commission in April 2001. This authority provides SAWPA the means to implement the specific terms and conditions of the sub-agreements which the implementing parties must follow.

Monitoring at the plan level

SAWPA, with the support of stakeholders in the watershed, will evaluate the performance of the OWOW Plan in terms of accomplishing the plan objectives and targets. While objectives are overarching principles that guide water sustainability in the watershed, targets are more specific and

measurable, and can be mapped to specific objectives of the plan. For this reason, plan performance indicators are aligned to individual targets. Nevertheless, it is important to point out that some targets are difficult to quantify (e.g. increase resource efficient land use). **Table 9.1** shows the performance indicators to be used.

It is anticipated that plan performance will be evaluated every two years. SAWPA will lead the effort, but active support from many stakeholders in the Watershed will be required to provide data and information, as well as insight.

Results of the bi-annual evaluation will be published by SAWPA in the OWOW Webpage, and will include the use of visual tools (i.e. dashboards) to show progress to date in achieving the plan targets.

Table 9.1 Plan Performance Indicators for Targets

Plan Objectives	Plan Targets	Plan performance
Provide reliable water supply Promote sustainable water solutions Use rainfall as a resource	Recycle and reuse 100% of wastewater Store water to account for half of watershed demand for 3 years Reuse all of Santa Ana River flow at least once Reduce potable water use by 20% Capture and recharge 80% of rainfall Reduce GHG emissions from water mgmt activities Assure adequate water supply and safe wastewater treatment and disposal Provide benefits and avoid adverse impacts to disadvantaged communities and Native American tribes	Percentage of effluent in watershed being reused Percentage of watershed 3-year demand in storage Percentage increase in recycling Percentage of water use reduction versus 2010 baseline Percentage of rainfall being captured and/or recharged Tons of CO_2eq mitigated or sequestered Percentage decrease in disadvantaged communities Number of projects completed in disadvantaged or Native American communities
Preserve and enhance the environment	Fill gaps in riparian corridors to provide wetlands and linkages between open space and natural habitat Meet California FloodSAFE goals & construct soft bottom flood systems Increase resource efficient land use	Percent reduction in riparian corridor gap Miles of soft-bottomed flood system and acres protected Percent land area using water efficient land use principals
Ensure high quality water	Meet all water quality standards Remove salt from watershed to improve salt balance	Number of TMDL's listed. Tons of salt removed from the watershed
Provide recreational opportunities	Complete the SAR Trail and connect all tributary corridors to	Percent reduction in SARI Trail corridor gap
Provide economically effective solutions	Not applicable	Not applicable
Improve regional integration & coordination	Increase active participation in the Watershed	Not applicable

Monitoring at the project level

In addition to monitoring the performance of the OWOW Plan as a whole, the performance of specific projects in the OWOW Plan receiving funding will be evaluated every six months. The evaluation will be led by SAWPA but will require extensive participation for the sponsor of the project in question.

Similar to the performance review at the plan level, the project performance review will be based on performance measures developed from the performance measures used to evaluate project applications. **Table 9.2** shows the project performance evaluation measures to be used.

Table 9.2 Project Performance Evaluation Measures

Project evaluation criteria	Sub-criteria	Performance measures
1. Provide water supply benefits	1.1 Reduce water demand 1.2 Increase water reuse in watershed 1.3 Increase water storage in the watershed 1.4 Create new local water supply	1.1 Percent of anticipated water demand reduction achieved 1.2 Percent of anticipated effluent reuse 1.3 Percent of anticipated water storage 1.4 Percent of anticipated new water supply created
2. Provide restoration and flood management benefits	2.1 Create or restore riparian habitat 2.2 Create or restore soft-bottom flood control systems	2.1 Percent of anticipated habitat creation or restoration 2.2 Percent of anticipated soft-bottom restoration
3. Provide water quality and salt management benefits	3.1 Meet all applicable water quality standards 3.2 Improve salt balance in the watershed	3.1 Compliance with applicable water quality standards (yes/no) 3.2 Percent of anticipated salt removal
4. Provide recreational benefits	4.1 Provide recreational benefits	4.1 Percent of anticipated recreational trails created
5. Provide benefits and avoid adverse impacts to disadvantaged communities and Native American tribes	5.1 Provide benefits and avoid adverse impacts to disadvantaged communities 5.2 Provide benefits and avoid adverse impacts to Native American tribes	5.1 Percent of anticipated number of people benefited 5.2 Percent of anticipated number of people benefited
6. Reduce greenhouse gas emissions from water management activities	6.1 Reduce greenhouse gas emissions from water management activities 6.2 Provide carbon sequestration	6.1 Percent of CO_2eq mitigated versus target 6.2 Percent of CO_2 sequestered per year (tons) versus target
7. Adherence to project schedule and budget	7.1 Adherence to project schedule 7.2 Adherence to project budget	7.1 Degree of adherence to project schedule 7.2 Degree of adherence to project budget

Results of the semi-annual project evaluation will be published by SAWPA in the OWOW Webpage, and will include the use of visual tools (i.e. dashboards) to show the progress to date in the implementation of each project.

Project implementation tracking

As part of SAWPA's process to provide program management and administration of projects through the integrated regional water management planning process SAWPA has instituted a series of measures to assure technical and economic feasibility, as well as, environmental compliance for each project as following:

CEQA Review

SAWPA will obtain all documentation needed from the CEQA lead agency to understand the project, as well as the requirements for environmental compliance or mitigation. SAWPA will review available information for compliance with CEQA and confirm that the necessary measures for compliance or mitigation have been addressed.

Schedule and Budget Tracking

SAWPA is required to periodically compile, summarize, and update schedule and budget information for all contracted projects. The purpose of maintaining and tracking project schedule and budget is to have readily available program and project information.

SAWPA maintains an automated Program Information Management System (System) to maintain and track data on the program, its projects, and their phase tasks and status. The following steps summarize the documentation required for schedule and budget tracking and maintenance:

- The Construction Agencies will prepare and submit cash flow projections, budget forecasts, and schedule information for each contracted project.
- Cash flow projections will be submitted for the remainder of the project period.
- Project schedule information including schedule of each phase and task of work completed will be submitted in accordance with the work breakdown structure for the project.
- Compile and summarize schedule and budget information into the System.
- Update schedule and cash flow projection information to the System at least once per quarter.

Site Visits

SAWPA staff performs site visits to better understand project progress, issues, and schedule. The Constructing Agency must ensure that the Grant Funding Agency, or any authorized representatives thereof, has suitable and reasonable access to the project site at reasonable times during project construction, and thereafter for the useful life of the project.

Documentation Requirement

Each Construction Agency is required to submit project documentation to assure compliance with the less specific terms of the agreement entered into between SAWPA and the individual Constructing Agency.

Periodic Review and Evaluation

SAWPA will perform a project review or otherwise evaluate any project to determine compliance with the project funding criteria and requirements at any time, or if questions about the proper use or management of the funds arise as indicated in the agreement.

Agreement Deliverables

Agreement deliverables required per the Program Management and Administration Agreement include project status reports for the Grant Funding Agency (submit monthly), quarterly reports (submit 30 days after the end of each quarter ending January, April, July, and October, for the duration of the contract), public outreach documents, program newsletters, and other documents.

Invoice Procedure

SAWPA uses an internal invoice review checklist to insure that all invoices and progress documentation submitted by the Constructing Agencies meet SAWPA's, as well as the Grant Funding Agency's, requirements. The purpose of the invoice review checklist is to ensure that invoice documents provided by the Constructing Agencies are complete and accurate.

SAWPA, through its contract with each Construction Agency, requires the Constructing Agency to:

- Maintain books, records, and other material relative to the Project in accordance with generally accepted government accounting standards.
- Retain books, records, and other material for a minimum of three years after Project completion.
- Make available books, records, and other material at all reasonable times for inspection, copying, and audit by the Grant Funding Agency or State auditors, or any authorized representatives thereof.

Audits

The Grant Funding Agency is authorized to review and obtain copies of all SAWPA's records pertaining to the Memorandum of Understanding and subsequent contracts. To manage SAWPA finance department workflow and minimize program cost, the Grant Funding Agency will give SAWPA 30 days notice, if possible, for any detailed audit or time-consuming review of financial information.

Closeout

SAWPA has developed a project closeout procedure to ensure that each project is closed in a manner that provides an auditable file. This procedure includes verifying completion of all required closeout activities and receipt of all needed documents and certifications upon completion of the project.

Each project will utilize the project closeout procedure provided for in the agreement. SAWPA will review and approve the completeness of the closeout process and transmit a completed project notice for approval from the Grant Funding Agency.

Additionally, SAWPA maintains Project accounts in accordance with generally accepted government accounting standards. The following activities have been implemented:

- Establish an official Project file.
- Maintain separate accounts that depict all amounts received and expended on the Project, including all grant funds received.
- Maintain separate accounts that depict all income received which is attributable to the Project, specifically including any income attributable to grant funds disbursed under this contract.
- Maintain an accounting system which accurately depicts final total costs of the Project, including both direct and indirect costs.
- Establish accounts and maintain records as necessary for the State to fulfill reporting requirements, including any and all reporting requirements under federal tax statutes or regulations.

Adaptive Management

In as much as this Plan presents a snapshot of the innovative projects and summarizes the plans and projects of many agencies, it will age quickly. The dynamic nature of projects and plans in the Watershed will result in the need for frequent updates. Because the Plan will be used by agencies in the Watershed to help integrate individual plans and to focus funding opportunities on projects that are most effective and ready to proceed, the information contained in the Plan must remain current to be effective.

In recognition of the ever changing aspects of the planning process, the OWOW Plan will be updated and refined every three to five years. The Plan update will take into consideration recent development in the Watershed, such as projects implemented since the last review, and new understanding of the Watershed issues. Furthermore, the results of the bi-annual performance review will be used to identify potential modification to the Watershed strategy. Through a number of Task Force efforts, significant data are collected reflecting surface, ground and stormwater quality, as well as, habitat data. Integrating this data set into a database that can receive input and readily be queried is the goal of the data management system. As SAWPA manages the database, they will develop quality assurance/quality control protocols specific to each data set to ensure validity.

Additionally, revisions to this Plan's strategies aimed at sustainability of the Watershed will develop over time forming a culture for the Watershed community. Future revisions of this document will capture these developments, new projects that are created, and projects currently listed that develop and evolve.

As new funding opportunities arise to support the implementation of the remaining water resource projects, SAWPA will continue to pursue these opportunities. With the support of local and State agencies, further progress can be made in meeting long-term goals of water sustainability for the region and the State.

Rank	Project ID	Agency	Agency Name	Project Name
Recommended for Prop 84 Round 2 Funding				
1	**2071**	IEUA	Inland Empire Utilities Agency	Wineville Regional Recycled Water Pipeline and Groundwater Recharge System Upgrades
2	**2068**	USFS	USDA Forest Service - San Bernardino National Forest	Forest First - Increase Stormwater Capture and Decrease Sediment Loading through Forest Ecological Restoration
3	**2050**	EMWD	Eastern Municipal Water District	Perris Desalination Program - Brackish Water Wells 94, 95 and 96
4	**2105**	IEUA	Inland Empire Utilities Agency	San Sevaine Ground Water Recharge Basin
5	**2275**	Fontana	City of Fontana	Vulcan Pit Flood Control and Aquifer Recharge Project
6	**2270**	OCWD	Orange County Water District	Alamitos Barrier Improvement Project
7	**2291**	Yucaipa	City of Yucaipa	Wilson III Basins Project and Wilson Basins/Spreading Grounds
8	**2285**	Irvine	City of Irvine	Peters Canyon Channel Water Capture and Reuse Pipeline
9	**2125**	Corona	City of Corona Department of Water & Power	Corona/Home Gardens Well Rehabilitation and Multi-Jurisdictional Water Transmission Line Project
10	**2284**	MWDOC	Municipal Water District of Orange County	Commercial/Industrial/Institutional Performance-Based Water Use Efficiency Program
11	**2062**	EMWD	Eastern Municipal Water District	Quail Valley Subarea 9 Phase 1 Sewer System Project
12	**2281**	Ontario	City of Ontario	Francis Street Storm Drain and Ely Basin Flood Control and Aquifer Recharge Project
13	**2237**	WMWD	Western Municipal Water District	Customer Handbook to Using Water Efficiently in the Landscape
14	**2078**	SBVWCD	San Bernardino Valley Water Conservation District	Plunge Creek Water Recharge and Habitat Improvement
15	**2098**	OCWD	Orange County Water District	Prado Basin Sediment Management Demonstration Project
16	**2154**	SBVMWD	San Bernardino Valley Municipal Water District	Enhanced Stormwater Capture and Recharge along the Santa Ana River
17	**2206**	Upland	City of Upland	14th Street Groundwater Recharge and Storm Water Quality Treatment Integration Facility
18	**2286**	Soboba	Soboba Band of Luiseno Indians	Soboba Band of Luiseño Indians Wastewater Project
19	**2174**	LESJWA	Lake Elsinore and San Jacinto Watersheds Authority	Canyon Lake Hybrid Treatment Process
20	**2287**	Riverside	City of Riverside	Recycled Water Project Phase I (Arlington-Central Avenue Pipeline)
21	**2012**	WMWD	Western Municipal Water District	Arlington Basin Water Quality Improvement Project
22	**2168**	IEUA	Inland Empire Utilities Agency	Regional Residential Landscape Retrofit Program

Rank	Project ID	Agency	Agency Name	Project Name
Not Recommended for Prop 84 Round 2 Funding				
23	**2272**	OCWD	Orange County Water District	North Basin Groundwater Protection Program Nitrate Treatment Project
24	**2246**	Chino	City of Chino	Magnolia Channel Detention Basin
25	**2294**	MWDOC	Municipal Water District of Orange County	Comprehensive Landscape Water Use Efficiency Program
26	**2290**	Menifee	City of Menifee	Line A Homeland/Romoland Flood Control System: Segment 2
27	**2238**	Chino	City of Chino	Drainage A Detention Basin
28	**2265**	OCWD	Orange County Water District	Fletcher Basin Stormwater Capture and Groundwater Recharge Enhancement
29	**2282**	Riverside	City of Riverside	Recycled Water Transmission Main (Santa Ana River Segment)
30	**2130**	JCSD	Jurupa Community Services District	East Side Non-Potable/Recycled Water Project
31	**2297**	Calimesa	City of Calimesa	Calimesa Creek and Basin Project
32	**2239**	Riverside	City of Riverside	Riverside North Aquifer Storage and Recovery Project
33	**2069**	OCWD	Orange County Water District	Five Coves and Lincoln Basins Bypass Pipeline
34	**2094**	IEUA	Inland Empire Utilities Agency	IEUA Regional Landscape Evaluation Program
35	**2247**	MVWD	Monte Vista Water District	Benson Avenue Transmission Pipeline Project
36	**2048**	IEUA	Inland Empire Utilities Agency	Residential Self-Regenerating Water Softener Removal Rebate Program
37	**2175**	IEUA	Inland Empire Utilities Agency	High Efficiency Sprinkler Nozzles Voucher Program
38	**2095**	IEUA	Inland Empire Utilities Agency	Regional Commercial Incentive Program
39	**2249**	MVWD	Monte Vista Water District	Recycled Water Phase II Retail Distribution System Expansion
40	**2132**	JCSD	Jurupa Community Services District	Weather-Based Irrigation Controllers Project
41	**2250**	MVWD	Monte Vista Water District	Grand Avenue Disadvantaged Community Pipeline Replacement Project
42	**2295**	IE keep	Inland Empire Waterkeeper	Santa Ana River Initiative
43	**2146**	IRWD	Irvine Ranch Water District	Baker Water Treatment Plant Project
44	**2252**	SAWA	Santa Ana Watershed Association	San Bernardino Mountains Front Range Invasive Plant Removal Project
45	**2123**	JCSD	Jurupa Community Services District	Selby Street/Geordie Way Water and Sewer Services Project
46	**2242**	Redlands	City of Redlands	City of Redlands Downtown Storm Drain Project
47	**2172**	IEUA	Inland Empire Utilities Agency	IEUA Residential Landscape Transformation Program
48	**2251**	MVWD	Monte Vista Water District	Budget-Based Tiered Rate Structure Improvement
49	**2148**	costa mesa	city of costa mesa	Industrial Way Water Quality and Storm Drain Improvement Project
50	**2185**	OCSD	Orange County Sanitation District	Plant 2 Recycled Water Feasibility Study
51	**2119**	IEUA	Inland Empire Utilities Agency	Prado Basin Habitat Sustainability Program
52	**2152**	SBVMWD	San Bernardino Valley Municipal Water District	Inland Empire Garden Friendly Demonstration Project
53	**2258**	OCWD	Orange County Water District	Sunset Gap Seawater Intrusion
54	**2292**	OCWD	Orange County Water District	Groundwater Replenishment System Final Expansion
55	**2116**	LESJWA	Lake Elsinore and San Jacinto Watersheds Authority	San Jacinto Urban Runoff Treatment & Control
56	**2198**	IEUA	Inland Empire Utilities Agency	RP-1 Outfall Parallel Pipeline
57	**2115**	LESJWA	Lake Elsinore and San Jacinto Watersheds Authority	San Jacinto River Riparian Habitat Restoration
58	**2201**	IRWD	Irvine Ranch Water District	Tustin Legacy Wells 1, 2, 3, and 4
59	**2110**	IEUA	Inland Empire Utilities Agency	Renewable Energy Expansion Program

Rank	Project ID	Agency	Agency Name	Project Name
60	**2113**	LESJWA	Lake Elsinore and San Jacinto Watersheds Authority	Lake Elsinore Fishery Enhancement
61	**2121**	IEUA	Inland Empire Utilities Agency	Turner Basin Improvements
62	**2196**	IRWD	Irvine Ranch Water District	Well 53
63	**2236**	WMWD	Western Municipal Water District	Jurupa Community Services District West Side Recycled Water Project
64	**2199**	IRWD	Irvine Ranch Water District	Well 51 and 52
65	**2149**	IRWD	Irvine Ranch Water District	Well 106 Well Drilling, Equipping, Conveyance, and Treatment Plant Modifications
66	**2257**	OCWD	Orange County Water District	Mid-Basin Injection Project
67	**2147**	IRWD	Irvine Ranch Water District	Orange Park Acres Well No. 1 Well Equipping and Disinfection Facilities
68	**2188**	IRWD	Irvine Ranch Water District	Joint Anaheim/IRWD Well Field
69	**2171**	WMWD	Western Municipal Water District	Arlington Desalter Biodenitrification Project
70	**2158**	IEUA	Inland Empire Utilities Agency	Regional Public Sector Program
71	**2117**	LESJWA	Lake Elsinore and San Jacinto Watersheds Authority	San Jacinto Watershed Nutrient TMDL Pollutant Trading Study
72	**2118**	LESJWA	Lake Elsinore and San Jacinto Watersheds Authority	Stormwater Treatment Wetlands for Canyon Lake
73	**2248**	IEUA	Inland Empire Utilities Agency	Baseline Regional Pipeline
74	**2211**	Anaheim	City of Anaheim	Disneyland Resort and Platinum Triangle Area Recycled Water Project
75	**2226**	Anaheim	City of Anaheim	Water Recycling Expansion Project
76	**2102**	LESJWA	Lake Elsinore and San Jacinto Watersheds Authority	Canyon Lake Dredging Enhancements
77	**2271**	OCWD	Orange County Water District	Santiago Enhanced Recharge
78	**2177**	OCWD	Orange County Water District	Santiago Basins Intertie
79	**2096**	OCWD	Orange County Water District	Placentia Basin Enhancement Project
80	**2097**	OCWD	Orange County Water District	Raymond Basin Enhancement Project
81	**2103**	OCWD	Orange County Water District	Recharge Water Sediment Removal Project
82	**2124**	IEUA	Inland Empire Utilities Agency	RP-1 and RP-2 Cogeneration Facility Expansion
83	**2180**	OCWD	Orange County Water District	Prado Basin Sediment Management Project
84	**2194**	SBCFCD	County of San Bernardino Flood Control District	Cactus Basins 4 & 5 (Proposition 84 only)
85	**2233**	Anaheim	City of Anaheim	Urban Runoff Reuse - Anaheim Hills Golf Course
86	**2227**	Anaheim	City of Anaheim	Shallow Aquifer Pumping for Non-potable Uses
87	**2111**	LESJWA	Lake Elsinore and San Jacinto Watersheds Authority	Lake Elsinore & Canyon Lake Nutrient TMDL Monitoring
88	**2176**	OCWD	Orange County Water District	Solar at OCWD Facilities
89	**2112**	IEUA	Inland Empire Utilities Agency	Local Recycled Water Laterals Construction
90	**2127**	IEUA	Inland Empire Utilities Agency	Digester Gas Cleaning System and RP-2 Digester Gas System Modification
91	**2128**	IEUA	Inland Empire Utilities Agency	RP-1 Secondary System Modifications
92	**2205**	SBCFCD	County of San Bernardino Flood Control District	Comprehensive Storm Drain Plan (CSDP 3-5)
93	**2278**	IRWD	Irvine Ranch Water District	East Orange County Water District/Irvine Ranch Water District Joint Well Project
94	**2273**	OCWD	Orange County Water District	Mid-Basin Injection Demonstration
95	**2051**	OCWD	Orange County Water District	Chino Creek Wetlands
96	**2101**	IEUA	Inland Empire Utilities Agency	Chino Creek Multipurpose Corridor

Rank	Project ID	Agency	Agency Name	Project Name
97	**2228**	Anaheim	City of Anaheim	Water Use Efficiency Improvements/Brackish Groundwater Treatment and Constructed Wetland Installation at Yorba Regional Park
98	**2262**	OCWD	Orange County Water District	Recharge Basin Rehabilitation
99	**2296**	OCWD	Orange County Water District	Subsurface Recharge
100	**2283**	WMWD	Western Municipal Water District	Elsinore Conjunctive Use Program Expansion
101	**2276**	IRWD	Irvine Ranch Water District	Syphon Reservoir Expansion
102	**2203**	IRWD	Irvine Ranch Water District	Construction Circle Recycled Water Conversion Project
103	**2186**	SAWPA	Santa Ana Watershed Project Authority	Characterization and optimization of cost-effective treatment wetlands for surface water quality improvement
104	**2225**	SBCFCD	County of San Bernardino Flood Control District	Wilson Creek Channel Improvements, Yucaipa Boulevard to 10th Street
105	**2235**	SBCFCD	County of San Bernardino	Sand Creek / Warm Creek Confluence
106	**2240**	SBCFCD	County of San Bernardino Flood Control District	Plunge Creek Spillway
107	**2245**	OCWD	Orange County Water District	Prado Basin CA Feasibility Study
108	**2170**	OCWD	Orange County Water District	New Recharge Facilities for Santiago Basins and Creek
109	**2204**	SBCFCD	County of San Bernardino Flood Control District	Rialto Channel at Riverside Avenue
110	**2223**	SBCFCD	County of San Bernardino Flood Control District	Elder Creek Channel
111	**2224**	SBCFCD	County of San Bernardino Flood Control District	Del Rosa Channel Improvements and Repair
112	**2243**	SBCFCD	County of San Bernardino Flood Control District	Wildwood Creek Channel Improvements
113	**2183**	WMWD	Western Municipal Water District	WMWD Recycled Water Project
114	**2190**	SBCFCD	County of San Bernardino Flood Control District	West Fontana Channael
115	**2178**	WMWD	Western Municipal Water District	Chino II Desalter Treated Water Pump Station
116	**2179**	WMWD	Western Municipal Water District	La Sierra Pipeline Project
117	**2181**	WMWD	Western Municipal Water District	Riverside-Corona Feeder Wells in the San Bernardino Basin Area
118	**2182**	WMWD	Western Municipal Water District	Lake Mathews Water Treatment Plant
119	**2187**	SBCFCD	County of San Bernardino Flood Control District	West State Street Storm Drain Segment IIIB
120	**2202**	SBCFCD	County of San Bernardino Flood Control District	Rialto Channel
121	**2173**	WMWD	Western Municipal Water District	Chino II Desalter Brine Minimization
122	**2063**	OCWD	Orange County Water District	Mill Creek Diversion Project
123	**2066**	OCWD	Orange County Water District	North Basin Groundwater Protection Project
124	**2081**	OCWD	Orange County Water District	MTBE Interim Remediation
125	**2084**	OCWD	Orange County Water District	River Road Treatment Wetlands
126	**2085**	OCWD	Orange County Water District	Temescal Creek Wetlands
127	**2087**	OCWD	Orange County Water District	Convert Deep Wells to Injection Wells
128	**2088**	OCWD	Orange County Water District	South Basin Groundwater Protection Project Interim Remediation
129	**2104**	IRWD	Irvine Ranch Water District and Serrano Water District	Santiago Dam Outlet Tower Seismic Study
130	**2109**	IEUA	Inland Empire Utilities Agency	Cypress Channel Multipurpose Corridor

Rank	Project ID	Agency	Agency Name	Project Name
131	**2114**	LESJWA	Lake Elsinore and San Jacinto Watersheds Authority	Lake Elsinore Water Quality Modeling
132	**2135**	SBCFCD	San Bernardino County Flood Control District	Cable Creek Flood Plain and Project Feasibility Study
133	**2136**	SBCFCD	San Bernardino County Flood Control District	Lytle Cajon Basin Feasibility Study
134	**2137**	SBCFCD	San Bernardino County Flood Control District	Etiwanda/San Sevaine Debris and Flood Plain Study
135	**2155**	SBCFCD	San Bernardino County Flood Control District	Mission Zanja Creek Feasibility Study
136	**2169**	OCWD	Orange County Water District	Orange County Regional Stormwater Infiltration Program

Map for Proposition 84 Guidelines (Table 2.1)

IRWM Plan Standard	Refer to section…
Governance	Chapter 1 – One Water One Watershed Program
Region Description	Chapter 3 – Regional Description
Objectives	Chapter 6 – Regional Goals and Objectives
Resource Management Strategies	Chapter 5 – Resource Management Strategies
Integration	Chapter 1 – One Water One Watershed Program Chapter 4 – Institutional Setting and Current Collaborative Efforts
Project Review Process	Chapter 7 – Regional Projects
Impact and Benefit	Chapter 8 – Benefits of Sustainable Integrated Solutions
Plan Performance and Monitoring	Chapter 9 – Strategy Implementation (section 9.2)
Data Management	Chapter 9 – Strategy Implementation (section 9.1)
Finance	Chapter 2 – Funding
Technical Analysis	Chapter 5, Introduction
Relation to Local Water Planning	Chapter 4 – Institutional Setting and Current Collaborative Efforts Chapter 5 – Resource Management Strategies (sub-section on Relation of Plan to local land use and water planning)
Stakeholder Involvement	Chapter 1 – One Water One Watershed Program
Coordination	Chapter 1 – One Water One Watershed Program Chapter 4 – Institutional Setting and Current Collaborative Efforts
Climate Change	Chapter 5 – Resource Management Strategies; Section 5.9 Climate Change

Technical Analysis

As administrator for the OWOW plan, numerous sources of technical information and data sets were collected in order to develop the water management needs of the Plan. Shown below is a table most of the key technical studies that were collected, reviewed and applied by SAWPA and the Pillars to evaluate the current conditions, the historic data and projections for the future. These studies are often the product of multi-agency task forces that were administered by SAWPA and reflect the key technical components for the planning process.

Technical analysis and feasibility analysis is also performed on a project level basis as well for the projects submitted as part of the OWOW prioritization list of implementation projects. As part of the Call for Projects, data is acquired for each project that provide technical project details such as project location, metrics for benefits such as acre-feet of water recharged or stored, number of acres of habitat restored, volume of stormwater captured or treated, amount of greenhouse gas emissions, and project readiness. Thereafter, priority projects are screened by an independent review panel to assure that the project is technically feasible and meets the project proponent's claims on the project information form. Thereafter, for those projects that are selected for funding, an even more detailed technical evaluation and economic analysis is required and will be submitted to SAWPA for review. Depending on the funding program such as the DWR Proposition 84 IRWM program, the projects submitted will be required to then complete detailed evaluation forms as part of the grant application that assure technical and economic feasibility before implementation.

	Title	Author	Date
Climate Change Impacts	Santa Ana Watershed Project Authority, Integrated Water Management Plan	SAWPA	2009
	Presenting Uncertainty About Climate Change to Water Resource Managers, A Summary of Workshops with the Inland Empire Utilities Agency	Rand Corporation	2008
	Presentation of Uncertainty About Climate Change Modeling to SAWPA Area	Rand Corporation	2008
Water Quality Changes in Groundwater Basins and Surface Water	Santa Ana River Wasteload Allocation Model Report	Wildermuth Environmental, Inc.	2009
	Recomputation of Ambient Water Quality in the Santa Ana Watershed for the Period 1987 to 2006, Final Technical Memorandum	Wildermuth Environmental, Inc.	2008
Water Supply and Water Quality	Chino Basin Recharge Master Plan Update	Wildermuth Environmental, Inc.	2010
	Salinity Management Study, Technical Memorandum 1-3	CDM	2010
	Middle Santa Ana River Watershed Bacterial Indicator TMDL Triennial Report	CDM	2010
	Santa Ana Watershed Salinity Management Program, Phase 1-2	CDM, Corollo and Wildermuth Environmental, Inc.	2010
	Upper Santa Ana Watershed Integrated Regional Water Management Plan	GEI Consultants, Inc.	2009
	Phase I and II Reports of the Emerging Constituents Workgroup	Risk Sciences	2009
	Santa Ana Watershed "One Water One Watershed", Integrated Regional Water Management Plan	SAWPA	2009
	California Regional Water Quality Control Board, Water Quality Control Plan for the Santa Ana River Basin (Region 8)		2008
	Santa Ana Integrated Watershed Plan		2005
	Stormwater Quality Standards Study, Phase I Study Report	CDM	2005
	Santa Ana Integrated Watershed Plan, Volume 1-3		2002
	Optimum Basin Management Program for the Chino Basin	Wildermuth Environmental, Inc.	1999

Pillar Leaders

Behrooz Mortazavi	Water Recycling
Bob Tincher	Water Supply Reliability
Greg Woodside	Water Quality Improvement
Martha Davis	Climate Change
Norris Brandt	Environment and Habitat
Susan Lien-Longville	Water and Land Use
Maria Elena Kennedy	Environmental Justice
Scott Bangle	Parks, Recreation and Open Space
MaryAnne Skorpanich	Flood Risk Management
Tim Barr	Water Use Efficiency

(Former Pillar Leaders)

Larry Mckinney	Flood Risk Management
Paul Frandsen	Parks, Recreation and Open Space
Tedi Jackson	Water Use Efficiency

Table 5.4-2

SAWPA WATER CONSERVATION MEASURES

	Other Conservation Measures/SAWPA OWOW Region																																													
	Program Implementation																																													
	Financial		Partnerships and Outreach					Policy Initiatives				Landscape																														Regional					
	Grants/Loans	Allocated Tiered Water Rates/Water Budget Tiered Rates	RCDs	Pollution Prevention / Water Quality	Education for Elected Officials and Managers	UC Cooperative Extension	Develop Energy and Water Partnerships	Monitor and Advocate Water Use Efficiency: Legislation, Ordinances, and Resolutions	Plumbing and Appliance Standards	Support Statewide, High-Level Partnerships, e.g. Dept. of Education	Develop Landscape and Irrigation Standards	Landscape Design Assistance	Pay for Performance	Urban Run-off Collection	Irrigation System Improvements (audits and equipment)	Educate and Outreach to "Joe Mow & Go" and Facility and Maintenance Workers	Landscape Contractor Training and Certification Program	"CA Friendly Smart from the Start" Focus on Landscape Architects and Contractors	Standardized ET Protocol	"Cash for Grass" Incentive Program	Dedicated Landscape Meter	Standardized Bid Document for Landscape Contractor RFPs to be Used by HOAs, Prop Mgmt Companies	Runoff Reduction (Irrigation Strategies)	Outreach to Green Waste Haulers and Sites	Develop Landscape Irrigation Budgets	Web Applications or Computer-Based Training & Education	Landscape Contest	Assistance to Restaurants and Hotels (Customer Placards)	Direct Install Programs	Water Softeners That Do Not Use Salt	Dishwashers	Point-of-Use Water Heaters	Rain Sensors	Pool Covers	Cisterns	Agricultural Water Use Efficiency	Recycling -- Agricultural Irrigation	HETs	HECWs	CII Large-Scale and Key Account Audits and Implementation	Turnkey Pilot Program with Check-Ups and Education	Regional Rebate Program/Wholesalers	"Save Water, Save A Buck" Program	Regional Support from MWD	Conservation Summit	Consumer Education	CII Pay for Performance (not landscape)
SAWPA Joint Power Authority Members																																														
Eastern Municipal Water District (EMWD)																																														
Inland Empire Utilities Agency (IEUA)																																														
Orange County Water District (OCWD)																																														
San Bernardino Valley Municipal Water District (SBVMWD)																																														
Western Municipal Water District (WMWD)			1		1	1		1										1																					1	1	1	1		1	1			
EMWD																																														
Lake Hemet Municipal Water District					1			1															1																1	1					1			
Rancho California Water District		1												1	1		1				1				1				1								1	1	1	1	1		1	1				
McCanna Ranch Water Company																																														
Nuevo Water Company				1																			1			1												1	1	1							
IEUA																																														
Cucamonga Valley Water District				1										1									1																1	1	1			1	1			
Monte Vista Water District				1									1		1					1									1										1	1	1		1	1	1		1	
Fontana Water Company																																														
Chino Basin Watermaster																																														
City of Chino																																														
City of Chino Hills																																														
City of Ontario																																														
City of Upland																																														
City of Montclair																																														
City of Fontana																																														
San Antonio Water Company															1						1		1																1	1	1			1	1			
Municipal Water District of Orange County (MWDOC)	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1		1	1	1		1	1	1	1		1	1		1	1				1	1	1	1	1	1	1	1		
East Orange County Water District			1	1																																										
Emerald Bay Services District																																														
Golden State Water Company			1	1			1																																							
Irvine Ranch Water District	1	1	1	1			1	1					1				1	1	1	1	1		1		1											1	1	1	1	1		1	1				1
La Habra Water Department			1	1																																										
Laguna Beach County Water District			1	1																																										
Mesa Consolidated Water District			1	1													1																														
Serrano Water District			1	1																																										
Orange County Water District																																														
Yorba Linda Water District			1	1																																										
East Orange County Water District			1	1																																										
Orange County Sanitation District			1	1																																										
City of Brea Water Department			1	1																																										
City of Buena Park			1	1																																										
City of Fountain Valley Water Department			1	1																																										
City of Garden Grove Water Department			1	1																																										
City of Huntington Beach			1	1	1										1											1											1						1		1			
City of La Palma Water Department			1	1																																										
City of Newport Beach Water Department			1	1																																										
City of Orange Water Department			1	1																																										
City of Tustin Water Department			1	1																																										
City of Westminster Water Department			1	1																																										

Table 5.4-2

SAWPA WATER CONSERVATION MEASURES

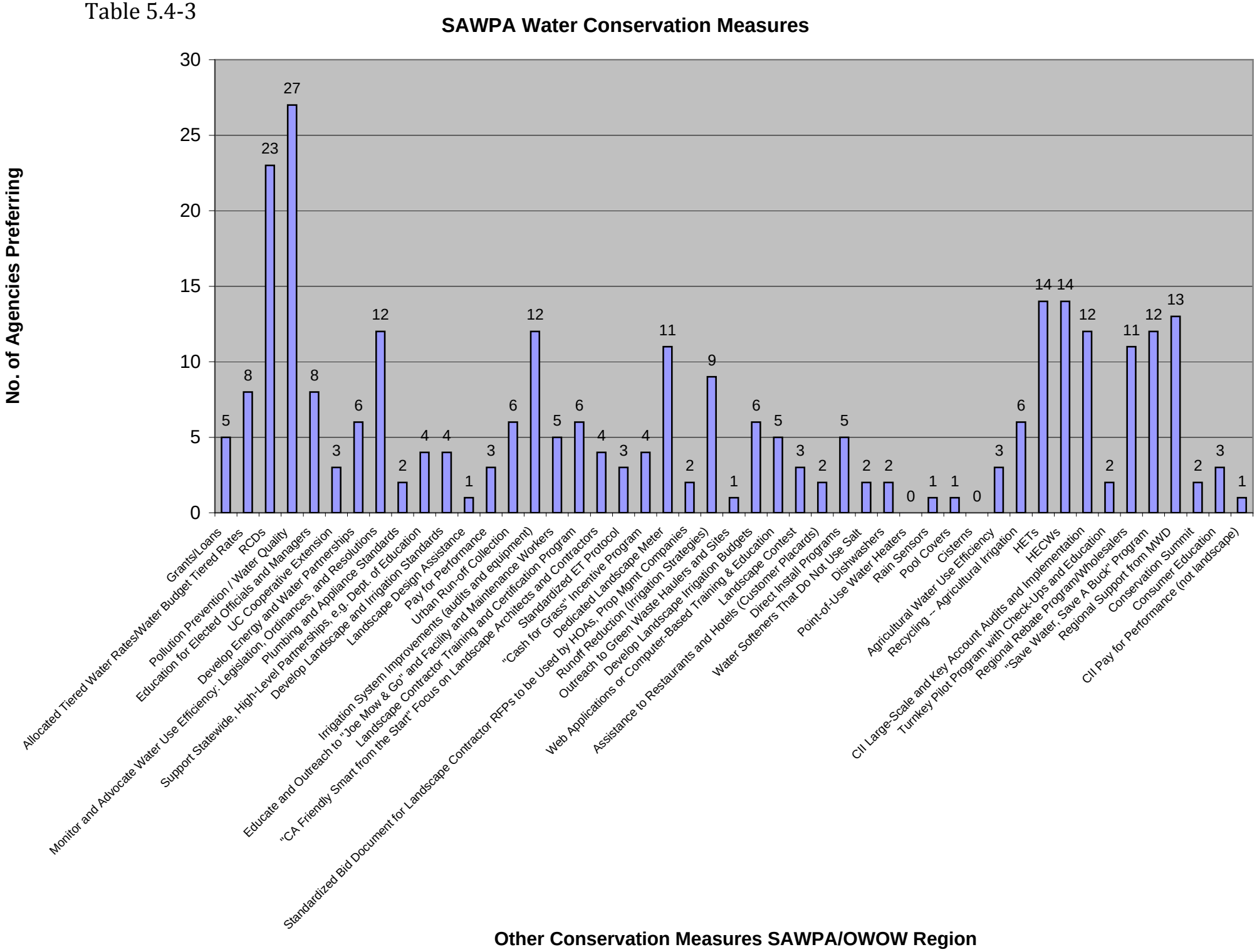
	Financial		Partnerships and Outreach					Policy Initiatives				Landscape																														Regional					
	Grants/Loans	Allocated Tiered Water Rates/Water Budget Tiered Rates	RCDs	Pollution Prevention / Water Quality	Education for Elected Officials and Managers	UC Cooperative Extension	Develop Energy and Water Partnerships	Monitor and Advocate Water Use Efficiency: Legislation, Ordinances, and Resolutions	Plumbing and Appliance Standards	Support Statewide, High-Level Partnerships, e.g. Dept. of Education	Develop Landscape and Irrigation Standards	Landscape Design Assistance	Pay for Performance	Urban Run-off Collection	Irrigation System Improvements (audits and equipment)	Educate and Outreach to "Joe Mow & Go" and Facility and Maintenance Workers	Landscape Contractor Training and Certification Program	"CA Friendly Smart from the Start" Focus on Landscape Architects and Contractors	Standardized ET Protocol	"Cash for Grass" Incentive Program	Dedicated Landscape Meter	Standardized Bid Document for Landscape Contractor RFPs to be Used by HOAs, Prop Mgmt Companies	Runoff Reduction (Irrigation Strategies)	Outreach to Green Waste Haulers and Sites	Develop Landscape Irrigation Budgets	Web Applications or Computer-Based Training & Education	Landscape Contest	Assistance to Restaurants and Hotels (Customer Placards)	Direct Install Programs	Water Softeners That Do Not Use Salt	Dishwashers	Point-of-Use Water Heaters	Rain Sensors	Pool Covers	Cisterns	Agricultural Water Use Efficiency	Recycling – Agricultural Irrigation	HETs	HECWs	CII Large-Scale and Key Account Audits and Implementation	Turnkey Pilot Program with Check-Ups and Education	Regional Rebate Program/Wholesalers	"Save Water, Save A Buck" Program	Regional Support from MWD	Conservation Summit	Consumer Education	CII Pay for Performance (not landscape)
SBVMWD																																															
Bear Valley Mutual Water Company																																															
Lugonia Water Company																																															
North Fork Water Company																																															
Redlands Water Company																																															
San Bernardino Valley Water Conservation District																																															
Banning Heights MWC																																															
Beaumont Cherry Valley W.D.																																															
Big Bear City Community Services District																																															
Muscoy Mutual Water Company																																															
Western Heights Water Company																																															
Yucaipa Valley Water District																																															
East Valley Water District																																															
WMWD																																															
Box Springs Mutual Water Company																																															
Eagle Valley Mutual Water Company																																															
Elsinore Valley Municipal Water District	1	1						1						1	1					1		1		1				1									1	1	1		1	1	1			
City of Norco																																															
City of Corona Department of Water & Power			1		1	1		1			1			1	1	1				1		1				1											1	1	1		1	1	1			
Lee Lake Water District																																															
Rancho California Water District																																															
El Sobrante Municipal Water Company																																															
Home Gardens County Water District																																															
Jurupa Community Services District																																															
March AFB																																															
Riverside Public Utilities		1		1	1		1	1	1	1	1				1	1					1				1		1				1						1									
Mutual Water Company of Glen Avon																																															
Riverside Highland Water Company	1	1		1			1	1		1	1																										1					1		1	1	1	
Rubidoux Community Services District																																															
Riverside County Flood Control and Water Conservation District																																															
Wholesaler Suppliers																																															
Municipal Water District of Orange County								1							1								1	1																						
Western Municipal Water District																																															
Eastern Municipal Water District	1	1			1			1							1		1				1	1	1			1			1									1	1	1		1	1	1			
Inland Empire Utilities Authority		1			1		1	1						1	1					1	1							1	1	1							1	1	1	1		1	1	1		1	
San Bernardino Valley Municipal Water District																																															
Metropolitan Water District of Southern California								1		1				1	1	1	1	1	1	1	1					1												1	1	1		1	1	1			
Other Water Suppliers and Cities																																															
Crestline-Lake Arrowhead W.A.																																															
Fort Fremont Mutual																																															
Gage Canal Company																																															
High Valleys Water Dist																																															
Marigold Mutual Water Company																																															
Meeks and Daley W.C.																																															
Mutual of W. Riverside																																															
Rio Rancho Mutual																																															
San Gorgonio Pass Water Agency																																															
San Jacinto Water Department																																															
South Mesa Water Company																																															
Temescal Water Company																																															

Table 5.4-2

SAWPA WATER CONSERVATION MEASURES

	Financial		Partnerships and Outreach					Policy Initiatives				Landscape																														Regional					
	Grants/Loans	Allocated Tiered Water Rates/Water Budget Tiered Rates	RCDs	Pollution Prevention / Water Quality	Education for Elected Officials and Managers	UC Cooperative Extension	Develop Energy and Water Partnerships	Monitor and Advocate Water Use Efficiency: Legislation, Ordinances, and Resolutions	Plumbing and Appliance Standards	Support Statewide, High-Level Partnerships, e.g. Dept. of Education	Develop Landscape and Irrigation Standards	Landscape Design Assistance	Pay for Performance	Urban Run-off Collection	Irrigation System Improvements (audits and equipment)	Educate and Outreach to "Joe Mow & Go" and Facility and Maintenance Workers	Landscape Contractor Training and Certification Program	"CA Friendly Smart from the Start" Focus on Landscape Architects and Contractors	Standardized ET Protocol	"Cash for Grass" Incentive Program	Dedicated Landscape Meter	Standardized Bid Document for Landscape Contractor RFPs to be Used by HOAs, Prop Mgmt Companies	Runoff Reduction (Irrigation Strategies)	Outreach to Green Waste Haulers and Sites	Develop Landscape Irrigation Budgets	Web Applications or Computer-Based Training & Education	Landscape Contest	Assistance to Restaurants and Hotels (Customer Placards)	Direct Install Programs	Water Softeners That Do Not Use Salt	Dishwashers	Point-of-Use Water Heaters	Rain Sensors	Pool Covers	Cisterns	Agricultural Water Use Efficiency	Recycling -- Agricultural Irrigation	HETs	HECWs	CII Large-Scale and Key Account Audits and Implementation	Turnkey Pilot Program with Check-Ups and Education	Regional Rebate Program/Wholesalers	"Save Water, Save A Buck" Program	Regional Support from MWD	Conservation Summit	Consumer Education	CII Pay for Performance (not landscape)
Terrace Water Company																																															
Three Valleys Municipal Water District																																															
Walnut Valley Water District																																															
Water Replenishment District of Southern California																																															
West Valley Water District																																															
City of Aliso Viejo																																															
City of Anaheim Water Department																																															
City of Banning																																															
City of Beaumont																																															
City of Big Bear																																															
City of Calimesa																																															
City of Canyon Lake																																															
City of Claremont																																															
City of Colton																																															
City of Covina																																															
City of Fullerton Water Department																																															
City of Grand Terrace																																															
City of Hemet Water Department																																															
City of Highland																																															
City of La Habra Heights																																															
City of La Mirada																																															
City of La Verne																																															
City of Loma Linda																																															
City of Moreno Valley																																															
City of Murrieta																																															
City of Perris Water Department																																															
City of Pomona																																															
City of Redlands																																															
City of Rialto																																															
City of Running Springs																																															
City of San Bernardino				1												1					1																										
City of San Jacinto																																															
City of Santa Ana Water Department																																															
City of Temecula																																															
City of Yucaipa																																															
Total	**5**	**8**	**23**	**27**	**8**	**3**	**6**	**12**	**2**	**4**	**4**	**1**	**3**	**6**	**12**	**5**	**6**	**4**	**3**	**4**	**11**	**2**	**9**	**1**	**6**	**5**	**3**	**2**	**5**	**2**	**2**	**0**	**1**	**1**	**0**	**3**	**6**	**14**	**14**	**12**	**2**	**11**	**12**	**13**	**2**	**3**	**1**

Table 5.4-3


SAWPA Water Conservation Measures
No. of Agencies Preferring
0
5
10
15
20
25
30
5
8
23
27
8
3
6
12
2
4
4
1
3
6
12
5
6
4
3
4
11
2
9
1
6
5
3
2
5
2
2
0
1
1
0
3
6
14
14
12
2
11
12
13
2
3
1
Grants/Loans
Allocated Tiered Water Rates/Water Budget Tiered Rates
RCDs
Pollution Prevention / Water Quality
Education for Elected Officials and Managers
UC Cooperative Extension
Develop Energy and Water Partnerships
Monitor and Advocate Water Use Efficiency: Legislation, Ordinances, and Resolutions
Support Statewide, High-Level Partnerships, e.g. Dept. of Education
Plumbing and Appliance Standards
Develop Landscape and Irrigation Standards
Landscape Design Assistance
Pay for Performance
Urban Run-off Collection
Irrigation System Improvements (audits and equipment)
Educate and Outreach to "Joe Mow & Go" and Facility and Maintenance Workers
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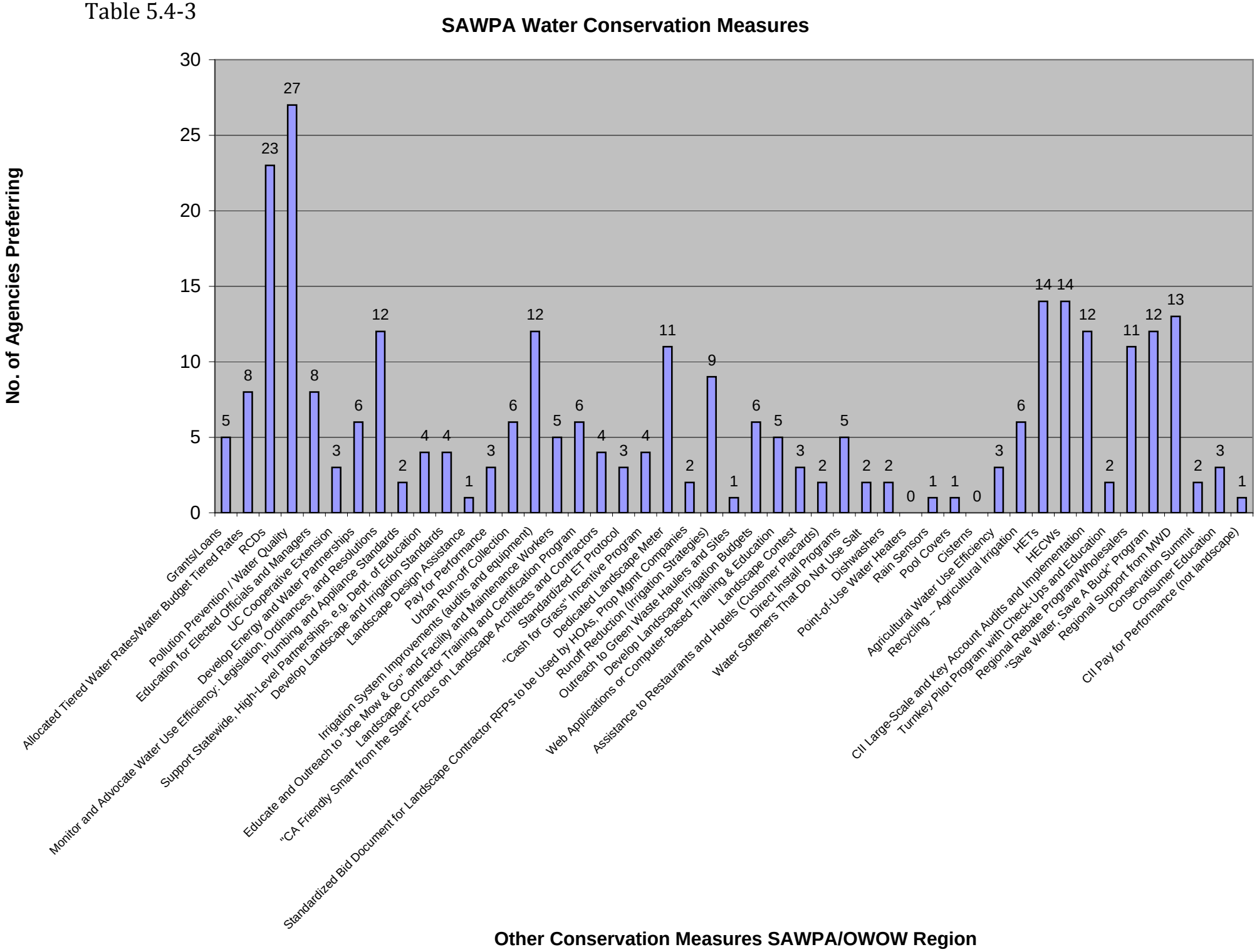
Standardized ET Protocol
"Cash for Grass" Incentive Program
Dedicated Landscape Meter
Runoff Reduction (Irrigation Strategies)
Outreach to Green Waste Haulers and Sites
Develop Landscape Irrigation Budgets
Web Applications or Computer-Based Training & Education
Landscape Contest
Assistance to Restaurants and Hotels (Customer Placards)
Direct Install Programs
Water Softeners That Do Not Use Salt
Point-of-Use Water Heaters
Dishwashers
Rain Sensors
Pool Covers
Cisterns
Agricultural Water Use Efficiency
Recycling – Agricultural Irrigation
HETs
HECWs
CII Large-Scale and Key Account Audits and Implementation
Turnkey Pilot Program with Check-Ups and Education
Regional Rebate Program/Wholesalers
"Save Water, Save A Buck" Program
Regional Support from MWD
Conservation Summit
Consumer Education
CII Pay for Performance (not landscape)
Other Conservation Measures SAWPA/OWOW Region

Table 5.4-3


SAWPA Water Conservation Measures
No. of Agencies Preferring
0
5
10
15
20
25
30
5
8
23
27
8
3
6
12
2
4
4
1
3
6
12
5
6
4
3
4
11
2
9
1
6
5
3
2
5
2
2
0
1
1
0
3
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14
12
2
11
12
13
2
3
1
Grants/Loans
Allocated Tiered Water Rates/Water Budget Tiered Rates
RCDs
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Education for Elected Officials and Managers
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Consumer Education
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Other Conservation Measures SAWPA/OWOW Region

One Water One Watershed Project Information Form

® Indicates Required Fields

Yellow represents check boxes / pull down menus

A. Lead Agency Information

Agency or Organization ®: _____

Project Director ®: First: _____ Last: _____

Mailing Address ®: _____

City ®: _____State: CA Zip®: _____

Email ®: _____

Phone ®: (_____) _____-_____ Ext. _____ Fax: (_____) _____-_____

Cell Phone: (_____) _____-_____

B. Project Partners

List Partners (complete form)

- Partner 1
- Partner 2
- Partner 3
- Partner 4

Check box (check all that apply for each partner)

- Coordinated planning
- Provides direct funding
- Provides in-kind services
- Co-operator/Co-manager

(provide for each project partner)

Agency or Organization ®: _____

Primary Contact®: First: _____ Last: _____

Mailing Address ®: _____

City ®: _____State: CA Zip®: _____

Email ®: _____

Phone ®: (_____) _____-_____ Ext. _____ Fax: (_____) _____-_____

Cell Phone: (_____) _____-_____

C. Project Type ®

Check box (only can check one, not multiple)

- Construction
- Program
- Study/Investigation

Q. Is this project included in an existing regional, sub-regional plan ®? Yes No

If yes, name plan (200 characters): _____

D. Project Location

Q. Describe Location/Area (500 characters)®:

_____

_____ (Please be as specific as possible)

Q. Please provide an electronic GIS shapefile delineating the project: Attach File

or if no GIS shapefile is available provide a set of point coordinates (lat/long)

Latitude: _____

Longitude: _____

E. Project Funding and Economic Feasibility

Q. Approximately what portion of the project funding is expected from ®:

Requested Funding	$_____	_____%
Non-State Share (Funding Match)	$_____	_____%
Local Contribution	$_____	_____%
Federal Contribution	$_____	_____%
In-Kind Contribution	$_____	_____%
SRF Loan	$_____	_____%
Total Project	$_____	_____%

Q. Has funding been secured for project ®? Yes No

If yes, explain certainty and longevity of funding (500 characters):

_____

_____

Q. Has O&M funding been secured ®? Yes No

If yes, explain certainty and longevity of funding (500 characters):

_____

_____

F. Project Information and Technical Feasibility

Q. Project Name (200 characters)®: _____

Q. Project Description (1,000 characters)®:

_____

_____

Q. Goals and Objectives of the Project (1,000 characters)®:

_____

_____

Q. Purpose and Need of the Project (1,000 characters)®:

_____

_____

Q. Are there any significant institutional/technical barriers to project ®? Yes No

If Yes, describe (500 characters):

_____

_____

G. Resources Stewardship and Sustainability

Landuse

Q. Does the project employ resource efficient landuse (LID, LEED, or Ahwahnee Principles)®? Yes No

Q. Percentage of the project footprint that implements resource efficient landuse ®: _____(%)

Describe the resource efficient landuse practices implemented (1000 characters)®:

Q. _____

Q. What are the impacts to natural hydrology and alluvial fans®? Negative impacts, No impacts, Positive impacts

Describe impacts (1000 characters)®:

_____

Q. _____

Climate Change Adaptation

Describe how the project adapts to the potential effects of climate change (1000 characters)®:

_____

Q. _____

Greenhouse Gas Emissions

Q. Reduction of greenhouse gas emissions achieved by project _____ (metric tons CO2 /year)®

Q. If this is a water supply project that depends on metered energy resources, estimate _____ (KWh/Acre foot)®

Describe the measures to reduce greenhouse gas emissions of your project (1,000 characters)®:

_____

_____

Q. _____

H. Strategic Considerations

Q. Where do the benefits of the projects accrue ®?

Check box (only can check one, not multiple) | linked to **specific** option

- Benefits mainly serve single municipality/community — Name municipality/community: _____
- Benefits multiple municipalities/communities — List municipalities/communities: _____
- Benefits serve sub-watershed — Identify subwatershed: _____
- Benefits multiple sub-watersheds — List subwatersheds: _____
- Benefits serve entire Santa Ana watershed

Describe project synergies and linkages that result in added value, and coordinated implementation and/or operation (1,000 characters)®:

Q. _____

I. Disadvantaged/Native American Tribal Communities

Q. Does project provide direct benefits to disadvantaged communities ®? Yes No

Q. Does project provide direct benefits to Native American tribal communities ®? Yes No

Q. Percentage of the project benefiting disadvantaged communities ®: _____(%)

Q. Percentage of the project benefiting Native American tribal communities ®: _____(%)

Describe the benefits to disadvantaged and/or Native American tribal communities (1,000 characters)®:

Q. _____

J. Environmental Justice

How does the proposed project address any Environmental Justice concerns ®?

Q. Explain (1,000 characters) _____

K. Water Resource Management Strategies

Q. Indicate the strategies that the project addresses ®:

Check all that apply, and indicate performance metrics for those checked | Performance metrics (tied **specifically** to each strategy)

- Water use efficiency — Customers meeting guidelines (hyperlink) _____ (% in project area)
- Water conservation (urban and/or agricultural) — Annual conserved water_____ (acre-feet/year)
- Recycled water — Annual water supply _____ (acre-feet/year)
- Desalination (brackish and/or seawater) — Annual water supply _____ (acre-feet/year)
- Surface storage — New storage capacity_____ (acre-feet)
- Groundwater storage/conjunctive management — New storage capacity_____ (acre-feet)
- Water transfers & operational efficiency — Annual water supply _____ (acre-feet/year)
- Stormwater capture — Flows captured _____ (acre-feet/year)
- Ecosystem/habitat restoration (wetlands creation, invasive species removal, forest management) — Habitat created/restored _____ (acres)
- Open space/parks/recreation — Open space/parks created _____ (acres)
- Non-point source and stormwater pollution reduction — Water treated _____ (mgd)
- Groundwater recharge (new or restored) — Recharge capacity _____ (acre-feet/year)
- Salt/contaminant removal — Salt/contaminant removed _____ (tons/yr)
- Flood risk reduction — Flood plain protected _____ (acres)
- Drinking water treatment and distribution — Water treated _____ (mgd)
- Wastewater treatment — Water treated _____ (mgd)
- Other Source of new water supply, describe (100 characters): _____ — Annual water supply _____ (acre-feet/year)

Describe the technical basis supporting the achievement of performance metrics for the proposed project benefits specified above (1,000 characters)®:

Q. _____

L. Economic Incentives

Q. Number of jobs created by project ®:

construction _____ (# of individuals)

operational _____ (# of individuals)

M. Project Readiness/Status

Q. What is the status of the project ®?

Check box (only can check one, not multiple)

Planning studies completed
Conceptual design (15%) completed
Preliminary design (30%) completed
Final design (100%) completed
Project ready for construction bid (permits secured)

Q. CEQA Status ®

Check box (only can check one, not multiple)

not applicable	Neg Dec Filing date: _____ (MM/DD/YYYY)
in progress	Estimated completion date: _____ (MM/DD/YYYY)
complete	Filing date: _____ (MM/DD/YYYY)

Q. NEPA Status

Check box (only can check one, not multiple)

not applicable	
in progress	Estimated completion date: _____ (MM/DD/YYYY)
complete	Filing date: _____ (MM/DD/YYYY)

Q. Estimated completion date of project ®: _____ (MM/DD/YYYY)

Q. Estimated operational life of project ®: _____ (MM/DD/YYYY)

Q. Has your agency constructed similar projects in the past ®? Yes No

Prioritized OWOW Master Project List*

* ranks determined based on self-reported data submitted before 6/30/2010

Main Project Statistics Page

Project No	Project Ranking	Project Name	Agency	Total Cost	Requested Funding
1167	1	City of Fontana Flood Control and Aquifer Recharge Program	City of Fontana	$6,000,000.00	$1,000,000.00
1015	2	The Project consists of two detention basins and approximately 11,800 lineal feet of open channel and storm drains from Juniper Flats westerly. It represents Phase 1 of the four phase MDP.	City of Menifee	$6,000,000.00	$3,500,000.00
1236	3	San Jacinto Wildlife Area Habitat Sustainability and Enhancement Utilizing Recycled Water	Eastern Municipal Water District	$150,000.00	$75,000.00
1272	4	Repairs to the Unlined RCP Reach IVA and Reach IVB Santa Ana Regional Interceptor (SARI)	Santa Ana Watershed Project Authority	$25,000,000.00	$4,000,000.00
1096	5	San Jacinto Indirect Potable Reuse	Eastern Municipal Water District	$2,000,000.00	$1,000,000.00
1171	6	Perris II Desalination Facility	Eastern Municipal Water District	$57,000,000.00	$28,700,000.00
1211	7	Sludge Dewatering, Odor Control, and Primary Sludge Thickening at Plant No. 1, Project No. P1-101	Orange County Sanitation District (OCSD)	$100,000,000.00	$1,000,000.00
1205	8	Storm Water Capture and Groundwater Recharge in the Perris North Groundwater Management Zone	Eastern Municipal Water District	$200,000.00	$100,000.00
1190	9	Cactus Basins No. 3 and No. 3A	San Bernardino County Flood Control District	$10,000,000.00	$1,000,000.00
1104	10	Temescal Gardens Online	Elsinore Valley Municipal Water District	$300,000.00	$200,000.00
1173	11	Hemet/San Jacinto Integrated Recharge and Recovery Program Phase II	Eastern Municipal Water District	$2,400,000.00	$1,800,000.00
1136	12	Groundwater Replenishment System - Flow Equalization	Orange County Water District	$23,218,000.00	$5,804,500.00
1113	13	Regional Recycling Plant No.5 Expansion	Inland Empire Utilities Agency	$70,000,000.00	$52,500,000.00
1117	14	RP-5 De-bottlenecking and RP-2 Capacity Improvement	Inland Empire Utilities Agency	$39,000,000.00	$29,250,000.00
1047	15	Industrial Way Water Quality and Storm Drain Improvement Project	city of costa mesa	$3,000,000.00	$2,400,000.00
1082	16	Arlington Desalter Connection Project No. 27-1208 & Western Municipal Water District Promenade Connection	City of Corona	$800,000.00	$400,000.00
1188	17	West Fontana Basin	San Bernardino County Flood Control District	$10,000,000.00	$2,000,000.00
1181	18	Perris II Desalter Ancillary Facilities	Eastern Municipal Water District	$42,000,000.00	$31,500,000.00
1135	19	Groundwater Replenishment System Expansion	Orange County Water District	$104,000,000.00	$26,000,000.00
1103	20	San Jacinto River Gap Project	Riverside County Flood Control & Water Conservation District	$40,000,000.00	$30,000,000.00
1250	21	Cucamonga Creek Watershed Regional Water Quality Project (Mill Creek Wetlands)	City of Ontario	$20,000,000.00	$10,000,000.00
1166	22	Infiltration and Inflow Reduction Program	Costa Mesa Sanitary District	$3,000,000.00	$2,400,000.00
1226	23	Brine Line (SARI) SCADA System	Santa Ana Watershed Project Authority	$25,000,000.00	$4,000,000.00

1291	24	Place-Based GIS Land Use Design Tool to Protect Watershed Function in the Upper Santa Ana River Watershed	California Resource Connections, Inc.	$475,000.00	$475,000.00
1168	25	Modjeska Park Parking Detention/Infiltration Facility (Design Only)	City of Anaheim	$250,000.00	$125,000.00
1160	26	Constructed Wetland Habitat Restoration and Water Reclamation project for the Santa Ana River Borrow Pit.	San Bernardino Valley Water Conservation District	$4,400,000.00	$1,000,000.00
1180	27	Cactus Basins No. 4 and No. 5	San Bernardino County Flood Control District	$21,600,000.00	$6,600,000.00
1090	28	San Bernardino National Forest Ecological Restoration and Watershed Improvement	USDA Forest Service - San Bernardino National Forest	$8,000,000.00	$1,000,000.00
983	29	East Garden Grove Wintersburg Channel Urban Runoff Diversion Project, Phase I	CIty of Huntington Beach	$5,488,700.00	$5,200,000.00
1163	30	Cable Creek Basin and Spreading Grounds	San Bernardino County Flood Control District	$1,000,000.00	$250,000.00
1000	31	Characterization and optimization of cost-effective treatment wetlands for surface water quality improvement	Santa Ana Watershed Project Authority	$300,000.00	$150,000.00
1162	32	Sun City Force Main and Recycled Water Pipeline Replacement	Eastern Municipal Water District	$12,610,000.00	$9,458,000.00
1247	33	Arlington Basin Water Quality Improvement Project	Western Municipal Water District	$726,000.00	$216,000.00
987	34	San Jacinto Urban Runoff Treatment & Control	Lake Elsinore and San Jacinto Watersheds Authority	$250,000.00	$125,000.00
1214	35	Pharmaceutical Collection Program	Orange County Sanitation District (OCSD)	$185,000.00	$90,000.00
986	36	San Jacinto Watershed Nutrient TMDL Pollutant Trading Study	Lake Elsinore and San Jacinto Watersheds Authority	$250,000.00	$125,000.00
948	37	The Quail Valley Groundwater Infiltration Improvements Project	City of Menifee	$100.00	$250,000.00
1133	38	Sunset Gap Seawater Intrusion	Orange County Water District	$700,000.00	$175,000.00
1094	39	Chino Creek Multipurpose Corridor	Inland Empire Utilities Agency	$13,900,000.00	$10,425,000.00
988	40	San Jacinto River Riparian Habitat Restoration	Lake Elsinore and San Jacinto Watersheds Authority	$300,000.00	$150,000.00
1176	41	Mission Zanja Creek Feasibility Study	San Bernardino County Flood Control District	$1,000,000.00	$250,000.00
989	42	Lake Elsinore Water Quality Modeling	Lake Elsinore and San Jacinto Watersheds Authority	$300,000.00	$150,000.00
1216	43	IEUA Regional Water Budget Program	Inland Empire Utilities Agency	$315,000.00	$200,000.00
1075	44	Enhanced Stormwater Capture and Recharge along the Santa Ana River	San Bernardino Valley Municipal Water District	$8,000,000.00	$6,000,000.00
1186	45	Etiwanda/San Sevaine Basins 1 through 4	San Bernardino County Flood Control District	$4,000,000.00	$1,000,000.00
1213	46	Regional Residential Landscape Retrofit Program	Inland Empire Utilities Agency	$315,000.00	$200,000.00
975	47	Lake Elsinore Alum/Phoslock Treatment	Lake Elsinore and San Jacinto Watersheds Authority	$2,500,000.00	$1,250,000.00
1206	48	Watershed Action Plan	Inland Empire Utilities Agency	$1,000,000.00	$750,000.00
1129	49	Drainage A Detention Basin	City of Chino	$5,200,000.00	$3,900,000.00
1201	50	IEUA Regional Landscape Evaluation Program	Inland Empire Utilities Agency	$165,000.00	$100,000.00

1208	51	Regional Residential Landscape Financing Program	Inland Empire Utilities Agency	$240,000.00	$150,000.00
1219	52	Regional Commercial Incentive Program	Inland Empire Utilities Agency	$415,000.00	$250,000.00
985	53	Lake Elsinore & Canyon Lake Nutrient TMDL Monitoring	Lake Elsinore and San Jacinto Watersheds Authority	$1,500,000.00	$750,000.00
1240	54	Chino Creek Wellfield, Wells 1, 2, and 3	Western Municipal Water District	$6,700,000.00	$1,675,000.00
1143	55	Central Orange County Trash Reduction Project	Orange County Coastkeeper	$355,408.00	$266,566.00
1215	56	La Sierra Pipeline Project	Western Municipal Water District	$16,000,000.00	$3,000,000.00
1174	57	Quail Valley Sewer Improvements (Subarea 9)	Eastern Municipal Water District	$18,932,000.00	$14,199,000.00
1164	58	Orange County LID Implementation Project	Orange County Coastkeeper	$420,481.00	$315,361.00
1217	59	Regional Public Sector Program	Inland Empire Utilities Agency	$665,000.00	$500,000.00
974	60	Lake Elsinore Fishery Enhancement	Lake Elsinore and San Jacinto Watersheds Authority	$1,700,000.00	$850,000.00
1003	61	Mill Creek Diversion Project	Orange County Water District	$7,000,000.00	$1,750,000.00
1158	62	Brine Line (SARI) Flow Equalization Structure	Santa Ana Watershed Project Authority	$2,000,000.00	$1,500,000.00
951	63	River Road Treatment Wetlands	Orange County Water District	$8,500,000.00	$2,125,000.00
1270	64	San Bernardino Clean Water Factory – Phase I	City of San Bernardino Municipal Water Department	$2,728,776.00	$1,000,000.00
1243	65	Borrego Canyon Wash Stabilization and Restoration Project	County of Orange/OC Watersheds	$3,232,000.00	$1,939,200.00
1278	66	Wells 21 and 22 Project	Irvine Ranch Water District	$39,768,000.00	$10,000,000.00
1049	67	Upper Santa Ana Watershed Alluvial Scrub Habitat Restoration Project and Mitigation Banking Assessment	San Bernardino Valley Water Conservation District	$225,000.00	$130,000.00
955	68	Cypress Channel Multipurpose Corridor	Inland Empire Utilities Agency	$7,600,000.00	$5,700,000.00
1279	69	Wineville Extension Pipeline	Inland Empire Utilites Agency	$11,212,500.00	$8,409,375.00
1281	70	Baker Water Treatment Plant Project	IRVINE RANCH WATER DISTRICT	$62,000,000.00	$10,000,000.00
1089	71	Temescal Gardens	Elsinore Valley Municipal Water District	$1,000,000.00	$750,000.00
1169	72	Strand Ranch Water Banking Project Recovery Wells and Conveyance Facilities	Irvine Ranch Water District	$7,353,000.00	$1,800,000.00
1260	73	Mid-Basin Injection Project	Orange County Water District	$18,000,000.00	$4,500,000.00
1016	74	Santa Ana Watershed Vireo Monitoring and Breeding Bird Surveys	Santa Ana Watershed Association	$1,167,846.00	$875,885.00
1128	75	Big Bear Lake Hypolimnetic Oxygenation System	Santa Ana Watershed Project Authority	$1,500,000.00	$1,125,000.00
1280	76	Renewable Energy Expansion Program	Inland Empire Utilities Agency	$4,000,000.00	$3,000,000.00
1283	77	Brine Line Maintenance Access Structures, Reach V and Reach	Santa Ana Watershed	$5,600,000.00	$4,600,000.00

		IVB	Project Authority		
1111	78	930-Zone Pipeline and Reservoir, Expansion of the CCWRF-RP-1 S.Zone Pump Station and Installation of a Parallel Line to RP-1 Outfall	Inland Empire Utilities Agency	$39,338,000.00	$29,503,500.00
990	79	Stormwater Treatment Wetlands for Canyon Lake	Lake Elsinore and San Jacinto Watersheds Authority	$300,000.00	$150,000.00
1116	80	Lake Mathews Watershed Master Water Quality Improvement Project Phase II	Riverside County Flood Control & Water Conservation District	$8,000,000.00	$6,000,000.00
943	81	In-Conduit Hydroelectric Project	NLine Energy, Inc.	$950,000.00	$450,000.00
1185	82	Lytle Cajon Basin	San Bernardino County Flood Control District	$1,000,000.00	$250,000.00
1002	83	Fletcher Basin Rehabilitation	Orange County Water District	$5,000,000.00	$1,250,000.00
976	84	Canyon Lake Dredging Enhancements	Lake Elsinore and San Jacinto Watersheds Authority	$550,000.00	$275,000.00
999	85	Orange County Regional Stormwater Infiltration Program	Orange County Water Distict	$2,000,000.00	$500,000.00
1269	86	Brine Line (SARI) Solids Control Structures	Santa Ana Watershed Project Authority	$2,000,000.00	$1,500,000.00
1229	87	East Diamond Valley Recycled Water Storage Pond and Distribution Pipeline Project	Eastern Municipal Water District	$10,783,600.00	$8,087,700.00
1200	88	ARTIC Use of GWRS Water for Irrigation and Groudwater Recharge	City of Anaheim	$4,000,000.00	$2,000,000.00
1288	89	Borrego Canyon Wash Bypass Channel Improvements within the portion of Shea/Baker Ranch Property (Bypass Channel)	Shea/Baker Ranch, LLC	$15,500,000.00	$6,200,000.00
1212	90	Chino II Desalter Brine Minimization	Western Municipal Water District	$30,600,000.00	$4,590,000.00
977	91	Canyon Lake Alum/Phoslock Treatment	Lake Elsinore and San Jacinto Watersheds Authority	$1,500,000.00	$750,000.00
1227	92	Perchlorate Wellhead Treatment System Pipelines	West Valley Water District	$1,541,000.00	$1,541,000.00
1020	93	Water Conservation Demonstration Garden	San Bernardino Valley Municipal Water District	$115,000.00	$86,250.00
1130	94	Santiago Enhanced Recharge	Orange County Water District	$840,000.00	$210,000.00
945	95	Hypolimnetic Oxygenation System for Canyon Lake	Lake Elsinore and San Jacinto Watersheds Authority	$800,000.00	$400,000.00
1137	96	Enhanced Water Conservation at Prado	Orange County Water District	$5,500,000.00	$1,375,000.00
1088	97	Magnolia Channel Detention Basin	City of Chino	$83,600.00	$62,700.00
981	98	Santiago Basins Pump Station	Orange County Water District	$3,100,000.00	$775,000.00
1265	99	Riverside North Aquifer Storage and Recovery Project	City of Riverside	$12,500,000.00	$2,000,000.00
1275	100	A Shared Workspace is the Foundation for Collaborative Watershed Management.	S4S Solutions Inc.	$80,000.00	$60,000.00
984	101	Water Use Effieciency Program	City of Ontario Municipal Utlities Company	$150,558.00	$75,218.00
1095	102	Perchlorate Wellhead Treatment System Wells and SCADA	West Valley Water District	$1,315,000.00	$1,315,000.00
1234	103	The San Jacinto Citrus In-Lieu Recycled Water Pond Pump Station and Distribution Pipeline Project	Eastern Municipal Water District	$7,240,000.00	$5,430,000.00
1149	104	Santa Ana River Interceptor (SARI) Line Relocation Project	Orange County Flood Control District	$86,000,000.00	$43,000,000.00
1172	105	Quail Valley Sewer Improvements (Subareas 1-8)	Eastern Municipal Water	$56,762,000.00	$42,572,000.00

			District		
1300	106	Inland Empire Brine Line Capacity Pool Program	Santa Ana Watershed Project Authority	$6,025,000.00	$4,150,000.00
1018	107	Perris Water Filtration Plant Reject Recovery Facility	Eastern Municipal Water District	$6,765,828.00	$5,074,371.00
1284	108	Natural Treatment System Facility No. 62 (NTS-62)	IRVINE RANCH WATER DISTRICT	$2,460,000.00	$440,000.00
1287	109	Enhanced Stormwater Capture and Recharge along the Santa Ana River Phase II	San Bernardino Valley Municipal Water District	$22,000,000.00	$16,500,000.00
1050	110	14th Street Groundwater Recharge and Storm Water Quality Treatment Integration Facility	City of Upland	$5,000,000.00	$3,750,000.00
1091	111	Recycled Water Transmission Main (Santa Ana River Segment)	City of Riverside	$26,000,000.00	$2,000,000.00
965	112	Fairview Park Wetlands and Riparian Habitat Project	City of Costa Mesa	$4,560,000.00	$2,200,000.00
1132	113	Miraloma Recharge Basin	Orange County Water District	$6,100,000.00	$1,525,000.00
1170	114	EMWD Desalination Recovery Enhancement and Brine Concentrate Management Demonstration Facility	Eastern Municipal Water District	$12,000,000.00	$9,000,000.00
1092	115	Groundwater Interception and Conveyance System for Selenium Load Reduction at the Lower Peters Canyon Wash, Orange County, California	Orange County Watersheds Program	$1,250,000.00	$500,000.00
1147	116	East Garden Grove-Wintersburg Channel (OCFCD Facility No. C05) from Tidegates to upstream Warner Avenue.	Orange County, Public Works, Flood Control Section, Flood Programs	$44,000,000.00	$11,000,000.00
1152	117	East Garden Grove-Wintersburg Channel (OCFCD Facility No. C05) from upstream Warner Avenue to downstream Goldenwest Street.	Orange County, Public Works, Flood Control Section, Flood Program	$22,000,000.00	$5,500,000.00
1007	118	Randolph Creek Water Quality and Habitat Enhancement Project	City of Brea	$870,000.00	$700,000.00
998	119	Chino Creek Wetlands	Orange County Water District	$12,000,000.00	$3,000,000.00
958	120	Colored Water Treatment Facility Technology Replacement and Expansion	Mesa Consolidated Water District	$24,000,000.00	$2,000,000.00
1134	121	Mid-Basin Injection Demonstration	Orange County Water District	$4,900,000.00	$1,225,000.00
1277	122	Brookhurst Widening Bio-Swale and Synthetic Turf Installation	City of Anaheim	$1,600,000.00	$800,000.00
962	123	North Basin Groundwater Protection Project	Orange County Water District	$42,000,000.00	$10,500,000.00
1151	124	Irvine Ranch Water District Advanced Metering Infrastructure (AMI) Project	Irvine Ranch Water District	$2,125,000.00	$500,000.00
1220	125	French Valley Recycled Water Distribution Pipeline Project	Eastern Municipal Water District	$3,192,800.00	$2,394,600.00
1237	126	The Menifee Recycled Water Pond Pump Station and Distribution Pipeline Project	Eastern Municipal Water District	$11,980,320.00	$8,985,240.00
1165	127	San Bernardino River Corridor Revitalization	California Resource Connections		
1115	128	Hickory / Banana Basin Turout Flow Meter	Inland Empire Utilities Agency	$101,567.00	$76,175.00
1296	129	Orange Park Acres Groundwater Supplies and Conveyance Facilities	Irvine Ranch Water District (IRWD)	$25,000,000.00	$6,250,000.00
1178	130	Well 17 & 18 Water Treatment Facility	Rubidoux Community Services District	$5,000,000.00	$5,000,000.00
1264	131	Second Lower Cross Feeder Project	Municipal Water District of Orange County	$50,000,000.00	$12,500,000.00
994	132	City of Tustin Main Street Facility Improvements	City of Tustin	$300,000.00	$150,000.00
1244	133	Riverside-Corona Feeder Wells	Western Municipal Water District	$7,500,000.00	$2,000,000.00
970	134	Serrano Creek Restoration Plan	County of Orange	$3,345,212.00	$1,338,085.00

1184	135	SMART Landscapes	Irvine Ranch Water District	$290,000.00	$100,000.00
1245	136	Chino II Desalter Treated Water Pump Station	Western Municipal Water District	$2,970,000.00	$1,485,000.00
1106	137	Agency Wide Aeration System Modifications	Inland Empire Utilities Agency	$2,000,000.00	$1,500,000.00
1032	138	Construction and Quantitative Evaluation of the Low Impact Development Retrofit Project for Orange County Public Works Glassell Yard, Orange, California	County of Orange/OC Watersheds Program	$3,000,000.00	$2,000,000.00
1025	139	Model Institutional Water Conservation Makeover	San Bernardino Valley Municipal Water District	$345,000.00	$258,750.00
1045	140	Water Use Efficiency Improvements/Brackish Groundwater Treatment and Constructed Wetland Installation at Yorba Regional Park	City of Anaheim	$200,000.00	$100,000.00
1230	141	Haster Retarding Basin and Pump Station (OCFCD Facility No. C05B02/C05PS1)	Orange County, Public Works, Flood Control Section, Flood Programs	$27,119,078.00	$6,779,770.00
1242	142	Huntington Harbour Copper Reduction Project	Orange County Coastkeeper	$630,000.00	$472,500.00
954	143	Local Recycled Water Laterals Construction	Inland Empire Utilities Agency	$25,000,000.00	$12,500,000.00
1024	144	Restoration of the Lower Santa Ana River Marsh	Orange Coast River Park	$2,260,000.00	$1,000,000.00
1105	145	City of Fontana Local Recycled Water Distribution Facilities	Inland Empire Utilities Agency	$8,000,000.00	$6,000,000.00
1138	146	Montclair Basin SCADA improvments	Inland Empire Utilities Agency	$132,567.00	$99,425.00
1040	147	Eastvale Water Recycling Project	Jurupa Community Services District	$28,000,000.00	$1,000,000.00
1202	148	San Jacinto Recycled Water Distribution Pipeline Project	Eastern Municipal Water District	$3,809,480.00	$2,857,110.00
1248	149	Huntington Harbour Water Quality Improvemnent Program	Orange County Coastkeeper	$320,200.00	$240,150.00
1126	150	RP-5 Wind Turbine	Inland Empire Utilities Agency	$3,000,000.00	$2,250,000.00
1125	151	Turner Basin Improvements	Inland Empire Utilities Agency	$13,453,000.00	$10,089,750.00
1057	152	DWR Pump Station Alternative 1	San Bernardino Valley Municipal Water District	$23,000,000.00	$17,475,000.00
1038	153	Non-Potable Water Distribution System and Van Buren Bridge Recycled Water Pipeline	Jurupa Community Services District_	$8,920,000.00	$1,000,000.00
968	154	Five Coves and Lincoln Basins Bypass Pipeline	Orange County Water District	$6,440,000.00	$1,610,000.00
1005	155	Prado Basin Sediment Management Project	Orange County Water District	$2,500,000.00	$625,000.00
1157	156	Cypress Nature Park Restoration Project	City of Cypress	$1,557,180.00	$1,443,180.00
1107	157	Local Recycled Water Laterals Construction	Inland Empire Utilities Agency	$25,000,000.00	$18,750,000.00
1109	158	Central Area Recycled Water Project	Inland Empire Utilities Agency	$27,920,000.00	$20,940,000.00
1305	159	San Bernardino Clean Water Factory – Phase IV	City of San Bernardino Municipal Water Department	$122,624,000.00	$61,312,000.00
991	160	Temescal Creek Master Trail and Park Project	Inland Empire Waterkeeper	$3,030,000.00	$3,000,000.00
1123	161	Ely Basin Cla Valve Replacement and Electrial Service	Inland Empire Utilities Agency	$98,090.00	$73,568.00
1118	162	Jurupa Pumpstation	Inland Empire Utilities Agency	$871,487.00	$653,615.00

1120	163	Motorized Gate Actuator Installation at RP-3	Inland Empire Utilities Agency	$710,776.00	$533,082.00
1241	164	Co-generation Facilities Cooling Water System Modifications and Upgrades Project J-109.	Orange County Sanitation District (OCSD)	$9,094,000.00	$1,000,000.00
1293	165	Syphon Reservoir Expansion	Irvine Ranch Water District	$70,000,000.00	$17,500,000.00
1026	166	Water Recycling Demonstration Project	City of Anaheim	$8,000,000.00	$1,600,000.00
1154	167	East Garden Grove-Wintersburg Channel (OCFCD Facility No. C05) from upstream Oceanview Channel (C06) Confluence to downstream Beach Boulevard.	Orange County, Public Works, Flood Control Section, Flood Programs	$11,000,000.00	$2,750,000.00
1156	168	East Garden Grove-Wintersburg Channel (OCFCD Facility No. C05) from upstream Quartz Street to upstream Bushard Street.	Orange County, Public Works, Flood Control Section, Flood Programs	$15,000,000.00	$37,500,000.00
1041	169	Roger B. Teagarden Ion Exchange Treatment Plant (IXP) Expansion	Jurupa Community Services District	$10,200,000.00	$1,000,000.00
1155	170	East Garden Grove-Wintersburg Channel (OCFCD Facility No. C05) from upstream Beach Boulvevard to downstream Woodruff Street.	Orange County, Public Works, Flood Control Section, Flood Programs	$9,600,000.00	$2,400,000.00
1199	171	Baseline Feeder Well Replacement Project	San Bernardino Valley Municipal Water District	$7,430,000.00	$5,572,500.00
966	172	South Basin Groundwater Protection Project Interim Remediation	Orange County Water District	$2,800,000.00	$700,000.00
1037	173	West End Pump Station	San Bernardino Valley Municipal Water District	$10,000,000.00	$7,500,000.00
1301	174	Well 53	Irvine Ranch Water District	$1,700,000.00	$400,000.00
1302	175	Norco/Stagecoach Park Recycled Waterline	City of Corona Department of Water and Power	$3,700,000.00	$1,850,000.00
1179	176	East Garden Grove-Wintersburg Channel (OCFCD Facility No. C05) from 300-feet downstream the intersection of Haster Street/Lampson Avenue to 800-feet upstream.	Orange County, Public Works, Flood Control Section, Flood Programs	$14,560,000.00	$3,640,000.00
1266	177	Joint Anaheim/IRWD Well Field	Irvine Ranch Water District	$40,000,000.00	$5,000,000.00
1004	178	Recycled Water Reservoir	Orange County Great Park Corporation	$3,500,000.00	$2,300,000.00
1298	179	Goldenwest 6 MG Tank	Rubidoux Community Services District	$4,750,000.00	$4,750,000.00
1177	180	East Garden Grove-Wintersburg Channel (OCFCD Facility No. C05) from upstream Bushard Street to upstream the intersection of McFadden Street/Brookhurst Street.	Orange County, Public Works, Flood Control Section, Flood Programs	$11,000,000.00	$2,750,000.00
1246	181	Arlington Desalter Biodenitrification Construction	Western Municipal Water District	$10,780,000.00	$5,390,000.00
1119	182	CMSD #101 West Side Pumping Station Abandonment	Costa Mesa Sanitary District	$3,000,000.00	$1,000,000.00
1124	183	City of Chino Hills Local Recycled Water Distribution Facilities	Inland Empire Utilities Agency	$10,000,000.00	$7,500,000.00
1187	184	Ocean View Channel (OCFCD Facility No. C06) from upstream of the Confluence with East Garden Grove-Wintersburg Channel (C05) to downstream Beach Boulevard.	Orange County, Public Works, Flood Control Section, Flood Programs	$2,175,000.00	$543,750.00
1306	185	San Bernardino Clean Water Factory – Phase V	City of San Bernardino Municipal Water Department	$77,791,000.00	$38,895,500.00
1011	186	San Jacinto Watershed Urban and Agricultural Land Use Survey and Impervious Surface Mapping	Western Riverside County Agriculture Coalition	$625,000.00	$312,500.00
1290	187	24" Mission Blvd Pipeline (Carrera to Goldenwest tank)	Rubidoux Community Services District	$1,500,000.00	$1,500,000.00
		Non-Potable Water Distribution System and Indian Hills	Jurupa Community		

1039	188	Wastewater Treatment Plant Rehabilitation	Services District	$19,520,000.00	$1,000,000.00
1303	189	San Bernardino Clean Water Factory – Phase II	City of San Bernardino Municipal Water Department	$18,000,000.00	$9,000,000.00
993	190	Tustin Avenue Well	City of Tustin	$4,500,000.00	$2,250,000.00
1122	191	City of Chino Local Recycled Water Distribution Facilities	Inland Empire Utilities Agency	$7,000,000.00	$5,250,000.00
1144	192	Rhine Channel Remediation Project	Orange County Coastkeeper	$4,000,000.00	$2,000,000.00
1097	193	North Trumble Recycled Water Storage Ponds	Eastern Municipal Water District	$12,100,000.00	$9,075,000.00
1231	194	Syphon Reservoir Integration Project	Irvine Ranch Water District	$6,900,000.00	$2,000,000.00
1307	195	San Bernardino Clean Water Factory – Phase VI	City of San Bernardino Municipal Water Department	$65,593,000.00	$32,796,500.00
1087	196	Crescent Avenue Sewer Replacement	City of Buena Park	$2,376,000.00	$950,400.00
1112	197	San Sevaine Lateral and Turnouts	Inland Empire Utilities Agency	$2,631,700.00	$1,973,776.00
1203	198	Wintersberg Chanel Source Identification Study	Orange County Coastkeeper	$278,000.00	$208,500.00
1108	199	Hickory Basin Conservation Berm Outlet Modification	Inland Empire Utilities Agency	$92,752.00	$69,564.00
1189	200	Ocean View Channel (OCFCD Facility No. C06) from upstream of Beach Boulevard to downstream of Newland Street.	Orange County, Public Works, Flood Control Section, Flood Programs	$2,570,000.00	$642,500.00
1140	201	Jurupa Force Main Outlet Modifications	Inland Empire Utilities Agency	$1,555,113.00	$1,166,335.00
1204	202	Santa Ana-Delhi Channel (OCFCD Facility No. F01) from Upper Newport Back Bay to downstream of Mesa Drive.	Orange County, Public Works, Flood Control Section, Flood Programs	$12,350,000.00	$3,087,500.00
1238	203	Brea Creek Channel (OCFCD Facility No. A02) at Beach Boulevard.	Orange County, Public Works, Flood Control Section, Flood Programs	$8,400,000.00	$2,100,000.00
1295	204	Pacific Avenue 16" and 12" Water Pipeline	Rubidoux Community Services District	$1,000,000.00	$1,000,000.00
1207	205	Natural Treatment System Site 67	Irvine Ranch Water District	$19,700,000.00	$5,500,000.00
961	206	Rawlings Reservoir Replacement	City of Tustin	$15,000,000.00	$7,500,000.00
1192	207	Westminster Channel (OCFCD Facility No. C04) from downstream Bolsa Chica Street to upstream the intersection of Springdale Street and Edinger Avenue.	Orange County, Public Works, Flood Control Section, Flood Programs	$16,900,000.00	$4,225,000.00
1193	208	Westminster Channel (OCFCD Facility No. C04) from upstream the intersection of Springdale Street and Edinger Avenue to downstream Bolsa Avenue.	Orange County, Public Works, Flood Control Section, Flood Programs	$21,000,000.00	$5,250,000.00
1233	209	Rubidoux Community Services District Emergency Interconnections	Rubidoux Community Services District	$2,000,000.00	$2,000,000.00
995	210	Wilson III Basins Project and Wilson Basins/Spreading Grounds	City of Yucaipa	$9,100,000.00	$7,100,000.00
1282	211	Lane Channel (OCFCD Facility No. F08) from Confluence with F05 channel to Von Karman	Orange County, Public Works, Flood Control Section, Flood Programs	$15,500,000.00	$3,875,000.00
1285	212	Lane Channel (OCFCD Facility No. F08) from Von Karman to 1000' downstream Redhill Avenue	Orange County, Public Works, Flood Control Section, Flood Programs	$15,000,000.00	$3,750,000.00
1251	213	Fullerton Creek Channel (OCFCD Facility No. A03) from downstream Western Ave to downstream Beach Blvd.	Orange County, Public Works, Flood Control Section, Flood Programs	$9,800,000.00	$2,450,000.00

1267	214	Planning & Integration Assistance Program	California Resource Connections	$200,000.00	$150,000.00
1191	215	Ocean View Channel (OCFCD Facility No. C06) from downstream of Bushard Street to downstream of Brookhurst Street.	Orange County, Public Works, Flood Control Section, Flood Programs	$5,600,000.00	$1,400,000.00
978	216	Raymond Basin Enhancement Project	Orange County Water District	$3,600,000.00	$900,000.00
1209	217	Newland Storm Channel (OCFCD Facility No. C05S01) from Confluence with C05 channel to downstream McFadden Avenue.	Orange County, Public Works, Flood Control Section, Flood Programs	$10,000,000.00	$2,500,000.00
1074	218	Seven Oaks Dam and Reservoir Construction Area	San Bernardino Valley Municipal Water District	$31,322,346.00	$23,491,760.00
1076	219	Santa Ana River Construction Area	San Bernardino Valley Municipal Water District	$41,061,083.00	$30,795,812.00
1197	220	NEW 12-INCH RECYCLED WATER MAIN TO THE REDHILL GOLF COURSE	CUCAMONGA VALLEY WATER DISTRICT	$600,000.00	$450,000.00
1256	221	Carbon Creek Channel (OCFCD Facility No. B01) from upstream Beach Boulevard to upstream Dale Street.	Orange County, Public Works, Flood Control Section, Flood Programs	$7,000,000.00	$1,750,000.00
1225	222	PROPOSED 8-INCH REDHILL PARK LATERAL	CUCAMONGA VALLEY WATER DISTRICT	$336,000.00	$252,000.00
1093	223	1N09 Reconstruction and Water Quality Improvement	USDA Forest Service - San Bernardino National Forest	$430,000.00	$215,000.00
960	224	Prado Basin Sediment Management Demonstration Project	Orange County Water District	$4,250,000.00	$1,062,500.00
1114	225	Construction Circle Recycled Water Conversion Project	Irvine Ranch Water District	$1,000,000.00	$790,000.00
1210	226	Newland Storm Channel (OCFCD Facility No. C05S01) from downstream McFadden Avenue to downstream Bolsa Avenue	Orange County, Public Works, Flood Control Section, Flood Programs	$10,000,000.00	$2,500,000.00
1255	227	Carbon Creek Channel (OCFCD Facility No. B01) from upstream Orange to upstream Beach Boulevard.	Orange County, Public Works, Flood Control Section, Flood Programs	$7,500,000.00	$1,875,000.00
979	228	Placentia Basin Enhancement Project	Orange County Water District	$3,800,000.00	$950,000.00
1252	229	Fullerton Creek Channel (OCFCD Facility No. A03) from downstream Beach Blvd. including undercrossing to downstream I-5 Freeway.	Orange County, Public Works, Flood Control Section, Flood Programs	$8,400,000.00	$2,100,000.00
1253	230	Fullerton Creek Channel (OCFCD Facility No. A03) from downstream I-5 Freeway to downstream Dale Street.	a. Orange County, Public Works, Flood Control Section, Flood Programs	$8,400,000.00	$2,100,000.00
1254	231	Carbon Creek Channel (OCFCD Facility No. B01) from downstream Western Avenue to upstream Orange (including both undercrossings).	Orange County, Public Works, Flood Control Section, Flood Programs	$9,100,000.00	$2,275,000.00
1008	232	Recharge Water Sediment Removal Demonstration Project	Orange County Water District	$1,570,000.00	$392,500.00
1198	233	Active Recharge Project in the Tributaries of the Santa Ana River	San Bernardino Valley Municipal Water District		
1159	234	University of California Irvine Water Use Efficiency Upgrades	Irvine Ranch Water District	$115,000.00	$34,000.00
1239	235	Perris Valley Recycled Water Distribution Pipeline Project	Eastern Municipal Water District	$3,821,520.00	$2,866,140.00
1014	236	Recharge Water Sediment Removal Project	Orange County Water District	$26,000,000.00	$6,500,000.00
1043	237	Platinum Triangle/ARTIC and Disneyland Resort Area Water Recycling Project	City of Anaheim	$16,500,000.00	$8,250,000.00
1297	238	Peters Canyon Channel (OCFCD Facility No. F06) from Barranca	Orange County, Public Works, Flood Control	$16,800,000.00	$4,200,000.00

		Parkway to Warner Avenue.	Section, Flood Programs		
1001	239	Temescal Creek Wetlands	Orange County Water District	$3,000,000.00	$750,000.00
1196	240	Citywide Street Median Rehabilitation Project	City of Garden Grove	$6,161,000.00	$4,000,000.00
1099	241	Ball Road Regional Recycled Water Project	City of Anaheim	$20,000,000.00	$10,000,000.00
1299	242	Santa Ana-Santa Fe Channel (OCFCD Facility No. F10) from confluence with Peters Canyon Channel to downstream Redhill Avenue.	Orange County, Public Works, Flood Control Section, Flood Programs	$21,000,000.00	$5,250,000.00
1257	243	Carbon Creek Channel (OCFCD Facility No. B01) from upstream Gilbert Street to downstream I-5 Freeway including B01P01 & B01B02	Orange County, Public Works, Flood Control Section, Flood Programs	$20,000,000.00	$5,000,000.00
1294	244	Peters Canyon Channel (OCFCD Facility No. F06) from Confluence with San Juan Creek Channel (F05) to downstream Barranca parkway.	Orange County, Public Works, Flood Control Section, Flood Programs	$9,800,000.00	$2,450,000.00
1228	245	PROPOSED 12-INCH VILLAGE OF HERITAGE	CUCAMONGA VALLEY WATER DISTRICT	$3,600,000.00	$27,000,000.00
1079	246	Lytle Creek Construction Area	San Bernardino Valley Municipal Water District	$13,500,000.00	$10,125,000.00
1224	247	Commercial, Industrial & Institutional Water Use Efficiency Upgrades	Irvine Ranch Water District	$3,880,000.00	$1,000,000.00
1289	248	Reservoir Management System at 5 Domestic Water Reservoirs	Irvine Ranch Water District	$2,500,000.00	$1,250,000.00
980	249	Santiago Basins Intertie	Orange County Water District	$2,800,000.00	$700,000.00
1042	250	Shallow Aquifer Pumping for Non-potable Uses	City of Anaheim	$3,720,000.00	$1,600,000.00
1292	251	Tustin Legacy Wells 1, 2, 3, and 4	Irvine Ranch Water District		$1,000,000.00
1081	252	Surface Water Treatment Plant(s)	San Bernardino Valley Municipal Water District	$70,000,000.00	$52,500,000.00
1131	253	Recharge Basin Rehabilitation	Orange County Water District	$850,000.00	$212,500.00
1053	254	Mentone Pipeline	San Bernardino Valley Municipal Water District	$1,090,000.00	$817,500.00
1101	255	Orange County/Beaumont Conjunctive Use Water Project	City of Anaheim	$66,000,000.00	$33,000,000.00
1175	256	Yockey/Newland Storm Drain Line B-5 Phase 2	City of Garden Grove	$5,067,000.00	$3,800,000.00
1276	257	Santa Ana Gardens Channel (OCFCD Facility No. F02) from downstream Alton to Segerstrom.	Orange County, Public Works, Flood Control Section, Flood Programs	$11,200,000.00	$2,800,000.00
1070	258	Redlands Reservoir	San Bernardino Valley Municipal Water District	$1,800,000.00	$1,350,000.00
1304	259	San Bernardino Clean Water Factory – Phase III	City of San Bernardino Municipal Water Department	$6,981,169.00	$3,490,585.00
967	260	MTBE Interim Remediation	Orange County Water District	$15,000,000.00	$3,750,000.00
1027	261	Lytle Creek Turnout	San Bernardino Valley Municipal Water District	$2,300,000.00	$172,500.00
1078	262	Devil Canyon Construction Area	San Bernardino Valley Municipal Water District	$1,720,000.00	$1,290,000.00
1031	263	Central Feeder Pipeline	San Bernardino Valley Municipal Water District	$41,213,536.00	$30,910,152.00
1084	264	Alamitos Barrier Improvement Project	Orange County Water District	$20,000,000.00	$5,000,000.00
1061	265	Yucaipa Lakes Pipeline Replacement	San Bernardino Valley Municipal Water District	$760,000.00	$570,000.00
1029	266	PVRWRF Biosolids Dryer Facility	Eastern Municipal Water District	$13,000,000.00	$7,800,000.00

1100	267	RP-1 Cogeneration Facility Expansion	Inland Empire Utilities Agency	$8,300,000.00	$6,225,000.00
1121	268	RP-2 Cogeneration Facility Expansion	Inland Empire Utilities Agency	$4,000,000.00	$3,000,000.00
1148	269	Digester Gas Cleaing System	Inland Empire Utilities Agency	$4,479,000.00	$3,359,250.00
1161	270	RP-2 Digester Gas System Modifications	Inland Empire Utilities Agency	$2,997,000.00	$2,247,750.00
1044	271	Urban Runoff Reuse - Anaheim Hills Golf Course	City of Anaheim	$9,800,000.00	$4,900,000.00
1034	272	San Bernardino Pump Station #1	San Bernardino Valley Municipal Water District	$2,900,000.00	$2,175,000.00
1060	273	Baseline Feeder Pump Station (East and/or West ALternative)	San Bernardino Valley Municipal Water District	$3,100,000.00	$2,325,000.00
941	274	Construction of a Reclaimed Water Pipeline to Buena Park, California	City of Buena Park	$5,000,000.00	$500,000.00
1069	275	San Bernardino Reservoir	San Bernardino Valley Municipal Water District	$4,500,000.00	$3,375,000.00
1033	276	Biodiesel Feedstock Production	Eastern Municipal Water District	$13,000,000.00	$13,000,000.00
1030	277	Glen Helen Turnout	San Bernardino Valley Municipal Water District	$1,860,000.00	$1,395,000.00
1035	278	San Bernardino Pump Station #2	San Bernardino Valley Municipal Water District	$12,000,000.00	$9,000,000.00
1051	279	9th Street Feeder	San Bernardino Valley Municipal Water District	$24,100,000.00	$18,075,000.00
1052	280	South End Feeder	San Bernardino Valley Municipal Water District	$11,500,000.00	$8,625,000.00
1059	281	Baseline Feeder West Extension	San Bernardino Valley Municipal Water District	$30,300,000.00	$22,725,000.00
1067	282	City Creek Crossing	San Bernardino Valley Municipal Water District	$5,200,000.00	$3,900,000.00
1077	283	Morton Canyon Hydroelectric Generation Plant	San Bernardino Valley Municipal Water District	$38,000,000.00	$28,500,000.00
1058	284	DWR Pump Station Alternative 2	San Bernardino Valley Municipal Water District	$23,000,000.00	$17,475,000.00
1071	285	North Lake Project	San Bernardino Valley Municipal Water District	$133,000,000.00	$99,750,000.00
1150	286	RP-1 Secondary System Modifications	Inland Empire Utilities Agency	$30,200,000.00	$22,650,000.00
1127	287	Agency Wide Lighting Improvements	Inland Empire Utilities Agency	$1,670,000.00	$1,252,500.00
1183	288	Septic System Source Water Elimination Water Source Protection Project	Rubidoux Community Services District	$3,000,000.00	$3,000,000.00
1139	289	Subsurface Recharge	Orange County Water District	$1,000,000.00	$250,000.00
1010	290	Water Well Decontamination - City of Redlands	City of Redlands	$2,100,000.00	$2,000,000.00
1063	291	Yucaipa Connector	San Bernardino Valley Municipal Water District	$4,500,000.00	$3,375,000.00
1064	292	Orange Street Connector Pipeline	San Bernardino Valley Municipal Water District	$4,900,000.00	$1,225,000.00
1066	293	Alabama Street Well Field	San Bernardino Valley Municipal Water District	$4,500,000.00	$3,375,000.00
996	294	Patterson Street Storm Drain Upgrade	City of Garden Grove	$3,600,000.00	$3,240,000.00
1062	295	Yucaipa Lakes Pump Station	San Bernardino Valley Municipal Water District	$12,900,000.00	$9,675,000.00
1065	296	Alabama Street Connector Pipeline	San Bernardino Valley	$9,000,000.00	$6,750,000.00

			Municipal Water District		
1068	297	Foothill Pipeline Enlargement	San Bernardino Valley Municipal Water District	$25,000,000.00	$18,750,000.00