Attachment 1

Authorization and Eligibility Requirements

Integrated Regional Water Management Implementation
Prop 84, Round 1

Santa Ana Watershed Project Authority

Santa Ana One Water One Watershed IRWM
Prop 84, Round 1 Implementation Proposal

Urban Water Management Plan • 2005

WESTERN MUNICIPAL WATER DISTRICT

WESTERN MUNICIPAL WATER DISTRICT

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General Manager

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December, 2005

Readers of Western Municipal Water District's
2005 Urban Water Management Plan

Western Municipal Water District is pleased to publish its 2005 Urban Water Management Plan.

This plan provides significant information regarding Western's retail service area, specifically related to water demands and supplies, but also contains information on a regional basis related to demands and supplies within the 510 square mile area comprising Western's General District.

This plan has been prepared pursuant to procedures of California Water Code Sections 10640 through 10645 and is organized as recommended in the Guidebook to Assist Water Suppliers in the Preparation of a 2005 Urban Water Management Plan. It satisfies the requirements contained within the applicable code sections and provides information to aid in the evaluation of future water supplies in accordance with Senate Bill SB 610 and SB 221.

As this document is reviewed and used as an informative resource, should you have questions please contact us.

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Section 1
Introduction

Western Municipal Water District (Western) was formed by the voters in 1954 to bring supplemental water to growing western Riverside County. Today, the District serves more than 19,000 retail and nine wholesale customers with water from both the Colorado River and the State Water Project. Supplemental water is also received from the City of Riverside.

As a member agency of the Metropolitan Water District of Southern California (MWD), Western provides wholesale water to the cities of Corona, Norco, and Riverside and the water agencies of Elsinore Valley and Rancho California. Western serves customers in the unincorporated areas of El Sobrante, Eagle Valley, Temescal Creek, Woodcrest, Lake Mathews, and March Air Reserve Base.

Western 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, and the City of Norco.

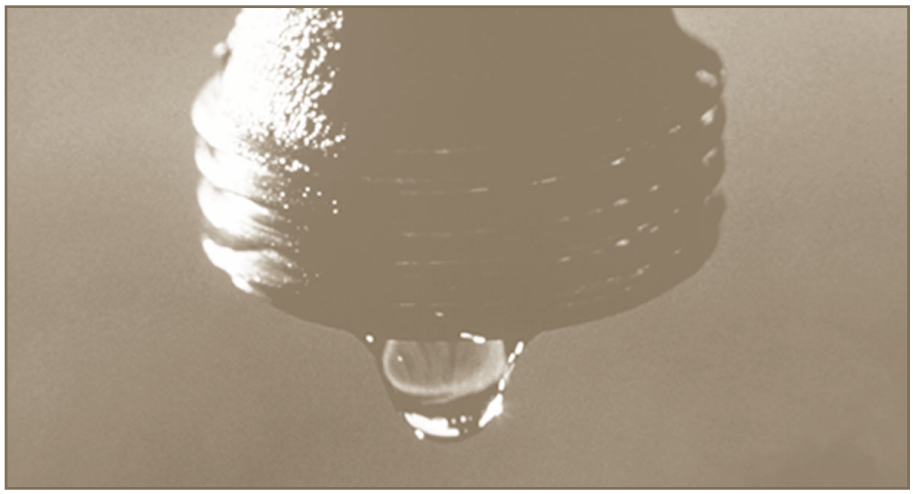
Western is one of five of the member agencies of the Santa Ana Watershed Project Authority (SAWPA), a regional water resources planning and project implementation organization. Western's general manager is a court-appointed Watermaster, responsible for reporting compliance with water quality and quantity provisions of court orders regarding water rights issues in the Santa Ana watershed.

Western's general district consists of a 510 square mile area of western Riverside County and a population of more than one-half million people. Western currently sells over 90,000 acre-feet (AF) of water annually. Improvement districts, the retail portion of Western's general district, covers about 73 square miles and Western's retail service provides water to an estimated population of 61,000, based on 3.2 persons per household for about 19,100 residential domestic services. The location of Western and its retail and wholesale areas are shown in Figure 1.

About sixty percent of the water Western sells is treated; the balance is untreated or raw water. About one-third of Western's water sales are for domestic purposes; the rest wholesale. Water sold by the District for agricultural purposes is used to irrigate crops such as citrus and avocados, and nurseries. Agricultural water use in the retail area has decreased in past years with increasing urbanization.

About one-quarter of the water Western purchases from the MWD comes from the Colorado River Aqueduct and about three-quarters from the State Water Project, which transports water from Northern California via the California Aqueduct. Western also imports a small quantity of groundwater from the Riverside/San Bernardino area. Western owns no wells for groundwater production.

The five member Board of Directors comprise the governing body of the District and are responsible to the members of the public of his or her division, and to the general public within the District, for proper conduct of District affairs. Board members are elected to four-year terms by the registered voters in five geographic divisions apportioned by population. Terms are staggered to ensure continuity, with public elections held in at least two divisions every two



years. The director must reside in the division from which he or she is elected.

This Urban Water Management Plan (UWMP) provides information regarding projected water use and supplies. This Plan is organized as recommended in the *Guidebook to Assist Water Suppliers in the Preparation of a 2005 Urban Water Management Plan* (January 18, 2005). For each discussion provided in the Plan, the regulatory citation is presented followed by the requested information.

Section 2
Agency Coordination

Western is a retail and wholesale water agency serving more than 3,000 customers and therefore, is submitting an UWMP. This UWMP provides information for our retail area only, unless specifically noted.

2.1 Law

Water Code Section 10620

10620. (a) Every urban water supplier shall prepare and adopt an urban water management plan in the manner set forth in Article 3 (commencing with Section 10640).

(b) Every person that becomes an urban water supplier shall adopt an urban water management plan within one year after it has become an urban water supplier.

(c) An urban water supplier indirectly providing water shall not include planning elements in its water management plan as provided in Article 2 (commencing with Section 10630) that would be applicable to urban water suppliers or public agencies directly providing water, or to their customers, without the consent of those suppliers or public agencies.

(d) (1) An urban water supplier may satisfy the requirements of this part by participation in areawide, regional, watershed, or basinwide urban water management planning where those plans will reduce preparation costs and contribute to the achievement of conservation and efficient water use.

(2) Each urban water supplier shall coordinate the preparation of its plan with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies, and relevant public agencies, to the extent practicable.

(e) The urban water supplier may prepare the plan with its own staff, by contract, or in cooperation with other governmental agencies.

(f) An urban water supplier shall describe in the plan water management tools and options used by that entity that will maximize resources and minimize the need to import water from other regions.

Water Code Section 10621

10621. (a) Each urban water supplier shall update its plan at least once every five years on or before December 31, in years ending in five and zero.

(b) Every urban water supplier required to prepare a plan pursuant to this part shall notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan. The urban water supplier may consult with, and obtain comments from, any city or county that receives notice pursuant to this subdivision.

(c) The amendments to, or changes in, the plan shall be adopted and filed in the manner set forth in Article 3 (commencing with Section 10640).

Water Code Section 106110617. "Urban water supplier" means a supplier, either publicly or privately owned, providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually. An urban water supplier includes a supplier or contractor for water, regardless of the basis of right, which distributes or sells for ultimate resale to customers. This part applies only to water supplied from public water systems subject to Chapter 4 (commencing with Section 116275) of Part 12 of Division 104 of the Health and Safety Code.

2.2 Coordination with Appropriate Agencies

This 2005 UWMP has been coordinated with a variety of agencies throughout the process. In the planning stages, Western coordinated with Metropolitan Water District of Southern California and our wholesale customers to determine potential demands and supplies. The draft UWMP was

Table 1. Coordination with Appropriate Agencies

Agency	Participated in UWMP Development	Commented on Draft	Attended Public Meeting	Contacted for Assistance	Received Copy of Draft	Sent Notice of Intention to Adopt
City of Riverside				X	X	10/5
City of Corona				X	X	10/5
City of Norco					X	10/5
County of Riverside					X	10/5
MWD of Southern California				X		10/5
Rancho California Water District				X	X	10/5
Box Spring Mutual Water Company				X	X	10/5
SAWPA					X	10/5
Rubidoux Community Services District					X	10/5
Jurupa Community Services District					X	10/5
Elsinore Valley Municipal Water District				X	X	10/5
Home Gardens County Water District					X	10/5
Lee Lake Water District				X	X	10/5

provided to local agencies for their comment. A summary of the coordination effort is provided in Table 1. A copy of the letter requesting information and inviting participation are provided in Appendix A.

2.3 Resource Maximization/ Import Minimization Plan

Western has used many tools and options to maximize resources and minimize the need to import water. These tools include, but are not limited to, regional planning; water efficiency programs; and water transfers and exchanges.

Through a variety of basin water management programs, Western is attempting to ensure that the regional water supply is being efficiently used and re-used. Western's commitment to cooperation as the avenue for solving regional problems dates back to the District's formation. Western has been involved in virtually every water rights adjudication in the region since then. For example, several decades of litigation among users in the Santa Ana River watershed culminated in settlement in 1969. The stipulated judgment contains a declaration of rights of the entities in the lower area of the Santa Ana River Basin downstream of Prado Dam against those in the upper area, and provides a physical solution to implement the provisions of the judgment. Western's general manager serves as a court-appointed watermaster for the judgment.

The Seven Oaks Dam Conservation Project is a long-term attempt to better utilize storm water runoff within its watershed. This regional program has the potential to greatly improve the management of local urban water supplies in the Santa Ana River watershed and increase the water available to such beneficiaries as Agua Mansa, Meeks and Daley Water Companies, and the city of Riverside. The impact on the entire District will be a reduced rate of demand growth for imported water as more local waters are conserved and reused.

During the past 15 years, Western has addressed the long-standing issues of liquefaction in the San Bernardino Basin area. These efforts were made to produce

groundwater in the pressure area in a manner in which liquefaction and associated earthquake-related damages would not occur. Additional safe yield is declared annually that benefits users. Western is currently working with San Bernardino Valley Municipal Water District and the city of Riverside on the Riverside-Corona Feeder, a major water storage and conveyance pipeline that will assist with liquefaction and provide a dry-year supply of water and provide other benefits to the San Bernardino Valley community.

Western has assumed responsibility for a cooperative well-measuring program in the basin. Twice yearly, a Well Measurement Report is distributed to purveyors within the District. The report includes data from 47 agencies for more than 1820 wells in the Santa Ana and San Jacinto watersheds.

Western also participates in regional planning through the Santa Ana Watershed Project Authority (SAWPA), a joint powers agency charged with basin planning and development of regional water and wastewater facilities. SAWPA is composed of the five major water districts that share the Santa Ana and San Jacinto rivers, including Western. Those agencies are committed to working collectively and have prepared a Basin Plan under contract to the California Regional Water Quality Control Board to protect the Santa Ana River basin. The Plan calls for extensive wastewater treatment facilities, changes in imported water supply, massive export of saline waters, and a brine line from the upper watershed to the ocean. Among the water quality improvement projects that Western has participated in through SAWPA to benefit the region, are:

Santa Ana Regional Interceptor – The SARI line is a water pipeline designed to convey 30 million gallons of non-reclaimed wastewater from the upper Santa Ana River basin to the ocean for disposal after treatment. An extension of the SARI line southerly from Corona through the Temescal Canyon to the Lake Elsinore area and the San Jacinto watershed has recently been completed.

Arlington Desalter – The Arlington Desalter extracts and treats impaired groundwater from the Arlington Basin in Riverside with delivery of high quality product water to Norco. Western provided local match for this project and serves as operator of the facility.

Lake Elsinore San Jacinto Watershed Authority (LESJWA) – LESJWA works to curtail the impacts of the flood and drought cycles that have plagued Lake Elsinore in the past. The project has restricted the boundaries of the Lake and provides a source of replenishment water to replace evaporative losses. Through SAWPA, Western has provided funding and participation on LESJWA.

Western Riverside County Regional Wastewater Treatment Facility – In 1992, a Joint Powers Authority was formed to pursue the construction and operation of a new regional wastewater treatment facility on a site located just northwest of Norco. The facilities include processes needed for reaching tertiary treatment levels that meet or exceed all California Regional Water Quality Control Board standards.

Rapid Infiltration/Extraction (RIX) Wastewater Treatment Project – This demonstration project was developed to evaluate the effectiveness of using an experimental wastewater tertiary treatment process.

With SAWPA, Western is also participating in the Integrated Water Resources Plan (IWRP) process for the Santa Ana River watershed that focuses on the following:

• Changes in terms of recent water districts' planning updates and funding status that warrant a fresh analysis of the watershed.

• Planning time horizons for 2010, 2025, and 2050 of water demands and supplies.

• Water resource plans by member districts.

• A breakdown of planned water resource projects into six major project categories.

• Balancing and integration of available resources, including projects that enhance the environment.

• Identification of regional problems, issues, and descriptions of long-term integrated solutions.

2.4 City and County Notification and Participation

Western has notified appropriate cities and counties regarding the UWMP update process. Draft Plans were provided to the agencies listed in Table 1 and copies of letters inviting participation are provided in Appendix A.

2.5 Review and Adoption of UWMP Changes

Western follows the procedures of Water Code sections 10640 through 10645 when reviewing and making changes or additions to the UWMP. This revision of the UWMP is provided for the year 2005, meeting the deadline for providing UWMPs by December 31 in years ending in "0" and "5". The plan was adopted by the Western Board of Directors on December 7th through Resolution No. 2388. A copy of Resolution No. 2388 is provided in Appendix B.

Section 3
UWMP Planning Steps

3.1 Appropriate Level of Planning

3.1.1 Law

Water Code Section 10630

10630. It is the intention of the Legislature, in enacting this part, to permit levels of water management planning commensurate with the numbers of customers served and the volume of water supplied.

3.1.2 Contents of Plan

Western supplies water to both retail and wholesale customers. This UWMP focuses on retail services and provides all elements required by the Urban Water Management Planning Act. The retail service information is provided to a level of detail appropriate for planning for the current customer base. As available, historic information is provided.

Western supplies wholesale water to the cities of Corona, Norco and Riverside and the water agencies and companies of Elsinore Valley, Rancho California, Box Springs, Eagle Valley, and Lee Lake. Information regarding our wholesale customers is provided in Section 3.11.

3.2 Service Area Information With 20 Year Projections

3.2.1 Law

Water Code Section 10631(a)

10631. A plan shall be adopted in accordance with this chapter and shall do all of the following:

(a) Describe the service area of the supplier, including current and projected population, climate, and other demographic factors affecting the supplier's water management planning. The projected population estimates shall be based upon data from the state, regional, or local service agency population projections within the service area of the urban water supplier and shall be in five-year increments to 20 years or as far as data is available.

3.2.2 Service Area Information

Demographic factors that may affect water use include current and projected population, climate, population density, and customer type.

Western's retail service area is within the County of Riverside. The County of Riverside is one of the most rapidly growing areas of the State of California. Between 1994 and 1999, the population of Riverside County increased at an overall growth rate of 7% (David Taussing & Associates, Inc. 2003). In western Riverside County, the overall growth rate between 1994 and 1999 was 6% with population growth in cities and unincorporated areas at 7.9% and 1.1%, respectively. The 2000 Census indicated that Riverside County had a residential population of

over 1.5 million and approximately 585,000 dwelling units (David Taussing & Associates, Inc. 2003). The Southern California Association of Governments (SCAG) estimates that by 2020 the population in Riverside County will nearly double to approximately 2.8 million people with about 918,000 dwelling units (David Taussing & Associates, Inc. 2003). A separate study by the California Department of Finance estimates that the County population will be 3.5 million by 2030 (David Taussing & Associates, Inc. 2003). SCAG estimates that population in Riverside County will grow at an annual rate of 3.4% (Southern California Association of Governments [SCAG], 2004). The population in western Riverside County, which includes Western's retail service area, is projected to increase at an annual rate of 3.3% and the number of households is expected to show an average annual growth rate of 3.9% (SCAG, 2004).

Based on the total number of domestic customers, Western experienced growth of about 4% for the period from 2002 to 2004. This exceeds the growth rate estimated by SCAG for western Riverside County. Western's accelerated growth rate is influenced by the amount of undeveloped area in the retail service area compared to historically urban areas. This growth rate is expected to continue for several years then slow to the annual rate for western Riverside County (3.3%). Based on these assumptions, the estimated current and projected population for the Western retail service area is presented in Table 2.

Table 2. Estimated Population – Current and Projected

	2005	2010	2015	2020	2025	2030
Retail Service Area Population	16,000	72,700	85,500	100,600	118,400	139,200

Note: Population is estimated based on served residential customers.

Table 3. Climate Characteristics

	Jan	Feb	Mar	Apr	May	Jun	
Standard Monthly Average ETo (Inches)	2.49	2.91	4.16	5.27	5.94	6.56	
Average Rainfall (Inches)	2.16	2.15	1.75	0.81	0.23	0.07	
Average Temperature (Fahrenheit)	54.0	55.5	57.5	61.4	65.9	71.3	
	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Standard Monthly Average ETo (Inches)	7.22	6.92	5.35	4.05	2.94	2.56	56.37
Standard Monthly Average ETo (Inches)	0.04	0.12	0.26	0.32	0.93	1.21	10.04
Standard Monthly Average ETo (Inches)	77.0	77.7	74.4	67.3	59.1	54.3	64.6

Western is located in the Inland Valley approximately 50 miles east of Los Angeles where the warm dry climate is generally considered Mediterranean in characteristics (WMWD, 2004a). The climate typically exhibits hot, dry summers and mild, wet winters. Annual precipitation totals vary substantially from year to year. Most rainfall occurs during the months of November through April. Onshore airflow occurs during most of the year producing southwesterly winds. "Santa Ana" conditions occur occasionally producing warm, dry, northeast winds that can reach high velocities. Average temperatures are 64.6° F. Table 3 provides average climatic data for a weather station near the Western retail service area.

Note: Evapotranspiration (ETo) data from station at University of Riverside as provided on the CIMIS website database at www.cimis.water.ca.gov for the period of record from June 1985. Rainfall and temperature data from station at the Riverside Citrus Experiment Station as provided on the NOAA Western Regional Climate Center website database at www.wrcc.dri.edu for the period of record from July 1948. Copies of the downloaded data are provided in Appendix C.

Other demographic factors may also influence water usage. Residential development within Western's retail area ranges from homes on large lots to small mobile home parks and apartments. Businesses are generally neighborhood shopping centers and commercial strips along major streets, such as Van Buren Boule-

vard. The industrial base is growing and includes a Pepsi Bottling Plant and Ralph's Grocery Dairy Unit. One large industrial/commercial park, the Meridian Business Center, is in construction and other industrial/commercial units are planned.

The Riverside County General Plan provides information about the Lake Mathews/Woodcrest Area (Figure 2). This area encompasses most of Western's retail service area, but it does not include the commercial/industrial area immediately west of Interstate 215. The General Plan describes the Lake Mathews/Woodcrest Area as generally rural in characteristics with a strong equestrian presence (County of Riverside, 2003). Thirty percent of the land in this area is designated as open space. Planned housing density ranges from 8 dwelling units per acre to a minimum 10-acre lot size. Over 60% of the area is planned as residential with a lot size of greater than 0.5 acres. Less than 4% of the area is planned as residential with a lot size of less than 0.5 acres. Less than 1% of the area is planned as commercial, retail or light industrial and no heavy industry areas are planned. Minimum ten-acre agricultural areas are specified for 66 acres. It is estimated that the total population for this area will be 30,887 based on 3.1 persons per dwelling unit (County of Riverside, 2003). The total estimated employment for Lake Mathews/Woodcrest Area is 5,162 (County of Riverside, 2003).

The Western retail area is partially within the boundary of the City of Riverside with the remainder in the County of Riverside. The respective municipal and county authorities perform master planning within their jurisdictions. Master Planning is controlled by other agencies, with limited input by Western. Therefore, Western does not have the independent authority to approve new development in its service area.

3.3 Water Sources

3.3.1 Law

Water Code Section 10631(b)

10631. A plan shall be adopted in accordance with this chapter and shall do all of the following:

(b) Identify and quantify, to the extent practicable, the existing and planned sources of water available to the supplier over the same five-year increments described in subdivision (a). If groundwater is identified as an existing or planned source of water available to the supplier, all of the following information shall be included in the plan:

(1) A copy of any groundwater management plan adopted by the urban water supplier, including plans adopted pursuant to Part 2.75 (commencing with Section 10750), or any other specific authorization for groundwater management.

(2) A description of any groundwater basin or basins from which the urban water supplier pumps groundwater. For those basins for which a court or the board has adjudicated the rights to pump groundwater, a copy of the order or decree adopted by the court or the board and a description of the amount of groundwater the urban water supplier has the legal right to pump under the order or decree. For basins that have not been adjudicated, information as to whether the department has identified the basin or basins as overdrafted or has projected that the basin will become overdrafted if present management conditions continue, in the most current official departmental bulletin that characterizes the condition of the groundwater basin, and a detailed description of the efforts being undertaken by the urban water supplier to eliminate the long-term overdraft condition.

(3) A detailed description and analysis of the location, amount, and sufficiency of groundwater pumped by the urban water supplier for the past five years. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

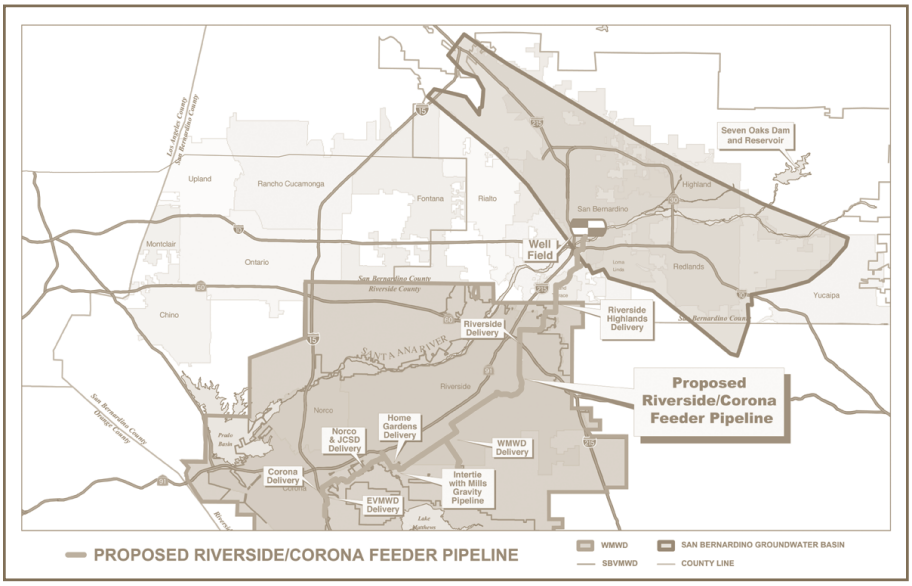
(4) A detailed description and analysis of the amount and location of groundwater that is projected to be pumped by the urban water supplier. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

3.3.2 Current and Planned Water Supplies

Western provides both potable and non-potable water in the retail service area from various sources.

Potable sources include Metropolitan Water District of Southern California State Water Project water and supplemental water from the City of Riverside. Western became a member agency of MWD in November 1954 and has a purchase agreement for an initial base demand of 65,298.5 AF with an initial Tier 1 annual maximum of 58,768.7 AF (Appendix D). Supplemental water may be purchased from the City of Riverside (Appendix D). The City of Riverside operates a well water supply system of over 40 domestic quality wells. When surplus water is available from the City of Riverside and required by Western, an intertie and portable chloramination station allows Western to take up to approximately 4,900 gallons per minute. Water is purchased from Riverside on an emergency or off-season basis.

Non-potable water is used for irrigation purposes at various locations throughout the retail area. The irrigation distribution system distributes non-potable irrigation water through a large area of the retail service area. The main sources of non-potable water are the Colorado River Aqueduct (CRA) and groundwater from the San Bernardino/Riverside Area. Western does not treat this surface water supply, and, therefore, it is not considered a potable water source for Western. An intertie with a local irrigation system provides access to up to 6,000 acre-feet per year (AF/YR) of non-potable water for irrigation purposes. This water is pumped from wells in the San Bernardino/Riverside area and wheeled through canals and pipelines under an agreement with Elsinore Valley Municipal Water District. Western has the right to purchase up to 9.0 cfs of groundwater and transport the water through the Riverside Canal or Gage Canal to turnouts connecting to Western's non-potable irrigation system. The use of this high Total Dissolved Solids and nitrate groundwater can make high quality imported water available for domestic purposes.



The Riverside/Corona Feeder project will make Western less dependent on the direct delivery of water from MWD (WMWD, 2005a). The proposed project will provide the infrastructure to allow Western to purchase SWP water from MWD when available and store this water in the San Bernardino Basin Area. This water would then be extracted as needed, and transported to Western's customers and other water purveyors within Western's boundaries for use during dry years. The surplus water could be derived from not only the State Water Project, but also local runoff from regulated releases from the Army Corps of Engineers Seven Oaks Reservoir and other local water sources with surplus water during wet periods.

Water derived from the Seven Oaks Reservoir will be distributed based on priorities. The highest priority would be direct delivery within the Western and San Bernardino Valley Municipal Water District's areas (WMWD, 2004b), mainly to water treatment plants replacing water that would otherwise be met by imported water or groundwater. The second priority would be direct groundwater recharge of basins within the San Bernardino area to provide for future recovery of stored surplus water. The third priority would be recharge of groundwater basins outside the San Bernardino area, but within the Western and San

Bernardino Valley Municipal Water District areas. The fourth and last priority would be delivery of water to agencies outside the Western and San Bernardino Valley Municipal Water District areas as part of an exchange.

Non-potable water from the March Wastewater Reclamation Facility (WWRF) also is used for irrigation purposes in the Western retail area. Currently, all treated wastewater is used to irrigate the Riverside National Cemetery and the Archie J. Old Golf Course. In 2004, a total of 138.7 million gallons [(MG), 425.5 AF] were provided to the National Cemetery and the Golf Course. In January through March 2005, a total of 21.4 MG (65.8 AF) were provided to the National Cemetery and the Golf Course. During the summer months, the reclaimed wastewater must be supplemented with CRA water to meet the demand. In the winter months when precipitation reduces demand, treated wastewater can be stored in open reservoirs until demand increases. As the flow to the March WWRF increases with corresponding increased volumes of treated wastewater, the plant will be upgraded to tertiary treatment and the treated effluent will be pumped into the non-potable irrigation distribution system for delivery to additional non-potable customers. It is anticipated that treated wastewater volumes available for irrigation will increase to 6,130 AF/YR by 2030 as shown in Table 4. These volumes were derived by projections of estimated domestic and industrial discharges based on projects known to Western then application of growth factors of 3.3% per year.

Western does not directly extract groundwater for potable or non-potable purposes in its retail area. The retail area generally is underlain by an area characterized by the Regional Water Quality Control Board as not within a designated groundwater basin (California Regional Water Quality Control Board, Santa Ana Region, 1995, Figure 4-1). Therefore, Tables 6 and 7 as referenced in the Guidebook are not included.

A summary of the water sources is provided in Table 4. A further discussion of MWD supplied water is provided in Sections 3.4 and 3.11.

3.4 Reliability of Supply

3.4.1 Law

Water Code Section 10631(c)

(c) Describe the reliability of the water supply and vulnerability to seasonal or climatic shortage, to the extent practicable, and provide data for each of the following:

(1) An average water year.

(2) A single dry water year.

(3) Multiple dry water years.

For any water source that may not be available at a consistent level of use, given specific legal, environmental, water quality, or climatic factors, describe plans to supplement or replace that source with alternative sources or water demand management measures, to the extent practicable.

3.4.2 Normal and Drought Supply Years

A normal supply year is a year in the historical sequence that most closely represents median runoff levels and patterns. Normal is defined by evaluating a minimum of 30 years of historical records for rainfall and runoff. From the basis of a normal year, years of surplus and drought can be defined. MWD developed a computer model named IRPSIM that uses 70 years of historical hydrology (from 1922 to 1991) to develop estimates of water surplus and shortage over a

Table 4. Current and Projected Water Supplies

Water Supply Sources	2005	2010	2015	2020	2025	2030
MWD- Retail Service Area	26,688	31,007	35,726	41,278	47,809	55,491
MWD – Western Wholesale Service	78,024	88,902	101,146	111,837	123,784	134,028
Riverside/Corona Feeder (Potential as needed source)			10,000	40,000	40,000	40,000
Agricultural Water Purchase	3,000	6,000	6,000	6,000	6,000	6,000
Recycled Water-March WWRF	450	2,680	3,850	4,430	5,210	6,130

Quantities in Acre-Feet per Year
MWD – Metropolitan Water District of Southern California
SWP –State Water Project
CRA – Colorado River Aqueduct
WWRF – Wastewater Reclamation Facility

Table 8. Supply Reliability

			Multiple Dry Water Years		
	Normal Water Year (AF Year)	Single Dry Water Year (% of Normal)	Year 1(% of Normal)	Year 2(% of Normal)	Year 3(% of Normal)
MWD Supplies	Varies (see Table 4)	100	100	100	100
Non-potable groundwater	6,000	100	100	100	100
Recycled water	Varies (see Table 33)	100	100	100	100

Table 9. Basis of Water Year Data

Water Source	Water year Type	Base Year(s)	Historic Sequence
MWD Supplies			
	Normal Water Year	NA-Modeled by IRPSIM	
	Single - Dry Year	1977	1922-1991
	Multiple - Dry Years (3)	1990-1992	1922-1991

Ref: MWD, 2005

20-year period (MWD, 2005). The model is used to analyze the extent to which a particular supply option can add to the region's supply reliability and determine the need for additional supplies and aid in determining the appropriate supply targets.

Core water supplies provide a base quantity of water each year, regardless of whether surplus supplies already exist (MWD, 2005), such as recycled water projects, safe yield groundwater production, and CRA base supplies. They provide a reliable source, but if developed to meet demands of infrequent dry years can result in redundancy in wet years and higher costs. Flexible water supplies provide supply only when needed (such as a dry year) and do not result in increased amounts of surplus water during years of plentiful supply, such as voluntary water transfers and storage. Flexible supplies tend to be more cost-effective, but are less reliable.

The IRPSIM model studies tested the supply reliability of a mix of core and flexible supplies (MWD, 2005). The IRPSIM modeled MWD's ability to respond in future years under a repeat of the 1977 and 1990-92 drought cycles, that is, in the case of worst single year and multiple dry year droughts. The IRPSIM analyses of the IRP Update report show that MWD can maintain reliable supplies under the conditions that have existed in past dry periods throughout the period 2005 through 2030.

Supplies associated with the Riverside/Corona Feeder are expected to be reliable sources during drought period. These supplies will be derived from excess SWP stored in the San Bernardino area and local groundwater. Santa Ana Water diversions may also be stored for future extraction.

Western's local non-potable supplies will also be reliable sources. Recycled water has little dependency on drought conditions and the supply of non-potable water from a nearby groundwater basin that is imported by canals and pipelines also will not be impacted by drought. The groundwater to be purchased from Elsinore Valley Municipal Water District is based on water rights Elsinore Valley Municipal Water District holds in the Meeks and Daley Water Company.

A summary of estimated water supply during a normal and drought years is shown in Table 8. The modeled drought years are summarized in Table 9.

3.4.3 Factors in Inconsistency of Supply

Historical water deliveries provide us with an indication, but not a certainty, as to the reliability of future water supplies. Significant changes over time may impact water delivery including changes in water storage and delivery facilities, regulatory constraints on the use of facilities, water quality issues, long-term climatic changes, and legal re-allocation of supply. However, MWD has identified a resource management plan that should result in reliability for non-discounted non-interruptible demands through 2030 (MWD, 2005). This plan relies on a multi-faceted approach using local resources, various storage programs, and transfer agreements.

Water quality issues and implementation risks were identified as concerns to future supply reliability by MWD (MWD, 2005). Water

quality concerns may occur through contamination of supplies or more stringent water quality standards. These factors may cause a loss of water supply or a reduced usefulness because of the need to blend supplies to meet standards. Implementation concerns include the competitive approach to securing new local supplies or a failure to acquire the supply within the expected schedule. Imported water supplies may also not perform as expected. Environmental issues may also impact imported supplies for concerns such as endangered species requiring a minimum water flow limiting quantities that can be exported from the source.

Drought conditions always pose a threat to water supplies, but especially in low rainfall areas such as southern California. Drought conditions in the water supply areas such as the Colorado River system and northern California have been shown to impact supplies available to the SWP and CRA. Plans continue to reduce potential shortfalls with the development of storage and new supplies.

The non-potable supplies, including groundwater and recycled water, are expected to be consistent. These supplies are not expected to be affected by legal issues since the water rights are held by EVMWD for the non-potable groundwater and the recycled water is controlled by Western and distribution facilities generally are in place. Endangered species are also not a concern since these supplies are not a source used by endangered species. Since the supplies are not used for domestic purposes, water quality issues are of lesser importance. They also are not impacted by drought.

A summary of factors that may cause an inconsistency of supply is provided in Table 10.

Table 10. Factors Potentially Resulting in Supply Inconsistency

Name of Supply	Legal	Environmental	Water Quality	Climatic
MWD	Competition for new supplies	Endangered species	Contamination of Supply More Stringent Water Quality Standards	Drought Condition

3.5 Transfer and Exchange Opportunities

3.5.1 Law

Water Code Section 10631(d)

(d) Describe the opportunities for exchanges or transfers of water on a short-term or long-term basis.

3.5.2 Transfers and Exchanges for Western's Retail Area

Western's primary source of potable water is the SWP from MWD. MWD has established various transfer and storage programs (MWD, 2005). MWD believes it currently has in place transfer and storage programs to supplement deliveries from the SWP with 300,000 AF of water. The MWD transfer and storage program includes the following agreements:

- Semitropic;
- Arvin-Edison;
- San Bernardino Valley Municipal Water District (one current and one under development);
- Kern Delta Water District;
- Desert Water Agency/Coachella Valley Water District;
- Mojave Storage Program;
- North Kern Storage Program; and
- Kern Water Bank (under development).

In any given year, actual yields may vary from the expected values, but MWD models indicate that in the aggregate, the resource targets can be met under a wide range of hydrologic conditions. Additional details on these and other programs can be found in the Regional Urban Water Management Plan (MWD, 2005).

MWD also expects to use spot markets and option contracts to provide water to meet dry-year demands (MWD, 2005). The quantities obtained from these will vary significantly from year to year. For example, in 2003, MWD secured options to purchase approximately 145,000 AF of water from the Sacramento Valley during the irrigation season. These options protect against potential shortages that might arise from a decrease in Colorado River supply or as a result of drier-than-expected hydrologic conditions.

Table 11. Transfer and Exchange Opportunities

Source Transfer Agency	Tansfer or Exchange	Short Term	Proposed Quantities	Long Term	Proposed Quantities
NA					

Western also participates both directly and indirectly in many regional water exchanges, acting as a direct participant or as the Santa Ana watershed's Watermaster. However, Western has no specific transfer or exchange agreements specifically for its retail area. Therefore, no specific transfers or exchanges are identified in Table 11.

3.6 Water Use by Customer-type – Past, Current and Future

3.6.1 Law

Water Code Section 10631(e)

(e) (1) Quantify, to the extent records are available, past and current water use, over the same five-year increments described in subdivision (a), and projected water use, identifying the uses among water use sectors including, but not necessarily limited to, all of the following uses:

(A) Single-family residential.
(B) Multifamily.
(C) Commercial.
(D) Industrial.
(E) Institutional and governmental.
(F) Landscape.
(G) Sales to other agencies.
(H) Saline water intrusion

Table 12. Past, Current, and Projected Water Deliveries

		Water Use Sectors	Single family	Multi-family	Com-mercial	Indus-trial	Institu-tional/gog	Land-scape	Agri-culture	Other	Total
2000	metered	# of accounts	13,747	2	136	5	174	175	231		14,470
		Deliveries AF/YR	12,406		756	407	543	1,032	8,049	768	23,959
	unmetered	# of accounts	0	0	0	0	0	0	0	0	0
		Deliveries AF/YR	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005	metered	# of accounts	19,725	1	300	5	300	250	198		20,779
		Deliveries AF/YR	17,338	180	1890	720	578	1472	4,227	283	26,688
	unmetered	# of accounts	0	0	0	0	0	0	0	0	0
		Deliveries AF/YR	NA	NA	NA	NA	NA	NA	NA	NA	NA
2010	metered	# of accounts	23,500	1	360	6	360	300	198		24,725
		Deliveries AF/YR	20,672	215	2,254	858	689	1,755	4,227	337	31,007
	unmetered	# of accounts	0	0	0	0	0	0	0	0	0
		Deliveries AF/YR	NA	NA	NA	NA	NA	NA	NA	NA	NA
2015	metered	# of accounts	27,700	2	420	7	420	360	198		29,107
		Deliveries AF/YR	24,315	253	2,651	1,009	810	2,065	4,227	396	35,726
	unmetered	# of accounts	0	0	0	0	0	0	0	0	0
		Deliveries AF/YR	NA	NA	NA	NA	NA	NA	NA	NA	NA
2020	metered	# of accounts	32,500	2	490	8	500	420	198		34,118
		Deliveries AF/YR	28,601	297	3,118	1,187	953	2,429	4,227	466	41,278
	unmetered	# of accounts	0	0	0	0	0	0	0	0	0
		Deliveries AF/YR	NA	NA	NA	NA	NA	NA	NA	NA	NA
2025	metered	# of accounts	38,300	3	580	10	590	490	198		40,171
		Deliveries AF/YR	33,642	350	3,668	1,396	1,121	2,857	4,227	548	47,809
	unmetered	# of accounts	0	0	0	0	0	0	0	0	0
		Deliveries AF/YR	NA	NA	NA	NA	NA	NA	NA	NA	NA
2030	metered	# of accounts	45,000	3	680	11	690	580	198		47,162
		Deliveries AF/YR	39,571	412	4,314	1,643	1,319	3,360	4,227	645	55,491
	unmetered	# of accounts	0	0	0	0	0	0	0	0	0
		Deliveries AF/YR	NA	NA	NA	NA	NA	NA	NA	NA	NA

barriers, groundwater recharge, or conjunctive use, or any combination thereof.
(I) Agricultural.
(2) The water use projections shall be in the same five-year increments described in subdivision (a).

3.6.2 Western's Customers

Western tracks retail water usage by customer types including residential, commercial, industrial, institutional, and agricultural accounts. Tracking is done by user code and reports can be generated to determine the number of accounts and quantities.

The number of future residential and commercial/industrial customers is expected to increase at the same rate as the estimated population growth. Based on 4 percent growth per year for 2006 and 2007 and subsequent 3.3 percent growth to 2030, Western will have nearly 39,500 residential, 600 commercial, and 605 governmental/institutional customers by 2030. Landscape irrigation customers are also expected to grow at the same rate. The number of agricultural users is not expected to increase, but rather may decrease with urbanization. However, to be conservative in demand estimations, the number of agricultural customers was kept at the 2005 level. A summary of the expected accounts by category is provided in Table 12. Water delivery projections are also based on increases at the same rate as the estimated population growth. The projected water deliveries are summarized in Table 12.

Western also provides wholesale water sales to various agencies within the District boundaries. These agencies provided an estimate of potential water demands through 2030. The projected wholesale demands include both domestic and non-domestic water uses such as commercial/industrial and landscape and agricultural irrigation. Some of these demands may be interruptible during water shortages. These projected demands are summarized in Table 13.

Western does not use water for saline barriers, groundwater recharge or conjunctive use within its retail area. However, our distribution system does have unaccounted for water losses. These water losses are summarized in Table 14.

A summary of total water demand is provided in Table 15.

3.7 Demand Management Measures

3.7.1 Law

Water Code Section 10631(f)

(f) Provide a description of the supplier's water demand management measures. This description shall include all of the following:

(1) A description of each water demand management measure that is currently being implemented, or scheduled for implementation, including the steps necessary to implement any proposed measures, including, but not limited to, all of the following:

(A) Water survey programs for single-family residential and multifamily residential customers.

(B) Residential plumbing retrofit.

(C) System water audits, leak detection, and repair.

(D) Metering with commodity rates for all new connections and retrofit of existing connections.

(E) Large landscape conservation programs and incentives.

(F) High-efficiency washing machine rebate programs.

(G) Public information programs.

(H) School education programs.

(I) Conservation programs for commercial, industrial, and institutional accounts.

(J) Wholesale agency programs.

(K) Conservation pricing.

(L) Water conservation coordinator.

(M) Water waste prohibition.

(N) Residential ultra-low-flush toilet replacement programs.

Table 13. Sales to Other Agencies- AF/YR

Water Distributed	2000	2005	2010	2015	2020	2025	2030
Box Springs Mutual Water Company	121	132	448	448	448	448	448
City of Corona	25,056	22,948	21,302	23,519	25,967	28,670	28,670
City of Riverside	400	2,300	3,800	5,300	6,800	8,300	9,800
Elsinore Valley Municipal Water District	12,900	15,023	22,715	29,515	35,015	41,515	49,015
Lee Lake Water District	945	3,980	5,753	6,236	6,236	6,236	6,236
Rancho California Water District	32,698	33,641	34,884	36,128	37,371	38,615	39,859
Total	**72,120**	**78,024**	**88,902**	**101,146**	**111,837**	**123,784**	**134,028**

Note: Includes both domestic, commercial/industrial and interruptible uses such as landscape and agricultural irrigation.

Table 14. Additional Water Uses and Losses - AF/YR

Water Distributed	2000	2005	2010	2015	2020	2025	2030
Saline Barriers	0	0	0	0	0	0	0
Groundwater recharge	0	0	0	0	0	0	0
Conjunctive use	0	0	0	0	0	0	0
Raw water	0	0	0	0	0	0	0
Recycled (Golf Course/Cemetery)	386	450	500	500	500	500	500
Unaccounted - for system losses	6	1,415	1,690	1,980	2,330	2,750	3,230
Total	**492**	**1,865**	**2,190**	**2,480**	**2,830**	**3,250**	**3,730**

Notes: Raw and recycled water, except as noted, were included in Table 12 and therefore not included in Table 14.

Values for 2010 include 4% increase for 2 years then 3.3% for 3 years to match projected population growth. Subsequent years are increased 3.3% per year.

System losses for 2000 were unusually low.

System losses for 2005 were based on 2001 to 2004 average quantity escalated by 4%.

Table 15. Total Water Use – AF/YR

Water Use	2000	2005	2010	2015	2020	2025	2030
Total of Tables 12, 13, 14	96,571	106,577	122,099	139,352	155,945	174,843	193,249

(2) A schedule of implementation for all water demand management measures proposed or described in the plan.

(3) A description of the methods, if any, that the supplier will use to evaluate the effectiveness of water demand management measures implemented or described under the plan.

(4) An estimate, if available, of existing conservation savings on water use within the supplier's service area, and the effect of the savings on the supplier's ability to further reduce demand.

3.7.2 California Urban Water Conservation Council Reporting

Western is a signatory to the California Urban Water Conservation Council and submits annual reports in accordance with the "Memorandum of Understanding Regarding Urban Water Conservation in California." Copies of our Best Management Practices (BMP) Reports are provided in Appendix E to meet the information requirements for Demand Management Measures (DMMs).

In summary, Western's regional water education, public information and water conservation programs continue to expand with the surge in population.

Water Education

Western has been a leader in the field of water education support for area schools since 1982. There are seven school districts with more than 225 public and private schools in Western's service area. Western's School Program is designed to encourage and assist educators as they teach students about water supply, distribution, reclamation, conservation and the future of water supplies. The material and services offered meet the requirements of the California Science Framework Addendum and are provided at no charge to participating teachers, schools and students, public and private, within Western's 510 square mile District. Western offers materials including student workbooks, teachers' guides, videos, speakers and field trips. Complete class water education units are also distributed along with needed in-servicing.

Public Information

Western provides extensive public outreach to the communities it serves by participating in local events such as the Community Water Festival, a one-day festival celebrating water that attracts hundreds of people including children held in Temecula in the spring. Through its Water Talk program, Western staff makes a direct connection by presenting water information to local service groups and chambers of commerce within its service area. In the calendar year ended December 31, 2004, Western's public affairs staff conducted more than 25 presentations.

Water Conservation

Western and its wholesale customers participate in a Metropolitan Water District managed water conservation incentive program for commercial, industrial and institutional water customers. The program, called *Save Water – Save A Buck*, is administered by a Metropolitan contracted vendor. The vendor maintains a toll-free number and processes rebates throughout Southern California. Rebates range from $60 for the installation of a commercial ULFT, $100 for a high pressure water broom, $500 for a cooling tower conductivity controller, to $2,000 for a hospital X-ray film processing water re-circulation system. Four-color informational brochures are regularly distributed at local chamber of commerce meetings and in business newsletters.

Businesses in Western's general service area have received more than $115,000 in incentive funds. The installation of water conserving fixtures and appliances and the implementation of new water saving technologies resulting from this incentive program represent an annual savings of 72 acre-feet per year.

Western has been working with Riverside County Planning Office and developers to enforce the County's water-efficient landscaping ordinance by providing area developers with educational materials. This new program is still in its infancy, but in addition to the water conservation education materials that are being given to new home developers for their customers, Western has met with County Planning staff to encourage the enforcement of the County's landscape ordinance.

Western's staff conducts landscape plan reviews and inspections of all new commercial, industrial and institutional landscapes within Western's retail service area to ensure compliance with either the City or County of Riverside's water efficient landscape ordinance resulting from AB 325.

Western cosponsors an Irrigation Water Management Laboratory (CIMIS Mobile Lab) with the Riverside-Corona Resource Conservation District and the City of Riverside. This service offers those with large (one-acre or larger) parcels of land a free irrigation evaluation by the Conservation District staff. Each irrigator is given a detailed report on where and how to improve the irrigation system's efficiency and instructions on how to set their timers. The Conservation District will also visit residential homeowners within Western's general service area, conduct a landscape inspection and leave a helpful checklist of recommendations to improve landscape water-use efficiency.

Western opened the gates to its *Landscapes Southern California Style℠* June 24, 1989. Through *Landscapes Southern California Style℠*, Western reaches the community with its outdoor water conservation message. During the months of September through May, seminars are conducted for the general public, addressing such topics as landscape design, irrigation methods, drip irrigation systems and many other subjects that impact the water-efficiency of a homeowner's landscape. Western reaches roughly 300 residents annually with these water-efficient landscaping messages. Local schoolchildren participate in special activities within the garden that contribute toward making them lifelong conscientious water users. For example, up to 100 students attend the annual Earth Day celebration where they learn about water conservation measures during this fun and engaging event. Staff members work continuously to make water-efficient landscaping techniques even easier to understand and incorporate into the everyday environment. To date, more than 150,000 people have walked the trails in this unique one-acre, water conservation education center.

In the last five years, more than 8,800 (data through 12/31/2004) non-conserving toilets were replaced with ultra-low-flow toilets (ULFT) in single and multi-family residences within Western's general service area. Western and its wholesale customers provide incentives ranging from $50 to $75 per non-conserving unit replaced. The installation of these ULFTs represents an annual water savings of more than 235 acre-feet of water. Since the inception of the High Efficiency Clothes Washer (HECW) incentive program in 2002, more than 3,850 (data through 12/31/2004) HECW rebates were distributed for the installation of qualified washers in single family homes. The HECW incentive is $100 per unit. To date the program has saved an estimated 90 acre-feet of water. A summary of Western's water conservation program history is included in Appendix E.

3.8 Evaluation of Demand Management Measures Not Implemented

3.8.1 Law

Water Code Section 10631(g)

(g) An evaluation of each water demand management measure listed in paragraph (1) of subdivision (f) that is not currently being implemented or scheduled for implementation. In the course of the evaluation, first consideration shall be given to water demand management measures, or combination of measures, that offer lower incremental costs than expanded or additional water supplies. This evaluation shall do all of the following:

(1) Take into account economic and noneconomic factors, including environmental, social, health, customer impact, and technological factors.

(2) Include a cost-benefit analysis, identifying total benefits and total costs.

(3) Include a description of funding available to implement any planned water supply project that would provide water at a higher unit cost.

(4) Include a description of the water supplier's legal authority to implement the measure and efforts to work with other relevant agencies to ensure the implementation of the measure and to share the cost of implementation.

3.8.2 Unimplemented DMMs

Western has implemented all DMMS except System Water Audits, Leak Detection & Repair. Although all identified leaks are repaired in a timely manner, Western does not have a formal leak detection program. Water loss for Fiscal Year 2003-2004 (latest data available) is estimated (Western MWD Construction & Operations Report 2004) to be 100.4 acre-feet or 0.36% of all water delivered through the system.

Western has determined the cost-effectiveness of the unimplemented DMMs using the California Urban Water Conservation Council cost-benefit formula. The cost-effectiveness evaluation identifies all relevant costs and benefits from the perspective of society/supplier/customer, as appropriate; addresses program cost-sharing with other project beneficiaries; and discusses all major assumptions and data used to measure, value and discount program costs and benefits with a sensitivity analysis.

3.9 Planned Water Supply Projects and Programs

3.9.1 Law

Water Code Section 10631(h)

(h) Include a description of all water supply projects and water supply programs that may be undertaken by the urban water supplier to meet the total projected water use as established pursuant to subdivision (a) of Section 10635. The urban water supplier shall include a detailed description of expected future projects and programs, other than the demand management programs identified pursuant to paragraph (1) of subdivision (f), that the urban water supplier may implement to increase the amount of the water supply available to the urban water supplier in average, single-dry, and multiple-dry water years. The description shall identify specific projects and include a description of the increase in water supply that is expected to be available from each project. The description shall include an estimate with regard to the implementation timeline for each project or program.

3.9.2 Expected Future Water Supply Projects and Programs

Western has several projects and programs planned to meet the demands. Some of these projects were previously discussed in Section 3.3.2.

Table 16. Evaluation of unit cost of water resulting from non-implemented / non-scheduled DMMs and planned water supply project and programs

Non-implemented & Not Scheduled DMM / Planned Water Supply Projects (Name)	Per-AF Cost ($)
System Water Audits, Leak Detection & Repair	$2054.28

Cost Effectiveness Summary for System Water Audits, Leak Detection and Repair

Total Costs	$206,250 ($750 per mile)
Total Benefits	$52,610 ($524 per AF)
Discount Rate	4.0
Time Horizon	1 year
Cost of Water ($ per AF)	$524 (Tier 2 Water)
Water Savings (AF/Yr)	100.4

Table 17. Future Water Supply Projects

Project Name	Projected Start Date	Project Comple-tion Date	Normal-year AF to Agency	Single-Dry AF/Year to Agency	Mutliple-Dry AF/ Years to gency		
					Year 1 AF	Year 2 AF	Year 3 AF
Riversid/ Corona/Feeder/ Santa Ana Water Divisions	2010	2015	0	40,000	40,000	40,000	40,000

Note: Multiple dry years are as described in Section 3.4. Planned Water Supply Projects and Programs.

Potable demand will be supplemented through the Riverside/ Corona Feeder Project. This project will allow the capture and storing of new water sources, especially in wet years. The water would be stored in the San Bernardino Basin area, most likely the Bunker Hill Basin, which has a safe yield of 5,000,000 AF. Water from the SWP and local runoff, including releases from Seven Oaks Reservoir, could be stored until needed then pumped out for delivery to western Riverside County. This would reduce the cost of water and reliability of supply, especially during drought years. The project would provide better water table control in the City of San Bernardino's high groundwater area and improve water quality in the San Bernardino area.

San Bernardino Municipal Water District and Western have jointly filed two applications with the State Water Resource Control Board to appropriate water from the Santa Ana River (WMWD, 2004b). The applications seek the right to divert up to 200,000 AF-YR of local water to help meet anticipated demands. Over the long-term, the average annual diversions could be as high as 27,000 AF. This project would allow increased capture of storm flows otherwise lost.

A summary of the future projects and programs is provided in Table 17.

3.10 Development of Desalinated Water

3.10.1 Law

Water Code Section 10631(i)

(i) Describe the opportunities for development of desalinated water, including, but not limited to, ocean water, brackish water, and groundwater, as a long-term supply.

3.10.2 Desalination Project Potential in the Western Retail Area

As discussed in Section 3.3, Western does not extract groundwater for retail supply. The retail area generally is underlain by an area characterized by the Regional Water Quality Control Board as not within a designated groundwater basin (California Regional Water Quality Control Board, Santa Ana Region, 1995, Figure 4-1), nor is Western near an ocean water supply. Therefore, Western has no opportunity to provide desalinated water for its retail customers except from wells outside its retail area or by purchase from or exchanges with other agencies. Because no desalination projects are proposed Table 18 as provided in the guidebook is not included in this Plan.

The Arlington Desalter Facility extracts and treats water from the Arlington Groundwater Basin to the north of Western's retail area. The Desalter is owned by SAWPA, and lies outside the Western retail area. The Desalter supplied the City of Norco with 4,594 AF during 2004. The treated groundwater from the Desalter can be pumped into Western's retail area as an emergency supply. However, pumping costs are high and economics limit the usefulness as a normal supply source.

3.11 Current or Projected Supply Includes Wholesale Water

3.11.1 Law

Water Code Section 10631(k)

(k) Urban water suppliers that rely upon a wholesale agency for a source of water, shall provide the wholesale agency with water use projections from that agency for that source of water in five-year increments to 20 years or as far as data is available. The wholesale agency shall provide information to the urban water supplier for inclusion in the urban water supplier's plan that identifies and quantifies, to the extent practicable, the existing and planned sources of water as required by subdivision (b), available from the wholesale agency to the urban water supplier over the same five-year increments, and during various water-year types in accordance with subdivision (c). An urban water supplier may rely upon water supply information provided by the wholesale agency in fulfilling the plan informational requirements of subdivisions (b) and (c).

3.11.2 Wholesale Water Supply

Western currently receives all non-emergency potable water for its retail service area from Metropolitan Water District of Southern California. This supply is supplemented as needed on an emergency basis with water from the City of Riverside. Western provided demand projections to MWD for the period from 2005 to 2030 (Table 19) and MWD has provided information on the planned sources and quantities in their Regional Urban Water Management Plan (MWD, 2005). MWD's average supply capability for all its member agencies is summarized in Table 20. These supplies exceed the estimated demand (MWD, 2005). A summary of MWD projected total demands and demands for Western's service area is provided in Appendix F.

As previously discussed in Section 3.4.2, MWD's IRPSIM analyses of the IRP Update report shows that Metropolitan can maintain reliable supplies under the conditions that have existed in past dry periods throughout the period 2005 through 2030 (MWD, 2005). Table 21 summarizes MWD expected reliability for drought periods. Potential inconsistencies in MWD supplies were discussed in Section 3.4.3 and summarized below in Table 22.

Table 19. Agency Demand Projections Provided to Wholesale Supplier – AF/YR

Wholesaler	2010	2015	2020	2025	2030
MWD					
Estimated Retail Demand	33,197	38,206	44,108	51,059	59,221
Estimated Wholesale Demand	88,902	101,146	111,837	123,784	134,028

Note: Retail Demand includes water loss.

Table 20. Wholesaler Identified and Quantified Existing and Planned Sources of Water – AF/YR

Wholesaler sources	2010	2015	2020	2025	2030
MWD					
Current Supplies					
Colorado River	711,000	678,000	677,000	677,000	677,000
California Aqueduct	1,772,000	1,772,000	1,772,000	1,772,000	1,772,000
In-Basin Storage	0	0	0	0	0
Supplies Under Development					
Colorado River	0	0	0	0	0
California Aqueduct	185,000	185,000	240,000	240,000	240,000
Transfers to other agencies	0	0	0	0	0
Maximum Supply Capability (1)	2,688,000	2,600,000	2,654,000	2,654,000	2,654,000

Notes: 1 — Represents expected supply capability for resource programs for all of MWD. Source: MWD, 2005

Table 21. Wholesale Supply Reliability - % of Normal Supply

		Multiple Dry Years		
Wholesaler sources	**Single Dry**	**Year 1**	**Year 2**	**Year 3**
MWD	100	100	100	100

Table 22. Factors Resulting in Inconsistency of Wholesaler's Supply

Name of Supply	Legal	Environment	Water Quality	Cimatic
MWD	Competition for new supplies	Endangered species	Contamination of Supply More strigent Water Quality Standards	Drought Conditions

Table 23. Water Supply Shortage Stage and Conditions

Stages No.	Water Supply Conditions (1)	% Reduction in Deliveries
I	Severe Shortage	10% (goal) for firm deliveries, voluntary conservation for non-firm deliveries
II	Extreme Shortage	5% for firm deliveries, 20% for non-firm deliveries
III	Extreme Shortage	10% for firm deliveries, 30% for non-firm deliveries
IV	Extreme Shortage	15% for firm deliveries, 40% for non-firm deliveries
V	Extreme Shortage	20% for firm deliveries, 50% for non-firm deliveries
VI	Extreme Shortage	30% for firm deliveries, 90% for non-firm deliveries

Note: (1) Terminology of Water Surplus and Drought Management Plan (MWD, 2005)

Section 4
Determination of DMM Implementation

4.1 Law

Water Code Section 10631.5

The department shall take into consideration whether the urban water supplier is implementing or scheduled for implementation, the water demand management activities that the urban water supplier identified in its urban water management plan, pursuant to Section 10631, in evaluating applications for grants and loans made available pursuant to Section 79163. The urban water supplier may submit to the department copies of its annual reports and other relevant documents to assist the department in determining whether the urban water supplier is implementing or scheduling the implementation of water demand management activities.

4.2 Implemented DMMs

Western is a signatory to the CUWCC MOU regarding Urban Water Conservation in California and has provided the 2004 Best Management Practices Report in Appendix E to show DMM implementation.

Section 5
Water Shortage Contingency plan

Western has prepared a Water Shortage Contingency Plan to respond to water shortages within its retail service area.

5.1 Stages of Action

5.1.1 Law

Water Code Section 10632 (a)

The plan shall provide an urban water shortage contingency analysis which includes each of the following elements which are within the authority of the urban water supplier:

(a) Stages of action to be undertaken by the urban water supplier in response to water supply shortages, including up to a 50 percent reduction in water supply, and an outline of specific water supply conditions which are applicable to each stage.

5.1.2 Water Shortage Stages

Supply shortage triggering levels are set by MWD for their supplies of SWP and CRA (MWD, 2005). Under most shortages, MWD believes it will be able to meet demands for water by withdrawals from storage. Should mandatory import water allocations become necessary for a severe long-term drought, allocation will be calculated on the basis of need, rather than historical purchases. The following would be considered for equitable allocation of imported water:

- Impact on retail consumers and regional economy;
- Investments in local resources including recycling and conservation;
- Population growth;
- Changes in local supplies;
- Participation in MWD interruptible programs; and
- Investment in MWD facilities.

Under a severe water shortage, MWD would enforce allocations using rate surcharges of up to 3 times the full-service rate for deliveries exceeding 102% of the allocation.

During a previous drought period, Western developed a Drought Contingency Plan (WMWD, 1992). The plan identified stages of action with required reductions in water use. These stages of action were enforced with mandatory water use restrictions which could also be enforced during future severe water shortages. Water use restrictions included:

- Street/sidewalk Cleaning;
- Washing Cars;
- Watering Lawn/Landscapes;
- Uncorrected Plumbing Leaks;
- Gutter Flooding;
- Restricted Outdoor Watering (watering per schedule only);
- Non-permanent Agriculture;
- Restriction on Construction Water Use; and
- Restrictions on New Landscaping.

5.2 Estimation of Minimum Supply for the Next Three Years

5.2.1 Law

Water Code Section 10632 (b)

(b) An estimate of the minimum water supply available during each of the next three water years based on the driest three-year historic sequence for the agency's water supply.

5.2.2 Supply for 2006 to 2008

The minimum water supply for the next three years has been estimated for the Western retail service area. Based on a three-year drought sequence, both SWP and Colorado River sources could be reduced. However, MWD has identified a resource management plan that should result in 100 percent reliability for non-discounted non-interruptible demands through 2030 (MWD, 2005). A summary of the estimated minimum water supply is provided in Table 24.

5.3 Catastrophic Supply Interruption Plan

5.3.1 Law

Water Code Section 10632 (c)

(c) Actions to be undertaken by the urban water supplier to prepare for, and implement during, a catastrophic interruption of water supplies including, but not limited to, a regional power outage, an earthquake, or other disaster.

5.3.2 Plan for Water Supply During Catastrophes

For non-drought events, interruption in supplies may occur. Such events may include sudden unexpected occurrences such as fires, floods, earthquakes, accident or sabotage. These types of events could interrupt power supplies or cause damage to facilities. Western participated in the Multi-Jurisdictional Local Hazard Mitigation Plan (LHMP) for the Riverside Operational Area (County of Riverside, 2004) to identify and plan for local hazards. Identified hazards include earthquakes, flooding, hazardous material incidents, power losses, extreme weather, and terrorism as summarized below. Some facilities modification identified in the LHMP may help limit the severity of potential impacts should a catastrophe occur. This would lessen the potential for impact to the water supply.

Table 24. Three-Year Estimated Minimum Water Supply – AF/YR

Source	Normal	2006	2007	2008
MWD-Retail Service Area	26,688	27,755	28,866	29,818
Total	26,688	27,755	28,866	29,818

Notes: Multiple dry years are as described in Section 3.4. Planned Water Supply Projects and Programs
Values include 4% increase for 2006 and 2007, then 3.3% for 2008 to match projected population growth. Normal year is assumed to be 2005.

Western Municipal Water District Critical Facilities Assessed July 2003 Hazard Assessment			
Hazard	**Probability of occurrence**	**2006**	**2007**
Step 1	**Step 2**	**Step 3**	**Step 4**
Natural Events			
Earthquake	3	3	9
Import Failure	2	3	6
Severe Storm	2	2	4
High Winds (70+)	2	2	4
Landslide	0	3	0
Flood	1	2	2
Drought	2	1	2
Man-Made Events			
Waterborne Disease	2	2	4
Fire/Arson	1	3	3
Loss of Key Staff	1	2	2
Full Shortage	1	1	1
Terrorism	1	3	3
Technological Events			
Power Outage	3	3	9
HVAC Failure	2	2	4
SCADA Failure	2	2	4
Computer Virus	3	3	9

Step 2:

0 = Not Applicable
1 = Low
2 = Medium
3 = High

Step 3:

3 = No Early Warning
2 = Short Duration Early Warning
1 = Long Early Warning

Step 4:

Probability X Reaction
The higher the rating, the greater the potential

Table 25. Preparation Actions for a Catastrophe

Possible Catastrophe	Summary of Actions
Regional power outage	Assess facility/systems; Repair or reactivate as appropriate; Work with MWD and local agencies to provide potable water; Perform appropriate community outreach
Earthquake	Assess facility/systems; Repair or reactivate as appropriate; Work with MWD and local agencies to provide potable water; Perform appropriate community outreach; MWD to release from Emergency Storage as required.
Extreme Weather	Assess facility/systems; Repair or reactivate as appropriate; Work with MWD and local agencies to provide potable water; Perform appropriate community outreach
Terrorism/Sabotage (includung computer	Check for signs of contamination; Assess facility/systems; Repair or reactivate as appropriate; Work with MWD and local agencies to provide potable water; Perform appropriate community outreach
Water Borne Disease	Check for signs of contamination; Assess facility/systems; Repair or reactivate as appropriate; Work with MWD and local agencies to provide potable water; Perform appropriate community outreach
System Failure (HVAC and SCADA)	Assess facility/systems; Repair or reactivate as appropriate; Work with MWD and local agencies to provide potable water; Perform appropriate community outreach

To respond to catastrophes, Western has prepared an Emergency Response and Recovery Plan (WMWD, 2005b). This document is designed to prepare Western for a planned response to emergency situations associated with natural disasters, technological incidents, and national security emergencies in, or affecting, a water/ wastewater utility facility and its service area. This plan describes the following:

- Western's emergency management organization required to assist in mitigating any significant emergency or disaster.
- Authorities, policies, responsibilities, and procedures required to protect the health and safety of customers, personnel, and facility property.
- Operational concepts and procedures associated with field response to emergencies, Emergency Operations Center (EOC) activities, and the recovery process.
- Implementation of the Standardized Emergency Management System (SEMS) for use within Riverside County operational area, regional, and state systems.
- Multi-agency and multi-jurisdictional coordination, particularly between Western and local, state, and federal agencies during emergency operations.
- Pre-event emergency planning as well as emergency operations procedures.

This plan has been designed for conformance with SEMS (Government Code Section 8607) and should be used in conjunction with the State Emergency Plan and local emergency plans.

To manage water supply concerns during catastrophes, Western will isolate areas that will take the longest to restore to service and work with local government and MWD to provide alternate water supplies. The Office of Emergency Services has developed a guidance document entitled *Multi-Agency Emergency Response Procedures for Potable Water Procurement and Distribution* to assist water utilities and local governments in meeting the requirement to provide water to the public, and Western will work with this Agency to provide the public with potable water.

In general to manage catastrophes, Western will:

- Set priorities on repair work.
- Plan to restore service area by area.
- Get input from the emergency operations center on essential uses.
- Consider feeder lines.
- Keep in mind the need for firefighting water.
- Request mutual aid/assistance if the needed repairs exceed Western's ability to complete repairs in a timely manner.

The public will be kept informed through activating Western's Water Service Emergency Notification Plan.

MWD has also prepared plans to safeguard from a catastrophic loss of water supply by developing emergency storage (MWD, 2005). MWD emergency storage require-

ments have been based on the potential for a major earthquake damaging aqueducts and causing supply interruptions through the aqueducts for six months. In this scenario, MWD would suspend interruptible service deliveries and firm supplies would be limited to 75% of normal-year demand levels. With only a few exceptions, the emergency supplies would be deliverable through gravity, reducing dependence on power sources.

5.4 Prohibitions, Penalties and Consumption Reduction Methods

5.4.1 Law

Water Code Section 10632 (d-f)

(d) Additional, mandatory prohibitions against specific water use practices during water shortages, including, but not limited to, prohibiting the use of potable water for street cleaning.

(e) Consumption reduction methods in the most restrictive stages. Each urban water supplier may use any type of consumption reduction methods in its water shortage contingency analysis that would reduce water use, are appropriate for its area, and have the ability to achieve a water use reduction consistent with up to a 50 percent reduction in water supply.

(f) Penalties or charges for excessive use, where applicable.

5.4.2 Prohibitions During Water Shortages

Previously, Western has adopted Ordinances to restrict water usage and apply penalties for excess usage using water shortages. Copies of these Ordinances are provided in Appendix G. Although ordinances were rescinded after the water shortage, these restrictions will serve as a model for future needs. A summary of the prohibi-

Table 26. Mandatory Prohibitions

Examples of Prohibitions	Stage When Prohibition Becomes Mandatory
Street/sidewalk Cleaning	May Vary
Washing Vars	May Vary
Watering Lanw/Landscapes	May Vary
Non-permanent Agriculture	May Vary
Uncorrected Plumbing Leaks	May Vary
Gutter Flooding	May Vary
Restricted Outdoor Watering (watering per schedule only)	May Vary
Restriction on Construction Water Use	May Vary
Restriction on New Landscaping	May Vary

Table 27. Consumption Reduction Methods

Consumption Reduction Methods	Stage When Method Takes Effect	Project Reduction (%)
Demand Reduction Program	May Vary	Varies with Stage
Voluntary Rationing	May Vary	10% (Total)
Education Program	May Vary	10% (Total)
Plumbing Fixture Replacement	May Vary	10% (Total)
Mandatory Rationing	May Vary	Up to 50% (Total)
Flow Restriction	May Vary	Up to 50% (Total)
Use Prohibitions	May Vary	Up to 50% (Total)
Water Shortage Pricing	May Vary	Up to 50% (Total)
Per Capita Allotment by Customer Type	May Vary	Up to 50% (Total)
Percentage Reduction by Customer Type	May Vary	Up to 50% (Total)

Table 28. Penalties and Charges

Penalties or Charges	Stages When Penalty Takes Effect
Charge for Excess Use	May Vary
Charge per Unit over Allotment	May Vary

tions is provided in Table 26 and consumption reduction methods in Table 27. Penalties that have been imposed are summarized in Table 28. The stage at which prohibitions become mandatory and consumption reduction methods are imposed could be staggered such that sufficient reductions in demand are achieved. Additional penalties also could be required such as citations for violations of outdoor watering, such as were imposed during the February 2005 water shortage (See Ordinance 358 in Appendix G).

5.5 Analysis of Revenue Impacts of Reduced Sales During Shortages

5.5.1 Law

Water Code Section 10632 (g)

(g) An analysis of the impacts of each of the actions and conditions described in subdivisions (a) to (f), inclusive, on the revenues and expenditures of the urban water supplier, and proposed measures to overcome those impacts, such as the development of reserves and rate adjustments.

5.5.2 Impact to Revenues from Consumption Reduction

Consumption reduction will impact revenues by decreasing the amount of water sold to customers. Historically, the penalties for excess water use have encouraged conservation, thereby, reducing revenues from water sales. Generally, penalties provide only a very small amount of revenues. If the water shortage is deemed temporary, a rate increase may not be required. However, for long-term shortages, immediate rate increases would be considered. A consequence of rate increases may be further conservation by customers. Fixed domestic monthly service charges would not be expected to significantly change due to a water shortage. These charges would provide revenue for operational expenditures.

Water shortages may also impact construction activities. A reduction in construction activities will reduce fees collected by Western such as water service connection fees, engineering services fees such as plan checking, and annexation fees.

A summary of actions and conditions that impact revenues is provided below.

As consumption decreases, some expenditures are expected to increase. Staff costs for community education, enforcement of ordinances, monitoring and evaluation of water use, drought planning, and dealing with customer questions and complaints are expected to rise. If construction is drastically reduced, staff may not be required for certain functions, but it is expected that the increased work load to deal with water shortage issues will more than offset the reduced work load for construction support. Operations and maintenance costs may also increase because of the need to identify and quickly repair all water losses. Power costs may also increase if supplies from temporary sources such as the Arlington Desalter must be used. MWD has adopted a policy expected to stabilize rates during water shortages (MWD, 2005). Therefore, water supply costs from MWD are not expected to increase because of water shortages.

A summary of actions and conditions that impact expenditures is provided below.

Western has developed reserve funds to sustain the revenue and expendi-

Actions and Conditions that Impact Revenues

Type	Anticipated Revenue Reduction
Reduced Sales	Proportional to the decrease in water sales and are expected to range from 10to 30%.
Reduced Construction	Reduction in fees collected during planning and construction activities.

Actions and Conditions that Impact Expenditures

Category	Anticipated cost
Increase Staff Cost	Estimated at 5 to 15%
Increase O&M Cost	Estimated at 5 to 15%
Increase Cost of Supply	Temporary supplies at increase cost. MWD supply cost expected to be stable

ture impacts of a short-term water shortage. Reserve funds could be withdrawn for a 1 to 2 year period to cover the increased costs and reduced revenue. If the water shortage is long-term, rate increases are expected to be considered to mitigate the increased expenditures. Long-term water shortages may also require reducing capital expenditures by delaying projects for major facilities construction, upgrade or replacement, limiting new connections to decrease operational expenditures, and evaluating methods to reduce overhead. Summaries of measures to overcome revenue and expenditure impacts are provided in Table 29 and 30.

Table 29. Proposed Measures to Overcome Revenue Impacts

Names of measures	Summary of Effects
Rate Sales	Proportion to the rate increase and amount of water sold. Increased rates may also decrease water usage.
Reserves	Use of reserves may provide short-term rate stabilization, but require delays in capital expenditures and rebuilding of reserves after the water shortage.

Table 30. Proposed Measures to Overcome Expenditure Impacts

Names of measures	Summary of Effects
Decrease Capital Expenditurs	Delay major construction projects for facilities as well as upgrades and replacements.
Reduce Overhead	If staff reductions required, may impact operations and customer response.

5.6 Draft Ordinance and Use Monitoring Procedure

5.6.1 Law

Water Code Section 10632 (h&i)

(h) A draft water shortage contingency resolution or ordinance.

(i) A mechanism for determining actual reductions in water use pursuant to the urban water shortage contingency analysis.

5.6.2 Draft Water Shortage Ordinance

Western has previously adopted several ordinances for water shortages. These ordinances have dealt with drought conditions and water shortage emergencies.

Ordinances passed in 1991 outlined Western's mandatory water use restrictions to deal with water supply cutbacks caused by drought. Conservation measures included:

- Prohibitions on hosing of driveways and sidewalks, and washing of vehicles;
- Timing of landscape watering;
- Serving of water in restaurants and other public places serving food only on request;
- Operation of irrigation systems to avoid overspray, runoff, and waste;
- Prohibition of water use for certain construction uses; and
- Prohibition of new connections unless water efficient landscaping approved by Western was installed.

Customers were recommended to install spa and pool covers, check for indoor leaks, use water saving devices, and incorporate low water demand landscaping in new construction. Surcharges were imposed for excess water consumption.

Copies of the 1991 drought ordinances are provided in Appendix G.

In February 2005, a 5-day shutdown of the MWD treatment plant supplying potable water to Western required mandatory water conservation under a water shortage emergency. Ordinance 358 (provided in Appendix G) restricted all non-essential indoor and outdoor water use to maintain water supply levels necessary for human consumption, sanitation and fire protec-

tion. This water shortage emergency required prohibition of use of potable water for:

- Irrigation of lawns and landscapes, parks, school grounds, golf courses, medians, agriculture, groves and other outdoor planted areas;
- Hosing down of driveways, sidewalks, patios, building walls or other paved areas excepted as required by health and safety codes;
- Washing of cars, trucks, vans, campers, trailers, or other vehicles without using solely a hose with an automatic shutoff nozzle other than at a commercial car wash or service station using reclaimed or recycled water; and
- Construction purposes such as dust control, site cleanup, compaction or street washing.

Additionally, Western could, at any time during the Water Shortage Emergency period, discontinue wholesale water deliveries.

Similar ordinances would be passed in the event of a future water shortage.

5.6.3 Use Monitoring Procedures

Western monitors sales and deliveries on a monthly and daily basis. All Western's water sales are metered and all connections are read monthly. Water orders are scheduled on a daily basis with water deliveries recorded daily. Water deliveries and transfers at booster stations can be monitored through Western's SCADA system to determine usage in various portions of the retail area.

Table 31 summarizes the water use monitoring mechanisms.

Table 31. Water Use Monitoring Mechanisms

Mechanisms for determining actual reductions	Type and Quality of Data Expected
Normalized/Average Water Use Baseline Used to Determine Reduction	Quantity Comparisons of Previous Water Use, expected to be within approximately 10% if weather conditions are similar and other user conditions have not changed.

Section 6
Recycled Water Plan

6.1 Law

Water Code Section 10633

The plan shall provide, to the extent available, information on recycled water and its potential for use as a water source in the service area of the urban water supplier. The preparation of the plan shall be coordinated with local water, wastewater, groundwater, and planning agencies that operate within the supplier's service area, and shall include all of the following:

6.2 Introduction

Western Municipal Water District is responsible for the collection and treatment of wastewater at the March Wastewater Reclamation Facility (WWRF). The wastewater collection and treatment system originally served an Air Force installation. This installation has been realigned from an active military base to an Air Reserves Base with the on-going conversion of a large portion of the former facility to non-military uses. Additionally, the wastewater collection and treatment area is expanding to include an area of former agricultural lands that is rapidly changing into residential and commercial developments. The portion of the Western retail service area that is served by the March WWRF is shown in Figure 3. Wastewater in the remainder of the retail service area is collected and treated by the City of Riverside or the West Riverside County Regional Wastewater Treatment Plant or individual septic treatment systems. The City of Riverside sewer collection system area is shown in Figure 4. The West Riverside County Regional Wastewater Treatment Plant

services the Lake Hills area in the extreme northwest portion of Western's retail area.

Many private septic systems serve residences in the less-densely developed area of Western's retail service area. Prior to 1988 all homes and business in the retail service area were on septic systems and the majority of those units remain on septic systems, as well as additional homes in outlying areas not near a location with a sewage collection system. After 1988, some areas were annexed into the City of Riverside and installation of sewers began.

6.3 Coordination

Western has coordinated the development of the plan with the appropriate agencies. Western owns and operates the water delivery system through its retail area with minor exceptions that are served by the City of Riverside. Western also operates the March WWRF and the West Riverside County Regional Wastewater Treatment Plant. Only a small portion of the retail area is serviced by a wastewater collection system operated by the City of Riverside. The City of Riverside has been provided a copy of the draft UWMP for review. The City and County of Riverside are the planning agencies with jurisdiction in the Western retail area, and they have also been provided with a copy of the draft UWMP for review.

6.4 Wastewater Quantity, Quality and Current Uses

6.4.1 Law

Water Code Section 10633 (a-c)

(a) A description of the wastewater collection and treatment systems in the supplier's service area, including a quantification of the amount of wastewater collected and treated and the methods of wastewater disposal.

(b) A description of the quantity of treated wastewater that meets recycled water standards, is being discharged, and is otherwise available for use in a recycled water project.

(c) A description of the recycled water currently being used in the supplier's service area, including, but not limited to, the type, place, and quantity of use.

Table 32. Participating Agencies

	Role in Plan Development
Water agencies	Provided for review
Wastewater agencies	Provided for review
Groundwater agencies	NA
Planning agencies	Provided for review

6.4.2 Wastewater Collection and Treatment in the Retail Service Area

The March Wastewater Reclamation Facility (WWRF) currently treats to secondary standards approximately 0.3 million gallons per day (MGD) collected from the area shown in Figure 3. An ongoing upgrade of the facility will allow the plant to treat up to 1.0 MGD. It is predicted that the increased residential and commercial load to the facility will require expansion to treat up to 5 MGD within the next 25 years.

The treated wastewater is currently reclaimed for irrigation at a public golf course and the Riverside National Cemetery. These two irrigators use, on average, 0.75 MGD for seven months of the year. When wastewater flow exceeds irrigation demands (during the winter months), the treated wastewater is stored in an existing 40 million gallon pond until demand increases. The existing distribution system for the reclaimed water from the March WWRF consists of storage ponds and piping to deliver water only to the public golf course and the Riverside National Cemetery north of the treatment plant. Treated wastewater is stored in a pond at the treatment plant and pumped out to the users on demand. When irrigation demand exceeds the treatment plant supply, untreated imported water from the Colorado River Aqueduct purchased from MWD is pumped and gravity fed through an existing non-potable irrigation distribution system to a holding pond southwest of the golf course. This water then can be delivered from the holding pond to the public golf course and the Riverside National Cemetery.

Currently treated wastewater cannot be fed into the existing non-potable irrigation distribution system.

The existing non-potable distribution system consists of an interconnected series of pipelines, reservoirs and pump stations designed to distribute non-potable water through a large area of the District. The water in this system can be derived from two sources - imported water from Metropolitan Water District of Southern California (MWD) or non-potable groundwater pumped from a nearby groundwater basin and delivered via a canal and pump station to the system. Not including the facilities delivering non-potable groundwater, the non-potable irrigation distribution system has approximately 180,000 feet of main pipelines ranging from 42 inches to 8 inches in diameter. Pump stations and gravity feed from reservoirs move water to the extremes of the distribution system. There is available storage capacity of approximately 19 million gallons in nine tanks, not including holding ponds for irrigation of the public golf course and the Riverside National Cemetery. The main system has 23 pumps in 6 pump stations with a combined rating of 4285 horsepower.

With the expansion of the March WWRF, additional recycled water will be available in excess of that used by the public golf course and the National Cemetery. This will require integration of the system distributing treated wastewater to the golf course and the National Cemetery with the existing non-potable distribution system. A study is currently underway to provide the required information for conversion of the system for use of recycled water.

Wastewater volumes treated at the March WWRF are expected to increase. Commercial and residential wastewater volumes are expected to be 2250 AF in 2010 based on currently anticipated growth. Using a growth factor of 3.3% per year from 2010 to 2030, volumes treated at the March WWRF will reach 3780 AF in 2030. A summary of estimated wastewater volumes to March WWRF is provided in Table 33. All treated wastewater from the March WWRF is expected to be recycled for irrigation or industrial purposes. As shown in Table 34, no recycled water is expected to be disposed of by methods other than beneficial use. Table 35a provides the amount of recycled water sent to the golf course and cemetery in 2005.

Wastewater is collected in the areas within the City of Riverside shown on Figure 4 by the City of Riverside for treatment at the Riverside Regional Water Quality Control Plant. Minor amounts are reclaimed for irrigation use and the remainder is discharged to the Santa Ana River for downstream and in-stream uses. A majority of the discharge flow is required to meet downstream water right obligations (Orange County Water District vs. City of Chino et. al., Case #117628). The City of Riverside has conceptual plans to expand recycling (Personal communication, Rod Cruze, City of Riverside, March 2005).

Wastewater from the Lake Hills area in the extreme northwestern portion of Western's retail service area flows to the Western Riverside County Wastewater Treatment Plant. This plant also receives flows from the City of Norco and unincorporated areas of Riverside County. Treated wastewater from this facility is currently discharged to the Santa Ana River. However, diversion of some of the flows to the City of Norco for landscape

Table 33. Wastewater Collected and Treated – AF/YR

Water Distributed	2000	2005	2010	2015	2020	2025	2030
Wastewater collected & treated in service area	386	450	2680	3850	4430	5210	6130
Volume that meets recycled water standard	386	450	2680	3850	4430	5210	6130

Table 34. Disposal of Wastewater (non-recycled) - AF/YR

Water Distributed	Treatment Level	2005	2010	2015	2020	2025	2030
	Total	0	0	0	0	0	0

Note: All wastewater from the March WWRF is and will be recycled. Depending on rainfall, some storm water may require disposal, on an emergency basis.

irrigation will be initiated in mid-2005. It is estimated that up to 3 MGD of treated wastewater may be supplied to the City of Norco for parkway irrigation and supply of Lake Norcoian.

In areas of Western's retail area not serviced by the systems described above, septic systems are still in use.

Table 35a. Recycled Water Uses – Actual AF/YR

User type	Treatment Level	2005
Agriculture		0
Landscape	Secondary	450
Wildlife Habitat		0
Wetlands		0
Industrial		0
Groundwater Recharge		0
	Total	0

Note: Actual volumes through mid- 2005. Remainder of year is estimated based on historic demand.

6.5 Potential and Projected Use, Optimization Plan with Incentives

6.5.1 Law

Water Code Section 10633 (d-g)

(d) A description and quantification of the potential uses of recycled water, including, but not limited to, agricultural irrigation, landscape irrigation, wildlife habitat enhancement, wetlands, industrial reuse, groundwater recharge, and other appropriate uses, and a determination with regard to the technical and economic feasibility of serving those uses.

(e) The projected use of recycled water within the supplier's service area at the end of 5, 10, 15, and 20 years, and a description of the actual use of recycled water in comparison to uses previously projected pursuant to this subdivision.

(f) A description of actions, including financial incentives, which may be taken to encourage the use of recycled water, and the projected results of these actions in terms of acre-feet of recycled water used per year.

(g) A plan for optimizing the use of recycled water in the supplier's service area, including actions to facilitate the installation of dual distribution systems, to promote recirculating uses, to facilitate the increased use of treated wastewater that meets recycled water standards, and to overcome any obstacles to achieving that increased use.

Table 35b. Recycled Water Uses – Potential AF/YR

User type	Treatment Level	2010	2015	2020	2025	2030
Agriculture/Landscape	Tertiary	2,100	2,970	3,910	4,920	6,020
Landscape	Secondary	1,100	1,150	1,210	1,270	1,340
Wildlife Habitat		0	0	0	0	0
Wetlands		0	0	0	0	0
Industrial		0	0	0	0	0
Groundwater Recharge		0	0	0	0	0
	Total	3,200	4,120	5,120	6,190	7,360

Note: This table provides information for the March WWRF. Assumes 3% increase in usage of tertiary treated wastewater per 5 year increment. Additional wastewater from Western's retail area may be recycled at the Western Riverside County Wastewater Treatment Facility and the Riverside Regional Water Quality Control Plant. Flows from Western will be a small percentage of the total flows to these plants, and, therefore, a small percentage of the wastewater recycled from these plants.

6.5.2 Future Recycled Water Uses in Retail Service Area

As previously discussed, recycled water from the March WWRF will be available for additional uses with the upgrade to tertiary treatment. The amount of available recycled water is anticipated to increase within the next 5 to 10 years as the flows to the March WWRF increase with the rapid expansion of residential and commercial development in the District. As flows exceed the demands of the golf course and the Riverside National Cemetery, the excess reclaimed water must be either reused, discharged, or allowed to percolate. With construction of the tertiary treatment facilities and associated interconnection to the distribution system, it is expected that all recycled wastewater generated can be used at various locations. Current agricultural users, including nurseries, could then be supplied tertiary treated reclaimed water through the existing non-potable distribution

Table 36. Projected Future Use of Recycled Water in Service Area – AF/YR

User type	Treatment Level	2010	2015	2020	2025	2030
Agriculture/Landscape	Secondary	1,100	1,150	1,210	1,270	1,340
Landscape	Tertiary	1,580	2,700	3,220	3,940	4,790
Wildlife Habitat		0	0	0	0	0
Wetlands		0	0	0	0	0
Industrial		0	0	0	0	0
Groundwater Recharge		0	0	0	0	0
	Total	2,680	3,850	4,430	5,210	6,130

system. The existing distribution system can supply up to 7,200 gallons per minute to potential users. Table 35b provides a summary of the potential for use of recycled water. These projections are based on historic use of non-potable water within Western's retail service area, including the golf course and national cemetery. Additional landscape users such as new golf course, school playgrounds and parks are expected. Table 36 shows the expected available recycled water for these potential users.

In the 2000 Urban Water Management Plan, recycled water use was expected to increase rapidly. It was also anticipated that the interconnection to the treatment plant would be completed. However, actual usage is less than estimated 5 years ago as summarized in Table 37. One major factor has been the decreased agricultural uses. Additionally, other sources of non-potable water such as the importation of groundwater from a nearby basin have reduced the urgency to expend the funds for treatment plant upgrades and pipeline interconnection as long as all treated wastewater is being recycled at the golf-course and cemetery.

Table 37. Recycled Water Uses – 2000 Projection Compared with 2005 Actual – AF/YR

User type	2000 Projection for 2005	2005 use
Agriculture/Landscape	6,000	0
Landscape	5,500	450
Wildlife Habitat		
Wetlands		
Industrial		
Groundwater Recharge		
Total	11,500	450

Table 38. Methods to Encourage Recycled Water Use

User type	AF of use projected to result from this action				
Agriculture/Landscape	2010	2015	2020	2025	2030
Landscape	X	X	X	X	X
Wildlife Habitat	X	X	X	X	X
Wetlands	X	X	X	X	X
Total	3	3	3	3	3

Methods are being pursued to encourage use of recycled water. It is expected that recycled water will be available to customers at rates below that of potable water. It is also expected that recycled water use will be mandated by ordinance at sites where recycled water is available and can be properly used. Additionally, industrial/commercial developers near non-potable distribution pipelines are required to plan for the future use of recycled water. This includes installation of proper piping and facilities to minimize economic impacts when recycled water becomes available at the use site. This is being implemented through the plan checking process, with plans not approved until required recycled water facilities are designed. Western also launched a public outreach campaign in 2005 to inform the general public about the benefits of use of recycled water. A summary of the methods to encourage use of recycled water is provided in Table 38.

Section 7
Water Quality Impacts on Reliability

7.1 Law

Water Code Section 10634

The plan shall include information, to the extent practicable, relating to the quality of existing sources of water available to the supplier over the same five-year increments as described in subdivision (a) of Section 10631, and the manner in which water quality affects water management strategies and supply reliability.

Table 39. Wastewater Collected and Treated – AF/YR

Water Source	2005	2010	2015	2020	2025	2030
Potable: SWP	0	0	0	0	0	0
Non-potable: CRA, Recycled and Groundwater	0	0	0	0	0	0

7.2 Water Quality Effects to Water Management Strategies and Reliability

For potable water, Western relies almost entirely on SWP. The salinity of SWP delivered to Western is generally less than 300 mg/L and not a significant concern. In drought periods this may rise and was up to 430 mg/L in the 1977 drought (MWD, 2005). Other water quality issues to SWP include total organic carbon, bromide, pathogenic microbes and other unknown contaminants. The Delta Improvement Package including the Franks Tract levee modification is a series of projects designed to increase water supply reliability, improved water quality, environmental protection and ecosystem restoration, protection of the Delta Levee system, and improved real-time and long-term management. Supply reliability would also be enhanced. Recent modeling has shown that bromide concentrations could be significant reduced by modifications of the Franks Tract levee. Currently there are no significant constraints due to water quality. If projects continue as planned no reduction in supply due to water quality are projected.

Non-potable water may be supplied by CRA, recycled water, or purchased imported groundwater. Because this is used for non-potable purposes such as landscape irrigation, there is no expected reduction in water supply due to water quality.

Table 39 summarized the current and projected water supply changes due to water quality.

Section 8
Water Service Reliability

8.1 Law

Water Code Section 10635

(a) Every urban water supplier shall include, as part of its urban water management plan, an assessment of the reliability of its water service to its customers during normal, dry, and multiple dry water years. This water supply and demand assessment shall compare the total water supply sources available to the water supplier with the total projected water use over the next 20 years, in five-year increments, for a normal water year, a single dry water year, and multiple dry water years. The water service reliability assessment shall be based upon the information compiled pursuant to Section 10631, including available data from state, regional, or local agency population projections within the service area of the urban water supplier.

(b) The urban water supplier shall provide that portion of its urban water management plan prepared pursuant to this article to any city or county within which it provides water supplies no later than 60 days after the submission of its urban water management plan.

(c) Nothing in this article is intended to create a right or entitlement to water service or any specific level of water service.

(d) Nothing in this article is intended to change existing law concerning an urban water supplier's obligation to provide water service to its existing customers or to any potential future customers.

8.2 Projected Normal Water Year Supply and Demand

The projected normal water year supply includes both potable water from the SWP for various uses and untreated non-potable water from the CRA for agricultural and landscape irrigation. Wholesale water sales also comprise a portion of the supply Western receives from MWD. MWD has projected that sufficient supplies exist to meet demands for their agencies (MWD, 2005). Therefore, supplies will equal demands since MWD will deliver the needed quantities of water while placing supplies not required on a yearly basis into storage for use in droughts or emergency conditions. Table 40 summarizes the projected supply for the Western retail and wholesale transactions. These supplies will be used to meet the demand summarized in Table 41. A comparison of the supply and demand is provided in Table 42.

Table 40. Projected Normal Water Year Supply – AF/YR

Water Source	2010	2015	2020	2025	2030
Supply					
Retail Service Area	33,197	38,206	44,108	51,059	59,221
Wholesale Water Sales	88,902	101,146	111,837	123,784	134,028
% of Normal year	100	100	100	100	100

Note: Normal Year supply will vary as MWD brings on additional supplies.

Table 41. Projected Normal Water Year Demand – AF/YR

	2010	2015	2020	2025	2030
Demand					
Retail Service Area	33,197	38,206	44,108	51,059	59,221
% of Year 2005	116%	134%	154%	179%	207%
Wholesale Water Sales	88,902	101,146	111,837	123,784	134,028
% of Year 2005	114%	130%	143%	159%	172%

Note: See Table 12, 13, 14 and 15 for further details.

Table 42. Projected Normal Year Supply and Demand Comparison – AF/YR

	2010	2015	2020	2025	2030
Retail Service Area					
Supply Totals	33,197	38,206	44,108	51,059	59,221
Demand Totals	33,197	38,206	44,108	51,059	59,221
Difference (Supply Minus D Demand)	0	0	0	0	0
Difference as % of Supply	0	0	0	0	0
Difference as % of Demand	0	0	0	0	0
Wholesale Water Sales					
Supply Totals	88,902	101,146	111,837	123,784	134,028
Demand Totals	88,902	101,146	111,837	123,784	134,028
Difference (Supply Minus D Demand)	0	0	0	0	0
Difference as % of Supply	0	0	0	0	0
Difference as % of Demand	0	0	0	0	0

Table 43. Projected Single Dry Year Supply – AF/YR

Water Source	2010	2015	2020	2025	2030
Supply					
Retail Service Area	33,197	38,206	44,108	51,059	59,221
Wholesale Water Sales	91,174	104,098	115,339	127,936	138,930
% of Projected Normal	101%	102%	102%	102%	102%

Note: Normal as defined on Table 40.

Table 44. Projected Single Dry Year Demand – AF/YR

Water Source	2010	2015	2020	2025	2030
Demand					
Retail Service Area	33,197	38,206	44,108	51,059	59,221
Wholesale Water Sales	91,174	104,098	115,339	127,936	138,930
% of Projected Normal	104%	104%	104%	104%	104%

Note: Normal as defined on Table 41.

Table 45. Projected Single Dry Year Supply and Demand Comparison – AF/YR

	2010	2015	2020	2025	2030
Retail Service Area					
Supply Totals	33,197	38,206	44,108	51,059	59,221
Demand Totals	33,197	38,206	44,108	51,059	59,221
Difference (Supply Minus D Demand)	0	0	0	0	0
Difference as % of Supply	0	0	0	0	0
Difference as % of Demand	0	0	0	0	0
Wholesale Water Sales					
Supply Totals	91,174	104,098	115,339	127,936	138,930
Demand Totals	91,174	104,098	115,339	127,936	138,930
Difference (Supply Minus D Demand)	0	0	0	0	0
Difference as % of Supply	0	0	0	0	0
Difference as % of Demand	0	0	0	0	0

8.3 Projected Single Dry Year Supply and Demand Comparison

MWD has predicted that sufficient supply exists to meet demands for single dry year requirements. As required, droughts may prompt additional water conservation measures to ensure sufficient supply is maintained. However, normal demands are used to provide conservative estimations of demand. MWD has projected that sufficient supplies exist to meet demands during dry years for their agencies (MWD, 2005). Therefore, supplies will equal demands since MWD will deliver only the needed quantities of water. Supplies during years of excess water that are not required for normal demands will be placed into storage for use in droughts or emergency conditions. A summary of projected single dry year supply is summarized in Table 43, single dry year demand in Table 44, and a comparison in Table 45.

8.4 Projected Multiple Dry Year Supply and Demand Comparison

MWD has predicted that sufficient supply exists to meet demands for multiple dry year requirements. As required, droughts may prompt additional water conservation measures to ensure sufficient supply is maintained. However, normal demands are used to provide conservative estimations of demand. MWD has projected that sufficient supplies exist to meet demands during dry years for

Table 46. Projected Supply During Multiple Dry Year Period Ending in 2010 – AF/YR

Water Source	2006	2007	2008	2009	2010
Supply					
Retail Service Area	29,557	30,715	31,403	32,286	33,197
Wholesale Water Sales	81,856	84,185	86,515	88,844	91,174
% of Projected Normal	102%	102%	102%	102%	103%

Note: Normal as defined on Table 40. Multiple Dry Year Period is based on Table 8.

Table 47. Projected Demand During Multiple Dry Year Period Ending in 2010 – AF/YR

Water Source	2006	2007	2008	2009	2010
Demand					
Retail Service Area	29,557	30,715	31,403	32,286	33,197
Wholesale Water Sales	81,856	84,185	86,515	88,844	91,174
% of Projected Normal	102%	102%	102%	102%	103%

Note: Normal as defined on Table 41. Multiple Dry Year Period is based on Table 8.

Table 48. Projected Supply and Demand Comparison During Multiple Dry Year Period Ending in 2010– AF/YR

	2006	2007	2008	2009	2010
Retail Service Area					
Supply Totals	29,557	30,715	31,403	32,286	33,197
Demand Totals	29,557	30,715	31,403	32,286	33,197
Difference (Supply Minus D Demand)	0	0	0	0	0
	0	0	0	0	0
Difference as % of Demand	0	0	0	0	0
Wholesale Water Sales					
Supply Totals	81,856	84,185	86,515	88,844	91,174
Demand Totals	81,856	84,185	86,515	88,844	91,174
Difference (Supply Minus D Demand)	0	0	0	0	0
Difference as % of Supply	0	0	0	0	0
Difference as % of Demand	0	0	0	0	0

their agencies (MWD, 2005). Therefore, supplies will equal demands since MWD will deliver only the needed quantities of water. Supplies during years of excess water not required for normal demands will be placed into storage for use in droughts or emergency conditions. A summary of projected multiple year supply is summarized in Table 46, multiple dry year demand in Table 47, and a comparison in Table 48 for the period ending 2010. A summary of projected multiple year supply is summarized in Table 49, multiple dry year demand in Table 50, and a comparison in Table 51 for the period ending 2015. A summary of projected multiple year supply is summarized in Table 52, multiple dry year demand in Table 53, and a comparison in Table 54 for the period ending 2020. A summary of projected multiple year supply is summarized in Table 55, multiple dry year demand in Table 56, and a comparison in Table 57 for the period ending 2025. A summary of projected multiple year supply is summarized in Table 58, multiple dry year demand in Table 59, and a comparison in Table 60 for the period ending 2030.

Table 49. Projected Supply During Multiple Dry Year Period Ending in 2015 – AF/YR

Water Source	2011	2012	2013	2014	2015
Supply					
Retail Service Area	34,138	35,109	36,110	37,142	38,207
Wholesale Water Sales	93,758	96,343	98,928	101,513	104,098
% of Projected Normal	102%	102%	102%	102%	103%

Note: Normal as defined on Table 41. Multiple Dry Year Period is based on Table 8.

Table 50. Projected Demand During Multiple Dry Year Period Ending in 2015 – AF/YR

Water Source	2011	2012	2013	2014	2015
Demand					
Retail Service Area	34,138	35,109	36,110	37,142	38,207
Wholesale Water Sales	93,758	96,343	98,928	101,513	104,098
% of Projected Normal	102%	102%	102%	102%	103%

Note: Normal as defined on Table 41. Multiple Dry Year Period is based on Table 8.

Table 51. Projected Supply and Demand Comparison During Multiple Dry Year Period Ending in 2015– AF/YR

	2011	2012	2013	2014	2015
Retail Service Area					
Supply Totals	34,138	35,109	36,110	37,142	38,207
Demand Totals	34,138	35,109	36,110	37,142	38,207
Difference (Supply Minus D Demand)	0	0	0	0	0
Difference as % of Supply	0	0	0	0	0
Difference as % of Demand	0	0	0	0	0
Wholesale Water Sales					
Supply Totals	93,758	96,343	98,928	101,513	104,098
Demand Totals	93,758	96,343	98,928	101,513	104,098
Difference (Supply Minus D Demand)	0	0	0	0	0
Difference as % of Supply	0	0	0	0	0
Difference as % of Demand	0	0	0	0	0

Table 52. Projected Supply During Multiple Dry Year Period Ending in 2020 – AF/YR

Water Source	2016	2017	2018	2019	2020
Supply					
Retail Service Area	39,316	40,460	41,639	42,855	44,109
Wholesale Water Sales	106,346	108,594	110,842	113,090	115,339
% of Projected Normal	103%	103%	103%	103%	103%

Note: Normal as defined on Table 40. Multiple Dry Year Period is based on Table 8.

Table 53. Projected Demand During Multiple Dry Year Period Ending in 2020 – AF/YR

Water Source	2011	2012	2013	2014	2015
Demand					
Retail Service Area	39,316	40,460	41,639	42,855	44,109
Wholesale Water Sales	106,346	108,594	110,842	113,090	115,339
% of Projected Normal	103%	103%	103%	103%	103%

Note: Normal as defined on Table 41. Multiple Dry Year Period is based on Table 8.

Table 54. Projected Supply and Demand Comparison During Multiple Dry Year Period Ending in 2020 – AF/YR

	2016	2017	2018	2019	2020
Retail Service Area					
Supply Totals	39,316	40,460	41,639	42,855	44,109
Demand Totals	39,316	40,460	41,639	42,855	44,109
Difference (Supply Minus D Demand)	0	0	0	0	0
Difference as % of Supply	0	0	0	0	0
Difference as % of Demand	0	0	0	0	0
Wholesale Water Sales					
Supply Totals	106,346	108,594	110,842	113,090	115,339
Demand Totals	106,346	108,594	110,842	113,090	115,339
Difference (Supply Minus D Demand)	0	0	0	0	0
Difference as % of Supply	0	0	0	0	0
Difference as % of Demand	0	0	0	0	0

Table 55. Projected Supply During Multiple Dry Year Period Ending in 2025 – AF/YR

Water Source	2021	2022	2023	2024	2025
Supply					
Retail Service Area	45,415	46,762	48,151	49,583	51,059
Wholesale Water Sales	117,858	120,377	122,897	125,416	127,936
% of Projected Normal	103%	103%	103%	103%	103%

Note: Normal as defined on Table 40. Multiple Dry Year Period is based on Table 8.

Table 56. Projected Demand During Multiple Dry Year Period Ending in 2025 – AF/YR

Water Source	2021	2022	2023	2024	2025
Demand					
Retail Service Area	45,415	46,762	48,151	49,583	51,059
Wholesale Water Sales	117,858	120,377	122,897	125,416	127,936
% of Projected Normal	103%	103%	103%	103%	103%

Note: Normal as defined on Table 41. Multiple Dry Year Period is based on Table 8.

Table 57. Projected Supply and Demand Comparison During Multiple Dry Year Period Ending in 2025 – AF/YR

	2021	2022	2023	2024	2025
Retail Service Area					
Supply Totals	45,415	46,762	48,151	49,583	51,059
Demand Totals	45,415	46,762	48,151	49,583	51,059
Difference (Supply Minus D Demand)	0	0	0	0	0
Difference as % of Supply	0	0	0	0	0
Difference as % of Demand	0	0	0	0	0
Wholesale Water Sales					
Supply Totals	117,858	120,377	122,897	125,416	127,936
Demand Totals	117,858	120,377	122,897	125,416	127,936
Difference (Supply Minus D Demand)	0	0	0	0	0
Difference as % of Supply	0	0	0	0	0
Difference as % of Demand	0	0	0	0	0

Table 58. Projected Supply During Multiple Dry Year Period Ending in 2030 – AF/YR

Water Source	2026	2027	2028	2029	2030
Supply					
Retail Service Area	52,593	54,175	55,806	57,487	59,221
Wholesale Water Sales	130,134	132,333	134,532	136,731	138,930
% of Projected Normal	103%	103%	103%	103%	104%

Note: Normal as defined on Table 40. Multiple Dry Year Period is based on Table 8.

As shown, supplies are expected to meet demands for all multiple dry year scenarios.

Section 9
Adoption and Implementation of UWMP

9.1 Law

Water Code Section 10640-10645

10640. Every urban water supplier required to prepare a plan pursuant to this part shall prepare its plan pursuant to Article 2 (commencing with Section 10630). The supplier shall likewise periodically review the plan as required by Section 10621, and any amendments or changes required as a result of that review shall be adopted pursuant to this article.

10641. An urban water supplier required to prepare a plan may consult with, and obtain comments from, any public agency or state agency or any person who has special expertise with respect to water demand management methods and techniques.

10642. Each urban water supplier shall encourage the active involvement of diverse social, cultural, and economic elements of the population within the service area prior to and during the preparation of the plan. Prior to adopting a plan, the urban water supplier shall make the plan available for public inspection and shall hold a public hearing thereon. Prior to the hearing, notice of the time and place of hearing shall be published within the jurisdiction of the publicly owned water supplier pursuant to Section 6066 of the Government Code. The urban water supplier shall provide notice of the time and place of hearing to any city or county within which the supplier provides water supplies. A privately owned water supplier shall provide an equivalent notice within its service area. After the hearing, the plan shall be adopted as prepared or as modified after the hearing.

10643. An urban water supplier shall implement its plan adopted pursuant to this chapter in accordance with the schedule set forth in its plan.

10644. (a) An urban water supplier shall submit to the department, the California State Library,

Table 59. Projected Demand During Multiple Dry Year Period Ending in 2030 – AF/YR

Water Source	2026	2027	2028	2029	2030
Demand					
Retail Service Area	52,593	54,175	55,806	57,487	59,221
Wholesale Water Sales	130,134	132,333	134,532	136,731	138,930
% of Projected Normal	103%	103%	103%	103%	104%

Note: Normal as defined on Table 41. Multiple Dry Year Period is based on Table 8.

Table 60. Projected Supply and Demand Comparison During Multiple Dry Year Period Ending in 2030– AF/YR

	2026	2027	2028	2029	2030
Retail Service Area					
Supply Totals	52,593	54,175	55,806	57,487	59,221
Demand Totals	52,593	54,175	55,806	57,487	59,221
Difference (Supply Minus D Demand)	0	0	0	0	0
Difference as % of Supply	0	0	0	0	0
Difference as % of Demand	0	0	0	0	0
Wholesale Water Sales					
Supply Totals	132,333	134,532	136,731	138,930	132,333
Demand Totals	132,333	134,532	136,731	138,930	132,333
Difference (Supply Minus D Demand)	0	0	0	0	0
Difference as % of Supply	0	0	0	0	0
Difference as % of Demand	0	0	0	0	0

and any city or county within which the supplier provides water supplies a copy of its plan no later than 30 days after adoption. Copies of amendments or changes to the plans shall be submitted to the department, the California State Library, and any city or county within which the supplier provides water supplies within 30 days after adoption.

(b) The department shall prepare and submit to the Legislature, on or before December 31, in the years ending in six and one, a report summarizing the status of the plans adopted pursuant to this part. The report prepared by the department shall identify the outstanding elements of the individual plans. The department shall provide a copy of the report to each urban water supplier that has submitted its plan to the department. The department shall also prepare reports and provide data for any legislative hearings designed to consider the effectiveness of plans submitted pursuant to this part.

10645. Not later than 30 days after filing a copy of its plan with the department, the urban water supplier and the department shall make the plan available for public review during normal business hours.

9.2 Adoption Resolution

Western has adopted the 2005 Urban Water Management Plan with Resolution No. 2388. A copy of the resolution is provided in Appendix B.

9.3 DMM Implementation

At its regular meeting held on January 12, 1994, Western's Board of Directors authorized signing the Memorandum of Understanding regarding Urban Water Conservation in California. Since signing the MOU, Western has worked to implement the California Urban Water Conservation Council's Best Management Practices (BMPs) throughout its service area. A copy of the Minutes of the meeting is provided in Appendix E along with the BMP reports.

9.4 Public Review of 2005 UWMP

Public review of the 2005 Urban Water Management Plan included a public meeting conducted on December 7th. Documentation of

the announcement of the public meeting is provided in Appendix H. The draft Plan was made available prior to the public meeting to provide opportunity for review prior to the meeting. Comments received on the Plan at the public meeting include:

No comments received during public review period.

All comments on the 2005 UWMP were resolved prior to finalization of the document.

9.5 Distribution of 2005 UWMP

The final Western Municipal Water District 2005 UWMP was distributed to the following entities:

- City of Riverside;
- City of Corona;
- City of Norco;
- County of Riverside;
- MWD of Southern California;
- Rancho California Water District;
- Box Spring Mutual Water Company;
- SAWPA;
- Rubidoux Community Services District;
- Jurupa Community Services District;
- Elsinore Valley Municipal Water District;
- Home Gardens County Water District; and
- Lee Lake Water District.

Copies of the Plan are available to the general public upon request.

California Regional Water Quality Control Board, Santa Ana Region, 1995
Water Quality Control Plan Santa Ana River Basin (8).

City of Riverside, 2004.
General Plan and Supporting Documents, Environmental Impact Report.

County of Riverside, 2003.
General Plan, October 2003.

County of Riverside, 2004.
Multi-Jurisdictional Local Hazard Mitigation Plan (LUMP), Riverside Operational Area.

David Taussing & Associates, Inc. 2003.
Western Riverside County Multiple Species Habitat Conservation Plan, Final Mitigation Fee Nexus Report, July 2003.

Department of Water Resources Bay-Delta Office, 2002.
The State Water Project Delivery Reliability Report.

Dudek & Associates, Inc., 2005.
Riverside LAFCO, Water & Wastewater Municipal Service Review, Final Report, February 2005.

MWD, 2005.
Draft Regional Urban Water Management Plan, May 2005.

Southern California Association of Governments, 2004.
2004 Regional Transportation Plan/Growth Vision: Socio-Economic Forecast Report, June 2004.

U.S. Census Bureau,
American FactFinder Web Site 2005
County and City Data Book: 2000.

WMWD, 1992.
The Drought Contingency Plan of Western Municipal Water District of Riverside County, January 1992.

WMWD, 2004a.
Santa Ana River Water Right Application for Supplemental Water Supply, Draft Environmental Impact Report, October 2004.

WMWD, 2004b.
Santa Ana River Water Right Application for Supplemental Water Supply, Community Report, October 2004.

WMWD, 2005a.
Riverside-Corona Feeder Program Environmental Impact Report, prepared by Albert Webb & Associates, May 2005.

WMWD, 2005b.
Emergency Response and Recovery Plan, January 2005.

LIST OF ACRONYMS

AF	Acre-Feet
AF/YR	Acre-Feet per Year
BMP	Best Management Practices
CRA	Colorado River Aqueduct
DMM	Demand Management Measures
IWRP	Integrated Water Resources Plan
MG	Million Gallons
MWD	Metropolitan Water District of Southern California
SAWPA	Santa Ana Watershed Project Authority
SCAG	Southern California Association of Governments
SWP	State Water Project
UWMP	Urban Water Management Plan
WMWD	Western Municipal Water District
WWRF	Wastewater Reclamation Facility

FIGURES

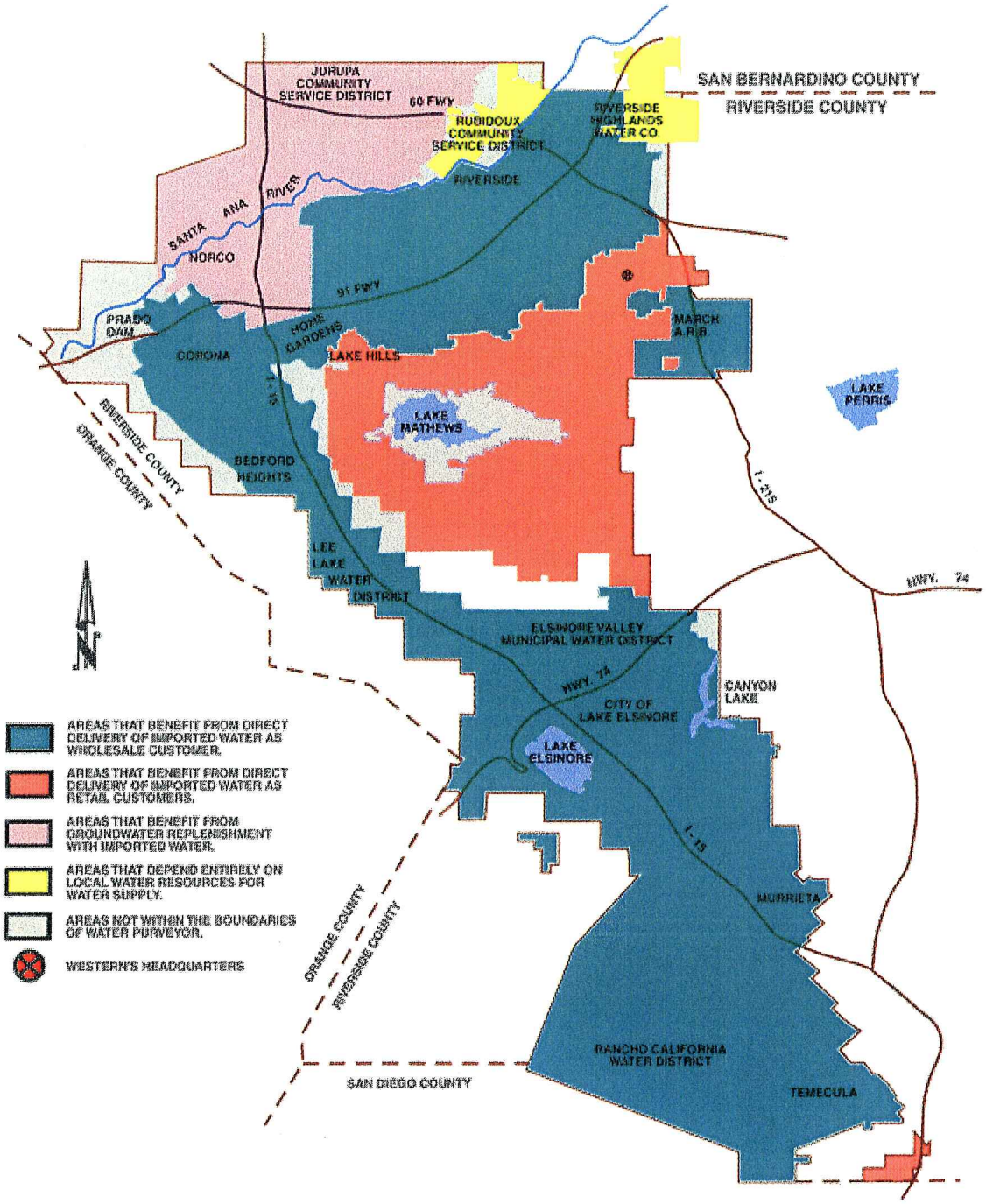
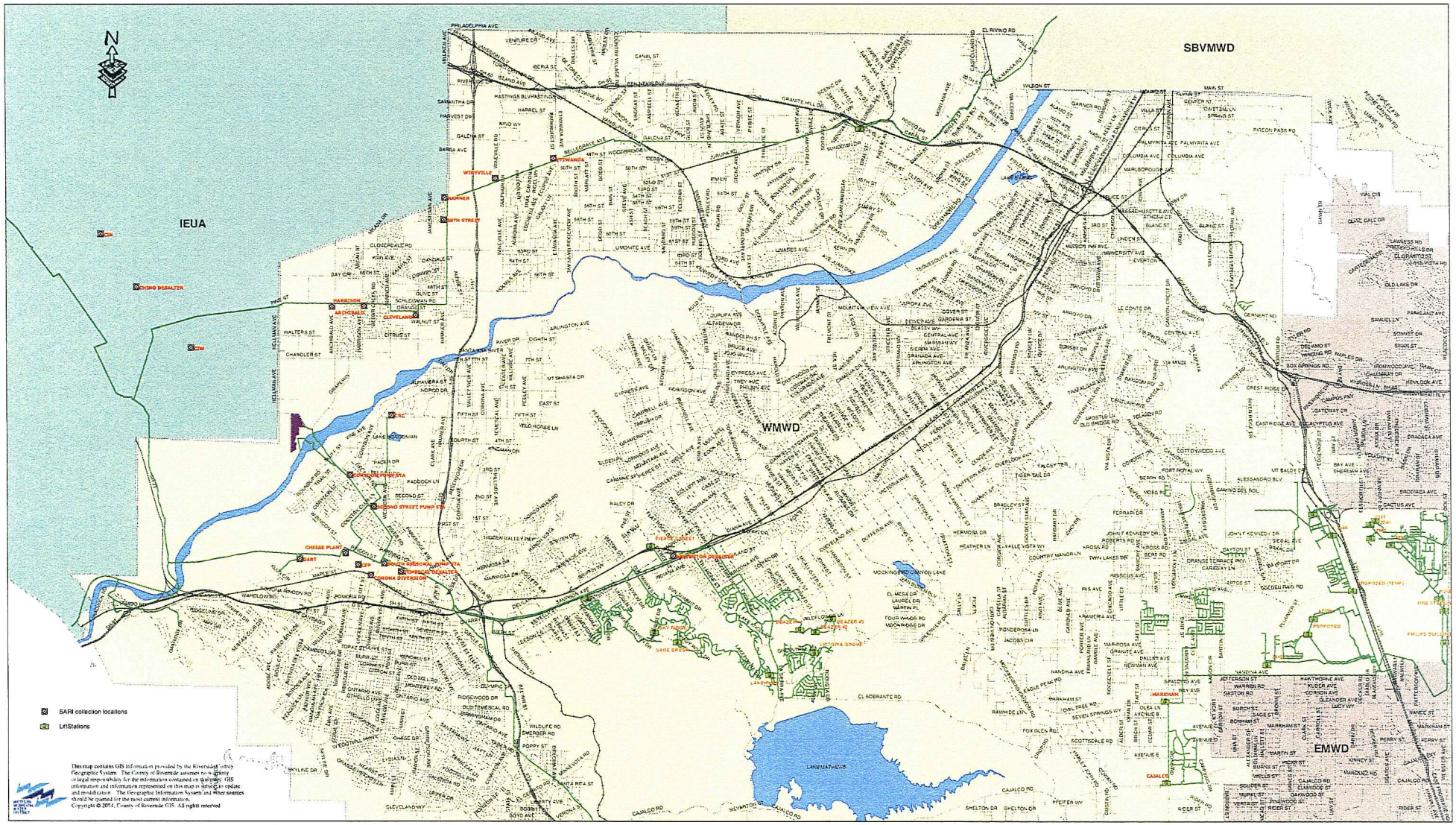


Figure 1
Western Municipal Water District
Boundary and Subagencies

WASTEWATER MAP



h\autocad\mxd\wastewater map.mxd 8-17-05

Figure 3

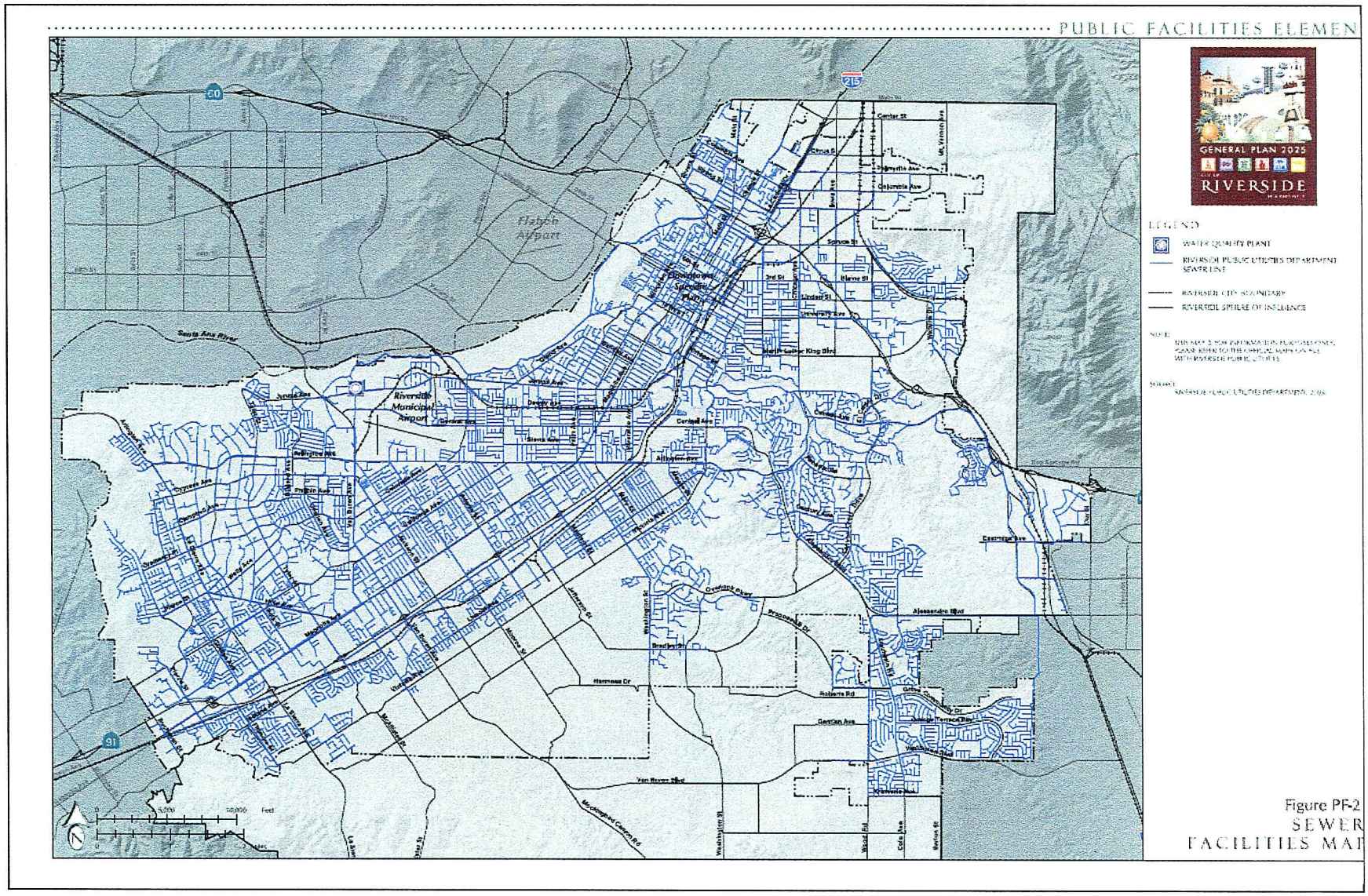


Figure 4
City of Riverside, Wastewater Collection Area

Appendix A
Requests for Participation in Western's 2005 Urban Water Management Plan

February 1, 2005

«FirstName» «LastName»
«Company»
«Address1»
«City», «State» «PostalCode»

REQUEST FOR INFORMATION FOR THE 2005 URBAN WATER MANAGEMENT PLAN

Western Municipal Water District (Western) is reviewing its Urban Water Management Plan (UWMP) and is considering amendments or changes. This plan provides a means to assess water resource needs and supplies. To complete this assessment, water use projections for water supplied from Western to your agency will be required. This information will be required in 5-year increments for at least the next 20 years as shown below.

Actual and Projected Demand in AF/YR

Water Demand	2000	2005	2010	2015	2020	2025	2030

Western is also requesting information for 2030 to provide a full 20-year period for integration into water supply assessments. Please also provide any supplemental information that is required to fully evaluate your water use projections, such as expected demand change for a single dry year or multiple dry years. In turn, Western will provide information to your agency identifying and quantifying, to the extent practicable, the existing and planned sources of water over the 5-year increments and during various water-year types as that information is provided to us by Metropolitan Water District of Southern California.

When Western's UWMP is available in draft form later this year, a copy will be provided to you for your review. Additionally, a public hearing will be conducted to discuss the plan.

We appreciate your assistance in providing information for this vital plan. Should you have any questions, please do not hesitate to contact me at (951) 789-5077 or by email at bmeyer@wmwd.com.

BRENDA MEYER, P.E.
Civil Engineer

bsm/bj

cc: Central File: UWMP 2005

UWMP 2005
REQUEST FOR INFORMATION LETTERS SENT 2/1/05
TO:

Mr. Ethan Gottschalk
Box Springs Mutual Water Company
21740 Dracea Ave.
Moreno Valley, CA 92553

Mr. Kevin Milligan
City of Riverside Public Utilities
3900 Main Street
Riverside, CA 92522

Mr. Dieter Wirtzfeld Assistant Director - Water
City of Riverside Public Utilities
3900 Main Street
Riverside, CA 92522

Mr. Don Williams
City of Corona
730 Corporate Yard Way
Corona, CA 92880

Mr. Bill Thompson
City of Norco
2820 Clark Avenue
Norco, CA 91760

Mr. Julius Ma, P.E.
Elsinore Valley Municipal Water District
P.O. Box 3000
Lake Elsinore, CA 92530

Mr. Andy Webster
Rancho California Water District
P.O. Box 9017
Temecula, CA 92589

Mr. John Pastore
Lee Lake Water District
22646 Temescal Canyon Road
Corona, CA 91719

Appendix B
Resolution Adopting Western's 2005 Urban Water Management Plan

RESOLUTION 2388

RESOLUTION OF THE BOARD OF DIRECTORS
OF WESTERN MUNICIPAL WATER DISTRICT
OF RIVERSIDE COUNTY ADOPTING THE 2005
URBAN WATER MANAGEMENT PLAN

WHEREAS, The California Legislature enacted Assembly Bill 797 during the 1983-84 regular session of the California Legislature (Water Code Section 100610 et. seq.), known as the Urban Water Management Planning Act, which mandates that every urban supplier of water providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre feet of water annually, prepare an Urban Water Management Plan, the primary objective of which is to plan for the conservation and efficient use of water;

WHEREAS, AB 797 requires that said Plan be adopted by December 31, 1985, after public review and hearing, and filed with the California Department of Water Resources within thirty days of adoption;

WHEREAS, Western Municipal Water District of Riverside County did prepare and file said Plan with the California Department of Water Resources in December 1985;

WHEREAS, AB 797 requires that said Plan be periodically reviewed at least once every five years, and that the urban water supplier shall make any amendments or changes to its plan which are indicated by the review; and

WHEREAS, Western Municipal Water District of Riverside County is an urban supplier of water providing water to over 19,000 customers, and prepared and circulated for public review a draft Urban Water Management Plan (2015 Update), in compliance with the requirements of AB 797, and held a properly noticed public hearing regarding said draft Plan on October 5, 2005, prior to publishing the final Plan.

NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of Western Municipal Water District of Riverside County as follows:

1. The Urban Water Management Plan for 2005, is hereby adopted as amended by changes incorporated by the Board of Directors as a result of input received (if any) at the public hearing and ordered filed with the Secretary of the Board of Directors;

2. The General Manager is hereby authorized and directed to file the 2005 Plan with the California Department of Water Resources within 30 days after the date adopted in accordance with AB 797; and

3. The General Manager is hereby authorized and directed to further consider the adopted 2005 Urban Water Management Plan, and to provide recommendations to the Board of Directors regarding necessary budgets, procedures, rules, and regulations to carry out effective and equitable water conservation programs.

ADOPTED this 7th day of December 2005.

Elizabeth L. Cunnison
Secretary-Treasurer

I HEREBY CERTIFY that the foregoing is a full, true and correct copy of Resolution 2388 adopted by the Board of Directors of Western Municipal Water District of Riverside County at its Regular Meeting held December 7, 2005.

JOHN V. ROSSI
General Manager

Appendix C
Climate Data

RIVERSIDE CITRUS EXP ST, CALIFORNIA

Period of Record General Climate Summary - Temperature

Station:(047473) RIVERSIDE CITRUS EXP ST

From Year=1948 To Year=2004

	Monthly Averages			Daily Extremes				Monthly Extremes				Max. Temp.		Min. Temp.	
	Max.	Min.	Mean	High	Date	Low	Date	Highest Mean	Year	Lowest Mean	Year	>= 90 F	<= 32 F	<= 32 F	<= 0 F
	F	F	F	F	dd/yyyy or yyyymmdd	F	dd/yyyy or yyyymmdd	F	-	F	-	# Days	# Days	# Days	# Days
January	66.4	41.5	54.0	97	31/2003	24	13/1963	62.8	103	49.0	***	0.0	0.0	1.9	0.0
February	67.9	43.1	55.5	92	07/1963	27	17/1956	60.7	95	48.5	***	0.2	0.0	0.8	0.0
March	70.1	44.9	57.5	98	26/1988	29	01/1962	66.5	104	50.6	***	0.7	0.0	0.4	0.0
April	75.1	47.8	61.4	104	06/1989	33	02/1956	66.6	92	53.2	***	2.5	0.0	0.0	0.0
May	79.4	52.4	65.9	108	29/1984	38	08/1965	73.3	97	61.5	77	4.6	0.0	0.0	0.0
June	86.5	56.2	71.3	112	16/1961	44	10/1964	77.9	81	63.8	65	12.2	0.0	0.0	0.0
July	93.7	60.3	77.0	113	21/1960	49	09/1960	81.1	84	71.2	87	23.7	0.0	0.0	0.0
August	94.3	61.1	77.7	112	30/1976	49	22/1968	83.0	98	74.0	89	24.5	0.0	0.0	0.0
September	90.4	58.4	74.4	113	14/1971	42	21/1965	80.1	84	66.9	65	16.9	0.0	0.0	0.0
October	82.3	52.3	67.3	108	01/1980	32	28/1970	73.1	103	62.4	69	7.8	0.0	0.0	0.0
November	73.1	45.2	59.1	97	02/1997	26	17/1958	64.0	76	53.6	94	1.1	0.0	0.2	0.0
December	67.4	41.2	54.3	93	04/1958	22	23/1990	59.3	58	48.7	71	0.0	0.0	1.5	0.0
Annual	78.9	50.4	64.6	113	19600721	22	19901223	66.7	97	61.6	82	94.2	0.0	4.9	0.0
Winter	67.2	41.9	54.6	97	20030131	22	19901223	58.2	81	50.5	69	0.2	0.0	4.3	0.0

RIVERSIDE CITRUS EXP ST, CALIFORNIA (047473)

Period of Record Monthly Climate Summary

Period of Record : 7/ 1/1948 to 9/30/2004

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	66.4	67.9	70.1	75.1	79.4	86.5	93.7	94.3	90.4	82.3	73.1	67.4	78.9
Average Min. Temperature (F)	41.5	43.1	44.9	47.8	52.4	56.2	60.3	61.1	58.4	52.3	45.2	41.2	50.4
Average Total Precipitation (in.)	2.16	2.15	1.75	0.81	0.23	0.07	0.04	0.12	0.26	0.32	0.93	1.21	10.04
Average Total SnowFall (in.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average Snow Depth (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0

Percent of possible observations for period of record.
Max. Temp.: 85.3% Min. Temp.: 85.3% Precipitation: 91.5% Snowfall: 85.8% Snow Depth: 85.8%
Check Station Metadata or Metadata graphics for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu

Monthly Average ETo Report

California Irrigation Management Information System
Department of Water Resources
Office of Water Use Efficiency
Rendered in ENGLISH units
Printed on January 25, 2005

Number	Name	Region
44	U.C. Riverside	Los Angeles Basin

Stn	Jan	Mar	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
44	2.49	2.91	4.16	5.27	5.94	6.56	7.22	6.92	5.35	4.05	2.94	2.56	56.37

Back to:

State Map | Western U.S. map | Home Page

NOTE:
To print data frame (right side), click on right frame before printing.

1971 - 2000

- Daily Temp. & Precip.
- Daily Tabular data (~23 KB)
- Monthly Tabular data (~1 KB)
- NCDC 1971-2000 Normals (~3 KB)

1961 - 1990

- Daily Temp. & Precip.
- Daily Tabular data (~23 KB)
- Monthly Tabular data (~1 KB)
- NCDC 1961-1990 Normals (~3 KB)

Period of Record

- Station Metadata
- Station Metadata Graphics

General Climate Summary Tables
- Temperature
- Precipitation
- Heating Degree Days
- Cooling Degree Days
- Growing Degree Days

Temperature
- Daily Extremes and Averages
- Spring 'Freeze' Probabilities
- Fall 'Freeze' Probabilities
- 'Freeze Free' Probabilities
- Monthly Temperature Listings
  - Average
  - Average Maximum
  - Average Minimum

Precipitation
- Monthly Average
- Daily Extreme and Average
- Daily Average
- Precipitation Probability by Duration.
- Precipitation Probability by Quantity.
- Monthly Precipitation Listings

Monthly Totals

Snowfall

- Daily Extreme and Average
- Daily Average
- Monthly Snowfall Listings

Monthly Totals

Snowdepth

- Daily Extreme and Average
- Daily Average

Heating Degree Days

- Daily Average

Cooling Degree Days

- Daily Average

Period of Record Data Tables

- Daily Summary Stats (~55 KB)
- Monthly Tabular data (~2 KB)

Western Regional Climate Center,
wrcc@dri.edu

CALIFORNIA THE GOLDEN STATE

CALIFORNIA HOMEPAGE | GOVERNOR'S HOMEPAGE

CALIFORNIA IRRIGATION MANAGEMENT INFORMATION SYSTEM
DEPARTMENT OF WATER RESOURCES
OFFICE OF WATER USE EFFICIENCY

WELCOME | INFO CENTER | DATA | RESOURCE CENTER | MY CIMIS

General

- CIMIS Overview
- CIMIS Data Uses

Weather Stations

- Station List
- Location Maps
- Sensor Specs
- Siting Info
- Network Maintenance

Evapotranspiration

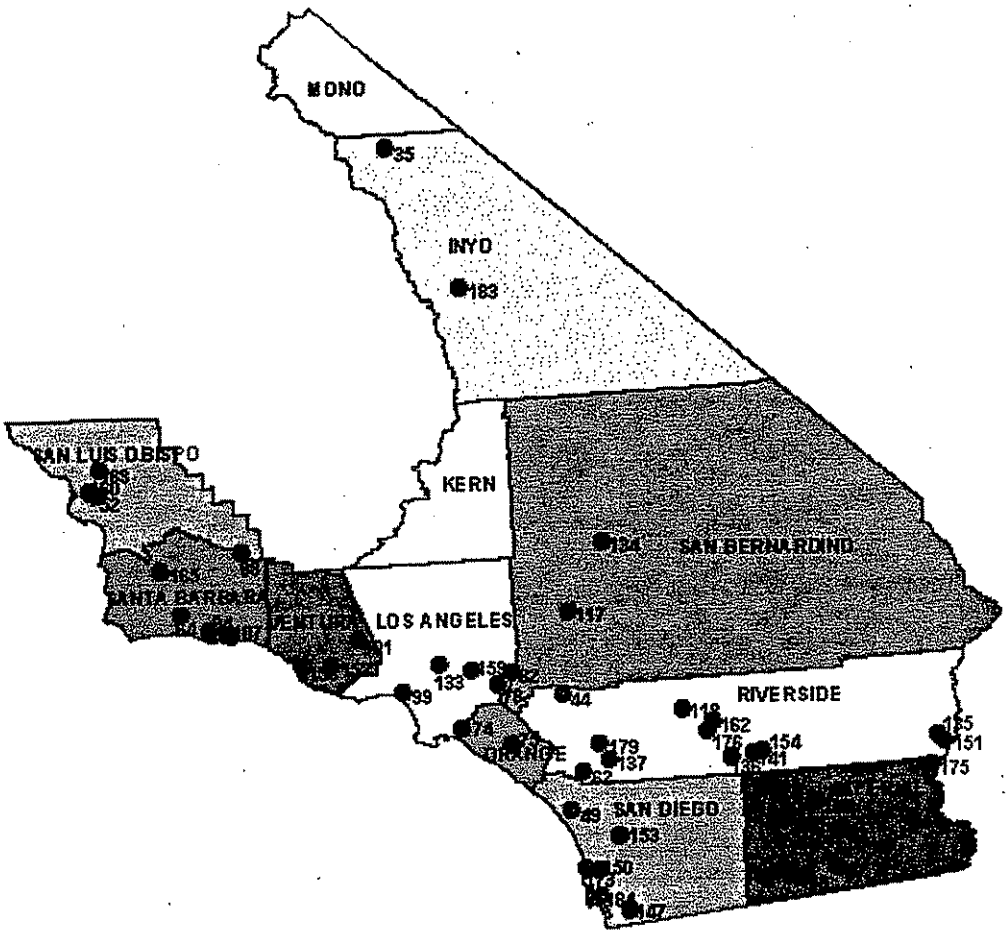
- ET Overview
- Equations
- Crop Coefficients
- ETo Zones Map

Irrigation

- Irrigation Overview
- Water Budget
- Irrigation Scheduling
- Mobile Labs
- Software
- Consultants

Southern District

Click on any station to view its detailed station description.



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Station Detail Report

The **Station Detail Report** provides detailed information on CIMIS stations including the region in which they are located, nearby city, installation dates, termination dates (if inactive), geographic locations (latitude and longitude), elevations above see level, zip codes, surface types (grass or alfalfa), station site descriptions, and photographs of the stations.

U.C. Riverside #44

Los Angeles Basin Region Riverside County Southern District
Nearby city is Riverside

- Activated On June 02, 1985
- Station is Active
- ETo Reported
- Reference Surface is Grass
- Datalogger is CR10

Station 44
North | South | East | West |

Geographic Information

Elevation (ft):	1020
Latitude:	33°57'54"N / 33.97
Longitude:	117°20'08"W / -117.34

Associated Zip Codes

92501, 92502, 92503, 92504, 92505, 92506, 92507, 92509, 92513, 92514, 92515, 92516, 92517, 92518, 92519, 92521, 92522

Station Siting Description

Sorry, this information is not available at this time.

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Appendix D
Western's Water Supply Agreements

PURCHASE ORDER FOR IMPORTED WATER SUPPLY TO BE PROVIDED BY THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

PURCHASER: **Western Municipal Water District of Riverside County**	**TERM** 10 years
INITIAL BASE DEMAND: **65,298.5** acre-feet	**EFFECTIVE DATE:** January 1, 2003
INITIAL TIER 1 ANNUAL MAXIMUM: **58,768.7** acre-feet	
PURCHASE ORDER COMMITMENT: **391,791.0** acre-feet	

Definitions of capitalized terms used in this Purchase Order are provided in Attachment 1. Terms used in this Purchase Order and not defined in Attachment 1 are defined in Metropolitan's Administrative Code.

COMMITMENT TO PURCHASE.

In consideration of Purchaser's commitment to purchase System Water pursuant to this Purchase Order, Metropolitan agrees to sell such System Water to Purchaser at the Tier 1 Supply Rate each year in an amount up to the Tier 1 Annual Maximum. System Water sold to Purchaser (excluding deliveries of System Water made under the Interim Agricultural Water Program and Long-term Seasonal Storage Service) in an amount greater than the Tier 1 Annual Maximum shall be sold to the Purchaser at the Tier 2 Supply Rate. In connection with the receipt of System Water, the Purchaser also agrees to pay all other applicable rates and charges, as established by Metropolitan from time to time in accordance with Section 4304 of the Administrative Code. The rates and charges applicable to System Water as of the Effective Date are shown in Attachment 2.

Purchaser agrees to purchase System Water from Metropolitan during the Term in an amount (excluding deliveries of System Water, made under the Interim Agricultural Water Program and Long-term Seasonal Storage Service) not less than the Purchase Order Commitment.

Purchaser recognizes and agrees that Metropolitan has relied and will, during the term of this Purchase Order, rely on this commitment by Purchaser in setting its rates and charges, planning and providing its capital facilities and developing its water supply, management and reliability programs. If Purchaser's applicable System Water purchases during the Term are less than the Purchase Order Commitment, Purchaser agrees to pay Metropolitan an amount equal to the difference between the Purchase Order Commitment and Purchaser's applicable System Water purchases during the Term times the average of the Tier 1 Supply Rate in effect during the Term. The Purchaser agrees to pay such amount to Metropolitan within the next regular billing cycle following the reconciliation of all certifications for special programs that the Purchaser may participate in (e.g. Interim Agricultural Water Program, Long-term Seasonal Storage Service). The Purchaser may elect to pay such amount in twelve equal monthly

payments over the course of the next twelve months beginning with the first regular billing cycle following the reconciliation of all outstanding certifications for special programs. If the Purchaser elects to pay such amount over the course of the next twelve months following the regular billing cycle any outstanding balance shall bear interest at Metropolitan's then current investment portfolio average yield. All other amounts payable under this Purchase Order shall be billed and paid in accordance with the Administrative Code.

The Purchaser further recognizes that this Purchase Order is entered into for the direct benefit of the holders and owners of Metropolitan's Bonds issued from time to time under the Act and the Bond Resolutions, and the income and revenues derived from this Purchase Order will be pledged for the purposes set forth in the Bond Resolutions, including the payment of principal of and interest on such Bonds.

RENEWAL:

Prior to but not later than December 31, 2010, the Purchaser may provide a non-binding written notice to Metropolitan of the Purchaser's determination to extend this Purchase Order. Upon the receipt of such notice, the Board of Directors of Metropolitan (the "Board") shall determine whether Metropolitan will continue to provide System Water to member agencies by Purchase Order. If the Board so determines, the Purchaser and Metropolitan shall amend this Purchase Order to include an extended term and/or to include such other terms and conditions as may be mutually agreed by the parties. If the Purchaser elects not to renew this Purchase Order it will terminate upon the expiration of the Term.

WATER SERVICE:

Conditions of water service by Metropolitan to the Purchaser, including but not limited to (i) delivery points, (ii) water delivery schedules, and (iii) water quality, will be determined in accordance with Chapter 5 (Section 4500 through 4514, inclusive, as applicable) of Metropolitan's Administrative Code.

In accordance with its Administrative Code, Metropolitan shall use its reasonable best efforts to supply System Water in the quantities requested by the Purchaser, but is not obligated to dedicate any portion of System capacity for the conveyance, distribution, storage or treatment of System Water for the benefit of the Purchaser or any other member agency. Metropolitan shall use its reasonable best efforts to deliver the Base Demand when needed by the Purchaser during the Term; provided however, there shall be no default under this Purchase Order if Metropolitan fails to deliver water to the Purchaser in accordance with any such schedule of deliveries during the Term.

By execution of this Purchase Order, the Purchaser recognizes and agrees that it acquires no interest in or to any portion of the System or any other Metropolitan facilities, or any right to receive water delivered through the System, excepting the right to purchase up to Purchaser's Tier 1 Annual Maximum at the Tier 1 Supply Rate provided that System Water is available. This Purchase Order governs pricing of the System Water delivered to the Purchaser pursuant to this Purchase Order and does not confer any entitlement to receive System Water.

System Water provided to the Purchaser under the terms of this Purchase Order shall be subject to reduction in accordance with the shortage allocation provisions of the Water Surplus and Drought Management Plan (the "WSDM Plan") or other such policies and principles governing the allocation of System Water as adopted by the Board.

In the event that Metropolitan's Board determines to reduce, interrupt or suspend deliveries of System Water (excluding deliveries of System Water made under the Interim Agricultural Water Program and Long-term Seasonal Storage Service) any outstanding balance of the Purchase Order Commitment at the end of the Term shall be reduced by the reduction in System Water made available to the Purchaser under this Purchase Order.

MISCELLANEOUS:

This Purchase Order will be interpreted, governed and enforced in accordance with the laws of the State of California.

This Purchase Order will apply to and bind the successors and assigns of the Purchaser and Metropolitan.

No assignment or transfer of the rights of the Purchaser under this Purchase Order will be valid and effective against Metropolitan or the Purchaser without the prior written consent of Metropolitan and the Purchaser.

If at any time during the Term, by reason of error in computation or other causes, there is an overpayment or underpayment to Metropolitan by the Purchaser of the charges provided for under this Purchase Order, which overpayment or underpayment is not accounted for and corrected in the annual re-determination or reconciliation of said charges, the amount of such overpayment or underpayment shall be credited or debited, as the case may be, to the Purchaser. .Metropolitan will notify the Purchaser in writing regarding the amount of such credit or debit, as the case may be. In no case will credits or debits for charges provided for under this Purchase Order be administered beyond the limit for billing adjustments as specified in Metropolitan's Administrative Code.

IN WITNESS WHEREOF, this Purchase Order is executed by the duly authorized officers of the Metropolitan Water District of Southern California and [Purchaser], to be effective January 1, 2003.

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

By: Ronald R. Gastelum
Ronald R. Gastelum
Chief Executive Officer

WESTERN MUNICIPAL WATER DISTRICT OF RIVERSIDE COUNTY

By:

[Title] GENERAL MANAGER

APPROVED AS TO FORM AND CONTENT:

General Counsel

Best Best & Krieger LLP
General Counsel

By:

By: Steven M. And

Attachment 1
Purchase Order for Imported Water Supplies
DEFINITIONS

"Act" means the Metropolitan Water District Act, California Statutes 1969, Chapter 209, as amended and supplemented from time to time.

"Base Demand" means the greater of (i) the Initial Base Demand or (ii) the ten-year rolling average of the Purchaser's Firm Demand, measured on a fiscal year basis.

"Bonds" means water revenue bonds or notes issued under the Bond Resolutions.

"Bond Resolutions" means Resolution No. 8329 or Resolution No. 8322, both as amended and supplemented, or any other resolution authorizing the issuance of bonds, notes or other obligations secured by Metropolitan's water sales revenues.

"Effective Date" means the effective date of this Purchase Order as specified above.

"Firm Demand" means the Purchaser's purchases of non-surplus System Water supplies, including full-service and seasonal shift deliveries.

"Initial Base Demand" means the Purchaser's highest annual Firm Demand on Metropolitan in any fiscal year during the period from fiscal year 1989/90 through fiscal year 2001/02. In accordance with procedures set forth in Metropolitan's Administrative Code, the Initial Base Demand will be revised to reflect certified and verified deliveries under the Interim Agricultural Water Program and Long-term Seasonal Storage Service Program as such certifications affect the Initial Base Demand.

"Metropolitan" means The Metropolitan Water District of Southern California.

"Purchase Order Commitment" means 60% of the Initial Base Demand times 10. Deliveries of System Water made under the Interim Agricultural Water Program and Long-term Seasonal Storage Service, will not count toward the Purchase Order Commitment.

"Purchase Order" means this Purchase Order.

"Purchaser" means the member public agency specified above, a duly organized [city/water district/county water authority] of the State of California.

"System" means the properties, works and facilities of Metropolitan necessary for the supply, development, storage, conveyance, distribution, treatment or sale of water.

"System Water" means water supplies developed by Metropolitan and delivered to the Purchaser through the System or other means (e.g. conjunctive use storage).

"Term" means the term of this Purchase Order as specified above.

"Tier 1 Annual Maximum" means an amount equal to 90% of the Base Demand.

"Tier 1 Supply Rate" means Metropolitan's per-acre-foot Tier 1 Supply Rate, as determined from time to time by Metropolitan's Board of Directors. The initial Tier 1 Rate is $73/AF.

"Tier 2 Supply Rate" means Metropolitan's per-acre-foot Tier 2 Supply Rate, as determined from time to time by Metropolitan's Board of Directors. The initial Tier 2 Rate is $154/AF.

"Water Surplus and Drought Management Plan (WSDM)" means Metropolitan's policy and procedures for managing supplies and drought conditions as adopted by the Board from time to time.

Attachment 2
Purchase Order for Imported Water Supplies
RATES AND CHARGES

	Effective January 1, 2003
Tier 1 Supply Rate ($/af)	$73
Tier 2 Supply Rate ($/af)	$154
System Access Rate ($/af)	$141
System Power Rate ($/af)	$89
Water Stewardship Rate ($/af)	$23
Untreated Long-term Storage Water Rate ($/af)	$233
Untreated Interim Agricultural Water Program ($/af)	$236
Treated Long-term Storage Water Rate ($/af)	$290
Treated Interim Agricultural Water Program ($/af)	$294
Treatment Surcharge ($/af full-service)	$82
Readiness-to-Serve Charge ($millions)	$80.0
Capacity Reservation Charge ($/cfs)	$6,100
Peaking Surcharge ($/cfs)	$18,300

NON-POTABLE WATER PROJECT AGREEMENT
CITY OF RIVERSIDE AND WESTERN MUNICIPAL WATER DISTRICT OF RIVERSIDE COUNTY

AGREEMENT, made this 5th day of March 2003 between the City of Riverside ("City") , a municipal corporation, and Western Municipal Water District of Riverside County ("Western"), a municipal water district.

RECITALS:

1. The City owns and operates a municipal water supply system which provides water for domestic and irrigation purposes. Included as part of the City's water system are wells, pipelines and appurtenant facilities located in the Colton and Riverside Basins, and in the San Bernardino Basin Area, as those areas are described in the Judgment in *Western Municipal Water District v. East San Bernardino Water District*, Riverside Superior Court No. 78426.

2. Western also owns and operates potable and non-potable water supply systems which provide water service to the eastern portion of the City located at high elevations, and to adjacent areas located outside of the City but within the City's sphere of influence. Western's present water supply comes from The Metropolitan Water District of Southern California ("MWD"), and is used for both domestic purposes and the irrigation of

agricultural and other lands. Western has a need for non-potable water to be used for irrigation purposes in lieu of deliveries from MWD.

3. The Santa Ana Watershed Project Authority ("SAWPA") is a joint powers agency established for the protection of water quality and supply within the Santa Ana River Watershed. One SAWPA project, known as Project No. 16, calls for additional pumping of non-potable water from the Colton and Riverside Basins in order to lower the groundwater table, to enhance storm flow recharge, and thereby to improve the quality of groundwater in the Basin.

4. The City also owns and operates the Riverside Canal, which transports water from the Colton and Riverside Basins as far as Jefferson Street in the City. At times, the Canal also carries storm flow runoff.

5. Western also asserts that it may have groundwater available from the San Bernardino Basin Area and the Colton and Riverside Basins pursuant to agreements with the San Bernardino Valley Municipal Water District and the Elsinore Valley Municipal Water District (as successor to the rights of Agua Mansa and Meeks & Daley mutual water companies).

6. The purpose of this Agreement is to provide for the sale of non-potable water from the City to Western and to allow the limited use of surplus capacity in the Riverside Canal, and in City pipelines and appurtenant facilities, when such capacity is available, in order to supply non-potable water to Western; to improve the quality of groundwater in the Colton and Riverside Basins; and to assist in the improvement of the Riverside Canal.

7. Western represents, as the appropriate lead agency for the project, that all proceedings required under the California Environmental Quality Act ("CEQA") in order to permit approval of the project, and execution of this Agreement have been completed in accordance with law, and to the satisfaction of SAWPA and the State Water Resources Control Board for purposes of grant funding.

8. Proposition 13, adopted by the California voters in March of 2000, authorized the Southern California Integrated Watershed Program ("SCIWP") for the purpose of allocating Proposition 13 Water Bond Funds. The Santa Ana Watershed Project Authority, which acts initially as the State of California's representative for funding under the SCIWP, recommended to the State for approval and the State has now approved, a $5,250,000 grant to the City of Riverside for the reconstruction of portions of the Riverside Canal, and a $7,425,000 grant to Western for the non-potable water project. Both of these grants have now been approved by the State Water Resources Control Board. The City's grant is subject to the execution of this Agreement.

AGREEMENT

Based upon the foregoing facts, and in consideration of the mutual covenants of the parties, it is hereby agreed as follows:

9. Supply. To the extent that the City has surplus non-potable water available, the City shall sell to Western such quantities of non-potable water as Western may determine it needs, subject to two conditions: (1) such quantities shall not exceed a rate of flow of 7,200 gpm and 6,000 acre-feet per year at the point of delivery, and (2) surplus capacity is available in the Riverside Canal for the delivery of such water to Western. The wells to be used for such purpose shall be determined by the City in its sole discretion, provided that the City shall use its best efforts to use wells best suited to accomplish the purposes of SAWPA's Project 16, as identified in the SAWPA Project Information Form for Potential SCIWP Funding, a copy of which is attached hereto as Exhibit A. The City, at its sole discretion, may provide surplus water to Western in excess of the quantities stated above, but Western shall have no right under this agreement to demand such sale.

The City makes no representations or warranties as to the capacity of its wells or the quality of the water to be sold. The City will use its best efforts to sell whatever amounts of non-potable water that may be requested by Western, but does not guarantee either the quantity or timing of such deliveries. The parties recognize (aside from capacity limitations)

that the City's facilities and the Riverside Canal may sometimes be shut down for repairs, or the Canal may be unavailable because of storm flow conditions.

If the City does not have sufficient non-potable water to sell and meet the 7,200 gpm/6,000 acre-feet per year quantities identified above, Western may acquire such supplies, in whole or in part, from others who pump from the Santa Ana River System, or from its own wells, for delivery through the Riverside Canal. Western shall bear the full cost of constructing and operating facilities necessary to deliver water into the Riverside Canal other than the City's wells. In addition, with City approval, Western may utilize surplus capacity in the Riverside Canal, as set forth below, to convey water which Western may acquire from the Santa Ana River System.

Any water introduced by Western into the Canal shall not result in the diminution of the beneficial use or quality of the water otherwise in the Canal. Any such water shall only be introduced if City has approved point of delivery of any such water and quality of such water. Western shall construct, operate and pay for all facilities necessary to take water from the pont of delivery.

10. Riverside Canal Capacity. The surplus carrying capacity existing from time to time in the Riverside Canal for the transportation of non-potable water shall be subject to: (1) the City's own present and future uses for the Canal; (2) the carrying rights of the

Elsinore Valley Municipal Water District, as successor to the Confirming Agreement with the Temescal Water Company, dated November 18, 1974, or to any party holding rights thereto by agreement with Elsinore Valley Municipal Water District; (3) the Water Exchange Agreement between the City and The Gage Canal Company, dated March 12, 1991; and (4) any use of the canal for storm flow runoff. The Canal capacity subject to this Agreement extends from its headworks, downstream to approximately Jefferson Street in the City.

11. Pumping and Transportation Payments. The pricing structure for all water pumped and delivered by the City to Western pursuant to this Agreement shall be based upon the incremental costs incurred by the City. It is the intent of the parties that such costs will be calculated so that financially the City is no better off, nor worse off, than it would be in the absence of water deliveries to Western. Initially, Western shall pay the City $38 per acre-foot for non-potable delivered water. This total is based on the cost of the following components: (a) energy to pump groundwater from wells, $20 per acre-foot; (b) well and well pump operating labor and maintenance, $11 per acre-foot; (c) amortization of well rehabilitation, $2 per acre-foot; and (d) additional maintenance or other legally-required improvement to Riverside Canal from Arlington to Jefferson, $5 per acre-foot. Such incremental cost does not include a general fund transfer fee, which is currently set by the Riverside City Council at 11.5%.

To the extent that Western may convey water through the Riverside Canal that is not pumped by the City, as provided in Section 9 above, Western shall pay only the costs of additional maintenance of the Riverside Canal from Arlington to Jefferson Street, as provided in Section 11(d) above. Charges for the use of the Riverside Canal for water delivered to Western pursuant to Agua Mansa and Meeks & Daley water rights, and agreement with Elsinore Valley Municipal Water District, are governed by prior agreements affecting those rights, and are not subject to this Agreement. Western's rights to the use of surplus capacity in the Riverside Canal, as provided herein, are in addition to any rights that Western may hold pursuant to agreement with the Elsinore Valley Municipal Water District.

The prices paid by Western hereunder shall be reviewed periodically as requested by either party, and shall be adjusted as may be necessary to reflect changes in any incremental cost components associated with this Agreement.

12. Point of Delivery and Metering. The point of delivery to Western of water sold or transported pursuant to this Agreement shall be at the end of the active portion of Riverside Canal near Jefferson Street. Western shall install, maintain and calibrate a meter on the discharge side of its pumps at the point of delivery. Charges shall be determined on the basis of such metered deliveries. Western shall present evidence that the meter is properly calibrated and read. The City may require the meter to be recalibrated. Western

shall have the sole responsibility to construct, operate and pay for all facilities necessary to take the water from the point of delivery for use within its own service area.

13. Treatment of Delivered Water. Western at its own expense shall have the right to treat the non-potable water delivered hereunder, and to put all or any part of such deliveries to any beneficial use for which the treated water is appropriate; provided that Western shall not require any degree of quality of the non-potable water delivered in order to make such water treatable for domestic use, or to complain otherwise about any condition affecting the Riverside Canal that would preclude the use of water delivered hereunder for domestic purposes. This Agreement shall not preclude the City from using the Riverside Canal for transmission and/or delivery of recycled water. The quality of the water shall be in accordance with California Code of Regulations, Title 22, Section 60304(a)(5), pertaining to use of recycled water for irrigation of unrestricted access golf courses.

14. Elsinore Water. By agreement with the Elsinore Valley Municipal Water District, Western has the right to 9 cfs of water from the former Meeks & Daley, Agua Mansa wells ("Elsinore Water"), and carrying rights for such water in the Gage or Riverside Canals. Western shall have the right to deliver its Elsinore water, whenever it is available, through the Riverside Canal and the City's storm drain system for discharge to the Santa Ana River. So long as the City delivers to Western 7,200 gpm/6,000 acre-feet per year of non-potable water, Western shall not utilize the City's Olivewood booster station to take delivery

of its Elsinore water at the Gage Canal, and instead will discharge such water to the Santa Ana River through the City's storm drain system. If the City does not deliver to Western 7,200 gpm/6,000 acre-feet per year of non-potable water, then Western will still take delivery of any Elsinore water from the Riverside Canal at its Jefferson Street pump station, provided Western's pump station and pipeline to the Gage Canal are operational. However, if such facilities are not operational, then Western reserves the right to require delivery of its Elsinore water at the end of the Gage Canal.

15. Recordation Filings. The City shall include all Riverside Basin pumping for delivery to Western in its Notices filed pursuant to Water Code Sections 5000 et seq. Western, however, does not waive any claim to the water rights associated with such pumping.

16. Indemnity. Except as to sole negligence, or willful misconduct of City, Western shall defend, indemnify and hold City, their officers, agents, and employees harmless from and against any and all liability, loss, expense (including reasonable attorneys' fees), or claims for injury or damages arising out of this Agreement to the extent such liability, loss, expense, attorneys' fees, or claims for injury or damages are caused by or resulting from the acts or omissions of Western, its officers, agents, or employees. The parties expressly agree that any payment, attorney fee, cost or expense City incurs or makes to or on behalf of an injured employee under City's self-administered workers' compensation

program is included as a loss, expense or cost. The provisions of this paragraph shall survive the expiration or early termination of this Agreement.

17. Term. The term of this Agreement shall be for 20 years, commencing when the City first delivers water to Western hereunder. The parties may renew the Agreement for an additional 20-year term, subject to re-negotiation of costs on an incremental basis, and approval thereof shall not be unreasonably withheld. If the City decides to abandon the Riverside Canal during the term of this Agreement, or any renewal thereof, Western shall have an option to acquire the City's interest in the portion of the Riverside Canal covered by this Agreement at the fair market value of the property at the time the option is exercised, and subject to whatever obligations may then exist.

18. Integration. This Agreement constitutes the final, complete, and exclusive statement of the terms of the agreement between the Parties pertaining to the subject matter of this Agreement, and supersedes all prior and contemporaneous understandings or agreements of the parties. Neither party has been induced to enter into this Agreement by, and neither party is relying on, any representation or warranty outside those expressly set forth in this Agreement.

19. CEQA. If any court, governmental official, agency, department or bureau having jurisdiction over activities arising out of this Agreement or under Project 16, requires

further review or compliance under the California Environmental Quality Act ("CEQA) by or from the City, Western shall, at its own expense, comply with all such requirements. Western shall also reimburse the City for any costs the City may incur in complying with such CEQA requirements or in any lawsuit arising out of such CEQA requirements, including but not limited to attorneys' fees, filing fees or other court costs, any costs incurred in connection with any lawsuits brought against City as a result of this Agreement, and any costs of environmental studies and reviews.

IN WITNESS WHEREOF, the parties have executed this Agreement, to be effective on the date above written.

CITY OF RIVERSIDE

By _____
City Manager

ATTEST:

_____
City Clerk
City of Riverside

APPROVED AS TO FORM:

_____
City Attorney

WESTERN MUNICIPAL WATER
DISTRICT OF RIVERSIDE COUNTY

By: _____

President

ATTEST:

_____

Secretary

APPROVED AS TO FORM:

BEST BEST & KRIEGER LLP

By: _____

Arthur L. Littleworth

AMENDMENT NO. 1

AGREEMENT BETWEEN THE WESTERN MUNICIPAL WATER DISTRICT OF RIVERSIDE COUNTY AND THE ELSINORE VALLEY MUNICIPAL WATER DISTRICT FOR THE RECIPROCAL USE OF CERTAIN ASSETS RELATED TO THE PRODUCTION AND/OR CONVEYANCE OF WATER

THIS FIRST AMENDMENT ("Amendment") is executed by and between the WESTERN MUNICIPAL WATER DISTRICT OF RIVERSIDE COUNTY, a municipal water district ("Western"), and the ELSINORE VALLEY MUNICIPAL WATER DISTRICT, a municipal water district ("EVMWD"). Western and EVMWD are sometimes hereinafter individually referred to as "Party" and hereinafter collectively referred to as the "Parties." This Amendment shall be considered by the Parties to be dated and effective as of February 1, 2003.

RECITALS

A. Western and EVMWD are parties to an agreement dated August 23, 2001, entitled "Agreement Between the Western Municipal Water District of Riverside County and the Elsinore Valley Municipal Water District for the Reciprocal Use of Certain Assets Related to the Production and/or Conveyance of Water" (hereinafter "Reciprocal Use Agreement"). In general, the Reciprocal Use Agreement provides that subject to specified terms and conditions, EVMWD may use up to nine (9.0) cubic feet per second (cfs) of capacity in Reaches A through F of the Mills Pipeline to receive water, and Western may use certain groundwater production rights and facilities, and certain canal carrying rights owned by EVMWD ("EVMWD Assets"), to produce and convey up to nine (9.0) cubic feet per second of water.

B. Western is also party to an agreement with the Orange County Water District ("OCWD"), dated December 16, 2001 ("OCWD Agreement"), which provides that subject to certain terms and conditions, the groundwater produced and conveyed by Western with the EVMWD Assets shall be discharged by Western into the Santa Ana River, and OCWD shall pay Western $150.00 for every acre-foot of delivered groundwater, for purposes of helping recharge groundwater resources in Orange County.

C. EVMWD has determined that the EVMWD Assets are capable of producing and conveying additional quantities of groundwater, and Western and EVMWD now desire to amend the Reciprocal Use Agreement to provide for the delivery and conveyance of additional quantities of groundwater to meet the purposes identified in the Reciprocal Use Agreement and the OCWD Agreement.

NOW THEREFORE, in consideration of the mutual covenants and conditions stated herein and other valuable consideration, the sufficiency of which is hereby acknowledged, the Parties agree as follows:

TERMS

1.0 Section 3.3 Added to Reciprocal Use Agreement. A new Section 3.3 is hereby added to the Reciprocal Use Agreement to read as follows:

> "3.3 Production, Conveyance, and Payment of Additional Water. Notwithstanding Sections 3.0 and 3.1 of this Agreement, and subject to the availability of water and capacity in the EVMWD Assets, EVMWD may produce and deliver to Western, at the locations designated in Section 3.1 of this Agreement, more than nine (9.0) cfs of water. Notwithstanding Section 3.2 of this Agreement, if during any one (1) month, EVMWD produces and delivers to Western, at the locations designated in Section 3.1 of this Agreement, more than five hundred and forty three (543) acre-feet of water, then Western shall pay to EVMWD one hundred and fifty dollars ($150.00) for every acre-foot of water produced and delivered to Western during that month in excess of five hundred and forty three (543) acre-feet, and no other charges shall be applied or assessed to Western for the production or delivery of such water. Western, however, shall have no obligation to make any payment for water delivered by EVMWD pursuant to this Section during such times as the water would escape to the ocean and not be available for recharge purposes within Orange County; provided that Western has given notice to EVMWD of such conditions."

2.0 Affirmation of Reciprocal Use Agreement. Except as amended by this Amendment, all provisions of the Reciprocal Use Agreement shall remain in full force and effect and shall govern the actions of the Parties. Each Party represents and warrants to the other that except as amended by this Amendment, there have been no written or oral modifications of the Reciprocal Use Agreement. Each Party ratifies and reaffirms each and every one of their respective rights and obligations arising under the Reciprocal Use Agreement. Each Party represents and warrants to the other that the Reciprocal Use Agreement is currently an effective, valid, and binding obligation.

3.0 Definitions. Terms not otherwise expressly defined in this Amendment, shall have the meaning and intent set forth in the Reciprocal Use Agreement.

IN WITNESS WHEREOF, the Parties have caused this Amendment to be executed by their respective duly authorized officers.

WESTERN MUNICIPAL WATER DISTRICT OF RIVERSIDE COUNTY

By: Thaeme H. Yoleoal
President

Date: 4-16-03

ELSINORE VALLEY MUNICIPAL WATER DISTRICT

By: Phil Williams
President

Date: 4/23/04

PURCHASE ORDER FOR IMPORTED WATER SUPPLY TO BE PROVIDED BY THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

PURCHASER: **Western Municipal Water District of Riverside County**	**TERM** 10 years
INITIAL BASE DEMAND: **65,298.5** acre-feet	**EFFECTIVE DATE:** January 1, 2003
INITIAL TIER 1 ANNUAL MAXIMUM: **58,768.7** acre-feet	
PURCHASE ORDER COMMITMENT: **391,791.0** acre-feet	

Definitions of capitalized terms used in this Purchase Order are provided in Attachment 1. Terms used in this Purchase Order and not defined in Attachment 1 are defined in Metropolitan's Administrative Code.

COMMITMENT TO PURCHASE.

In consideration of Purchaser's commitment to purchase System Water pursuant to this Purchase Order, Metropolitan agrees to sell such System Water to Purchaser at the Tier 1 Supply Rate each year in an amount up to the Tier 1 Annual Maximum. System Water sold to Purchaser (excluding deliveries of System Water made under the Interim Agricultural Water Program and Long-term Seasonal Storage Service) in an amount greater than the Tier 1 Annual Maximum shall be sold to the Purchaser at the Tier 2 Supply Rate. In connection with the receipt of System Water, the Purchaser also agrees to pay all other applicable rates and charges, as established by Metropolitan from time to time in accordance with Section 4304 of the Administrative Code. The rates and charges applicable to System Water as of the Effective Date are shown in Attachment 2.

Purchaser agrees to purchase System Water from Metropolitan during the Term in an amount (excluding deliveries of System Water, made under the Interim Agricultural Water Program and Long-term Seasonal Storage Service) not less than the Purchase Order Commitment.

Purchaser recognizes and agrees that Metropolitan has relied and will, during the term of this Purchase Order, rely on this commitment by Purchaser in setting its rates and charges, planning and providing its capital facilities and developing its water supply, management and reliability programs. If Purchaser's applicable System Water purchases during the Term are less than the Purchase Order Commitment, Purchaser agrees to pay Metropolitan an amount equal to the difference between the Purchase Order Commitment and Purchaser's applicable System Water purchases during the Term times the average of the Tier 1 Supply Rate in effect during the Term. The Purchaser agrees to pay such amount to Metropolitan within the next regular billing cycle following the reconciliation of all certifications for special programs that the Purchaser may participate in (e.g. Interim Agricultural Water Program, Long-term Seasonal Storage Service). The Purchaser may elect to pay such amount in twelve equal monthly

payments over the course of the next twelve months beginning with the first regular billing cycle following the reconciliation of all outstanding certifications for special programs. If the Purchaser elects to pay such amount over the course of the next twelve months following the regular billing cycle any outstanding balance shall bear interest at Metropolitan's then current investment portfolio average yield. All other amounts payable under this Purchase Order shall be billed and paid in accordance with the Administrative Code.

The Purchaser further recognizes that this Purchase Order is entered into for the direct benefit of the holders and owners of Metropolitan's Bonds issued from time to time under the Act and the Bond Resolutions, and the income and revenues derived from this Purchase Order will be pledged for the purposes set forth in the Bond Resolutions, including the payment of principal of and interest on such Bonds.

RENEWAL:

Prior to but not later than December 31, 2010, the Purchaser may provide a non-binding written notice to Metropolitan of the Purchaser's determination to extend this Purchase Order. Upon the receipt of such notice, the Board of Directors of Metropolitan (the "Board") shall determine whether Metropolitan will continue to provide System Water to member agencies by Purchase Order. If the Board so determines, the Purchaser and Metropolitan shall amend this Purchase Order to include an extended term and/or to include such other terms and conditions as may be mutually agreed by the parties. If the Purchaser elects not to renew this Purchase Order it will terminate upon the expiration of the Term.

WATER SERVICE:

Conditions of water service by Metropolitan to the Purchaser, including but not limited to (i) delivery points, (ii) water delivery schedules, and (iii) water quality, will be determined in accordance with Chapter 5 (Section 4500 through 4514, inclusive, as applicable) of Metropolitan's Administrative Code.

In accordance with its Administrative Code, Metropolitan shall use its reasonable best efforts to supply System Water in the quantities requested by the Purchaser, but is not obligated to dedicate any portion of System capacity for the conveyance, distribution, storage or treatment of System Water for the benefit of the Purchaser or any other member agency. Metropolitan shall use its reasonable best efforts to deliver the Base Demand when needed by the Purchaser during the Term; provided however, there shall be no default under this Purchase Order if Metropolitan fails to deliver water to the Purchaser in accordance with any such schedule of deliveries during the Term.

By execution of this Purchase Order, the Purchaser recognizes and agrees that it acquires no interest in or to any portion of the System or any other Metropolitan facilities, or any right to receive water delivered through the System, excepting the right to purchase up to Purchaser's Tier 1 Annual Maximum at the Tier 1 Supply Rate provided that System Water is available. This Purchase Order governs pricing of the System Water delivered to the Purchaser pursuant to this Purchase Order and does not confer any entitlement to receive System Water.

System Water provided to the Purchaser under the terms of this Purchase Order shall be subject to reduction in accordance with the shortage allocation provisions of the Water Surplus and Drought Management Plan (the "WSDM Plan") or other such policies and principles governing the allocation of System Water as adopted by the Board.

In the event that Metropolitan's Board determines to reduce, interrupt or suspend deliveries of System Water (excluding deliveries of System Water made under the Interim Agricultural Water Program and Long-term Seasonal Storage Service) any outstanding balance of the Purchase Order Commitment at the end of the Term shall be reduced by the reduction in System Water made available to the Purchaser under this Purchase Order.

MISCELLANEOUS:

This Purchase Order will be interpreted, governed and enforced in accordance with the laws of the State of California.

This Purchase Order will apply to and bind the successors and assigns of the Purchaser and Metropolitan.

No assignment or transfer of the rights of the Purchaser under this Purchase Order will be valid and effective against Metropolitan or the Purchaser without the prior written consent of Metropolitan and the Purchaser.

If at any time during the Term, by reason of error in computation or other causes, there is an overpayment or underpayment to Metropolitan by the Purchaser of the charges provided for under this Purchase Order, which overpayment or underpayment is not accounted for and corrected in the annual re-determination or reconciliation of said charges, the amount of such overpayment or underpayment shall be credited or debited, as the case may be, to the Purchaser. .Metropolitan will notify the Purchaser in writing regarding the amount of such credit or debit, as the case may be. In no case will credits or debits for charges provided for under this Purchase Order be administered beyond the limit for billing adjustments as specified in Metropolitan's Administrative Code.

IN WITNESS WHEREOF, this Purchase Order is executed by the duly authorized officers of the Metropolitan Water District of Southern California and [Purchaser], to be effective January 1, 2003.

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

By: Ronald R. Gastelum
Ronald R. Gastelum
Chief Executive Officer

WESTERN MUNICIPAL WATER DISTRICT OF RIVERSIDE COUNTY

By:

[Title] GENERAL MANAGER

APPROVED AS TO FORM AND CONTENT:

General Counsel

Best Best & Krieger LLP
General Counsel

By:

By:

Attachment 1
Purchase Order for Imported Water Supplies
DEFINITIONS

"Act" means the Metropolitan Water District Act, California Statutes 1969, Chapter 209, as amended and supplemented from time to time.

"Base Demand" means the greater of (i) the Initial Base Demand or (ii) the ten-year rolling average of the Purchaser's Firm Demand, measured on a fiscal year basis.

"Bonds" means water revenue bonds or notes issued under the Bond Resolutions.

"Bond Resolutions" means Resolution No. 8329 or Resolution No. 8322, both as amended and supplemented, or any other resolution authorizing the issuance of bonds, notes or other obligations secured by Metropolitan's water sales revenues.

"Effective Date" means the effective date of this Purchase Order as specified above.

"Firm Demand" means the Purchaser's purchases of non-surplus System Water supplies, including full-service and seasonal shift deliveries.

"Initial Base Demand" means the Purchaser's highest annual Firm Demand on Metropolitan in any fiscal year during the period from fiscal year 1989/90 through fiscal year 2001/02. In accordance with procedures set forth in Metropolitan's Administrative Code, the Initial Base Demand will be revised to reflect certified and verified deliveries under the Interim Agricultural Water Program and Long-term Seasonal Storage Service Program as such certifications affect the Initial Base Demand.

"Metropolitan" means The Metropolitan Water District of Southern California.

"Purchase Order Commitment" means 60% of the Initial Base Demand times 10. Deliveries of System Water made under the Interim Agricultural Water Program and Long-term Seasonal Storage Service, will not count toward the Purchase Order Commitment.

"Purchase Order" means this Purchase Order.

"Purchaser" means the member public agency specified above, a duly organized [city/water district/county water authority] of the State of California.

"System" means the properties, works and facilities of Metropolitan necessary for the supply, development, storage, conveyance, distribution, treatment or sale of water.

"System Water" means water supplies developed by Metropolitan and delivered to the Purchaser through the System or other means (e.g. conjunctive use storage).

"Term" means the term of this Purchase Order as specified above.

"Tier 1 Annual Maximum" means an amount equal to 90% of the Base Demand.

"Tier 1 Supply Rate" means Metropolitan's per-acre-foot Tier 1 Supply Rate, as determined from time to time by Metropolitan's Board of Directors. The initial Tier 1 Rate is $73/AF.

"Tier 2 Supply Rate" means Metropolitan's per-acre-foot Tier 2 Supply Rate, as determined from time to time by Metropolitan's Board of Directors. The initial Tier 2 Rate is $154/AF.

"Water Surplus and Drought Management Plan (WSDM)" means Metropolitan's policy and procedures for managing supplies and drought conditions as adopted by the Board from time to time.

Attachment 2
Purchase Order for Imported Water Supplies
RATES AND CHARGES

	Effective January 1, 2003
Tier 1 Supply Rate ($/af)	$73
Tier 2 Supply Rate ($/af)	$154
System Access Rate ($/af)	$141
System Power Rate ($/af)	$89
Water Stewardship Rate ($/af)	$23
Untreated Long-term Storage Water Rate ($/af)	$233
Untreated Interim Agricultural Water Program ($/af)	$236
Treated Long-term Storage Water Rate ($/af)	$290
Treated Interim Agricultural Water Program ($/af)	$294
Treatment Surcharge ($/af full-service)	$82
Readiness-to-Serve Charge ($millions)	$80.0
Capacity Reservation Charge ($/cfs)	$6,100
Peaking Surcharge ($/cfs)	$18,300

WATER SUPPLY AGREEMENT
BETWEEN
CITY OF RIVERSIDE PUBLIC UTILITIES DEPARTMENT
AND
WESTERN MUNICIPAL WATER DISTRICT

WHEREAS, the City of Riverside (Riverside) has rights and access to certain water supplies in the Bunker Hill and Riverside basins in excess of its immediate needs; and

WHEREAS, depending on seasonal and other peaking constraints, the existing water system infrastructure is generally capable of transporting this water to the Western Municipal Water District (Western) facilities at Mockingbird; and

WHEREAS, Western presently purchases its water requirements from MWD at rates considerably higher than Riverside's marginal cost of delivery;

NOW, THEREFORE, Riverside agrees to provide this excess water to the Western Mockingbird Pumping Plant and Western agrees to purchase said water to the maximum extent possible, at a price intended to split the savings equally after accounting for each organizations incremental costs associated with this delivery. Based on the cost information detailed in Attachment A, the initial price to Western shall be set at $210/per acre foot. The cost information in Attachment A shall be reviewed at least annually and revised by the mutual consent of both parties.

FURTHERMORE, the Operating Divisions of both organizations shall develop operating protocols to effectively coordinate these water sales and provide for proper accounting and billing procedures.

This agreement supersedes any previous agreements or portions of agreements regarding potable water sales by Riverside to Western and shall be effective the last day signed and shall remain in effect until terminated by either party on 30 day notice.

Bill D. Carnahan
City of Riverside

10/21/96
Date

Don Harriger
Western Municipal Water District

10/16/96
Date

Attachment

WATER SUPPLY AGREEMENT
BETWEEN
CITY OF RIVERSIDE PUBLIC UTILITIES DEPARTMENT
AND
WESTERN MUNICIPAL WATER DISTRICT

ATTACHMENT "A"*

Riverside Incremental Costs

Riverside Well Pumping	$27/AF	
Riverside Booster Pumping	$27/AF	
Riverside O&M	$08/AF	
	Total:	$62/AF

Western Incremental Costs

Western Booster Pumping	$62/AF	
Western O&M	$04/AF	
		$66/AF

Total Incremental Costs: $128/AF

Calculation of Savings

Metropolitan Rate to Western	$425/AF	
Less - Incremental Costs	($128)	
Total Project Savings:		$297/AF

Split the Savings $297÷2 = $148/AF

Sale Price to Western

Riverside Savings	$148/AF	
Riverside Costs	$ 62/AF	
		$210/AF

*Costs based on no new facilities constructed, and equal split of savings between Riverside and Western.

Costs based on an incremental cost analysis and is independent of total sales under this agreement, which are projected to be between 1,200 and 2,000 AF/YR.

AGREEMENT BETWEEN THE WESTERN MUNICIPAL WATER DISTRICT OF RIVERSIDE COUNTY AND THE ORANGE COUNTY WATER DISTRICT FOR THE DELIVERY OF WATER

THIS AGREEMENT ("Agreement") is made by and between the WESTERN MUNICIPAL WATER DISTRICT OF RIVERSIDE COUNTY, a municipal water district ("Western"), and the ORANGE COUNTY WATER DISTRICT, a municipal water district ("OCWD"). Western and OCWD are sometimes hereinafter individually referred to as "Party" and hereinafter collectively referred to as the "Parties." This Agreement is dated this 16th day of December, 2001 for reference purposes only.

RECITALS

A. A comprehensive settlement affecting the waters of the Santa Ana River System was reached in 1969 which included two stipulated judgments in the cases of Orange County Water District v. City of Chino, et al., Orange County Superior Court Action No. 117628 ("Orange County Judgment"), and Western Municipal Water District of Riverside County v. East San Bernardino County Water District, et al., Riverside Superior Court Action No. 78426 ("Western Judgment").

B. Pursuant to an agreement dated August 23, 2001, between Western and the Elsinore Valley Municipal Water District ("EVMWD"), Western acquired the right to temporarily use certain groundwater production and conveyance assets owned by EVMWD ("EVMWD Assets") to produce and convey up to nine (9.0) cubic feet per second ("cfs") of water, for a maximum of 6,515.46 acre-feet per year. The EVMWD Assets are identified on the map set forth in Exhibit "A," and are more particularly described as follows:

1. Meeks and Daley Rights. EVMWD owns a controlling interest in the Meeks and Daley Water Company, a mutual water company and California corporation, which entitles EVMWD to 56% of the groundwater production rights and facilities, and 56% of the canal carrying rights owned by the Meeks and Daley Water Company ("Meeks and Daley Rights"). The Meeks and Daley Rights are more particularly described as follows:

a. The groundwater production rights and facilities owned by the Meeks and Daley Water Company are located in the San Bernardino Basin Area and are subject to the Western Judgment, which provides that the Meeks and Daley Water Company holds a right to produce up to 7,833 acre-feet per year in the San Bernardino Basin Area.

b. The canal carrying rights owned by the Meeks and Daley Water Company are located in the Riverside Canal and Gage Canal.

2. Palm Avenue Well. Separate and apart from EVMWD's interest in the Meeks and Daley Water Company, EVMWD also owns a well in the Riverside South Basin which is physically capable of producing water into the Riverside Canal and Gage Canal. The production rights of EVMWD in the Riverside South Basin are not specifically provided for in the Western Judgment.

C. Western and OCWD now desire to execute an agreement for the delivery of water by Western to OCWD through use of the EVMWD Assets, to help reduce high groundwater levels in the San Bernardino Basin Area and Riverside Basin Area through increased groundwater extractions, and to help recharge groundwater resources in Orange County by discharging the extracted groundwater into the Santa Ana River or its tributaries. The location of the wells that will be used in the program are shown on Exhibit B.

NOW THEREFORE, in consideration of the mutual covenants and conditions stated herein and other valuable consideration, the sufficiency of which is hereby acknowledged, the Parties hereby agree as follows:

TERMS

1.0 Delivery of Water. Western shall cause to be delivered into the Santa Ana River or its tributaries up to a maximum of 6,515 acre-feet of water per year beginning on the Effective Date of this Agreement.

1.1 Point and Schedule for Delivery. All water delivered by Western to OCWD under this Agreement shall be delivered to the Santa Ana River at such location(s) and at such time(s) as shall be mutually agreed on by both Parties. If the Parties are unable to agree on mutually acceptable location(s) or time(s) for delivery of the water, either Party may immediately terminate this Agreement upon providing written notice to the other Party.

1.2 Measuring and Accounting for Deliveries. The Parties shall mutually agree on a methodology for quantifying the water delivered by Western to OCWD under this Agreement. If the Parties are unable to agree on mutually acceptable methodology for quantifying the water delivered under this Agreement, either Party may immediately terminate this Agreement upon providing written notice to the other Party.

1.2.1 OCWD shall bear all losses of water which may occur between the point at which the water is discharged into the Santa Ana River or tributaries and the place of use by OCWD. Such deliveries shall not be considered as base flow under the Orange County Judgment, and the Upper Area districts (as defined in the Orange County Judgment) shall not be entitled to credit at Prado or Riverside Narrows for any such deliveries. All water delivered under this Agreement shall be in

addition to all obligations of the Upper Area districts under the Orange County Judgment.

1.2.2 All water delivered under this Agreement through Western's use of the Meeks and Daley Rights is part of the natural water supply to the San Bernardino Basin Area, and shall be appropriately accounted for by the Watermaster established under the Western Judgment. No water delivered under this Agreement is from the State Water Project.

1.3 No Minimum Delivery Guarantee. The actual amount of water delivered under this Agreement is contingent on groundwater extractions made bv Western through its use of the EVMWD Assets. Western shall make a good faith effort to deliver as much water as feasible, but no minimum deliveries are assured. Western shall not be responsible or liable to OCWD, for any damage, injury, or economic loss suffered by OCWD, or any third party including its customers, due to any interruption, reduction, lack of flow, or cessation in deliveries of water made under this Agreement.

2.0 Water Quality. Western makes no warranty or representation as to the quality of the water delivered to OCWD pursuant to this Agreement, provided that such deliveries shall comply with any requirements of the Santa Ana Regional Water Quality Control Board. If such compliance is not feasible or other required approvals cannot be obtained, as determined by Western in its discretion, Western shall have the option to immediately terminate this Agreement upon providing written notice to OCWD. Western shall not be liable for any damage or injury to persons or facilities resulting from the quality of water delivered under this Agreement. Western shall provide OCWD all available historic water quality data on all wells utilized in this agreement within 30 days of execution of the agreement. All future water quality data on any wells in this program will also be transmitted to OCWD.

3.0 Water Rights Not Affected. No production or delivery of water under this Agreement shall confer any appropriative, overlying, public trust, or other water right on any person or entity. The only rights granted to the Parties as a result of this Agreement are those expressly set forth herein.

4.0 Permits and CEQA Compliance. Western shall be responsible for obtaining any permits and regulatory approvals, and shall be the lead agency for purposes of complying with the California Environmental Quality Act (CEQA).

5.0 Payment. OCWD shall pay to Western the sum of One Hundred and Fifty Dollars ($150.00) per acre-foot of water delivered to OCWD by Western in accordance with the terms of this Agreement. OCWD shall have no obligation to pay for water delivered by Western during such times as the water would escape to the ocean and not be available for recharge purposes within Orange County; provided that OCWD has given notice to Western of such conditions. During such times, Western shall have no

obligation under this Agreement to deliver water to OCWD. All sums owed under this Agreement shall be payable by OCWD within thirty (30) days of its receipt from Western of a written invoice indicating the amount of water delivered and the applicable charges as set forth in this section. Any amount not paid when due, shall bear interest at the maximum legal rate.

6.0 Term. This Agreement shall begin on the Effective Date and shall continue in effect until terminated in accordance with the provisions of this Agreement.

7.0 Termination. In addition to the rights of the Parties to terminate this Agreement as provided in other sections, this Agreement may be terminated in accordance with the following:

7.1 Termination by Notice. Either Party may terminate this Agreement by providing the other Party written notice that the Agreement will terminate on the date specified in the notice, which shall be no earlier than one (1) year from the date such notice is placed in the mail or delivered.

7.2 Termination for Nonpayment. Either Party may terminate this Agreement fifteen (15) days after providing written notice to the other Party of its failure to pay when due any sums required under this Agreement.

8.0 Effect of Termination. Within thirty (30) days of the termination of this Agreement, OCWD shall pay to Western all sums due and owing under this Agreement. Western's rights under this section are in addition to any legal rights and remedies which it may otherwise have in the event of a breach of this Agreement.

9.0 Assignment or Transfer of Agreement. Neither Party shall assign, hypothecate, or transfer, either directly or by operation of law, this Agreement or any interest or obligation herein without prior written consent of the other Party, which shall not be unreasonably withheld. Any attempt to do so shall be null and void, and any assignee, hypothecatee, or transferee shall acquire no right or interest by reason of such attempted assignment, hypothecation, or transfer.

10.0 Reciprocal Indemnities.

10.1 Western's Indemnification. Western agrees to indemnify, defend, and hold harmless OCWD, its officers, employees, and agents, from any and all claims, demands, causes of action, liability, loss, damage, injury, to property or persons, including wrongful death, whether imposed by a court of law or by administrative action of any federal, state, or local governmental body or agency arising out of or connected with Western's performance or non-performance of this Agreement. Western's indemnification obligation includes, without limitation, the payment of all penalties, fines, judgments, awards, decrees, attorneys fees, and related costs or expenses, and the

reimbursement of OCWD, its elected officials, officers, employees, and agents for all legal expenses and costs incurred by each of them. Western's indemnification obligation under this section shall survive the expiration or termination of this Agreement.

10.2 OCWD's Indemnification. OCWD agrees to indemnify, defend, and hold harmless Western, its officers, employees, and agents, from any and all claims, demands, causes of action, liability, loss, damage, injury, to property or persons, including wrongful death, whether imposed by a court of law or by administrative action of any federal, state, or local governmental body or agency arising out of or connected with: (1) use by OCWD, its customers, or other third parties of the water delivered to OCWD under this Agreement, or (2) OCWD's performance or non-performance of this Agreement. OCWD's indemnification obligation includes, without limitation, the payment of all penalties, fines, judgments, awards, decrees, attorneys fees, and related costs or expenses, and the reimbursement of Western, its elected officials, officers, employees, and agents for all legal expenses and costs incurred by each of them. Western's indemnification obligation under this section shall survive the expiration or termination of this Agreement.

11.0 Future Judicial Proceedings. In any future proceedings to interpret, modify or enforce the Orange County Judgment, or for violation thereof, neither this Agreement, nor any specific project subject to this Agreement, nor any previous agreements between or among any of the parties hereto, including, but not limited to the Agreement to Produce Additional Water From The Artesian Zone of the San Bernardino Basin Area and for Reimbursement of Costs, dated February 25, 1985; the Joint Participation Agreement Between the Orange County Water District, the Western Municipal Water District of Riverside County and the Santa Ana Watershed Project Authority for the Development and the Utilization of Desalted Water From the Arlington Desalter, dated July 6, 1988; the Agreement for Temporary Exchange of Well Water for Metropolitan Water District Water between the Western Municipal Water District of Riverside County, the Orange County Water District and the Municipal Water District of Orange County, dated May 22, 1991; and the Water Exchange and Storage Agreement between the Western Municipal Water District of Riverside County, the Orange County Water District and the City of Anaheim, dated August 24, 1993, or any action taken pursuant to such agreements, shall constitute an admission or precedent with respect to the meaning of the Judgment, or grounds for modification thereof, and shall not be offered into evidence (except for the purpose of giving effect to this paragraph). Nor shall any claim of laches, waiver or estoppel be made based upon the decision to approve and implement this Agreement rather than to seek a judicial resolution of the disagreement over the meaning of the Orange County Judgment concerning the rights of OCWD, or the limitation of such rights, to export or otherwise cause water to flow from the Upper to the Lower Area.

12.0 General Provisions.

12.1 Authority to Enter Agreement. Each Party warrants that the individuals who have signed this Agreement have the legal power, right, and authority make this Agreement and bind each respective Party.

12.2 Notice. All notices, demands, invoices, and written communications required to be provided under this Agreement, shall be delivered at following addresses or such other addresses as Parties may designate by written notice:

To Western:
Western Municipal Water District
Attn: General Manager
P.O. Box 5286
Riverside, California 92517-5286
Tel: 909-780-4170
Fax: 909-780-3837

To OCWD:
Orange County Water District
Attn: General Manager
P.O. Box 8300
Fountain Valley, CA 92728-8300
Tel: 714-378-3200
Fax: 714-378-3373

Depending on the method of transmittal, notice shall be deemed received as follows: by facsimile, as of the date and time sent; by messenger, as of the date delivered; and by U.S. Mail first class postage prepaid, as of seventy-two (72) hours after deposit in the U.S. Mail.

12.3 Amendment; Modification. No supplement, modification, or amendment of this Agreement shall be binding unless executed in writing and signed by the Parties.

12.4 Waiver. No waiver of any default shall constitute a waiver of any other default or breach, whether of the same or other covenant or condition. No waiver, benefit, privilege, or service voluntarily given or performed by a Party shall give the other Party any contractual right by custom, estoppel, or otherwise.

12.5 No Third Party Beneficiaries. There are no intended third party beneficiaries of any right or obligation assumed by the Parties.

12.6 Time is of the Essence. Time is of the essence in this Agreement, and the Parties agree to execute all documents and proceed with due diligence to complete all covenants and conditions.

12.7 Counterparts. This Agreement may be signed in counterparts, each of which shall constitute an original and which collectively shall constitute one instrument.

12.8 Entire Agreement. This Agreement contains the entire agreement between the Parties on the subject matter of this Agreement, and it supersedes any prior oral or written statements or agreements between the Parties.

13.0 Effective Date. This Agreement shall become effective on the date water is first delivered by Western to OCWD in accordance with the terms of this Agreement, even if such date precedes the date upon which the Parties sign this Agreement.

IN WITNESS WHEREOF, the Parties have caused this Agreement to be executed by their respective duly authorized officers.

WESTERN MUNICIPAL WATER DISTRICT OF RIVERSIDE COUNTY

By: _____
President

Date: December 16, 2001

ORANGE COUNTY WATER DISTRICT

By: _____
President

Date: 12-19-01

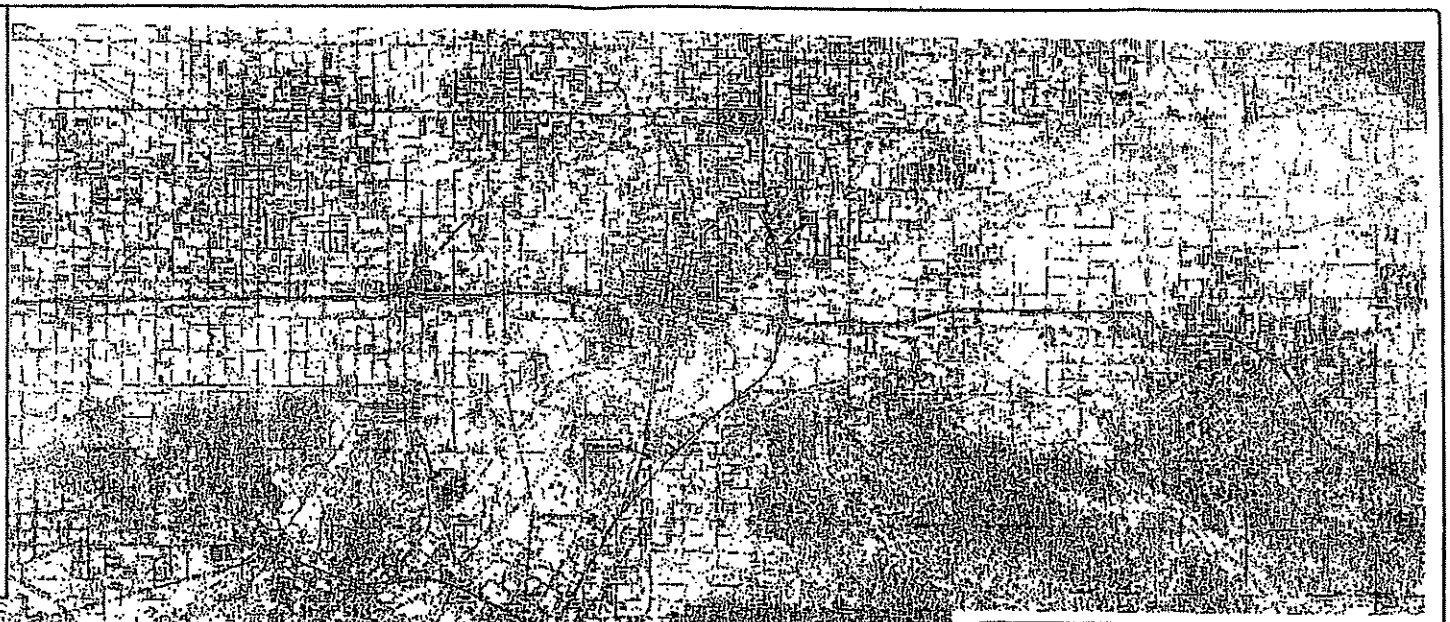
By: _____
General Manager

APPROVED AS TO FORM

By _____
General Counsel for
Orange County Water District

Mutual System Overview

Area of Interest



Legend

Wells
- EVMWD
- Arlington Line
- Olivewood Booster

Gage Canal
- Potable
- Non Potable

Riverside Canal

N

Data Sources: USGS, EVMWD, SBMWCD, City of Riverside

Scale

1" = 4500'
1:54000

4500 0 4500 9000 13500 18000 Feet

MAP HAS BEEN REDUCED
NOT TO SCALE

EVMWD GIS

Elsinore Valley Municipal Water District

Appendix E
Best Management Practices (BMP) Report & DMM Information

BMP 03: System Water Audits, Leak Detection and Repair

Reporting Unit:	BMP Form Status:	Year:
Western MWD of Riverside County - Wholesale	**100% Complete**	**2004**

A. Implementation

1. Has your agency completed a pre-screening system audit for this reporting year?	no
2. If YES, enter the values (AF/Year) used to calculate verifiable use as a percent of total production:	
a. Determine metered sales (AF)	
b. Determine other system verifiable uses (AF)	
c. Determine total supply into the system (AF)	
d. Using the numbers above, if (Metered Sales + Other Verifiable Uses) / Total Supply is < 0.9 then a full-scale system audit is required.	0.00
3. Does your agency keep necessary data on file to verify the values used to calculate verifiable uses as a percent of total production?	yes
4. Did your agency complete a full-scale audit during this report year?	no
5. Does your agency maintain in-house records of audit results or the completed AWWA audit worksheets for the completed audit?	no
6. Does your agency operate a system leak detection program?	no
a. If yes, describe the leak detection program:	

B. Survey Data

1. Total number of miles of distribution system line.	275
2. Number of miles of distribution system line surveyed.	0

C. System Audit / Leak Detection Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP?	No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

E. Comments

Western has no specific charge account to record labor costs associated with leak detection activities. The cost is charged to general maintenance activities.

BMP 07: Public Information Programs

Reporting Unit:	BMP Form Status:	Year:
Western MWD of Riverside County - Wholesale	**100% Complete**	**2004**

A. Implementation

1. Does your agency maintain an active public information program to promote and educate customers about water conservation? yes

   a. If YES, describe the program and how it's organized.

   Western's public affairs team broadcasts water information to customers via many activities. The activities are focused into categories including media information, customer communication, public information, Landscapes Southern California Style garden, consumer confidence report, government affairs, and water use efficiency programs.

2. Indicate which and how many of the following activities are included in your public information program.

Public Information Program Activity	Yes/No	Number of Events
a. Paid Advertising	no	0
b. Public Service Announcement	yes	1
c. Bill Inserts / Newsletters / Brochures	yes	8
d. Bill showing water usage in comparison to previous year's usage	yes	
e. Demonstration Gardens	yes	18
f. Special Events, Media Events	yes	10
g. Speaker's Bureau	yes	4
h. Program to coordinate with other government agencies, industry and public interest groups and media	yes	

B. Conservation Information Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	142624	145277
2. Actual Expenditures	111506	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

   a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Western's budget categories are not divided in such a way as to easily distinguish public information program expenditures solely for water conservation: The dollar amounts in section B above include all public information activities.

BMP 08: School Education Programs

Reporting Unit:	BMP Form Status:	Year:
Western MWD of Riverside County - Wholesale	**100% Complete**	**2004**

A. Implementation

1.Has your agency implemented a school information program to promote water conservation? yes

2. Please provide information on your school programs (by grade level):

Grade	Are grade-appropriate materials distributed?	No. of class presentations	No. of students reached	No. of teachers' workshops
Grades K-3rd	yes	24	6981	0
Grades 4th-6th	yes	0	358	0
Grades 7th-8th	yes	0	0	0
High School	yes	0	22	0

3. Did your Agency's materials meet state education framework requirements? yes

4. When did your Agency begin implementing this program? 09/01/1982

B. School Education Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	61783	57065
2. Actual Expenditures	53564	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

No comments BMP 8 - Wholesale

BMP 10: Wholesale Agency Assistance Programs

Reporting Unit:
Western MWD of Riverside County - Wholesale

BMP Form Status:
100% Complete

Year:
2004

A. Implementation

1. Financial Support by BMP

BMP	Financial Incentives Offered?	Budgeted Amount	Amount Awarded	BMP	Financial Incentives Offered?	Budgeted Amount	Amount Awarded
1	yes	0	0	8	No	0	0
2	yes	0	0	9	yes	0	0
3	yes	0	0	10	yes	9573	8518
4	No	0	0	11	No	0	0
5	yes	20000	20000	12	No	0	0
6	yes	0	0	13	No	0	0
7	No	0	0	14	yes	0	0

2. Technical Support

a. Has your agency conducted or funded workshops addressing CUWCC procedures for calculating program savings, costs and cost-effectiveness?	No
b. Has your agency conducted or funded workshops addressing retail agencies' BMP implementation reporting requirements?	No
c. Has your agency conducted or funded workshops addressing:	
1) ULFT replacement	No
2) Residential retrofits	No
3) Commercial, industrial, and institutional surveys	No
4) Residential and large turf irrigation	No
5) Conservation-related rates and pricing	No

3. Staff Resources by BMP

BMP	Qualified Staff Available for BMP?	No. FTE Staff Assigned to BMP	BMP	Qualified Staff Available for BMP?	No. FTE Staff Assigned to BMP

1	yes	1	8	yes	1
2	yes	1	9	yes	1
3	yes	1	10	yes	1
4	yes	1	11	yes	1
5	yes	1	12	yes	1
6	yes	1	13	yes	1
7	yes	1	14	yes	1

4. Regional Programs by BMP

BMP	Implementation/ Management Program?	BMP	Implementation/ Management Program?
1	No	8	yes
2	No	9	No
3	No	10	No
4	No	11	No
5	No	12	No
6	No	13	No
7	No	14	No

B. Wholesale Agency Assistance Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	43212	41190
2. Actual Expenditures	35209	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP?

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

All BMP incentives offered by Metropolitan Water District of Southern California are passed through to Western's subagencies. Western and its subagencies participate in MWD's regional CII incentive program. Western's Board approved payment of 50% of it subagencies' CUWCC dues in 2003. Western sponsors a regional school education program and included activities in its general service area.

BMP 11: Conservation Pricing

Reporting Unit:	BMP Form Status:	Year:
Western MWD of Riverside County - Wholesale	**100% Complete**	**2004**

A. Implementation

Rate Structure Data Volumetric Rates for Water Service by Customer Class

1. Residential	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$28855660
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$261520
2. Commercial	
a. Water Rate Structure	
b. Sewer Rate Structure	
c. Total Revenue from Volumetric Rates	$
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$
3. Industrial	
a. Water Rate Structure	
b. Sewer Rate Structure	
c. Total Revenue from Volumetric Rates	$
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$
4. Institutional / Government	
a. Water Rate Structure	
b. Sewer Rate Structure	
c. Total Revenue from Volumetric Rates	$
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$
5. Irrigation	
a. Water Rate Structure	
b. Sewer Rate Structure	
c. Total Revenue from Volumetric Rates	$
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$
6. Other	
a. Water Rate Structure	
b. Sewer Rate Structure	
c. Total Revenue from Volumetric Rates	$
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$

B. Conservation Pricing Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

No comments regarding BMP 11 - Wholesale

BMP 12: Conservation Coordinator

Reporting Unit:	BMP Form Status:	Year:
Western MWD of Riverside County - Wholesale	**100% Complete**	**2004**

A. Implementation

1. Does your Agency have a conservation coordinator?	yes
2. Is this a full-time position?	yes
3. If no, is the coordinator supplied by another agency with which you cooperate in a regional conservation program ?	no
4. Partner agency's name:	N/A
5. If your agency supplies the conservation coordinator:	
a. What percent is this conservation coordinator's position?	60%
b. Coordinator's Name	TIM BARR
c. Coordinator's Title	COMMUNICATION SPECIALIST
d. Coordinator's Experience and Number of Years	13 YEARS
e. Date Coordinator's position was created (mm/dd/yyyy)	01/12/1994
6. Number of conservation staff, including Conservation Coordinator.	1

B. Conservation Staff Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	17029	12904
2. Actual Expenditures	19779	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? no

   a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

ACTUAL EXPENDITURES ARE YEAR-TO-DATE TOTALS (11.30.04). BUDGET FIGURES FROM WMWD ACTIVITY A465 ONLY (COORDINATOR SALARY).

Water Conservation Incentive Program History

All Programs in Western's General Service Area

Year	Residential Programs: Ultra-Low-Flow Toilets unit quantity	Ultra-Low-Flow Toilets water savings(AF)	High Efficiency Clothes Washers unit quantity	High Efficiency Clothes Washers water savings(AF)
1995	-	-	-	-
1996	2359	82	-	-
1997	2450	85.6	-	-
1998	1780	62	-	-
1999	1708	59.7	-	-
2000	1384	48	-	-
2001	1468	51.3	-	-
2002	1914	66.9	204	3.3
2003	2182	76.2	1346	21.5
2004	1892	66.1	2317	37.1

Residential Water Savings Totals (savings in acre feet) current year	cumulative total	Year
0.0	0.0	1995
82.4	82.4	1996
85.6	250.4	1997
62.2	563.1	1998
59.7	853.0	1999
48.4	1191.2	2000
51.3	1580.8	2001
70.1	2040.5	2002
97.8	2597.9	2003
103.2	3258.6	2004

Year	Total Incentive Dollars: by Metropolitan ULFT	by Metropolitan HECW	Third Party Grants ULFT	Third Party Grants HECW	by Local Agency ULFT	by Local Agency HECW	Totals ULFT	Totals HECW
1995	-	-	-	-	-	-	-	-
1996	$141,540	-	-	-	$141,540	-	$283,080	-
1997	$147,000	-	$48,000	-	$70,650	-	$265,650	-
1998	$106,800	-	-	-	$74,760	-	$181,560	-
1999	$102,480	-	-	-	$69,738	-	$172,218	-
2000	$83,040	-	-	-	$58,128	-	$141,168	-
2001	$88,080	-	-	-	$42,252	-	$130,332	-
2002	$114,840	$7,140	-	$15,300	$45,378	$10,545	$160,218	$32,985
2003	$130,920	$47,110	-	$100,950	$44,466	$28,035	$175,386	$176,095
2004	$113,520	$81,095	-	$173,775	$41,271	$38,490	$154,791	$293,360

Average AF Cost of Water Saved (over the estimated life of device) ULFT (10years)	HECW (14 years)	Year
-	-	1995
$343.45	-	1996
$310.33	-	1997
$291.93	-	1998
$288.58	-	1999
$291.93	-	2000
$254.10	-	2001
$239.58	$721.84	2002
$230.05	$584.06	2003
$234.15	$565.23	2004

MINUTES
ADJOURNED REGULAR MEETING OF THE BOARD OF DIRECTORS
WESTERN MUNICIPAL WATER DISTRICT
OF RIVERSIDE COUNTY

January 12, 1994

14673 The adjourned regular meeting of the Board of Directors of Western Municipal Water District was held in the District office at 9:30 a.m., January 12, 1994.

Present

14674 Directors Present:

President Donald L. Schroeder, Presiding
Wayne C. Keith, Vice President
John M. Mylne III, Secretary-Treasurer
Wayne H. Holcomb
Frances J. Nelson

Others Present:

Donald L. Harriger, General Manager and Deputy Secretary-Treasurer
Norman L. Thomas, Manager of Engineering and Operations
Kenneth P. Weel, Manager of Finance
Renae M. Hinchey, Manager of Administration and Public Affairs
Anne Thomas, Best, Best & Krieger
Joan Seeley, Recording Secretary

Dick Smith, SAWPA
Mike Wright, SAWPA
Tim Quinn, MWD
Kathy Gibson, MWD
Doug Beeman, Press-Enterprise
Mrs. Liz Cunnison, Riverside

14675 President Schroeder appointed District Counsel, Anne Thomas, as Temporary Chairman. Ms. Thomas stated that this was the time and place to consider the election of a president, vice president and secretary-treasurer of the Board, and opened the floor for nominations for president. Director Mylne nominated Director Keith for the Office of President of the Board of Directors. Director Holcomb nominated Director Schroeder for the Office of President. Director Mylne moved that the nominations be closed. Director Nelson seconded the motion. Counsel Thomas asked for a show of hands of all those in favor of Director Keith as President. There were four ayes and one no vote. Counsel Thomas stated that by a majority vote of the Board, Director Keith is elected President of the Board of Directors.

M-4311
Election of President

M-4312
Election of
Vice
President

14676 Nominations were opened for the Office of Vice President of the Board of Directors. Director Nelson nominated Director Holcomb for the Office of Vice President. Director Mylne moved that the nominations for vice president be closed. The motion was seconded by Director Keith and there was a unanimous vote for Director Holcomb to serve as Vice President of the Board of Directors.

M-4313
Election of
Secretary-
Treasurer

14677 Nominations were opened for the Office of Secretary-Treasurer. Director Nelson nominated Director Mylne for the Office of Secretary-Treasurer. Director Nelson moved that nominations be closed for the office of secretary-treasurer. Director Keith seconded the motion and there was a unanimous vote for Director Mylne to serve as Secretary-Treasurer of the Board of Directors.

The gavel was passed to the newly elected President of the Board, Director Keith, who thanked the Board and stated that in looking back over the past few years, Western has made some great progress. A mission statement was adopted, long range planning was done, and procedures were developed to identify revenue and expenses and how they relate to each other. At the same time, the District went through some difficult times. MWD chose to pass on a large increase in water rates and this had to be passed on to Western's customers. Efforts were also made by this district for our agricultural customers in terms of water supply with arrangements made for wheeling water, and making arrangements with Orange County and San Bernardino for water exchanges. President Keith stated that Western can look back and see that great strides forward have been made and hopefully this will continue in supplying water and sewer service to our customers.

The Board thanked the outgoing president, Director Schroeder for his efforts during the past year.

M-4314
Minutes
12/8/93
12/15/93
1/5/94

14678 Director Holcomb moved, Director Mylne seconded and it carried that approval be given to the minutes of the Adjourned Regular Board Meeting of December 8, 1993, as corrected, theRegular Board Meeting of December 15, 1993, and the Regular Board Meeting of January 5, 1994, as mailed to the Directors.

14679 A letter signed by General Manager Harriger, dated January 12, 1994, addressed to the Board of Directors regarding the proposal to provide water and sewer service to March Air Force Base, was read by Manager of Engineering Norman Thomas. March AFB was annexed to Western in 1968, at their request, and the District now provides service not only to March AFB but the National Cemetery and Air Force Village West as well. Early in 1993 the Civil Engineering

office at March contacted the District regarding alternative water and sewer service in the event of base realignment or closure. The President's decision in July changed the mission at March to that of Air Force Reserve and Air National Guard. District staff, at the request of Chancellor Orbach, has been participating in the Technical Advisory Committee for March Realignment in order to provide technical support. Western's Board adopted a resolution December 1, 1993, affirming its obligations and commitments to provide water and wastewater services to March, the golf course, the National Cemetery, Air Force Village West and adjacent lands which might be converted to private use. The District also prepared a conceptual proposal for the March realignment entitled "Revitalizing the March Community". The Ad Hoc Committee, at their meeting December 30, approved the proposal and distribution to Air Force personnel in Washington, D.C., as well as March AFB, the National Cemetery, Air Force Village West. The Committee also recommended further distribution to members of the Joint Powers Authority and Technical Advisory Committee for March Realignment, including representatives of the County of Riverside, City of Riverside, City of Moreno Valley, City of Perris, Western Riverside Council of Governments, and Chancellor Raymond Orbach. Following discussion, it was moved by Director Nelson, seconded by Director Mylne and carried unanimously that the action of the Ad Hoc Committee be ratified.

M-4315
March AFB

14680 A letter, signed by General Manager Harriger, dated January 12, 1994, addressed to the Board of Directors regarding an application to LAFCo and a resolution for determining property tax exchange with Riverside County in relation to the 35th Fringe Annexation to WMWD, Elsinore Valley MWD, and MWD was summarized by Manager of Engineering, Norman Thomas. Following discussion, it was moved by Director Schroeder, seconded by Director Holcomb and carried unanimously that Resolutions 1861 and 1862 be adopted as follows:

RESOLUTION 1861

RESOLUTION OF THE BOARD OF DIRECTORS OF WESTERN MUNICIPAL WATER DISTRICT OF RIVERSIDE COUNTY MAKING APPLICATION TO THE LOCAL AGENCY FORMATION COMMISSION OF RIVERSIDE COUNTY FOR THE ANNEXATION OF CERTAIN UNINHABITED TERRITORY IDENTIFIED AS THE THIRTY-FIFTH FRINGE AREA

R-1861
Application to LAFCo 35th Fringe Area Annexation

(See Resolution Book)

14681 General Manager Harriger stated that Tim Quinn of MWD has not yet arrived. Mr. Quinn is scheduled to talk on the next agenda item, the Memorandum of Understanding regarding Urban Water Conservation in California. Mr. Harriger requested that this item be postponed until Mr. Quinn arrives.

Report on Arlington Desalter

14682 General Manager Harriger reported on the Arlington Desalter, as requested by the Board at their last meeting. The problem at the Desalter is the result of a change in the MWD pricing structure. MWD abandoned the interruptible rate structure a couple of years ago in favor of the seasonal storage rate. Interruptible water was available to a replenishment agency like Orange County Water District on a year round basis and was only interrupted in the event MWD was having trouble making service. The effect on the project has been that Orange County WD can only buy water at this preferred rate during certain months of the year and our agreement with Orange County WD says that to the extent that Western MWD can take water and serve it in its area, we have a right to one-half the water. We were unable to establish a market for this water largely because water at the same price is available from other sources within MWD, particularly the Mills Filtration Plant, at a higher elevation which means more energy and less nitrates than in the Mills water and Colorado River water. The market for Arlington Desalter water would be in Norco and Corona but both cities have problems with high nitrates so they are looking for water they can blend with their local supply. The agreement with Orange County states that if Western does not have a market for the water, Orange County WD is obligated to take the water. At the time of the agreement, Orange County assumed that obligation on the basis the interruptible rate would stay in place on a year round basis. When MWD implemented the seasonal storage rate, Orange County was buying non-interruptible water, during the summer months, at the non-interruptible rate. In 1992, arrangements were made with MWD whereby the seasonal rate paid by Orange County WD was extended through the summer months while we were trying to work out this problem. In 1993, because of the abundance of water in the MWD service area, the seasonal storage rate was extended for all seasonal storage users through the summer months so it was not a problem in 1993. MWD recognizes that they are essentially the cause of the problem so it is hoped there will also be relief for 1994.

Dick Smith of SAWPA addressed the Board and stated that one of the primary alternatives SAWPA would very much like to take advantage of is to move the Arlington Desalter out of the local projects program and into Metropolitan's ground

water recovery program which offers some advantages in terms of subsidy from MWD. It would require, however, that the product water be placed in a potable water system. Mr. Smith stated that the most cost effective way to currently operate the Arlington Desalter is one that pushes the nitrate level near the upper limits as allowed by the State Health Department. There are opportunities, under the groundwater recovery program, but until there is a firm commitment on the purchase of the water, it is not feasible to evaluate the alternative of producing lower nitrate water from the Desalter. A question and answer period followed this report.

14683 Director Holcomb reported to the Board on the Special Districts Meeting held January 5, 1994 in Banning. The purpose of this meeting was to elect a special district member to LAFCo. Mr. Holcomb reported that Western was supporting the election of Don Galleano, however, Marion Ashley of Eastern MWD won the election by four votes. Don Galleano will remain an alternate. Mr. Holcomb also stated that Director Mylne and MWD Representative, Lois Krieger also attended the meeting.

Directors Reports

Director Mylne reported to the Board on MWD activities. The Blue Ribbon Committee made an extensive report to the MWD Board on Tuesday, January 11. Each of the sub-committee members also made their own report. Chancellor Ray Orbach led the sub-committee on integrated resources planning combined with the financial structure. Jack Yeager led a sub-committee on the business aspects of MWD activities. The recommendation made by Chancellor Orbach was that the integrated resource planning process should be as open as possible and that all resources be brought up for consideration, and that this be combined with the rate setting process. It is felt that the facilities that are being proposed to serve water into the next century are associated with the cost. Another area the Blue Ribbon Committee covered was the governance issue. The Committee felt strongly that MWD needed to be much more than an engineering function for the acquisition, conveyance and delivery of water; MWD needs to broaden its political base and its perspective in what it was doing to support the business people infrastructure of Southern California and possibly

throughout the State. Mr. Mylne stated that the Committee was very complimentary of MWD in a number of ways, but also had suggestions where certain elements could be improved upon. One element the Committee felt strongly about was that the rates MWD is suggesting can have a significant effect on agriculture. They want to be sure that a segment of business that needs a resource in this area is not destroyed. Mr. Mylne also reported that Assemblyman Haynes spoke to the Water Problems Committee on Monday, January 10th regarding agriculture water pricing. The MWD General Manager asked the Board for approval to appoint an ad hoc committee to review agriculture water pricing. Approval was given to appoint this committee.

Director Nelson stated that since she and Director Holcomb were appointed to the Ad Hoc Committee regarding March AFB they have been handling the issues as they come up. In this regard, Mrs. Nelson stated it would be helpful for the Board members to pass on any information they might obtain through discussions or meetings.

14684 A letter, signed by General Manager Harriger, dated January 12, 1994, addressed to the Board of Directors regarding the Memorandum of Understanding regarding Urban Water Conservation in California was summarized by Manager of Administration and Public Affairs, Renae Hinchey. This agreement was formulated in cooperation with the State Department of Water Resources and the State Water Conservation Coalition, and has been signed by many of the major urban water suppliers and environmental and public interest groups in California. Miss Hinchey introduced Tim Quinn and Kathy Gibson of MWD, who came out at the request of MWD Representative Lois Krieger, to make a presentation to the Board on the subject. Mr. Quinn addressed the Board and stated that he is a division director at MWD responsible for the State Water Project, everything that happens with respect to the Bay Delta, water transfer negotiations in the Central Valley and conservation. Mr. Quinn stated that conservation is a vital part of the job in convincing people that MWD is a wise user of water and that demand management in Southern California is an equal and important part of the long range planning exercise. Part of the long term planning is the integrated resources plan which was discussed by the Blue Ribbon Committee. Mr. Quinn stated that Mr. Harriger, on behalf of Western MWD, has been one of the general managers playing a continuous role in the planning process. Mr. Quinn also stated that it is quite apparent that conservation, reclamation, and groundwater recovery are going to play a major role in the long term reliability program. The basis of the MOU is that the water suppliers who sign will focus on implementing water conservation programs that are cost effective. There are

16 different conservation measures identified in the MOU and they are referred to as Best Management Practices. Agencies can exempt themselves from BMP requirements if they can show that a particular program is not cost effective for them. The member agencies will make their own decisions on the programs but MWD will provide service, not only in the conservation credits program, but also staff support. Mr. Quinn also stated that Western has a conservation record to be very proud of. Following a question and answer period, it was moved by Director Mylne, seconded by Director Schroeder and carried unanimously that the Board approve the MOU Regarding Urban Water Conservation in California, and authorize signature by the President.
The Board requested that staff bring this item back for re-evaluation in one year.

M-4316
MOU Re Urban Water Conservation in California

14685 Director Holcomb reported to the Board that the SAWPA Commission, on Tuesday, January 11, 1994, approved payment to Western of the $567,846 receivable. The Board was very pleased with this outcome.

SAWPA Receivable

14686 The Minutes of the November 1993 Meeting of the Santa Ana Watershed Project Authority were received and filed.

SAWPA Minutes 11/93

14687 MWD Representative, John Mylne III, reported to the Board that the Chairman of the Blue Ribbon Committee appointed a Review Committee of the Board to determine how the recommendations of the Blue Ribbon Committee could be integrated into MWD's operations. Mr. Mylne reported that he was appointed to this committee. Mr. Mylne also reported that the MWD Board gave the general manager approval to pay the State Contract as he felt necessary and desirable in compliance with the contract.

MWD Report

14688 Manager of Administration and Public Affairs, Renae Hinchey, stated that the presentation that General Manager Harriger made before the Senate Agriculture and Water Resources Committee has been put in slide presentation. This was shown to the Board. Following this showing Director Mylne stated that the Ag Committee appointed at the MWD Board Meeting January 11, was requested to report back with

Slide Presentation on the Effect of MWD Pricing Polic on Agricultur

their report and recommendations at the April Board Meeting. Mr. Mylne stated he felt this was because it has been made clear to MWD by General Manager Harriger that that is the time agriculture is most likely to turn off the water for the summer.

Mr. Harriger stated there would be more focus on this issue between now and the next couple of months.

Adjourn

14689 There being no further business to come before the Board, at 11:31 a.m., President Keith adjourned the meeting.

Wayne C. Keith
President

John M. Mylne III
Secretary-Treasurer

Appendix F
Metropolitan Water District
Summary Demand Forecasts

Final Draft

Western Municipal Water District

Average Year

Demographics (1)	2005	2010	2015	2020	2025	2030
Population	779,700	838,200	932,000	1,022,000	1,106,300	1,185,700
Occupied Housing Units	234,200	259,000	294,400	330,600	366,700	402,500
Single Family	172,000	188,800	209,000	235,200	261,000	281,600
Multi-Family	62,200	70,100	85,400	95,300	105,600	120,900
Persons Per Household	3.26	3.17	3.10	3.03	2.96	2.89
Urban Employment	275,600	320,000	364,900	409,800	456,200	504,500

Conservation	2005	2010	2015	2020	2025	2030
Conservation (2)	18,500	25,400	32,400	38,600	46,400	54,200
Installed Active Devices Through 2004	800	700	700	300	0	0
Code-Based and Price-Effect Savings	17,700	24,700	31,700	38,300	46,400	54,200

Total Demands After Conservation	2005	2010	2015	2020	2025	2030
Total Demand	303,600	337,200	365,300	388,400	411,500	432,100
Retail Agricultural	82,300	74,400	67,300	60,800	54,900	49,700
Retail Municipal and Industrial (3)	220,300	251,800	277,000	306,600	335,600	361,400
Groundwater Replenishment	1,000	11,000	21,000	21,000	21,000	21,000
Sea Water Barrier	0	0	0	0	0	0

Local Supplies	2005	2010	2015	2020	2025	2030
Total Local Supplies	205,900	206,100	206,100	206,100	206,100	206,100
Groundwater	189,000	189,000	189,000	189,000	189,000	189,000
Surface Water	0	0	0	0	0	0
Los Angeles Aqueduct	0	0	0	0	0	0
Groundwater Recovery	14,200	14,200	14,200	14,200	14,200	14,200
Total Recycling	2,700	2,900	2,900	2,900	2,900	2,900
M&I and Agricultural	*2,700*	*2,900*	*2,900*	*2,900*	*2,900*	*2,900*
Groundwater Replenishment	*0*	*0*	*0*	*0*	*0*	*0*
Seawater Barrier	*0*	*0*	*0*	*0*	*0*	*0*
Other Imported Supplies	0	0	0	0	0	0

Demands on Metropolitan	2005	2010	2015	2020	2025	2030
Total Metropolitan Demands	97,700	131,200	159,200	182,300	205,500	226,000
Full Service (Tier I and Tier II)	72,800	98,600	118,700	143,700	168,500	190,600
Replenishment Water Rate (4)	1,000	11,000	21,000	21,000	21,000	21,000
Interim Agricultural Water Program	23,900	21,600	19,500	17,600	15,900	14,400

Notes:
All units are acre-feet unless specified, rounded to the nearest hundred
Totals may not sum due to rounding
(1) Growth Projections: SCAG 2004 Regional Transportation Plan; SANDAG 2030 Forecast
(2) Includes code-based, price-effect and existing active savings through 2004; does not include future active conservation savings
Code-based conservation includes plumbing codes for pre-rinse spray heads and high-efficiency washing machines
(3) The retail M&I projections include existing active conservation through 2004, but do not include future active conservation savings
(4) Replenishment Water Rate demands include: seasonal shift, groundwater spreading, and groundwater in-lieu

Metropolitan Water District of Southern California

Average Year

Demographics (1)	2005	2010	2015	2020	2025	2030
Population	18,233,700	19,138,000	19,914,600	20,664,600	21,367,500	22,053,200
Occupied Housing Units	5,803,800	6,145,200	6,444,600	6,751,100	7,075,600	7,376,400
Single Family	3,477,300	3,651,000	3,767,600	3,945,800	4,128,700	4,250,100
Multi-Family	2,326,500	2,494,200	2,677,000	2,805,300	2,946,800	3,126,300
Persons Per Household	3.08	3.05	3.03	3.01	2.97	2.94
Urban Employment	8,186,200	8,991,300	9,402,700	9,795,200	10,163,000	10,537,600

Conservation	2005	2010	2015	2020	2025	2030
Total Conservation	735,900	865,200	955,200	1,027,600	1,106,900	1,188,300
Installed Active Devices Through 2004	91,200	85,800	63,200	23,000	900	100
IRP Conservation Target (2)	6,100	27,100	38,300	45,700	30,500	23,800
Code-Based and Price-Effect Savings (3)	388,600	502,300	603,700	708,900	825,500	914,400
Pre-1990 Conservation	250,000	250,000	250,000	250,000	250,000	250,000

Total Demands After Conservation	2005	2010	2015	2020	2025	2030
Total Demands	4,303,900	4,649,500	4,767,600	4,930,600	5,071,500	5,193,800
Retail Agricultural	347,800	318,800	285,000	250,500	215,000	194,600
Retail Municipal and Industrial	3,768,000	4,053,400	4,196,900	4,392,100	4,569,600	4,719,400
Groundwater Replenishment	140,100	200,400	212,800	215,100	214,000	206,900
Seawater Barrier	48,000	76,900	72,900	72,900	72,900	72,900

Local Supplies	2005	2010	2015	2020	2025	2030
Total Local Supplies	2,084,600	2,352,400	2,441,000	2,567,500	2,588,500	2,587,100
Groundwater	1,343,500	1,418,000	1,431,800	1,433,000	1,445,500	1,444,300
Surface Water	59,400	100,000	99,500	99,200	99,200	98,600
Los Angeles Aqueduct	373,300	252,500	253,000	252,900	253,200	253,600
IRP Local Resource Program Target	600	28,900	43,400	49,500	49,500	49,500
Groundwater Recovery	58,100	79,300	79,700	82,900	82,900	82,900
Total Recycling	208,800	315,100	342,900	366,900	367,700	367,700
M&I and Agricultural	*140,000*	*165,200*	*193,000*	*217,000*	*217,800*	*217,800*
Groundwater Replenishment	*52,000*	*90,000*	*90,000*	*90,000*	*90,000*	*90,000*
Sea Water Barrier	*16,800*	*59,900*	*59,900*	*59,900*	*59,900*	*59,900*
Other Imported Supplies	40,900	158,600	190,600	283,100	290,600	290,600

Demands on Metropolitan	2005	2010	2015	2020	2025	2030
Total Metropolitan Demands	2,219,100	2,297,200	2,326,700	2,363,200	2,482,900	2,606,700
Full Service (Tier I and Tier II)	1,941,900	2,034,100	2,067,500	2,114,600	2,253,800	2,393,200
Replenishment Water Rate (4)	167,500	169,200	179,700	182,800	183,100	176,800
Interim Agricultural Water Program	109,700	93,900	79,500	65,800	46,000	36,700
Firm Demands on Metropolitan (5)	2,019,000	2,100,000	2,123,000	2,161,000	2,286,000	2,419,000

Notes:
All units are acre-feet unless specified, rounded to the nearest hundred
Totals may not sum due to rounding
(1) Growth Projections: SCAG 2004 Regional Transportation Plan; SANDAG 2030 Forecast
(2) The 2030 savings target is derived from the 2003 IRP Update forecast projections for 2030; it is not an official target for 2030.
(3) Measured from 1990; Includes plumbing codes for pre-rinse spray heads and high efficiency washing machines
(4) Replenishment Water Rate demands include: seasonal shift, groundwater spreading, and groundwater in-lieu
(5) Firm demand on Metropolitan equals Full Service demands plus 70% of the Interim Agricultural Water Program demands

Appendix G
Sample Drought Management Resolutions

ORDINANCE 268

AN ORDINANCE OF THE BOARD OF DIRECTORS
OF WESTERN MUNICIPAL WATER DISTRICT
OF RIVERSIDE COUNTY ESTABLISHING A
RETAIL DOMESTIC WATER CONSERVATION PLAN

WHEREAS, California is in the fifth consecutive year of below normal precipitation, and reduced supplies in storage will cause shortfalls in imported water deliveries to the region unless appropriate conservation measures are implemented; and

WHEREAS, one hundred percent (100%) of the Western Municipal Water District's ("District") water supply is imported from the Metropolitan Water District of Southern California ("MWD"); and

WHEREAS, MWD has implemented a staged program called its Incremental Interruption and Conservation Plan requiring its member agencies to achieve stepped reductions ranging from twenty percent (20%) to fifty percent (50%) in the use of water for interruptible deliveries and from five percent (5%) to twenty percent (20%) for firm deliveries and imposes economic penalties for failure to meet such goals; and

WHEREAS, MWD has called upon its member agencies and subagencies to comply with its mandatory water conservation program to mitigate a water supply shortfall and related impacts; and

WHEREAS, in response to drought conditions, Western has determined that the existing stage of water shortage within Western requires that it adopt and enforce water conservation measures for retail domestic customers set forth in this ordinance; and

WHEREAS, on February 20, 1991, the District passed Resolution No. 1720, thereby declaring a water shortage emergency pursuant to Water Code Sections 350 et seq. and Water Code Sections 71640 et seq; and

WHEREAS, the District has the power and authority to enact a water conservation plan and water conservation measures pursuant to Water Code Sections 350 et seq., 375 et seq. and 71640 et seq.; and

WHEREAS, The Board of Directors may enact future amendments to this ordinance increasing or decreasing water conservation measures to reflect then-existing water shortage conditions; and

WHEREAS, the District has determined that adoption of a water conservation plan is necessary to meet the target reduction in water use mandated by MWD and to protect the public health, safety and welfare.

NOW, THEREFORE, BE IT ORDAINED BY THE BOARD OF DIRECTORS OF WESTERN MUNICIPAL WATER DISTRICT OF RIVERSIDE COUNTY as follows:

Section 1. Definitions.

The following terms are defined for the purposes of this ordinance:

"Base year" means fiscal year 1990 (July 1, 1989 through June 30, 1990).

"Board of Directors" means the Board of Directors of the Western Municipal Water District.

"Customer" means all retail domestic or municipal customers of the District.

"Developer" means any person, company or corporation which plans to construct or to have constructed a single family dwelling unit or any other new structure which will require new water connection and service from the District.

"District" means the Western Municipal Water District.

"General Manager" means the general manager of the Western Municipal Water District.

"Target water use" means 80% of the amount used by the customer during the same month in the base year of fiscal 1990, or 20 units,

whichever is greater, except that there shall be no base year allowance for construction water.

"Unit of water means an amount equal to 748 gallons or 100 cubic feet of water.

"Wasteful use" means any unreasonable or nonbeneficial use of water, or any unreasonable method of use of water, included, but not limited to, the specific uses restricted by this ordinance as hereinafter set forth.

"Water" means water supplied by the Western Municipal Water District.

"Water Conservation Measure" means a measure calculated to reduce the amount of water used by District customers.

Section 2. Purpose and Scope.

(a) The purpose of this ordinance is to provide a mandatory water conservation plan to minimize the effects of a water supply shortage on the customers of the District. Pursuant to Water Code Sections 350 *et seq.*, and 71640 *et seq.*, the Board of Directors has previously declared a water shortage emergency. The adoption of a water conservation plan and implementation of water conservation measures is therefore necessary to (1) protect the health, safety, and welfare of the inhabitants and customers of the District, (2) assure the maximum beneficial use of the water supplies of the District and (3) ensure sufficient water supplies to meet the basic needs of human consumption, sanitation and fire protection.

(b) This ordinance adopts regulations to implement a mandatory water conservation plan consistent with the goals of MWD's Incremental Interruption and Conservation Plan and projected water supply availability.

(c) This ordinance shall remain in effect until the Board of Directors finds and declares by ordinance that the provisions of this ordinance are no longer applicable to existing water supply conditions or until increasing or decreasing water shortages require the Board to amend the ordinance.

Section 3. Authorization.

(a) The Board of Directors may adopt a water conservation plan following a public hearing upon the determination by majority vote that such implementation is necessary to reduce water consumption by District customers to conserve water supplies.

(b) A public hearing shall be held to determine whether the District should adopt a water conservation plan. Notice of the time and place of this public hearing shall be published not less that ten (10) days before the hearing in a newspaper of general circulation.

(c) The provisions of Section 6 of this ordinance shall become effective immediately upon adoption by the Board of Directors. Section 5 and any other sections related to curtailment in the use of water shall become effective at the start of the first full billing period commencing on or after August 1, 1991. Prohibitions related to construction water use and new connections provided for in Sections 7 and 8 shall become effective on August 1, 1991.

Section 4. Application.

The provisions of this ordinance shall apply to all retail domestic water customers served by the District.

Section 5. Curtailment of Consumer Water Usage.

(a) No customer shall use District water in excess of eighty percent (80%) of the amount used by the customer during the same month in the base year of fiscal 1990. The customer's target water use amount for the following month will be included on each monthly District invoice.

(b) Notwithstanding the above, no customer shall be required to reduce water consumption below the minimum allocation amount of twenty (20) units of water per month. Twenty (20) units of water constitutes approximately five hundred (500) gallons of water per day per connection. If actual customer water usage is twenty (20) units of water or less per month, the base year allocation does not apply. New residential and commercial connections shall be allocated twenty (20) units of water per month.

Section 6. Water Conservation Measures.

The following uses shall be prohibited:

(a) Hosing down driveways, sidewalks, patios, building walls or any paved area except as necessary for public health or sanitation.

(b) Washing cars, trucks, vans, campers, trailers or any other vehicle without using a bucket or a hose equipped with an automatic shutoff nozzle except on the premises of a commercial car wash or service station using reclaimed or recycled water.

(c) Restaurants and other public places serving food shall not serve drinking water to customers unless expressly requested.

(d) Lawns or outdoor landscaping shall be irrigated only between the hours of 6:00 p.m. and 6:00 a.m.

(e) Parks, school grounds and golf courses shall be irrigated only between the hours of 6:00 p.m. and 6:00 a.m.

(f) The operation of sprinklers and irrigation systems shall be adjusted to avoid overspray, runoff and waste. Irrigation using these systems is prohibited during high wind periods.

The following water conservation measures are strongly recommended:

(a) The installation and use of spa and pool covers.

(b) All indoor and outdoor plumbing, such as pipes, faucets and toilets should be periodically checked for leaks and repaired promptly.

(c) The use of water saving devices such as ultra low flush toilets, toilet dams, low flow showerheads and faucet aerators.

(d) New landscaping should incorporate low water demand trees, shrubs, grasses, and water-efficient irrigation systems. The installation of large turf areas is discouraged. District resources are available to provide reasonable assistance regarding water conservation techniques. The District recommends the use of a landscaping manual entitled "Landscapes Southern California Style". The District's garden display provides examples of water conservation landscaping.

Section 7. Prohibition on Construction Water Use.

No District water shall be used for construction purposes unless no alternative water sources are available and the General Manager has determined that the District has water available for this purpose. Developers may be required to find alternative sources of water for uses such as dust control, site clean-up and compaction purposes. Potable water may only

be used for construction purposes for the disinfection and pressure testing of the delivery system and for pressure testing and limited on-site building construction needs. No potable water shall be used in conjunction with construction to wash down streets without written authorization from the District. In the event District water is available for construction uses, the rate for such water shall be twice the regular rate for such water.

New temporary unmetered connections ("jumpers") shall be prohibited after the effective date of this ordinance unless the General Manager determines that the District has water available for this purpose.

Section 8. Prohibition on New Connections Unless Water Efficient Landscaping is used.

No new connections shall be approved by the District unless the applicant has a plan for water efficient landscaping approved by the District. Developers must submit a water efficient landscaping plan for all developer planted areas to the District for approval prior to the issuance of new meter connections. These areas include, but are not limited to, landscaping medians, common areas, model homes and developer planted yard areas. Developers are encouraged to use as a resource the landscaping manual entitled "Landscapes Southern California Style".

Individual homeowners may comply with this Section by one or more of the following:

(a) Submission of a plan for low water use irrigation system acceptable to the District;

(b) Submission of a plan for low water use landscaping materials acceptable to the District;

(c) Such other measures as the District may approve upon individual application.

Section 9. Surcharge for Excess Water Consumption.

Water use in excess of the target amount permitted in Section 5 shall be billed at twice the normal water rate established by the District.

Section 10. Exemption from Compliance.

Any customer may apply in writing for exemption from any provision of this ordinance with the District. District staff may grant such exemption if special circumstances make compliance not reasonably possible, or that the restrictions herein would:

(a) Cause an unnecessary and undue hardship to the customer or the public; or

(b) Cause an emergency condition affecting the health, sanitation, fire protection or safety of the customer or of the public; or

(c) Cause unfairness if historic water use records of the customer indicated that substantial existing water conservation actions have previously been taken. Such indications would include:

(i) Use of xeriscape landscaping during the base year.

(II) Installation of interior and/or exterior permanent plumbing fixtures to conserve water, such as low flow showerheads, ultra low flush toilets, or a drip irrigation system.

(d) Cause unfairness due to the customer's justifiable increase in water use from the base year.

The request for exemption must be supported by evidence to support the applicant's request for special consideration. District staff may require the applicant to submit any additional information necessary to verify the request for exemption and may conduct an inspection of the premises in question before deciding whether to grant such

relief. A decision shall be made on the application within thirty (30) days of receipt of the request and the District shall inform the applicant of the decision in writing. If an exemption is granted, the District may impose any conditions it deems proper.

Section 11. Appeal.

An applicant shall have the right to appeal the decision regarding his or her application in writing to the Board of Directors. The appeal must be in writing and received by the District within ten(10) days of the date of the District's initial written decision. The appeal shall be heard by the Board of Directors within thirty (30) days from the date the appeal is filed. The Board of Directors, at its discretion, may affirm, reverse or modify the decision and impose any conditions it deems proper. The decision of the Board of Directors shall be final.

Section 12. Severability.

If any provision, section, subsection, sentence, clause, or phrase of this ordinance or the application of same to any person or set of circumstances is held to be unconstitutional, void, or invalid, such decision shall not affect the remaining portions of this ordinance which shall remain in full force and effect, and all provisions of this ordinance are declared to be severable for that purpose.

Section 13. Incompatible Provisions.

To the extent any provision of this ordinance is incompatible with or at variance with any prior adopted ordinance or resolution, the provisions of this ordinance shall take precedence, and all prior ordinances and resolutions shall be interpreted to harmonize with and not change the provisions of this ordinance.

Section 14. Public Health and Safety Not to be Affected.

Nothing in this ordinance shall be construed to require the District to curtail the supply of water to any customer when such water is required by that customer to maintain an adequate level of public health or public safety.

Section 15. Exemption from California Environmental Quality Act.

The Board of Directors hereby determines that the adoption of this ordinance and implementation of the measures set forth herein are exempt from review under the California Environmental Quality Act (California Public Resources Code Section 21000 et seq.) as it is an action take to mitigate a water shortage emergency. The Board of Directors hereby directs staff to prepare and file a Notice of Exemption within five (5) working days of adoption of this ordinance.

ADOPTED AND APPROVED this 3rd day of July, 1991, by the Board of Directors of Western Municipal Water District of Riverside County.

Frances J. Nelson
Frances J. Nelson
President of the Board of Directors

ATTEST:

Wayne C. Keith
Wayne C. Keith
Secretary of the Board of Directors

ORDINANCE 279

AN ORDINANCE OF THE BOARD OF DIRECTORS
OF WESTERN MUNICIPAL WATER DISTRICT
OF RIVERSIDE COUNTY AMENDING ORDINANCE 268
TO MODIFY THE RETAIL DOMESTIC WATER
CONSERVATION PLAN

WHEREAS, California is in the fifth consecutive year of below normal precipitation, and reduced supplies in storage will cause shortfalls in imported water deliveries to the region unless appropriate conservation measures are implemented; and

WHEREAS, one hundred percent (100%) of the Western Municipal Water District's ("District") water supply is imported from the Metropolitan Water District of Southern California ("MWD"); and

WHEREAS, MWD has implemented a staged program called its Incremental Interruption and Conservation Plan requiring its member agencies to achieve stepped reductions ranging from twenty percent (20%) to fifty percent (50%) in the use of water for interruptible deliveries and from five percent (5%) to twenty percent (20%) for firm deliveries and imposes economic penalties for failure to meet such goals; and

WHEREAS, MWD has called upon its member agencies and subagencies to comply with its mandatory water conservation program to mitigate a water supply shortfall and related impacts; and

WHEREAS, in response to drought conditions, Western has determined that the existing stage of water shortage within Western requires that it adopt and enforce water conservation measures for retail domestic customers set forth in this ordinance; and

WHEREAS, on February 20, 1991, the District passed Resolution No. 1720, thereby declaring a water shortage emergency pursuant to Water Code Sections 350 et seq. and Water Code Sections 71640 et seq; and

WHEREAS, the District has the power and authority to enact a water conservation plan and water conservation measures pursuant to Water Code Sections 350 et seq., 375 et seq. and 71640 et seq.; and

WHEREAS, The Board of Directors may enact future amendments to this ordinance increasing or decreasing water conservation measures to reflect then-existing water shortage conditions; and

WHEREAS, the District has determined that adoption of a water conservation plan is necessary to meet the target reduction in water use mandated by MWD and to protect the public health, safety and welfare.

WHEREAS, on July 3, 1991, the District adopted Ordinance 268 establishing a retail water conservation plan which prohibits District residential and commercial customers from using water in excess of eighty percent (80%) of the amount used during the same month in the base year of fiscal 1990; and

WHEREAS, approximately twenty-five percent (25%) of District residential customers did not use District water service in all twelve months of the base year of fiscal 1990 and therefore do not have a complete year in which to compare water usage; and

WHEREAS, in order to implement the plan uniformly for the benefit of all residential customers, the District has determined that the target water use of these customers should be adjusted to reflect the average usage of similar water users; and

WHEREAS, certain customers reside within the boundaries of governmental agencies that overlap the District's service area which do not limit water usage or impose a surcharge for excess water consumption; and

WHEREAS, in certain situations, water from these governmental agencies may be made available to the District; and

WHEREAS, the cost of making such water available to District customers within the boundaries of the governmental agency would be borne by the agency and no additional costs would be incurred by the District; and

WHEREAS, in order to implement the plan fairly for the benefit of all customers, the District has determined that such water can be supplied to these customers at the District's regular rate without a surcharge for excess water consumption.

NOW, THEREFORE, BE IT ORDAINED BY THE BOARD OF DIRECTORS OF WESTERN MUNICIPAL WATER DISTRICT OF RIVERSIDE COUNTY as follows:

Section 1. Section 1 of Ordinance No. 268 is hereby amended to read as follows:

Section 1. Definitions.

The following terms are defined for the purposes of this ordinance:

"Base year" means fiscal year 1990 (July 1, 1989 through June 30, 1990).

"Board of Directors" means the Board of Directors of the Western Municipal Water District.

"Customer" means all retail domestic or municipal customers of the District.

"Developer" means any person, company or corporation which plans to construct or to have constructed a single family dwelling unit or any other new structure which will require new water connection and service from the District.

"District" means the Western Municipal Water District.

"General Manager" means the general manager of the Western Municipal Water District.

"Target water use" means eighty percent (80%) of the amount used by the customer during the same month in the base year of fiscal 1990, or 20 units, whichever is greater, except that

residential customers who did not receive more than 25 units of water in any month of the base year shall be considered to have used an amount of water equal to the average usage of similar users as determined by the General Manager and there shall be no base year allowance for construction water.

"Unit of water means an amount equal to 748 gallons or 100 cubic feet of water.

"Wasteful use" means any unreasonable or nonbeneficial use of water, or any unreasonable method of use of water, included, but not limited to, the specific uses restricted by this ordinance as hereinafter set forth.

"Water" means water supplied by the Western Municipal Water District.

"Water Conservation Measure" means a measure calculated to reduce the amount of water used by District customers.

Section 2. Section 5 of Ordinance 268 is hereby amended to read as follows:

Section 5. Curtailment of Consumer Water Usage.

(a) No customer shall use District water in excess of eighty percent (80%) of the amount used by the customer during the same month in the fiscal year. The customer's target water use amount for the following month will be included on each monthly District invoice.

(b) Notwithstanding the above, no customer shall be required to reduce water consumption below the minimum allocation amount of twenty (20) units of water per month. Twenty (20) units of water constitutes approximately five hundred (500) gallons of water per day per connection. If actual customer water usage is twenty (20) units of water or less per month, the base year allocation does not apply. Customers granted new service connections after August 1, 1991 shall be allocated twenty (20) units of water per month.

(c) Further not withstanding the above, residential customers who were granted water service prior to August 1, 1991 but did not receive more than 25 units of water in any month of the base year of fiscal 1990 shall not use District water in excess of eighty percent (80%) of the average amount of water used by similar customers during the same month in the base year. The average amount of water shall be determined by the General Manager. The customer's target water use amount for the following month will be included on each monthly District invoice.

Section 3. Section 10 of Ordinance 268 is hereby amended to read as follows:

Section 10. Exemption from Compliance.

Any customer may apply in writing for exemption from any provision of this ordinance with the District. District staff may grant such exemption if special circumstances make compliance not reasonably possible, or that the restrictions herein would:

(a) Cause an unnecessary and undue hardship to the customer or the public; or

(b) Cause an emergency condition affecting the health, sanitation, fire protection or safety of the customer or of the public; or

(c) Cause unfairness if historic water use records of the customer indicated that substantial

existing water conservation actions have previously been taken. Such indications would include:

(i) Use of xeriscape landscaping during the base year.

(II) Installation of interior and/or exterior permanent plumbing fixtures to conserve water, such as low flow showerheads, ultra low flush toilets, or a drip irrigation system.

(d) Cause unfairness due to the customer's justifiable increase in water use from the base year.

The request for exemption must be supported by evidence to support the applicant's request for special consideration. District staff may require the applicant to submit any additional information necessary to verify the request for exemption and may conduct an inspection of the premises in question before deciding whether to grant such relief. A decision shall be made on the application within thirty (30) days of receipt of the request and the District shall inform the applicant of the decision in writing. If an exemption is granted, the District may impose any conditions it deems proper.

Staff may exempt groups of customers from Sections 5 and 9 provided the following conditions are met:

(a) A city, county or other governmental agency which both overlaps the District's service area and represents the interests of the District's customers submits a request for exemption from Sections 5 and 9 for a specific group of District customers.

(b) The city, county or other governmental agency requesting an exemption enters into an agreement with the District to make water available to the District for delivery to the

specific group of customers at the District's regular rate under terms and conditions acceptable to the District.

(c) Customers exempted from provisions of Sections 5 and 9 pursuant to the above shall receive notification through the normal billing procedure of their allowable usage, the actual amount of usage and the amount of surcharge that would have been required in the absence of the exemption

(d) The District shall report monthly to the city, county or other governmental agency the amount of water delivered to the exempted group of customers in excess of the amounts allowed under Section 5.

ADOPTED AND APPROVED this 4th day of September, 1991, by the Board of Directors of Western Municipal Water District of Riverside County.

Frances J. Nelson

Frances J. Nelson
President of the Board of Directors

ATTEST:

Wayne C. Keith

Wayne C. Keith
Secretary of the Board of Directors

ORDINANCE 280

AN ORDINANCE OF THE BOARD OF DIRECTORS
OF WESTERN MUNICIPAL WATER DISTRICT
OF RIVERSIDE COUNTY REPEALING
ORDINANCE 268 AND ALL AMENDING ORDINANCES

WHEREAS, the Board finds that drought emergency conditions no longer exist,

NOW, THEREFORE, BE IT ORDAINED BY THE BOARD OF DIRECTORS OF WESTERN MUNICIPAL WATER DISTRICT OF RIVERSIDE COUNTY, as follows:

Ordinance No. 268 and all ordinances amendatory thereof, are hereby repealed and rescinded effective March 30, 1992.

ADOPTED AND APPROVED this 18th day of March 1992.

Ayes: Holcomb
Keith
Mylne
Nelson
Schroeder

Noes: None

Absent: None

Frances J. Nelson
Frances J. Nelson
President, Board of Directors

ATTEST:

Secretary-Treasurer

ORDINANCE 358

AN ORDINANCE OF THE BOARD OF DIRECTORS OF WESTERN MUNICIPAL WATER DISTRICT OF RIVERSIDE COUNTY DECLARING THAT A WATER SHORTAGE EMERGENCY CONDITION WILL EXIST IN THE DISTRICT DURING A SCHEDULED SHUTDOWN OF THE MILLS FILTRATION PLANT AND ESTABLISHING A SUPPLY INTERRUPTION WATER CONSERVATION PLAN

WHEREAS, Western Municipal Water District was formed by the voters in 1954 for the purpose of importing water supplies from the Metropolitan Water District of Southern California; and

WHEREAS, Western delivers these imported water supplies, from the State Water Project and the Colorado River Aqueduct and treated at Metropolitan's Henry J. Mills and Robert A. Skinner Filtration Plants, to communities on a wholesale basis to augment their own supplies; and

WHEREAS, Western serves a population of more than 60,000 people directly on a retail basis with State Water Project water treated at the Mills Filtration Plant; and

WHEREAS, the Metropolitan Water District periodically interrupts its water supply deliveries and/or treatment facilities operations for extended periods for routine and/or emergency maintenance; and

WHEREAS, Metropolitan has scheduled a shutdown of its Mills Filtration Plant from February 1 through February 5, 2005, creating such an extended interruption in water supply to Western; and

WHEREAS, on October 6, 2004, the Board of Directors of the Western Municipal Water District adopted Resolution

2314, setting a public hearing regarding the proposed declaration of water shortage emergency during the scheduled shutdown of the Mills Filtration Plant; and

WHEREAS, Water Code Section 71640 et seq. authorizes the District to restrict the use of District water during any emergency caused by drought, or other threatened or existing water shortage, and may prohibit the wastage of District water or the use of District water during such periods for any purpose other than household uses or such other restricted uses as the District determines to be necessary; and

WHEREAS, Water Code Section 350 et seq. and Section 375 et seq. authorize the District to declare a water shortage emergency condition whenever it finds and determines that the ordinary demands and requirements of water consumers will not be satisfied without depleting the water supply of the District to the extent that there will be insufficient water for human consumption, sanitation and fire protection; and

WHEREAS, the District has the power and authority to enact a water conservation plan and water conservation measures pursuant to Water Code Section 350 et seq., 375 et seq and 71640 et seq; and

WHEREAS, the District has determined that adoption of a water conservation plan is necessary to ensure an available water supply at the levels necessary to maintain human consumption, sanitation, and fire protection during the period of this shutdown; and

WHEREAS, in order to ensure that there are adequate water supplies to meet the needs of human consumption, sanitation, and fire protection, the District is requiring that all customers refrain from using water for non-essential

indoor and all outdoor uses, and to implement conservation measures for essential uses; and

WHEREAS, customers within the District's service area have been given notice of the severity of the situation and the restrictions, which will be in place during the water shortage emergency.

NOW, THEREFORE, BE IT ORDAINED BY THE BOARD OF DIRECTORS OF WESTERN MUNICIPAL WATER DISTRICT OF RIVERSIDE COUNTY AS FOLLOWS:

Section 1. Notice and Public Hearing. The Board conducted a public hearing on October 20, 2004 at 450 Alessandro Blvd., Riverside CA in order for customers to have the opportunity to be heard to protest against the proposed declaration of a water shortage emergency and to present their respective needs to the Board. Notice of the public hearing was published on October 12, 2004 in the Press Enterprise.

Section 2. Declaration of Water Shortage Emergency. The Board of Directors hereby determines that the scheduled shutdown of the Metropolitan Water District of its Mills Filtration Plant from February 1 through February 5, 2005, will constitute, during that time, a water shortage emergency condition. Therefore, the Board hereby declares that for the period of February 1 through February 5, 2005 ("Emergency Period"), a water shortage emergency condition shall be deemed to be in effect. The restrictions set forth in this Ordinance shall constitute a mandatory water conservation plan ("Plan") to minimize the effects of the water shortage emergency condition during the Emergency Period. The Emergency Period may be extended or revised if it is determined, in the discretion of the General Manager, that the period of the

shutdown of the Mills Filtration Plant has been extended or revised.

Section 3. Application of the Plan. The provisions of the Plan and this Ordinance shall apply to all retail and wholesale water customers served water treated at the Mills Filtration Plant by the District. The District shall provide appropriate notice and instructions to customers and recommendations for wise water usage during the Emergency Period.

Section 4. Curtailment of Water Usage by Retail Customers. The following restrictions shall apply during the Emergency Period to District retail customers served water treated at the Mills Filtration Plant.

(a) The following uses shall be prohibited:

1. Irrigating outdoor lawns and landscapes, parks, school grounds, golf courses, medians, agriculture, groves, and any other outdoor planted areas, whether for personal, aesthetic, commercial, or recreational use.

2. Hosing down driveways, sidewalks, patios, building walls, or any paved area except as required by local, county, or state health and safety codes and laws.

3. Washing cars, trucks, vans, campers, trailers or any other vehicle without using solely a hose equipped with an automatic shutoff nozzle other than on the premises of a commercial car wash or service station using reclaimed or recycled water.

(b) No District water shall be used for exterior construction purposes, including, but not limited to dust control, site cleanup, compaction or wash down of streets.

Section 5. Curtailment of Water Usage by Wholesale Customers.

a) The District will discontinue water deliveries on a wholesale basis during all or any portion of the Emergency Period. Based on availability, as determined by the General Manager, limited supply delivery may be made available in the discretion of the General Manager if the General Manager determines that such deliveries are necessary for domestic use, sanitation or fire protection.

Section 6. Enforcement.

a) Retail Customers, Excluding Construction Water Service Customers. Any user of District water in violation of the provisions of the Plan and this Ordinance shall receive a written citation upon the first occurrence. Upon the second occurrence by the same customer, the District will turn water service off to the customer's building, residence, or irrigation. Following expiration of the Emergency Period, the customer will be required to pay in person at the District's offices all applicable turn-on fees, in order to resume service, as established by the District's rules and regulations for water service. Customers without separate irrigation or landscape meters will not be required to wait for the expiration of the Emergency Period to pay fees for resumption of service.

b) Construction Water Service Customers. Any user of District water for construction water service in violation of the provisions of the Plan and this Ordinance shall receive a written citation and all water service to the construction site shall be turned off at the time of citation. Following expiration of the Emergency Period, the customer will be

required to pay all applicable turn-on fees in person at the District's offices, in order to resume service, as established by the District's rules and regulations. In addition, all water used on a construction site in violation of the Plan and this Ordinance will be billed at twice the normal District rate for such water.

Section 7. Severability. If any provision, section, subsection, sentence, clause, or phrase of this Ordinance or the application of same to any person or set of circumstances is held to be unconstitutional, void, or invalid, such decision shall not affect the remaining portions of this Ordinance which shall remain in full force and effect, and all provisions of this Ordinance are declared to be severable for that purpose.

Section 8. Incompatible Provisions. To the extent any provision of this Ordinance is incompatible with or at variance with any other District policy or rules and regulations, the provisions of this Ordinance shall be controlling, and all other District policies and rules and regulations shall be interpreted to harmonize with and not change the provisions of this Ordinance.

Section 9. Public Health and Safety Not To Be Affected. Nothing in this Ordinance shall be construed to require the District to curtail the supply of water to any customer when such water is required by that customer to maintain an adequate level of public health or public safety.

Section 10. Exemption From California Environmental Quality Act. The Board determines that the adoption of the Plan and this Ordinance, for the purpose of addressing the

supply interruption due to the scheduled maintenance of the Mills Filtration Plant, are exempt from the requirements of the California Environmental Quality Act pursuant to sections 15268(a) and 15378(b)(2) of the State CEQA Guidelines. The Board hereby directs staff to prepare and file a Notice of Exemption within five (5) working days of adoption of this Ordinance.

Section 11. Effective Date. This Ordinance shall be effective immediately upon adoption and shall remain in effect until expiration of the Emergency Period, as said Emergency Period may be extended or revised as set forth in this Ordinance. Upon said expiration of the Emergency Period, this Ordinance shall be deemed to expire and shall be of no further force or effect. Within ten days from the date of adoption, this Ordinance shall be published one time in full in the Press Enterprise. The Plan shall only be effective during the Emergency Period, as said Emergency Period may be extended or revised as set forth in this Ordinance.

ADOPTED AND APPROVED this 20th day of October, 2004 by the Board of Directors of the Western Municipal Water District.

WAYNE H. HOLCOMB
President

October 20, 2004

I HEREBY CERTIFY that the foregoing is a full, true and correct copy of Ordinance 358 adopted by the Board of Directors of Western Municipal Water District of Riverside County at its Regular Meeting held October 20, 2004.

ELIZABETH L. CUNNISON
Secretary-Treasurer

Appendix H
Public Meeting Documentation

NOTICE OF PUBLIC HEARING
ON URBAN WATER
MANAGEMENT PLAN

The Western Municipal Water District of Riverside County provides retail water service to about 14,000 customers and wholesales imported water to ten water purveyors in Western Riverside County. Western has prepared a draft water conservation and water management plan for its retail service areas to satisfy the Urban Water Management Planning Act, Water Code Section 10610 et. Seq. (Act).

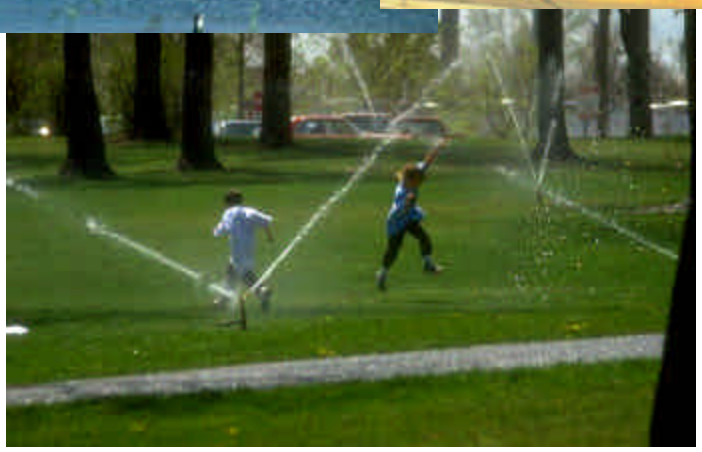
There will be a public hearing pursuant to the Act on the draft plan on Wednesday, December 7, 2005 at 9:30 a.m. at the District office located at 450 Alessandro Blvd. In Riverside. Copies of the draft plan may be obtained by contacting Ms. Carroll at (951) 789-5064.

Jeffrey D. Sims
District Engineering Manager

WESTERN
MUNICIPAL
WATER
DISTRICT

Western Municipal Water District
450 Alessandro Blvd • Riverside, California 92508
Website: www.wmwd.com • Email: water@wmwd.com • (951) 789-5000

Optimum Basin Management Program



Draft Phase I Report

Prepared for

Chino Basin Watermaster

August 19, 1999

WE Wildermuth Environmental, Inc.

Optimum Basin Management Program

Phase I Report

Prepared for the

Chino Basin Watermaster

August 19, 1999

Wildermuth Environmental, Inc.
415 North El Camino Real, Suite A
San Clemente, CA 92672
949.498.9294
www.wild-environment.com

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SECTION 1
INTRODUCTION

An Optimum Basin Management Program (OBMP) for the Chino Basin (Figure 1-1) is being developed pursuant to a Judgment entered in the Superior Court of the State of California for the County of San Bernardino and a February 19, 1998 ruling as described below. Pursuant to the Judgment, the Chino Basin Watermaster (Watermaster) files an annual report of Watermaster activities with the Court each year. The information presented below regarding the Judgment, Watermaster, and the events leading up to the February 19, 1998 ruling was obtained from these annual reports.

THE CHINO BASIN JUDGMENT AND WATERMASTER

The Chino Basin Watermaster was established under a Judgment entered in the Superior Court of the State of California for the County of San Bernardino, entitled "Chino Basin Municipal Water District v. City of Chino *et al*," (originally Case No. SCV 164327, file transferred August 1989, by order of the Court and assigned new Case No. RCV 51010). The Honorable Judge Howard B. Wiener signed the Judgment on January 27, 1978. The effective date of this Judgment for accounting and operations was July 1, 1977.

The Judgment resulted from studies and discussions that began in the early 1970's and continued for several years. The initial action to formalize the producers' intentions was the passage in 1974 of a "Memorandum of Agreement on the Chino Basin Plan." In January 1975, Senator Ruben S. Ayala introduced Senate Bill 222 (S.B. 222) in the California Legislature. This bill authorized a production assessment levy of $2.00 per acre-foot per year for a period of three years. The funds were utilized to finance the essential studies and negotiations to implement a water management program for the Chino Groundwater Basin.

S.B. 222 was subsequently renumbered as a part of the Municipal Water District Law at Section 74120 of the Water Code. It was approved by Governor Ronald Reagan and filed with the Secretary of State on June 28, 1975. Three major groups that represented the majority of the producer's interests became active in the early negotiations under S.B. 222. The groups formalized into committees and eventually became known as the: Overlying (Agricultural) Pool, including the State of California and minimal producers; Overlying (Non-Agricultural) Pool representing industries; and Appropriative Pool, representing cities, water districts and water companies. Engineering, legal and other working sub-committees were formed to analyze and define specific problem areas. Representatives of the three pools, when acting together, were called the "Watermaster Advisory Committee." The Watermaster Advisory Committee forwarded recommendations for formal action to the Chino Basin Municipal Water District (CBMWD), which was assigned the responsibility of administering S.B. 222. Socio-economic, safe yield and other studies were conducted to provide the information necessary to reach an agreement regarding the allocation of rights between and within the pool committees.

The Watermaster Advisory Committee was established as the policy setting body and charged with oversight of Watermaster's discretionary activities. Members of each of the three pool committees met regularly to transact the business concerns of its respective producers. Decisions affecting more than one pool committee were forwarded to the Watermaster Advisory Committee. The Judgment provided a method to determine the voting power of the producers on the committees, through a formula based on assessments paid in the prior year and allocated safe yield.

The Judgment declares that the safe yield of the Chino Basin is 140,000 acre-ft/yr, which is allocated among the three pools as follows:

Overlying agricultural pool	82,800 acre-ft/yr
Overlying non-agricultural pool	7,366 acre-ft/yr
Appropriative pool	49,834 acre-ft/yr

A fundamental premise of the Judgment (aka the physical solution) is that all Chino Basin water users will be allowed to pump sufficient water from the Basin to meet their requirements. To the extent that pumping exceeds the share of the safe yield, assessments are levied by the Watermaster to replace the overproduction. The Judgment recognizes that there exists a substantial amount of available groundwater storage capacity in the Chino Basin that can be utilized for storage and conjunctive use of supplemental water and basin waters; makes utilization of this storage subject to Watermaster control and regulation; and provides that any person or public entity, whether or not a party to the Judgment, may make reasonable beneficial use of the available storage, provided that no such use shall be made except pursuant to a written storage agreement with the Watermaster.

EVENTS LEADING UP TO THE FEBRUARY 19, 1998 RULING

During fiscal year 1995-96, it was determined that the reappointment of the CBMWD board as Watermaster had not been submitted to the Court for approval in 1993. In January 1996, a motion was made and supported by a majority of the Advisory Committee to appoint the Advisory Committee to serve as Watermaster. Initially, this motion was supported by 71.64% of the Advisory Committee and as provided in Paragraph 16 of the Judgment, Watermaster Counsel was directed by the Advisory Committee to file the motion with the Court. A Watermaster Ad Hoc Transition Committee of pool members and interested parties was formed to work out the logistics involved with changing the Watermaster. Shortly after the motion was filed, the case was assigned to the Honorable Judge J. Michael Gunn. Fifteen committee members attended the first Ad Hoc Transition Committee meeting on January 31, 1996, and agreed unanimously to propose that an arbitrator or an arbitration process be put in place to address initial concerns raised by some parties to the Judgment regarding the Advisory Committee serving as Watermaster.

By early March, the Overlying (Agricultural) Pool and a few appropriators had reconsidered their positions and were opposed to the motion to appoint the Advisory Committee as Watermaster, even with an arbitration process. As a result, the motion was taken off calendar and additional Ad Hoc Transition Committee meetings were held. These meetings resulted in the development of a proposal for a nine-member board, which was approved by the Advisory Committee in April 1996. Watermaster Counsel was directed to file a motion to appoint the nine-member board, which was set for hearing on June 18, 1996.

On June 3, 1996, CBMWD filed an ex-parte motion to shorten the time on a motion to appoint itself as Interim Watermaster, to appoint itself "*nunc pro tunc*" Watermaster and to disqualify Watermaster Counsel based on the allegation that Counsel had a conflict of interest in serving both Watermaster and the Advisory Committee. The motion to shorten time was granted and the hearing was set for June 18, 1996. At the June 18, 1996 hearing, the Honorable Judge J. Michael Gunn granted the motions to appoint CBMWD nunc pro tunc and Interim Watermaster, and denied the motion to disqualify Watermaster Counsel. The Judge also ordered the parties to meet and confer regarding the nine-member board

proposal, which continued the matter to a *meet and confer* among all the interested parties, held July 29, 1996.

July 29, 1996, was the first of two *meet and confers*, held at the City of Chino Council Chambers. Although there was much discussion on that date, the only substantive decision made was to hold an additional *meet and confer* on August 28, 1996.

As a result of the second *meet and confer*, a three-member Watermaster Board proposal was submitted to the Court for hearing on September 18, 1996. As of the Court hearing date, only two of the three municipal water districts invited to participate on the proposed three-member Watermaster Board had responded affirmatively. CBMWD was expected to agree to participate after consideration at their October board meeting and the Court continued the motion until November 20, 1996. CBMWD did not take action to participate on the three-member Watermaster Board as anticipated and the motion was taken off calendar in November of 1996. Four additional workshops were held during late 1996 and into the early months of 1997. As a result, the original nine-member Watermaster Board proposal was modified and approved by the Watermaster Advisory Committee on January 30, 1997, by a majority vote of 67.99 percent.

On March 11, 1997, a new motion to appoint a nine-member Watermaster Board was heard by the Honorable Judge J. Michael Gunn. On April 29, 1997, Judge Gunn issued a ruling which:

- Appointed Anne J. Schneider, Esq. as Special Referee to make a recommendation to the Court regarding the issues raised by the motions.
- Ordered CBMWD, the Advisory Committee, and the DWR (Department of Water Resources) to negotiate terms for the DWR to serve as Interim Watermaster.
- Granted a motion submitted on March 6, 1997, by the law firm of Cihigoyenetche, Grossberg & Clouse, general counsel for CBMWD, to disqualify Watermaster Counsel.

Negotiations began regarding the DWR serving as interim Watermaster through Special Counsel to the Watermaster Advisory Committee, James L. Markman, CBMWD Counsel, Jean Cihigoyenetche, and the attorneys for the DWR.

Anne Schneider accepted the Court's appointment to become a Special Referee and began the process necessary to make a recommendation to the Court. No substantial decisions were reached by fiscal year end and the matter continued into fiscal year 1997-98.

The Special Referee held a special hearing on October 21, 1997, at the Watermaster offices. By mid December 1997, the Special Referee filed her written *Report and Recommendation* with the Court. Based on the *Report and Recommendation*, the Honorable J. Michael Gunn entered a ruling on February 19, 1998 which:

- Appointed the Nine-Member Board as Interim Watermaster.
- Directed that an Optimum Basin Management Program be developed.
- Directed negotiation with DWR be resumed.
- Set hearing dates regarding:
  - The Optimum Basin Management Program (October 28, 1999).
  - Continuance of the Nine-Member Board (October 28, 1999).

- Status of negotiations with DWR to serve as Watermaster and to carry out Watermaster operations (September 30, 1999).

This report documents the development of the OBMP for the Chino Basin pursuant to the Honorable J. Michael Gunn's February 19,1998 ruling.

PROCESS TO DEVELOP THE OBMP

Since the ruling, the Watermaster, the producers, and other interested parties have met twice a month and held special workshops to develop the scope of work to prepare an OBMP and to cooperatively develop the OBMP. The Court officially accepted the scope of work to develop the OBMP on November 5, 1998.

Development of the OBMP required three parallel processes: institutional, engineering, and financial. The institutional process defined the management agenda, directed the engineering and financial processes, and built an institutional support for OBMP implementation. The engineering process developed planning data and management elements, and evaluated the technical and economic performance of the management elements. The financial process was supposed to develop alternative financing plans for the OBMP through its evolution. However because of institutional complexity involved in developing regional water supply facilities and their related financing, most of the financial process will occur in the latter half of 1999 and into the year 2000 – after this document is submitted to the Court in October 1999.

Institutional Process

The institutional process consisted of the following tasks:

Task 1 Identify needs and interests of interested parties.

Task 2 Establish a meeting schedule necessary to complete the OBMP within the time frame allocated.

Task 3 Develop and refine the scope of work based on identified needs.

Task 4 Identify early implementation actions and develop a list of potential program (management) elements of the OBMP to balance needs and interests.

Task 5 Evaluate program elements and develop recommended management and implementation plan.

The first three tasks were completed with the submission of the recommended scope of work to the Special Referee and the Court. Task 4 work was begun in June 1998 with several early implementation action items having already been approved and with initial management concepts submitted to begin the list of potential program elements of the OBMP. The management concepts that were submitted represented concepts or implementation plans that described the party's vision of the OBMP. Submission of management concepts continued into July and August of 1998 and reflected the needs and interests that were previously identified for the OBMP. All proposals submitted were discussed and listed.

As part of Task 5, those proposals that appeared the most promising were forwarded to the engineering and financial consultants for reconnaissance-level, technical, economic and financial analyses. The results of the engineering and financial analyses were submitted to the producers and Watermaster for

review. Working together, the producers and the Watermaster Board have developed an Optimum Basin Management Program for the Chino Basin.

Engineering Process

The engineering process consisted of the following tasks:

Task 1 Develop Optimum Basin Management Program Criteria

Task 2 Assess Current State of the Basin

Task 3 Prepare Sections 1, 2, and 3 of the Optimum Basin Management Program document

Task 4 Develop the Components of the Optimum Basin Management Program

Task 5 Develop Implementation Plan

Task 6 Finalize Optimum Basin Management Program document

Tasks 1 and 2 define the basin problems, planning environment, and the needs and interests of the basin producers. Tasks 1, 2, and 3 were completed in December 1998 and draft Sections 1, 2, and 3 of the OBMP were provided to all interested parties for review. A matrix was developed that contains the goals, impediments to the goal, action items to achieve the goals and the implications of the action items. This matrix was used to define the program elements of the OBMP. Tasks 4 and 5 were engineering efforts to develop these elements and to describe the implementation process.

Over time, the institutional process Tasks 4 and 5, and engineering process Tasks 4 and 5 merged and became one seamless process. Completion of engineering process Task 6 will be completed when the financial process is completed sometime in the year 2000.

ORGANIZATION OF THE OPTIMUM BASIN MANAGEMENT PROGRAM REPORT

The OBMP report is being presented in two phases. This document is the Phase I report and contains a description of the OBMP and the following additional sections:

Section 2 – Current Physical State of the Basin – This section 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. Problems in these areas are identified and potential solutions or solution processes are described.

Section 3 – Goals of the Optimum Basin Management Program – This section describes the major issues defined by stakeholders in the OBMP process, the mission statement for the OBMP process and the goals for the OBMP process.

Section 4 – Management Plan – This section describes program elements to achieve the goals of the OBMP, a management plan, and a process to periodically review and update the OBMP.

Appendix A – Public Comments. This appendix contains written correspondence and a transcript of public comments on the OBMP from a Watermaster hearing held on September 15, 1999 (bound separately).

The technical memoranda produced to support the program elements and implementation process described in Section 4 are on file at the Watermaster offices. Copies are available upon request.

The Phase II report consists of more detailed descriptions of capital-intensive and institutionally complex features of the OBMP. The Phase 2 report will be bound separately.

SECTION 2
STATE OF THE BASIN

This section has been prepared for the OBMP stakeholders so that they will have a common starting point or frame of reference from which to develop the OBMP. The stakeholders developed the outline of this section with input from the Special Referee.

This section of the OBMP report describes the Basin, its physical state, future water demands in the Chino Basin area, and concludes with a summary of problems within the Basin. The physical state of the Basin includes a description of groundwater levels, groundwater storage, production patterns, groundwater quality, and safe yield. These characteristics of the Basin are intimately related, as are the solutions to the problems associated with these characteristics. Water demands in the Chino Basin area include an estimate of current water usage and future water demand projections for groundwater and other sources, an assessment of water quality conditions, and future projections of wastewater generation – including the relationship of source water quality and wastewater quality.

DESCRIPTION OF THE BASIN

The Chino Basin consists of about 235 square miles of the upper Santa Ana River watershed. Figure 1-1 illustrates the boundary of the Chino Basin as it is legally defined in the stipulated Judgment in the case of Chino Basin Municipal Water District vs. the City of Chino *et al.* Figure 1-1 also shows the hydrologic boundary of the Basin, which is slightly different from the adjudicated boundary. Chino Basin is an alluvial valley that is relatively flat from east to west and slopes from the north to the south at a one to two percent grade. Valley elevation ranges from about 2,000 feet in the foothills to about 500 feet near Prado Dam. Chino Basin is bounded:

- on the north by the San Gabriel Mountains and the Cucamonga Basin;
- on the east by the Rialto-Colton Basin, Jurupa Hills, and the Pedley Hills;
- on the south by the La Sierra area and the Temescal basin; and
- on the west by the Chino Hills, Puente Hills, and the Pomona and Claremont Basins.

The Chino Basin is one of the largest groundwater basins in southern California with about 5,000,000 acre-ft of water in the Basin and an unused storage capacity of about 1,000,000 acre-ft. Cities and other water supply entities produce groundwater for all or part of their municipal and industrial supplies; and about 300 to 400 agricultural users produce groundwater from the Basin. The Chino Basin is an integral part of the regional and statewide water supply system. Prior to 1978, the Basin was in overdraft. After 1978, the Basin has been operated as described in the 1978 Judgment in Chino Basin Municipal Water District vs. City of Chino *et al*. (Chino Judgment or Judgment).

SURFACE WATER RESOURCES

The principal drainage course of the Chino Basin is the Santa Ana River. It flows 69 miles across the Santa Ana Watershed from its origin in the San Bernardino Mountains to the Pacific Ocean. The Santa Ana River enters the Basin at the Riverside Narrows and flows along the southern boundary to the Prado Flood Control Reservoir where it is eventually discharged through the outlet at Prado Dam. Chino Basin is traversed by a series of ephemeral and perennial streams that include: Chino Creek, San Antonio Creek, Cucamonga Creek, Deer Creek, Day Creek, Etiwanda Creek and San Sevaine Creek. Figure 2-1

illustrates the stream system in the Chino Basin. San Antonio Creek joins Chino Creek and along with Cucamonga Creek, discharges directly into the Prado Reservoir. Cucamonga Creek changes its name to Mill Creek just north of the Prado Reservoir. Deer Creek was realigned and now discharges into Cucamonga Creek. Currently, Etiwanda Creek discharges into Day Creek at Wineville Basin. In the near future, Etiwanda Creek will be joined with San Sevaine Creek. Day Creek and San Sevaine Creek flow south and enter the Santa Ana River upstream of the Prado Reservoir.

These creeks carry significant flows only during, and for a short time after, intermittent storms that typically occur from November through March. Year-round flow occurs along the entire reach of the Santa Ana River due to year round surface inflows at Riverside Narrows, discharges from municipal water recycling plants that discharge in the River between the narrows and Prado Dam, and rising groundwater. Rising groundwater occurs in Chino Creek, in the Santa Ana River at Prado Dam, and potentially other locations on the Santa Ana River depending on climate and season. The rising groundwater in Chino Creek and the Santa Ana River contains high concentrations of total dissolved solids (TDS). Year-round discharges are sustained:

- in Chino Creek from the Inland Empire Utilities Agency (IEUA) Regional Plant No. 2 (RP2) to the Prado Reservoir, the source of which is from recycled water discharges from RP2; and
- in Cucamonga Creek from IEUA Regional Plant No. 1 (RP1) to the Prado Reservoir, the source of which is from recycled water discharges from RP1.

Significant nuisance flows have developed in Cucamonga Creek above RP1, the source of which is excess landscape irrigation and other outside urban uses. Some of the storm water runoff from the San Gabriel Mountains and urban areas is diverted for recharge in flood retention and spreading basins. These basins are shown in Figure 2-1.

Geology

Chino Basin was formed when eroded sediments from the San Gabriel Mountains, the Chino Hills, Puente Hills, and the San Bernardino Mountains filled a structural depression. The formation of the Basin is described in detail in the *Final* Task 2.2 and 2.3 Report, Describe Watershed Hydrology and Identify Current TDS and TIN Inflows in the Watershed (Wildermuth, 1997). The bottom of the Basin – the effective base of the freshwater aquifer – consists of impermeable sedimentary and igneous rocks. The base of the aquifer is overlain by older alluvium of the Pleistocene period followed by younger alluvium of the Holocene period.

The younger alluvium varies in thickness from over 100 feet near the mountains to a just few feet, south of Interstate 10 and generally covers most of the north half of the Basin in undisturbed areas. The younger alluvium is not saturated and thus does not yield water directly to wells. Water percolates readily in the younger alluvium and most of the large spreading basins are located in the younger alluvium.

The older alluvium varies in thickness from about 200 feet thick near the southwestern end of the Basin to over 1,100 feet thick southwest of Fontana, and averages about 500 feet throughout the Basin. Well capacities range between 500 and 1,500 gallons per minute (gpm). Well capacities exceeding 1,000 gpm are common, with some modern production wells test-pumped at over 4,000 gpm (e.g., Ontario Wells 30 and 31 in southeastern Ontario). In the southern part of the Basin where sediments tend to be more clayey, wells generally yield 100 to 1,000 gpm. Three main water-bearing (hydrostratigraphic) units were identified by Montgomery Watson (1992) during the development of a three-dimensional groundwater model of the Basin. Figure 2-2 shows the locations of two (of seven) generalized cross-sections through

the Chino Basin. These generalized cross-sections illustrate these main aquifer units and are shown in Figures 2-3 and 2-4.

Faults are one of the principal agents in the development of the landscape and restriction of groundwater flow in the Chino Basin. The basin is bounded by major fault systems along which the mountains and hills have been uplifted. The location of fault and groundwater barriers, and displacements in the effective base of the aquifer at faults are shown in Figure 2-2. The faults and groundwater barriers are significant in that they define the external boundaries of the Basin and influence the magnitude and direction of groundwater flow near the boundaries.

MAJOR FLOW SYSTEMS

While considered one basin from geologic and legal perspectives, the Chino Basin can be hydrologically subdivided into at least five flow systems that act as separate and distinct basins. Figure 2-5 is a groundwater elevation contour map for fall of 1997. Figure 2-5 also shows the location of five groundwater flow systems developed during the *TDS and Nitrogen Study* (Wildermuth, 1999) of which the Watermaster, the Chino Basin Water Conservation District (CBWCD), and the IEUA are study participants. Each flow system has a unique hydrology, and water resource management activities that occur in each flow system have little or no impact on the other systems. Each flow system can be considered a management zone. These management zones can be subdivided further if necessary to define and manage flow systems at a finer scale. These management zones are used to characterize the groundwater level, storage, production, and water quality conditions. Figure 2-6 shows these management zones relative to the subbasins used in the 1995 Regional Water Quality Control Plan (Basin Plan) for the Santa Ana Watershed. The Regional Water Quality Control Board, Santa Ana Region (Regional Board) has established water quality objectives for these subbasins and writes waste discharge requirements for waste dischargers based in part on these objectives. Presently, the Basin Plan subbasin boundaries and objectives are being rigorously reviewed. New boundaries similar to the management zone boundaries have been proposed. Revised boundaries and water quality objectives should be adopted sometime in the year 2000.

Management Zone 1. Management Zone 1 is bounded:

- on the southwest by the Chino and Puente Hills,
- on the northwest by the San Jose fault that separates Chino Basin from the Pomona and Claremont Heights Basins,
- on the north by an unnamed non-echelon fault system associated with the Cucamonga and Red Hill faults and separates the Chino Basin from the Cucamonga Basin,
- and on the east by a line that stretches from the southern most edge of the Red Hill fault to Prado Dam.

Groundwater in Management Zone 1 flows generally south with some localized flows to the west in response to groundwater production. Sources of water to Management Zone 1 include direct percolation of precipitation, returns from irrigation, recharge of storm flows and imported water in spreading basins, and subsurface inflow from the Pomona, Claremont Heights, and Cucamonga Basins. Discharge is through groundwater production and as rising groundwater in Chino Creek and the Santa Ana River.

Management Zone 2. Management Zone 2 is bounded:

- on the west by Management Zone 1,
- on the north by the Red Hill fault that separates the Chino Basin from the Cucamonga Basin,
- on the northeast by a segment of the Rialto-Colton fault,
- and on the east by a segment of Barrier J and a line extending from Barrier J in a southwesterly direction to a point of convergence with other management zone boundaries near Prado Dam.

Groundwater in Management Zone 2 flows generally in a southwesterly direction in the northern half of the management zone and then due south in the southern half of the zone. Sources of water to Management Zone 2 include direct percolation of precipitation, returns from irrigation, recharge of storm flows and imported water in spreading basins and subsurface inflow from the part of the Rialto Basin northwest of Barrier J and the Cucamonga Basin. Discharge is mainly through groundwater production and potentially small amounts of rising groundwater in the Prado Reservoir area.

Management Zone 3. Management Zone 3 is bounded:

- on the west by Management Zone 2,
- on the northeast by the Rialto-Colton fault that separates the Chino Basin from the Rialto Basin,
- on the southeast by the Bloomington divide, Jurupa Hills and line projecting from the most western extension of the Jurupa Hills to a point of convergence with other management zone boundaries near Prado Dam.

Groundwater in Management Zone 3 flows generally in a southwesterly direction. Sources of water to Management Zone 3 include direct percolation of precipitation, returns from irrigation, and subsurface inflow from the part of the Rialto Basin southeast of Barrier J. Discharge is mainly through groundwater production and potentially small amounts of rising groundwater in the Prado Reservoir area.

Management Zone 4. Management Zone 4 is bounded

- on the west by Management Zone 3,
- on the north by the Jurupa Hills,
- on the southeast by the Pedley Hills, and
- on the south by Management Zone 5.

Groundwater in Management Zone 4 flows west. Sources of water to Management Zone 4 include direct percolation of precipitation, and returns from irrigation. Discharge is through groundwater production.

Management Zone 5. Management Zone 5 is bounded:

- on the north and west by the Management Zones 3 and 4, Prado Dam,
- on the east by the Riverside Narrows, and
- on the south by the La Sierra area and Temescal Basin.

Sources of water to Management Zone 5 include streambed percolation in the Santa Ana River, direct percolation of precipitation, returns from irrigation and subsurface inflow from the Temescal Basin. Discharge is through groundwater production, consumptive use by phreatophytes, and rising groundwater

in the Prado Reservoir area, and potentially other locations on the Santa Ana depending on climate and season.

GROUNDWATER LEVELS AND STORAGE

Historical Groundwater Level Monitoring

Various entities have collected groundwater-level data in the past. Municipal and agricultural water supply entities have historically collected groundwater-level data in programs that range from irregular, study-oriented measurements to long-term periodic measurements. Groundwater-level measurements were made for specific investigations such as various California Department of Water Resources (DWR) studies, the 1969 Judgment on the Santa Ana River (Orange County Water District *vs.* City of Chino *et al.*), and the Chino Basin Judgment (Chino Basin Municipal Water District vs. City of Chino *et al.*). The spatial extent and temporal history of groundwater-level measurements south of State Route 60 have always been less than north of State Route 60. The DWR and the San Bernardino County Flood Control District (SBCFCD) were very active in collecting groundwater-level measurements in the Chino Basin prior to the settlement of the Chino Basin adjudication. After the Judgment was entered in 1978, the water level monitoring south of State Route 60 stopped almost completely except for the cities of Chino, Chino Hills, and the Jurupa Community Services District (JCSD). Most of the pre-1978 measurements were digitized by the DWR.

Watermaster conducted its first mass groundwater-level monitoring program for the Chino Basin in the spring of 1986. In 1989, Watermaster initiated a more regular monitoring program for the Basin with groundwater-level measurements obtained in 1990, and periodically thereafter through 1997. Watermaster's program relies on municipal producers and other government agencies supplying their groundwater-level measurements on a cooperative basis. Watermaster staff supplements these data with groundwater-level measurements collected by staff, primarily south of State Route 60. In addition to Watermaster staff efforts, private contractors conducting well efficiency tests collect groundwater-level measurements and submit these measurements to Watermaster. Watermaster has digitized all of these recent measurements. Watermaster has combined digitized groundwater-level measurements from all known sources into a database structure that is maintained at Watermaster's office.

Watermaster began a process to develop a comprehensive groundwater-level monitoring program in the spring of 1998. The process consists of collecting groundwater-level data at all wells in the Basin from which groundwater-level measurements can be obtained for fall 1999, spring 2000, fall 2000, and spring 2001. These data will be mapped and reviewed. Based on this review and Watermaster management needs, a long-term water-level monitoring program will be developed and implemented in the fall of 2001.

Historical Groundwater Levels

This section describes the groundwater-level time histories in the Chino Basin by management zone and characterizes the differences between management zones. Figure 2-7 illustrates the location of wells whose groundwater-level time histories are discussed herein and the management zone boundaries described in Section 1. The wells were selected based on length of record, completeness of record, and geographical distribution. Wells discussed herein are identified by their state well number. The behavior of groundwater-levels at specific wells is compared to climate, to pre- and post-Judgment periods, and to other factors as appropriate.

Management Zone 1. Wells 01S07W08N01 (Figure 2-8) and 01S08W11R01 and 01S08W14A03 (Figure 2-9) illustrate typical groundwater-level time histories in the northern end of Management Zone 1. The accumulated departure from mean precipitation (ADFM) curve is plotted on Figures 2-8 and 2-9 to illustrate climatic conditions. Positive sloping lines on the ADFM curve imply wet years or wet periods. Negatively sloping lines imply dry years or dry periods. For example, the period between 1937 to 1944 and 1978 to 1983 are extremely wet periods, and are represented as positively sloping lines. The period 1945 through 1977 is a drought period and is represented as a negatively sloping line, punctuated with a few wet years (positively sloped in 1952, 1958 and 1969). Short-term groundwater-level fluctuations shown in these figures are caused by including static and dynamic observations in the groundwater-level time histories. These time histories follow the climatic trends very closely with the 01S08W11R01 and 0S08W14A03 (westernmost wells) being slightly more sensitive to high rainfall years than 01S7W08N01 (eastern well). The groundwater-level response in well 01S7W08N01 lags the 1937 to 1944 and the 1978 to 1983 wet periods by about three to four years. By comparison, wells 01S08W11R01 and 0S08W14A03 responded to the 1978 to 1983 wet period within a year. The difference in response time is due to proximity of recharge to the area near the wells. Wells 01S08W11R01 and 0S08W14A03 are relatively close the Upland and Montclair Basins. Well 01S7W08N01 is two miles east of wells 01S08W11R01 and 0S08W14A03 with no significant recharge facilities nearby. In addition, the Metropolitan Water District of Southern California (MWDSC) recharged large quantities of State Water Project (SWP) water in the Montclair Basins during the period 1978 to 1983. The depth to water in the vicinity of these wells ranged from about 460 feet in the late 1920s to about 600 feet in 1996.

Wells 01S08W28E01 (Figure 2-10) and 01S08W31J01 and 01S08W33D01 (Figure 2-11) are about three miles south of wells 01S08W11R01 and 01S08W14A03 (Figure 2-9). These wells follow the general climatic trend, but show essentially no response to intermittent wet years in 1952, 1958, and 1969. The post-1977 groundwater-level increase is due to the 1978 to 1983 wet period, the reduction in overdraft following the implementation of the Chino Basin Judgment, the initiation of groundwater replenishment with imported water, and the reduction in pumping due to increased use of imported surface water. The groundwater-level response in these wells responded to the 1978 to 1983 wet period within a year. The depth to water in the vicinity of these wells ranged from about 130 to 160 feet in the late 1920s to about 150 to 280 feet in 1996 with well 01S08W28E01 showing the greatest depth to water. Well 01S08W28E01 is a municipal production well owned by the City of Pomona and is located in an area of regionally depressed groundwater levels.

Wells 02S08W04P01 and 02S08W12F01 (Figure 2-12) are located about two to three miles south of well 01S08W28E01 (Figure 2-10) and wells 01S08W31J01 and 01S08W33D01 (Figure 2-11). These wells follow the general climatic trend, but show essentially no response to intermittent wet years in 1952, 1958 and 1969. The groundwater-level responses in these wells lag the 1937 to 1944 and the 1978 to 1983 wet periods by about two to three years. The response to the 1937 to 1944 wet period is surprisingly subtle compared to most other wells with contemporaneous time histories in Management Zone 1. This suggests that recharge in the area is low and that production is high. The post-1977 groundwater level increase for 02S08W04P01 is due to the 1978 to 1983 wet period, the reduction in overdraft following the implementation of the Chino Basin Judgment, the initiation of groundwater replenishment with imported water, and the reduction in pumping due to increased use of imported surface water. The depth to water in the vicinity of these wells ranged from about 20 to 40 feet in the late 1920s to about 200 feet in 1982.

From north to the south, the following observations can be made regarding time histories of groundwater levels in Management Zone 1:

- groundwater levels are down from observed period of record highs in the late 1920s;
- the lowest groundwater levels were observed around 1977;

- groundwater levels have recovered slightly since 1977 due in part to the wet period of 1978 to 1983, reduction in overdraft after 1977, the initiation of groundwater replenishment with imported water, and the reduction in pumping due to increased use of imported surface water;
- a condition of long-term overdraft has occurred in this management zone with groundwater levels dropping by about 100 to 140 feet between the late 1920s to the present with most of the decline prior to 1977 and the Chino Basin Judgment (1978).

Management Zone 2. Figure 2-13 contains groundwater-level time histories for 01S07W14G01, 01S07W27D01, and 02S07W09M01. These wells are aligned north to south, approximately along a flow line. The groundwater-level time histories in Figure 2-13 show a general decline since before the 1937 to 1944 wet period, with little or no response to wet years until 1978. The post-1977 increase is probably due to the combination of 1978 to 1983 wet period, reduction in overdraft following the implementation of the Chino Basin Judgment, the start of artificial replenishment with imported water in the San Sevaine and Etiwanda flood control basins, and the increased use of imported surface water. The depth to water for 01S07W27D01 ranged from about 200 feet in the late 1920s to about 380 feet in 1974, a decline in groundwater levels of about 180 feet.

Management Zone 3. Figure 2-14 contains time histories for wells 01S06W11B01 and 01S05W16C01 that are located in the most upgradient part of Management Zone 3. The groundwater-level observations in these wells follow the general climatic trend. The groundwater-level time history for well 01S06W16C01 shows a general decline since the 1920s and a general non-responsiveness to significant wet years or periods. For example, there is a slight response to the 1937 to 1944 and 1978 to 1983 wet periods and no response to wet years in 1952, 1958, and 1969. Well 01S06W11B01 behaves in a similar manner with slightly less responsiveness. The lack of responsiveness is due to the lack of significant sources of recharge. There are no major streams or recharge basins in the upper part of Management Zone 3. The peak groundwater levels for both of these wells are lagged about three years behind the peaks in the ADFM curve for the 1937 to 1944 and 1978 to 1983 wet periods. The depth to water ranges from about 360 to 430 feet in the late 1920s to about 430 to 540 in 1978 for wells 01S05W16C01 and 01S06W11B01, respectively. The groundwater decline from the 1920s to the early 1990s is about 20 feet and 60 feet for wells 01S05W16C01 and 01S06W11B01, respectively. Figure 2-15 is a similar plot for wells 01S05W30L01 and 01S06W23D01. These wells have similar response characteristics as 01S06W11B01 and 01S05W16C01 with about 60 to 70 feet of groundwater decline over the period from the late 1920s to the early 1990s.

The relative amount of decline from 1920s to 1977 is less in Management Zone 3 than in Management Zone 1. This is due to greater production in Management Zone 1 than in Management Zone 3 and because of the specific yield (fraction of usable groundwater per unit volume), which is greater in the eastern portion of Chino Basin than in the western portion. The alluvium in the eastern part of the Chino Basin is derived from granitic rocks of the San Gabriel Mountains. The alluvium on the west side of Chino Basin is derived in part from the San Gabriel Mountains and marine sedimentary rocks of the Chino and Puente Hills. The latter produce finer-grained alluvium with more clay and poorer storage properties.

Figure 2-16 contains time histories for wells 02S06W05B01 and 02S07W34H01. These wells are aligned northeast to southwest, approximately along a flow line. The groundwater-level time histories end in the late 1970s or early 1980s, as is typical for agricultural wells in the southern half of the Basin. These time histories follow the general climatic trend, however, there is trend among the wells of a decreasing climatic influence from northeast to southwest. The depth to water for 02S06W05B01 ranged from 130 feet in the late 1920s, to about 200 feet in 1978, a decline in groundwater levels of about 70 feet.

Management Zone 4. Management Zone 4 is bounded on the north by the Jurupa Hills, on the east by the Pedley Hills, on the south by Management Zone 5 and on the west by Management Zone 3. The only outflow from Management Zone 4 is by production. Figure 2-17 contains groundwater-level time histories for wells 02S06W16B02 and 02S06W14C02. These wells generally follow the climatic trend. The depth to water for 02S06W14C02 ranged from about 7 feet in 1945 to about 17 feet in 1993, corresponding to an overall decline in groundwater levels of about 10 feet for this period.

Management Zone 5. Management Zone 5 is bounded on the north and west by the Management Zones 3 and 4, on the east by the Riverside Narrows and on the south by various unnamed hills. Figure 2-18 contains time histories for wells 02S07W36H02, 02S06W26D02, and 03S07W03N01. Groundwater levels in these wells follow the general climatic trend. However, wells 2S07W36H02 and 03S07W03N01 are much less responsive than well 02S07W26D02 due to the stabilizing effects of being adjacent to the Santa Ana River. The depth to water for 02S07W26D02 ranged from about 24 feet in 1939 to about 28 feet in 1992, corresponding to an overall decline in groundwater levels of about 4 feet for this period.

For the most part, the response of groundwater levels in the Chino Basin to significant storms and wet climatic periods is small. There are two reasons for this. First, the mountain drainage areas tributary to the Chino Basin are relatively small compared to the size of Chino Basin (235 square miles) and the amount of water in storage (~5,000,000 acre-ft). The mountain drainage areas tributary to the Chino Basin areas are:

San Antonio Creek	17.7	sq mi
Cucamonga Creek	13.6	
Deer Creek	6.4	
Day Creek	7.7	
Etiwanda Creek	6.7	
San Sevaine Creek	9.7	
Total	61.7	sq mi

San Antonio Creek is mostly diverted for direct use and recharge in the Claremont Heights and Cucamonga Basins. Cucamonga, Deer, and Day Creeks are diverted for direct use and recharge in the Cucamonga Basin. Large storm flows from these creeks can make it into the Chino Basin, however these channels are concrete-lined and consequently large amounts of storm flow are not recharged. In contrast, San Bernardino area groundwater basins (Bunker Hill and Lytle Basins) – located just to the east of the Chino Basin – consist of about 120 square miles of aquifer and with about 466 square miles of tributary areas in the San Gabriel and San Bernardino mountains. The groundwater level response in the Chino Basin due to wet years is small, on the order of a few feet to tens of feet. In contrast, the San Bernardino area groundwater-level response to significant wet years and climatic periods could range from 100 to 300 feet.

Regional Groundwater Level Changes

Figures 2-19 and 2-20 are groundwater elevation contour maps for the Chino Basin for 1997 and 1933, respectively. The 1997 map is based on data collected in Watermaster's ongoing monitoring programs and is representative of current conditions. The 1933 map is based on groundwater-level data compiled and mapped by the DWR. Figure 2-21 shows the change in groundwater level from 1933 to 1997 based on the groundwater elevation maps for 1933 and 1997. The regional groundwater decline by management zone is:

Management Zone	Range
1	50 to 150 feet
2	50 to 100 feet
3	50 to 100 feet
4	less than 50 feet
5	less than 50 feet

Figure 2-22 is a map similar to Figure 2-21 with the water service area boundaries shown in place of management zone boundaries. The areas of greatest regional groundwater decline underlie the city of Pomona, the Monte Vista Water District, the City of Chino, and the western half of the City of Ontario.

Figure 2-23 shows the depth to water for fall 1997. Mendenhall surveyed the Basin in 1902 and found parts of the Chino Basin to be artesian as evidenced by springs and marshy areas (Mendenhall, 1904). This artesian area is also shown on Figure 2-23. In the artesian areas, the historical groundwater level or piezometric surface was at or exceeded the ground surface. Figure 2-23 suggests that the regional groundwater decline in the western Chino Basin is up to 200 feet since 1902. Groundwater levels appear to have stabilized since the Chino Basin Judgment was implemented and groundwater production has been managed within the Basin's safe yield. However, there may still be areas experiencing localized overdraft including the area overlain by the Cities of Chino, Chino Hills, Pomona, the western portion of the City of Ontario, and the Monte Vista Water District. Todd defines the *safe yield* of a groundwater basin as the amount of water that can be withdrawn annually without producing an undesirable result. Withdrawal or production is excess of safe yield is an *overdraft*. Domenico (1972) defines undesirable results to include not only the depletion of groundwater in storage but also intrusion of water of undesirable quality, contravention of existing water rights, and the deterioration of the economic advantages of pumping. Cherry (1979) includes subsidence in the list of undesirable results.

The significant issues related to large-scale regional groundwater declines in the Chino Basin include: decline in storage, higher pumping costs, loss of production capacity, water quality degradation, and subsidence.

In the mid-1970s, ground fissuring was identified in the southwestern portion of Chino Basin. Ground fissuring in this area has continued to the present, and subsidence has been documented and identified as the cause of ground fissuring (Kleinfelder, 1993; 1996). Kleinfelder documented regional subsidence through an analysis of topographic benchmarks from 1987 to 1993, 1993 to 1995, and from 1995 to 1999. The resulting contour maps of equal differences in elevation revealed a north-south trending, elongated area of subsidence underlying the City of Chino and California Institute of Men (CIM) (see Figures 2-23 and 2-24). Maximum subsidence over the period 1987-1995 was reported to be about 2 feet located along Central Avenue between Schaefer and Eucalyptus Avenues. However, about one foot (or 50 percent) of this subsidence occurred over the period from 1993-1995 – indicating that the rate of subsidence has increased. This was confirmed independently by scientists at the Jet Propulsion Laboratories using remote sensing (see www-radar.jpl.nasa.gov/sect323/InSar4crust/LosAngeles.html). Kleinfelder (1993; 1996) concluded that regional subsidence was caused by localized groundwater overdraft and declining groundwater levels. The reasoning to support this conclusion is four-fold:

- As shown in Figure 2-23, the area of regional subsidence and ground fissuring geographically coincides with the late 1800s artesian area mapped by Mendenhall (1904, 1908) – an area that has experienced extreme declines in groundwater levels.

- Subsidence is well documented in areas where underlying soils have experienced extensive fluid withdrawal. In saturated soils, buoyant conditions exist, where stresses between soil particles are low. But as the water level drops, the stresses between soil particles increase and overburden pressure causes soil consolidation.
- The initiation of ground fissuring temporally coincides with new groundwater production by the city of Chino Hills in the area of maximum subsidence. By 1975, groundwater levels had declined by a maximum of 200 feet in the former artesian area.
- Regional subsidence and ground fissuring is not attributable to other potential causes of subsidence. The area does not coincide with known faults or groundwater barriers and the area has not experienced significant petroleum extractions.

Methodology for Estimating Groundwater Storage

Estimating groundwater storage within the Chino Basin is a critical exercise because of the direct influence of storage upon the safe yield and reliability of the aquifer. The safe yield of a groundwater basin approximates the average annual recharge in a basin if the storage in the basin is large. The larger the storage, the more reliable the basin will be in dry period. The amount of water in storage in the Chino Basin is directly proportional to groundwater level.

The methodology for computing the volume of groundwater in storage consists of the following steps:

1. develop groundwater elevation maps for the basin;
2. obtain and map aquifer storage properties;
3. obtain and map the effective base of the freshwater aquifer;
4. divide the basin into a regular grid – with each grid cell assigned a:
   - groundwater elevation,
   - tops and bottom elevations of each aquifer
   - elevation of the effective base of the bottommost aquifer (*e.g.*, bedrock elevation), and
   - storage properties;
5. compute the volume of groundwater in storage for each grid cell, and sum the storage values of all grid cells.

In most parts of the Chino Basin, unconfined aquifers overlie confined aquifers. Thus, the storage in some grid cells consists of the sum of water in storage in confined and unconfined aquifers. The volume of groundwater in storage in each grid cell is estimated from the following equations:

volume in an unconfined aquifer in a grid cell is given by:

$$V_{i,l} = (GWE_{i,l} - B_{i,l}) * A_i * P_{i,l} \qquad \text{(Equation 1)}$$

volume in a confined aquifer in a grid cell is given by:

$$V_{i,l} = [(GWE_{i,l} - T_{i,l}) * SC_{i,l} + (T_{i,l} - B_{i,l}) * P_{i,l}] * A_I \qquad \text{(Equation 2)}$$

where:

$GWE_{i,l}$ is the groundwater/piezometric elevation for grid cell *i* and aquifer *l*
$T_{i,l}$ is the effective top elevation of a grid cell *i* and aquifer *l*
$B_{i,l}$ is the effective bottom elevation of grid cell *i* and aquifer *l*
A_i is the surface area of grid cell *i*
$P_{i,l}$ is the effective porosity of grid cell *i* and aquifer *l*
$SC_{i,l}$ is the storage coefficient of a grid cell *i* and aquifer *l*

Not all the water in storage is available for production. A minimum volume of groundwater must be maintained in storage to ensure that groundwater can flow to wells. This minimum storage is included in the volume computations described above.

A maximum storage could also be defined, although it is more difficult to do so. The difficulties associated with maximum storage relate to defining which high groundwater-level impacts are acceptable and to whom. An across-the-basin increase of 50 feet would probably impact only those lands near the Santa Ana River with unknown water quality impacts everywhere.

Time History of Groundwater Storage for the Basin

Groundwater-level maps were prepared using all available data for 1933, 1965, 1969, 1974, 1977, 1983, 1991, and 1997. Aquifer geometry and storage properties were developed from the Chino Basin Water Resources Management Study (CBWRMS) (Montgomery Watson, 1995). Equations 1 and 2 were used to estimate the groundwater in storage for these years. Figures 2-19 and 2-20 illustrate the spatial distribution of groundwater elevations within the Chino Basin for the fall 1997 and 1933, respectively. The estimated volume of groundwater in storage in the Chino Basin using this methodology and information was:

Year	Volume (acre-ft)
1933	6,300,000
1997	5,300,000

Groundwater storage decreased by about 1,000,000 acre-ft during the 64-year period of 1933 to 1997. Table 2-1 lists the estimated storage in each of the management zones shown in Figure 2-5 and aggregations of the management zones into the Lower Chino Basin (south of State Route 60), the Upper Chino Basin (north of State Route 60) and the Total Chino Basin. The storage estimates in Table 2-1 are shown graphically in Figures 2-25 and 2-26. The lowest level of groundwater storage during the period 1960 to the present occurred in 1977 at the end of a 33-year drought. Prior to 1977, groundwater storage was falling at a rate of about 25,500 acre-ft/yr. The decline in storage was due to drought and groundwater production in excess of sustainable yield. The period of 1978 though 1983 was an extremely wet period. The physical solution with the Chino Basin Judgment was implemented in 1978. The end of the drought and the elimination of basin-wide overdraft caused an increase in storage. Table 2-1 shows the change in storage relative to 1977 (the lowest level of storage) for the period 1965 to 1997. The losses in storage that occurred during the period 1965 to 1977 have been partially offset by gains in storage that occurred after 1977.

Figure 2-27 shows the time history of storage in the upper and lower parts of the Chino Basin. There was a decline in storage prior to 1977. After 1977, storage in the upper basin increases, however the rate of increase declines over time. This continued increase in storage after 1983 probably is due to:

- accumulation of unproduced safe yield rights in local storage accounts;
- lagged inflows from the deep unsaturated zone in the northern half of the Basin; and
- lagged subsurface inflows from the Lytle Basin north of Barrier J and the Riverside Basin through the Bloomington divide.

After 1977, storage in the lower part of the Basin appears to have stabilized and follows the general climatic pattern.

Table 2-2 and Figure 2-28 show a comparison of the time history of total Chino Basin storage to groundwater production, volume of water stored in cyclic and local storage accounts, and climate. As of fall 1997, the combined volume of water in cyclic and local storage accounts was about 274,000 acre-ft and is greater than the increase in total storage that occurred between 1977 (pre-Judgment) and the present. The increase in storage since 1977 is about 174,000 acre-ft. This is counter intuitive, that is, the change in total storage since 1977 should be greater than the volume of water in cyclic and local storage accounts – especially given that the Basin has experienced a wetter than average period since 1977. The discrepancy may be due in part to under reporting of production in the agricultural pool, storage losses to the Santa Ana River, and inaccuracies in the methods used to compute storage herein.

Losses From Storage

The surface water discharge in the Santa Ana River consists of storm flow and baseflow. Baseflow is divided into two components: wastewater discharged from publicly-owned treatment plants (POTWs) and rising groundwater. The rising groundwater component in the Santa Ana River can be divided into two components: short-term storage water from seasonal recharge along the river, and persistent rising water caused by the regional groundwater gradient towards the river. The short-term storage component of rising water will decrease when total groundwater storage is increased either naturally (wet years) or artificially. If total groundwater storage is maintained at higher levels, recharge of surface water from the Santa Ana River will decrease.

Because of the spatial distribution of storage, the rising groundwater response to increases in groundwater storage is often lagged and variable in time. For example, the baseflow at Riverside Narrows (the location where the Santa Ana River enters the Chino Basin) peaks about five to seven years after heavy recharge years in the upstream groundwater basins. Chino Basin groundwater discharge to the river also exhibits a slight lag time. The time history of baseflow at Prado consists of a complicated mix of rising water responses from the Bunker Hill, Riverside, Chino and Temescal Basins. Analysis of the increase in rising water in the Chino Basin caused by an increase in groundwater storage requires the filtering out of these other sources of surface discharge from historical records and modeling results.

The accumulation of groundwater in storage will cause an increase in groundwater discharge in the Santa Ana River and its tributaries Chino Creek and Mill Creek – losses from storage that are not recoverable. The physics of the groundwater storage-baseflow relationship can be represented by linear reservoir theory where outflow is directly proportional to storage:

$$O = K * S \qquad \text{(Equation 3)}$$

where:

O is the outflow from storage (L^3/T)

S is volume of water in storage (L^3)
K is the linear reservoir coefficient (T^{-1})
L denotes units of length and
T denotes unites of time.

This formula can be calibrated to a specific range of storage and groundwater management conditions. The flow in the Santa Ana River in the Chino Basin was decomposed into rising water from the Chino Basin and other components. The rising water component was subdivided into short-term storage water from seasonal recharge along the river in Management Zone 5, and persistent rising water caused by the regional groundwater gradient towards the River from all management zones. This decomposition was done using simulation model results from the **C**hino Basin **I**ntegrated **G**roundwater and **S**urface Water **M**odel (CIGSM) developed for the Chino Basin Water Resources Management Task Force (Montgomery Watson, 1995, and unpublished modeling results for calibration and planning simulations).

Historical Storage Losses to the Santa Ana River. Rising groundwater estimates were made for the period of model calibration 1960 to 1989, and the forecasting period of 1990 to 2040. Certain historical periods were studied to isolate the spatial effects of groundwater production patterns and hydrology on rising groundwater. For example, the period 1960 to 1977 represents the pre-Judgment period that has higher groundwater production than the period after 1978 that represents the period when the Basin was managed by Watermaster without basin-wide overdraft. Linear reservoir theory was used to develop a simple relationship of change in groundwater discharge to the Santa Ana River to incremental change in groundwater storage.

Hydrograph decomposition for the historical period was done using water balance tables from CIGSM for reaches of the Santa Ana River and its tributaries. Analysis of the hydrology of the period suggest that two periods could be used to develop a linear reservoir relationship:

- 1970 to 1977 representing a pre-Judgment period; and
- 1984 to 1989 representing a post-Judgment period.

The period 1970 to 1977 was a dry period following significant recharge along the river from the 1969 storms. The 1984 to 1989 period was also a dry period following the wet period from 1978 to 1983. Both of these periods exhibit recession flows typical of streams fed by groundwater systems. CIGSM model-estimated rising water was plotted against the model-estimated storage in the Chino Basin. The annual rising water estimates and respective storage estimates are shown graphically in Figures 2-34 and 2-35. Simple linear regressions were done for the 1974 to 1977 period and 1987 to 1989 period to estimate the linear reservoir coefficient (K) for the linear reservoir equation (Equation 3). The linear reservoir coefficient is the slope of the best-fit lines in Figures 2-34 and 2-35. The resulting linear reservoir coefficients are 0.0254 for the 1970 to 1977 period, and 0.0203 for the 1987 to 1989 period. Physically, the linear reservoir coefficient represents the fraction of the storage that annually becomes rising water. Thus, an increase in storage of 100,000 acre-ft in the 1987 will cause about 2,000 acre-ft of new rising water in the first year. Groundwater storage after the first year would be reduced to 98,000 acre-ft. In the second year, the storage would be reduced another 2.03 percent, or 1,970 acre-ft, and so on. The 0.0051 difference in linear reservoir coefficients for the pre- and post-Judgment periods is due in part to changes in groundwater production patterns, hydrology, and CIGSM modeling artifacts.

Future Storage Losses to the Santa Ana River. An estimate of the linear reservoir coefficient for the period 1990 through 2040 was estimated by comparing the total Santa Ana River flow at Prado Dam and groundwater storage for Alternatives 3 and 4 of the CBWRMS. Alternative 3 represents a specific groundwater management strategy that could be implemented. Alternative 4 is identical to Alternative 3 with the addition of a conjunctive use program and an increase in limits for local storage accounts. The

conjunctive use program has three cycles of build up in storage to approximately 300,000 acre-ft and subsequent pump-out periods. The increase in storage in local storage accounts is gradual and incremental throughout the period. The rising water losses from the conjunctive use storage and the increase in local storage accounts are simply the difference in Santa Ana River flow between these alternatives. Table 2-3 lists the differences in groundwater storage and Santa Ana River flow. The linear reservoir coefficient for future conditions is estimated to be about 0.0408, or 4.1 percent of storage – about double that of the 1984 to 1989 period. The increase in the linear reservoir coefficient was caused by changes in groundwater production patterns, hydrology, and CIGSM modeling artifacts.

Computation of Storage Losses to Santa Ana River. The linear reservoir equation can be used to estimate losses from groundwater storage accounts to the Santa Ana River:

$$q_t = K * (S_t + 0.5 * T *(I_t - Q_t)) \qquad \text{(Equation 4)}$$

where:

q_t	is the annual loss from a storage account in period *t* to *t+1* (acre-ft/yr)
K	is the linear reservoir coefficient
S_t	is water in a storage account at the end of period *t* (acre-ft)
I_t	is the water put into a storage account in period *t* to *t+1* (acre-ft/yr)
Q_t	is the water taken from the storage account for use in period *t* to *t+1* (acre-ft/yr)
T	duration of time between *t* to *t+1*, assumed to be one year

The volume of water in storage accounts at the end of a period is equal to:

$$S_{t+1} = S_t + T * (I_t - Q_t - q_t) \qquad \text{(Equation 5)}$$

Using a linear reservoir coefficient of 0.0201 and Equation 4, the total water lost from local storage accounts and cyclic storage since the Judgment became active in 1978 is estimated to be about 50,000 acre-ft or about 18 percent of the volume that Watermaster currently assumed was in storage. The time history of accumulating storage accounts and estimated losses to baseflow are listed in Table 2-4. Watermaster does not currently compute losses from storage accounts. This means that when water in storage accounts is produced, additional overdraft of the Basin will occur. Losses from conjunctive use projects could be very large. In the example in Table 2-3, three filling and withdrawal cycles were done over a 40-year period with each reaching a fill capacity of 300,000 acre-ft. The model estimated losses of over 300,000 acre-ft over three fill and extraction cycles – a loss of over one-third of the water stored. If these losses were not accounted for, the Basin would be overdrafted by 300,000 acre-ft over the 40-year period.

The losses described above were developed from modeling studies. Monitoring to verify these losses has not been done in the past nor is it practical in the future. The measuring errors associated with such a program would be larger than the probable losses from storage. The only practical ways to estimate such losses are to:

- Use a linear reservoir model as described above, or
- Calibrate a groundwater flow model over the period that water is held in cyclic, local, and conjunctive use storage and compare it to a simulation run with the same hydrology that did not have water in these storage accounts. The difference in groundwater discharge to the river would be the losses due to cyclic, local, and conjunctive use storage. Adjustments to storage accounts could be made retroactively or a new loss factor established for the next period.

GROUNDWATER PRODUCTION

Historical Groundwater Production Monitoring

Prior to 1975, groundwater production monitoring was not formally done by a single entity for the benefit of the Basin. Municipal and some industrial producers kept production records with some submitting annual production reports to the State Water Resources Control Board (SWRCB). Very few agricultural wells had meters and fewer kept records of production. During the period 1975 to 1978, production monitoring at agricultural wells improved slightly. Most of the agricultural production volumes for the period preceding 1978 are comprised of estimates provided by producers and are not based on direct measurements from in-line flow meters.

Since 1978, Watermaster has collected information to develop production estimates. Production estimates in the appropriative pool and overlying non-agricultural pool are based on totalizing in-line flow meter data provided to Watermaster on a quarterly basis by these producers. Watermaster aggregates these quarterly values to obtain annual production for these pools. Production estimates for the agricultural pool are based in part on totalizing in-line flow meter data, water duty methods, and hour-meter data combined with well efficiency tests. As with the other pools, reporting is done by the producers. However, not all agricultural pool producers provide Watermaster with estimates of their production. About one third of agricultural pool producers either did not file production reports or filed incomplete reports in fiscal year 1997/98 (telephone discussion with Jim Theirl, 1998).

Historical Groundwater Production

Table 2-4 contains estimates of annual groundwater production in the Chino Basin from three different sources: summaries of SWRCB filings and interviews with some producers; Watermaster estimates, and production estimates developed for calibration of CIGSM developed for the CBWRMS. The second column in Table 2-5 contains annual production estimates that were used to develop the safe yield in the Judgment. The third column contains Watermaster estimates of annual production that are based on production reports submitted to Watermaster by the producers. The fourth column contains annual production estimates that are based on SWRCB filings, production reports from producers, and water duty methods. In the latter case, water duty methods were used as a check on reported production and supplemented reported production data when production data was missing or under-reported at wells.

The safe yield of the Chino Basin was based on the hydrology of the period 1965 to 1974. The average annual groundwater production for that period from SWRCB filings and interviews was estimated at 152,100 acre-ft/yr. The engineer working on the historical production data knew there was *unaccounted for* production and assumed that actual production was 20 percent more than the estimate from SWRCB filings and interviews, or about 180,000 acre-ft/yr (Carroll, 1977). This estimate is close to the 189,400 acre-ft/yr average for the same period from the CBWRMS.

In Table 2-5, the period of Watermaster groundwater production estimates overlaps the period of CBWRMS production estimates. For their common period of record (1975 through 1989), the CBWRMS estimates are consistently higher. This occurs in part because some of the agricultural producers fail to report production or fail to provide production information to Watermaster. For the CBWRMS, water demands based on land use were compared to reported production. If the water demand for the land uses in a given area was greater than reported production, then reported production was increased to meet the demands based on land use. This method was validated in the CIGSM model calibration process (Montgomery Watson, 1993). In the latter years, the CBWRMS production estimates increasingly diverge from Watermaster estimates. For their common period of record, the average annual groundwater production was estimated at 147,900 acre-ft/yr by Watermaster and 174,000 acre-ft/yr by the CBWRMS – a difference of about 26,000 acre-ft/yr. Actual production is probably somewhere in between Watermaster and CBWRMS estimates.

Spatial and Temporal Changes in Groundwater Production

Table 2-6 lists Watermaster's estimates of Chino Basin production by pool for the period of fiscal year 1974/75 to 1997/98, and the relative amount of production by pool. Over this period, groundwater production has ranged from a high of 181,000 acre-ft/yr (1975/76) to a low of about 122,600 acre-ft/yr (1982/83), and has averaged about 147,100 acre-ft/yr. The distribution of production by pool has shifted since 1975 with the agricultural pool production dropping from about 55 percent in 1974/75 to 28 percent in 1996/97. During the same period, appropriative pool production increased from about 40 percent in 1974/75 to 68 percent in 1996/97. The increases in appropriative pool production have kept pace with decline in agricultural production. Production in the overlying non-agricultural pool declined from about 5 percent in 1974/74 to about 2 percent in the mid-1980s, rose to about 4 percent by 1990/91 and has remained at about 4 percent of total production thereafter.

Figure 2-29 is a plot that compares the change in total groundwater production in the Chino Basin to the change in urban and agricultural/other non-urban land uses. Prior to 1980, the decline in groundwater production appears proportional to the decline in agricultural and other non-urban land uses. After 1980, groundwater production appears to be relatively stable even though the decline in agricultural and other non-urban land uses is accelerating.

Figures 2-30 and 2-31 are similar to Figure 2-29 except they represent the Basin north of State Route 60 and south of State Route 60, respectively. North of State Route 60, the pattern of land use change is similar to the entire basin, but the groundwater production that was declining from 1960 to 1980 rose sharply after 1980. South of State Route 60, groundwater production was generally declining throughout the period of 1960 to 1990. The rate of decline in production in the southern half of the Basin after 1980 matches the rate of increase in production north of State Route 60, such that the total annual production in the Basin after 1980 is relatively constant (see Figure 2-29).

Figures 2-32 through 2-36 illustrate the location and magnitude of groundwater production at wells in the Chino Basin for years 1960, 1970, 1980, 1989 and 1997. These maps are based on production estimates developed in the *Chino Basin Water Resources Management Study* (Montgomery Watson, 1995) and by Watermaster. Two trends are evident in the period 1960 through 1998:

- In the southern half of the Basin there is an increase in the number of active wells and a decrease in the per well production. This is due to the land use transition from predominately irrigated agriculture uses to predominately dairy uses and due to a recent well inspection program, resulting in more wells of record.

- In the northern half of the Basin there is an increase in the number of wells producing over 2,000 acre-ft/yr. This is consistent with the land use transition from agricultural uses to urban uses and with the trend for increasing imported water costs.

Groundwater Production and Safe Yield

Recent and past studies have provided some insight into the influence of groundwater production in the southern end of the Chino Basin on the safe yield of the Basin. Three studies were done that quantified the impacts of proposed desalters in the lower Chino Basin on groundwater discharge to the Santa Ana River. The proposed desalters were first described in *Nitrogen and TDS Studies, Upper Santa Ana Watershed* (James M. Montgomery, Consulting Engineers, Inc., 1991). This study matched desalter production to meet future potable demands in the lower Chino Basin through the year 2015. The well fields were sited to maximize the interception of rising water and to induce streambed percolation in the Santa Ana River. The decrease in rising water and the increase in streambed percolation were projected to range from 45 to 65 percent of total desalter production.

Well field design studies for the SAWPA desalter provided estimates of the volume of rising water intercepted by the currently proposed desalter – scheduled for completion in March 2000 (Wildermuth, 1993). These studies used a very detailed model of the lower Chino Basin (rectangular 400-foot by 400-foot grid covering the lower Chino Basin) to evaluate the hydraulic impacts on rising water and groundwater levels at nearby wells. These studies showed the relationship of interception of rising water to well field location and well field capacity. The fraction of the desalter production composed of decreased rising water and the increased stream bed percolation water was estimated to range from 40 to 50 percent.

No formal studies and estimates of desalter well field interception of rising water were made during the *Chino Basin Water Resources Management Study* (Montgomery Watson, 1995). An informal estimate of the interception of rising water was made by Wildermuth (letter to Neil Cline, dated August 9, 1993). Wildermuth used the groundwater model developed in *Chino Basin Water Resources Management Study* for a well field similar to the SAWPA desalter well field and used the model calibration period of 1960 to 1989. This study estimated the interception of rising groundwater at about 80 percent of desalter production capacity.

These three studies suggest that the yield of the Basin could be increased by simply increasing the production near the river, and that for every two acre-ft of new, near-river production the safe yield could be increased by one acre-ft, that is the marginal change in safe yield with increased near-river production is about 0.5 acre-ft/yr per acre-ft/yr of production. The opposite is also true. That is, if production were to decrease in the southern half of the Basin, the safe yield will also decrease. Agricultural production is projected to decrease about 40,000 acre-ft/yr when current agricultural land use transitions to urban use. If the magnitude and spatial distribution of current agricultural production is not replaced with new production then the yield of the Chino basin will decrease by a comparable amount.

HISTORICAL AND CURRENT GROUNDWATER QUALITY

Historical Groundwater Quality Monitoring

Various entities have collected groundwater quality data in the past. Municipal and agricultural water supply entities have collected groundwater quality data to comply with Department of Health Services requirements under Title 22 or for programs that range from irregular study-oriented measurements to long-term periodic measurements. Groundwater quality observations have been made by the DWR, by

participants in the 1969 Judgment on the Santa Ana River (Orange County Water District *vs.* City of Chino *et al.*), by dischargers under order from the Regional Board, and by the County of San Bernardino. The DWR and the SBCFCD were very active in collecting groundwater quality data in the Chino Basin prior to the settlement of the Chino Basin adjudication. After the Judgment was entered in 1978, monitoring south of State Route 60 stopped almost completely except for the cities of Chino, Chino Hills, and Norco, and the Jurupa Community Services District (JCSD). Most of the pre-1978 measurements were digitized by the DWR. In 1986, Metropolitan Water District of Southern California (Metropolitan) conducted the first comprehensive survey of groundwater quality covering all constituents regulated in California Code of Regulations Title 22.

In 1989, Watermaster initiated a regular monitoring program for the Basin with groundwater quality data obtained in 1990 and periodically thereafter to the present. Watermaster's program relies on municipal producers and other government agencies supplying their groundwater quality data on a cooperative basis. Watermaster staff supplements this data with data obtained through a Watermaster sampling and analysis program in the area south of State Route 60. Water quality data are also obtained from special studies and monitoring that takes place under orders of the Regional Board. Watermaster has combined previously digitized groundwater quality data from all known sources into a database structure that is maintained at Watermaster's office.

Watermaster plans to begin the development of a new, more comprehensive water quality monitoring program to support the OBMP starting in July 1999. The program consists of two phases. The initial phase consists of collecting and analyzing groundwater quality samples at all producing wells in the over a three year period starting in July 1999. These data will be mapped and reviewed. Based on this review and Watermaster management goals in the OBMP, a long-term monitoring program will be developed The second phase consists of implementing the long term monitoring program and will start in July 2002.

Water Quality Conditions

Sources of water quality degradation can be classified into point and non-point sources. Point sources are confined to point discharges to the soil, groundwater, or stream systems. Examples include conventional wastewater and industrial discharges to streams or ponds, and leaky underground storage tanks. Non-point sources are areal discharges to soil, groundwater and surface waters, such as land application of waste and fertilizers and atmospheric deposition of contaminants to the soil and water bodies. The discussion below describes the water quality state of the Basin as it exists today for specific constituents of concern. The constituents described below are regulated for drinking water purposes in *California Code of Regulations, Title 22* or are regulated in the *1995 Water Quality Control Plan for the Santa Ana River Basin* (Basin Plan).

Figures 2-37a-h illustrate land uses in the Chino Basin in 1933, 1949, 1957, 1963, 1975, 1984, 1990 and 1993. These land use maps were developed from DWR land use surveys for 1933 through 1984, and from Southern California Association of Governments surveys for 1990 and 1993. The maps show a steady, dramatic change over time from agricultural to urban land uses. An exception to this occurs in the southern Chino Basin where dairies have moved in to replace irrigated and non-irrigated agriculture. These maps are useful in characterizing water quality degradation associated with non-point source loading from agriculture. The land uses shown in these maps are quantified in Table 2-7.

Total Dissolved Solids (TDS). TDS is regulated as a secondary contaminant in Title 22. The recommended drinking water maximum contaminant level (MCL) for TDS is 500 mg/L, however the upper limit is 1,000 mg/L. For irrigation uses, TDS should generally be less than 700 mg/L. The Regional Board has established TDS limitations for all municipal wastewater plants that discharge

recycled water to the Santa Ana River. A problem arises in that TDS concentrations increase through municipal use -- typically by about 150 to 250 mg/L. The TDS limitations for water recycling plants that discharge to the Santa Ana River in the Chino Basin are listed below:

Plant	TDS Limit (mg/L)
IEUA RP1	540
IEUA RP2	610
IEUA Carbon Canyon	555
IEUA RP4	505
Western Riverside Regional	625
City of Riverside	650
Jurupa Indian Hills	650

The TDS in source (drinking) water generally must be kept well below 500 mg/L (preferably less than 300 mg/L) to ensure that recycled water discharged to the Santa Ana River and its tributaries meets Regional Board limitations. The treatment cost to remove TDS from water is very expensive – about $500 to $700 per ton.

Table 2-9 provides the average TDS concentrations by well for five-year periods from 1961 to 1995. These wells are grouped by management zones. Figures 2-38, 2-39, and 2-40 show average TDS concentrations in groundwater measured at wells for the periods 1961 to 1965, 1971 to 1975, and 1991 to 1995. Historically, TDS has not been measured at wells on an annual basis. The choice of one year, say 1963 for example, might have only one-third as many TDS measurements at wells compared to a five-year period. Thus, averaging TDS over a five-year period was necessary to get adequate spatial coverage of measurements.

TDS concentrations in the northeast part of the Basin range from about 170 to about 300 mg/L for the period 1960 through 1990, with typical concentrations in the mid- to low-200s. TDS concentrations in excess of 200 mg/L indicate degradation from overlying land use. With few exceptions, areas with significant irrigated land use or dairy waste disposal histories overlie groundwater with elevated TDS concentrations. The exceptions are areas where point sources have contributed to TDS degradation, such as the former Kaiser Steel site in Fontana and the former wastewater disposal ponds near IEUA Regional Plant No. 1 (RP1) in South Ontario. The TDS anomaly from Kaiser is not shown on Figures 2-38, 2-39 and 2-40. A TDS anomaly from former municipal wastewater ponds can be seen in the east central part of Management Zone 2.

The impacts of agriculture on TDS in groundwater primarily are caused by fertilizer use on crops, consumptive use, and dairy waste disposal. The TDS impacts from the dairies located in the southern half of the Basin is reflected at least partially in Figures 2-39 and 2-40. The intensity of the TDS loading from dairy waste to the Basin is illustrated in Table 2-8 (Table 2-1 from *Final Task 6 Memorandum, Development of a Three-Dimensional Groundwater Model*, Montgomery Watson, 1994). This table shows the steady buildup of the dairy cattle population in the southern Chino Basin between 1949 and 1989. The total amount of TDS from manure discharged to the southern half of the Basin that will reach groundwater is estimated to be about 1,200,000 tons through 1989 and averages about 29,000 tons per year. The dairy loading numbers in Table 2-8 assume that half of the manure was hauled out of the Basin after 1973, which was a requirement of the Santa Ana watershed Water Quality Control Plan enacted in

1973. The amount of manure exported out of the Basin was never verified until the late 1990's. The TDS loading to groundwater from dairy waste disposal activities could be far greater than estimated in Table 2-8.

As irrigation efficiency increases, the impact of consumptive use on TDS in groundwater also increases. For example, if source water has a TDS concentration of 250 mg/L, and the irrigation efficiency is about 50 percent (flood irrigation), the resulting TDS concentration in the returns to groundwater will be 500 mg/L, exclusive of the mineral increments from fertilizer. If the irrigation efficiency were increased to 75 percent, the resulting TDS concentration in the returns to groundwater will be 1,000 mg/L, exclusive of the mineral increments from fertilizer. For modern irrigated agriculture, the TDS impacts of consumptive use are more significant than mineral increments from fertilizers.

TDS concentrations in groundwater have increased slightly or remained relatively constant in the northern parts of Management Zones 1, 2, and 3. TDS concentrations are significantly higher in the southern parts of Management Zones 1, 2, and 3, and all of Management Zone 5 where they typically exceed the 500 mg/L recommended MCL and frequently exceed the upper limit of 1,000 mg/L.

Nitrate. Nitrate is regulated in drinking water in Title 22 with an MCL of 10 mg/L (as nitrogen). Table 2-10 provides the average nitrate concentrations by well for 5-year periods from 1961 to 1995. These wells are grouped by management zones. Figures 2-41, 2-42, and 2-43 show the average nitrate concentrations in groundwater measured at wells for the periods 1961 to 1965, 1971 to 1975, and 1991 to 1995. Nitrate measurements in the surface water flows in the San Gabriel Mountains and in groundwater near the foot of these mountains are generally less than 0.5 mg/L (Montgomery Watson, 1993). Nitrate concentrations in excess of 0.5 mg/L indicate degradation from overlying land use. Similar to TDS, areas with significant irrigated land use or dairy waste disposal histories overlie groundwater with elevated nitrate concentrations. The primary areas of nitrate degradation are the areas formerly or currently overlain by:

- Citrus in the northern parts of Management Zones 1, 2 and 3; and
- Dairy areas in the southern parts of Management Zones 1, 2 and 3 and all of Management Zone 5.

Nitrate concentrations in groundwater have increased slightly or remained relatively constant in northern parts of Management Zones 1, 2 and 3 over the period 1960 to the present. These are areas formerly occupied by citrus and vineyard land uses (see Figures 2-37a-d), and nitrate concentrations underlying these areas rarely exceed 20 mg/L (as nitrogen). Over the same period, nitrate concentrations have increased significantly in the southern parts of Management Zones 1, 2 and 3, and all of Management Zone 5. These are areas where land use has progressively converted from irrigated/non-irrigated agriculture to dairy uses (see Figures 2-37e-h), and nitrate concentrations typically exceed the 10 mg/L MCL and frequently exceed 20 mg/L by 1991-1995.

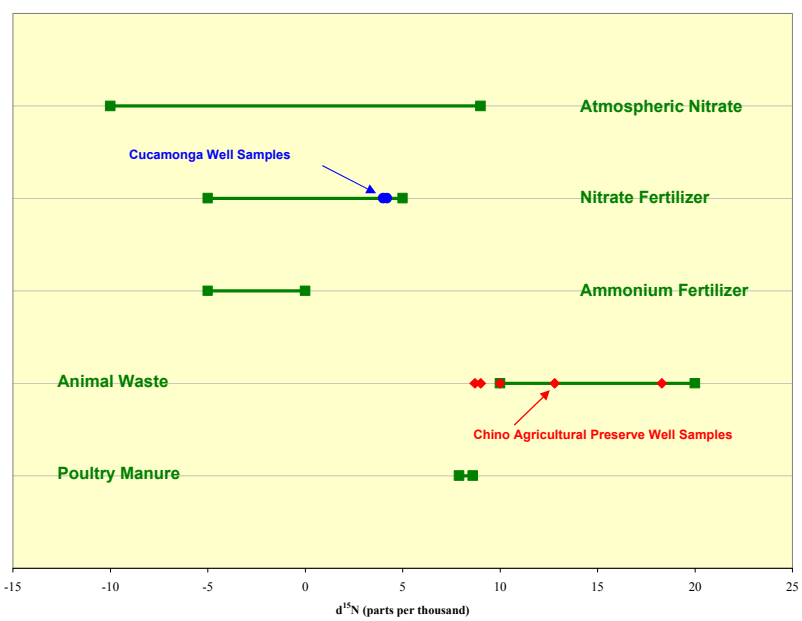
There are two stable isotopes of nitrogen: ^{14}N and ^{15}N. Within the nitrogen cycle, thermodynamic and kinetic processes occur which fractionate these isotopes in various nitrogen-bearing compounds. Most biologically-mediated reactions (*e.g.*, assimilation, nitrification, and denitrification) result in ^{15}N enrichment of the substrate and depletion of the product. Nitrogen isotope chemistry is a technique to help distinguish potential sources of nitrogen in the environment (Clark and Fritz, 1997). The enrichment of ^{15}N relative to atmospheric nitrogen is expressed as $\delta^{15}N$ and has units of parts per thousand (permil). The following table shows the ranges of nitrogen isotopes of potential sources of nitrate (Battaglin *et al.*, 1997):

Source of Nitrate	$d^{15}N$ of Nitrate (permil)
Atmospheric Nitrate	-10 to 9
Nitrate Fertilizer	-5 to 5
Ammonium Fertilizer	-5 to 0
Animal Waste	10 to 20
Poultry Manure	7.9 to 8.6

As part of the 1997 groundwater-monitoring program, samples were collected from six wells for nitrogen isotope analysis:

State Well Number	Region	Nitrate-N (mg/L)	$d^{15}N$ (permil)
01S07W14D01	Cucamonga – Former Citrus	3.2	4.0
01S07W14D02	Cucamonga – Former Citrus	4.0	4.2
02S07W34D	Chino Agricultural Preserve	106.0	12.8
03S07W05G	Chino Agricultural Preserve	77.3	18.3
02S07W20A	Chino Agricultural Preserve	64.5	10.0
02S07W16D	Chino Agricultural Preserve	63.6	8.7
02S07W16D - Duplicate		63.6	9.0

The samples from the wells in areas where the antecedent land use was predominantly citrus had nitrate values that were significantly below the maximum contaminant level (MCL) of 10 mg/L. Nitrate values in samples from the Chino Agricultural Preserve all exceeded the MCL by at least a factor of six. In addition, the $\delta^{15}N$ values for the Cucamonga wells were about 4 permil, while the $\delta^{15}N$ values for the Chino Agricultural Preserve wells ranged from 8.7 to 18.3 permil. The nitrogen isotope results are compared graphically with ranges from known sources in the figure below.



The high nitrate concentrations shown in Figure 2-43 probably depict the nitrate impacts from the agricultural waste disposal areas located in the southern half of the Basin.

Other Constituents of Potential Concern. Tables 2-11a through 2-11c summarize inorganic and organic constituents that have been analyzed for and detected in groundwater samples from wells in the Chino Basin through July 1998. Table 2-12 summarizes the information in Tables 2-11a through 2-11c for the constituents detected at or above their MCLs. This is a synoptic analysis and includes all available data, including data from several monitoring programs and studies. The water quality data reviewed in this synoptic analysis are derived from production wells and monitoring wells. Hence, the data do not represent a programmatic investigation of potential sources nor do they represent a randomized study designed to ascertain the water quality status of the Chino Basin. The data do represent the most comprehensive information available to date.

A large subset of this data was extracted from the California Department of Health Services (DHS) database (current through July 1998). For each constituent, the tables lists:

- the number of measurements at or above one-half the applicable MCL;
- the number of wells with measurements at or above one-half the applicable MCL;
- the number of measurements at or above the applicable MCL;
- the number of wells with measurements at or above the applicable MCL; and
- the applicable MCL.

The tables are organized as follows:

- Table 11a: Inorganic constituents, total trihalomethanes (THMs) and radioactivity with primary MCLs;
- Table 11b: Organic chemicals with primary MCLs;
- Table 11c: Inorganic constituents and organic chemicals with secondary MCLs, lead and copper rule, and California DHS Action Levels.

Table 12 summarizes the constituents that were detected at concentrations greater than one-half their MCL, and are grouped by chemical type. These values represent a mixture of data from monitoring and production well samples. Monitoring wells targeted at a potential source will likely have a greater concentration than a municipal or agricultural production well. Wells with constituent concentrations greater than one-half the MCL represent areas that warrant concern and inclusion in a long-term monitoring program. Groundwater in the vicinity of wells with samples greater than the MCL may be impaired from a beneficial use standpoint.

Inorganic Constituents. Five inorganic constituents were detected at or above their MCL in more than 20 wells:

- TDS;
- nitrate;
- fluoride;
- iron; and
- manganese.

TDS and nitrate have been discussed in previous subsections. Fluoride, iron, and manganese naturally exist in groundwater. Their concentrations depend on mineral solubility, ion exchange reactions, surface

complexations, and soluble ligands. These speciation and mineralization reactions, in turn, depend on pH, oxidation-reduction potential, and temperature. Fluoride occurs naturally in groundwater in concentrations ranging from less than 0.1 mg/L to 10-20 mg/L (Freeze and Cherry, 1979). Based on the available data, none of these constituents shows a spatial pattern throughout Chino Basin (see Figures 2-44, 2-45 and 2-46). However, site-specific monitoring wells may reveal point sources (*e.g.*, wells near landfills have shown relatively high concentrations of manganese).

In addition, perchlorate has recently been detected in several wells in the Chino Basin (Figure 2-47), in other basins in California and other states in the West. The probable reason that perchlorate was not detected in groundwater until recently is that analytical methodologies did not previously exist that could attain a low enough detection limit. Prior to 1996, the method detection limit for perchlorate was 400 µg/L. By March 1997, an ion chromatographic method was developed with a detection limit of 1 µg/L and a reporting limit of 4 µg/L.

Perchlorate (ClO_4^-) originates as a contaminant in the environment from the solid salts of ammonium perchlorate (NH_4ClO_4), potassium perchlorate ($KClO_4$), or sodium perchlorate ($NaClO_4$). The perchlorate salts are quite soluble in water. The perchlorate anion (ClO_4^-) is exceedingly mobile in soil and groundwater environments. It can persist for many decades under typical groundwater and surface water conditions, because of its resistance to react with other available constituents. Perchlorate is a kinetically stable ion, which means that reduction of the chlorine atom from a +7 oxidation state in perchlorate to a -1 oxidation state as a chloride ion requires activation energy or the presence of a catalyst to facilitate the reaction. Since perchlorate is chemically stable in the environment, natural chemical reduction in the environment is not expected to be significant.

At very high levels, perchlorate interferes with the function of the thyroid gland and the production of hormones necessary for normal human development. In the extreme cases, it can cause brain damage in fetuses and a potentially fatal form of anemia in adults. However, effects of chronic exposures to lower levels currently detected in groundwater are not known.

Ammonium perchlorate is manufactured for use as an oxygenating component in solid propellant for rockets, missiles, and fireworks. Because of its limited shelf life, inventories of ammonium perchlorate must be periodically replaced with a fresh supply. Thus, large volumes of the compound have been disposed of since the 1950s in Nevada, California, Utah, and likely other states. While ammonium perchlorate is also used in certain munitions, fireworks, the manufacture of matches, and in analytical chemistry, perchlorate manufacturers estimate that about 90 percent of the substance is used for solid rocket fuel

Perchlorate is of concern because of the existing uncertainties in:

- the toxicological database documenting its health effects at low levels in drinking water;
- the actual extent of the occurrence of perchlorate in ground and surface waters, which is compounded by some uncertainty in the validation of the analytical detection method;
- the efficacy of different treatment technologies for various water uses such as drinking water or agricultural application; and
- the extent and nature of ecological impact or transport and transformation phenomena in various environmental media.

The requisite toxicology data available to evaluate the potential health effects of perchlorate are extremely limited. The US Environmental Protection Agency (EPA) Superfund Technical Support Center issued a provisional reference dose (RfD) in 1992 and a revised provisional RfD in 1995. Standard assumptions for ingestion rate and body weight were then applied to the RfD to calculate the reported range in the groundwater cleanup guidance levels of 4 to 18 (µg/L). In 1997, the DHS and California EPA's Office of Environmental Health Hazard Assessment reviewed the EPA risk assessment reports for perchlorate. Consequently, California established its provisional action level of 18 µg/L. On August 1, 1997, DHS informed drinking water utilities of its intention to develop a regulation to require monitoring for perchlorate as an unregulated chemical. Legislative action to establish a state drinking water standard for perchlorate has been introduced but has not been brought to a vote (CA Senate Bill 1033).

Volatile Organic Chemicals. Six volatile organic chemicals (VOCs) were detected at or above their MCL in more than 10 wells:

- 1,1-dichloroethene;
- 1,2-dichloroethane;
- benzene;
- tetrachloroethene (PCE);
- trichloroethene (TCE); and
- vinyl chloride.

TCE and PCE were/are widely used industrial solvents. TCE was commonly used for metal degreasing and was also used as a food extractant. PCE is commonly used in the dry-cleaning industry. About 80 percent of all dry cleaners used PCE as their primary cleaning agent (Oak Ridge National Laboratory, 1989). The areal distributions of PCE and TCE are shown in Figures 2-48 and 2-49. 1,1-Dichloroethane, 1,1-Dichloroethene, *cis*-1, 2-dichloroethene, 1,2-dichloroethane, and vinyl chloride are degradation by-products of PCE and TCE and their areal distributions are shown in Figures 2-50 though 2-54.

The spatial distributions of TCE and PCE appear to be correlatable to identified point sources in the Chino Basin (see the following subsection and Figure 2-58.) The areal distributions of 1,2-dichloroethane and vinyl chloride appear to be more extensive. 1,2-Dichloroethane is used as a lead-scavenging agent in gasoline (Oak Ridge National Laboratories, 1989) and the greater areal distribution of 1,2-dichloroethane and vinyl chloride may reflect numerous minor releases from gasoline stations, automobile service stations, *et cetera*. This hypothesis appears to be corroborated, in part, by the distribution of benzene, which is a minor contaminant in gasoline (see Figure 2-55). Gasoline used in the United States contains between 0.8 and 2 percent benzene (Oak Ridge National Laboratories, 1989).

Pesticides/herbicides. Two were detected at or above their MCL in more than 10 wells:

- dibromochloropropane (DBCP); and
- lindane.

DBCP was used as a fumigant for citrus, other orchards and some field crops prior to being banned in 1987. The areal distribution of DBCP appears to be related to historical citrus crop production in Chino Basin (see Figures 2-37a-d and 2-56). Lindane is used as an insecticide on foliar plants and fruit and vegetable crops; its areal distribution is shown in Figure 2-57.

Point Sources of Concern

The previous water quality discussion described water quality conditions broadly across the entire basin. The discussion presented below describes the water quality anomalies associated with known point source discharges to groundwater. Figure 2-58 shows the location of various point sources and areas of water quality degradation associated with these sources.

Chino Airport. The Chino Airport is located approximately four miles east of the City of Chino and six miles south of Ontario International Airport, and occupies an area of about 895 acres. From the early 1940s until 1948, the airport was owned by the federal government and used for flight training and aircraft storage. The County of San Bernardino acquired the airport in 1948 and has operated and/or leased portions of the facility ever since. Since 1948, past and present businesses and activities at the airport include modification of military aircraft, crop dusting, aircraft-engine repair, aircraft painting, stripping and washing, dispensing of fire-retardant chemicals to fight forest fires, and general aircraft maintenance. The use of organic solvents for various manufacturing and industrial purposes has been widespread throughout the airport's history (Regional Board, 1990). From 1986 to 1988, a number of groundwater quality investigations were performed in the vicinity of Chino Airport. Analytical results from groundwater sampling revealed the presence of VOCs above MCLs in six wells downgradient of Chino Airport. The most common VOC detected above its MCL is TCE. TCE concentrations in the contaminated wells ranged from 6.0 to 75.0 µg/L. Figure 2-58 shows the approximate areal extent of TCE in groundwater in the vicinity of Chino Airport at concentrations exceeding its MCL as of 1990. The plume is elongate in shape, about 2,200 feet wide and extends approximately 8,000 feet from the airport's northern boundary in a south to southwestern direction.

California Institute for Men. The California Institute for Men (CIM) located in Chino is bounded on the north by Edison Avenue, on the east by Euclid Avenue, on the south by Kimball Avenue and on the west by Central Avenue. CIM is a state correctional facility and has been in existence since 1939. It occupies approximately 2,600 acres – about 2,000 acres are used for dairy and agricultural uses and about 600 acres are used for housing inmates and related support activities (Geomatrix Consultants, 1996). In 1990, PCE was detected at a concentration of 26 µg/L in a sample of water collected from a CIM drinking water supply well. Analytical results from groundwater sampling indicate that the most common VOCs detected in groundwater underlying CIM are PCE and TCE. Other VOCs detected include carbon tetrachloride, chloroform, 1,2-dichloroethene, bromodichloromethane, 1,1,1-trichloroethane, and toluene. The maximum PCE concentration in groundwater detected at an individual monitoring well (GWS-12) was 290 µg/L. The maximum TCE concentration in groundwater detected at an individual monitoring well (MW-6) was 160 µg/L (Geomatrix Consultants, 1996). Figure 2-58 shows the approximate areal extent of VOCs in groundwater at concentrations exceeding MCLs as of May 1996. The plume is approximately 1,000 feet wide and extends about 3,600 feet southwest.

General Electric Flatiron Facility. The General Electric Flatiron Facility (Flatiron Facility) occupied the site at 234 East Main Street, Ontario, California from the early 1900s to 1982. Its operations consisted primarily of the manufacturing of clothes irons. Currently, the site is occupied by an industrial park. The Regional Board issued an investigative order to General Electric in 1987 after an inactive well in the City of Ontario was found to contain TCE and chromium above drinking water standards. Analytical results from groundwater sampling indicated that VOCs and total dissolved chromium were the major groundwater contaminants. The most common VOC detected at levels significantly above its MCL is TCE, which reached a measured maximum concentration of 3,700 µg/L. Other VOCs periodically detected, but commonly below MCLs, include PCE, toluene, and total xylenes, (Geomatrix Consultants, 1997). Figure 2-58 shows the approximate areal extent of TCE in groundwater at concentrations exceeding MCLs, as of November 1997. The plume is approximately 3,000 feet wide and

extends about 8,400 feet south-southwest (hydraulically downgradient) from the southern border of the site.

General Electric Test Cell Facility. The General Electric Company's Engine Maintenance Center Test Cell Facility (Test Cell Facility) is located at 1923 East Avion, Ontario, California. Primary operations at the Test Cell Facility include the testing and maintenance of aircraft engines. A soil and groundwater investigation, followed by a subsequent quarterly groundwater-monitoring program, began in 1991 (Dames & Moore, 1996). The results of these investigations showed that VOCs exist in the soil and groundwater beneath the Test Cell Facility and that the released VOCs have migrated off site. Analytical results from subsequent investigations indicate that the most common and abundant VOC detected in groundwater is TCE. Other VOCs detected include PCE, *cis*-1,2-dichloroethene, 1,2-dicholoropropane, 1,1-dichloroethene, 1,1-dichloroethane, benzene, toluene and xylenes, among others. The historical maximum TCE concentration measured at an on-site monitoring well (directly beneath the Test Cell Facility) is 1,240 µg/L. The historical maximum TCE concentration measured at an off-site monitoring well (downgradient) is 190 µg/L (BDM International, 1997). Figure 2-58 shows the areal extent of VOC contamination exceeding federal MCLs as of March 1997. The plume is elongate in shape, about 1,000 to 1,200 feet wide and extends approximately 8,000 feet from the Test Cell Facility in a southwesterly direction.

Kaiser Steel Fontana Steel Site. Between 1943 and 1983, Kaiser Steel Corporation (Kaiser), operated an integrated steel manufacturing facility in Fontana. During the first 30 years of the facility's operation (1945-1974), a portion of the Kaiser brine wastewater was discharged to surface impoundments and allowed to percolate into the soil. In the early 1970s, the surface impoundments were lined to eliminate percolation to groundwater (Wildermuth, 1991). In July of 1983, Kaiser initiated a groundwater investigation that revealed the presence of a plume of degraded groundwater under the facility. In August of 1987, the Regional Board issued Cleanup and Abatement Order Number 87-121, which required additional groundwater investigation and remediation activities. The results of these investigations showed that the major constituents of the release to groundwater were inorganic dissolved solids and low molecular weight organic compounds. Wells sampled during the groundwater investigations measured concentrations of total dissolved solids (TDS) ranging from 500-1,200 mg/L and concentrations of total organic carbon (TOC) ranging from 1 to 70 mg/L. Figure 2-58 shows the approximate areal extent of the TDS/TOC groundwater plume as of November 1991. The plume is approximately 3,000 feet wide and extends about 17,000 feet southwest. As of November 1991, the plume had migrated almost entirely off the Kaiser site.

Milliken Sanitary Landfill. The Milliken Sanitary Landfill (MSL) is a Class III Municipal Solid Waste Management Unit located near the intersections of Milliken Avenue and Mission Boulevard in the City of Ontario. The facility is owned by the County of San Bernardino and managed by the County's Waste System Division. The facility was opened in 1958 and continues to accept waste within an approximate 140-acre portion of the 196-acre permitted area (GeoLogic Associates, 1998). Groundwater monitoring at the MSL began in 1987 with five monitoring wells as part of a Solid Waste Assessment Test investigation (IT, 1989). The results of this investigation indicated that the MSL has released organic and inorganic compounds to the underlying groundwater. At the completion of an Evaluation Monitoring Program (EMP) investigation (GeoLogic Associates, 1998), a total of 29 monitoring wells were drilled to evaluate the nature and extent of groundwater impacts identified in the vicinity of the MSL. Analytical results from groundwater sampling indicate that VOCs are the major constituents of the release. The most common VOCs detected are TCE, PCE, and dichlorodifluoromethane. Other VOCs detected above MCLs include vinyl chloride, benzene, 1,1-dichloroethane, and 1,2-dichloropropane. The historical maximum total VOC concentration in an individual monitoring well is 159.6 µg/L (GeoLogic Associates, 1998). Figure 2-58 shows the approximate areal extent of VOCs in groundwater at concentrations

exceeding MCLs as of April 1998. The plume is approximately 1,900 feet wide and extends about 2,000 feet south of the MSL's southern border (GeoLogic Associates, 1998).

Municipal Wastewater Disposal Ponds. Treated municipal wastewater has been disposed into ponds located near the current IEUA Regional Plant 1 (RP1) located in south Ontario and the former Regional Plant 3 (RP3) located in south Fontana. The ponds located just east of RP1, commonly called the Cucamonga ponds, were used to dispose of untreated effluent collected by the Cucamonga County Water District (CCWD) and IEUA. RP3 and its disposal ponds are located on the southwest corner of Beech and Jurupa Avenues in the City of Fontana. Discharge to the Cucamonga ponds and the ponds of RP3 ceased between the early 1970s and the mid-1980s. The areas downgradient of these recharge ponds typically have elevated TDS and nitrate concentrations. The locations of these ponds are shown in Figure 2-58. Contaminant plumes emanating from these ponds have never been fully characterized.

Upland Sanitary Landfill. The closed and inactive Upland Sanitary Landfill (USL) is located on the site of a former gravel quarry at the southeastern corner of 15th Street and Campus Avenue in the City of Upland. The facility operated from 1950 to 1979 as an unlined Class II and Class III municipal solid waste disposal site. In 1982, USL was covered with a 10-inch thick, low permeability layer of sandy silt over the entire disposal site (GeoLogic Associates, 1997). Groundwater monitoring at the USL began in 1988 and now includes three on-site monitoring wells (an upgradient well, a cross-gradient well, and a downgradient well) (City of Upland, 1998). The results of groundwater monitoring indicate that USL has released organic and inorganic compounds to underlying groundwater (GeoLogic Associates, 1997). Groundwater samples from the downgradient monitoring well consistently contain higher concentrations of organic and inorganic compounds than samples from the upgradient and cross-gradient monitoring wells. Analytical results from groundwater sampling indicate that VOCs are the major constituents of the organic release. All three monitoring wells have shown detectable levels of VOCs. The most common VOCs detected above MCLs are dichlorodifluoromethane, PCE, TCE, and vinyl chloride. Other VOCs that have been periodically detected above MCLs include methylene chloride, *cis*-1,2 dichloroethene, 1,1-dichloroethane, and benzene. The 1990-95 average total VOC concentration in the downgradient monitoring well is 125 µg/L (GeoLogic Associates, 1997). Figure 2-58 shows the approximate areal extent of VOCs in groundwater at concentrations exceeding MCLs as of April 1998. However, the plume is defined only by the three on-site monitoring wells. The plume extent may be greater than is depicted on Figure 2-58.

National Priorities List Sites. Three facilities in, or directly tributary to, the Chino Basin are on the current National Priorities List (NPL) of Superfund sites:

- Stringfellow;
- Dodson Brothers; and
- Pacific Polishing (Figure 2-58).

Elevated levels of TCE and its degradation by-products have been detected in groundwater in the vicinity of the Dodson Brothers Superfund site (*cf.* Tables 2-44 and 2-53).

TCE/PCE Anomaly – South of the Ontario Airport. A plume containing TCE and PCE exists south of the Ontario Airport. The plume extends from approximately State Route 60 on the north, Turner Avenue on the east to Schaeffer Avenue on the south and Vineyard Avenue on the west. Figure 2-58 shows the approximate areal extent of the plume. The plume appears to be approximately 6,000 feet wide and 9,000 feet long. The maximum reported TCE and PCE concentrations are 142 µg/L and 2 µg/L, respectively.

Role of the Vadose Zone in Future Water Quality

The vadose zone is the unsaturated part of the aquifer that lies between the water table surface and the land surface. The vadose zone has become larger and thicker over time as the groundwater levels in the Basin have declined due to overdraft. Some of the contaminants discharged to the land surface or into ponds remain in the vadose zone. The mechanisms for retention of contaminants within the vadose zone are complex, but are generally caused by sorption and precipitation. Some contaminants move down towards the saturated zone at much lower rates (a few feet per year) than they can move once they get to the saturated zone (a few feet per day). MWDSC completed a study of the TDS and nitrate impacts in the Chino Basin from a proposed 700,000 acre-ft storage program California (MWDSC, 1988). The outcome of this study suggested that the raising of groundwater levels associated with the increase in storage would mobilize TDS and nitrates in the vadose zone and cause serious water quality problems throughout the Basin. The proposed storage program did not add contaminants – it flushed contaminants already in the vadose zone into the saturated zone. This potential effect could not be verified with more advanced modeling in the CBWRMS due to problems with the model. Real-world experiments to verify the TDS and nitrate contamination are not practical for a basin as large as the Chino Basin.

As the agricultural land uses in the Chino Basin convert, the loading of contaminants to the vadose zone will be significantly reduced, as will percolation at the land surface that drives the contaminants down towards the saturated zone. This will have the effect of reducing the rate of vadose zone loading to the saturated zone.

SAFE YIELD

The safe yield of the Chino Basin was established in the 1978 Judgment to be 140,000 acre-ft/yr. The basis for this estimate is described by William J. Carroll in his testimony on December 19 and 20, 1977, during the adjudication process. Table 2-13 lists the hydrologic components developed by Carroll to estimate the safe yield of the Chino Basin. These components were developed for the period 1965 to 1974, a period that Carroll referred to as the *base period*. The hydrologic components listed in Table 2-13 are described below.

Deep Percolation of Precipitation and Surface Inflow – consists of the deep percolation of precipitation and streamflow. Carroll developed the estimate of 47,500 acre-ft/yr based on an extrapolation of the early Chino Basin modeling results from the DWR.

Deep Percolation of Artificial Recharge – consists of the percolation of local runoff in spreading basins. Carroll estimated that the local runoff recharged in SBCFCD-controlled facilities to be about 2,800 acre-ft/yr during the base period. The Etiwanda Water Company also recharged about 1,000 acre-ft/yr of Deer and Day Creek water in the Chino Basin during the base period.

Deep Percolation of Chino Basin Groundwater Used for Irrigation (domestic and agricultural) – defined as the fraction of water applied for irrigation that percolates through the soil and recharges underlying groundwater. Carroll estimated that about 15 percent of the water used for domestic irrigation would percolate to groundwater; and that 45 percent of the water used for agricultural irrigation would percolate to groundwater. The volume of percolation of Chino Basin groundwater used for irrigation over the base period was estimated by Carroll to be about 61,700 acre-ft/yr.

Deep Percolation of Imported Water Used for Irrigation (domestic and agricultural) – same as deep percolation of Chino Basin groundwater except that the water used for irrigation is imported to and used

over the Chino Basin. The volume of percolation of imported water used for irrigation over the base period was estimated by Carroll to be about 7,000 acre-ft/yr.

Recharge of Sewage – defined to be the percolation in ponds of wastewater discharged by municipal wastewater treatment plants. This component almost completely ceased during the base period and was known to be eliminated as a recharge source when the safe yield was estimated. The volume of sewage recharge over the base period was about 18,200 acre-ft/yr. The inclusion of recharge of sewage as a component of safe yield in the stipulated Judgment was therefore not hydrologically consistent with how the Basin was to be operated post-Judgment.

Subsurface Inflow – defined to be the groundwater inflow to the Chino Basin from adjacent groundwater basins and mountain fronts including:

Bloomington Divide (Riverside Basin)	3,500 acre-ft/yr
San Gabriel Mountain front	2,500 acre-ft/yr
Colton Rialto Basin	500 acre-ft/yr
Cucamonga Basin	100 acre-ft/yr
Claremont and Pomona Basins	100 acre-ft/yr
Jurupa Hills	500 acre-ft/yr
Total	**7,200 acre-ft/yr**
	say 7,000

Subsurface Outflow – defined as groundwater that rises to the ground surface in Prado Basin to become Santa Ana River flow. Estimates of subsurface outflow were based on studies by DWR, United States Geological Survey (USGS), and Carroll. Carroll estimated the subsurface outflow to average about 6,800 acre-ft/yr over the base period.

Extractions – consists of groundwater extractions from the Chino Basin. Carroll estimated the groundwater extractions to average about 180,000 acre-ft/yr during the base period.

In addition to these components, Carroll estimated the change in storage over the base period to be about 40,000 acre-ft/yr; that is, the groundwater in storage declined by about 400,000 acre-ft between 1965 and 1974. Carroll estimated the safe yield to be the equal to the average extraction over the base period minus the average annual overdraft during the base period:

safe yield = extraction - overdraft
= 180,000 - 40,000
= 140,000 acre-ft/yr

A more recent estimate the safe yield can be abstracted from the groundwater modeling work done for the *Chino Basin Water Resources Management Study -- Task 6 Memorandum Develop Three Dimensional Groundwater Model* (Montgomery Watson, 1994). The hydrologic components derived from the modeling results for a 30-year period -- October 1960 to September 1989 (water years 1961 to 1989) - are listed in Table 2-14. The safe yield based on the CBWRMS results (1961 to 1989) computed in a manner similar to Carroll is:

safe yield = extraction - overdraft
= 183,000 - 17,000

= 166,000 acre-ft/yr

The safe yield based on CBWRMS modeling results for the base period (1965 to 1974) used by Carroll would be:

safe yield = extraction - overdraft
= 189,000 - 20,000
= 169,000 acre-ft/yr

A more conceptually correct estimate of the safe yield would include a reduction for artificial recharge of imported water and other waters that are currently not part of the yield, such as recharge of reclaimed water. The adjusted estimates would then be:

Carroll's estimate 1965 to 1974	118,000 acre-ft/yr
CBWRMS estimate 1961 to 1989	151,000 acre-ft/yr
CBWRMS estimate 1965 to 1974	156,000 acre-ft/yr

Watermaster may decide to change the safe yield of the Basin based on new information such as that developed from the CBWRMS and subsequent studies. Safe yield is used to determine the need for replenishment obligation for individual parties to the judgment. New water from the capture and recharge of storm water, from induced recharge caused by increased southern basin production (or, conversely, the reduction of yield from reduced production in the southern Chino Basin), or from other sources will enhance the yield of the Basin and thereby reduce the cost of purchasing imported water for replenishment.

At the time the Chino Judgment was implemented (1978), about 41 percent of the safe yield was estimated to come from irrigation returns. Since that time, irrigated agriculture has declined and is projected to be almost completely gone by 2020. This will result in a decline in irrigation returns to groundwater and a potential decrease in the safe yield. In addition, San Bernardino County, Riverside County, and the US Army Corps of Engineers (USACE) have constructed flood control projects that capture and convey runoff to the Santa Ana River - effectively eliminating the groundwater recharge that formerly took place in the stream channels and flood plains in the Chino Basin. This also may have resulted in a decrease in the safe yield of the Chino Basin.

Water harvesting opportunities exist that can be used to offset the yield lost to urbanization and flood control improvements. Water harvesting consists of capturing and recharging runoff caused by urbanization. Most of the precipitation falling on undeveloped land or land in agricultural uses is lost to evapotranspiration. Runoff increases dramatically with urbanization due to drainage improvements, increased impervious land cover, and decreased evapotranspiration of rainfall. The potential yield from this additional runoff is numerically equal to the increase in runoff that occurs when the land is converted to urban uses. The actual yield is equal to the additional runoff that is captured and put to beneficial use. In the Chino Basin, the best and least expensive way to put this yield to beneficial use is groundwater recharge.

Urbanization also creates reclaimed water. Presently, most of this water is discharged to the Santa Ana River. IEUA currently plans to use some of their reclaimed water for direct uses, including non-potable industrial uses, irrigation, and groundwater recharge. Increasing the yield of the Chino Basin by increased capture of local runoff will improve the dilution of reclaimed water used for groundwater recharge and reduce the cost of mitigation requirements for such reclamation.

WATER DEMANDS AND WATER SUPPLY PLANS

Current and Future Water Demands

The purpose of this subsection is to describe the current and projected water demands and supplies for agencies that produce groundwater from the Chino Basin. This information will serve as the basis for identifying future water resources issues in the Chino Basin area. Updated forecasts of water demands and supplies were requested from each Chino Basin water agency and industrial producer. Requested data included demands, water supply plans by individual well or source, well construction and operating data, and water production and treatment costs. Many agencies provided updated information. Where responses were incomplete, previous information developed as part of the 1995 Chino Basin Water Resources Management Study (CBWRMS) was used. The planning period for this evaluation is 2000 to 2020.

Growth Projections. There are several indicators of potential growth within the Chino Basin study area. These include population, housing, employment, and land use. The Southern California Association of Governments (SCAG) periodically develops population, housing, and employment projections. SCAG prepares growth projections as part of its regional transportation planning for Imperial, Los Angeles, Orange, Riverside, San Bernardino, and Ventura counties. The most recent SCAG projection is SCAG-98, which was adopted in April 1998.

The SCAG-98 projection indicates the six-county region will grow from 15.6 million people in 1994 to 22.4 million in 2015. This represents an increase 6.7 million people between 1994 and 2015 and a growth rate of 43 percent. San Bernardino and Riverside counties are projected to grow at a rate that is more than double the regional average. San Bernardino County is projected to grow from 1,558,000 people in 1994 to 2,830,000 in 2020. Riverside County is projected to increase from 1,377,000 people in 1994 to 2,816,000 in 2020.

Population. Table 2-15 summarizes the population projections for the Chino Basin area by water purveyor. The SCAG projections were desegregated by city and census tract and combined by water purveyor service area. These projections indicate population will increase from 971,000 in 1994 to 1,631,000 in 2020. This is a growth rate of 68 percent or 2.6 percent per year. The population in some water service areas in the San Bernardino County portion of the Basin are projected to increase by as much as 125 percent.

Housing. Total housing is projected to increase from 284,000 units in 1994 to 496,000 in 2020, a growth rate of 75 percent. By comparing population and housing, the average occupancy is projected to decrease slightly from 3.4 to 3.3 persons per dwelling unit.

Employment. Employment is projected to increase from 316,000 jobs in 1994 to 702,000 jobs in 2020, a growth rate of 122 percent.

Water Demand Projections. Current water demands and supply projections form the basis for evaluating future water management programs in the Chino Basin area. Water demands are developed based on the water service areas shown in Table 2-16.

Water demand projections can be developed by several different methods. These include per capita, water duty and units of use approaches. The most frequently used methods are the per capita consumption method and the water duty method.

For this assessment, all water demands are based on information provided by the water agencies. In the absence of agency data, the assumptions in the CBWRMS have been used. These projections have been compared with the current SCAG projections. However, no adjustments to he demands have been made.

Projected water demands for the Chino Basin are presented in Table 2-16. This table indicates that Chino Basin area water demands will reach 348,000 acre-ft/yr in 2000 to 418,000 acre-ft/yr in 2020. Significant municipal water demand growth is expected to occur in the agricultural preserve area. This will result in increased demands for the Cities of Chino, Chino Hills and Ontario, and Jurupa Community Services District. Agricultural water demands are expected to decrease during the planning period as land is converted to urban uses.

Water Supply Plans

The principal water supplies in the Chino Basin area are groundwater pumped from the Chino Basin, other local groundwater and surface water, imported water purchased from Metropolitan and recycled water. The amounts of water utilized from each source are based on data provided by each water purveyor. If data was not provided, the supplies area based on projections developed for the Chino Basin Water Resources Management Study (1995). Each of these sources is discussed below. Table 2-17 presents projected water supply plans for appropriators in the Chino Basin area. Table 2-18 summarizes the water demands by major source categories. The growth in demand and general source plan is shown is shown graphically in Figure 2-60. Review of Table 2-18 and Figure 2-60 shows that there will be about 40,000 to 50,000 acre-ft/yr of Chino Basin production that will incur a replenishment obligation. The replenishment obligation can be met by the recharge of imported and reclaimed water, in-lieu replenishment involving imported water, and from water in local storage accounts. In the long run, the replenishment obligation of about 40,000 to 50,000 acre-ft/yr will need to be met with imported and recycled water. Thus the imported and recycled water components in Table 2-18 and Figure 2-60 should sum to a total of 40,000 to 50,000 acre-ft/yr higher.

Chino Basin Groundwater. The Chino Basin is the largest groundwater basin in the Upper Santa Ana Watershed. Water is reallocated from the Overlying Agricultural Pool to the Appropriative Pool when it is not put to use by the agricultural users. As agricultural production declines, the reallocations to the Appropriative Pool will increase. Total production from the Chino Basin is projected to range between 180,000 to 190,000 acre-ft/yr over the planning period. Production in excess of safe yield must be replaced through the purchase of replenishment water, which is imported into the Chino Basin, by the Watermaster.

Other Local Supplies. Other local water sources provide a portion of the water supplies for Chino Basin water agencies. These supplies include surface water and groundwater.

Surface Water. A number of water supply agencies, which produce groundwater from the Chino Basin, obtain a portion of their water supplies from local surface water sources. These agencies include the: City of Pomona, City of Upland, Cucamonga County Water District, Fontana Water Company, San Antonio Water Company, West End Consolidated Water Company, and West San Bernardino County Water District. The principal surface water sources include San Antonio Canyon, Cucamonga Canyon, Day Creek, Deer Creek, Lytle Creek and several smaller surface sources. For the most part, these surface water sources are fully developed and no significant additional supplies are anticipated to be developed in the future. Usage is expected to remain at 16,000-17,000 acre-ft/yr.

Other Groundwater. Other local groundwater supplies represent a significant supplemental source of water for Chino Basin water agencies. Other groundwater supplies in the study area include the Claremont Heights, Live Oak, Pomona and Spadra Basins in Los Angeles County, the Riverside South

and Temescal Basins in Riverside County, and the Colton-Rialto, Cucamonga, Lytle Creek Bunker Hill, and Riverside North Basins in San Bernardino County. Agencies using other local groundwater include: City of Pomona, City of Upland, Cucamonga County Water District, Fontana Water Company, San Antonio Water Company, Southern California Water Company, West End Consolidated Water Company, and West San Bernardino County Water District. These supplies may increase slightly in the future as additional wells are constructed. However, most of these sources are essentially fully developed. Descriptions of these groundwater basins were presented in the CBWRMS Final Report (1995). The aggregate supply from these basins is currently 63,000 acre-ft/yr and is projected to be 76,000 acre-ft/yr in 2020.

Imported Water. Two regional agencies are responsible for imported water deliveries within the study area: Metropolitan Water District of Southern California (Metropolitan) and San Bernardino Valley Municipal Water District (SBVMWD). Metropolitan is a wholesale water agency serving supplemental imported water to 27 members (city and water agencies) in portions of Los Angeles, Orange, Riverside, San Bernardino, San Diego and Ventura counties. This service area has a current population of more than 16 million people. Approximately one-half of the total water used throughout the entire Metropolitan service area is imported water purchased from Metropolitan to supplement the local water supplies in its service area. Metropolitan obtains imported supplies from the Colorado River and the State Water Project (SWP). The demand for direct delivery of imported water for the Chino Basin purchased from Metropolitan is projected to increase from about 68,000 acre-ft/yr in 1997 to 129,000 acre-ft/yr by 2020, an increase of about 90% percent. The demand for replenishment water in the Chino Basin could reach 40,000 acre-ft/yr by 2020 if reclaimed water is not used for replenishment or direct uses and water in local storage accounts is not available for use as replenishment.

SBVMWD is a wholesale water purveyor in the easternmost portion of the study area and adjacent portions of San Bernardino County. SBVMWD is a SWP Contractor having an entitlement of 102,600 acre-ft/yr. In addition, SBVMWD is responsible for basin management in the Bunker Hill basin. The City of Rialto and West San Bernardino County Water District obtain water from SBVMWD through its Baseline Feeder that supplies Bunker Hill groundwater (included in *other groundwater* above).

Recycled Water. There are several existing sources of recycled water in use within the Chino Basin study area. These are the Pomona Water Reclamation Plant (operated by the Los Angeles County Sanitation Districts), Regional Plants 1, 2 and 4, and Carbon Canyon Water Reclamation Plant operated by IEUA, Upland Hills Water Reclamation Plant operated by the City of Upland, CIM Water Reclamation Plant operated by the California Institution for Men at Chino, and Indian Hills Water Reclamation Plant operated by Jurupa Community Services District. For this section, only existing and planned recycled water uses that will be implemented in the next two years are included in the water supply plans. This is about 11,500 acre-ft/yr.

Summary. The plans summarized in this section represent the current non-OBMP water supply plans of each individual water agency, as qualified previously. Future evaluation of these plans may indicate problems relative to their long-term feasibility. Availability of imported water supplies will have a significant effect on plan feasibility.

WASTEWATER FLOWS, TREATMENT AND DISPOSAL

This section summarizes existing and proposed municipal wastewater treatment and disposal plans for the Chino Basin study area for the planning period of 2000 through 2020. Existing municipal wastewater treatment facilities are described briefly along with a review of present and projected wastewater flows. Future treatment and disposal plans for the study area are also discussed.

Wastewater Flow Projections

Wastewater flow projections are made using a combination of methods similar to water demand projections. Depending on the planning data available, wastewater flow projections are made using per capita-based, EDU-based, area-based, and water consumption-based methods. The per capita method uses projected populations and average unit wastewater flows per person (90-110 gallons per day per person). EDU-based projections use unit flows per equivalent dwelling unit (EDU), where an EDU is the average amount of sewage generated by a single-family residential household (about 270 gallons per day). EDUs are estimated for commercial and industrial land uses using fixture unit counts or estimated wastewater flows. Flow projections are computed by projecting future EDUs and multiplying by the unit flow per EDU. Area-based methods typically use unit flow factors for each land use type. Flows are computed by multiplying the unit factor for each land use type by the corresponding acreage and totaling the individual flows for each land use type. Water consumption-based methods compute wastewater flows based on the difference between water demand and water consumption. Water consumption is the amount of water that does not return to the sewer system and is a function of the particular land use type and water use group. Currently, most wastewater flow projections in the study area are based on either per capita or EDU methods. Figure 2-61 illustrates the projected wastewater flows for each service area described below.

LACSD Service Area. The Los Angeles County Sanitation Districts (LACSD) furnishes wastewater services for Pomona and Claremont. Using the SCAG-98 growth projections and a wastewater generation factor of 110 gpcd, the wastewater flows for this area are estimated to increase from 22,000 acre-ft/yr to 30,000 acre-ft/yr in 2020.

IEUA Service Area. IEUA develops ten-year wastewater forecasts for its service area in conjunction with its annual capital improvement plan (CIP). As part of its current CIP, IEUA also prepared a fifty-year projection of wastewater flows. These projections indicate wastewater flows will increase from 57,000 acre-ft/yr in 1997 to 112,000 acre-ft/yr in 2020. This represents an increase of 96 percent.

Riverside County Service Area. Wastewater collection for the portion of the study area in Riverside County is provided by several agencies including Jurupa Community Services District and Norco. Other portions are unsewered. Wastewater flows for the Riverside County area are estimated to increase from 10,000 acre-ft/yr in 1997 to 15,000 acre-ft/yr by 2020 based on projected population increases. This includes wastewater generated by unsewered areas. Additional wastewater from outside the study area is expected to be treated at the Western Riverside Regional Water Reclamation Plant. However, no estimates of these additional flows were received.

Treatment and Disposal

Seven agencies are responsible for wastewater treatment and disposal for their respective areas. In Los Angeles County, LACSD is the treatment and disposal agency. In western San Bernardino County, IEUA and the City of Upland perform this role. In the easterly portion of the study area, the City of Rialto provides this service. In Riverside County, several agencies are responsible for wastewater treatment, including the Cities of Riverside and Corona, and JCSD.

There are three basic wastewater service areas within the study area. These areas include:

- LACSD System (Los Angeles County)
- IEUA System (Western San Bernardino County)
- Riverside County

LACSD System. The LACSD provides regional wastewater collection and treatment for most of Los Angeles County. LACSD is divided into districts that handle wastewater management within their service areas. LACSD No. 21 provides this service for the Claremont, La Verne, and Pomona service areas. Urban and industrial wastewater flows from the Los Angeles County portion of the study area are collected by the cities of Claremont, La Verne, and Pomona. This wastewater is routed to LACSD No. 21 for treatment at LACSD's Pomona WRP and San Jose Creek WRP. With the exception of recycled water used by the City of Pomona from the Pomona WRP, all wastewater reaching the sewer system is exported out of the study area. The Pomona WRP has capacity of 15 MGD and is expected to operate at that level during the planning period.

IEUA System. IEUA has constructed a Regional Sewerage System within its service area to collect, treat and dispose of wastewater delivered by contracting local agencies. The contracting cities and water districts are responsible for wastewater collection within their individual service areas. A system of regional trunk and interceptor sewers that convey sewage to regional wastewater treatment plants is owned and operated by IEUA. IEUA's wastewater collection system is divided into two major service areas: the Northern Service Area and the Southern Service Area.

IEUA currently operates four wastewater treatment plants: Regional Plant No. 1 (RP1), Regional Plant No. 2 (RP2) Regional Plant No. 4 (RP4), and Carbon Canyon Water Reclamation Plant (CCWRP). A fifth regional plant, known as Regional Plant No. 3 (RP3), is no longer in service. One new treatment plant, Regional Plant No. 5 (RP5), is in the planning stages. All of these plants are or will be capable of producing effluent that meets Title 22 requirements for water reclamation. Figure 2-62 illustrates the projected flows and capacity staging of these plants. Each of these plants are described below

Regional Plant No. 1. Although RP1 is designed to treat 44 mgd, the capacity was downrated to 32 mgd in 1992 due to more stringent permit requirements. The plant is being operated at an interim capacity of 41 mgd while plant upgrades are completed. A 1996 Regional Board cease and desist order requires the plant to be restored to its design capacity by 1999. RP1 is expected to operate at near its design capacity and treat wastewater flows from its service area and excess flows from RP4 until 2014. A plant expansion to about 56 mgd is planned to be on-line by 2014 to meet increased flows from its service area.

Regional Plant No. 2. RP2 serves the City of Chino and surrounding areas. A 1994 cease and desist order by the Regional Board requires the plant to be flood protected or relocated. Consequently, the plant will be potentially abandoned and its capacity replaced by a new RP5 by 2001. Solids handling facilities will continue to operate at this site.

Regional Plant No. 4. RP4 is a 7-mgd wastewater treatment facility that recently began operation. The plant will be expanded to 14 mgd by 2008 and 21 mgd by 2021. Population growth and corresponding wastewater production in the northeastern region of the District, including portions of City of Fontana and Cucamonga County Water District will determine the rate of expansion.

Carbon Canyon Water Reclamation Plant. Carbon Canyon Water Reclamation Plant (CCWRP) became operational in May 1992. CCWRP is designed to produce recycled water that can be used for non-potable purposes including industrial and irrigation uses in the western region of the Chino Basin. The initial design capacity of 10.2 mgd is planned for increase to 15.3 mgd in the year 2014. Sludge generated at the CCWRP is treated at the RP2 sludge processing facilities and will be for the foreseeable future.

Regional Plant No. 5. Growth in the southern portion of the IEUA service area will require additional treatment capacity. IEUA plans to construct a new RP5 by 2001. The initial phase of this plant will be 12 mgd of which 5 mgd will replace capacity at RP2. The new RP5 is expected to serve the San

Bernardino Agricultural Preserve area as well as treating 3.6 mgd from southern Ontario. A second phase expansion to 18 mgd is projected to be completed by 2008 with a third phase expansion by 2021.

Western Riverside County Regional Wastewater Treatment System. The Western Riverside County Regional Wastewater Authority, a Joint Powers Authority, has constructed a regional wastewater treatment facility to serve portions of Jurupa CSD, Norco, Home Gardens Sanitary District and Western MWD. This facility is located in Western Riverside County near the intersection of McCarty Road and Hellman Avenue. This facility has an initial treatment capacity of 8.5 mgd. The treatment plant will be expanded to an ultimate capacity of 13.3 mgd. The facility provides tertiary filtration and nitrogen removal to meet projected discharge requirements. Effluent from this plant will be discharged to the Santa Ana River. Projections of flows to this plant are not available as of the date of this report.

SUMMARY OF GROUNDWATER LEVEL, STORAGE, PRODUCTION AND WATER QUALITY PROBLEMS

Groundwater Level Problems

Overall, groundwater levels have declined between 50 to 200 feet in the Chino Basin since the turn of the century. The western side of the Basin, notably Management Zones 1a and 1b, has experienced the greatest decline in groundwater levels. The City of Chino and CIM have recently experienced ground-surface fissures that are thought to be related to increased groundwater production in the vicinity of the City of Chino. Groundwater producers that affect groundwater levels in this area include the cities of Chino, Chino Hills, Ontario, Pomona, the Monte Vista Water District, CIM, and agricultural producers. The City of Chino Hills has reported loss of production at one well due to recently declining groundwater levels. The management steps to eliminate groundwater-level problems in this area are described below.

Ground Level Survey. Conduct a ground-level survey of the area in Management Zone 1. This would include a review of past surveys and new surveys. The survey results would be compared to historical surveys to determine the location, rate, and magnitude of subsidence in the Basin. Periodic surveys should be conducted afterwards to monitor for further subsidence.

Monitoring. Develop and implement a groundwater-level and quality monitoring program that can be used to observed groundwater trends. This program should be developed and implemented before a groundwater recharge/production management plan is developed for Management Zone 1 in order to define local groundwater flow systems for better management of recharge and production.

Balance Groundwater Production and Recharge. Balance groundwater production with recharge in Management Zone 1, or, if necessary, balance production and recharge more locally within Management Zone 1. This may require temporarily reducing production below the level at which balance occurs to bring groundwater levels up to a safe level. A *safe* level needs to be determined. Recharge of local or native and imported water should be increased as much as practical. Given that recharge in the area is maximized, production may still have to be reduced in Management Zone 1 and replaced with either production from Management Zone 2 or some other source of water.

Groundwater Storage

The Chino Basin has immense storage capacity. Since the Judgment was implemented, total groundwater storage appears to have stabilized. However, as noted earlier, the storage in the Basin has declined by about 1,000,000 acre-ft since 1933. Therefore, there is at least 1,000,000 acre-ft of unused storage capacity available in the Basin. Increasing storage has some costs. There will be losses to the Santa Ana River due to rising groundwater. The analysis previously presented suggests that the losses from local

and cyclic storage accounts due to rising groundwater during the period 1978 to 1997 could be as high as 50,000 acre-ft (or 18 percent of the volume that Watermaster assumes is in storage). Ignoring these losses will result in overdraft of the Chino Basin. A significant increase in groundwater storage, say on the order of 100,000s of acre-ft, may induce large groundwater losses to the Santa Ana River. In addition, a storage increase of this magnitude may have groundwater quality impacts due to flushing of contaminants within the vadose zone. The volume of safe storage from a water quality perspective is unknown. The management steps to mitigate the significant issues with groundwater storage are described below:

Develop Storage Accounting System that Includes Losses. Presently, Watermaster keeps track of transfers to and from local and cyclic storage accounts without accounting for groundwater losses. Watermaster should adopt a loss-estimating procedure and adjust the volume in storage accounts each year.

Water Quality Impacts from Conjunctive Use Programs. Mitigation measures need to be developed to protect producers in the event that large conjunctive-use programs cause unacceptable water quality impacts.

Groundwater Production

The primary issues for groundwater production are localized overdraft in Management Zone 1, and the potential changes in safe yield that can occur with changes in the location and magnitude of pumping. The location and amount of groundwater production generally appears to be balanced in the Basin except for Management Zone 1. Groundwater levels need to be increased in Management Zone 1 to minimize future subsidence and ground fissures, maintain production at a sustainable level, and improve groundwater quality. The management steps for this issue are identical to those for *Groundwater Levels.*

Groundwater production in the southern half of the Basin will need to be managed to ensure that safe yield is not reduced as agricultural areas convert to urban uses. Losses in safe yield due to decreases in agricultural production in the southern part of the Basin are distributed among the appropriators based on their initial share of safe yield. Thus, the loss in yield is translated throughout the Basin. Increasing production near the Santa Ana River could enhance exiting safe yield. The management steps for addressing this issue are listed below.

Optimization Studies. Conduct studies to optimize groundwater production patterns in southern Chino Basin. These studies will involve geologic investigations and modeling of southern Chino Basin.

Southern Basin Water Supply Plan. Develop a groundwater production and treatment plan that matches the emerging water demands of development in the southern Chino Basin with facilities necessary to provide water of appropriate quality.

Water Quality

The TDS and nitrate problems in the Basin are the most costly ones to deal with and are primarily non-point source related. By contrast, point-source dischargers of organic solvents and other contaminants are dealing with most of their related groundwater plumes. The cost of TDS and nitrate removal is estimated to be about $700 per acre-ft. The cost to remove solvents is generally under $100 per acre-ft. Figure 2-59 shows the locations of known point sources and areas with impaired water quality in the Chino Basin.

The source of the TDS and nitrate contamination in the northern part of the Basin has mostly disappeared. The primary sources of TDS and nitrate contamination in the southern part of the Basin are dairies and they will probably remain active for the next 20 years. TDS and nitrate degradation should continue in

the southern basin for the foreseeable future and the cost to treat contaminated groundwater will escalate over current costs due to past and continued animal waste disposal practices. The steps to manage groundwater quality problems in the Basin are described below.

Point-Source Management. Watermaster should work with the Regional Board, Department of Toxic Substances Control and other regulatory agencies to identify point-source discharge related problems, facilitate their solution, and where necessary, use its institutional influence to obtain prompt and satisfactory mitigation. In some cases, the solution to a point-source problem and a non-point source problem can be addressed through one coordinated capture and treat project with reduced cost to all parties.

Non-point Source Management. The groundwater contaminated from non-point sources in the northern and southern parts of the Basin will need to be treated through dilution, demineralization or some other process, so that the water can be put to beneficial use. This is absolutely necessary in the southern Chino Basin to maintain safe yield. The *Optimization Studies* and *Southern Basin Water Supply Plan* steps listed under *Groundwater Production* apply here as well. The export of dairy waste from the Basin should be maximized.

Safe Yield

All the problems listed above need to be addressed to maintain safe yield. In addition to those steps, maximizing the capture and recharge of storm water and reclaimed water could increase safe yield. The SBCFCD, Riverside County Flood Control and Water Conservation District (RCFCWCD), and the USACE have developed and continue to develop new flood control projects that efficiently convey flood waters out of the Chino Basin and reduce recharge. This has a negative impact on safe yield. Watermaster needs to participate in these flood control projects to maximize recharge. Watermaster and the Chino Basin Water Conservation District initiated a multiphase recharge master plan study and completed Phase 1 in May 1998. Phases 2 and 3 need to be completed.

SECTION 3
GOALS OF THE OBMP

This section presents the mission statement for the OBMP, the issues, needs and interests that were articulated by the stakeholders, and the goals of the OBMP. Each of these items was developed as part of the institutional process. These items were discussed in numerous public meetings and their final form is based on the consensus of those stakeholders that participated in the process.

MISSION STATEMENT

The stakeholders have met twice per month since the February 19, 1998 ruling by Judge Gunn, to develop the OBMP. As part of this process, the stakeholders defined a new paradigm from which they view their stewardship responsibilities, current and anticipated problems in the Basin, and the solution approaches to those problems. This new paradigm is described in the following mission statement and core values developed by the stakeholders:

> *The purpose of the Optimum Basin Management Program 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 stakeholders have adopted the following core values associated with the mission statement.

Water Quality. All producers desire to produce water of a quality that is safe and suitable for the intended beneficial use.

Long View. All producers desire a long term, stable planning environment to develop local water resources management projects. The producers, independently and through Watermaster, will strive to take the long view in their planning assumptions and decisions to ensure a stable and robust management program.

Increased Local Supplies. All producers will, for an undetermined time into the future, be dependent on high quality imported water for direct uses and for groundwater replenishment. Because high quality imported supplies may not be available, the producers will strive to minimize their dependency on imported water and to increase their dependency on local supplies when economically justified.

Groundwater Storage. Unused groundwater storage capacity in the Chino Basin is a precious natural resource. The producers will manage the unused storage capacity to maximize the water quality and reliability and minimize the cost of water supply for all producers. The program will encourage the development of regional conjunctive use programs.

Storm Water Recharge. The producers will strive to increase storm water recharge and thereby maintain and enhance the safe yield and water quality.

Reclaimed Water Recharge. The safe yield of the Chino Basin will be enhanced through the recharge of reclaimed water. The producers will strive to maximize the recharge of reclaimed water to enhance the safe yield and water quality.

Cost of Groundwater Supplies. The producers are committed to finding ways to subsidize the cost of using poor quality groundwater in a cost-effective and efficient manner.

MANAGEMENT ISSUES, NEEDS, AND INTERESTS

As part of the OBMP scoping process, issues, needs and interest were solicited from the stakeholders in the Basin. These issues, needs and interests have been summarized in a tabular form in Tables 3-1 through 3-7, where each table refers to a class of issues, needs and interests that include:

- safe yield
- native and imported water recharge
- quality and quantity
- reclaimed water
- conjunctive-use storage
- costs
- human resources and administration

Attribution for the source of each issue, need, and interest is listed in these tables. In some cases, a specific issue, need and interest may show up in more than one class. These needs and interests were discussed at several scoping meetings and were used to focus problem identification, OBMP goals, and the resulting OBMP scope of work.

MANAGEMENT GOALS OF THE OBMP

In June 1998, the stakeholders began the process of developing management goals for the OBMP that address the issues, needs, and interests of the producers. The process involved the proposal of an initial set of goals followed by discussion and group editing at the bi-monthly meetings. The initial set of goals of the OBMP is listed below.

Goal No. 1 – Enhance Basin Water Supplies. This goal applies not only to local groundwater, but also to all sources of water available for the enhancement of the Chino Groundwater Basin. The following activities enhance basin water supplies:

- *Enhance recharge of storm water runoff*. Increasing the recharge of storm water in the Basin will increase the water supplies in the Chino Basin. The relatively low TDS and nitrate concentrations of storm flow will improve groundwater quality.
- *Increase the recharge of recycled water*. The recharge of recycled water above that required for replenishment obligations can be used for safe yield augmentation and/or conjunctive use.
- *Develop new sources of supplemental water*. New sources of supplemental water, including surface and groundwater from other basins, can be used to meet Chino Basin area demands, reduce dependency on Metropolitan supplies, and improve drought reliability.
- *Promote the direct use of recycled water*. Promoting the direct use of recycled water for non-potable uses will make more native groundwater available for higher-priority beneficial uses.
- *Promote the treatment and use of contaminated groundwater*. Groundwater in some parts of the Basin is not produced because of groundwater contamination problems and thus the yield of the Basin may be reduced. The yield of the Basin can be maintained and enhanced by the production and treatment of these contaminated waters.

- *Reduce groundwater outflow*. Increasing groundwater production near the Santa Ana River will increase the streambed percolation of the Santa Ana River into the groundwater basin, and reduce groundwater outflow from the Basin and thereby increase the supply of groundwater in the Basin.
- *Re-determine safe yield.* Recent studies suggest that the safe yield may be greater than the 140,000 acre-ft as stated in the Judgment. The activities listed above will cause the yield to increase further. Continuing to operate the Basin at 140,000 acre-ft/yr will cause groundwater in the Basin to be lost to the Santa Ana River. The safe yield will be re-determined on an as needed basis to maximize the current yield and to cause future increases in yield

Goal No. 2 – Protect and Enhance Water Quality. This goal will be accomplished by implementing activities that capture and dispose of contaminated groundwater, treat contaminated groundwater for direct high-priority beneficial uses, and encourage better management of waste discharges that impact groundwater. The following activities will protect and enhance water quality:

- *Treat contaminated groundwater to meet beneficial uses*. Groundwater in some parts of the basins is not produced because of groundwater contamination problems. Groundwater quality can be protected by intercepting contaminants before they spread. Intercepted groundwater could be treated and used directly for high priority beneficial uses or injected back to the aquifer.
- *Monitor and manage the Basin to reduce contaminants and to improve water quality*. Actively assisting and coordinating with the Regional Board, the EPA, and other regulatory agencies in water quality management activities would help improve water quality in the Basin.
- *Manage salt accumulation through dilution or blending, and the export of salt*.
- *Address problems posed by specific contaminants.*

Goal No. 3 – Enhance Management of the Basin. This goal will be accomplished by implementing activities that will lead to optimal management of the Chino Basin. The following activities will protect and enhance management of the Basin:

- *Develop policies and procedures that will encourage stable, creative and fair water resources management in the Basin*.
- *Optimize the use of local groundwater storage.* Policies and procedures for local storage, cyclic storage and other types of storage accounts will be created to maximize drought protection and improve water quality, and to create an efficient system to transfer water from producers with surplus water to producers that need water.
- *Develop and/or encourage production patterns, well fields, treatment and water transmission facilities and alternative water supply sources to ensure maximum and equitable availability of groundwater and to minimize land subsidence*.
- *Develop conjunctive-use programs with others to optimize the use of the Chino Basin for in-basin producers and the people of California*.

Goal No. 4 – Equitably Finance the OBMP. This goal is based on the following principles:

- *The primary source of revenue to finance the implementation will be the consumers of the Chino Basin groundwater.*

- *The consumers in the Chino Basin must be treated equitably by passing the cost of the OBMP on a per acre-foot basis or by other methods, based on formulas to be determined.*
- *Financial incentives and disincentives will be established to assure that existing groundwater is pumped out of the Basin and a higher quality of water is used to replenish the Basin.*
- *Opportunities for creativity will be provided to the producers so that they are motivated to use their assets and abilities in the implementation of the OBMP.*
- *Recover value from utilization of storage of supplemental water and from rising water outflow.*

The Special Referee and her engineer reviewed these goals and provided direction to the stakeholders. In particular, the Special Referee suggested that the goals and action items were too vague. The goals and action items were refined and produced in a tabular format. The goals setting process concluded on November 26, 1998. The final set of goals is listed in Table 3-8. Table 3-8 lists each goal, the impediments to each goal, action items to surmount each impediment and achieve the goal, and the implication of the individual action items. The stakeholders were asked to review the final set of goals and action items listed in Table 3-8 to make sure that their individual issues, needs, and interests were addressed by the management goals. The stakeholders concluded that the set of goals listed in Table 3-8 addressed their needs and interests.

SECTION 4
MANAGEMENT PLAN

INTRODUCTION

The Optimum Basin Management Program (OBMP) goals, impediments to the goals, action items to remove the impediments, and implications of the action items are summarized in Table 3-8. This section of the OBMP report describes the actions that, when implemented, will achieve the goals of the OBMP. Table 3-8 includes a column that cross-references the action items listed for each goal with OBMP program elements. The program elements described herein include:

- Program Element 1 – Develop and Implement Comprehensive Monitoring Program
- Program Element 2 – Develop and Implement Comprehensive Recharge Program
- Program Element 3 – Develop and Implement Water Supply Plan for the Impaired Areas of the Basin
- Program Element 4 – Develop and Implement Comprehensive Groundwater Management Plan for Management Zone 1
- Program Element 5 – Develop and Implement Regional Supplemental Water Program
- Program Element 6 – Develop and Implement Cooperative Programs with the Regional Water Quality Control Board, Santa Ana Region (Regional Board) and Other Agencies to Improve Basin Management
- Program Element 7 – Develop and Implement Salt Management Program
- Program Element 8 – Develop and Implement Groundwater Storage Management Program
- Program Element 9 – Develop and Implement Conjunctive-Use Programs

The scope of the program elements was developed by the Chino Basin stakeholders. Each program element contains a series of comprehensive actions and plans to implement those actions. It is anticipated that a specific implementation program will be the result of Phase II of the OBMP development process. It will include the specific details of how the plan will be implemented and funded, and by whom. Implementation of all program elements is necessary to achieve the goals of the OBMP. Because of overlap and synergies, some of the program elements were combined as they were developed. The following program elements were combined: 3/5, 6/7, and 8/9. The program elements are summarized in this section. Task Memorandums were prepared for each program element during development of the OBMP Phase I Report and are available from the Watermaster offices. They describe each program element in detail and generally include:

- need and function
- description of program element actions
- cost
- implementation entities
- implementation schedule for the short-term (first three years), mid-term (4th through 10th years) and-long term (11th through 50th years)

The emphasis in this section is on a description of OBMP actions, schedule and cost. The program element descriptions provide Watermaster and the Court with a means of comparing actions taken in OBMP implementation with progress in achieving the goals of the OBMP.

PROGRAM ELEMENT 1 – DEVELOP AND IMPLEMENT COMPREHENSIVE MONITORING PROGRAM

Need and Function

Program Element 1 – Develop and Implement a Comprehensive Monitoring Program contains monitoring activities that are action items explicitly listed in Table 3-8 and provides information required by other program elements of the OBMP.

The first impediment to *Goal 1 – Enhance Basin Water Supplies* can be stated as: "Unless certain actions are taken, safe yield of the Basin will be reduced … due to groundwater outflow from the southern part of the Basin." This impediment speaks to the reduction in groundwater production in the southern part of the Basin as agricultural land is converted to urban uses, and to increase outflow as groundwater storage is increased due to other management activities. The amount of safe yield lost due to these activities needs to be computed and used in the administration of the Judgment – otherwise the Basin will be overdrafted. The re-determination of safe yield and estimation of losses from groundwater storage programs require comprehensive water level mapping across the Basin, analysis of water level time histories at wells, and accurate estimations of groundwater production. The current groundwater level monitoring is not adequate. The primary problems with the current groundwater level monitoring program include poor areal distribution of wells in the monitoring program, short time histories, questionable data quality, and insufficient resources to develop and conduct a comprehensive program. Groundwater production estimates from the agricultural pool rely on water duty methods for most of the producers and some producers do not provide the Chino Basin Watermaster (Watermaster) with information upon which production estimates can be made. Rigorous groundwater level and production monitoring programs are described below.

The first impediment to *Goal 2 – Protect and Enhance Water Quality* can be stated as: "Watermaster lacks comprehensive, long-term information on groundwater quality." The primary uses of water quality information include, but are not limited to:

- locate and characterize water quality challenges in the Basin and formulate corrective management plans;
- provide an understanding of how the Basin works;
- determine whether water quality produced by a well is suitable for the desired use (*e.g.*, potable quality for potable use); and
- design treatment systems to improve water quality to a level to meet a desired use.

Currently, Watermaster obtains water quality data from all the appropriators for their active wells and from the Regional Board for wells monitored under their supervision (*e.g.*, landfill monitoring and other special water quality investigations). Watermaster has a limited groundwater quality monitoring program in the southern part of the Basin measuring general minerals and physical properties at about 60 wells. There is little historical or current water quality information for most of the 600 agricultural wells in the southern half of the Basin, for wells in the overlying non-agricultural pool, and for inactive appropriative pool wells. The water quality being produced at a majority of the wells in the Basin is unknown.

A salt budget approach has been proposed as a management tool for the Basin. The salt management steps included in *Program Element 7 Develop and Implement Salt Management Program* will be used by

the Watermaster and other stakeholders to reduce the rate of salt accumulation in the Basin. Groundwater quality monitoring will be used to help assess the state of salt in the Basin in the future after the salt management plans are implemented. The direction and cost of future water management activities in the Basin depends on the water quality. A comprehensive groundwater quality monitoring program is fundamental to management of the Basin. A rigorous groundwater quality monitoring program is described below.

The fifth impediment to *Goal 2 – Protect and Enhance Water Quality* can be stated as: "The Basin is not using as much high quality storm water as it could for recharge." The first step in determining how much storm water recharge is occurring is to monitor the volume of inflow and outflow that is occurring at existing facilities, the amount of storm water that is available for recharge in the absence of recharge facilities, and to estimate the associated water quality. Characterizing the water quality of local and imported waters used for recharge in the Basin is necessary to protect water quality for beneficial uses, assess salt balance, design treatment processes to produce water of a quality suitable for intended uses, and to minimize the cost of recycled water recharge. Engineering investigations can utilize these data to design new facilities, and modify/operate existing facilities.

Storage of water in the Basin for local or regional conjunctive use may cause outflow to the Santa Ana River and some of its tributaries in the Chino Basin to increase. The water quality of this outflow may cause water quality deterioration in the Santa Ana River and require mitigation. Watermaster needs to develop a long-term database to assess losses from storage, and surface water impacts in the Santa Ana River and its Chino Basin tributaries from groundwater management activities.

The second impediment to *Goal 3 – Enhance Management of the Basin* can be stated as: "Existing production patterns are not balanced, cause losses, can contribute to local subsidence, and water quality problems." The impediment speaks to a lack of local balance between groundwater recharge and production. The lack of information on how groundwater moves in the Basin can lead to production and replenishment patterns that cause loss of yield and other problems as stated in the impediment. Groundwater level, groundwater quality, and accurate production estimates are necessary to define the groundwater flow systems and to implement equitable and cost-effective management plans.

Monitoring Programs to Support Water Resources Management in the Chino Basin

Groundwater Level Monitoring Program. Watermaster began a process to develop a comprehensive groundwater level monitoring program in the spring of 1998. The process consists of two parts – an initial survey followed by long-term monitoring at a set of key wells. The initial survey was to consist of collecting groundwater level data at all wells in the Basin from which groundwater level measurements can be obtained for spring 1998, fall 1998, spring 1999, and fall 1999. Due to resource limitations at the Watermaster, the initial survey is partially complete and will not be completed until after fall 2001. The data from the initial survey will be mapped and reviewed. Based on this review and Watermaster management needs, a long-term monitoring program will be developed and implemented in the fall of 2001. Watermaster staff will conduct this program with minimal outside assistance. Watermaster staff expects that they will measure groundwater levels in the initial survey at about 400 wells in overlying agricultural pool and about 100 other wells from the other pools and unassigned monitoring wells. The long-term monitoring program will use about half of the wells used in the initial survey plus all wells in the other pools and unassigned wells monitored under the direction of the Regional Board and others. Keys well located in agricultural areas will be replaced as necessary if the original well must be destroyed when the agricultural land surrounding the well is converted to other use.

Groundwater Quality Monitoring Program. Watermaster will begin the development of a comprehensive water quality monitoring program in July 1999. As with the groundwater level monitoring program, the water quality monitoring program will consist of an initial survey and a long-term monitoring effort. The initial survey will consist of:

- collection of all water quality data from appropriators' wells that are tested by appropriators;
- collection of all water quality data from Regional Board for water quality monitoring efforts that are conducted under their supervision; and
- collection and analysis of at least one water quality sample at all (or a representative set of) other production wells in the Basin. Assumed maximum number of wells sampled by Watermaster staff in the initial survey is 600.

Re-sampling and analysis will be done at wells sampled by Watermaster if volatile organic compounds (VOCs) are detected. These data will be mapped and reviewed. Based on this review and Watermaster management goals in the OBMP, a long-term monitoring program will be developed and implemented in the fall of 2002. The long-term monitoring program will contain a minimum set of key wells that can be periodically monitored to assess water quality conditions in the Basin over time. Table 4-1 lists the analytes and the analytical costs for sampling 200 wells per year for three years (plus an estimated 10 more wells for verification re-sampling). The average annual analytical cost is about $185,000 per year and totals about $555,000 if all wells were sampled. Watermaster staff will be trained to obtain samples at these wells and will require a total of about 140 person-days per year. Outside services will cost about $60,000 per year. Water quality data for all operable wells in the other pools will be provided by the well owners in those pools.

Production Monitoring Program. All wells that produce more than 10 acre-ft/yr will have in-line totalizing flow meters. To accomplish this, about 600 agricultural wells will be equipped with in-line totalizing flow meters. Production records from wells owned by appropriators and overlying non-agricultural pool members will report quarterly as has been done in the past. Watermaster staff will read the meters of wells owned by agricultural pool members at least once a year during the period of mid-May through June. Watermaster staff will digitize all production records in Watermaster's database and use this information in the administration of the Judgment. The cost of the installing in-line flow meters in the overlying agricultural pool is summarized in Table 4-2 and totals about $810,000. It has been recommended by the overlying agricultural pool that Watermaster fund up to 50 percent of the cost, with the remaining funds coming from the individual producers.

In addition to the above, all producers will provide Watermaster on an annual basis a *water use and disposal survey* form that describes the sources of water used by each producer and how that water is disposed after use. The purpose of the form is to provide information to Watermaster that will enable accurate salt budget estimates as described in *Program Element 6 – Develop and Implement Cooperative Programs with the Regional Board and Other Agencies to Improve Basin Management*, and for other water resources management investigations that may be undertaken by Watermaster in the future as part of the OBMP.

Surface Water Discharge and Quality Monitoring. The current program of measuring water quality at recharge basins should be expanded to all recharge and retention basins that contribute significant recharge to the Basin. Water level sensors will be installed in all recharge and retention basins that contribute significant recharge to the Chino Basin. These facilities were listed in Table 3 of the *Program Element 2 – Develop and Implement a Comprehensive Recharge Program* draft memorandum and are reproduced here in Table 4-3. A total of 16 new water-level sensors will be required at a total cost of

$192,000. Water level data acquisition and water quality sampling will be done by Watermaster staff. The annual cost of laboratory analysis and interpretation of water level and water quality data is about $45,000.

Watermaster needs to assess the existing surface water discharge and associated water quality monitoring programs for the Santa Ana River and its Chino Basin tributaries to determine the adequacy of the existing monitoring programs for characterizing historical ambient conditions and their utility in detecting water quality impacts from future Chino Basin management activities. If necessary, Watermaster could contract with the agencies conducting these programs to modify their programs to accommodate Watermaster. Ideally, a cooperative program involving all the interested agencies could be developed at a reduced cost for all. The cost of the initial assessment of surface water data for the Santa Ana River is about $15,000.

Ground Level Monitoring Program. Ground level surveys are proposed herein as an offshoot of the subsidence issues in Management Zone 1. The stakeholders are interested in determining if and how much subsidence has occurred in the Basin. Watermaster will conduct an analysis of historical ground level survey and remote sensing data to make this determination. The analysis consists of the following tasks:

- Historical survey data collected and/or on file by federal, state, and local agencies will be compiled, mapped, and reviewed to estimate total subsidence for as long a period as possible. Estimated cost to complete this review is about $15,000.
- Synthetic aperture radar (SAR) imagery will be used to assess the time history of subsidence in the Basin for the period 1993 though 1999. Estimated cost to develop this time history is about $20,000. It should be noted that the City of Chino has already conducted a similar investigation for most of the Basin and that the effort described herein is to expand on the work already done by the City.
- Based on the above information, a network of ground elevation stations in subsidence-prone areas will be developed and periodic surveys of these stations will be done. The frequency of periodic surveys will be established for the Basin as a whole with more frequent surveys done for some areas of the Basin. The estimated cost of this effort is not certain. It should be noted that the City of Chino has already conducted a similar survey within the City of Chino and that the effort described herein is to expand on the surveys done by the City to the entire Basin.

These tasks can be accomplished in the first year.

Well Construction, Abandonment and Destruction Monitoring. Watermaster maintains a database on wells in the Basin and Watermaster staff makes frequent well inspections. Watermaster sometimes finds a new well during routine well inspections. The near-term frequency of inspection is expected to increase due to the groundwater level, quality and production monitoring programs. Watermaster needs to know when new wells are constructed as part of its administration of the Judgment. Valuable information for use in managing the Chino Basin is usually developed when wells are constructed including: well design, lithologic and geophysical logs, groundwater level and quality data, and aquifer stress test data. Producers generally notify Watermaster when they construct a new well but seldom, if ever, provide the information listed above. Watermaster has not generally asked for these data. Well owners must obtain permits from the appropriate county and state agencies to drill a well and to put the well in use. Watermaster will develop cooperative agreements with the counties of Los Angeles, Orange, Riverside, and San Bernardino, and the California Department of Health Services (DHS) to ensure that the

appropriate entities know that a new well has been constructed. Watermaster staff will obtain well design, lithologic and geophysical logs, groundwater level and quality data, and aquifer stress test data.

The presence of abandoned wells is a threat to groundwater supply and a physical hazard. Watermaster staff will review its database, make appropriate inspections, consult with well owners, and compile a list of abandoned wells in the Chino Basin. The owners of the abandoned wells will be requested to properly destroy their wells following the ordinances developed by the county in which the abandoned well is located. Watermaster staff will update its list of abandoned wells annually and provide this list to the counties for follow-up and enforcement.

Cooperative Efforts with Appropriate Agencies to Implement Program

Groundwater Level Monitoring. Watermaster will develop a groundwater level measurement protocol for use by all cooperating entities. Groundwater levels will be obtained by the following entities:

- Overlying Agricultural Pool – Watermaster staff
- Overlying Non-agricultural Pool – pool member or Watermaster staff
- Appropriative Pool – pool member or Watermaster staff
- Other wells – Watermaster staff will obtain data from Regional Board or owners.

Groundwater Quality Monitoring. Watermaster will develop groundwater sampling and analysis protocols for use by all cooperating entities. Groundwater quality analyses will be obtained by the following entities:

- Overlying Agricultural Pool – Watermaster staff
- Overlying Non-agricultural Pool – pool member
- Appropriative Pool – pool member
- Other wells – Watermaster staff will obtain data from Regional Board or owners.

Proposed Production Monitoring Program. Watermaster will develop and implement an in-line meter installation program for the overlying agricultural pool. The installation program will take place over a three-year period starting in Watermaster fiscal year 1999/00. Groundwater production estimates and water use and disposal survey forms will be obtained by the following entities:

- Overlying Agricultural Pool – Watermaster will read meters and producers will prepare and submit water use and disposal survey forms
- Overlying Non-agricultural Pool – pool member will read the meters and prepare and submit the water use and disposal survey forms
- Appropriative Pool – pool member will read the meters and will prepare and submit the water use and disposal survey forms.

Surface Water Discharge and Water Quality Program. Watermaster will take the lead in completing the following activities:

- Chino Basin Water Conservation District (Conservation District) and Watermaster will jointly install water level sensors in all existing recharge and retention facilities that have potential for storm water recharge.
- Watermaster staff will obtain grab samples approximately every two weeks for all basins during the rainy season and have these samples analyzed.

- Watermaster will review the surface water discharge and associated water quality monitoring programs for the Santa Ana River and the lower Chino Basin tributaries, and compare what is available from these programs to what is needed for Watermaster investigations under the OBMP.

Ground Level Survey. Watermaster will conduct the analysis to estimate historical subsidence and to monitor future subsidence in the Chino Basin.

Monitoring of Well Construction, Abandonment and Destruction. Watermaster will take the lead in completing the following activities:

- Develop agreements with county and state agencies to notify each other regarding construction of new wells and to obtain construction related information.
- Watermaster staff will prepare a list of abandoned wells and request the owners of abandoned wells to properly destroy their wells.

The counties will follow-up to ensure that abandoned wells within their jurisdiction are properly destroyed.

Implementation Actions and Schedule

First Three Years (1999/00 to 2001/02). The following actions will be completed in the first three years commencing fiscal year 1999/00:

- Complete initial survey for the groundwater level program.
- Complete initial survey for groundwater quality program.
- Complete meter installation program for overlying agricultural pool.
- Complete ground level survey.
- Complete installation of water level sensors in recharge and retention facilities.
- Complete Santa Ana River surface water monitoring adequacy analysis.
- Start and continue surface water discharge and quality monitoring at recharge and retention facilities.
- Develop agreements with county and state agencies regarding notification of new well drilling.
- Well construction and related information will be requested as new wells are identified.
- A list of abandoned wells will be developed annually and the owners will be requested to properly destroy their abandoned wells.

Years Four to Ten (2002/03 to 2010/11). The following actions will be completed in years four through ten, commencing fiscal year 2002/03:

- Start and continue long-term groundwater level monitoring program, cause key wells to be relocated as necessary.
- Start and continue long-term groundwater quality monitoring program, cause key wells to be relocated as necessary.
- Continue production monitoring.

- Conduct remote sensing analysis using synthetic aperture radar or other techniques at least every ten years (2010/11) or sooner, if necessary.
- Participate, as necessary, in the Santa Ana River surface water monitoring.
- Continue surface water discharge and quality monitoring at recharge and retention facilities.
- Well construction and related information will be requested as new wells are identified.
- A list of abandoned wells will be developed annually and the owners will be requested to properly destroy their abandoned wells.

Years Eleven to Fifty (2011/12 to 2050/51). The following actions will be completed in years eleven to fifty, commencing fiscal year 2011/12:

- Continue long-term groundwater level monitoring program, cause key wells to be relocated as necessary.
- Continue long-term groundwater quality monitoring program, cause key wells to be relocated as necessary.
- Continue production monitoring.
- Conduct remote sensing analysis using synthetic aperture radar or other technique at least every ten years (2020/21, 2030/31, 2040/41, 2050/51) or sooner, if necessary.
- Participate as necessary in the Santa Ana River surface water monitoring.
- Continue surface water discharge and quality monitoring at recharge and retention facilities.
- Well construction related information will be requested as new wells are identified.
- A list of abandoned wells will be developed annually and the owners will be requested to properly destroy their abandoned wells.

PROGRAM ELEMENT 2 -- DEVELOP AND IMPLEMENT COMPREHENSIVE RECHARGE PROGRAM

Need and Function of the Program Element

The need for a comprehensive recharge program was described in the introduction to the Final Report for Phase 1 of the Chino Basin Recharge Master Plan (Wildermuth, 1998). Program Element 2 -- Develop and Implement Comprehensive Recharge Program contains action items explicitly listed in Table 3-8.

The first impediment to Goal 1 – Enhance Basin Water Supplies can be stated as: "Unless certain actions are taken, safe yield of the Basin will be reduced … due to groundwater outflow from the southern part of the Basin" speaks to poorly planned recharge where recharge of storm water and recycled water could be placed too low in the Basin to be recovered. Some recycled water projects that are currently being planned will increase recharge when groundwater production downgradient of these proposed recharge projects is decreasing. The result will be increased outflow to the Santa Ana River and no yield improvement. A comprehensive program must ensure that the locations of recharge and production are such that yield is maximized.

The second impediment to *Goal 1 – Enhance Basin Water Supplies* and the fifth impediment to *Goal 2 – Protect and Enhance Groundwater Quality* can be stated as: "The Basin is not using as much high quality storm water as it could for recharge." At the time the Chino Judgment was adopted (1978), about

41 percent of the safe yield was estimated to come from irrigation returns. Since that time, irrigated agriculture has declined and is projected to be almost completely converted to urban uses by 2020. This will result in a decline of irrigation returns to groundwater and a potential decrease in the safe yield. San Bernardino County, Riverside County, and the US Army Corps of Engineers (USACE) have constructed flood control projects that efficiently capture and convey storm flow to the Santa Ana River, effectively eliminating the groundwater recharge that formerly took place in the stream channels and flood plains in the Chino Basin. In most cases, no provisions were made to mitigate the loss of recharge from flood control projects. Also, there have been no mitigation efforts to preserve recharge when land use is converted from native and agricultural uses to urban uses. Thus, the safe yield may have decreased in the Chino Basin due to land use changes and flood control improvements. Water harvesting opportunities exist that can be used to offset the yield lost to urbanization and flood control improvements. Water harvesting consists of capturing and recharging new storm flow caused by urbanization. Most of the precipitation falling on undeveloped land or land in agricultural uses is lost to evapotranspiration. Storm flow increases dramatically with urbanization due to an increase in impervious land cover, decrease in evapotranspiration of rainfall, and construction of drainage improvements. The potential yield from this additional storm flow is numerically equal to the increase in storm flow that occurs when the land is converted to urban uses. The actual yield is equal to the additional rainfall-storm flow that is captured and put to beneficial use. In the Chino Basin, the best and least expensive way to put this new water to beneficial use is groundwater recharge.

Increasing the yield of the Chino Basin by increased capture of storm flow will improve ambient water quality and increase the assimilative capacity of the Chino Basin. Increasing the capture of storm flow will reduce the cost of mitigation requirements for recharge of recycled water. The Basin Plan assumes that a certain average annual quantity of storm flow will be recharged each year. The volume of recycled water that can be used in the Basin, without total dissolved solids (TDS) mitigation, is numerically-tied to the average annual quantity of storm flow that recharges the Basin. A decrease in the recharge of storm flow will result in a decrease in the volume of recycled water that will be permitted in the Basin without TDS mitigation. Likewise, an increase in the recharge of storm flow will result in an increase in the volume of recycled water that will be permitted in the Basin without TDS mitigation. Therefore, the volume of storm flow recharge from storm flow has a dramatic impact on the future and cost of recycled water recharge.

The annual replenishment obligation will grow from about 30,000 to 55,000 acre-feet per year (acre-ft/yr) over the next 20 to 30 years. Watermaster has access to spreading facilities with a current capacity of about 29,000 acre-ft/yr when imported water from Metropolitan is available. Assuming replenishment water is available seven out of ten years, the average annual recharge capacity of recharge facilities available to Watermaster is about 20,000 acre-ft year. The in-lieu recharge potential for the Chino Basin is about 57,000 acre-ft/yr and will remain constant over the next 20 to 30 years based on the water supply plan included in this OBMP. Assuming in-lieu replenishment water is available seven out of ten years, the average annual in-lieu recharge capacity available to Watermaster is about 40,000 acre-ft year. The replenishment obligation, available recharge capacity over the next 20 years is (acre-ft/yr):

Year	Replenishment Obligation	----------Recharge Capacity----------			Surplus Recharge Capacity
		Physical	In-Lieu	Total	
2000	31,000	20,000	40,000	60,000	29,000
2020	55,000	20,000	40,000	60,000	5,000

The surplus recharge capacity could be used up quickly by future replenishment needs and implementation of conjunctive-use programs. A modest conjunctive use program consisting of an annually occurring seasonal shift of imported demands and a dry year yield component that would use up 150,000 acre-ft of storage will require about 46,000 acre-ft of recharge capacity. New recharge capacity is needed immediately for even a modest conjunctive-use program. The availability of in-lieu recharge capacity listed above is not a certainty. In the present mode of basin management, in-lieu recharge capacity is available on an ad hoc basis and requires the cooperation of water supply agencies that have access to supplemental water. Watermaster needs to obtain enough recharge capacity to meet its replenishment obligations for ultimate demands on the Chino Basin. The safest and most conservative way to ensure that recharge capacity will be available is for Watermaster to develop new recharge capacity that will meet ultimate replenishment obligations. For an average annual recharge capacity of 55,000 acre-ft/yr, Watermaster will need an annual recharge capacity of about 80,000 acre-ft/yr (80,000~55,000/0.7). The new recharge capacity by management zone for the year 2020 is estimated to be about:

Management Zone 1	18,000 acre-ft/yr
Management Zone 2 and 3	34,000 acre-ft/yr
Total	52,000 acre-ft/yr

The allocation of recharge capacity to management zones is based on balancing recharge and production in each management zone with the year 2020 production pattern described in Program Elements 3 and 5. Figure 4-1 shows the existing spreading and storm water retention basins in the Chino Basin. Figure 4-1 also shows the preferred area, based on current knowledge, for new recharge basins in Management Zone 2 and 3. The preferred recharge area is rapidly developing. It is unlikely that Watermaster will be able to purchase lands already in urban use and construct new basins. Therefore, Watermaster needs to obtain new recharge sites in the preferred area immediately. Recharge capacity in Management Zone 1 can be obtained by expanding recharge capacity at the Montclair Basins, improving the Upland and Brooks Basins, and through groundwater injection. During Phase II of the OBMP, Watermaster will develop an implementation plan to secure a total physical recharge capacity of about 80,000 acre-ft/yr with recharge facilities sized and located that will balance the production and recharge.

Past Efforts by Watermaster and the Conservation District

The Conservation District and the Watermaster completed phase 1 of a three-phase work plan to improve recharge and establish a long-range recharge master plan for the Chino Basin. The three phases consist of:

Phase 1 - Initial Screening and Assessment. Conduct an assessment of how much storm flow is currently recharged and how much additional recharge could occur at new and existing spreading basin sites. From this assessment a list of promising spreading basins will be developed. Research questions will be developed for the promising sites and a detailed scope of work will be developed for Phase 2. Phase 1 was completed in January 1998 and is summarized below.

Phase 2 - Engineering Assessments of Promising Sites. Site-specific investigations, percolation rate monitoring and the preparation of cost estimates for developing and managing these basins will be developed in this phase. The institutional issues regarding ownership of facilities, management of non-Conservation District-owned facilities, disposition of water recharged, and Basin Plan modifications will be identified.

Principles of agreement will be developed that describe the institutional issues and means to resolve these issues through agreements. A list of recharge projects will be identified and prioritized based on need and cost effectiveness. A detailed scope of work will be developed for Phase 3.

Phase 3 - Develop an Implementation Plan. A plan to develop and manage spreading basins will be prepared. The plan will include existing and new basins and a schedule for spreading basin improvements based on developing recharge capacity to match need for increased groundwater yield at minimum cost.

The Phase 1 effort was completed in January 1998. The objective of the Phase 1 analysis of the Recharge Master Plan was to determine the potential for artificial recharge given the resources in the Chino Basin. This was accomplished through data collection, research, and a massive computational and engineering assessment. Existing storm water recharge in the Chino Basin was estimated to be about 12,000 acre-ft/yr. This 12,000 acre-ft is part of the existing safe yield. The potential storm water recharge was estimated to range from about 25,000 to 30,000 acre-ft/yr given proper routine maintenance at existing and then-current planned facilities. Subsequent investigations by the Conservation District suggest that the potential recharge is lower. Incorporating the Conservation District's recent work, the potential range is probably around 12,000 to 22,000 acre-ft/yr. Table 4-4 lists the existing flood control/spreading basins and annual average recharge estimates based on updated Phase 1 modeling results. Most basins are not maintained to optimize recharge and there is little quantitative information on basin conditions or current recharge performance. Recharge of storm flows at existing basins could reach about 28,000 acre-ft/yr under ultimate land use conditions. The investigation also showed that it was economical to construct recharge facilities in areas with low percolation rates (<0.25 ft/day) if the facilities were part of a flood retention project. The potential recharge capacity and cost for recharge of imported and recycled water were developed. Operational plans that specify the amount and scheduling of imported water and recycled water recharge were developed. About 17,000 acre-ft/yr of recycled water recharge capacity was developed. The potential for imported water recharge ranges from about 100,000 acre-ft/yr to 135,000 acre-ft/yr at existing basins and one new large facility. Based on the work done for Program Elements 3 and 5 of the OBMP, the imported water recharge capacity needs to be expanded from its current capacity of 29,000 acre-ft/yr to about 80,000 acre-ft/yr to accommodate Watermaster replenishment activities.

Phase 2 Scope of Work for Hydrogeologic and Engineering Investigations

The Phase 2 work, as recommended in the Phase 1 report, was not formally started. Phase 2 consists of eight tasks.

Task 1 Conduct Reconnaissance Analysis to Identify Existing Recharge Basins and Potential New Recharge Sites. The purpose of this task is to develop a list of existing basins that can be used to recharge storm water, recycled water and imported water; and to identify areas for new recharge facilities. Based on the results of this task, some existing basins and new sites with potential for recharge by spreading and injection will be studied in detail in subsequent tasks and others with little potential recharge will either be studied later or not considered as recharge sites. This task consists of the following subtasks:

1.1 Meeting(s) with San Bernardino County Flood Control District (SBCFCD), Riverside County Flood Control and Water Conservation District (RCFCWCD), Los Angeles County Public Works Department (LACPWD) (collectively, the flood control agencies), the USACE, the Conservation District and the Watermaster. The purpose of these meetings is to discuss the use of existing flood control/recharge basins, recharge potential of these basins, past

investigations, future flood control plans that could in include recharge, and institutional impediments to storm water recharge.

1.2 Meetings with planning agencies and the flood control agencies to inform these agencies of the need to set aside open space for recharge and to locate suitable areas for future recharge sites; to seek their cooperation in obtaining such lands, and to develop incentive programs to set aside land for recharge. A permanent basin-wide water conservation planning committee chaired by the Watermaster will be formed to facilitate the process of building and maintaining recharge facilities.

1.3 Develop a financing concept to provide capital for the improvement of existing facilities, construction of new facilities, operations and maintenance, and to mitigate adverse impacts of new spreading basins.

1.4 Review new hydrogeologic and facilities information that became available after completion of the Phase 1 analysis.

1.5 Evaluate Phase 1 computer simulation results to determine the location and magnitude of storm flow that is not being captured at existing facilities and that could be captured and recharged in either new facilities or from improved operations at existing facilities.

1.6 Develop a list of existing and proposed recharge facilities that merit detailed investigation. The priority list should be based on management issues (*e.g.*, subsidence and water quality), cost effectiveness, and for existing facilities, the availability of the facilities for recharge.

1.7 Conduct reconnaissance level feasibility investigation of using injection wells for recharge in Management Zone 1. The purpose of this recharge will be to increase the piezometric levels, reduce future subsidence, and improve water quality.

Task 2 Preliminary Assessment of the Capture of New Recharge. The objective of this task is to estimate the fate of artificial recharge. That is, to estimate the recharge benefits, areas of potential high groundwater, and losses to the Santa Ana River. The scenarios to be tested include recharge scenarios developed in the Phase 1 analysis (modified based on the results of Conservation District investigations and the results of Task 1). The *Rapid Assessment Model (RAM) Tool,* currently under development by the Watermaster, or *Chino Integrated Groundwater Surface Water Model (CIGSM)* are two models that could be used to make this assessment. It is not likely that the CIGSM would be used due to the time and expense to make it ready for use (see Program Elements 6 and 7 later in this section).

Task 3 Conduct Field Program. The purpose of this task is to develop fundamental information that can be used to assess the recharge potential of some existing and proposed basins, and to develop design information for new basins. The field program recommended for Phase 2 includes:

- obtaining and interpreting continuous cores for the upper 50 feet of sediment in existing facilities and the upper 100 feet of sediments from areas adjacent to existing and proposed basins;
- trenching to observe and interpret the near surface soil profiles;
- gradation tests of materials obtained from the trenches; and

- the installation of water level sensors identical to what Conservation District has installed in some of their basins.

Water level data will be collected at basins that are equipped with water level sensors. These data will be interpreted to produce percolation rates at each basin. The percolation rates will be correlated to soil properties and subsurface conditions to determine what is controlling recharge at a specific facility and to develop general design guidelines for the Chino Basin area. The field program is summarized in Table 4-5 covers 16 existing basins and up to three new surface water recharge facilities. Table 4-5 includes a cost estimate for this field program. Field programs for injection tests in Management Zone 1 will be developed in the work done in Program Element 4 – Develop and Implement Comprehensive Groundwater Management Plan for Management Zone 1.

Task 4 Develop Principles of Agreement. This task involves developing principles of agreement between SBCFCD, RCFCWCD, USACE, the Conservation District, and the Watermaster regarding the operation of existing and proposed storm flow management facilities. The goals of the principles are to maintain flood protection and maximize recharge. This work will involve the preparation of draft principles and many meetings. New technical information will need to be developed on an *ad hoc* basis in response to technical issues that will be involved in the principles. A set of principles will be developed with the Regional Board regarding TDS and nitrogen offset credits for recharge of recycled water.

Task 5 Develop Preliminary Operating Plans and Designs. Preliminary operating plans and facility improvements will be developed for all (new and proposed) recharge basins in the Chino Basin based on the results of Tasks 1 through 4. Preliminary capital and operating cost estimates will be developed.

Task 6 Estimate the Average Annual Recharge for Each Basin. Given the results of Tasks 1 through 5, the input data for the computer simulation models used in Phase 1 will be updated. The simulation models will be used to estimate the average annual recharge in each recharge basin. Estimates of imported water and recycled water recharge capacity will be updated. The priority list developed in Task 1 will be updated based on the results of this task.

Task 7 Develop Early Action Plan and Scope of Work for Phase 3. Given the results of Tasks 1 through 6, an early action plan and scope of work for Phase 3 will be developed. The early action plan, will include a list of high priority recharge projects that can be implemented with minimal additional analyses, and a list of lower priority projects that will require longer lead times to implement. These projects may include operating existing facilities to increase recharge, other non-controversial modifications to existing facilities, and construction of new recharge facilities. The scope of work will contain engineering design, environmental assessment and processing, and financing tasks. The scope of work will contain parallel tracks for the early action plan and the lower priority projects.

Task 8 Prepare Report. Technical memoranda will be prepared for Tasks 1 through 7. A final summary report will be prepared incorporating the task memoranda and a scope of work for Phase 3.

Cooperative Efforts with Appropriate Agencies to Implement Program

There are two fundamental levels of implementation appropriate for the comprehensive recharge program: one to develop the program, and one to construct, manage and operate the program. For development of the program, the implementing agencies include:

- the Watermaster, representing the producers who will benefit from the recharge and who will pay the cost of the plan development and implementation;

- the Conservation District, the flood control agencies, and the USACE who own the existing facilities and who (for the flood control agencies) will benefit from reduced flood control costs and improved storm water quality in the Santa Ana River and its tributaries;
- the planning agencies whose cooperation will be necessary to site new recharge facilities within their service areas; Inland Empire Utilities Agency (IEUA), Three Valleys Municipal Water District (TVMWD), and Western Municipal Water District (WMWD) as the provider of imported and recycled water for recharge; and producers that will utilize their own facilities for groundwater injection.

Watermaster will develop the recharge program for the Basin in the first four years of OBMP implementation. Watermaster will enter in to agreements with cooperative entities to implement the recharge program. Potential cooperative entities include Conservation District, the flood control agencies, USACE, Metropolitan Water District of Southern California (MWDSC), IEUA, TVMWD, and WMWD. These contracts will include specific performance goals and schedule. Watermaster will monitor these contracts very closely. If the cooperative entities fail to perform according to the terms of their contract, then Watermaster will terminate the agreements and either enter into an agreement with another cooperative entity or implement the program itself.

Implementation Actions and Schedule

First Three Years (1999/00 to 2001/02). The following actions will be completed in the first three years commencing fiscal year 1999/00:

- The Phase 2 scope of work should be completed within the first three years.
- Based on the results of the Phase 2 work, a list of high priority and low priority recharge projects will be identified. An action plan will be developed to implement the high priority projects as soon as possible and to implement the low priority projects as resources will allow.
- Task 1.1 and 1.2 should begin immediately, prior to the OBMP being submitted to the Court for approval.
- Watermaster advisory committee should form an *ad hoc* committee to start the coordination process and formalize the permanent basin-wide water conservation planning committee. Task 1.5 should also begin immediately.
- In year three, all high priority projects that involve re-operation of existing recharge/flood control facilities should be implemented, and Phase 3 should be started.
- Watermaster should begin the process of acquiring new recharge sites and easements identified in the Phase 2 and 3.

Years Four to Ten (2002/03 to 2010/11). The following actions will be completed in years four through ten, commencing fiscal year 2002/03:

Years four and five

- Complete Phase 3.
- Implement all high priority projects that involve construction and re-operation at existing facilities.

- Watermaster should continue the process of acquiring new recharge sites and easements identified in the Phase 2 and 3. By year five, recharge sites should have acquired to recharge at least 55,000 acre-ft/yr.
- Update the comprehensive recharge program in year 5.

Years five to ten

- Implement all high priority projects that involve the construction of new recharge facilities.
- Update the comprehensive recharge program in year 10.

Years Eleven to Fifty (2011/12 to 2050/51). The following actions will be completed in years eleven to fifty, commencing fiscal year 2011/12:

- Implement all other recharge projects based on need and available resources.
- Update the comprehensive recharge program every five years.

PROGRAM ELEMENT 3 – DEVELOP AND IMPLEMENT WATER SUPPLY PLAN FOR THE IMPAIRED AREAS OF THE BASIN

PROGRAM ELEMENT 5 – DEVELOP AND IMPLEMENT REGIONAL SUPPLEMENTAL WATER PROGRAM

Need and Function of the Program Elements

These program elements serve the OBMP goals listed in Table 3-8. The specific goals, impediments and action items are described below.

The first impediment in *Goal 1 – Enhance Basin Water Supplies* can be stated as: "Unless certain actions are taken, safe yield of the Basin will be reduced due to outflow from the southern part of the Basin." The fourth impediment in *Goal 2 – Protect and Enhance Water Quality* can be stated as: "Poor ambient groundwater quality limits direct use of groundwater and can lead to loss of Basin yield." Most of the agricultural land use in the southern part of the Basin will convert to urban uses over the next 20 to 30 years. Groundwater from the southern part of the Basin will have to be treated prior to use for these new land uses. Groundwater outflow to the Santa Ana River will occur if the decrease in agricultural groundwater production in the southern part of the Basin is not matched by an increase in municipal groundwater production in the same area. The increase in outflow will result in a decrease in safe yield that will reduce the initial rights of the producers in appropriative pool by about 74 percent. The increase in groundwater outflow to the Santa Ana River will cause an increase in river discharge and a degradation of water quality in the river. Currently, agricultural production in the southern part of the Basin is estimated using primarily water duty methods to be about 40,000 acre-ft/yr. Annual estimates of agricultural production are expected to be larger after in-line meters are in place. If the current level of groundwater production in the southern part of the Basin were to cease, the rising water discharge to the Santa Ana River could increase by approximately the numerical equivalent of the current production – about 40,000 acre-ft/yr. This new discharge would have an associated TDS concentration of about 1,300 milligrams per liter (mg/L) (almost twice the basin plan objective of 740 mg/L and 2.5 times the secondary drinking water MCL of 500 mg/L) and a nitrogen concentration of 30 mg/L-N (three times the basin plan objective of 10 mg/L-N and primary drinking water MCL of 10 mg/L-N). The Santa Ana River downstream of the Chino Basin is the primary drinking water supply for most of Orange County. Therefore, Santa Ana River water quality impacts caused by not producing Chino Basin groundwater will adversely affect the municipal water supplies in Orange County. The Regional Board has indicated that

any adverse impacts to the Santa Ana River water quality associated with increased outflows from Chino Basin groundwater will have to be completely mitigated – presumably by desalting recycled water discharges to the Santa Ana River.

The third impediment in Goal 1 – Enhance Basin Water Supplies can be stated as: "Because there is a lack of assimilative capacity for total dissolved solids and nitrogen in the Chino Basin, there are economic limitations on the recharge of recycled water." Most of the recycled water produced in the Basin is exported out of the Basin because of either lack of demand for direct use or economic limitations caused by the lack of assimilative capacity in the Chino Basin. The TDS and nitrogen objectives in the Santa Ana Watershed are under rigorous review and new water quality objectives and water recycling guidelines should be implemented in the next few years. Recharge of recycled water could be used to replenish over-production, supplement the yield of the Basin, and lower the demand for imported water from the Sacramento Delta. There are three treatment options that that can be used to enable the recharge of recycled water: desalting recycled water prior to recharge, desalting groundwater to offset the salt load in the recycled water, and blending recycled water with low TDS imported and/or storm waters.

The fourth impediment in *Goal 1 – Enhance Basin Water Supplies* can be stated as: "Because future demands are increasing and there are limitations on basin and traditional supplies, new sources of supplemental water need to be developed." Alternatives to the use of imported water from MWDSC need to be developed to meet future demands, improve reliability and minimize cost of supplies. The new supplies include recycled water, groundwater from adjacent basins, Santa Ana River water and other waters as can be identified and conveyed to the Chino Basin.

The third impediment in *Goal 2 – Protect and Enhance Water Quality* can be stated as: "There is ongoing legacy contamination in the vadose zone with TDS and nitrogen from agriculture." The vadose zone that underlies areas that were or are currently in agricultural use is likely to be degraded with TDS and nitrogen. The vadose zone will contribute to future TDS and nitrogen degradation of the saturated zone. The primary areas of concern are the areas that were formerly in citrus in the northern part of the Basin and the entire southern half of the Basin. There are two significant implications of legacy contamination in vadose zone: groundwater degradation from TDS and nitrogen will continue into the future long after the agriculture has left – even if extraordinary efforts are used to clean up degraded groundwater; and, groundwater treatment ranging from blending to desalting will be necessary far into the future to put the degraded groundwater to beneficial use.

There are other goals and impediments to goals that are listed for these program elements, but they are somewhat redundant with those listed above and are not described herein. Fundamentally, the goal of Program Elements 3 and 5 is to develop a regional, long range, cost-effective, equitable, water supply plan for producers in the Chino Basin that incorporates sound basin management. The water supply plan developed during Phase II of the OBMP process will include:

- a cost-effective plan to maximize the beneficial use of Chino Basin groundwater and the safe yield.
- a program to reliably meet the long-term water supply needs of area purveyors.
- an implementation program.

Water Demand Planning Assumptions

The planning assumptions and basic data used to develop and evaluate water supply plans are described below.

Available Water Supply from the Impaired Area. As urbanization of the agricultural areas of San Bernardino and Riverside counties in the southern half of the Basin occurs, the agricultural water demands will decrease and urban water demands will increase significantly. Future development in these areas is expected to be a combination of urban uses (residential, commercial, and industrial). The cities of Chino, Chino Hills, and Ontario, and the Jurupa Community Services District (JCSD) are expected to experience significant new demand as these purveyors begin serving urban customers in the former agricultural area. For planning purposes, the agricultural area is assumed to be fully developed by the year 2020.

Based on current estimates of overlying agricultural pool production, it is expected that at least 40,000 acre-ft/yr of groundwater will need to produced in the southern part of the Basin to maintain the safe yield. Actual replacement groundwater production required could be far greater than 40,000 acre-ft/yr if current agricultural production is greater than reported to Watermaster. Recall in the Section 2 discussion on Chino Basin production, that there was a difference in the agricultural production reported to Watermaster (based on water duty methods) and the production estimates developed in the CBWRMS based on water duty methods and water budget modeling, with Watermaster's estimates being about 26,000 acre-ft/yr lower for the period 1978 to 1989. Watermaster will install in-line meters on all wells over the next three years after which accurate estimates of agricultural production will be available. If these estimates show that agricultural production is higher than previously reported, then the groundwater production rates from the southern part of the Basin will have be increased to maintain yield.

Water Supply Plans. Water demands, supply projections for agencies that produce groundwater from the Chino Basin, and estimates of the safe operating yield of the Basin are the basis for evaluating the water supply plans presented in this analysis. Initial water supply plans were developed by Montgomery Watson in 1998 and modified by WE, Inc., based on information supplied by the municipal and industrial producers. The initial plans are shown in Table 2-17.

Based on the data presented in Section 2, the municipal and industrial demands are projected to increase 30 percent between 2000 and 2020. Several agencies will experience increases in demand exceeding 30 percent over the next 20 years, including the cities of Chino, Chino Hills, Norco, Ontario, Cucamonga County Water District (CCWD), Fontana Water Company (FWC), JCSD, and the West San Bernardino County Water District (WSBCWD). Forecasts from municipal and industrial entities indicate that water supply sources for the Chino Basin in 2020 will consist predominantly of Chino Basin wells through direct use or treatment and use, groundwater and treated surface water from other basins, and MWDSC supplies.

The demand data in Section 2 and individual water supply plans were used to quantify the future demand for each purveyor that will need to be satisfied from new water supply sources. Future sources for each purveyor were evaluated and classified into two categories: secure sources and non-secure sources. Secure sources are those with a high probability of being available throughout the planning period. These include existing and available supplies from Chino Basin wells, existing water and desalter plants (*i.e.*, WFA/JPA, CCWD, and TVMWD water treatment plants and Santa Ana Watershed Project Authority [SAWPA] Desalter), imported treated MWDSC water from the Weymouth treatment plant, and imported surface water from other basins. Non-secure sources are not currently available and must be developed to serve the Basin purveyors. These depend on a future event, such as the construction of a treatment plant or acquisition of a new water source.

Table 4-7 lists the 2020 demand projections, projected secure water supply sources including Chino Basin groundwater, production rights, over/under production, the water needed in the future, and the

replenishment obligations. The quantity of water that will be required by each water purveyor was found by subtracting the secure water supply for each purveyor from the purveyor's 2020 demand.

As shown in Table 4-6 of the 404,000 acre-ft/yr of total demand predicted in 2020, approximately 364,000 acre-ft/yr will be met from secure water sources with the remaining 40,000 acre-feet of demand being met from projects described in this program element. The breakdown of the 40,000 acre-ft/yr by purveyor from largest to smallest user is as follows:

Jurupa CSD	10,720 acre-ft/yr
City of Chino	9,540 acre-ft/yr
City of Ontario	8,400 acre-ft/yr
City of Chino Hills	5,600 acre-ft/yr
City of Norco	3,260 acre-ft/yr
Santa Ana River WC	2,170 acre-ft/yr
Swan Lake	350 acre-ft/yr
Total in 2020	40,040 acre-ft/yr

The demand in years 2005, 2010, and 2015 was predicted assuming a uniform increase in annual demand for each of the above purveyors. Table 4-7 lists the demands for these intermediate planning years.

For the purpose of this analysis, it was assumed that there is approximately 48,000 acre-ft/yr of agricultural production in the southern part of the Chino Basin in the year 2000, and that this production will reduce to about 8,000 acre-ft/yr in the year 2020. This decline in agricultural production must be matched by new production in the southern part of the Basin or the safe yield in the Basin will be reduced. The remaining 8,000 acre-ft/yr of production in the southern part of the Basin will be used by the State of California.

Potential Supplemental Water Supply Sources. An evaluation of potential future supplemental water supply sources is given in Table 4-8. Of these sources, the most viable is supplied through existing basin conventional water treatment plants that treat imported State Water Project (SWP) water from MWDSC. For the purposes of this analysis, it is assumed that future supplemental water supplies will come from expansion of the CCWD Lloyd Michael water treatment plant (WTP) and the WFA/JPA Agua de Lejos WTP.

Alternative Water Supply Plan Descriptions

Four initial water supply plan alternatives and ten subalternatives were developed. The initial alternatives consisted of various combinations of wells, desalters, water treatment plants, water and brine pipelines, and pumping stations. Purveyors that will require new water supplies include the cities of Chino, Chino Hills, Ontario, Norco, JCSD, Santa Ana River Water Company (SARWC), and Swan Lake. A fifth alternative was also developed that included three subalternatives for various levels of recycled water use. The water supply plans are described in detail in the Task Memorandum on file with the Watermaster for this Program Element. The initial alternatives that were evaluated included:

Alternative 1: Supplemental Water Deliveries Only

- Subalternative 1A: Supplemental Water Delivery – Agricultural Converts to Urban Uses
- Subalternative 1B: Supplemental Water Delivery – Agricultural Use Stays

Alternative 2: Groundwater Pump, Treat, and Serve Only

- Subalternative 2A-1: Regional Groundwater Pump, Treat, and Serve – Agricultural Converts to Urban Uses
- Subalternative 2A-2: Ad Hoc Groundwater Pump, Treat, and Serve – Agricultural Converts to Urban Uses
- Subalternative 2B-1: Regional Groundwater Pump, Treat, and Serve – Agricultural Use Stays
- Subalternative 2B-2: Ad Hoc Groundwater Pump, Treat, and Serve – Agricultural Use Stays

Alternative 3 – Conjunctive Use

- Subalternative 3A: Conjunctive – Agricultural Converts to Urban Uses
- Subalternative 3B: Conjunctive – Agricultural Use Stays

Alternative 4: Supplemental Water Delivery and Regional Groundwater Pump, Treat, and Serve

- Subalternative 4A: Supplemental Water Delivery and Regional Pump, Treat, and Serve – Agricultural Converts to Urban Uses
- Subalternative 4B: Supplemental Water Delivery and Regional Pump, Treat, and Serve – Agricultural Use Stays

Alternative 5: Reclaimed Water Delivery

- Subalternative 5A: Direct Non-Potable Reuse Only
- Subalternative 5B: Reclaimed Water Delivery for Spreading Only
- Subalternative 5C: Direct Non-Potable Reuse and Recharge of Reclaimed Water

Recommended Water Supply Plan for the OBMP

Considerable discussion of the alternative water supply plans occurred at the OBMP workshops in February through May of 1999. The discussions focused, in part, on the assumption and details of each alternative and cost. Based on technical, environmental, and cost considerations, the stakeholders selected Alternative 4A for detailed review and refinement. Alternative 6A was developed based on Alternative 4A and 5C, includes an accelerated desalting schedule and has no future supplemental water deliveries to the southern part of the Basin. The Alternative 6A water supply plan consists of the following key elements.

Groundwater Production Pattern. Groundwater production for municipal use will be increased in the southern part of the Basin to: meet the emerging demand for municipal supplies in the Chino Basin, maintain safe yield, and to protect water quality in the Santa Ana River. All new southern Basin production will require desalting prior to use. The cities of Chino, Chino Hills, Ontario and Norco, and the JCSD will maximize their use of groundwater from the southern part of the Basin prior to using other supplies. The SAWPA desalter, currently under construction will have to be expanded from 8 million

gallons per day (mgd) to 10 mgd by 2003. Two new desalters will be constructed – the *east* and *west* desalters. The east desalter will need to be on-line by late 2003 at a capacity of 14 mgd. The west desalter will need to be on-line by 2010 with a capacity of 7.5 mgd. Both these new desalters will be expanded in the future. The cost of the southern Basin desalting system will be shared by all Basin producers such that the agencies making direct use of this water above are not unfairly burdened with the cost of treating this water. It was demonstrated during discussions on this program element that equitable cost sharing could be achieved. It was also demonstrated that the groundwater production pattern in the Alternative 6A water supply plan was the least cost plan when lost safe yield and Santa Ana River water quality mitigation costs are avoided. The stakeholders came to an agreement on May 27, 1999 that the Alternative 6A water supply plan should be included in the OBMP.

The total replenishment obligation associated with this groundwater production pattern is 31,000 acre-ft/yr in the year 2000 and will increase to about 55,000 acre-ft/yr by the year 2020. The replenishment obligation can be satisfied using water in local storage, direct recharge of imported and recycled water, and by in-lieu exchange.

Imported Water. Imported water use will increase to meet emerging demands for municipal and industrial supplies in the Chino Basin area, Watermaster replenishment, and conjunctive use. Expanded use of imported water in the northern part of the Basin will have a lower priority than maintaining groundwater production in the southern part of the Basin.

Recycled Water. Recycled water use (direct use and recharge) will increase to meet emerging demands for non-potable water and artificial recharge. Under the current Basin Plan, all new recycled water use will require mitigation for TDS and nitrogen impacts. Recycled water use will be expanded as soon as practical. The two new desalters described above and the increase in storm water recharge will provide mitigation for the expanded use of recycled water.

Under Alternative 6A , two new desalters will be constructed and the SAWPA desalter currently under construction will be expanded immediately. The general location of these desalters, their respective well fields, product water pipelines, and delivery points are shown in Figure 4-2. Table 4-9 shows the timetable for the new desalters along with the salt removal capacity of these desalters. Table 4-10 contains the capital and annual costs for these facilities. An initial financing and cost sharing plan for this part of the OBMP will be developed during the Phase II OBMP process.

Implementation Requirements and Issues

Technical evaluation requirements and issues relating to facilities siting, facilities description and operations, and technical feasibility include:

- Basin exploration to assess ambient water quality and potential well field locations.
- Geotechnical and hydrogeological investigations.
- Siting investigations for desalters, wells, pipelines, and other facilities.
- Pump tests to determine viability of aquifer production.
- Modeling for safe yield impacts for alternatives identified in the OBMP.
- Preliminary engineering (reverse osmosis [RO] process design, facility layouts, pipeline alignments).
- Aquifer and groundwater quality monitoring.
- Santa Ana Regional Interceptor (SARI) capacity/availability.

- Analyses of the availability/capacity of existing infrastructure.
- Project phasing schedule.
- Construction delivery method (design-bid-build versus design-build).

Financial evaluation requirements and issues include:

- Economic feasibility analysis.
- Project financing plan.
- Interagency agreements/approvals/contracts.
- Potential impact on replenishment obligations.
- Cost/benefit analyses to evaluate incentives.
- Method of operation (agency operation versus contract operation).
- Future availability of MWDSC incentives.
- Sale of rising groundwater to Orange County.

California Environmental Quality Act (CEQA) and permitting requirements and issues include:

- Selection of implementing/lead agency.
- Preparation of necessary documents for CEQA/ National Environmental Policy Act (NEPA) compliance.
- Compliance with Basin Plan.
- Regulatory requirements/approvals from DHS and Regional Board Requirements.
- Interagency agreements/approvals/contracts.

Implementing Agencies

There are a number of specific responsibilities that must be defined when implementing any of the previously discussed alternatives. These responsibilities are listed in Table 4-11. One agency could assume all the responsibilities listed in Table 4-11; however, reality dictates that no single agency can typically meet all of these responsibilities. The following section provides a description of the agencies that could become the lead implementing agency for the construction, operation, and technical and financial support of the chosen water supply alternative.

Chino Basin Watermaster. Watermaster was created on January 27, 1978 by the San Bernardino County Superior Court after extensive negotiations between the municipal, industrial, and agricultural producers. The Chino Basin Watermaster is the entity charged with administering adjudicated water rights and managing groundwater resources within the Chino Basin. The Watermaster's primary responsibilities include: manage and control the replenishment of water supplies in the Basin, acquire and spread replenishment water as needed, approve and facilitate the storage of supplemental water in the Basin, and develop and implement an optimum basin management program to manage the Basin.

Inland Empire Utilities Agency. IEUA, formerly the Chino Basin Municipal Water District, serves 570,000 people and covers 242-square miles in the areas of Chino, Chino Hills, Fontana, Montclair, Ontario, Rancho Cucamonga, Upland and the Chino Agricultural Preserve. The Agency's major responsibilities are: wastewater treatment and disposal; supplemental water supply; industrial waste or non-reclaimable waste disposal; and water recycling. Under the *Regional Sewage Service Program*, the Agency operates three domestic wastewater treatment plants. The program enables local communities to take advantage of shared facilities and to further reduce costs by combining staffs and operations. Two

additional water recycling facilities will be on-line in the next 10 years to accommodate the growth of the area's industrial and residential communities, as well as to meet increasingly stringent environmental regulations.

Three Valleys Municipal Water District. In recognition of the need for additional sources of water for the growing region, the Pomona Area Water Committee was organized in 1945 for securing annexation to the MWDSC. Through the efforts of the committee, the District was formed on January 26, 1950 by public election. The District is a local government agency with a board of directors elected by the registered voters residing within the District's boundaries. The District's boundary includes approximately 133 square miles with a current population of 475,000. Approximately 126,600 retail customers are served by the local agencies to whom the District provides supplemental water.

Western Municipal Water District. Western Municipal Water District of Riverside County was formed in 1954 to bring supplemental water to growing western Riverside County. Western's district consists of a 510-square mile area of western Riverside County, with a population of nearly one-half million people. Western is in the heart of the Santa Ana Basin and within its district lies the communities of Jurupa, Mira Loma, Rubidoux, Riverside, Norco, Corona, Elsinore Valley, and Rancho California. A member agency of the Metropolitan Water District of Southern California, Western serves imported water directly to more than 10,000 retail customers who are located in the unincorporated and non-water bearing areas around Lake Mathews and portions of the city of Riverside. The District also serves ten wholesale customers with Colorado River and SWP water. In addition to its retail water service, the District has committed to retail sewer service to 2600 customers in the Lake Hill/Home Gardens area.

Santa Ana Watershed Project Authority. SAWPA is a joint powers agency that was originally formed to develop water and wastewater management plans for the Santa Ana River watershed. The agency is now responsible for regional water quality planning and implements projects at the request of its member agencies. Members of SAWPA include: IEUA, Eastern Municipal Water District (Riverside County), San Bernardino Valley Municipal Water District (SBVMWD), WMWD (Riverside County), and the Orange County Water District (OCWD). SAWPA owns and operates the Santa Ana Regional Interceptor (SARI) sewer brine disposal system that offers a means of exporting non-reclaimable wastewater from the southern portion of the Chino Basin (CBMWD Reclaimed Water Master Plan, 1993). In addition to the SARI, SAWPA, in cooperation with a number of other agencies who provided support and financial resources, constructed the Arlington Desalter to begin reversing the Arlington Basin's salinity. The Arlington Desalter produces approximately 6 mgd of drinking quality water. SAWPA also owns and operates the SAWPA Chino Desalter that, upon construction by the year 2000, will supply approximately 8 mgd of potable drinking water to JCSD, Chino, Chino Hills, and Norco.

Cooperative Efforts with Appropriate Agencies to Implement Program

Watermaster will assume the leadership role for developing and implementing the OBMP regional water supply plan (Alternative 6 described above) including the development of new desalting plants and the expansion of the new SAWPA desalter. Watermaster will enter into agreements with cooperative entities to implement the OBMP regional water supply plan. Potential cooperative entities include CCWD, IEUA, TVMWD, WMWD, SAWPA, WFA/JPA, and private entities. These contracts will include specific performance goals and schedule. If a cooperative entity fails to perform according to the terms of their agreement, then Watermaster will terminate the agreements and either enter into an agreement with another cooperative entity or implement the program itself.

The new desalting projects could be designed, built, operated and owned by IEUA, WMWD, SAWPA, or by private entity under long-term contract to supply water from the desalters. A private entity may be the preferred way to construct the east desalter because of rapid implementation requirements of that desalter.

CCWD, IEUA, TVMWD, and WFA/JPA will be responsible for providing imported supplies.

IEUA and WMWD will be responsible for expanding the recycled water use in the Basin.

Implementation Actions and Schedule

First Three Years (1999/00 to 2001/02). The following actions will be completed in the first three years commencing fiscal year 1999/00:

Preliminary Engineering – Year 1

- Basin exploration to assess current water quality and identify well field locations.
- Geotechnical and hydrogeological investigations.
- Siting investigations for desalters, wells, pipelines, and other facilities.
- Re-evaluation of potential purveyor water supplies/demands.
- Analysis of availability & capacity of existing infrastructure.
- Analysis of SARI capacity & availability.
- Concept design for new treatment facilities.
- Preparation of necessary documents for CEQA/NEPA compliance.
- Regulatory requirements/approvals from DHS and Regional Board Requirements.
- Conditional use and other permits from local agencies.
- Economic feasibility analysis.
- Project financing plan.
- Selection of implementing/lead agency.
- Interagency agreements/approvals/contracts.
- Method of operation (agency operation versus contract operation).

Design and Construction of East Desalter and
Design and Construction of Expansion of SAWPA Desalter – Years 2 and 3

- Purchase land for ultimate facilities.
- Pre-design investigations.
- Pump tests to determine groundwater production.
- Re-evaluation of purveyor water supplies/demands.
- Preliminary engineering.
- RO process design.
- Facility site layouts.
- Pump station design.
- Final design.
- Bidding and contract award.
- Construction.

- Start-up by 2003.

Years Four to Ten (2002/03 to 2010/11). The following actions will be completed in years four through ten, commencing fiscal year 2002/03

Design and Construction of Western Desalter

- Purchase land for ultimate facilities.
- Pre-design investigations.
- Pump tests to determine groundwater production.
- Re-evaluation of potential purveyor water supplies/demands.
- Geotechnical and hydrogeological investigations.
- Preliminary engineering.
- RO process design.
- Facility site layouts.
- Pump station design.
- Final design.
- Bidding and contract award.
- Construction
- Start-up by 2010

East, West, and SAWPA desalters:

- Operate facilities through period.
- Upgrade facilities as necessary to maintain state-of-the-art and to meet regulatory requirements.

Years Eleven to Twenty (2010/11 to 2019/20). The following actions will be completed in years eleven to twenty, commencing fiscal year 2010/11

Expansion of Eastern Desalter, and
Expansion of Western Desalter

- Pre-design investigations.
- Pump tests to determine groundwater production.
- Re-evaluation of potential water supplies/demands.
- Geotechnical and hydrogeological investigations.
- Preliminary Engineering.
- RO process design.
- Facility site layouts.
- Pump station design.
- Final design.
- Bidding and contract award.
- Construction.
- Start-up by 2015.

East, West, and SAWPA desalters:

- Operate facilities through period.

- Upgrade facilities as necessary to maintain state-of-the-art and to meet regulatory requirements.

PROGRAM ELEMENT 4 – DEVELOP AND IMPLEMENT COMPREHENSIVE GROUNDWATER MANAGEMENT PLAN FOR MANAGEMENT ZONE 1 (MZ1)

Need and Function

Program Element 4 – Develop and Implement Comprehensive Groundwater Management Plan for Management Zone 1 contains action items explicitly listed in Table 3-8.

The second impediment to *Goal 1 – Enhance Basin Water Supplies* can be stated as: "Unless certain actions are taken, piezometric levels in the deep aquifers of Management Zone 1 will continue to decline adding to the potential for additional subsidence and fissures, lost production capability and water quality problems. This impediment speaks to a localized subsidence and fissuring problem within the City of Chino and to a potentially larger and similar problem in the southern end of Management Zone 1 in the former artesian area. This part of the Basin contains a higher fraction of fine-grained materials that originated from sedimentary deposits in the Chino and Puente Hills. This area also consists of a multiple aquifer system. The upper aquifer(s) are moderately high in TDS and are often very high in nitrate. The City of Chino Hills has drilled a series of wells into the deeper aquifer(s) to obtain better quality water. The storage and hydraulic properties of the deeper aquifers are quite limited relative to the upper aquifer. The correlation of the recent groundwater production in the deep aquifers and the timing of the subsidence and fissuring, and a review of the hydrogeologic data from the area very strongly suggest that deep aquifer production is the likely cause of the subsidence. Figure 4-2 illustrates the location and magnitude of subsidence and fissuring in the City of Chino and Figure 4-3 shows the location of the this subsidence anomaly relative to Management Zone 1 and the former artesian area. The *Program Element 4 – Develop and Implement Comprehensive Groundwater Management Plan for Management Zone 1* task memorandum is on file and available from the Watermaster offices. It describes the subsidence problem in the Management Zone 1 area as it is currently understood in more detail.

MZ 1 Management Plan

The continued occurrence of subsidence and fissuring in Management Zone 1 is not acceptable and must be reduced to tolerable levels or completely abated. However, there is some uncertainty as to the causes of subsidence and fissuring and more information is necessary to distinguish among potential causes. An interim management plan must be developed and implemented to:

- minimize subsidence and fissuring in the short-term;
- collect the information necessary to understand the extent and causes of subsidence and fissuring; and
- formulate an effective long-term management plan.

MZ 1 Interim Management Plan. The interim management plan would consist of the following activities:

- Voluntarily modify groundwater production patterns in Management Zone 1 for a five-year period. For example, there is some indication that deep aquifer production beneath the City of Chino contributed to recent subsidence and fissuring in the area. Reduction or elimination of deep aquifer production beneath the area of subsidence and fissuring is a logical short-term mitigation strategy.

- Balance recharge and production in Management Zone 1. Based on preliminary engineering investigations with RAM tool, it appears that current levels of pumping and recharge are balanced. However, increases in pumping should be balanced with increases in recharge.
- Determine gaps in existing knowledge. Primarily, there is a lack of understanding of Management Zone 1 hydrogeology, of the nature and extent of subsidence and fissuring, and of the exact causes of subsidence and fissuring.
- Implement a process to fill the gaps in existing knowledge. This would include hydrogeologic, geophysical, and remote sensing investigations of Management Zone 1, as well as certain monitoring programs, such as piezometric, production, water quality, ground level, and subsidence monitoring.
- Formulate a long-term management plan. The long-term management plan will include goals, activities to achieve those goals, and a means to evaluate the success of the plan.

MZ 1 Long-Term Management Plan. The long-term management plan will be formulated during the interim management plan based on investigations, monitoring programs and data assessment. It will likely include modifications to groundwater pumping rates and the locations of pumping, recharge, and monitoring. The long-term management plan will be adaptive in nature – meaning monitoring and periodic data assessment will be used to evaluate the success of the management plan and to modify the plan, if necessary.

Cooperative Efforts with Appropriate Agencies to Implement Plan

The subsidence and fissuring problem appears to be currently focused in the City of Chino and the California Institution for Men (CIM). However, it is reasonable given the current knowledge, to expand the minimum area of concern to the entire former artesian area shown in Figure 4-3 and slightly beyond that area. Changes in pumping and recharge patterns in Management Zone 1, and more generally the area of concern, will most likely be part of the management plan. The producers in the area include the cities of Chino, Chino Hills, Ontario, Pomona and Upland, the Monte Vista Water District (MVWD), San Antonio Water Company (SAWC), Southern California Water Company (SCWC), the State of California (CIM, California Institution for Women [CIW]), and SAWPA. Watermaster may need to have entities that increase their production to provide for the recharge of an equivalent amount of water to maintain the balance of pumping and recharge. Watermaster will take the leadership role in the development and implementation of the Management Zone 1 management plan.

Implementation Actions and Schedule for the First Five Years

Year 1

- Establish a Management Zone 1 committee and develop interim management plan.

Years 2 to 5

- Implement the interim management plan, including appropriate monitoring.

Years 3 to 5

- Annual assessment of data from monitoring programs, and modification of monitoring programs if necessary.

Year 5

- Develop long-term management plan.

Implementation Actions and Schedule for Years Six to Ten.

Year 6

- Implement the long-term management plan.

Years 6 to 10

- Annual assessment of data from monitoring programs, and modification of management plan if necessary.

Implementation Actions and Schedule for Years Eleven to Fifty.

Assessment of data from monitoring programs every three years and modification of management plan if necessary.

PROGRAM ELEMENT 6 – DEVELOP AND IMPLEMENT COOPERATIVE PROGRAMS WITH THE REGIONAL BOARD AND OTHER AGENCIES TO IMPROVE BASIN MANAGEMENT

PROGRAM ELEMENT 7 – DEVELOP AND IMPLEMENT SALT MANAGEMENT PROGRAM

Need and Function

These program elements are needed to address some of the water quality management problems that have occurred in the Basin. These water quality problems are described in Section 2 *Current Physical State of the Basin* and Table 3-8 in Section 3 *Goals of the OBMP*. The specific water quality issues addressed by these program elements are listed below:

- The Special Referee has indicated that Watermaster needs to routinely demonstrate that implementation of the OBMP will lead to groundwater quality improvements. Watermaster should develop and use a method to determine water quality trends and to verify whether the OBMP is improving water quality.
- There is legacy contamination in the vadose zone from past agricultural activities (TDS and nitrogen) that will continue to degrade groundwater long into the future.
- Watermaster does not have sufficient information to determine whether point and non-point sources of groundwater contamination are being adequately addressed.
- There is ongoing salt and nitrogen loading from agriculture.

Demonstration of Water Quality Improvement

The TDS and nitrogen challenges in the Chino Basin are caused by agriculture and safe yield management. The TDS and nitrogen impacts from agriculture were described in Section 2. Table 4-12 shows in summary format how the TDS concentration in source supplies and fertilizer affect the TDS concentration in irrigation return flows to groundwater. The TDS concentration in the irrigation return flow is about four times higher than the TDS concentration in the irrigation supply. The majority of the increase in TDS concentration is caused by consumptive use and a negligible contribution from the fertilizer. The table also shows the affect of the use of dairy manure for fertilizer and soil improvement. The TDS contribution from manure is much larger than from commercial fertilizer, however the concentration increase from consumptive use is more significant particularly for source water TDS concentrations typical in the southern part of the Basin (>500 mg/L). Similar TDS concentration increases in irrigation return flows occur for other crop types such as citrus and grapes, both of which were significant in the past. Table 4-12 shows TDS concentrations for urban irrigation return flows for a

representative range in municipal source water TDS concentration. The range of TDS concentrations in urban irrigation returns is from about 1,200 to 1,800 mg/L with less than ten percent coming from fertilizers and the overwhelming majority of the TDS increase coming from consumptive use.

Figure 4-4 is a map that shows the general groundwater flow directions in the Chino Basin. The map contains velocity vectors that show direction and relative velocity of groundwater flow. One of the more interesting interpretations of this map is that groundwater generally flows away from the Santa Ana River. Small amounts of rising groundwater occur seasonally in Chino and Mill Creeks and are typically less than 11,000 acre-ft/yr. The only way significant amounts of groundwater can leave the Basin are through consumptive use, the discharge of recycled water to the Santa Ana River near Prado, and the discharge of brine to either the Santa Ana Regional Interceptor (SARI) or the Non-Reclaimable Waste Line (NRWL). The groundwater flow pattern shown in Figure 4-5 is largely influenced by production. If there were a significant reduction in groundwater production in the southern part of the Basin, then groundwater outflow to the Santa Ana River would increase and the safe yield would be reduced. The safe yield of the Basin depends on recharge of Santa Ana River water and minimal outflow of groundwater to the river. Without the recycled water discharges to the Santa Ana River near Prado dam and brine discharges to the SARI and the NRWL, the Chino Basin would almost be a completely closed system.

The vadose zone is the part of the aquifer that lies between the soil and the water table. The vadose zone is partially saturated and buffers the mineral salt loads entering from the soil. The buffering effect reduces the magnitude of the peak loads to the saturated zone and spreads out the loading of the saturated zone over a period of time that is longer than the soil loading. Salts in the vadose zone are being released to the saturated zone now and will continue to be released to the saturated zone for some time after the agricultural lands are converted to urban uses. The quantity of salt reaching groundwater should reduce in the future for two reasons:

- salt loading to the soil from agricultural will reduce over time
- less water will percolate through the vadose zone as the agricultural area becomes paved through urbanization (60 to 80 percent impervious).

If current rates of agricultural loading were to continue indefinitely, TDS and nitrate concentrations in groundwater could continue to rise. TDS projections for the Chino Basin that were made during the *Chino Basin Water Resources Management Study* (CBWRMS) suggested that the TDS concentrations would continue to rise in groundwater throughout most of the 50-year planning horizon of 1990 through 2040. These graphs are included in the Program Element 6 Task Memorandum on file and available from the Watermaster offices. In the CBWRMS, agricultural activities were assumed to decline to minimum levels by the year 2020. If and when the land use in the area is converted to urban uses, the source water TDS served to the new urban areas will be always less than 400 mg/L and the mineral salts from the source water will be mostly discharged in recycled water discharges to the Santa Ana River, brine line discharges (from new desalters) and increased rising groundwater flows to the Santa Ana River. The TDS concentration in groundwater will, after some period of time, decline slowly but should still remain significantly higher than be served as a municipal supply.

The Court will require Watermaster t develop and use a method to demonstrate that actions taken in the OBMP will improve groundwater quality. The question arises: how *do we assess progress towards improving groundwater quality if groundwater monitoring alone will continue to show degradation even after significant steps are taken to improve water quality?*

The alternatives available to the Watermaster range from groundwater quality monitoring alone to the application of numerical models in conjunction with monitoring. As mentioned above, if groundwater monitoring were the only metric for measuring improvement, then it will appear for many years that

construction of desalters and the export of dairy waste will have no benefit. The use of numerical models to assess progress in improving water quality is extremely expensive if their only use were to assess such progress.

A method that combines monitoring and a salt budget is more practical and cost-effective than large-scale modeling. The salt budget approach consists of a salt mass accounting in each management zone and the Basin as a whole. The magnitude of each inflow and outflow component would be estimated. The TDS and nitrogen concentration of each inflow and outflow component would be estimated. Water quality will improve if the flow-weighted concentration in the inflow is less than the flow-weighted concentration in the outflow.

$$[S\ I_k * C_k] / [S\ I_k] - [S\ O_j * C_j] / [S\ O_j] < 0 \quad \text{water quality is improving}$$

$$[S\ I_k * C_k] / [S\ I_k] - [S\ O_j * C_j] / [S\ O_j] > 0 \quad \text{water quality is degrading}$$

$$[S\ I_k * C_k] / [S\ I_k] - [S\ O_j * C_j] / [S\ O_j] = 0 \quad \text{water quality is not changing}$$

where: I_k is volumetric recharge component *k*
C_k is the TDS or nitrogen concentration associated with recharge component *k*
O_j is volumetric discharge component *j*
C_j is the TDS or nitrogen concentration associated with discharge component *j*

The inflow components include: precipitation, artificial recharge of storm flows, artificial recharge of recycled water, and applied water. The outflow components include: evapotranspiration, surface water outflow, recycled water export, groundwater export and brine export. The TDS and nitrogen mass increments added to water as it is applied to irrigated lands or to disposal land needs to be estimated. The inflow and outflow components used in this approach will produce average recharge and discharge from the Basin, that is, there will be no change in groundwater storage.

The salt budget will be computed for existing conditions to assess the current balance, hereafter referred to as the baseline case. An assessment of future water quality improvements that will occur from the OBMP will be made by changing the water and waste management assumptions in the baseline case to reflect OBMP implementation. The changes in the inflow and outflow components and their associated TDS and nitrogen concentration will be made and the salt budget equations would be re-solved. The relative improvement of water quality will be assessed by comparing the salt budget of the OBMP to the baseline plan. Later, during periodic OBMP updates, the salt budget will be computed based on the then current water quality (from monitoring programs) and the then current water and waste management plans. These periodic assessments will allow Watermaster to determine if the OBMP is improving water quality.

There are some limitations to the salt budget method and the use of such a method should be considered in light of all anticipated water quality assessment needs in the Basin. Table 4-13 presents a tabular comparison of future water quality information requirements with alternative methods and approximate costs to use those methods over the next 20 years. The CBWRMS developed a comprehensive set of models for the Chino Basin that is capable of assessing the impact of past and future water resources management activities on groundwater level, streamflow, and water quality. The *Chino Integrated Groundwater and Surface Water Model* (CIGSM) is extremely complex and expensive to maintain and use.

The salt budget method will cost about $80,000 to $100,000 to develop and use the first time. Subsequent uses, in either OBMP updates or *ad hoc* investigations, will involve developing new water quality input

data based on new monitoring data and revised water and waste management scenarios. Total cost over the next 20 years should range between $300,000 to $400,000. CIGSM is composed of series of models. In contrast to the salt budget method, CIGSM is very complex and difficult to use. The cost to re-calibrate CIGSM, to update the planning data, and to use the model to evaluate the initial OBMP is about $700,000 based on recent detailed estimates developed for the TIN/TDS Study (Wildermuth Environmental, 1999). The cost to use CIGSM over the next 20 years will run between $3,000,000 to $4,000,000.

Cooperative Efforts with the Regional Water Quality Control Board

Watermaster does not have sufficient information to determine whether point and non-point sources of groundwater contamination are being adequately addressed. Watermaster's past monitoring efforts have been largely confined to mineral constituents in the southern half of the Basin and to available monitoring data supplied by municipal and industrial producers. The Regional Water Quality Control Board (Regional Board) has limited resources to detect, monitor and cause the clean up of point and non-point water quality problems in the Chino Basin. The Regional Board commits its resources to enforce remedial actions when it has identified a potential responsible party. The Regional Board does not take action when the sources are not easily identified or when the sources are diffuse, such as non-point sources. Notable examples include the mercury problem in the east Ontario area and some solvent plumes in the lower Chino Basin. It is not a question of Regional Board willingness to in this area; it is the allocation of limited RWQCB resources. Watermaster can improve water quality management in the Basin by committing resources to:

- identify water quality anomalies through monitoring;
- assist the Regional Board in determining sources of the water quality anomalies;
- establish priorities for clean-up jointly with RWQCB; and
- remove organic contaminants through its regional groundwater treatment projects in the southern half of the Basin.

The last bulleted item requires some explanation. The well field for SAWPA desalter will eventually intercept a solvent plume of unknown origin that is emanating from the Chino airport area. There is a second solvent plume northeast of the Chino airport area that could be intercepted by the current desalter or another future desalter. This will require additional treatment for the water produced by the desalter. The desalter project can be used to clean up these plumes at some additional cost. The cost of cleaning up the solvent plumes at the desalters will be less than the cost of a dedicated solvent removal system. The additional cost should be paid for by the entity responsible for the solvent discharge. A similar process was used by the Regional Board and Kaiser Steel Corporation to mitigate a TDS plume in the north half of the Chino Basin.

TDS and Nitrogen (Salt) Management in the Chino Basin

TDS and nitrogen management will require minimizing TDS and nitrogen additions by fertilizers and dairy wastes, desalting of groundwater in the southern part of the Basin (for water supply purposes), and maximizing the artificial recharge of storm water. The latter two management components are included in Program Elements 3 and 2, respectively

The agricultural area in the southern part of the Chino Basin will gradually convert to urban uses over the next 20 to 30 years and, thus, in the long term, the TDS and nitrogen challenges from irrigated agriculture and dairy waste management will go away. The Regional Board will adopt new dairy waste discharge requirements in the summer of 1999. The requirements will include the following:

- Each dairy will develop and implement an engineered waste management plan that will contain dairy process water and on-dairy precipitation runoff for up to a 25-year, 24-hour storm
- Manure scraped from corrals must be exported from the dairy within 180 days
- All manure stockpiled in the Chino Basin as of December 1, 1999, will be exported from the Basin by December 1, 2001.
- No manure may be disposed of in the Chino Basin
- Some manure can be applied to land at agronomic rates if and only if in the opinion of the Executive Officer there is reasonable progress toward the construction of a new desalter in the Chino Basin.

The Santa Ana River Watershed Group (SARWG) is a stakeholder group made up of municipal, county, regional and federal agencies, and private individuals that are working through complex land use and environmental issues in the Santa Ana Watershed. One of their work products is a draft manure management strategy (MMS) for the Chino Basin. The primary component of MMS is the export of manure either as a raw or an improved material. The MMS describes the economics of manure management and the means to finance manure export.

The new dairy waste discharge requirements may have the unintended result of actually causing Santa Ana River quality to degrade. Some or all of the dairy farmers could move out of the Basin if they cannot afford to continue dairy operations as a result of the new waste discharge requirements. A rapid departure of the dairies will result in a rapid decline in groundwater production in the southern part of the Basin and a subsequent increase in poor quality rising water. The rising groundwater will degrade the river. As part of the OBMP, Watermaster will annually review the economics of dairy waste management in the Chino Basin and may contribute funds to subsidize the removal of manure from the Basin. In the first year of the OBMP implementation, Watermaster will contribute $150,000. Watermaster will closely monitor the activities of the Regional Board, SARWG and others whose actions will influence the amount of TDS and nitrogen entering the Basin.

The urban land use that will replace agriculture will require low TDS municipal supplies that in turn will produce lower TDS irrigation returns to groundwater than those generated by agriculture. The construction of desalters in the southern part of the Basin (as described in Program Elements 3 and 5) will extract and export huge quantities of salt from the Basin. Table 4-9 lists the salt removal capacity of desalters described in Program Elements 3 and 5. By 2020, the salt removal capacity of the desalters will reach over 80,000 tons per year. The dairy salt contribution is currently about 30,000 tons per year. It is premature to set salt reduction goals until the salt budget method described above is developed and the salt budget is assessed for the Basin. However, it seems reasonable to expect that the salt budget will be impacted favorably by the desalters and future land use conversions, and that Watermaster should expect a reduction in salt loading of about 80,000 to 100,000 tons of salt per year in the next 20 to 30 years.

Implementation Actions and Schedule

First Three Years (1999/00 to 2001/02). The following actions will be completed in the first three years commencing fiscal year 1999/00:

- Watermaster will form an ad hoc committee, hereafter *water quality committee*. The purposes of the *water quality committee* are to review water quality conditions in the Basin and to develop (with the Regional Board) cooperative strategies and plans to improve water quality in the Basin. The committee would meet regularly with

Regional Board staff to share information and to recommend cooperative efforts for monitoring groundwater quality and detecting water quality anomalies. The schedule and frequency of meetings will be developed with the Regional Board during the first year of the OBMP implementation.

- Watermaster will refine its monitoring efforts to support the detection and quantification of water quality anomalies. This may require additional budgeting for analytical work and staff/support.
- If necessary, Watermaster will conduct investigations to assist the Regional Board in accomplishing mutually beneficial objectives.
- Watermaster will seek funding from outside sources to accelerate detection and clean up efforts.
- Develop salt budget goals, develop the salt budget method described above and review all the OBMP actions.
- Watermaster will annually review the economics of dairy waste management in the Chino Basin and may contribute funds to subsidize the removal of manure from the Basin. In the first year of the OBMP implementation, Watermaster will contribute $150,000.

At the conclusion of the third year, the *water quality committee* will have met several times, developed and implemented a cooperative monitoring plan with the Regional Board, and developed a priority list and schedule for cleaning up all known water quality anomalies.

Years Four through Fifty (2002/03 to 2050/51). The following actions will be completed in years four through fifty, commencing fiscal year 2002/03:

- Continue monitoring and coordination efforts with the Regional Board.
- Annually update priority list and schedule for cleaning up all known water quality anomalies.
- Continue to seek funding from outside sources to accelerate clean up efforts.
- Implement projects of mutual interest.
- As part of periodic updates of the OBMP, re-compute the salt budget using the salt budget method. The salt budget method would be used to reassess future OBMP actions to ensure that salt management goals are attained.
- Annually review the economics of dairy waste management in the Chino Basin and consider contributing funds to subsidize the removal of manure from the Basin.

PROGRAM ELEMENT 8 – DEVELOP AND IMPLEMENT GROUNDWATER STORAGE MANAGEMENT PROGRAM

PROGRAM ELEMENT 9 – DEVELOP AND IMPLEMENT CONJUNCTIVE USE PROGRAMS

Need and Function

The first impediment to *Goal 1 – Enhance Basin Water Supplies* can be stated as: "Unless certain actions are taken, safe yield of the Basin will be reduced … (because) the current manner in which Watermaster manages cyclic and local storage accounts will cause overdraft." Watermaster is concerned about the magnitude of water lost from the Chino Basin from rising groundwater when groundwater is stored in the

local storage, cyclic, conjunctive use and other storage accounts. Watermaster is interested in determining how much water can be stored without significant loss from local accounts and in developing a procedure to equitably distribute these losses among entities that have storage accounts. Watermaster may consider setting limits for individual storage accounts for members of the overlying non-agricultural and appropriative pools that ensure reasonable and beneficial use of Chino Basin water.

The third impediment to *Goal 3 – Enhance Management of the Basin* can be stated as: "About 500,000 acre-ft of storage in the Chino Basin cannot be used due to water quality and institutional issues." The impediment speaks to two issues. The first issue is a concern by the producers of adverse water quality impacts if groundwater storage is significantly (see Section 2) increased. The second issue is the past inability of Watermaster, producers, and MWDSC to be able to agree on a conjunctive use program for the Chino Basin.

Parties to the Judgment can store un-pumped groundwater rights for various reasons that include:

> **Future use during shortage of other less expensive water supplies.** Some parties to the Judgment have access to other sources of water that are less expensive than producing Chino Basin groundwater. The alternative water supplies available to these parties include imported water, local streamflow, and other groundwater basins. By not pumping their Chino Basin rights, they can then store water in the Chino Basin for later use when their other less expensive sources are scarce. This is conjunctive use.
>
> **Exchange or sell to other producers.** Some parties to the Judgment produce less than their rights resulting from decreased demand, groundwater quality problems, or because they have access to other less expensive supplies. The un-pumped water pursuant to the Judgment can be exchanged or sold to other parties to the Judgment.
>
> **Temporary shortfall in production capacity.** Some parties may not be able to use all their rights due to temporary shortfalls in production capacity caused by water quality or mechanical problems. The un-pumped water goes into local storage accounts until production capacity is recovered or increased.

As a means of efficiently managing their available water supply, each appropriative and overlying non-agricultural producer tries to minimize the cost of water from the sources of supply available to that producer. Some producers have multiple sources of supply and some have limited supplies. Some agencies are in a position, because of the sources of supply available to them, to accumulate water in local storage accounts in most years. Conversely, some agencies produce groundwater from the Chino Basin in excess of their rights and cannot make use of local storage accounts except through the purchase or lease of other water. There are two fundamental reasons why storage limits should be considered.

> **Ensure reasonable beneficial use.** The accumulation of water in local storage accounts in quantities that cannot be put to a reasonable beneficial use is in conflict with Section 2 of Article X of the California Constitution. Therefore, if a local storage account maximum storage limit needs to be set, the limit should be based on the producer's ability to put the stored water to reasonable beneficial use.
>
> **Reduce groundwater losses to the Santa Ana River.** The cumulative losses of water from local storage accounts can grow to be large and, thus, the ability to use the stored water to Chino Basin producers is lost. These losses could be minimized by storing water for shorter periods of time prior to use and by limiting the water put into storage accounts to an amount that can be put to reasonable beneficial use.

Estimate of the Water Lost from Storage

The accumulation of groundwater in storage without an increase in groundwater production will cause the baseflow to increase in the Santa Ana River and some of its tributaries (Chino Creek and Mill Creek). Investigations conducted by Watermaster in 1995 concluded that losses from water in local storage accounts and cyclic storage are about two percent per year of the water in storage. These losses could reach over four percent in the future if groundwater production patterns are not managed in the southern part of the Basin. Exhibit A in the Program Element 8 Task Memorandum (on file and available from the Watermaster offices) shows the estimated losses from each local storage account, the cyclic storage account, and the Basin as a whole for the 20-year post-Judgment period of 1978 to 1997. The total water lost from local storage accounts and cyclic storage for the 20-year period of 1978 through 1997 is about 50,500 acre-ft. If the water in these storage accounts is produced without accounting for the losses then the Basin will be overdrafted by an amount equal to the water lost from storage.

Storage Limit Concepts

Currently there is no existing aggregate limit for local storage accounts. Watermaster's Uniform Groundwater Rules and Regulations (UGRR) contains an aggregate threshold storage value of 100,000 acre-ft above which losses to rising water are to be computed and allocated to the storage parties on a pro rata basis. The UGRR does not specify whether the loss is to be computed for the increment of storage above 100,000 acre-ft or total storage. The 100,000 acre-ft threshold value is an arbitrary number. Some loss will occur when water is placed into local storage. Using 100,000 acre-ft as a threshold value ensures that up to 2,000 acre-ft/yr of unaccounted-for-losses from storage will occur every year. This water will not be in the Basin when the storage parties attempt to recover the stored water. If losses are not accounted for, then the Basin is not being operated in the safe yield mode as required by the Judgment. Therefore, regardless of how storage limits are set, Watermaster should deduct the rising water losses from planned storage for all local storage accounts and for the storage accounts of non-Judgment parties. There are several different ways to develop upper limits on the individual local storage accounts. Some of these are described below.

Limit based on the ability to use. In this concept, an upper limit is based on the storage party's ability to store and recover all the water in its account over a fixed period, say five years. The storage party would have to demonstrate that it has enough production capacity to recover all the water in storage over a five-year period. The fixed period would be the same for all storage parties. In this concept, each storage party would have to demonstrate to Watermaster that they have the ability to put a specific volume of water into storage and be able to recover that water, adjusted for losses, over a fixed period of time. Thus, the storage party will have the facilities in place for groundwater production. This type of limit ensures that the water is put to a reasonable beneficial use. For example, suppose an agency has Chino Basin production capacity of 25,000 acre-ft/year, an operating yield of 15,000 acre-ft/yr and the fixed period has been set at five years. Then they would be allowed to put 50,000 acre-ft into its local storage account. If an agency were to increase its Chino Basin production capacity then its local storage account limit could be increased by an amount equal to five times the increase in production capacity. The five-year period used above is arbitrary – Watermaster would need to determine the length of the fixed period.

Arbitrary limits. In discussions regarding storage limits in prior years, Watermaster considered setting storage limits based on a multiple of safe yield for overlying non-agricultural pool and a multiple of operating safe yield for the appropriative pool. Parties that have historically over-produced and that will continue to over-produce may not ever be able to use such a local storage account. Parties that under-produce will fill their accounts and may hold water in these accounts for long periods of time and incur

large storage losses. This has been the trend with the past operation of the local storage accounts. Upper limits based on this concept are arbitrary and may not provide for reasonable beneficial use of Chino Basin water. Storage limits based on a multiple of prior years production, an arbitrary volume equal for all parties, or any other arbitrary volume suffer from the same limitations.

Limit based on time water is in storage. In this concept, no volume limit would be set. Water could not be kept in storage for more than some fixed period of time, say ten years, regardless of the amount of water in storage. Water transferred from the local storage account for use by the storage party would be taken from the earliest water put into the local storage account. The storage party would be required to recover a volume of groundwater from its local storage account, sell or transfer a similar volume to another party, or sell a similar volume to Watermaster in order to reduce the quantity in its storage account by an amount equal to the water stored prior to the fixed period less losses to rising water. Simply stated, unused water from the first year would either be used or sold to Watermaster or other producer in the eleventh year, unused water from the second year would either be used or sold in the twelfth year, and so on if a ten year time limit is used.

Upper limit based on total storage and time water is in storage. This is a composite of the *ability to use* and *time in storage* concepts. In this case a volumetric upper limit would be set for each storage party based on the storage party's ability to store and recover water over a fixed period of time. A time constraint would be added such that water would not be kept in storage more than some fixed period of time.

In all the above storage limit concepts, the storage parties would sell their current year under-production to Watermaster or other parties to the Judgment each year that their local storage accounts are full. Watermaster, or parties to the Judgment, would then use this water to meet current replenishment obligations.

Implementation of Local Storage Account Limits

Watermaster's UGRR presently require an *initial determination of local storage requirements to be made*. Watermaster then allocates this storage to members of the appropriative and overlying non-agricultural pools when specific parties make an application for a local storage agreement. Watermaster must periodically review the status of the local storage accounts and adjust the local storage requirement as described in the UGRR. While not explicitly described in the Judgment or UGRR, local storage account limits based on the *ability to us*e, *time in storage,* or a composite of the two, are consistent with the Judgment and could be implemented with some changes in the UGRR.

Local storage account limits based on the *ability to use* require that each agency make a determination of their Chino Basin groundwater production capacity and submit that finding to Watermaster. Watermaster would determine the duration over which the volume in local storage accounts would be used. Storage account limits for each storage party would be computed as:

Storage Limit = duration of storage period * (Chino Basin production capacity – average operating yield)

The average operating yield would equal the average of previous years operating yield entitlements (*e.g.*, five year average). Watermaster could periodically, or upon petition by a storage party, review and adjust the storage limits.

Local storage account limits based on the *time in storage* require that Watermaster determine the time-in-storage limit. Watermaster could then go through production and local storage account records to determine if water must be either used or sold to Watermaster. Local storage account limits based on the composite of the *ability to use* and *time in storage* require the implementation steps described for both concepts.

Some storage parties may currently have more water in their local storage accounts than would be allowed in the storage limit concepts listed above. In this case, the storage party would not be allowed to put water into their local storage accounts and under-production would be purchased by Watermaster.

If, as a result of these storage limits, Watermaster is required to purchase more water than is required for replenishment, then either the storage party will be allowed to temporarily store additional water in its local storage account or Watermaster payments for that water may have to be temporarily deferred.

Water in local storage accounts is used for replenishment of overdraft either by the producer's that hold a local storage account, or is sold to other producers with replenishment obligations. It is possible that Watermaster could fulfill all replenishment obligations exclusively from local storage accounts for several years. Watermaster should fulfill the need for replenishment from increased production with imported water for those areas that have a critical need for imported water and use the water stored in local storage accounts for the rest of the replenishment obligation.

Storage Management Program

Since 1995, the producers have developed numerous storage management proposals. This storage management program described here was developed in April and May of 1999 and differs from the previous proposals that sought to assign all the readily-useful storage in the Basin up among producers. If successfully implemented, storage limits on individual storage accounts may not need to be considered by Watermaster. The proposal described herein will allow:

- Watermaster to develop conjunctive use programs that will benefit <u>all</u> the producers in the Basin;
- ensure that Basin water and storage are put to maximum beneficial use; and
- maintain the integrity of the Judgment.

Definitions. *Operational Storage Requirement* – The operational storage requirement is the storage or volume in the Chino Basin that is necessary to maintain safe yield. In the context of this storage management program, the operational storage is estimated to be about 5,300,000 acre-ft. An engineering analysis will be done to assess the operational storage requirement of the Basin as part of the implementation of this program.

Safe Storage – Safe storage is an estimate of the maximum storage in the Basin that will not cause significant water quality and high groundwater-related problems. In the context of this storage management program, the safe storage is estimated to be about 5,800,000 acre-ft. An engineering analysis will be done to assess the safe storage requirement of the Basin as part of the implementation this plan.

Safe Storage Capacity – The safe storage capacity is the difference between safe storage and operational storage requirement and is the storage that could be safely used by producers and Watermaster for storage programs. Based on the above, the safe storage capacity is about 500,000 acre-ft. The allocation and use of storage in excess of safe storage will preemptively require mitigation, that is, mitigation must be defined and resources committed to mitigation prior to allocation and use.

Key Elements

- No maximum storage limit will be placed on local storage accounts for a period of five years ending on June 30, 2004, and water that becomes eligible for storage can be stored.
- The need for storage limits will be re-evaluated in five years based on the ability of the storing party to use the water in storage (ability to use concept) and on Watermaster's need for storage programs that provide regional benefits.
- Storage is not assignable.
- All water in local storage and other storage accounts will incur losses at a rate of 2 percent of water in storage each year starting in fiscal year 2002/03.
- The storage loss rate and safe yield will be estimated in the year 2012/13 and every ten years thereafter.
- Watermaster will develop regional conjunctive-use programs to store supplemental water for MWDSC and other entities that can cause supplemental water to be stored in the Basin.
- The regional conjunctive-use programs will provide benefits to all producers in the Basin, the people of California and the nation. Watermaster's conjunctive-use programs will take priority over conjunctive-use programs developed by others.
- Storage committed to conjunctive-use programs may consist of two parts, storage within the safe storage capacity and storage in excess of safe storage. Storage in excess of safe storage capacity will preemptively require mitigation.
- The initial target storage for Watermaster's conjunctive-use program will be 150,000 to 300,000 acre-ft within the safe storage capacity.
- Cyclic storage will be folded into conjunctive-use storage.
- Watermaster's conjunctive-use program tentatively consists of the following elements:
  - complete the existing short term conjunctive-use project;
  - seasonal peaking program for in Basin use and dry year program to reduce the demand on Metropolitan to 10 percent of normal summer demand (requiring 150,000 acre-ft of storage);
  - dry-year export program; and
  - seasonal peaking export program.

Re-determination of Safe Yield and Storage Loss Rates. The safe yield and storage loss rate will be assessed every ten years starting in the year 2012/13. The ten-year period of 2002/03 to 2011/12 will be used to compute the safe yield and to estimate the storage loss rate.

Safe yield and storage loss rate determinations require accurate groundwater level and production data. Watermaster does not have accurate production data from agricultural producers. Watermaster estimates most of the production in the agricultural pool using a water duty method that does not meet the requirements of the Judgment. Program Element 1 of the OBMP includes a program to install meters and obtain production measurements from all wells in the Basin. It will take three years to fully meter all agricultural wells. Watermaster will have accurate production monitoring at all wells starting in year

2002/03. Watermaster is in the process of developing a groundwater level monitoring program for the Basin. This plan should be implemented in the year 1999/00.

The safe yield in the Judgment was developed over the period 1965 to 1974 using the procedure described in Section 2 of the OBMP report. The safe yield will be re-determined in year 2012/13 using the ten-year period 2002/03 to 2011/12 because it will contain accurate production data and groundwater level data. A ten-year period is proposed to be consistent with the method used in the engineering work for the Judgment and is the minimum necessary to estimate a safe yield.

Re-determination of the storage loss rate will require the use of a numerical flow model. The *RAM Tool* developed by Watermaster will be modified and used for this purpose. The model would be used as follows:

- Calibrate the RAM tool for the safe yield period. In the calibration process, the hydrology for the period 2002/03 to 2011/12 will be developed including deep percolation of applied water and precipitation, unmeasured storm water recharge, subsurface inflow from adjacent basins, and uncontrolled discharges from the Basin (rising water).
- Once calibrated, the water supply plans of the producers and other storage entities will be modified to assume that no water would be put into storage accounts. The model will be rerun with this assumption and the results would be compared to the calibration run to determine losses from storage and the storage loss rate.
- The storage loss rate would be set based on the relationship of water in storage and associated losses.

Watermaster's new groundwater level and production monitoring are crucial to this effort.

Implementation Actions and Schedule

First Three Years (1999/00 to 2001/02). The following actions will be completed in the first three years commencing fiscal year 1999/00:

- Receive Court approval of OBMP.
- Evaluate need to modify Watermaster UGRR to reflect the storage management plan.
- Determine the operational storage requirement and safe storage.
- Begin formal implementation of comprehensive monitoring programs described in Program Element 1 (including groundwater level, groundwater quality, production, and surface water monitoring in the Santa Ana River).
- Complete the existing short-term conjunctive-use pilot project with MWDSC.
- Conduct engineering and environmental analyses, other feasibility efforts, and negotiate agreements to:
- implement a conjunctive-use program that includes seasonal peaking for in Basin use and dry year program to reduce the demand on MWDSC to 10 percent of normal summer in-Basin demand (requiring 150,000 acre-ft of storage);
- implement a conjunctive-use program for dry-year export; and
- implement a seasonal peaking program for export.

Years Four through Ten (2002/03 to 2008/09). The following actions will be completed in years four through ten, commencing fiscal year 2002/03:

- Continue monitoring as described in Program Element 1.
- Begin construction of facilities to implement the conjunctive-use projects listed in *years one through three*, in year 2003/04.
- Commence conjunctive-use operations.
- Start assessing losses in year 2002/03.

Years Eleven through Fifty (2009/10 to 2048/49). The following actions will be completed in years eleven through fifty, commencing fiscal year 2009/10:

- Continue monitoring as described in Program Element 1.
- Continue conjunctive-use operations.
- In year 2012/13, compute safe yield and storage loss rate for period 2002/03 through 2011/12, and reset safe yield and storage loss rates for the next the next ten-year period 2012/13 to 2021/22. Reassess storage management plan and modify Watermaster UGRR, if needed.
- In year 2022/23, compute safe yield and storage loss rate for period 2012/13 through 2021/22, and reset safe yield and storage loss rates for the next the next ten-year period 2022/23 to 2031/32. Reassess storage management plan and modify Watermaster UGRR, if needed.
- In year 2032/33, compute safe yield and storage loss rate for period 2022/23 through 2031/32, and reset safe yield and storage loss rates for the next the next ten-year period 2042/43 to 2041/42. Reassess storage management plan and modify Watermaster UGRR, if needed.
- In year 2042/43, compute safe yield and storage loss rate for period 2032/33 through 2041/42, and reset safe yield and storage loss rates for the next the next ten-year period 2052/53 to 2051/52. Reassess storage management plan and modify Watermaster UGRR, if needed.

PROGRAM COST AND EARLY IMPLEMENTATION PLAN

Table 4-14 contains a 20-year cost projection for implementation of the OBMP. The 20-year cost of OBMP implementation is about $400,000,000. The following program elements will be implemented entirely by Watermaster:

- Program Element 1 – Develop and Implement Comprehensive Monitoring Program
- Program Element 4 – Develop and Implement Comprehensive Groundwater Management Plan for Management Zone 1
- Program Element 6 – Develop and Implement Cooperative Programs with the Regional Water Quality Control Board, Santa Ana Region (Regional Board) and Other Agencies to Improve Basin Management
- Program Element 7 – Develop and Implement Salt Management Program
- Program Element 8 – Develop and Implement Groundwater Storage Management Program

Watermaster has committed to fund these program elements in their entirety through Watermaster assessments and through grants obtained directly by Watermaster. The Watermaster budget for fiscal 1999-2000 provides funding necessary to begin the efforts described in these program elements. The cost of the first three years is about $2,900,000 and average annual cost for the next 20 years is about $480,000.

The following program elements will be started by Watermaster in fiscal 1999-2000 and will be completed by others by agreement with Watermaster:

- Program Element 2 – Develop and Implement Comprehensive Recharge Program
- Program Element 3 – Develop and Implement Water Supply Plan for the Impaired Areas of the Basin
- Program Element 5 – Develop and Implement Regional Supplemental Water Program

The Watermaster budget for fiscal 1999-2000 provides funding necessary to begin the planning processes for these program elements. For Program Element 2, Watermaster's projected budget includes funds for completion of Phases 2 and 3 of the recharge master plan of $430,000 to be spent in the first three years of OBMP implementation. For Program Elements 3 and 5, the Watermaster budget contains funds to start the planning process and to define the scope of the facilities at enough detail so that agreements can be done for others to build and operate the facilities required in these program elements. Watermaster has budgeted about $650,000 for this process over the first three years of OBMP implementation. These agreements will be described in Part 2 of the OBMP report documents.

The Watermaster budget includes funds to begin the planning process for Program Element 9 – Develop and Implement Conjunctive-Use Programs. Watermaster has budgeted about $430,000 for this process over the first three years of OBMP implementation. The stakeholders envision that the cost of conjunctive use will be borne by outside interests that will store water in the Chino Basin.

OBMP PROGRESS REPORTS AND PROGRAM UPDATES

Watermaster will report progress on the OBMP in its annual report to the Court. Watermaster will formally review and update the OBMP at a frequency of five years or less.

LEGAL QUESTIONS AND ISSUES

The Judgment prescribes the process by which the Watermaster Board receives recommendations from the producers and is empowered to make decisions. To address the unresolved legal questions and issues identified below, the items will be brought to the individual pool committees for discussion and consideration. The pools in turn will develop their positions and recommendations for discussion and consideration by the Advisory Committee. The Advisory Committee will meet to discuss and consider the questions. The Advisory Committee's recommendations will be forwarded to the Watermaster Board for its consideration and implementation. Should the Watermaster Board disagree with the Advisory Committee recommendation, it has several options based on the Judgment and past practice. These options are:

If the Advisory Committee vote is equal to or greater than 80 percent:

1. Ask the Advisory Committee to reconsider the question based on a Board recommendation.

2. If the Advisory Committee does not wish to reconsider the matter, the Watermaster Board may ask the Court to consider the matter.

If the Advisory Committee vote is less than 80 percent:

1. Hold a hearing on the matter and develop written findings and conclusions.

During implementation of the OBMP, all unresolved legal questions and issues listed below will be addressed through the process described above. A schedule to address these items will be developed, and Watermaster will prepare written findings and conclusions to be submitted to the Court as part of the implementation process. This will be done regardless of the Advisory Committee vote or Watermaster findings and conclusions in an effort to more effectively keep the Court apprised of the OBMP implementation progress.

Watermaster recommends this manner of addressing legal questions and issues pursuant to the Judgment and in keeping with the Plaintiff's Post Trial Memorandum filed with the Court on July 12, 1978. At 4:13-20 in Paragraph B. 2. Watermaster Organization and Powers, of the Post Trial Memorandum it states:

> "At the same time, the Watermaster Advisory Committee was created and given broad powers to review, advise and consent to the actions of the Watermaster, subject to more detailed actions by the pool committees formed to advise, consent and administer the affairs of the several pools established under the Physical Solution. In these many provisions, there is a balance created to assure the protection of the private rights of the parties and the general public interest in the preservation of the resource. (emphasis added)."

The process described above will be used to address the legal questions and issues listed below.

- Transfers of water within and from the overlying non-agricultural pool
- Clarification and/or expansion of definitions of types of water in Judgment
- Evaluation of Judgment provisions and rules and regulations affected by the OBMP

These questions and issues will be resolved in the first three years of the OBMP implementation.

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Upper Santa Ana River Watershed

Integrated Regional Water Management Plan

November 2007

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1 Introduction

1.1 Background

In 2005, the Upper Santa Ana Water Resources Association (Association) members met and agreed to develop an Integrated Regional Water Management Plan (IRWM Plan) to address water management issues for the communities of the Upper Santa Ana River (SAR) watershed. The Association is composed of agencies in the Upper SAR watershed that share a common concern for the region's water resources. The list of Association member agencies is presented in Appendix D. San Bernardino Valley Municipal Water District (Valley District), a major regional water agency, agreed to lead the planning effort and applied for and received a grant from the California Department of Water Resources (DWR) to prepare this plan. An objective of developing the proposed IRWM Plan is to identify, define, and establish strategies to capitalize on all water management opportunities that are present today or may become available in the region in the future. With careful and thoughtful integrated planning, the participation of water managers and stakeholders, and the development of robust water management strategies and implementation tools, the region's water entities can improve their water supply reliability and self-reliance for future water supplies. Implementation of the IRWM Plan will help the fast-growing region, which is dependent upon the San Bernardino Basin and imported water from the State Water Project (SWP) to reduce its dependence on imported water, while providing reliable, good quality water for economic growth and enhancing the wellbeing of the residents of the Upper SAR region.

1.1.1 Overview of Plan Area

1.1.1.1 Santa Ana River Watershed

The SAR is the largest stream system in Southern California. It begins high in the San Bernardino Mountains where snowmelt and rainfall flow more than 100 miles southwesterly to

The Santa Ana River System originates high in the San Bernardino Mountains. (Photo by Ryan Gilmore).

discharge into the Pacific Ocean between Newport Beach and Huntington Beach. The SAR watershed covers over 2,650 square miles of urban, rural, agricultural, and forested terrain and the more populated urban areas of San Bernardino, Riverside, and Orange Counties, as well as a small portion of Los Angeles County. Figure 1-1 depicts the SAR watershed and its relationship to the IRWM Plan Area.

The IRWM Plan Area is the Upper SAR watershed and encompasses Big Bear Lake and the headwaters of the SAR until it reaches the Riverside Narrows and includes the cities and communities of San Bernardino, Yucaipa, Redlands, Beaumont, Cherry Valley, Calimesa, Highland, Rialto, Colton, Fontana, Grand Terrace, and Loma Linda. Figure 1-2 shows the region. The region covers 824 square miles, approximately 32 percent of the total SAR watershed, and is located in San Bernardino and Riverside Counties. The climate in the region is characterized by relatively hot, dry summers and cool winters with intermittent precipitation.

There are numerous tributaries that contribute flow to the main stem of the SAR in the Plan Area including Bear Creek, Keller Creek, Plunge Creek, Mill Creek, San Timoteo Creek, Yucaipa Creek and Mission Zanja Creek (tributaries to San Timoteo Creek), City Creek, East Twin Creek (a tributary to City Creek), Lytle Creek, Cajon Wash (a tributary to Lytle Creek), and Warm Creek (a tributary to Lytle Creek) (see Figure 1-2).

Figure 1-1
Santa Ana River Watershed

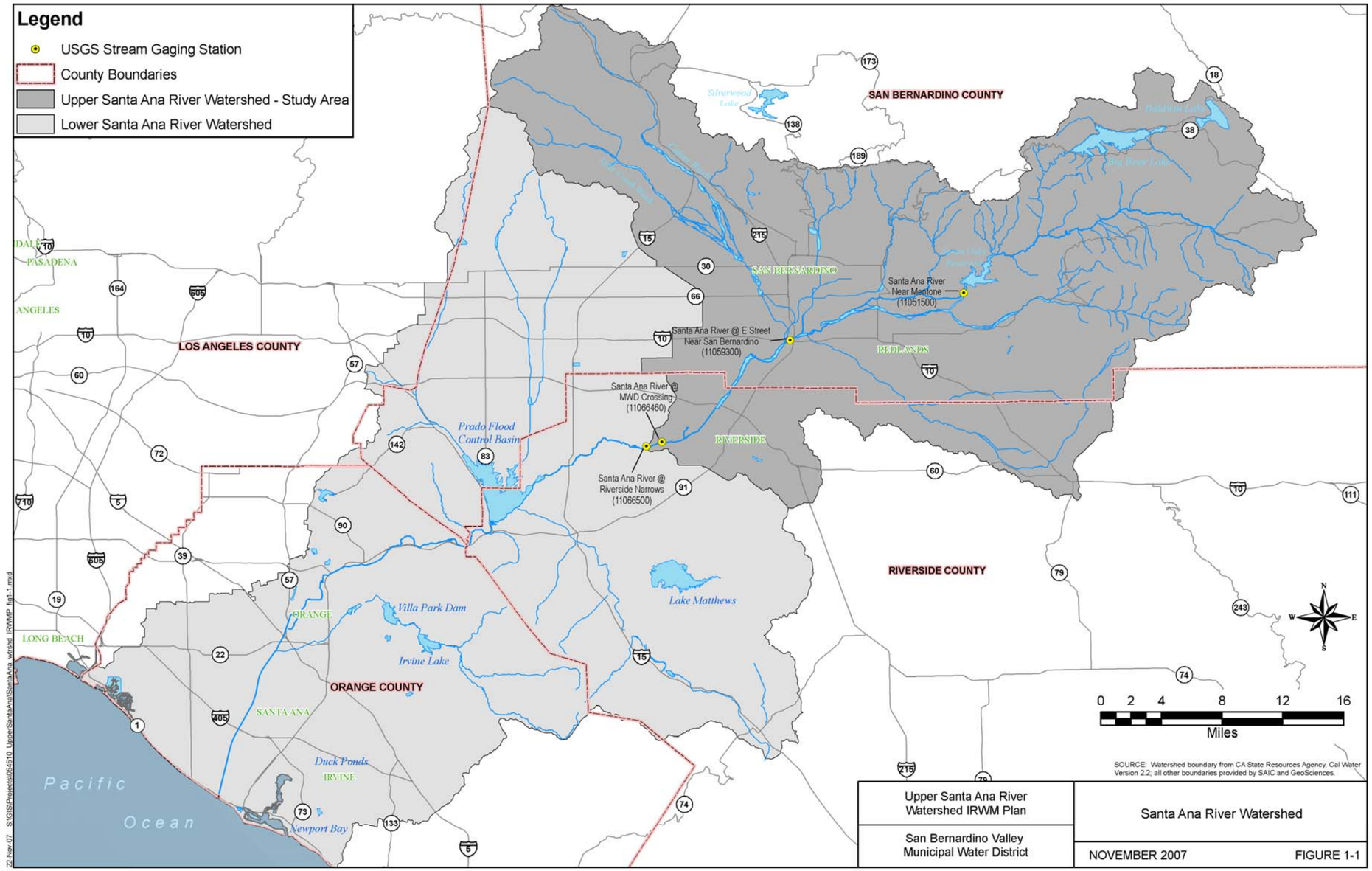
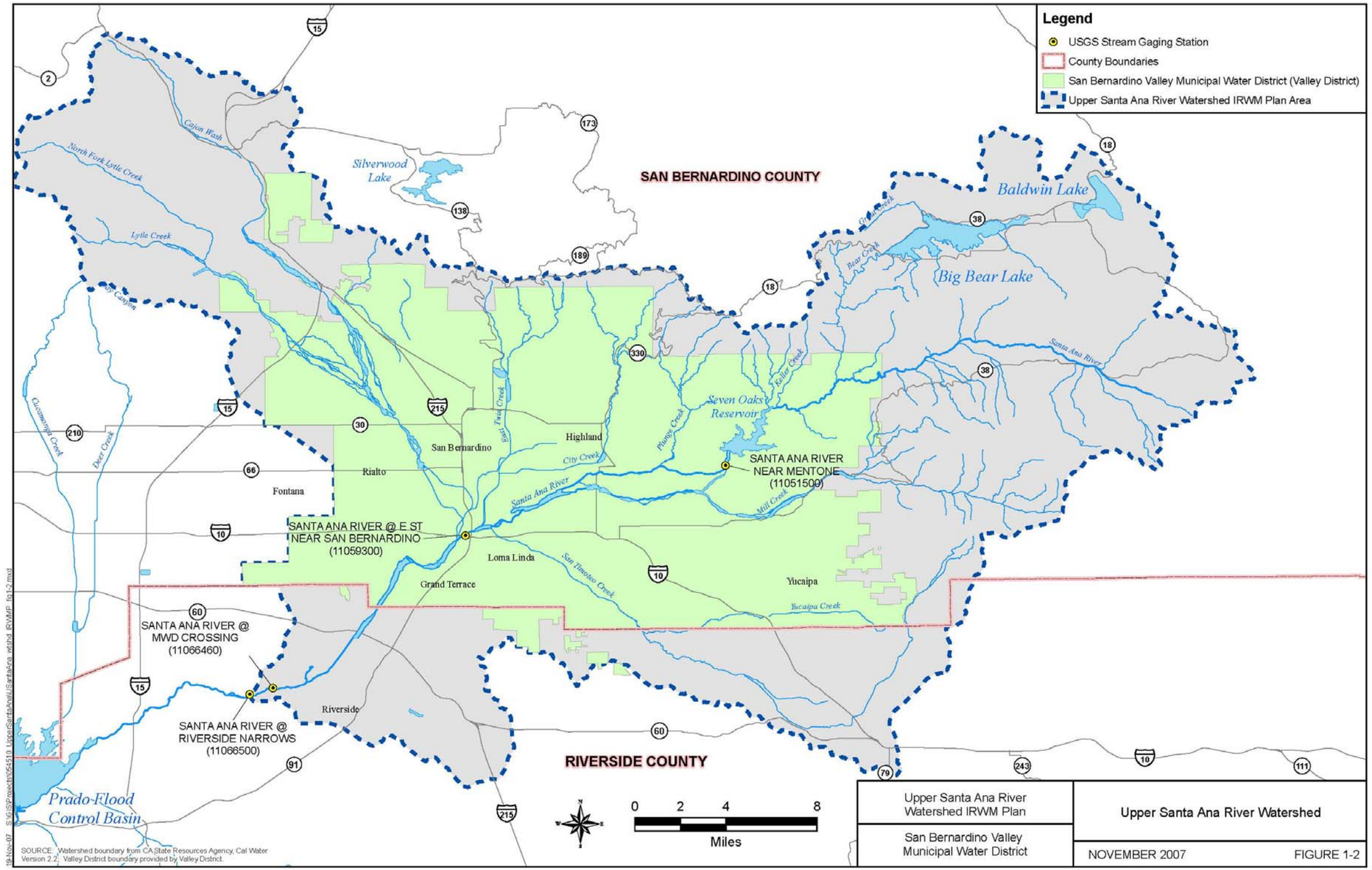


Figure 1-2
Upper Santa Ana River Watershed



1.2 Integrated Regional Water Management Plan

Management of water resources in the region takes place within a complex legal and institutional framework. Development of the IRWM Plan, a comprehensive and coordinated regional water management plan for the Upper SAR, involves the cooperation of many parties interested in water management, including water purveyors in the region. The development of an IRWM Plan is initiated by encouraging all stakeholders to participate in the planning process. The planning process includes stakeholder participation; consideration of historic plans; and compliance with institutional constraints, orders, accords, and government laws and judgments.

In 2005, nine members of the Association met and formed a Regional Water Management Group for the purpose of developing an IRWM Plan. The Regional Water Management Group is now called the Technical Advisory Group (TAG), with the regional lead agency, Valley District, coordinating development of the IRWM Plan. The TAG members actively participated in development of the IRWM Plan. Members of the TAG include:

- Valley District – Lead Agency
- City of Big Bear Lake Department of Water and Power
- City of Redlands Municipal Utilities Department
- City of Riverside Public Utilities Department
- East Valley Water District
- San Bernardino Municipal Water Department
- San Bernardino Valley Water Conservation District (SBVWCD)
- San Bernardino County Flood Control District
- San Gorgonio Pass Water Agency
- West Valley Water District
- Yucaipa Valley Water District
- Water Resource Institute, California State University, San Bernardino
- San Timoteo Watershed Management Authority (STWMA)
- Fontana Union Water Company

In the initial stages of the planning process for the IRWM Plan, the TAG identified a list of stakeholders. In general, the stakeholders for this planning process are described by four categories: (1) members of the TAG as listed above, (2) other regional stakeholders and water agencies located in the Upper SAR watershed region, (3**)** watershed-based stakeholders located in the SAR

watershed that are part of the larger integrated planning for the region discussed in the Santa Ana Watershed Project Authority (SAWPA) Plan, and (4) federal and State of California (State) agencies that were encouraged to participate throughout development of the IRWM Plan.

The TAG has encouraged local agencies to be active in the development of the IRWM Plan and to participate in the planning process. Specific steps taken by the TAG to inform and encourage stakeholders' participation are discussed below.

Early in the planning process, the TAG assembled a list of stakeholders and a letter was sent to each one informing them of the planning process and encouraging them to participate. Stakeholders were invited to participate in the TAG's bi-monthly face-to-face meetings and by conference calls. The TAG meetings focused on discussion of regional water management issues of the basin. TAG members and other participating agencies reviewed the work in progress and provided comments on the development of the plan. The agendas for the TAG meetings were posted on Valley District's website in advance so all agencies, other stakeholders, and interested parties could participate throughout the planning process in discussion of the issues in which they were interested. A copy of the draft IRWM Plan was sent to all stakeholders for review and comment.

This IRWM Plan was developed in coordination with Western, San Jacinto River Watershed Council, and SAWPA

Other Regional Water Agencies and Stakeholders

- San Bernardino County Board of Supervisors
- Riverside County Board of Supervisors
- Beaumont-Cherry Valley Water District
- Bear Valley Mutual Water Company
- Big Bear Municipal Water District
- City of Beaumont
- City of Calimesa
- City of Colton
- City of Fontana
- City of Loma Linda
- City of Rialto
- Marygold Mutual Water Company
- Muscoy Mutual Water Company
- Regents of the University of California (Regents)
- Riverside Highland Water Company
- Riverside Flood Control and Water Conservation District
- South Mesa Water Company
- Orange County Flood Control District
- Terrace Water Company
- Western Heights Mutual Water Company
- Fontana Water Company

Watershed-Based Stakeholders

- SAWPA and its member agencies (Eastern Municipal Water District, Inland Empire Utilities Agency, Orange County Water District (OCWD), Valley District, and Western Municipal Water District (Western))
- Beaumont Basin Watermaster
- Western-San Bernardino Watermaster
- California Resource Connections, Inc.

State and Federal Stakeholders

- California Department of Fish and Game
- California Department of Public Health
- California Department of Toxic Substances Control
- California Department of Water Resources
- Regional Water Quality Control Board (RWQCB)
- Southern California Edison
- State Water Resources Control Board (SWRCB)
- U.S. Army Corps of Engineers (USACE)
- U.S. Forest Service

and will become part of the SAWPA regional plan for the SAR watershed. A representative from SAWPA participated in the TAG meetings and actively engaged in the discussions. A representative from Western was also invited and attended the regular meetings of the TAG. The San Jacinto Watershed Council, although not an active participant in the TAG, has been briefed on the development of the plan and received a copy of the draft IRWM Plan for their review and comment.

1.2.1 Santa Ana Watershed Project Authority

SAWPA is a regional agency that has a major role in water resources planning in the SAR watershed. SAWPA was formed in 1968 as a planning agency and was transformed in 1972 through a change in its mission to plan and build facilities that would protect the water quality of the SAR watershed. SAWPA is a Joint Powers Authority, classified as a Special District (government agency) in which it carries out functions useful to its member agencies. SAWPA's vision is to have a sustainable SAR watershed that supports economic and environmental vitality as well as an enhanced quality of life. Its regional leadership is a model of collaboration and cooperation utilizing integrated solutions. To that extent, SAWPA has developed an IRWM Plan for the entire SAR watershed as well as a regional groundwater management plan and an urban water management plan (UWMP).

SAWPA's planning activities generally address water management and water supply reliability issues for the ever-growing population of the watershed. SAWPA works with planners, water experts, and other government agencies to identify issues and challenges of the region. To resolve the many water-related problems, SAWPA works with water planners to ensure there is enough water in the future; with regulators to ensure that the water is safe and clean; and with all other stakeholders (including the concerned public) to develop collaborative, regional solutions to the area's water needs.

SAWPA is working with its member agencies to update its IRWM Plan for the entire SAR watershed and is an active participant in the planning process for the Upper SAR Watershed IRWM Plan. The information from the Upper SAR Watershed IRWM Plan will be incorporated into SAWPA's integrated regional plan for the watershed.

1.3 Other Integrated Regional Water Management Activities in the Watershed

Integrated regional water management activities occurred in the SAR watershed as early as the 1960s. In 2002, SAWPA developed an Integrated Watershed Plan (IWP) for the Santa Ana watershed that was updated in 2005 as an IRWM Plan (IWRMP June 2005). In 2006, Western also prepared an IRWM Plan for its service area. SAWPA's IRWM Plan, Western's IRWM Plan, and the San Jacinto Watershed Component of the Santa Ana IWP are particularly related to the development of this IRWM Plan. In 2002, STWMA developed the San Timoteo Watershed Management Program (STWMA 2002). It was updated in 2005 as an IRWM Plan for the San Timoteo watershed (STWMA 2005). These plans are described below.

1.3.1 Santa Ana Watershed Project Authority IRWM Plan

Water users in the SAR watershed have worked together for decades to develop an integrated regional approach to water management for the entire watershed. In 2002, SAWPA developed a phased planning process called the *Santa Ana Integrated Watershed Plan (IWP)*. In 2005, the IWP was updated as an IRWM Plan (SAWPA Plan) to cover the entire SAR watershed. This broad planning document is the framework for water management in the watershed and is largely based upon the planning efforts of its member agencies. The SAWPA Plan is a "macro-level" plan that is consistent with DWR's California Water Plan Update (Bulletin 160) and State Water Resources Control Board's (SWRCB) Strategic Plan, Watershed Management Initiative, and the basin planning process. The SAWPA Plan builds upon local agencies' initiatives and programs and emphasizes integrated regional water management.

The IRWM Plan for the Upper SAR watershed is a complementary planning process that will be incorporated into the SAWPA Plan. "Zooming" in on a "micro-level" reveals that the Upper SAR watershed has several unique water management challenges and issues. The purpose of this planning process is to focus on these local issues and to assess water management opportunities in greater detail. This collaborative "grassroots" process will address some of the long-term water management strategies of the Upper SAR watershed and will greatly contribute to protecting and enhancing reasonable and beneficial uses of the watershed's water resources. This planning process is a part of the overall SAR water management planning process and is in agreement with past and current SAWPA regional planning initiatives.

1.3.2 Western Municipal Water District IRWM Plan, November 2006

Western's area consists of a 510-square-mile area primarily in western Riverside County with a population of over 500,000 people. Western relies on SWP and Colorado River water to augment its local water supplies. During drought years, these imported water sources will suffer from increased demands and increasingly poor water quality. Colorado River water may have salinity in excess of 800 milligrams per liter (mg/L) in dry years. Such water quality will not meet the water quality objectives of the Regional Water Quality Control Board (RWQCB) and will thus make Colorado River water unsuitable for use without desalination treatment. Western's IRWM Plan is focusing on putting water from all sources to maximum beneficial use. This includes storage of imported water, when it is available, to augment its dry year supplies.

It is the mission of Western to provide water supply, wastewater disposal, and water resource management to the public in a safe, reliable, environmentally sensitive, and financially responsible manner. Given the significant loss of water wells in the region due to water quality issues and the uncertainty of supplemental supplies flowing from the Colorado River, implementing an IRWM Plan is imperative to Western. The objectives of the plan are built on the identification of the water management issues and solutions and refinement of the plan through a consensus of appropriate stakeholders. A number of water management strategies have been considered to meet the objectives defined for Western's IRWM Plan.

Western has already started identifying and implementing regional projects that will create cleaner, more reliable water supplies and optimize the use of imported water to reduce reliance on imported water during drought periods. The projects include the recently completed Arlington desalter enhancement to provide 6,000 acre-feet of drinking water to the city of Norco; March Air Reserve Base Wastewater Treatment Plant improvement to enhance treatment capacity and improve conveyance lines to deliver reclaimed water for irrigation purposes; and the non-potable water conveyance system, which will bring 6,000 acre-feet of surplus water from the Riverside groundwater basin annually, redirecting it to beneficial uses. Western and Valley District share a long history of working cooperatively to address the imbalance between available water supplies and the demands of a growing population in the Inland Empire area of Southern California (the urbanized portions of San Bernardino and Riverside Counties). Valley District and Western sit on the Watermaster Committee for the Orange County Judgment (Orange County Water District v. City of Chino, et al., Case No. 117 628), and together make up the two-member Watermaster Committee for the Western Judgment (Western Municipal Water District of Riverside County v. East San Bernardino County Water District, Case No. 78426).

Western is a stakeholder in the Upper SAR region because of its share in managing the water resources of the Bunker Hill Basin.

1.3.3 The San Jacinto Watershed Component of the Santa Ana Integrated Watershed Plan

The San Jacinto IRWM Plan focuses on specific water management issues that address the unique and complex needs of the 732-square-mile San Jacinto watershed. The plan is a component of the Santa Ana IWP. The proposed San Jacinto Component Plan is a complementary planning effort that will build upon the work already completed by stakeholders participating in the SAWPA planning process. SAWPA's Santa Ana IWP adequately addresses management issues within the Santa Ana watershed as a whole. The San Jacinto Creek watershed component would carefully consider unique water quality, habitat, National Pollutant Discharge Elimination System (NPDES) projects, need for additional reclaimed water management, and potential impacts of total maximum daily load (TMDL) requirements that specifically affect the residents (human, avian, animal, fish, plant, or insect) of the San Jacinto Creek sub-watershed. This planning effort will address issues that are specific to the San Jacinto Creek watershed and integrate the solution strategies with the Santa Ana IWP. The sheer size of the SAR watershed and the array of water resources naturally lend themselves to a large regional solution that integrates a number of watershed issues.

Riverside County has been identified as one of the fastest growing counties in the United States. This growth caused Riverside County to revise its General Plan in 2002. Further integration of water management strategies and coordination between competing interests would benefit the watershed as a whole and would allow for more orderly development in Riverside County and overall protection of the San Jacinto watershed consistent with the proposed IRWM Plan for the San Jacinto Creek watershed.

1.3.4 The San Timoteo Watershed Management Authority IRWM Program

The STWMA was formed in January 2001 by the Beaumont-Cherry Valley Water District (BCVWD), the City of Beaumont (Beaumont), the South Mesa Water Company, and the Yucaipa Valley Water District (YVWD). The purpose of the STWMA is to prepare and implement a water resources management program for the San Timoteo watershed and the waters tributary thereto in order to conserve local water supplies, improve surface and groundwater quality and quantity, protect and enhance groundwater storage and recreational resources, preserve open space, protect wildlife habitat and wetlands, protect and enhance agriculture, and develop and enhance the region's water resources for the benefit of the public. The water resources management program is to include watershed

and basin monitoring; groundwater storage, banking, and conjunctive use; stormwater capture and management; recycled water programs and projects; wetlands, wildlife, and open space protection; water quality protection and enhancement; and water conservation and efficiency.

The STWMA formed a stakeholder group to develop a watershed-scale integrated water resources management program that will provide a safe and reliable water supply for all water users in the watershed. The San Timoteo Watershed Management Program (STWMP) was completed in March 2002 and was documented in the San Timoteo Watershed Management Program, Phase 1 Report (March 2002). The Phase 1 investigation inventoried the water resources in the STWMA service area and described the occurrence and quality of these waters. The current and future water demands of the member agencies were described based on planning information provided by the STWMA member agencies and the City of Banning (Banning). The water and recycled water master plans and the UWMPs of the agencies were reviewed to assess how STWMA member agencies and Banning were planning to meet their water demands and dispose of or reuse their recycled water. This research revealed daunting water resource management challenges and opportunities.

Currently, the proven local water supplies for the area are about 32,000 acre-feet per year and ultimate demand will be about 99,000 acre-feet per year; that is, the STWMA service area will need to develop 67,000 acre-feet per year of new supplies. The STWMP was designed to ensure that the additional 67,000 acre-feet per year of water will be there when it is needed.

The STWMP accomplishes consideration and integration of multiple management strategies through eight management initiatives or program elements that are as follows:

- Program Element 1 – Develop and Implement a Comprehensive Monitoring Program for Groundwater Level, Groundwater Quality, Production and Diversion, Subsidence, Surface Water Discharge, and Surface Water Quality. Status – developed and implemented.

- Program Element 2 – Develop and Implement a Comprehensive Surface Water Management and Recharge Program. Status – program developed with some facilities implemented.

- Program Element 3 – Develop and Implement a Regional Supplemental Water Master Plan for the STWMA Area. Status – Plan is in early development.

- Program Element 4 – Develop and Implement a Salt Management Program. Status – developed and implemented.

- Program Element 5 – Establish a Groundwater Management Entity. Status – developed and implemented.
- Program Element 6 – Develop Conjunctive-Use Programs. Status – no progress.
- Program Element 7 – Develop and Implement a Habitat and Recreation Program for the San Timoteo Creek Watershed. Status – no progress.
- Program Element 8 – Develop and Implement a Financial Plan to Enable the STWMP. Status – no progress.

The water resources management program and projects within the STWMP include improved water supply reliability, water quality protection and improvement, groundwater management, flood management, stormwater capture and management, water recycling, recreation and public access, environmental and habitat protection and improvement, wetlands enhancement and creation, and ecosystem restoration, as part of implementing the above program elements. These program elements and projects will enhance recharge of native and recycled water, maximize the direct use of recycled water, and optimize the use of imported water for direct use, recharge, and conjunctive use. The estimated cost of STWMP implementation ranges from $200 to $300 million.

STWMA updated the STWMP in 2005 to conform to the then IRWM Plan requirements. STWMA and its member agencies continue to work together and with adjacent water management entities to implement its IRWM Plan. The STWMA IRWM Plan is available for review at www.stwma.org.

1.4 Previous Related Work

1.4.1 State Water Resources Control Board Orders

In 1989 (WR 89-25) and again in 1998 (WR 98-08), the SWRCB included the SAR in its Declaration of Fully Appropriated Streams (Declaration). Per this Declaration, the river was considered fully appropriated year-round. In 1989, the California Water Code prevented the SWRCB from accepting any new applications to appropriate water from watercourses listed in the Declaration.

In 1991, Valley District submitted an application on behalf of itself and Western to appropriate up to 100,000 acre-feet annually from the SAR (First Application). At that time, the river was categorized as fully appropriated. However, in May 1995, the SWRCB adopted procedures for reviewing the fully appropriated stream status and Valley District subsequently submitted a petition to revise the Declaration (First Petition) together with the 1991 First Application.

The First Petition was followed in 1999 by a similar petition by Orange County Water District (OCWD). The SWRCB held hearings on the petitions in December 1999. Valley District provided evidence that demonstrated that urbanization, the resultant increased runoff, and increased releases of treated wastewater had increased flows in the SAR. Additionally, the operation of Seven Oaks Dam would increase the availability of water for diversion during wet years. Based on evidence in the hearing record, the SWRCB amended the Declaration in Order WR 2000–12 and allowed the water right applications submitted by Valley District and OCWD to be processed (SWRCB 2000). Order WR 2000-12 did not determine the specific amount of water available for appropriation by petitioners.

In May 2001, Valley District and Western jointly submitted a second application to appropriate another 100,000 acre-feet of water annually (Second Application) in addition to the 100,000 acre-feet per year previously requested under the First Application, along with a second petition to revise the Declaration (Second Petition). The Second Petition and Second Application were based on updated hydrologic analyses submitted during the 1999 hearings. These analyses indicated that in certain years more than 200,000 acre-feet of water is available for appropriation in the SAR. Based on the hydrologic evidence, the SWRCB issued Order WR 2002-06, which revised the Declaration pursuant to the Second Petition (and similar petitions by other parties) and accepted the following applications for processing:

- The Valley District and Western application (the Second Application) requesting a right to use a maximum of 100,000 acre-feet annually for direct delivery, recharge, or exchange;

- The Chino Basin Watermaster application requesting a right to divert 97,000 acre-feet per year to groundwater storage;
- The City of Riverside application proposing direct diversion of 75 cubic feet per second (cfs) throughout the year for a total maximum direct diversion of 41,400 acre-feet per year; and
- Four minor applications for diversions of up to 102 acre-feet annually throughout the year from the west and east forks of Cable Creek within the SAR watershed.

Order WR 2002-06 did not determine the specific amount of water available for appropriation or whether the amount of water available for appropriation is sufficient to approve the applications. As in Order WR 2000-12, prior to any potential approval of the applications, the SWRCB requires that applications meet all necessary obligations under the California Environmental Quality Act (CEQA).

1.5 Overview of Governing Laws, Judgments, and Agreements

This section briefly describes some of the governing laws, judgments, and agreements that are in place and have significant influence on water management in the region. The intent of these brief descriptions is to provide the readers a general overview of these documents. For a complete understanding of the agreements and judgments, please see the actual documents, which have been reproduced in Appendix A.

1.5.1 Integrated Regional Water Management Planning Act

In 2002, the California Legislature passed Senate Bill 1672, the Integrated Regional Water Management Planning Act, and the Governor signed it 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 Integrated Regional Water Management 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 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 IRWM Plans. In addition, they established set criteria for selection of the projects and programs to be funded under Chapter 8 of Proposition 50, the Integrated Regional Water Management 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 IRWM Plan is prepared in compliance with the Integrated Regional Water Management Planning Act and DWR and SWRCB Guidelines and the intent of the grant program.

1.5.2 Groundwater Management Planning Act

In 2002, Senate Bill 1938, Groundwater Management Planning Act of 2002, was enacted into law. This law amended AB3030, which authorizes 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 with the provisions of those adjudications and would require agreement and approval of the parties in those adjudications. The basins in the Upper Santa Ana 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 subbasin, 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 IRWM Plan is to meet the intent and requirements of Senate Bill 1938.

1.5.3 Orange County Judgment

In 1963, the 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, Western, and the Chino Basin Municipal Water District (now the Inland Empire Utilities Agency). 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 in the Upper SAR watershed to deliver a minimum quantity and quality of water to points downstream, including Riverside Narrows and Prado Dam. A provision of the Orange County Judgment related to conservation establishes that once the 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." 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, Inland Empire Utilities Agency, and Western nominate one member each to the Watermaster; OCWD nominates two members; and members are then appointed by the court.

1.5.4 Western Judgment

The Western Judgment, entered simultaneously with the Orange County Judgment, settled rights within the Upper SAR watershed in part to ensure that those resources upstream of Riverside Narrows would be sufficient to meet the flow obligations of the Orange County Judgment at Riverside Narrows. Toward this end, the Western Judgment generally provides for the following:

- A determination of safe yield of the San Bernardino Basin Area (SBBA),
- Establishment 64,872 acre-feet rights that can be extracted from the SBBA by plaintiff parties. This is equal to 27.95 percent of safe yield,
- An obligation of Valley District to replenish any extractions from SBBA by non-plaintiffs in aggregate in excess of 167,228 acre-feet(equal to 72.05 percent of safe yield),
- An obligation of Western to replenish the Colton and Riverside Basins if extractions for use in Riverside County in aggregate exceed certain specific amounts, and
- An obligation of Valley District to replenish the Colton and Riverside basins if water levels are lower than certain specific water level elevations in specified wells.

Like the Orange County Judgment, the Western Judgment identifies regional representative agencies to be responsible, on behalf of the numerous parties bound thereby, for implementing the replenishment obligations and other requirements of the judgment. The representative entities for the Western Judgment are Valley District and Western. Valley District and Western are principally responsible for providing replenishment of the groundwater basins if extractions exceed amounts specified in the judgment or as determined by the Watermaster. For the purposes of this replenishment obligation, Valley District acts on behalf of all defendants (Non-Plaintiffs) dismissed from the Western Judgment and, similarly, Western acts on behalf of the Plaintiffs and other dismissed parties within Western. Plaintiff parties with specific rights to produce 27.95 percent of the safe yield from the SBBA are the City of Riverside, Riverside Highland Water Company, Meeks & Daley Water Company, and the Regents of the University of California (Regents). The Western Judgment is administered by the two-person Western-San Bernardino Watermaster—one

person nominated each by Valley District and Western, and both appointed by the court.

Like the Orange County Judgment, the Western Judgment contemplates that the parties will undertake "new conservation," which is defined as any increase in replenishment from natural precipitation resulting from operation of works and facilities that did not exist in 1969. The Western Judgment specifies that the parties to the judgment have the right to participate in any new conservation projects and, provided their appropriate shares of costs are paid, rights under the judgment are increased by the respective shares in new conservation (72.05 percent by Valley District and 27.95 by Western).

1.5.5 The Beaumont Basin Judgment

In February 2003, the 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 pumpers. 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 acre-feet per year. 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 acre-feet. 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.

1.5.6 1961 Rialto Basin Judgment

The Rialto-Colton Basin was adjudicated in the Lytle Creek Water & 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 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 since the early 1990s.

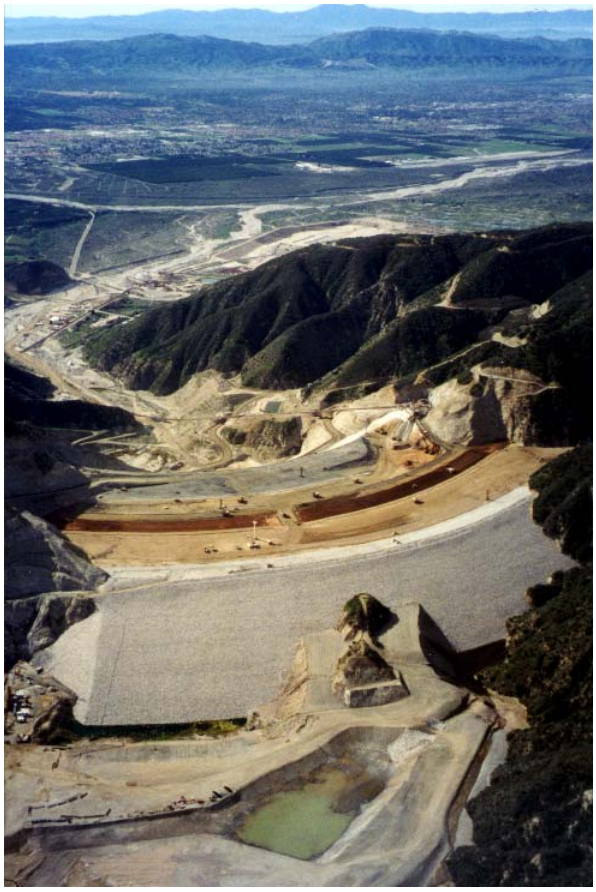
1.5.7 Cooperative Agreement to Protect Water Quality and Encourage the Conjunctive Uses of Imported Water in the Santa Ana River Basin

Water agencies within the Santa Ana River 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 RWQCB 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 RWQCB 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. A copy of this agreement is provided in Appendix A.

1.5.8 Seven Oaks Accord

On July 21, 2004, Valley District, Western, the City of Redlands, East Valley Water District, Bear Valley Mutual Water Company (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 Western 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 Western. All the parties to the Accord have agreed to support the granting of other necessary permits to allow Valley District and Western to divert water from the SAR. By



View from upstream of Seven Oaks Dam under construction

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. A copy of the Accord is shown in Appendix A.

Management of water resources in the Valley District/Western 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 SAR watershed to prepare a plan for the integrated management of the region's surface water and groundwater resources. This IRWM Plan enhances and refines the current management and planning activities within the region and develops regional water management strategies and the framework for their implementation.

1.5.9 Agreement Relating to the Diversion of Water from the Santa Ana River System Among Western Municipal Water District of Riverside County, Valley District and City of Riverside

In July 2004 a Settlement Agreement Relating to the Diversion of Water from the Santa Ana River System (the Seven Oaks Accord) was signed. The agreement requires Valley District and Western 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 of the Seven Oaks Accord are as follows:

i) 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.

ii) Thresholds of significance in terms of SAR water diverted by Valley District and Western and spreading by all parties should be observed. See Appendix I of the Accord (sidebar).

iii) The determination as to whether a certain groundwater management action will "worsen" high groundwater levels in the Pressure Zone is made through the use of the integrated surface and groundwater models.

iv) An "integrated management program" must be "adopted" within five years of the date the SWRCB grants a permit to Valley District/Western to divert water from the SAR. Valley District and Western have presented their data to the SWRCB and were told that any permit "terms" would be available in late 2007.

v) Water users agree to limit spreading to conform to an annual management plan.

1.5.10 Local Institutional Considerations

1.5.10.1 Santa Ana River-Mill Creek Cooperative Water Project Agreement

The SAR-Mill Creek Cooperative Water Project Agreement (informally known as the Exchange Plan) is an agreement among 9 agencies and water companies in eastern San Bernardino Valley executed in May 1976. The 9 parties to the Exchange Plan are as follows:

- Redlands Water Company, Bear Valley Mutual, Crafton Water Company, North Fork Water Company [East Valley Water District], Lugonia Water Company, City of Redlands, San Bernardino Water Conservation District (SBVWCD), YVWD, and the 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. Examples of exchanges that occur under the Exchange Plan include two-level exchanges, three-level exchanges, and water banking with

DWR. In a two-level exchange, two water sources are used; for example, SAR water is delivered to Mill Creek water users, and, in return, an equal amount of SWP water is delivered to SAR water users. In a three-level exchange, three sources are used. For example, Mill Creek water is delivered to the Yucaipa area, an equal amount of SAR water is then delivered to Mill Creek water users, and finally SWP water is delivered to SAR water users. To bank water within the SWP, a party entitled to local water exchanges their water when the local water is available and then takes SWP water at a later date.

1.5.10.2 Big Bear Lake Operations

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 SAR Water Quality Control 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 is now 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 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.

1.5.10.3 Settlement Agreement with San Bernardino Valley Water Conservation District

Within the settlement agreement dated August 9, 2005, Valley District, Western, and the SBVWCD have agreed to work cooperatively to develop an annual groundwater management plan. A copy of the agreement is provided in Appendix A.

1.5.10.4 Memorandum of Understanding (MOU) with the City of Riverside

In September 2005, Valley District, Western, and the City of Riverside entered into an MOU. The MOU stated that the intent of Valley District/Western 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/Western water right applications. The MOU states, “The Parties (Valley District, Western, 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 Western of imported water stored in the SBBA, and relating to storage, transport and delivery of conservation water from the Seven Oaks Dam...”

1.5.10.5 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, Central District of California, Western Division (Court), on August 18, 2004. The Consent Decree obligates 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). The

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.

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:

(1) City of San Bernardino Municipal Water Department

(2) Valley District

(3) Western Municipal Water District

(4) City of Riverside

(5) West Valley Water District

(6) East Valley Water District

(7) City of Colton

(8) 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.

1.5.10.6 Settlement Agreement between City of San Bernardino and City of Riverside and Riverside Water Company

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.

1.6 Purpose and Need for the IRWM Plan

The primary purpose of this IRWM Plan is to assist local agencies with developing tools for optimizing management and the use of the region's water resources while protecting the groundwater basins from water quality degradation and the threat of liquefaction. The implemented IRWM Plan will reduce reliance on imported water during the drought periods and optimize the use of both native and imported supplies to help meet water demands even during extended periods of below-average precipitation. Basin management objectives, an integral component of the IRWM Plan, will facilitate formulation of specific strategies and projects to meet local and regional drought-year water needs through conjunctive management, while ensuring that no particular water supply resource is jeopardized. The purpose of the plan as stated above is consistent with the intent and requirements of the Integrated Regional Water Management Planning Act and Groundwater Management Planning Act of 2002 described in Section 1.5. Below are the specific needs for developing this plan.

1.6.1 Uncertainty of Imported Water Alone to Meet Long-Term Needs

The water purveyors within the region will rely on imported water from the SWP to meet a portion of their water needs through groundwater recharge and direct deliveries into the future. Valley District's annual entitlement to SWP water is 102,600 acre-feet. Other SWP contractors in the region include SGPWA. There is uncertainty of SWP delivery capability in dry years and the expected SWP water deliveries are less than anticipated when the contracts were signed. In November 2005, DWR released the "Public Review Draft" of "The State Water Project Delivery Reliability Report 2005." This report presents water delivery capability of the SWP under various hydrologic conditions. Modeling was used to estimate the SWP water delivery capabilities. Table 1-1 summarizes the results of the SWP modeling efforts conducted for the report.

Table 1-1
SWP Dry Year Delivery as a Percentage of SWP Table A Entitlement

Study	Average 1922-94	Lowest Single-Year Delivery 1977	Lowest Two Consecutive Year Delivery 1976-77	Lowest Six Consecutive Year Delivery 1987-92
– 2005 Level of Demand	68%	4%	41%	42%
– 2030 Level of Demand	77%	5%	40%	42%
Public Draft of the State Water Project Delivery Reliability Report, 2005.				

The modeling results indicate that in a six-year dry period, SWP delivers less than half of its contractors' entitlements and in a 1977 drought-year type, SWP

can deliver only about five percent of its contractors' entitlements. Based partly on these projected SWP deliveries, the water purveyors within the region desire to improve their local and regional water supply reliability during future droughts and, therefore, have prepared this plan to manage their groundwater basins conjunctively with other sources in an effort to optimize their use.

The California Aqueduct conveys water from Northern California into the Region.

In addition, the Seven Oaks Accord calls for Valley District/Western to cooperatively develop an integrated groundwater management plan that is intended to maintain groundwater levels at a number of specified wells owned and operated by the other parties. The Accord requires that this integrated management program be adopted within five years of SWRCB approval of the Valley District/Western water right applications. This IRWM Plan will satisfy these requirements of the Accord for preparation and adoption of an integrated groundwater management plan for the SBBA.

1.6.2 Threat of Liquefaction in the Pressure Zone

Liquefaction is a form of seismically induced ground failure. In cohesionless, granular material having low relative density, such as loose sandy sediment, seismically induced vibrations can disturb the particle framework, leading to increased compaction of the material and reduction of pore space between the grains. If the sediment is saturated, water occupying the pore spaces resists this compaction and exerts pore pressure that reduces the contact stress between the sediment grains. With continued shaking, transfer of intergranular stress to pore water can generate pore pressures great enough to cause the sediment to lose its strength and change from a solid state to a liquid state, called liquefaction. This mechanical transformation can cause various kinds of ground failure at or near the ground surface.

The liquefaction process typically occurs at depths less than 50 feet below ground surface. Diminished susceptibility to liquefaction as depth increases is caused by an increase in overburden pressure and induration of sedimentary deposits. The depth to groundwater and distance to the causative fault affect the relative susceptibility to liquefaction. Much of the San Bernardino Valley is located in an area of liquefaction susceptibility. The most likely scenario for significant liquefaction to occur in the San Bernardino Valley would be as a

result of an earthquake on the adjacent San Andreas, San Jacinto, or Cucamonga faults (Matti and Carson 1991).

The main zones of elevated liquefaction susceptibility within the San Bernardino Valley are associated with shallow groundwater that occurs under the modern floodplains of Cajon Creek, Warm Creek, and the SAR. Recently deposited Holocene sediments that would be expected to have lower penetration resistance and higher susceptibility than older sediments underlie these areas. However, even the older Holocene and uppermost Pleistocene sediments have elevated susceptibilities comparable to those in the younger deposits. This fact accounts for zones of high and moderately high susceptibility that extend away from the modern floodplains and into adjacent areas underlain by older deposits (Matti and Carson 1991).

In the southern part of the SBBA, on the northeast side of the San Jacinto fault, there are approximately 1,200 feet of unconsolidated and partly consolidated water-bearing deposits. In the area between Warm Creek and the SAR, the upper confining member of this aquifer acts to restrict vertical flow, causing semi-confined conditions in the upper 50 to 100 feet of saturated materials (Dutcher and Garrett 1963). This area is considered the Pressure Zone of the SBBA and is also referred to as the Area of Historic High Groundwater. Historically, this scenario resulted in perched, very shallow groundwater conditions, at times rising to ground surface level, which increased the potential for liquefaction and locally flooded buildings in the City of San Bernardino. Groundwater pumping since the early 1900s increased the minimum depth to groundwater in this area to 50 feet by the 1960s but, during the 1970s and 1980s, groundwater was locally within 10 feet of the ground surface beneath the City of San Bernardino (CDMG 1976, Matti and Carson 1991).

In the past, groundwater levels in the Pressure Zone rose high enough under these semi-confined conditions to cause rising water and increase the potential for liquefaction. High groundwater levels in this area have damaged building foundations, flooded basements and utility structures, and increased the potential for liquefaction in this seismically active region. The Pressure Zone is located wholly within the City of San Bernardino. In the 1930s and 1940s, some wells in the Pressure Zone flowed artesian as shown below. Over the long-term, however, groundwater levels in the Pressure Zone are dropping with the depth to groundwater increasing.

The San Bernardino Basin area has unusually high groundwater levels in its history. This photo shows an artesian well.

High groundwater in the Pressure Zone is further aggravated by the direction of groundwater flow in the Bunker Hill Basin, which is generally in a southwesterly direction from the San Bernardino Mountains to the San Jacinto fault. The fault zone generally runs perpendicular to the groundwater flow and acts as a barrier, or partial barrier, causing the groundwater to "dam up" behind the fault and rise upward toward the land surface.

An objective of this IRWM Plan is to develop tools that might be used by water agencies to manage the groundwater levels in the Pressure Zone to reduce the risk of liquefaction in the area. Specific BMOs will be developed to manage the basin in order to reduce the associated risks.

1.7 IRWM Plan Planning Process

As the lead agency, Valley District facilitates meetings and coordinates preparation of the draft and final IRWM Plan. The district is organizing meetings and facilitating exchange and sharing of data and information among its members. Valley District has also signed a contract with DWR to receive a grant for preparation of the IRWM Plan and to provide contract administrative functions. Members of the Association who participate in the planning process and develop the IRWM Plan represent their respective agencies and provide comments on the planning process, studies, and the draft IRWM Plan. They also provide status reports to their agency boards. The final IRWM Plan will be presented to each agency's governing board or council for adoption.

1.7.1 Technical Advisory Group Member Agencies

In 2005, the TAG was formed to act as the "Regional Management Group" for preparing the IRWM Plan. The TAG consists of 14 members (see Section 1.2). Descriptions of each of the member agencies participating in the IRWM Plan preparation and their water management activities in the region are provided in Section 1.8.

1.7.2 Public Participation

The TAG developed and implemented the public involvement process to ensure that the public was also informed about the development of the IRWM Plan. This process included regularly scheduled meetings of the TAG throughout the IRWM Plan process that allowed the public recurring opportunities to provide its input. The public was given the opportunity to participate in the planning process in the following ways:

- Attending public meetings of the TAG. TAG meetings were designed to be public meetings. Notice was given in local publications about the meetings and how to get timely and up-to-date information about the planning process.

- Availability of the public draft of the plan was announced in local newspapers. The draft plan was made available to the public for review and comment. Comments were reviewed by the TAG and were incorporated as appropriate.

- The public was invited to provide written comments to Valley District throughout the planning process.

- The public was invited to attend all of the public hearings conducted during the planning process. Notice of these hearings was published in

two local newspapers prior to the scheduled meeting time. Each hearing notice included an agenda and the time and location of the hearing. Members of the TAG were at the hearings to answer questions, solicit input, and increase public awareness of the proposed IRWM Plan. Proof of Publication for each hearing can be found in Appendix D. Meeting minutes and board resolutions relating to the IRWM Plan development and adoption process are also included in Appendix D.

- The TAG held four public hearings, as follows:

  1. On May 9, 2005, Valley District, as the lead agency, conducted a public hearing to brief the public of its intent to act as the lead agency on behalf of the Association for purposes of submitting applications and entering into an agreement(s) to receive a planning grant and/or an implementation grant pursuant to the Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002, Water Code Section 79560 *et seq.*, (Proposition 50).

  2. On March 15, 2006, Valley District, as lead agency, held a public hearing and adopted a resolution of intent to prepare an IRWM Plan.

  3. On April 5, 2006, Valley District, acting as the lead agency, held a public hearing (after publication of a notice that included the schedule and location of the hearing) to inform the public of its adoption of a resolution of intent to prepare an IRWM Plan. The focus of the meeting was to brief the public and interested parties about the planning process, schedule, content, and how the public could provide input in developing the water management plan. Interested parties and the general public were encouraged to attend the hearing and provide comments to Valley District. At this hearing, the lead agency also described the manner in which interested parties could participate in developing the IRWM Plan.

  4. In December 2007, Valley District, acting as the lead agency, will hold a public hearing after publishing a notice of intent to hold a hearing to receive comments on the public draft of the IRWM Plan and the intent to adopt the plan. The notice will include a summary of the plan and state the means of providing copies of the plan to interested parties. Member agencies of the TAG will participate in this hearing.

- Each agency who participated in the TAG published a notice informing the public of its intention to participate in the planning process and held a public meeting to determine whether to adopt a resolution to engage in preparation of the agency's IRWM Plan, as documented in Appendix D.

- Throughout the development of the IRWM Plan, members of the TAG presented quarterly, or more frequent, status updates to their governing boards or board subcommittees at regularly scheduled meetings. These public meetings included a posted agenda item for the IRWM Plan. The public was encouraged to participate in these meetings.

- The governing bodies of the participating agencies scheduled a discussion of the draft plan in their regular meetings, provided information to the public regarding the content of the draft plan, and received comments prior to adopting the IRWM Plan. The TAG also coordinated the development of the IRWM Plan with SWRCB and DWR. The final IRWM Plan will be submitted to DWR and SWRCB, pursuant to the guidelines.

- The San Bernardino Valley Municipal Water District Advisory Commission on Water Policy (Advisory Commission) has been established to advise Valley District on water policy issues within its service area. The water purveyors and governmental entities in Valley District's service area have representatives on the Advisory Commission. During the preparation of the IRWM Plan, the Advisory Commission met on a regular basis, and the staff and consulting team briefed the Advisory Commission on development of the IRWM Plan. The Advisory Commission members showed a great level of interest in development of the IRWM Plan and provided guidance on the issues. The public was invited to these meetings and participated in the discussions.

SBVMWD Advisory Commission on Water Mission Statement

"It shall be the function of the Commission to study and make recommendations to the Board of Directors on matters of water policy for the District. The Commission shall study such matters of water policy as are submitted to it by the Board for Consideration and may study such other matters of water policy as the Commission deems appropriate." SBVMWD Ordinance No. 61, July 6, 1987.

- The Advisory Commission held a public meeting on October 18, 2007, to receive public comments on the Draft IRWM Plan.

In summary, the Advisory Commission and the TAG encouraged public participation in preparation of the IRWM Plan to ensure the public's comments were considered in decisions about water management in the region.

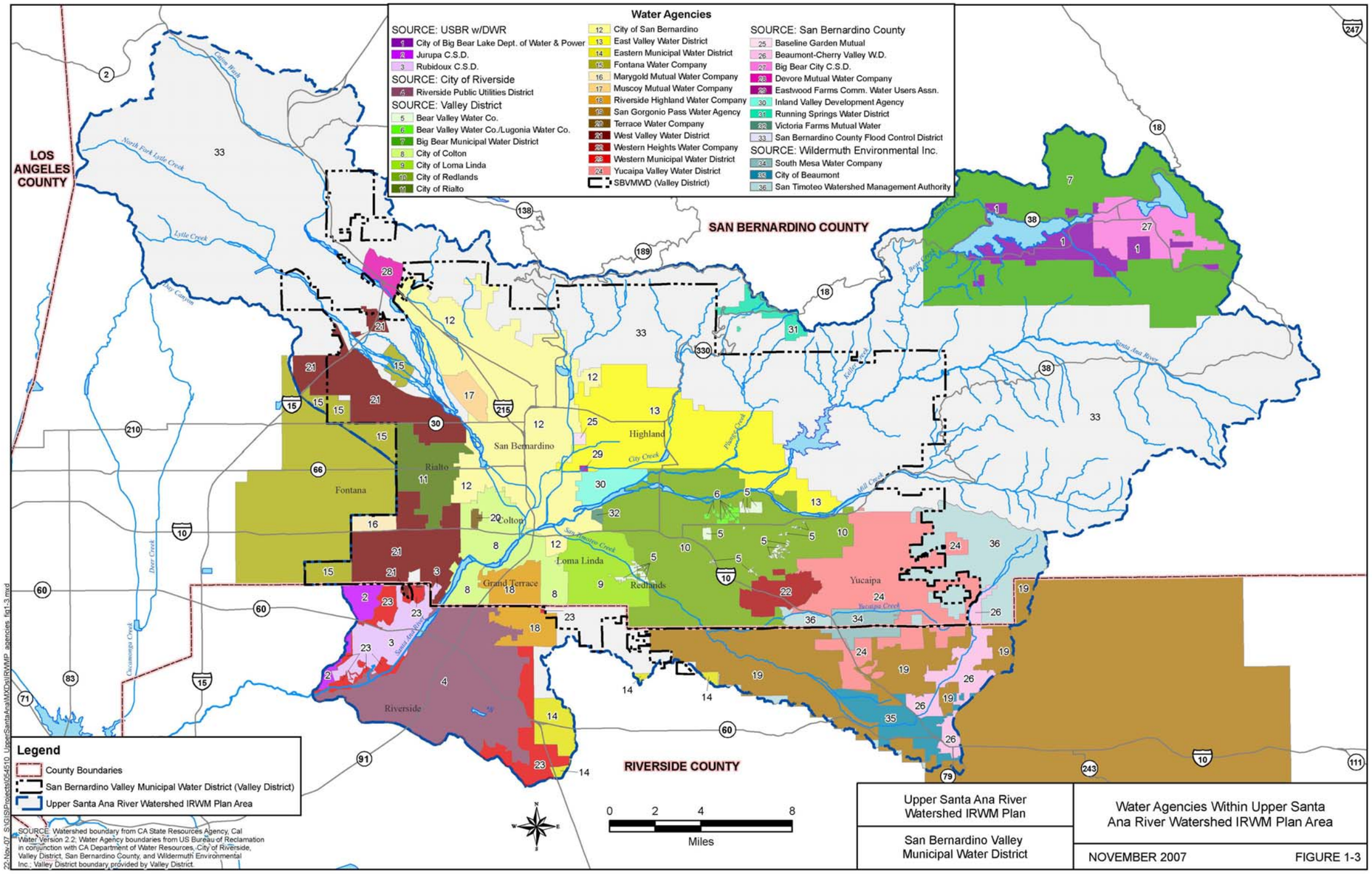
1.7.3 Dispute Resolution Process

The TAG was effectively used as a tool for the resolution of water management issues in the basin. Discussion of issues in the TAG meetings, an open and transparent process, resulted in a cooperative relationship between water users of the basin. The management process for the SBBA involves the creation of the Basin Technical Advisory Committee (BTAC). It is anticipated that the BTAC will provide a forum for discussion and early resolution of water issues in the region. If the dispute cannot be resolved at this level, it will be elevated to the policy level (Advisory Commission, Board of Directors, City Councils, etc.).

1.8 Water Agencies in the Region

Numerous agencies provide water services to communities within the IRWM Plan Area. Figure 1-3 shows the boundaries of water agencies within the region. A brief description of each member of the TAG as well as other water purveyors in the region is presented below.

Figure 1-3
Water Agencies in the Region



1.8.1 San Bernardino Valley Municipal District

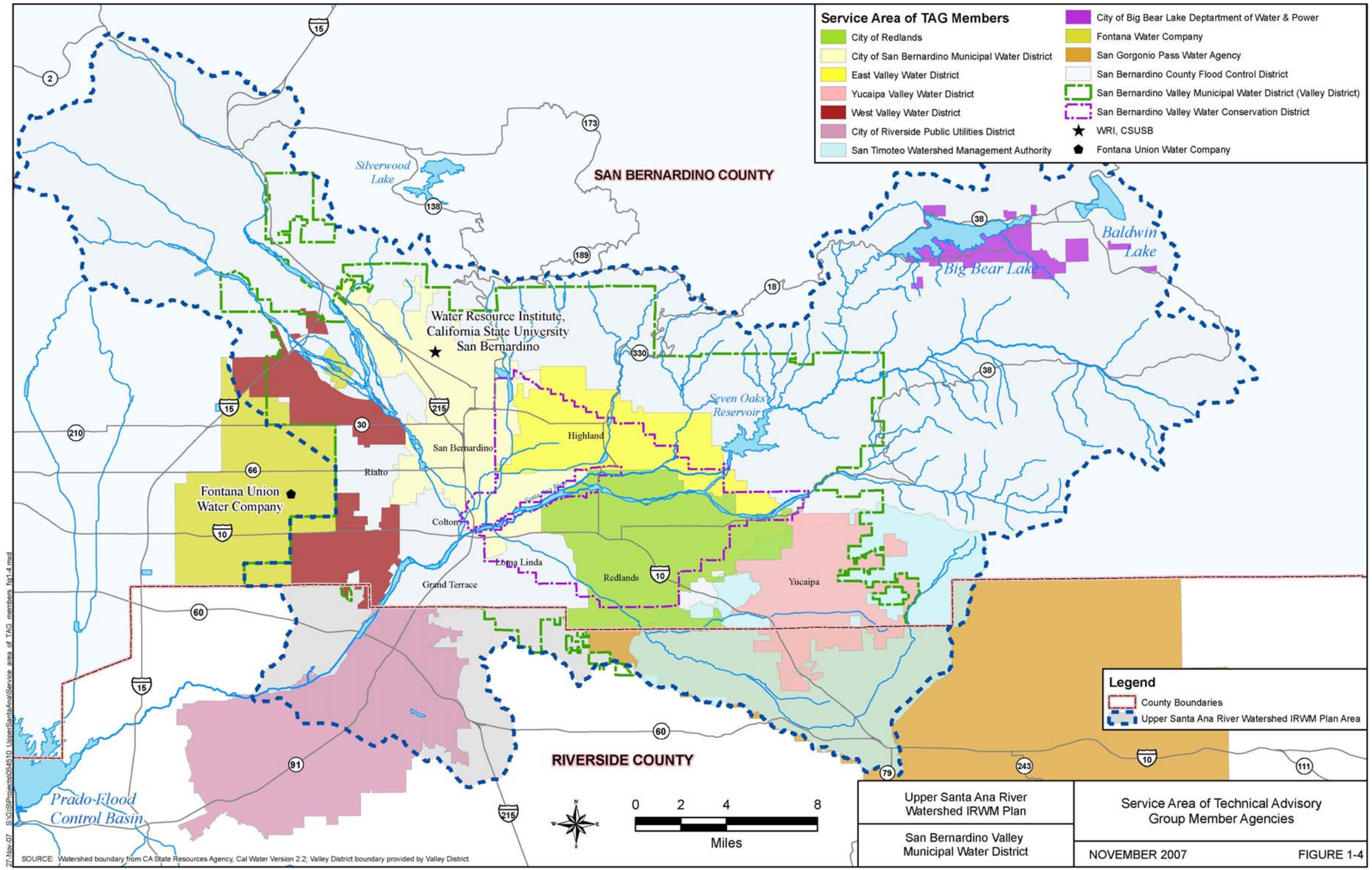
Valley District was formed in 1954, under the Municipal Water District Act of 1911 (California Water Code Section 71000 et seq.) as a regional agency to plan a long-range water supply for the San Bernardino Valley. It imports water into its service area through participation in the SWP and manages groundwater storage within its boundaries. Its enabling act includes a broad range of powers to provide water, wastewater and stormwater disposal, recreation, and fire protection services. Valley District does not deliver water directly to retail water customers.

Valley District covers about 325 square miles mainly in southwestern San Bernardino County, about 60 miles east of Los Angeles, and has a population of about 600,000. It spans the eastern two-thirds of the San Bernardino Valley, the Crafton Hills, and a portion of the Yucaipa Valley and includes the cities and communities of San Bernardino, Colton, Loma Linda, Redlands, Rialto, Fontana, Bloomington, Highland, East Highland, Grand Terrace, Mentone, and Yucaipa. A map illustrating Valley District's service area and the locations of other members of the TAG are shown in Figure 1-4.

Valley District is responsible for long-range water supply management, including importing supplemental water, and is responsible for most of the groundwater basins within its boundaries and for groundwater extraction over the amount specified in the aforementioned judgments. It has specific responsibilities for monitoring groundwater supplies in the San Bernardino and Rialto-Colton Subbasin and maintaining flows at the Riverside Narrows on the SAR. It fulfills its responsibilities in a variety of ways, including importing water through the SWP for direct delivery and groundwater recharge and coordinating water deliveries to retail agencies throughout its service area.

Valley District cooperates in a program to help replenish groundwater, using both SWP water and local runoff. It takes delivery of SWP water at the Devil Canyon Power Plant Afterbay, which is located just within its northern boundary. Water is conveyed 17 miles eastward to various spreading grounds and agricultural and wholesale domestic delivery points in the San Bernardino Basin. Water is also conveyed westward for direct delivery in the Colton-Rialto Subbasin.

Figure 1-4
Service Area of Technical Advisory Group Member Agencies



In the 1960s, the over-commitment of water in the SAR watershed led to lawsuits between water users in the upper and lower watersheds regarding the use of both surface flows and groundwater. The lawsuits culminated in 1969 in the Orange County and Western Judgments as they were previously described. Under the terms of the settlements, Valley District became responsible for providing a specified SAR base flow to Orange County and maintaining the safe yield of the SBBA. If the conditions of either judgment are not met by the natural water supply, including new conservation, Valley District is required to deliver supplemental water to offset the deficiency. The judgments resolved the major water rights issues that had prevented the development of long-term, region-wide water supply plans and established specific objectives for the management of the groundwater basins.

Valley District is legally required to maintain a flow equivalent to approximately 15,250 acre-feet per year at the Riverside Narrows on the SAR. This requirement is currently met with about 25,000 acre-feet per year of treated wastewater from the Cities of San Bernardino, Colton, and Rialto that is discharged to the SAR. Valley District has contracts with the Cities of San Bernardino and Colton that obligate a portion of their treated wastewater flows to meet this requirement. As a result of this discharge and normal streamflow in the SAR, Valley District has never had to use imported water to augment flows in the SAR. In addition, under terms of the adjudication, as of the end of the 2003-2004 water year, Valley District had 275,423 acre-feet in credit for flows in excess of requirements during prior years. It could, if needed, use these water credits to meet this part of its legal obligation during dry years, subject to a minimum annual flow of 12,420 acre-feet at the Riverside Narrows.

In March 2006, Valley District and DWR entered into an agreement and signed a contract to receive funding for the preparation of the IRWM Plan. Valley District, as the regional lead agency, is responsible for the IRWM Plan completion.

1.8.2 San Bernardino Valley Water Conservation District

The mission of the SBVWCD is to ensure that recharge of the Bunker Hill groundwater basin is accomplished in an environmentally and economically responsible way using local native surface water to the maximum extent practicable.

The SBVWCD and its predecessors have conducted water conservation (groundwater recharge) activities since 1912 or earlier in two areas that overlie the Bunker Hill groundwater basin in the San Bernardino Valley. These areas are at the upper end of the SAR wash area and on Mill Creek just upstream of the confluence with the SAR (collectively, the wash area). The SBVWCD diverts

surface water flows during both storm and normal runoff from the SAR and Mill Creek and channels the flows into two separate systems of recharge basins where it percolates into the groundwater basin for later pumping and use by local entities and private producers.

The SBVWCD's boundaries encompass more than 78.1 square miles and include portions of the communities of San Bernardino, Loma Linda, Redlands, and Highland, as well as the unincorporated county area of Mentone and various county "islands" within the incorporated cities.

1.8.3 City of Redlands

For more than 90 years, the City of Redlands has been providing high-quality drinking water to the Redlands and Mentone areas. Currently, the city has 21,000 water service connections. The city completed and adopted an UWMP in 2005.

More than 75,000 residents in Redlands, Mentone, parts of Crafton Hills and San Timoteo Canyon, and a small part of San Bernardino depend on the Redlands Municipal Utilities Department to provide water service to their homes and businesses. By supplying a blend of local groundwater, local surface water, and water imported from the SWP, the Redlands Municipal Utilities Department meets its customers' daily demands, which average 25 million gallons per day and peak at 48 million gallons per day.

The city also owns and operates a sewer collection system and a six million-gallon-per-day water reclamation plant that produces water for use at the Southern California Edison Mountainview Power Plant and by other irrigation users.

1.8.4 West Valley Water District

West Valley Water District (West Valley) is located mainly within southwestern San Bernardino County and to a lesser amount within northern Riverside County. It is part of the greater San Bernardino-Riverside-Ontario metropolitan area. It is situated in the San Bernardino Valley and within the SAR watershed.

The principal service area of West Valley is approximately 29.5 square miles, with an additional 5.2 square miles within its sphere of influence. The majority of its service area lies within Valley District's boundaries. West Valley currently has 18,000 water service connections. West Valley completed and adopted an UWMP in 2005.

1.8.5 East Valley Water District

East Valley Water District is a special district formed in 1954 through an election by local residents who wanted water service by a public water agency. Originally called the East San Bernardino County Water District, it was formed to provide domestic water service to the then unincorporated and agriculturally based communities of Highland and East Highland. Later, as the population increased, the need for a modern sewer system to replace the septic tanks became apparent. The residents voted to give East Valley Water District the responsibility for their sewer system, as they had done earlier with their water service.

Over the years, some of the service area was annexed to the City of San Bernardino, but water service remained with the district, primarily due to logistics and cost. In 1987, the City of Highland incorporated. Now, the district's previously agriculture-dominated area is urbanized, and few orange groves remain. Before September 2000, the service area was approximately 28.5 square miles. An annexation in September 2000 increased the service area by approximately five square miles and includes the Greenspot area. The district services approximately 65,000 persons. All services are financed solely by rates; customers pay only for the benefits and services they receive. The district currently has 21,827 water service connections.

The forefathers of the East Valley Water District, anticipating a higher demand and a larger customer base, obtained water rights that date back over 100 years for the use of surface water from the SAR. Today, this surface water meets one-quarter of the district's water needs. The district completed and adopted an Urban Water Management Plan in 2005.

1.8.6 San Bernardino Municipal Water Department

SBMWD meets its customers' needs by providing high-quality service in water supply, water reclamation, and geothermal heating.

SBMWD produces all of its own water, using 60 wells located in 45 square miles of water service area and delivering it to more than 40,000 service connections through 551 miles of water mains. The City of San Bernardino reclaims over 30 million gallons of water each day, using innovative and cost-effective methods to make the reclaimed water safe for the environment and for reuse. The city completed and adopted an UWMP in 2005.

1.8.7 Yucaipa Valley Water District

YVWD is a special district that provides water supply, treatment, and distribution; recycled water supply and distribution services; and wastewater

collection and treatment. Formed in 1971, it acquired many of the private water companies serving the Yucaipa Valley. Its most recent consolidations of water services occurred with the acquisition of the Harry V. Slack Water Company in 1987 and the Wildwood Canyon Mutual Water Company in 1992. YVWD currently satisfies the majority of its water demands from groundwater supplied through district-owned wells located throughout the service area. An extensive distribution system provides water storage and transmission throughout YVWD's 18 pressure zones. The only supply of surface water is provided through the Oak Glen Water Filtration Plant. Additional water sources that are expected to be available to the district in the near future include imported water through the SWP and recycled water from its wastewater treatment plant. The district completed and adopted an UWMP in 2005.

1.8.8 City of Riverside

The City of Riverside Public Utilities (RPU) Department provides potable water, non-potable water, recycled water, and electricity to the City of Riverside and was established in 1895 (electricity) and 1913 (water). The City of Riverside currently serves water to a population of 287,800 through 62,985 service connections within an area of 73.9 square miles. RPU is committed to providing the highest quality water and electric services at the lowest possible rates to benefit the community. RPU completed and adopted a Water Supply Plan in 2004 and an UWMP in 2005.

RPU produced 79,275 acre-feet of water between July 2005 and June 2006. As of 2005, RPU's annual water export rights in Bunker Hill basin were about 52,033 acre-feet. Export rights may increase with acquisition of additional rights in mutual water companies. RPU produces water from other basins – Rialto-Colton, Riverside North, and Riverside South. Annual total water demand is expected to increase from 77,767 acre-feet in 2005 to an estimated 104,374 acre-feet by 2030. RPU plans to develop additional water resources to meet future growth in demand. By 2030, available and planned water resources to meet demand would total about 116,421 acre-feet per year.

1.8.9 Water Resources Institute /California State University, San Bernardino

The Water Resources Institute /California State University San Bernardino (WRI-CSUSB) was established by the faculty senate in 1999. The senate and the university administration recognized that water is one of the most precious resources in its service area (San Bernardino and Riverside Counties) and set out to make water an area of distinction at this campus.

The WRI-CSUSB operates an extensive water resource archive that includes maps; aerial photographs; newspaper articles; water and environmental reference

books; and federal, State, and local government documents, studies, and reports. This archive is gradually being digitized to make it more accessible to users. It also includes water and environmental data and metadata, thus expanding the concept of an archive beyond the original concept of hard copies of old documents.

The WRI-CSUSB is an interdisciplinary center for research, policy analysis, and education. The full-time staff is engaged in a variety of partnerships providing technical assistance to public and private water stakeholders. The WRI-CSUSB specializes in integrated watershed projects promoting land use practices that minimize the impact of development on watershed functions. The WRI-CSUSB manages the Alluvial Fan Task Force for DWR by working with stakeholders in the watershed on resource-efficient guidelines for developing on alluvial fan floodplains. The WRI-CSUSB assists the Local Government Commission with presenting the Ahwahnee Water Principles for Resource Efficient Land Use to elected officials and developers on the connection between land use and water. The WRI-CSUSB partners with California Resources Connection, Inc. on the Inland Empire Sustainable Watershed Program developing Green Building Practices and Model Ordinances to overcome obstacles in resource-efficient land use.

1.8.10 San Bernardino County Flood Control District

The San Bernardino County Flood Control District (SBCFCD) was formed as a special district in April 1939 after the 1938 floods in the County of San Bernardino. The SBCFCD's functions include flood protection from major streams, flood control planning, storm drain management, debris removal programs, right-of-way acquisition, flood hazard investigations, and flood operations. The SBCFCD has numerous Master Plans of Drainage (MPD) for various areas within the county. An MPD is a coordinated plan of flood control improvements for an area based on its future planned development. It identifies existing flood control facilities that are inadequate to convey the 100-year peak storm flows, including needed improvements to existing facilities and new facilities that need to be constructed to provide an adequate level of flood protection. Since its inception, the SBCFCD has worked with United States Army Corps of Engineers (USACE) to develop federally funded major flood control facilities in the county. It manages its activities through six physical flood control zones. The budget projections are also determined for each zone through an annual budget study with most of the zones also having a 10-year plan. SBCFCD is also participating with Inland Empire Utilities Agency and Chino Basin Water Conservation District on the Chino Basin Recharge Improvement Project.

1.8.11 San Gorgonio Pass Water Agency

The San Gorgonio Pass Water Agency (SGPWA) was established in 1961 by the California State Legislature. Its boundaries extend through the cities of Calimesa, Beaumont, and Banning, and the Riverside County areas from Cherry Valley to Cabazon. The service area includes the incorporated cities of Calimesa, Beaumont, and Banning, and the communities of Cherry Valley, Cabazon, and the Banning Bench.

SGPWA, one of 29 State Water Contractors, purchases water from the State of California and sells it to local retail water agencies. Water is imported into the service area by the California Aqueduct. The final link of the SWP to the Pass region, the East Branch Extension, was completed in 2003. Phase 2 of the East Branch Extension is expected to be completed by 2011. Phase 2 will bring the capacity of the Extension to 17,300 acre-feet, which is the Agency's official allotment of SWP water. 17,300 acre-feet of water is enough to supply approximately 35,000 families each year.

SGPWA operates the Little San Gorgonio Creek Recharge Facility on Orchard Street in Cherry Valley. The facility includes six ponds in which SWP water is placed to percolate into the ground to recharge the Beaumont groundwater basin. The facility was partially funded by a Prop 13 grant from the State and SAWPA. SWP water is pumped to the facility via the East Branch Extension. The Cherry Valley Pump Station, located at the corner of Orchard Street and Taylor Street, is the terminal pump station on the Extension.

1.8.12 City of Big Bear Lake Department of Water and Power

The City of Big Bear Lake Department of Water and Power (BBLDWP) is nestled in the San Bernardino Mountains at approximately 6,750 feet above sea level. With more than 15,000 customers, BBLDWP is dedicated to providing the City of Big Bear Lake, Moonridge, Fawnskin, Sugarloaf, Lake William, and portions of Erwin Lake and Rimforest with a safe, reliable source of water for public health and safety.

BBLDWP's water supplies come from snow and rain that percolates into the groundwater basin. As of 2006, the BBLDWP service area is in its sixth year of drought and water efficiency is more important than ever for meeting water demands of the service area. BBLDWP does not use lake water for public health and safety and no additional water is imported into the Big Bear Valley.

Key components of the water system include adequate source capacity (wells) and storage capacity (reservoirs) to meet peak holiday and weekend demands; replacement of old, leaky, undersized steel mainlines to provide adequate fire

flow; and ongoing/recurring rehabilitation of older system components (buildings, reservoirs, pumps, motors, etc.) to ensure reliable service.

BBLDWP maintains 50 wells, 13 booster stations, 17 reservoirs, 16 chlorination stations, 20 sample stations, approximately 170 miles of water main pipeline, and a complex pressure-reducing network.

BBLDWP has an aggressive water conservation program that has significantly reduced summertime consumption over the past several years. Community outreach programs keep customers informed on current water conditions, and the Technical Review Team monitors, evaluates, and analyzes well and water consumption data on a continual basis. BBLDWP's five-member Board of Commissioners is appointed by the City of Big Bear Lake's City Council and is made up of policy makers committed to safeguarding its water resources. BBLDWP is dedicated to fiscal responsibility while focusing its resources on improving the infrastructure and ensuring that the current and future water needs of the community are met. BBLDWP prepared an UWMP that was adopted in April 2006.

1.8.13 Fontana Union Water Company

Fontana Union Water Company (Fontana Union) is a mutual water company and does not directly deliver water to domestic customers. Fontana Union has long-standing adjudicated vested rights to Lytle Creek surface and subsurface flows and Lytle Creek Basin groundwater, as well as groundwater rights in Rialto Basin and "No Man's Land." It delivers its available water to its shareholders in accordance with its Articles of Incorporation, Bylaws, and mutual water company law. Fontana Union is 97 percent owned by Cucamonga Valley Water District and San Gabriel Valley Water Company. Fontana Water Company, a division of San Gabriel Valley Water Company, diverts and produces water pursuant to its rights as Fontana Union's agent in accordance with a court-approved agreement. Under that court-approved agreement, Fontana Union allocates its Chino Basin pumping rights to Cucamonga Valley Water District, and Cucamonga also retains the option of taking delivery of its share of Fontana Union's other water sources.

1.8.14 San Timoteo Watershed Management Authority

STWMA was formed in January 2001 by BCVWD, Beaumont, the South Mesa Water Company, and the YVWD. The purpose of the STWMA is to prepare and implement a water resources management program for the San Timoteo watershed and the waters tributary thereto in order to conserve local water supplies, improve surface and groundwater quality and quantity, protect and enhance groundwater storage and recreational resources, preserve open space, protect wildlife habitat and wetlands, protect and enhance agriculture, and

develop and enhance the region's water resources for the benefit of the public. The water resources management program is to include watershed and basin monitoring; groundwater storage, banking and conjunctive use; stormwater capture and management; recycled water programs and projects; wetlands, wildlife, and open space protection; water quality protection and enhancement; and water conservation and efficiency.

1.8.15 Bear Valley Mutual Water Company

Bear Valley Mutual was formed in 1903 by the citrus growers of the Redlands/Highland area to give them a dependable water supply under their control. Bear Valley Mutual has pre-1914 water rights to the first 88 cfs of surface flow of the SAR. Bear Valley Mutual has appropriative rights on Bear Creek and a storage right in Big Bear Lake, as well as ownership of all the water inflow to the lake.

1.8.16 Beaumont-Cherry Valley Water District

BCVWD was formed in 1919 under the Wright Act of 1897 (Water Code Section 20000,et seq.) The District serves approximately eight square miles located in Riverside and San Bernardino Counties. BCVWD owns approximately 2,800 acres along Little San Gorgonio and Noble Creeks and holds pre-1914 water rights to both streams, which amounts to 3,000 miner's inches of water (approximately 45,000 acre-feet of right). The District has 20 wells in the Beaumont and Edgar Canyon Basins and currently serves about 30,000 consumers through 9,000 metered connections.

1.8.17 Big Bear Municipal Water District

Big Bear Municipal was formed in 1964 by the people of Big Bear Valley with the express purpose of stabilizing the level of Big Bear Lake. In January 1977, as a result of a stipulated judgment, Big Bear Municipal purchased title to the dam, reservoir lands lying beneath the lake, and the surface recreation rights to Big Bear Lake. As discussed above, Bear Valley Mutual has ownership rights to all water entering Big Bear Lake.

Big Bear Municipal is responsible for the following:

- Stabilization of the level of Big Bear Lake by managing the amount of water released to Bear Valley Mutual,
- Watershed/water quality management,
- Recreation management,

- Wildlife habitat preservation and enhancement, and
- Bear Valley Dam and Reservoir maintenance.

The judgment allows Big Bear Municipal to maintain a higher water level in the lake by delivering water to Bear Valley Mutual from an alternate source of water instead of from the lake. This alternate source of water is sometimes referred to as "in-lieu" water and mainly comes from the SWP. If Big Bear Municipal does not wish to purchase “in-lieu” water, it must deliver water from the lake to satisfy Bear Valley Mutual’s demands. Studies performed for Bear Valley Mutual have estimated average lake releases to be 4,279 acre-feet per year.

1.8.18 City of Colton Public Utilities Department

The City of Colton’s Public Utilities Department (Colton Public Utilities) provides water service within the City of Colton along with electric and wastewater service. Water sources include groundwater from the SBBA and the Rialto-Colton subbasin. Colton Public Utilities serves water to approximately 9,000 customers.

1.8.19 City of Loma Linda

The City of Loma Linda obtains groundwater from within the Bunker Hill subbasin area. Production facilities include six production wells, four above-ground steel reservoirs, and two in-ground pre-stressed concrete storage reservoirs, with a combined storage capacity of 14 million gallons. The reservoirs provide storage to the city's five different pressure zones. There are six pressure-reducing stations in the distribution system that lower water pressure from one zone to another to provide constant regulated pressure. To transfer water between zones, there are six booster stations located in the different zones. Loma Linda also has an “emergency” connection to the City of San Bernardino to meet its supplemental needs. The city’s population is approximately 20,000. Loma Linda also provides wastewater service.

1.8.20 City of Rialto

Residents of the City of Rialto obtain water from three purveyors: the Utilities Department of the City of Rialto (Rialto), West Valley, and Fontana Water Company (FWC). Rialto provides water service for approximately 12,000 connections. Generally, these are the more developed portions of the city (West Valley provides the water in the remaining areas).

Rialto obtains water from the Rialto-Colton groundwater subbasin, Lytle Creek Groundwater subbasin, SBBA, and the “Chino wells” (these wells are not located within the adjudicated boundaries of Chino Basin). In recent years, most of these

sources have been impacted by groundwater contamination (most significantly, perchlorate contamination of the Rialto-Colton subbasin and the Chino wells). Rialto has adopted a "zero tolerance" policy for perchlorate, meaning that they will not serve water with any perchlorate even if it meets all of the public health standards. Rialto has installed treatment systems on some wells and is pursuing installation of additional treatment systems. In 2003, the City of Rialto declared a water shortage emergency in accordance with California Water Code Sections 350-359. Rialto operates wastewater service within the city and has recently initiated deliveries of recycled water to the California Department of Transportation. Rialto also produces and transports water to Marygold Mutual Water Company (Marygold) under a cooperative agreement that expires in 2008. Surface water treatment of Lytle Creek water is provided by a treatment plant operated by West Valley. Rialto owns a portion of the capacity of that plant.

1.8.21 Fontana Water Company

FWC, a division of San Gabriel Valley Water Company, is a public utility regulated by the California Public Utilities Commission. FWC's service area covers approximately 52 square miles with boundaries including the San Gabriel Mountains to the north and the Riverside County Line to the south. FWC serves most of the City of Fontana and parts of Rancho Cucamonga, Ontario, and Rialto. FWC serves a population of approximately 158,000 with over 45,000 active service connections. Each year FWC produces between 45,000 – 50,000 acre-feet of water from water supply sources that include surface water from Lytle Creek and State Water Project water, which is treated at FWC's Sandhill Water Treatment Plant and groundwater from the Lytle, Rialto, No-Mans Land, and Chino Basins. FWC diverts and receives Lytle Creek surface water and produces groundwater in the Lytle, Rialto, and No-Mans Land Basins as an agent for Fontana Union, which holds extensive water rights to these sources of supply pursuant to longstanding court judgments.

1.8.22 Marygold Mutual Water Company

Marygold serves customers generally located in the unincorporated community of Bloomington. Marygold obtains water from the Chino Basin (Marygold has rights to the appropriative pool of Chino Basin) and the SBBA. Water from the SBBA is currently produced and transported by Rialto under a cooperative agreement that expires in 2008.

1.8.23 Muscoy Mutual Water Company

Muscoy Mutual Water Company (Muscoy) serves the majority of the unincorporated community of Muscoy. The SBMWD serves the remainder of the Muscoy community. The community is located between the cities of San Bernardino and Rialto. All water produced by Muscoy is from the SBBA.

1.8.24 Regents of the University of California

The Regents have rights to water from the SBBA, which is used by the University of California Riverside (UCR). The water is delivered to UCR by the Riverside Public Utilities Department.

1.8.25 Riverside Highland Water Company

The Riverside Highland Water Company (Riverside Highland) serves both domestic and irrigation water in San Bernardino and Riverside Counties. Riverside Highland provides water to over 3,800 customers in the community of Grand Terrace located on the Riverside Mesa south of the SAR and a portion of the Highgrove area of Riverside County. RPU owns shares in Riverside Highland and has export rights to 333 acre-feet per year of Bunker Hill groundwater through those shares. Riverside Highland obtains water from the Lytle Creek subbasin, the SBBA, the Rialto-Colton subbasin, and the Riverside North Basin.

1.8.26 Other Water Purveyors in the Region

Other water purveyors in the region include the following:

- South Mesa Water Company serves water to part of the City of Calimesa.
- Terrace Water Company services an area located between the service areas of Colton Public Utilities and West Valley.
- Western Heights Mutual Water Company serves the southeast portion of the City of Redlands and a portion of the City of Yucaipa.
- Eastwood Farms Community Water Users Association provides water to a small portion of the City of Highland.
- Arroyo Verde Mutual Water District provides water to a small portion of the City of Highland.
- Victoria Farms Mutual Water Company serves a population of approximately 1,000.
- Inland Valley Development Agency is a joint powers authority comprised of San Bernardino County and the Cities of San Bernardino, Colton, and Loma Linda. Formed in 1990, the agency is responsible for the redevelopment of the non-aviation portion of the San Bernardino International Airport. A water integration agreement between the agency

and the City of San Bernardino calls for the city taking over ownership and operation of the agency's water system.

- Devore Mutual Water Company serves an area near the intersection of Interstate 15 and Interstate 215.

- Running Springs Water District serves the community of Running Springs.

- Arrowhead Park County Water District serves an area adjacent to the Running Springs Water District.

- Big Bear City Community Services District provides water service for unincorporated areas near Big Bear Lake.

- The City of Riverside owns stock in several mutual water companies including the Meeks & Daley Water Company. Ownership interests in the Meeks & Daley Company entitle the City of Riverside to export rights of about 3,000 acre-feet from the Bunker Hill Basin. As of December 2007, the City of Riverside owns about 38.642 percent of the total shares of the Meeks & Daley Water Company. Meeks & Daley Water Company was incorporated on September 1, 1885, and is the successor company to three Mutual Water Companies - Meeks & Daley Water Company, Agua Mansa Water Company, and the Alta Mesa Water Company. Meeks & Daley Water Company provides water to the stockholders for agricultural purposes. To fund operating expenses, the company assesses all shareholders twice per year based on the number of shares owed on the date of the assessment.

  The company owns water rights in the Bunker Hill Basin and pumps water from a series of wells located within that basin, transporting this water through the Riverside and Gage Canals. At the end of the canal systems, Meeks & Daley Water Company operates a pipeline and pump station to deliver irrigation water to users in the southern portion of the City of Corona.

  With the construction of additional delivery facilities in 1996, Meeks & Daley Water Company began delivering water to OCWD under the Orange County Water Transfer Project, with water delivered to the SAR for storage behind Prado Dam and subsequent release and groundwater recharge downstream. Riverside owns 59 percent of the Gage Canal Company stock. This company owns surface water rights to the SAR.

1.9 Contents of the IRWM Plan

Chapter 1, **Introduction**, presents the background of the IRWM Plan, explaining the plan area and why it was selected, and describing the relationship between the IRWM Plan and other planning efforts occurring within the plan area or region. Previous water resources planning work that has influenced the plan is briefly reviewed along with the laws, judgments, and agreements that shape the existing conditions and institutional arrangements found in the region. Finally, this chapter lays out the purpose, need, and intent of the IRWM Plan, and the planning process used by the primary water agencies in the region to develop the plan.

Chapter 2, **Description of the Integrated Regional Water Management Plan Area,** provides a description of the existing physical and institutional conditions in the plan area. This chapter describes the water-related infrastructure, physical (climate, hydrology, groundwater, environment, water quality), and socioeconomic conditions that shape the region and influence plan development and implementation.

Chapter 3, **Water Budget for Integrated Regional Water Management Plan Region**, provides an overview of the published water budgets for the region, describes the data source(s), presents water demands and supplies, and anticipated future water demands and supplies conditions for each of the subareas within the region.

Chapter 4, **Develop Integrated Regional Water Management Plan,** describes the process used to develop the IRWM Plan and how the IRWM Plan is intended to serve as a roadmap for the management of water resources to ensure long-term, reliable water supplies. It defines the water management objectives and the water management strategies along with the specific projects and programs that will be required to help the region meet the stated objectives. This chapter also presents a process for actively managing the SBBA, the largest underground storage “reservoir” in the region.

Chapter 5, **Integrated Regional Water Management Plan Implementation**, describes implementation of the IRWM Plan including the identification of specific capital facilities, projects, and management actions to be implemented to help meet the established water management objectives. This chapter provides a realistic discussion of the obstacles that are likely to be encountered when implementing the IRWM Plan, and also discusses the impacts and benefits for the IRWM Plan and what is likely to occur if the plan is not put into place. The sources of funding and the institutional structures to be used to implement the plan are presented.

The report concludes with Chapter 6, **Data Management and Monitoring, Technical Analyses, and Plan Performance,** which describes the existing tools and techniques for data management and technical analyses conducted to evaluate planning alternatives, and determine the technical and scientific merit of the recommended actions. It also describes how data will be collected, managed, and reported in the future and how this information will be used to track the performance for each of the proposed projects and the overall IRWM Plan. The chapter discusses how the information and subsequent technical analysis will be used to update the plan as circumstances change and how the community will adopt the IRWM Plan.

Chapters 7 and 8 provide a glossary of terms and references, respectively. To keep the plan succinct and readable, much of the more detailed or technical information is presented in the appendices and the reader is directed to these materials for more information.

1.10 Meeting DWR Integrated Regional Water Management Plan Standards

DWR in collaboration with SWRCB has developed standards for preparation of IRWM Plans. Table 1-2 shows how the Upper Santa Ana River Watershed Integrated Regional Water Management Plan meets these standards.

Table 1-2
Upper Santa Ana IRWMP and State IRWM Plan Standards

Item from Minimum IRWM Plan Standards	Reference (Chapter, Section, Figure, Table #s of the IRWM Plan)
Adopted IRWM Plan	Plan will be adopted in December 2007
Regional Description, Study Period, and Appropriateness of Area for IRWM Plan	Sections 2.1 and 2.11
Formation of a Regional Water Management Group (TAG)	Section 1.7.1
Water Management Objectives and How They Were Developed	Sections 4.1, and 4.2
Water Management Strategies and How They Were Developed	Section 4.2
Integration of Water Management Strategies	Section 5.1
Regional Priorities and How They Were Developed	Section 5.3.5
Implementation Plan and Responsible Agencies	Sections 5.3.1 through 5.3.3
Impacts and Benefits of Regional Effects.	Section 5.6
Impacts and Benefits to Disadvantaged Communities and Other Resources.	Section 2.5.1
Technical Analysis to Develop IRWM Plan and Monitoring Systems to Measure Plan Performance	Chapter 6 and Section 4.2.1.6
Data Management, Data Dissemination, and Integration into SWAMP and GAMA	Section 6.2
Financing for Project Implementation and O&M	Section 5.4
Relationship between Local Planning and IRWM Plan	Sections 2.3, 2.4, 2.5, and 4.2.3.3
Plan Implementation Schedule	Section 5.3.4
Stakeholder Involvement and Coordination among Participating Agencies and with State and Federal Agencies	Sections 1.7.1.and 1.7.2
Public Outreach Activities Specific to Individual Stakeholder Groups	Sections 1.7.1 and 1.7.2
Processes that have been or will be Used to Facilitate Stakeholder Involvement and Communication during Plan Implementation	Sections 4.2.1.3.5 and 1.7.3
Partnerships Developed during the Planning Process Discussed	Sections 4.1, 4.2.1.3.2, and 4.2.1.3.5
Disadvantaged Communities were Identified and Environmental Justice Concerns Addressed.	Section 2.5, Table 2-4, and Figure 2-3

2 Description of the Integrated Regional Water Management Plan Area

2.1 Location

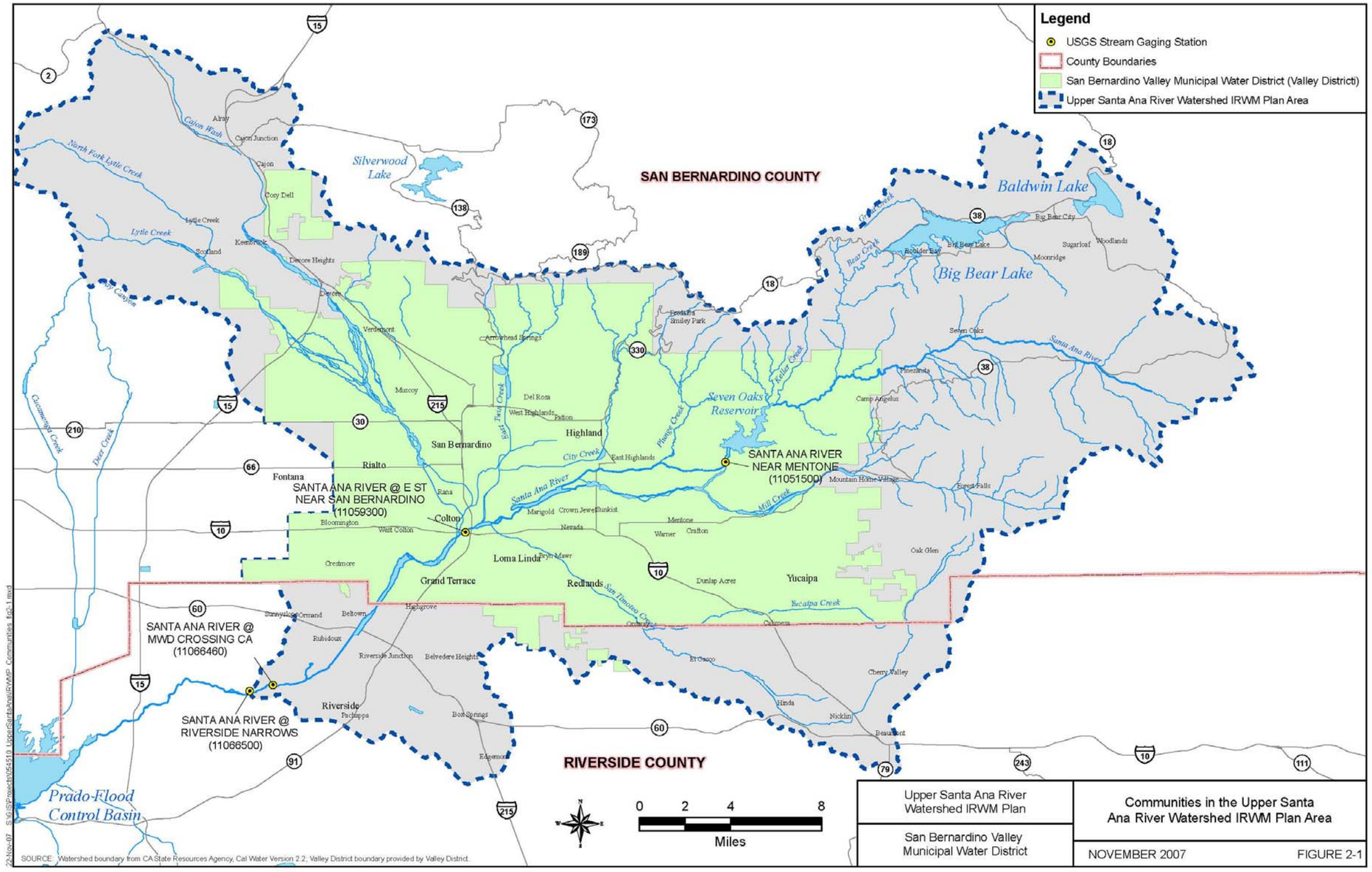
The Santa Ana River (SAR) is the largest stream system in Southern California. The headwaters originate in the San Bernardino Mountains and are discharged to the Pacific Ocean approximately 100 miles to the southwest between Newport Beach and Huntington Beach. The SAR watershed covers over 2,650 square miles of widely varying forested, rural, and urban terrain and covers the more populated urban areas of San Bernardino, Riverside, and Orange Counties, as well as a lesser portion of Los Angeles County. Disputes over the use of water in the SAR led to the subdivision of the watershed into the Upper SAR watershed and Lower SAR watershed at Prado Dam.

2.1.1 General Integrated Regional Water Management Plan Region

The Upper Santa Ana River Watershed Integrated Regional Water Management Plan (IRWM Plan) Area (Region) covers 852 square miles, approximately 32 percent of the total SAR watershed, and is primarily located in San Bernardino and Riverside Counties. The Region includes Big Bear Lake, the cities and communities of San Bernardino, Yucaipa, Redlands, Highland, Rialto, Mentone, Colton, Grand Terrace, Loma Linda, Beaumont, and Riverside (Figure 2-1). This region was selected for the IRWM Plan in large part because of the following factors:

- Rapid population growth in the area and the potential for continued rapid growth in the future.
- Significant institutional issues, hydrological characteristics, and court judgments separate the Upper SAR watershed from the downstream portion of the watershed at the Riverside Narrows just upstream from Prado Dam. The Orange County Water District v. City of Chino, et al., Case No. 117628 (Orange County Judgment) and the Western Municipal Water District of Riverside County v. East San Bernardino County Water District, Case No. 78426 (Western Judgment), which were discussed in more detail in Chapter 1, have significant influence on water management of the Upper SAR and dictate, to some degree, how water resources should be managed in the Upper SAR watershed.

Figure 2-1
Communities in the Upper Santa Ana Region



- The Upper SAR watershed is a region with unique physical characteristics. The Upper SAR has a widely variable hydrology, a demography that includes a high rate of population growth and urban development, and challenging water management issues, including the need to make use of local water supplies to make the region self-sufficient. The agencies in the Region plan to coordinate and manage among them the groundwater spreading and pumping and to establish a cooperative, integrated plan that will reduce or eliminate historical water right conflicts among the water agencies in the Upper SAR watershed.

- Groundwater basins in the Upper SAR watershed are generally separated from the lower basin. The groundwater basin in which most Region-related activities take place is the San Bernardino Basin Area (SBBA), which is composed of the Bunker Hill and Lytle Creek subbasins. A discussion of groundwater basins within the Region is presented later in this chapter.

The Region is defined by the area that contributes surface runoff to the Riverside Narrows at U.S. Geological Survey (USGS) Gage 11066500. The USGS has operated this site as a continuous record gaging station since March 1970. Specific conductance, temperature, and total dissolved solids (TDS) are collected bi-monthly. There are numerous tributaries that contribute flow to the main stem of the SAR in the region, including Mill Creek, City Creek, Plunge Creek (a tributary of City Creek), Mission Zanja Creek (located just upstream of the San Timoteo Creek), San Timoteo Creek, East Twin Creek, Warm Creek, and Lytle Creek.

2.2 Climate

Climate in the Region is characterized by relatively hot, dry summers and cool winters with intermittent precipitation. The largest portion (73 percent) of average annual precipitation occurs during December through March and rainless periods of several months are common in the summer. Precipitation is nearly always in the form of rain in the lower elevations and mostly in the form of snow above about 6,000 feet mean sea level (msl) in the San Bernardino Mountains. Mean annual precipitation ranges from about 12 inches in the vicinity of Riverside, to about 20 inches at the base of the San Bernardino Mountains, to more than 35 inches along the crest of the mountains. The long-term (water years 1883-84 through 2001-02)[1] mean annual precipitation recorded at the San Bernardino County Hospital Gage is 16.4 inches. The historical record indicates that a period of above-average or below-average precipitation can last more than 30 years, such as the recent dry period that extended from 1947 to 1977. Historical streamflow statistics for the SAR at the Metropolitan Water District of Southern California (Metropolitan) Crossing (located near the Riverside Narrows) show that flows vary widely from year to year. The median annual flow for SAR at Metropolitan Crossing is 75,900 acre-feet per year. During water years 1969-1970 through 2000-2001, annual flows have ranged from a high of 301,000 acre-feet to a low of 9,800 acre-feet. These data are indicative of highly variable streamflows.

Three types of storms produce precipitation in the SAR Basin: general winter storms, local storms, and general summer storms. General winter storms usually occur from December through March. They originate over the Pacific Ocean as a result of the interaction between polar Pacific and tropical Pacific air masses and move eastward over the basin. These storms, which often last for several days, reflect orographic (i.e., land elevation) influences and are accompanied by widespread precipitation in the form of rain and, at higher elevations, snow. Local storms cover small areas, but can result in high intensity precipitation for durations of approximately six hours. These storms can occur any time of the year, either as isolated events or as part of a general storm, and those occurring during the winter are generally associated with frontal systems (a “front” is the interface between air masses of different temperatures or densities). General summer storms can occur in the late summer and early fall months in the San Bernardino area, although they are infrequent.

The Region has an annual precipitation that ranges from 12 inches in low areas to 40 inches along the crest of the mountains.

[1] A water year runs from October through September of the following year. For example, water year 2000- 2001 begins on October 1, 2000, and ends on September 30, 2001.

2.3 Population

2.3.1 Historic Population and Housing Growth in the Plan Area

The Region covers part of the two-county area of San Bernardino and Riverside. Population figures for 1990 and 2000 for Riverside and San Bernardino Counties are presented in Table 2-1. Over the decade of the 1990s, both counties experienced substantial increases in population—32.6 percent for Riverside County (with an average rate of 3.3 percent annually) and over 21 percent for San Bernardino County (2.1 percent annually). The population of the two-county Region increased by over 681,400 persons or over 26 percent (2.6 percent annually) during this time period.

Table 2-1
Riverside and San Bernardino County Population, 1990 and 2000

Area	Population		Change: 1990-2000	
	1990	2000	Number	Average Annual Percent
Riverside County	1,170,413	1,551,943	381,530	3.3%
San Bernardino County	1,418,380	1,718,312	299,932	2.1%
Source: U.S. Census 1990 and 2000.				

In the period from 1990–2000, housing units in Riverside and San Bernardino counties grew 15.6 percent.

The number of housing units contained in the two counties grew from about 1,026,200 in 1990 to 1,186,000 in 2000. This increase of 15.6 percent took place at an average annual rate of 1.5 percent.

Population of the San Bernardino Valley Municipal Water District's (Valley District) service area between 2000 and 2005 grew by 56,000 or 10.5 percent, which is about a 2 percent growth annually. Population of the IRWM Plan Area grew by 21,200 from 2000 to 2005.

2.3.2 Future Population Growth in the Region and Valley District Service Area

The Southern California Association of Governments (SCAG) adopted the "2001 RTP Socioeconomic Forecast" in November 2006 that includes population projections for consecutive five-year increments from 2000 to 2025 for various geographic areas (SCAG 2001). Table 2-2 presents these data for Riverside and San Bernardino Counties. The counties are projected to

experience average annual growth rates of 3.4 percent and 2 percent, respectively, between 2000 and 2025.

Table 2-2
SCAG County Population Projections, 2010-2025

Area	Population						Change: 2000-2025		
	2000[a]	2005	2010	2015	2020	2025	Number	Percent	Average Annual Percent
Riverside	1,551,943	1,842,690	2,077,800	2,347,300	2,620,500	2,876,300	1,324,357	85%	3.4%
San Bernardino	1,718,312	1,919,145	2,059,400	2,229,700	2,397,700	2,558,700	840,388	48.9%	2%

[a]Based on 2000 U.S. Census information.

Estimates of future populations were developed for this plan using U.S. Census 2000 block-level data. The service area boundaries were overlaid digitally on census maps using a Geographic Information System (GIS). Where census blocks were split by service area boundaries, the proportion of the census block contained in the service area was calculated and used to prorate the population of the particular census block to the respective service area.

The Valley District service area had a population of 585,000 in 2000, of which approximately 583,482 lived in San Bernardino County. The remaining persons lived in Riverside County. The population contained in the Valley District service area comprises about 34 percent of the population of San Bernardino County and less than 0.1 percent of the Riverside County population.

Over the period 2000 to 2025, and using SCAG county-level population projections, the number of residents in the service areas of Valley District and the IRWM Plan area is projected to increase by approximately 199,500 and 297,800, respectively (Table 2-3).

Table 2-3
Population of Plan Area and Valley District Service Area, 2000-2025

Service Area	2000[a]	2005	2010	2015	2020	2025	Change: 2000-2025	
							Number	Percent
Valley District	585,003	641,004	680,100	719,800	751,200	784,500	199,497	34.1
San Bernardino County	1,718,312	1,919,145	2,059,400	2,229,700	2,397,700	2,558,700	840,388	48.9
IRWM Plan Area	870,866	892,048	958,400	1,034,400	1,101,700	1,168,700	297,834	34.2

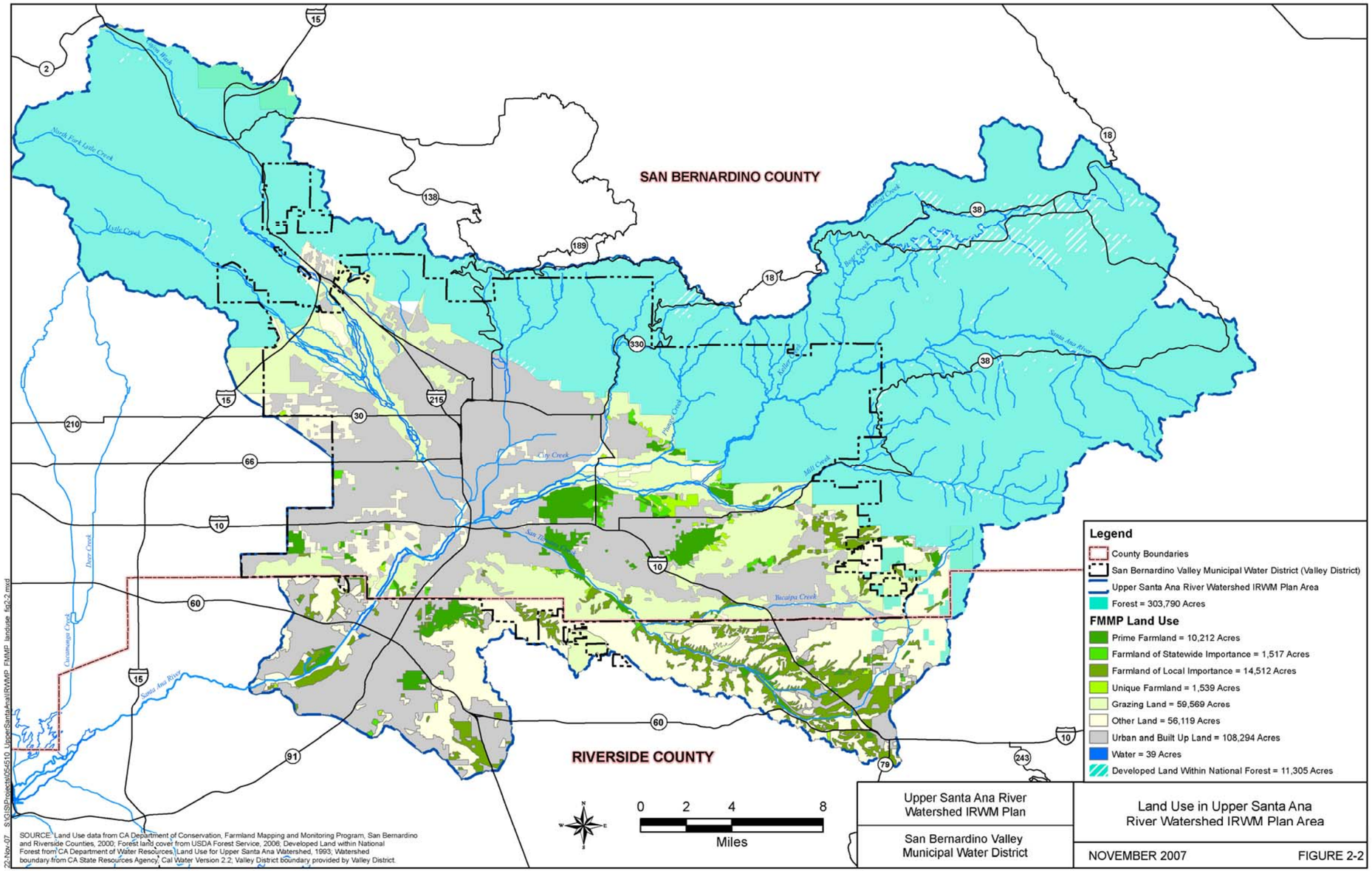
[a.] Based on 2000 U.S. Census information for the service area populations as of April 2000.

2.4 Land Use and Agricultural Lands Stewardship

Figure 2-2 presents the 2005 land use within the Region. The total area of the Region is 549,570 acres, of which 303,790 acres, or about 55 percent, are covered by the national forest located in the easterly and northerly areas of the Region. In addition to the national forest, native vegetation covers about 86,400 acres or about 16 percent of the Region. Agriculture acreage is being replaced by urban areas, and agriculture only represents a little over two percent of the land use of the Region today. Urban areas are about 15 percent of the Region. The large areas of agricultural land use are south of the SAR.

A number of local land use agencies have approved general plans and specific plans in the Region. These plans are relevant to this IRWM Plan. These local land use planning agencies play a major role in zoning and land use decisions in the Region. The California Government Code contains statutes addressing the subject of the applicability of local land use controls on planning and construction of public water facilities. However, it is generally the practice of Valley District and other local agencies to voluntarily comply with the standards specified in applicable local land use and building code regulations.

Figure 2-2
Land Use



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2.5 Economic Condition and Social and Cultural Composition of the Region

Food preparation and service, teaching, and construction jobs are the fastest growing employment opportunities in the Region.

Like most communities in Southern California, the Upper Santa Ana region has seen a continued increase in population and change in the economic base as agricultural and vacant land is replaced with residential housing, leading to urban and service sector jobs. The fastest growing jobs projected between 2001 and 2008 include food preparation and service, teaching, and construction, all generally showing more than a 25 percent increase. Services, retail trade, government, and manufacturing constitute the majority of jobs in the area, followed by construction, transportation, and wholesale trade. Employment growth in San Bernardino County is the third highest in the State of California (State), with a relatively low current unemployment rate of about 4.6 percent. Population estimates doubled between 1970 and 1990, increased better than 20 percent between 1990 and 2000, and continued to rise at a 14 percent rate from 2000 to 2005. San Bernardino County and Riverside County now rank fourth and fifth in county population in California, respectively. Continued residential and job growth is expected in the area.

Much of the population growth of the Upper Santa Ana region since the 1970s is linked with the economies of Los Angeles and Orange Counties because they are within commuter range, and the housing prices in the Upper Santa Ana region are more affordable. Also, population growth over the past three decades is attributed to a marked increase in immigration from Mexico, Latin America, and the Pacific Rim.

2.5.1 Composition of Population and Tribe

Most of the Region is considered economically disadvantaged. An economically disadvantaged community is defined by the State as a community with a median annual household income of 80 percent or less than the State median annual household income. In 2000, the State's annual median family income was $47,493. Figure 2-3 shows the economically disadvantaged communities in the Region. Table 2-4 presents median annual family incomes in service areas for various water purveyors. Communities within the service areas of the City of Rialto, City of San Bernardino, East Valley Water District (East Valley), and a number of mutual water companies are considered economically disadvantaged. Water management strategies evaluated and considered for the IRWM Plan are designed to improve water supply reliability and water quality for these communities in the Region. The disadvantaged communities are dispersed throughout the Plan Area, and are served water by different water purveyors. The location of disadvantaged communities relative to project locations determines the range and extent of benefit a given project provides to an individual disadvantaged community.

Figure 2-3
Economically Disadvantaged Communities

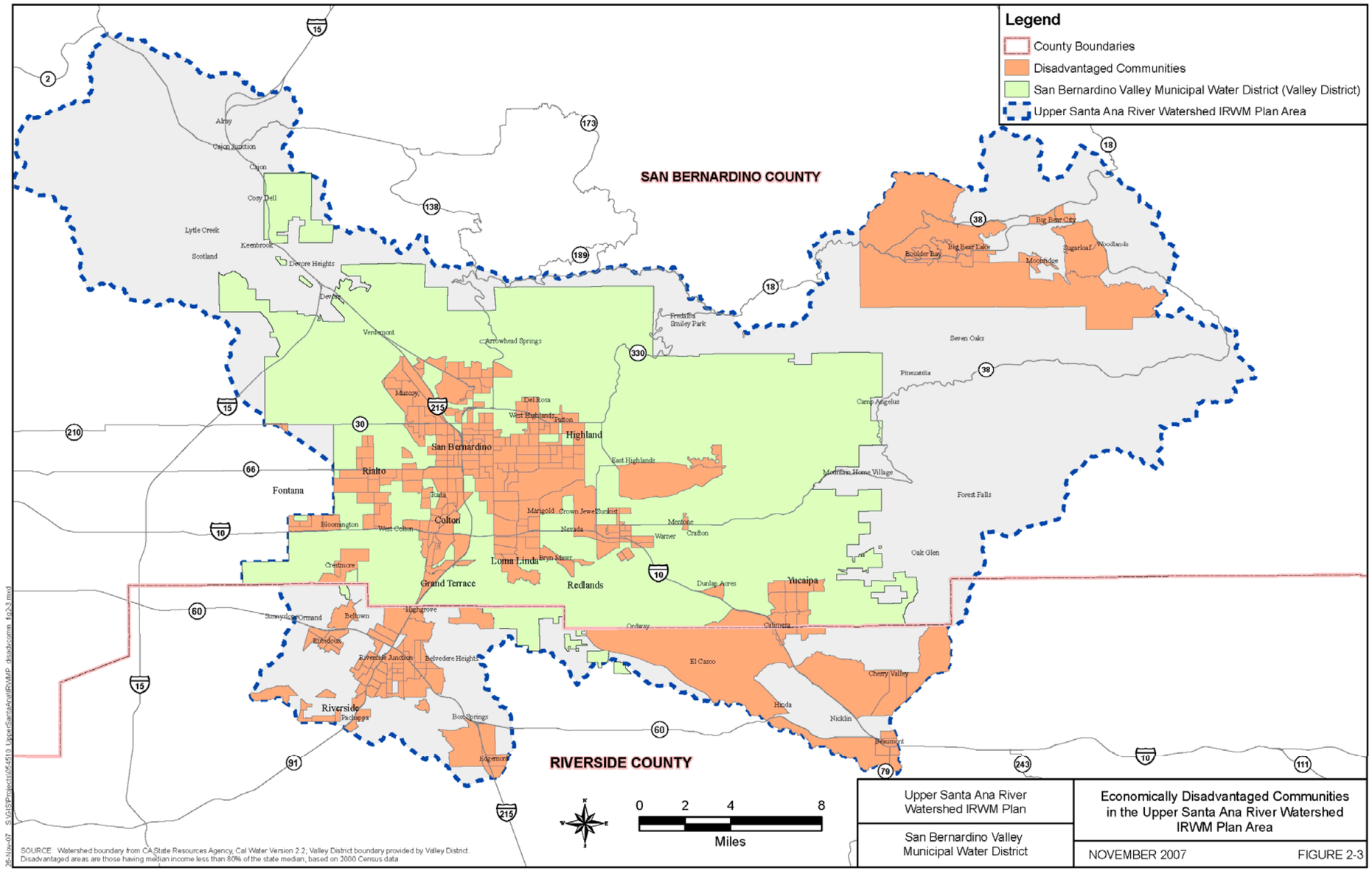


Table 2-4
Median Annual Household Income for Water Purveyor and Water Agency Service Areas

Service Area	Median Income 2000	Percent of State Median 2000
Baseline Garden Mutual	24,274	51%
Bear Valley Mutual Water Company	48,838	103%
Bear Valley Mutual Water Co./Lugonia Water Company	51,717	109%
Beaumont-Cherry Valley Water District	44,004	93%
Big Bear City Community Services District	38,165	80%
Big Bear Municipal Water District	32,764	69%
City of Beaumont	34,543	73%
City of Big Bear Lake Department of Water and Power	37,044	78%
City of Colton	41,506	87%
City of Loma Linda	43,353	91%
City of Redlands	53,413	112%
City of Rialto	39,072	82%
City of San Bernardino	38,310	81%
Devore Mutual Water Company	63,074	133%
East Valley Water District	54,337	114%
Eastern Municipal Water District	49,717	105%
Eastwood Farms Community Water Users Association	20,334	43%
Fontana Water Company	54,256	114%
Inland Valley Development Agency	22,917	48%
Jurupa Community Services District	53,679	113%
Marygold Mutual Water Company	30,160	64%
Muscoy Mutual Water Company	28,328	60%
Riverside Highland Water Company	51,834	109%
Riverside Public Utilities District	46,349	98%
Rubidoux C.S.D.	41,827	88%
Running Springs Water District	64,330	135%
San Gorgonio Pass Water Agency	39,091	82%
San Timoteo Watershed Management	50,849	107%
South Mesa Water Company	37,683	79%
Terrace Water Company	43,299	91%
Victoria Farms Mutual Water	36,069	76%
West Valley Water District	51,961	109%
Western Heights Water Company	73,029	154%
Western Municipal Water District	47,277	100%
Yucaipa Valley Water District	61,135	129%
Valley District	**39,354**	**83%**
State	**47,493**	**100%**

Source: U.S. Census Bureau, Census 2000

For example, the larger, regional projects provide water supply reliability and/or water quality benefits to a water provider's service area or the Plan Area in total. While these projects do not specifically target disadvantaged communities, the benefits of the project may extend to one or more disadvantaged communities.

In addition there are individual projects located within the disadvantaged communities that directly benefit those areas by improving water supply reliability and/or water quality to the targeted disadvantaged community.

Various tribes of Native Americans inhabited the Region in the past. Today, the San Manuel Band of Mission Indians and Morongo Band of Mission Indians are present in the region. Ethnic data for 2000 (Source: 2000 Census PL94) include 44 percent White, 39.2 percent Hispanic, 8.8 percent African American, 0.57 percent Native American, and 7.43 percent others.

2.6 Major Water-Related Infrastructure in Region

The water-related infrastructure of the Upper SAR watershed reflects the complex water history of the Region. The predecessors of many of the water agencies that are participating in this plan were constructing ditches in the 1800s. The water rights and facilities established at that time have helped determine the structure of today's water agencies and the arrangement of today's infrastructure. After State Water Project (SWP) facilities were extended into the Region in the early 1970s, State Water Contractors receiving deliveries from the East Branch, Valley District, San Gorgonio Pass Water Agency (SGPWA), and Metropolitan constructed pipelines to take advantage of the imported water. Figure 2-4 shows the major water-related infrastructure in the Region.

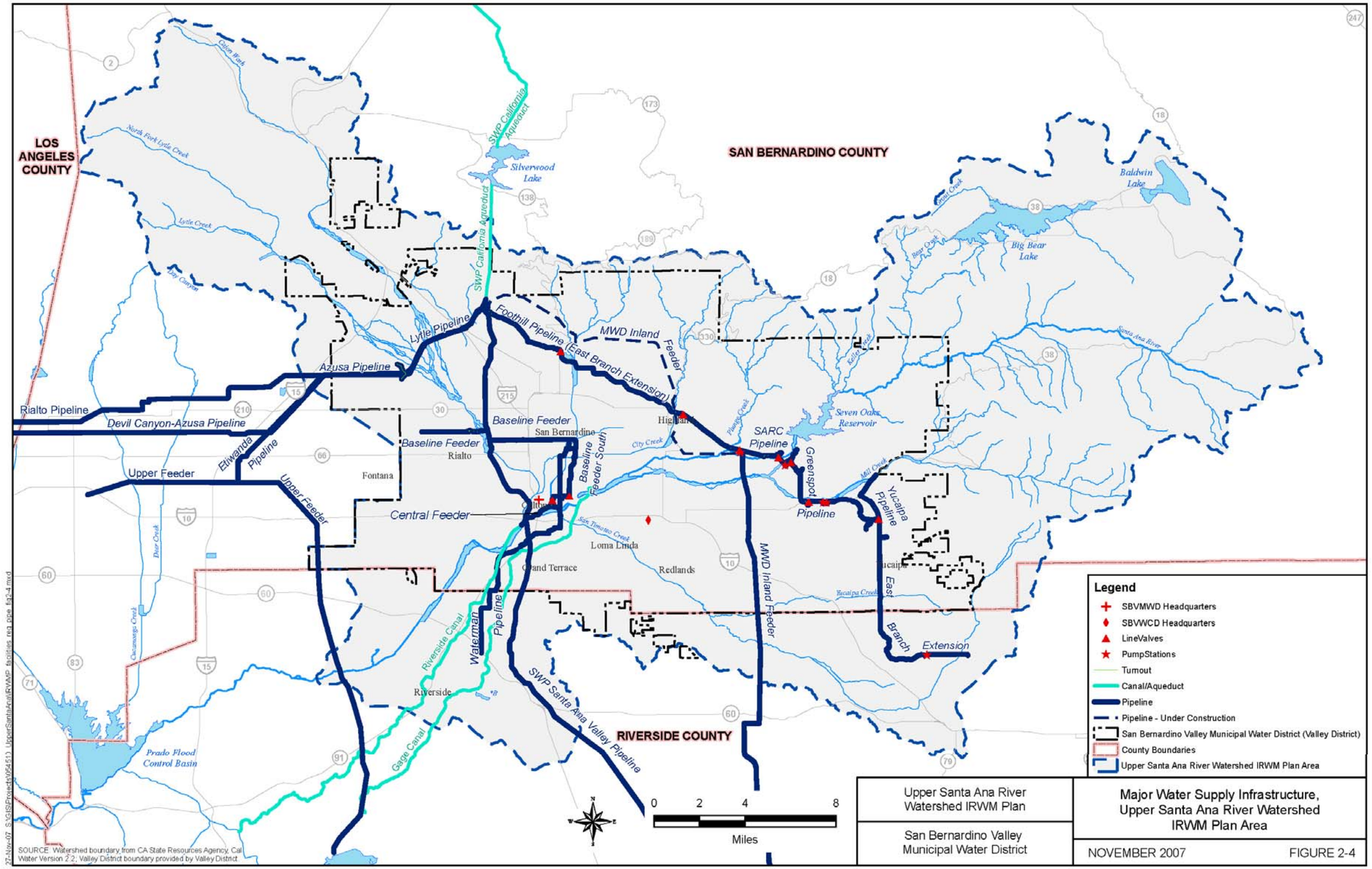
2.6.1 State Water Project Facilities

SWP water is imported into the Upper SAR watershed via the East Branch of the California Aqueduct. At the Devil Canyon Power Plant, located at the foot of the San Bernardino Mountains near Interstate 215, SWP water can be delivered in several directions in State facilities or in transmission systems belonging to three State Water Contractors.

The SWP Santa Ana Pipeline extends south, roughly paralleling Lytle Creek and on to Lake Perris. Deliveries can be made to Metropolitan member agencies including Western Municipal Water District (Western), Eastern Municipal Water District, and the San Diego County Water Authority.

The East Branch Extension of the SWP is a combination of facilities built by the Valley District and the State and funded by Valley District and SGPWA. Valley District operates these facilities for the State and for SGPWA. The East Branch Extension makes deliveries from Devil Canyon east along the foothills of the San Bernardino Mountains and as far as SGPWA. Portions of the East Branch Extension, including the Foothill Pipeline, are used to implement the Santa Ana River-Mill Creek Cooperative Water Project Agreement (Exchange Plan). This agreement provides for a three-level exchange that allows Valley District to deliver water to the Yucaipa area by exchanging SAR and Mill Creek water among ten agencies. In the past, the Foothill Pipeline was also used to deliver local water to Devil Canyon Afterbay and on to Metropolitan, the West Valley Water District (West Valley), and Fontana Water Company (FWC). The State is currently evaluating an increase in the capacity of the East Branch Extension.

Figure 2-4
Major Water-Related Infrastructure



2.6.2 State Water Contractors Facilities

Four State Water Contractors have facilities in the Region: Valley District, SGPWA, Metropolitan, and the San Gabriel Valley Municipal Water District.

Metropolitan's Inland Feeder will ultimately extend from Devil Canyon to Diamond Valley Lake when the tunnels within the San Bernardino Mountains are complete. Currently, the Foothill Pipeline is being used to make deliveries of SWP water to the completed portions of the Inland Feeder for delivery to Diamond Valley Lake.

Metropolitan's Rialto Pipeline is used to make deliveries from Devil Canyon to Metropolitan's F.E. Weymouth Treatment Plant in the San Gabriel Valley and to its Robert B. Diemer Treatment Plant, which supplies treated water to Western and Eastern Municipal Water District . In addition, the Rialto Pipeline makes deliveries to surface water treatment plants owned by Metropolitan's member agencies and to groundwater recharge facilities.

The San Gabriel Valley Municipal Water District's Devil Canyon-Azusa Pipeline is used primarily to make deliveries for replenishment of the Main San Gabriel Basin for the accounts of Alhambra, Azusa, Monterey Park, and Sierra Madre. Valley District owns capacity in this pipeline. Through this pipeline, Valley District can deliver SWP water to the western portion of its service area including West Valley and FWC as well as the Cactus Spreading Basins.

Many of Valley District's facilities have been integrated into the SWP and were described in the previous section. In addition, Valley District has three pipelines that are not integrated into the SWP. These are the Baseline Feeder, Baseline Feeder Extension South, and the Central Feeder.

The Baseline Feeder is a 48-inch pipeline that serves potable water from the San Bernardino Basin Area (SBBA) to the City of Rialto, West Valley, and Riverside-Highland Water Company. It is possible that the current hydraulic grade of this pipeline (1370 msl) will be reduced to match the Lower Zone (1249 msl) of the City of San Bernardino. The Baseline Feeder Extension South Pipeline is a 78-inch pipeline that was constructed north/south in alignment from the vicinity of 9th Street and Waterman Avenue in San Bernardino, south past the Antil area where there is a major concentration of production wells, and on to the vicinity of the SAR. This pipeline has been integrated into the Lower Zone of the City of San Bernardino and will ultimately serve water from the SBBA throughout Valley District's service area and on to Riverside County.

Valley District is currently constructing a portion of the Central Feeder, in an east/west alignment in San Bernardino Avenue from Opal Avenue Westerly to Texas Street in Redlands. The Central Feeder Pipeline may eventually be

extended and connected to the Baseline Feeder Extension South Pipeline and possibly to the Santa Ana Valley Pipeline.

2.6.3 Regional Water Supply Infrastructure

The SBBA is a major source of water supply for agencies in San Bernardino and Riverside Counties. The three major transmission systems used to deliver water to the City of Riverside are the Gage Canal, Waterman Pipeline, and the Riverside Canal. The Gage Canal is owned by the Gage Canal Company. As of 2005, the City of Riverside owned approximately 59 percent of the Gage Canal Company. The canal extends from the SAR near Loma Linda to the Arlington Heights area. The Gage Canal is used to deliver both potable and irrigation water.

The Riverside Canal is a 12-mile canal extending from the City of Colton to Jefferson Street in the City of Riverside. Non-potable water from Colton and Riverside North Groundwater Basin is conveyed in the Flume Pipeline to the Riverside Canal.

2.6.4 Regional Flood Control Infrastructure

The Upper SAR watershed consists of many tributaries flowing to the SAR. These tributaries are in various states of development from natural stream to concrete-lined channels. Many of the streams flow through heavily developed areas. The San Bernardino County Flood Control District (SBCFCD) operates and maintains many of these tributary systems deemed "regional" (750 cubic feet per second or greater of flow and/or 640 acres or greater of watershed) as well as portions of the SAR.

The San Timoteo flood channel is a concrete-lined flood channel.

2.7 Surface Hydrology

Surface hydrology of the Region is comprised of the SAR and its tributaries. A number of surface reservoirs in the Region are operated primarily for agricultural and urban water use, but are also regulated for instream flows and recharge of groundwater basins. The following sections describe the surface hydrology of the Region.

2.7.1 Natural Runoff

Runoff records provide information on the characteristics of flow in the SAR and its tributaries. Such records are available for a number of stream gaging stations located on the mainstem of the SAR and throughout the SAR watershed. The SAR runoff records demonstrate the highly variable nature of river flow, with large floods and long periods of extremely low flow. Three gaging stations provide streamflow data for the Upper SAR. Mentone Gage (USGS record 11051500) is representative of SAR flow near Seven Oaks Dam. There are two other USGS gaging stations located downstream of Seven Oaks Dam, but within the Upper SAR basin—the "E" Street Gage (USGS Gage 11059300) located in the City of San Bernardino at river mile (RM) 57.69 and the Metropolitan Water District Crossing Gage (Metropolitan Crossing) (USGS Gage 11066460) located at RM 45.7 near Riverside Narrows. Table 2-5 provides the annual median,[1] maximum, and minimum streamflow recorded at the River Only Mentone, "E" Street, and Metropolitan Crossing gages. (See Figure 2-1.)

Flow in the SAR is highly variable from year to year. Flow in the SAR increases downstream due to inflows from tributaries, rising water,[2] and treated water from wastewater treatment plants (WWTPs). SAR flows at the "E" Street Gage include flows from Mill Creek and San Timoteo Creek but not from Lytle and Warm Creeks, which enter the SAR below the "E" Street Gage. SAR flows at the Metropolitan Crossing include inflows from Lytle and Warm Creeks, two large public WWTPs, and rising water.

Flows in excess of about 70,000 acre-feet per year have a frequency of occurrence of only 10 percent at the River Only Mentone Gage, whereas this same flow has a frequency of occurrence of over 60 percent at the Metropolitan Crossing Gage. Additionally, in the upstream areas, minimum annual streamflows are generally much smaller than minimum annual flows in the downstream areas.

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1 Median is a measure of central tendency, as is mean (average). The median represents the 50th percentile, i.e., if data are sorted from highest value to lowest value, the median value is the value in the exact center of the range. The median is a more appropriate measure of central tendency than the mean when data are highly skewed.

2 Rising water is used to describe noticeable increases in streamflow in reaches where a subsurface restriction forces groundwater to the surface.

Table 2-5
Upper SAR Median, Maximum, and Minimum Annual Flow (in acre feet)

	Median Annual Flow	Maximum Annual Flow	Minimum Annual Flow
River Only Mentone [a]	7,991	204,812	9
"E" Street [b]	25,525	319,976	0
Metropolitan Crossing [c]	75,934	301,004	9,979

Source: USGS gage data.
[a.] USGS Gage 11051500. Period of record is WY 1911-12 through WY 1999-00.
[b.] USGS Gage 11059300. Period of record is WY 1938-39 through WY 1953-54, WY 1966-67 through WY 2000-01.
[c.] USGS Gage 11066460. Period of record is WY 1969-70 through WY 2000-01.

The largest monthly flows typically occurred in February and March, and the lowest monthly flows typically occurred between August and October. Although streamflow increases downstream, the timing of flows (i.e., when the monthly maximums and minimums occur) is similar to the timing of flows observed at the Mentone Gage.

There are numerous tributaries that contribute flow to the mainstem of the SAR in the Region, including Mill Creek, City Creek, Plunge Creek (a tributary of City Creek), Mission Zanja Creek (located upstream of San Timoteo Creek), San Timoteo Creek, East Twin Creek, Warm Creek, and Lytle Creek. The flow (under 100-year flood conditions[1]) contributed by each of these tributaries is provided in Table 2-6. As a reference, during a 100-year flood event, Seven Oaks Dam would release up to 5,000 cubic feet per second (cfs) (U.S. Army Corps of Engineers (USACE) 1988).

Table 2-6
Tributary Flow Contribution to the SAR (100-Year Flood Event Discharge in cfs)

Tributary	Inflow	River Mile
Mill Creek	19,500	68.67
City Creek & Plunge Creek (Combined)	5,000	62.87
Mission Zanja Creek	3,500	59.08
San Timoteo Creek	15,500	58.44
East Twin Creek	18,000	58.14
Lytle Creek & Warm Creek (Combined)	70,000	56.74

Source: USACE 2000.

[1] A flood as defined under the Standard Flood Insurance Policy is a general and temporary condition of partial or complete inundation of normally dry land areas from overflow of inland or tidal waters or from the unusual and rapid accumulation of runoff of surface waters from any source. A 100-year flood refers to a flood level with a 1 in 100 percent chance of being equaled or exceeded in any given year.

Urbanization taking place in the valley areas of the SAR Basin has resulted in increased responsiveness of the basin to rainfall. The increase in impervious surfaces (such as roofs, roads, parking lots, etc.) and constructed drainages to remove surface water from urban areas has resulted in decreased groundwater infiltration and increased runoff from urban areas. These actions have reduced the lag time between peak rainfall and peak runoff (i.e., constructed drainage systems move water from the urban areas to the river faster than this water would move if the land was not developed).

Compared to a basin without the influence of urbanization, the same rainfall occurring over an urbanized segment of the basin will result in higher peak discharges, a shorter lag-time to the peak discharge, and an overall larger volume of water entering the local drainage channels. Because the SAR Basin is experiencing rapid growth, increased urbanization of the basin is expected to continue; therefore, this trend in increased discharge and decreased lag times between peak rainfall and peak streamflow is expected to continue in the future.

2.7.2 Imported Water

Imported water from the SWP is available to the study area through Valley District and the SGPWA. Valley District is the fifth largest State Water Contractor, with an annual entitlement of 102,600 acre-feet. Valley District lies on the East Branch of the California Aqueduct and takes delivery of SWP water at the Devil Canyon Power Plant. From this location, Valley District can deliver water to the west via the San Gabriel Valley Municipal Water District Pipeline (Valley District owns capacity in this pipeline) or to the east through the East Branch Extension of the SWP. SGPWA is downstream of Valley District on the East Branch of the California Aqueduct.

Water availability through the SWP is intermittent and subject to frequent shortages. As a result, Valley District's "Rules for Service" require that all of its customers have a 100 percent backup for any amount of water they order from the SWP.

Redlands Wastewater Treatment Plant

2.7.3 Wastewater

There are 14 publicly owned WWTPs located above Prado Dam downstream of the Narrows (SAR Watermaster 2003). Nine of these plants contribute to surface flow of the SAR. Between 1970 and 2000, the total volume of treated wastewater contributions to SAR flows increased from 44,000 acre-feet per year to 169,000 acre-feet per year (SAR Watermaster 2003).

Three wastewater treatment plants (Redlands, Beaumont, and Yucaipa) discharge to the SAR and its tributaries upstream of the

City of San Bernardino, but these discharges generally do not flow continuously to the SAR at "E" Street (SAR Watermaster 2003). Two plants, the Rapid Infiltration and Extraction (RIX)[1] WWTP in the City of Colton and the Rialto WWTP in the City of Rialto, discharge directly to the SAR via a discharge channel at RM 53.46. Wastewater discharges from these plants have hydraulic continuity to the SAR above Riverside Narrows. Combined wastewater discharge from these two plants has risen from around 22,000 acre-feet per year in water year 1970-1971 to 57,750 acre-feet per year in water year 2000-2001 (SAR Watermaster 2003). The combined wastewater discharge is expected to increase to about 59,000 acre-feet per year, with both facilities operating at their respective design capacities. (See Table 2-7.)

Table 2-7
Treated Wastewater Discharged Directly to the SAR above Riverside Narrows

Facility	Current Discharge (acre-feet per year)	Potential Future Discharge (acre feet per year)
RIX	49,407 [a]	44,900
Rialto	8,346 [a]	14,200
Total Discharges Directly to the SAR in the Project Area	57,753	59,000

Notes:
[a.] Based on 2000-2001 water year data reported in the Thirty-Second Annual Report of the SAR Watermaster (SAR Watermaster 2003).

Despite the likelihood that WWTP discharges will increase in the future, not all of the treated water may enter the SAR. Several cities and utilities are in the process of developing plans to recycle water, which could decrease discharges to the river. For example, the City of San Bernardino is currently evaluating a program to sell approximately 18,000 acre-feet per year of tertiary effluent (of a total potential discharge of approximately 44,900 acre-feet per year) from the RIX facility. Valley District contracted with the City of San Bernardino to ensure that the RIX facility continues to release quantities of treated effluent to the SAR adequate to fulfill Valley District's obligations to provide 15,250 acre-feet of baseflow each year at the Riverside Narrows as called for in the Orange County Judgment.

[1] The RIX WWTP went into operation in 1996 and provides tertiary treatment to all of the effluent from the Colton and San Bernardino Water Reclamation Plants. Prior to 1996, effluent from these plants entered the SAR just above and just below "E" Street, respectively.

2.7.4 Surface Water Quality

The SAR Basin is within the boundaries of the Santa Ana Regional Water Quality Control Board (SARWQCB). The SARWQCB has divided the mainstem of the SAR into six reaches. Reaches 1 through 6 have reach numbers beginning at the Pacific Ocean and increasing upstream. Reaches 3 through 6 are located in the Upper SAR Basin. These reaches are described in more detail below, from upstream to downstream.

2.7.4.1 Reach 6 (RM 70.93 and Above)

This reach includes the river upstream of Seven Oaks Dam where flows consist largely of snowmelt and storm runoff and water tends to be of excellent quality (SARWQCB 1995).

2.7.4.2 Reach 5 (RM 70.93 to RM 57.68)

This reach extends from Seven Oaks Dam to the Bunker Hill Dike (San Jacinto fault), which marks the downstream edge of the Bunker Hill groundwater basin. This reach tends to be dry except during storm flows. The lower end of this reach sometimes has rising groundwater and San Timoteo Creek flows on an intermittent basis (SARWQCB 1995).

2.7.4.3 Reach 4 (RM 57.68 to RM 49.00)

This reach includes the SAR from Bunker Hill Dike downstream to Mission Boulevard Bridge in Riverside. The bridge is the upstream limit of rising groundwater resulting from the constriction at Riverside Narrows. Until about 1985, most water in the reach percolated to the local groundwater leaving the lower part of the reach dry. However, flows in the lower end of this reach may now intermittently contain rising groundwater and flows from San Timoteo Creek.

2.7.4.4 Reach 3 (RM 49.00 to RM 30.50)

This reach includes the SAR from Mission Boulevard Bridge in Riverside to Prado Dam. At the Riverside Narrows, rising groundwater feeds several small tributaries including Sunnyslope Channel, Tequesquite Arroyo, and Anza Park Drain (SARWQCB 1995).

The SARWQCB states that the quality of the SAR is a function of the quantity and quality of the various components of the flows (SARWQCB 1995). Three components make up the flow of the water in the SAR: (1) storm flows, (2) baseflow, and (3) non-tributary flow. The relative proportion of these components varies throughout the year.

The first component, storm flows, results directly from rainfall, usually occurring between the months of December and April. Much of the rainfall and surface water runoff from the storms is captured and percolated into the groundwater basins. The quality of storm flow water is highly variable.

Baseflow makes up the second component of water flow in the SAR, a large portion coming from the discharge of treated wastewater into the river in addition to rising groundwater in the basin. This baseflow includes the non-point source discharges as well as the uncontrolled and unregulated agricultural and urban runoff. Water quality objectives are set in relation to the baseflow in the river, not to the total flow in the river (see Table 2-8). The intent of these objectives is to protect the river's groundwater recharge beneficial use. Compliance with these objectives is verified by annual measurement of the baseflow quality.

The quantity and quality of baseflow is most consistent during the month of August. At that time of year the influence of storm flows and non-tributary flows is at a minimum and volumes of rising water and non-point source discharges tend to be low.

The major component of baseflow in August is municipal wastewater. For these reasons, this period has been selected by the SARWQCB as the time when baseflow will be measured and its quality determined. To determine whether the water quality and quantity objectives for baseflow in Reach 3 of the SAR are being met, the SARWQCB collects a series of grab and composite samples during August of each year. The results are compared with the continuous monitoring data collected by USGS and data from other sources.

The SARWQCB sets discharge requirements on wastewater discharges, the major source of baseflow in the SAR. Waste discharge requirements are developed on the basis of the limited assimilative capacity of the river. Non-point source discharges, generally from urban runoff and agricultural tailwater, are regulated by requiring compliance with Best Management Practices (BMPs), where appropriate.

The third component of flow in the SAR that influences water quality is characterized by the SARWQCB as non-tributary flow. Non-tributary flow is generally imported water released in the upper basin for recharge in the lower basin (SARWQCB 1995).

Table 2-8
SAR Basin Surface Water Quality Objectives (WQO)*

Inland Surface Streams Upper SAR Basin	Water Quality Objectives milligrams per liter (mg/L)						
	Total Dissolved Solids (TDS)	Hardness ($CaCO_3$)	Sodium (Na)	Chloride (Cl)	Total Inorganic Nitrogen (TIN) [a]	Sulfate (SO_4)	Chemical Oxygen Demand (COD)
Reach 2 - 17th Street in Santa Ana to Prado Dam	650 [b]	---	---	---	---	---	---
Reach 3 - Prado Dam to Mission Blvd. - Baseflow	700	350	110	140	10[a]	150	30
Reach 4 - Mission Blvd. in Riverside to San Jacinto Fault	550	---	---	---	10	---	30
Reach 5 - San Jacinto Fault in San Bernardino to Seven Oaks Dam	300	190	30	20	5	60	25
Reach 6 - Seven Oaks Dam to Headwaters	200	100	30	10	1	20	5

Source: SARWQCB 1995.
[a.] Total nitrogen, filtered sample.
[b.] Five-year moving average.
* A number of amendments to the WQOs of the Basin Plan have been proposed. However, these proposed amendments do not include changes to the WQOs applicable to Reaches 3 through 6 of the SAR (SARWQCB 2004).

2.7.4.5 Water Quality Measurement Activities

A recent USGS study conducted by the National Water Quality Assessment Program entitled, *Concentrations of Dissolved Solids and Nutrients in Water Sources and Selected Streams of the Santa Ana Basin, California, October 1998-September 2001*, examined concentrations of TDS and nutrients in selected Santa Ana Basin streams as a function of water source. The principal water sources considered in the study were mountain runoff, wastewater, urban runoff, and storm flow. The USGS study of water quality conditions in the SAR and tributaries focused on TDS and nutrient conditions representative of baseflow water of mountain sites, baseflow of the valley floor, and storm flow.

The USGS reports that streams on the Santa Ana Basin generally have increasing dissolved minerals as one goes downstream. This effect is due to the fact that water is used, recycled, and used again. The magnitude or amount of TDS concentration rises with each use of water. The USGS report notes that rising groundwater also enters basin streams in some reaches, and their sampling indicated that some of the highest TDS (and in some cases nitrates) may occur at sites on the valley floor that are dominated by rising groundwater. Nitrate concentrations are higher in Santa Ana Basin streams receiving treated wastewater than in streams without treated wastewater. The principal source of nitrate is fertilizer from historic agricultural operations.

While there are basin plan objectives for multiple constituents, water quality monitoring has focused on two constituents, TDS and nitrogen. These constituents have been reported at levels at or near regulatory standards and have thus been the focal point of regulatory activities.

Table 2-9 provides a summary of the available historical surface water quality data for TDS and nitrogen at points along the SAR.

Table 2-9
Average Historic Surface Water Quality for Locations on the SAR (1990-2001)

Water Quality Constituent	Metropolitan Crossing Gage (Reach 3)*	RIX-Rialto Effluent Outfall (Reach 4)*	Mentone Gage (Reach 5)*
TDS	560 [a]	520 [b]	230 [a]
TDS Basin Plan Objective by Reach	700	550	300
Total Inorganic Nitrogen (TIN)	7.3 [a]	8.5 [b]	0.3 [a]
TIN Basin Plan Objective by Reach	10 [c]	10	5

Source: USGS gage data. Data for River Only Mentone Gage begins in October 1998. Data for Riverside Narrows Gage begins in August 1997.
[a.] USGS 2004.
[b.] The TDS and TIN values assigned for RIX-Rialto are the maximum values that occurred during 2001-2002 as reported in Table 4.4-9 of the City of San Bernardino Municipal Water Department RIX Facility Recycled Water Sales Program Preliminary Environmental Impact Report (PEIR), March 2003.
[c.] Total nitrogen, filtered sample.
[*] Proposed amendments to the Basin Plan do not include changes to the water quality objectives in Reaches 3 through 6 of the SAR (SARWQCB 2004).

2.7.4.6 Imported Water Quality

Water is imported to the SAR Basin from the Colorado River via the Colorado River Aqueduct (CRA), owned and operated by Metropolitan, and from Northern California via SWP facilities. The TDS level in the CRA water averages approximately 700 mg/L and, during drought years, can increase to above 900 mg/L (Metropolitan and USBR 1999). Salinity projections for wet year conditions show TDS values between 650 and 800 mg/L (Metropolitan and USBR 1999). SWP water is suitable for most beneficial uses due to its low TDS levels of 200 to 300 mg/L (California Department of Water Resources (DWR) 2003a). However, TDS levels of SWP water can vary due to drought conditions, flood events, reservoir management practices, and salt input from local streams.

2.8 Geologic Setting and Groundwater Systems

The IRWM Plan Area lies on the south slope of the Transverse Ranges Geologic Province. The Transverse Ranges are an east-west trending series of steep mountain ranges and valleys. The east-west structure of the Transverse Ranges is oblique to the normal northwest trend of coastal California, hence the name *Transverse*. The province extends offshore to include San Miguel, Santa Rosa, and Santa Cruz Islands. Its eastern extension, the San Bernardino Mountains, has been displaced to the south along the San Andreas fault. Intense north-south compression is squeezing the Transverse Ranges. As a result, this is one of the most rapidly rising regions on earth.

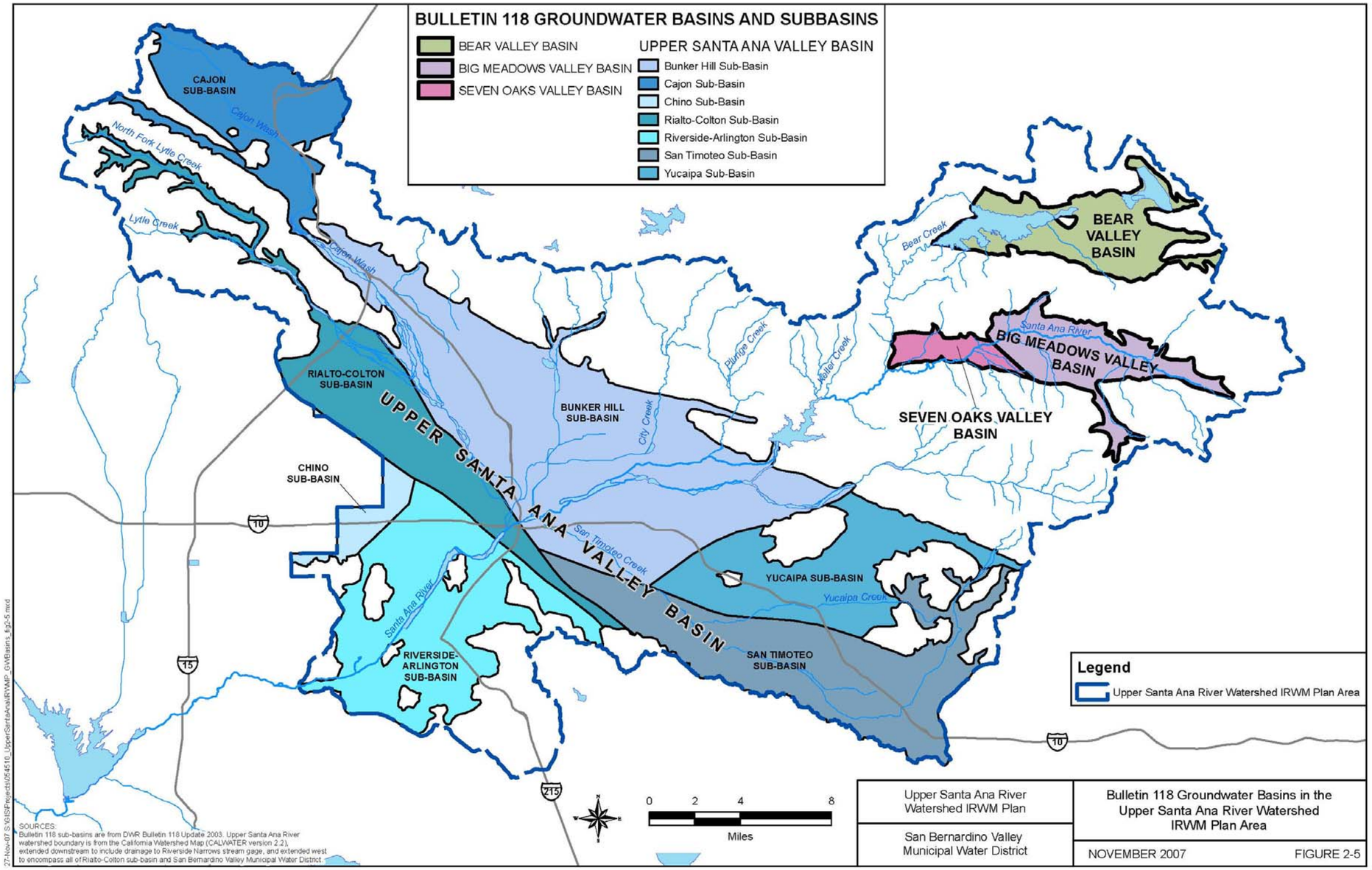
2.8.1 Groundwater Basins in the Upper Santa Ana Region

DWR Bulletin 118 shows four groundwater basins within the Region. They include Bear Valley, Big Meadows, Seven Oaks Valley, and the Upper Santa Ana Valley. The first three basins are small, with a combined storage capacity of approximately 66,000 acre-feet. The Upper Santa Ana Valley Groundwater Basin consists of nine subbasins: Bunker Hill, Rialto-Colton, Riverside-Arlington, San Timoteo, San Jacinto, Cajon, Yucaipa, Chino, and Cucamonga. Cucamonga subbasin is entirely outside this IRWM Plan Area and will not be discussed in the plan. Very small portions of the Chino and San Jacinto subbasins are within the IRWM Plan Area. Because of the small contribution of these two subbasins in overall groundwater management of the planning area, they will not be discussed in the plan. Portions of the San Timoteo and Riverside-Arlington subbasins are within the planning area. Bunker Hill, Rialto-Colton, Yucaipa, and Cajon subbasins are entirely within the Plan Area. Bunker Hill subbasin is the largest groundwater basin in the Upper SAR watershed. The storage capacity of this subbasin is 5,976,000 acre-feet (Table 2-10). A brief description of the groundwater basins and subbasins of the plan area is presented below. The basins and subbasins of the Region are mapped by DWR for Bulletin 118 as shown in Figure 2-5.

Table 2-10
Groundwater Basins in Upper Santa Ana Region

Groundwater Basin	DWR Groundwater Basin Number	Surface Area – (acres)	Groundwater Storage Capacity - 1000 acre-feet
Upper Santa Ana Valley:	8-02		
Bunker Hill Subbasin	8-02.06	89,600	5,976
Cajon Subbasin	8-02.05	23,200	—
Rialto-Colton Subbasin	8-02.04	30,100	2,517
Riverside-Arlington Subbasin	8-02.03	58,600	243
San Timoteo Subbasin	8-02.08	73,100	2,010
Yucaipa Subbasin	8-02.07	25,300	808
Bear Valley	8-09	19,600	42
Big Meadows	8-07	14,200	10
Seven Oaks Valley	8-08	4,080	14

Figure 2-5
Bulletin 118, Groundwater Basins in the Upper Santa Ana Region



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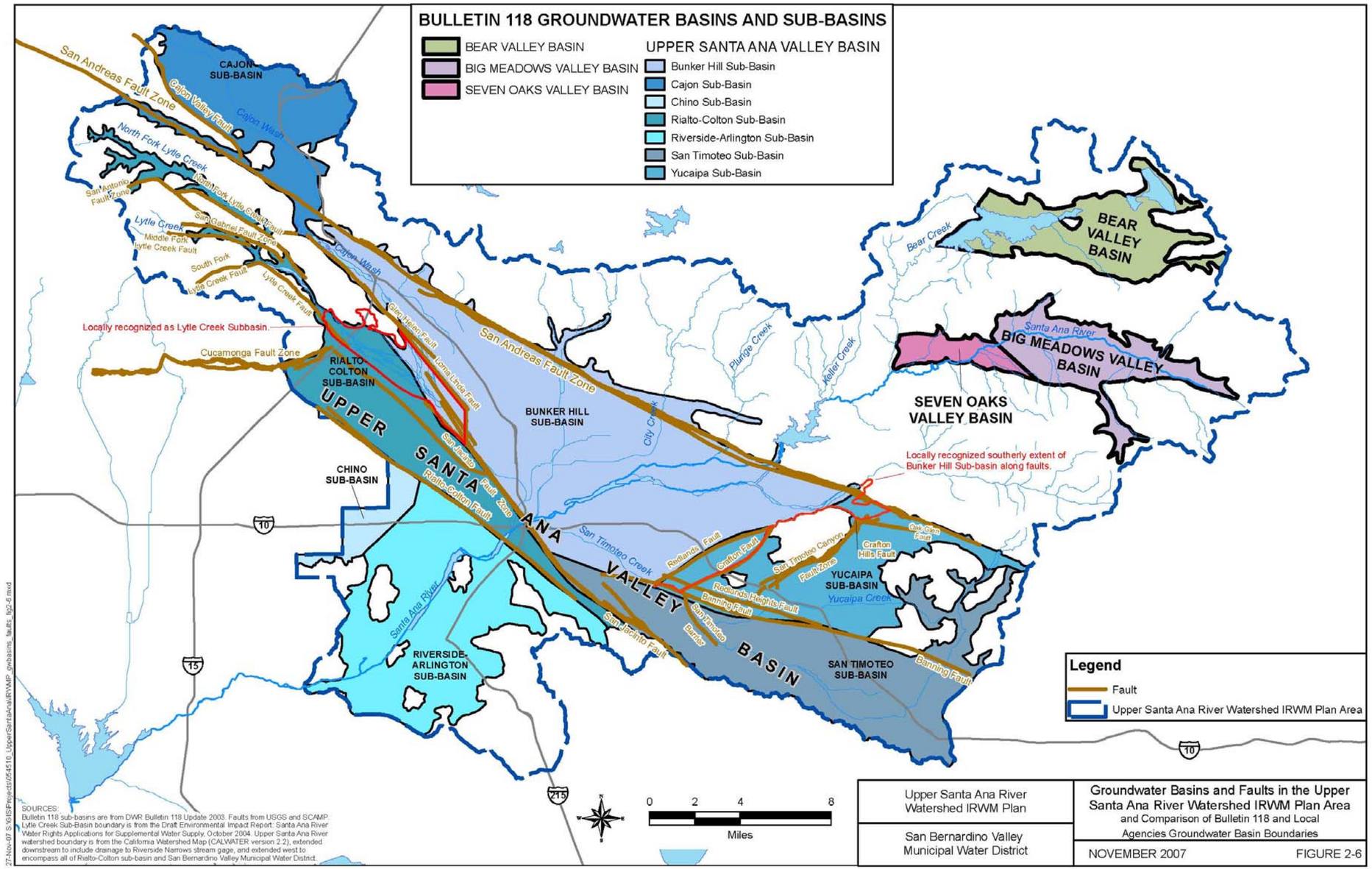
2.8.1.1 Upper Santa Ana Valley

Bunker Hill Subbasin (DWR 8-02.06)

The Bunker Hill subbasin consists of the alluvial materials that underlie the San Bernardino Valley. The basin is bordered on the northwest by the San Gabriel Mountains and Cucamonga fault zone; on the northeast by the San Bernardino Mountains and San Andreas fault zone; on the east by the Banning fault and Crafton Hills; and on the south by a low, east-facing escarpment of the San Jacinto fault and the San Timoteo Badlands (see Figure 2-6). Alluvial fans extend from the base of the mountains and hills that surround the valley and coalesce to form a broad, sloping alluvial plain in the central part of the valley. Within the central portion of the valley, relatively continuous clay produces confining conditions to underlying water-bearing sediments resulting in artesian flowing wells, high groundwater, and, historically, marshlands. The SAR, Mill Creek, and Lytle Creek are the main tributary streams in the subbasin (SBVWCD 2000). Groundwater recharge in the Bunker Hill subbasin is performed by the San Bernardino Valley Water Conservation District (SBVWCD), Valley District, and others. The Groundwater Management Plan in this IRWM Plan is the mechanism to be used to manage recharge and extractions to minimize liquefaction threats and maximize yield. The Western-San Bernardino Judgment (1969) combines the Bunker Hill subbasin with additional areas and classifies it as the SBBA. More discussion of the SBBA is included later in this report.

Figure 2-6
Groundwater Basins and Faults in the Region



Rialto-Colton Subbasin (DWR 8-02.04)

The Rialto-Colton subbasin underlies a portion of the upper Santa Ana Valley in southwestern San Bernardino County and northwestern Riverside County. This subbasin is about 10 miles long and varies in width from about 3.5 miles in the northwestern part to about 1.5 miles in the southeastern part. Figure 2-7 shows the location of the subbasin and pertinent features. This subbasin is bounded by the San Gabriel Mountains on the northwest, the San Jacinto fault on the northeast, the Badlands on the southeast, and the Rialto-Colton fault on the southwest. The SAR cuts across the southeastern part of the basin. The basin generally drains to the southeast, toward the SAR. Warm and Lytle Creek drains join near the southeastern boundary of the basin and flow to meet the SAR near the center of the southeastern part of the subbasin.

Water-bearing alluvium consists of gravel, sand, silt, and clay. Holocene-age alluvial deposits are found beneath the current courses of Lytle and Cajon Creeks. These Holocene deposits are typically less compacted and weathered than older deposits and have higher permeability (DWR 1970). Alluvial deposits of Pliocene and Pleistocene age are composed of somewhat compacted and weathered deposits of gravel, sand, silt, and clay in discontinuous lenticular bodies. The coarsest material occurs near the mouth of Lytle Creek and the material becomes finer toward the southeast where the coarsest gravels contain few cobbles.

The water-bearing units are grouped into three units—an upper, middle, and lower unit. Figure 2-8 shows the relationship of these water-bearing units. There are no distinct confining beds that separate the units. The upper unit includes the river deposits and alluvial fan deposits that grade to older river-channel deposits near the SAR. The upper unit ranges in thickness from a feather edge in the northwestern part of the basin to about 300 feet. The upper water-bearing unit was unsaturated in the northwestern part of the basin and was saturated in the southeastern part. The middle water-bearing unit exists throughout the basin and consists primarily of coarse-to-medium sand and interbedded fine sand and clay. The clay beds are more extensive in the northwestern part of the basin, southeast of Barrier J. The middle water-bearing unit is the main source of water to wells in the basin and is about 240 to 600 feet thick. The lower water-bearing unit exists throughout the basin, southeast of Barrier J and consists of interbedded sand and clay. This unit ranges from about 100 to 400 feet thick (Woolfenden 2001). Similar to the Bunker Hill subbasin, consolidated deposits underlie the lower water-bearing unit and form the base of the groundwater basin.

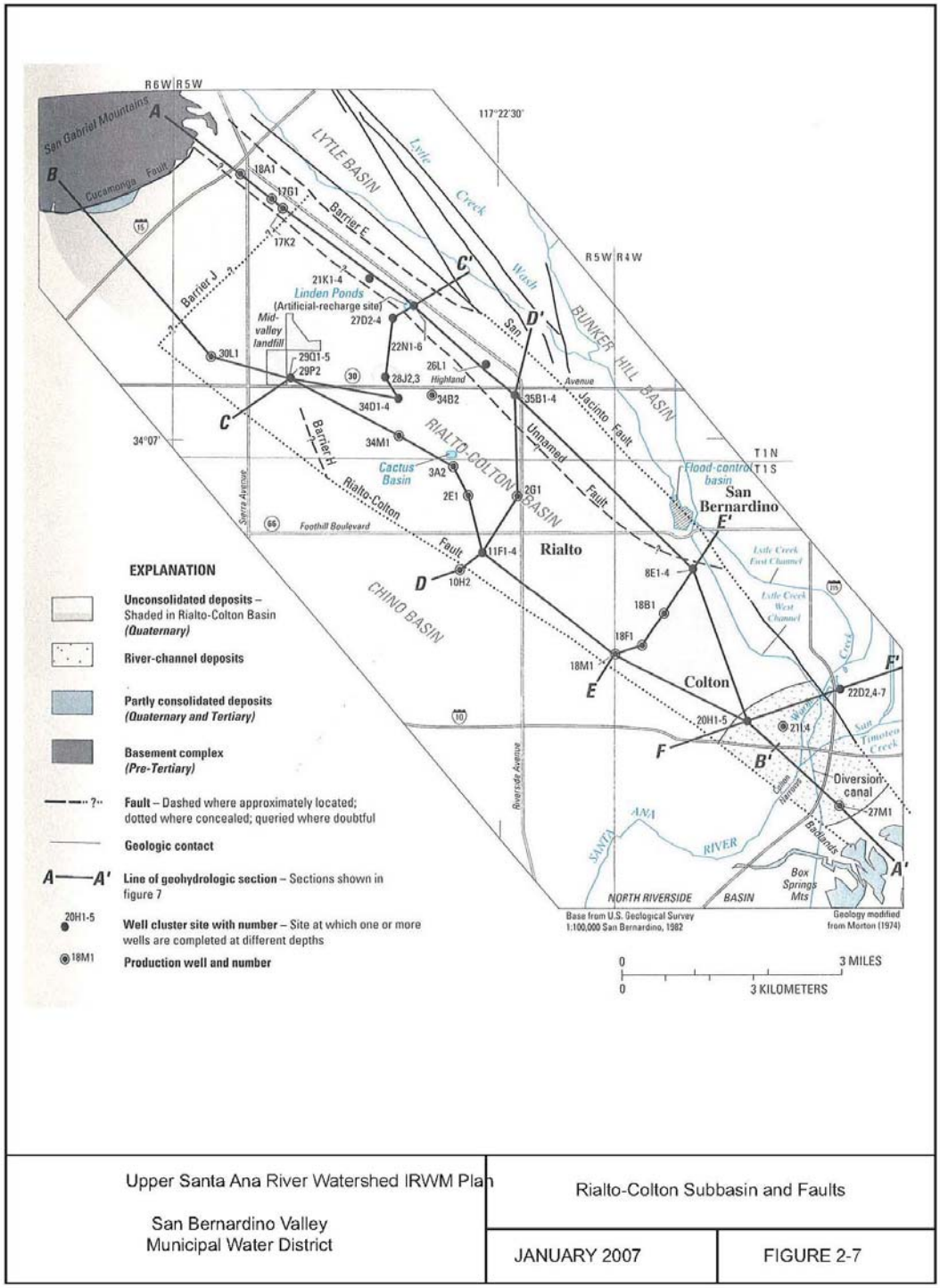
Groundwater within the subbasin is primarily unconfined to semi-confined (Wildermuth 2000). Specific yield ranges from about 6 percent northwest of Rialto to about 16 percent near Colton (DWR 1934).

The San Jacinto fault, its extension Barrier E, an unnamed fault that parallels the San Jacinto fault, and the Rialto-Colton fault are northwest-trending partial barriers to groundwater movement in this subbasin (DWR 1934, DWR 1970, Wildermuth 2000). Groundwater may flow relatively unrestricted in the shallow parts of the flow system; however, the faults generally become more restrictive at depth. The San Jacinto fault displaces water levels about 50 feet in older deposits, but is not a barrier in the youngest materials, particularly beneath the SAR (DWR 1970). Groundwater flows across the fault from the Bunker Hill subbasin in the vicinity of Warm Creek and the SAR, within the river deposits and upper water-bearing unit. Barrier E (Dutcher and Garrett 1963) forms the northeastern boundary of the basin. Groundwater flows across the section of Barrier E from the Lytle Creek subbasin between Barrier J and the San Gabriel Mountains (Woolfenden 2001). At depth, the fault displaces groundwater elevations by about 25 to 50 feet (Wildermuth 2000). The Rialto-Colton fault is a barrier to groundwater flow along much of its length, especially in its northern reaches where groundwater elevations can reach about 400 feet higher within the Rialto-Colton subbasin than in the Chino subbasin to the west (Wildermuth 2000). Groundwater flows across the fault in the river deposits and in the upper and middle water-bearing units in the southeastern part of the basin (Woolfenden 2001). Barrier J (Dutcher and Garrett 1963) is a northeast-trending, southward step in groundwater elevation of about 100 feet in the northern part of the subbasin that may be a barrier to groundwater movement southward (Dutcher and Garrett 1963, Wildermuth 2000) or may be a groundwater cascade (DWR 1970).

The principal recharge areas are Lytle Creek , Reche Canyon in the southeastern part, and the SAR in the south-central part. Lesser amounts of recharge are provided by percolation of precipitation to the valley floor, underflow, and irrigation and septic returns (DWR 1970, Wildermuth 2000). Underflow occurs from fractured basement rock (DWR 1970, Wildermuth 2000) and through the San Jacinto fault in younger SAR deposits at the south end of the subbasin (Dutcher and Garrett 1958) and in the northern reaches of the San Jacinto fault system (Wildermuth 2000).

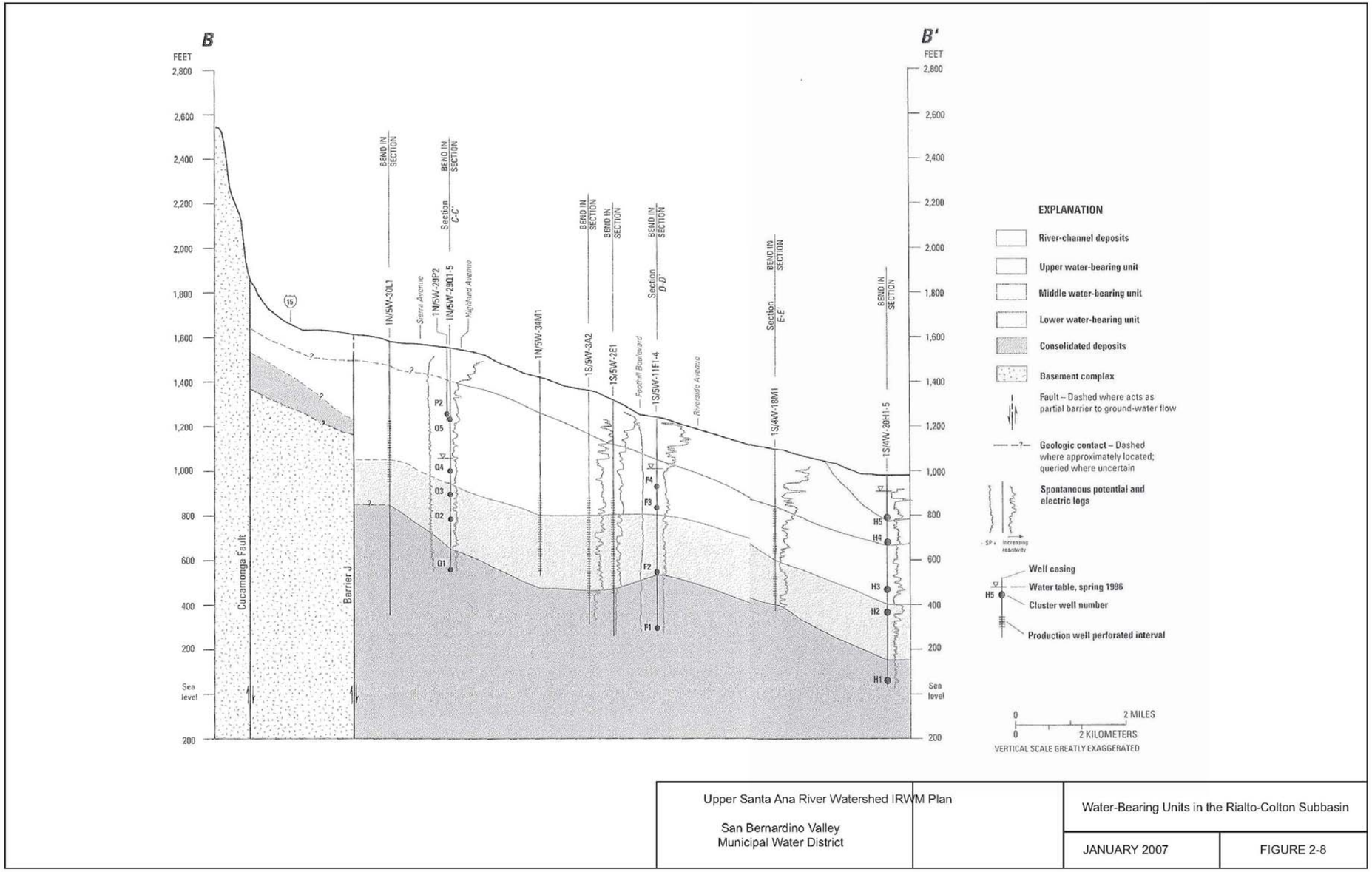
Groundwater recharge has been augmented through the use of two spreading basins, the Linden Ponds and the Cactus Basin. Figure 2-9 shows the locations of the basins. Groundwater modeling simulations showed that artificial recharge at the Cactus Basin may be more effective than recharge at Linden Ponds (no longer available as a spreading ground) at raising water levels in a greater part of the basin and that the imported water can be captured by production wells (Woolfenden 2001).

Figure 2-7
Rialto-Colton Subbasin and Faults



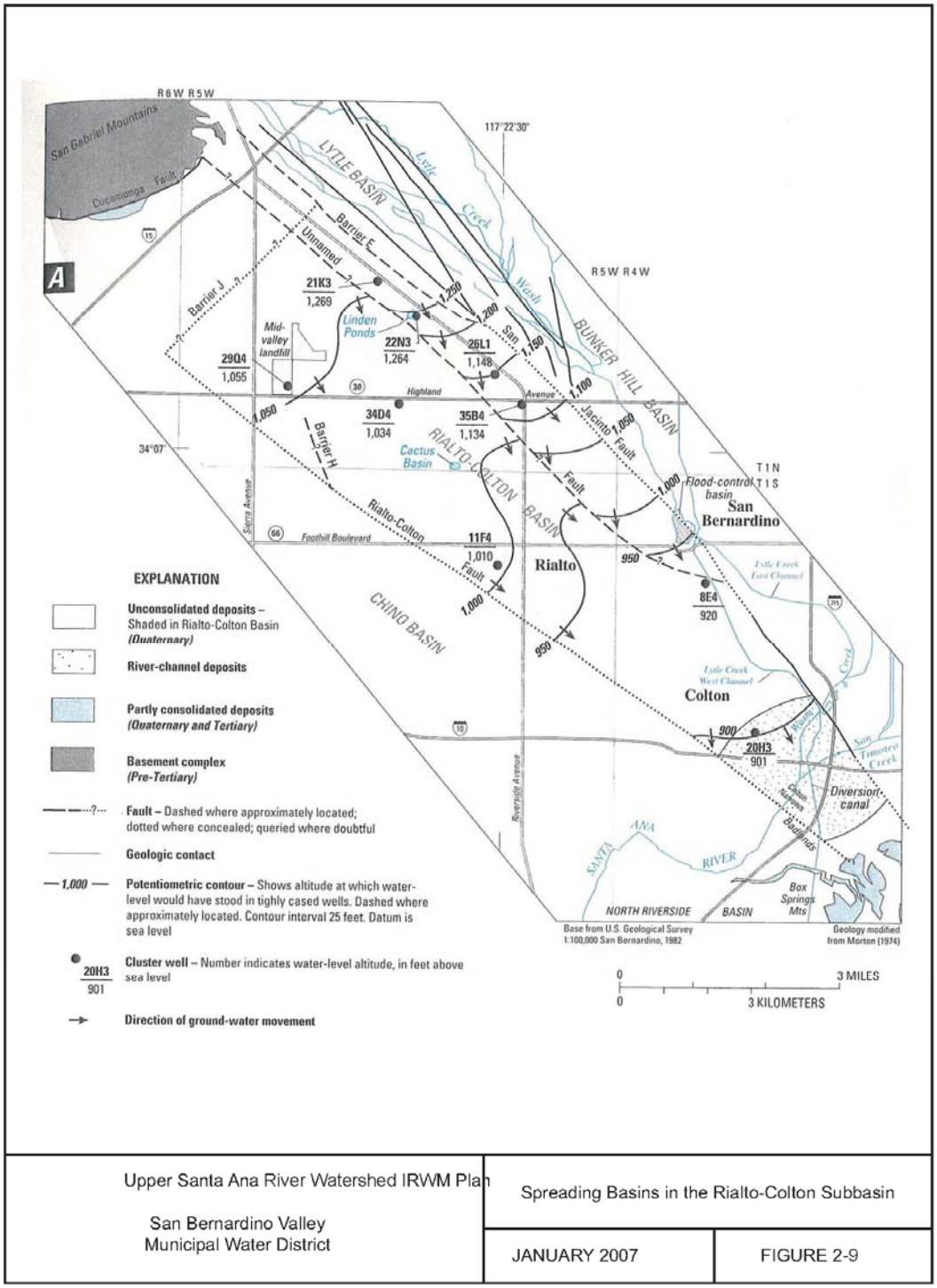
Upper Santa Ana River Watershed IRWM Plan San Bernardino Valley Municipal Water District	Rialto-Colton Subbasin and Faults
	JANUARY 2007 / FIGURE 2-7

Figure 2-8
Water-Bearing Units in the Rialto-Colton Subbasin



Source: USGS, 2002

Figure 2-9
Spreading Basins in the Rialto-Colton Subbasins



Upper Santa Ana River Watershed IRWM Plan San Bernardino Valley Municipal Water District	Spreading Basins in the Rialto-Colton Subbasin	
	JANUARY 2007	FIGURE 2-9

Source: USGS, 2002

Cajon Subbasin (DWR 8-02.05)

The Cajon subbasin underlies Cajon Valley and Lone Pine Canyon, mostly in Cajon Pass, which is the boundary between the San Gabriel and San Bernardino Mountains. This subbasin is bounded by the Upper Mojave River Valley Groundwater Basin on the north along a surface drainage divide and the Bunker Hill subbasin of the Upper Santa Ana Valley Groundwater Basin on the south. The subbasin is bounded by impermeable rocks of the San Gabriel Mountains on the west and the San Bernardino Mountains on the east. Cajon and Lone Pine Creeks drain the valley southward as tributaries to the SAR. Annual precipitation throughout the subbasin ranges from 23 inches to 33 inches. The San Andreas fault zone crosses the southern part of the subbasin and cuts up Lone Pine Canyon. Springs are found along the trace of the fault zone indicating it is a barrier to groundwater. Lost Lake is a spring-fed sag pond formed in older alluvium where there is a step in the fault trace.

The chief water-bearing material in the Cajon subbasin is alluvium. Holocene-age alluvium consists of relatively unweathered sand, silt, and gravel deposited in active creek beds (DWR 1970). Older Pleistocene-age alluvium is found as alluvial fan deposits derived from the bordering mountains. Recharge is derived from percolation of precipitation, return irrigation water, and streamflow.

Riverside-Arlington Subbasin (DWR 8-02.03)

The Riverside-Arlington subbasin underlies part of the SAR Valley in northwest Riverside County and southwest San Bernardino County. This subbasin is bounded by impermeable rocks of Box Springs Mountains on the southeast, Arlington Mountain on the south, La Sierra Heights and Mount Rubidoux on the northwest, and the Jurupa Mountains on the north. The northeast boundary is formed by the Rialto-Colton fault, and a portion of the northern boundary is a groundwater divide beneath the community of Bloomington. The SAR flows over the northern portion of the subbasin. Annual average precipitation ranges from about 10 to 14 inches.

Groundwater in the subbasin is found chiefly in alluvial deposits. Quaternary-age alluvial deposits in the subbasin consist of sand, gravel, silt, and clay deposited by the SAR and its tributaries. Near the City of Riverside, the upper 50 feet of deposits are principally clay; however, deposits near the neighborhood of Arlington have considerable sand and little clay. At the northern end of the subbasin, coarser gravels with cobbles four to six inches in diameter are common. Based on data from wells, a minimum specific yield of 15 percent was assigned to unweathered gravels at the extreme northern end of the subbasin. The specific yield increases sharply to 18 percent near the SAR, then increases gradually to a maximum of 20 percent near the neighborhood of Arlington (DPW 1934).

The Rialto-Colton fault to the northeast separates the Riverside-Arlington subbasin from the Rialto-Colton subbasin. The fault is a barrier to groundwater flow along its length, especially in its northern reaches (Wildermuth 2000). A groundwater divide in the alluvium separates the Riverside portion from the Arlington portion of the subbasin (DPW 1934). The Riverside-Arlington subbasin is replenished by infiltration from SAR flow, underflow past the Rialto-Colton fault, intermittent underflow from the Chino subbasin, return irrigation flow, and deep percolation of precipitation (DPW 1934, Wildermuth 2000).

San Timoteo Subbasin (DWR 8-02.08)

The San Timoteo subbasin underlies Cherry Valley and the City of Beaumont in southwestern San Bernardino and northwestern Riverside Counties. The subbasin is bounded to the north and northeast by the Banning fault and impermeable rocks of the San Bernardino Mountains, Crafton Hills, and Yucaipa Hills; on the south by the San Jacinto fault; on the west by the San Jacinto Mountains; and on the east by a topographic drainage divide with the Colorado River hydrologic region. The surface is drained by Little San Gorgonio Creek and San Timoteo Canyon to the SAR. Average annual precipitation ranges from 12 to 14 inches in the western part to 16 to 18 inches in the eastern part of the subbasin.

Holocene-age alluvium, which consists of unconsolidated clay, silt, sand, and gravel, is the principal water-bearing unit in this subbasin. The alluvium, which is probably thickest near the City of Beaumont (DPW 1934), thins toward the southwest and is not present in the central part of the subbasin.

The Pliocene-Pleistocene-age San Timoteo Formation consists of alluvial deposits that have been folded and eroded. These deposits are widely distributed and principally composed of gravel, silt, and clay, with comparatively small amounts of calcite-cemented conglomerate. The clasts are chiefly granitic, with lesser amounts of volcanic and metamorphic pebbles and cobbles (DPW 1934). The total thickness of the San Timoteo Formation is estimated to be between 1,500 and 2,000 feet, but logs of deep wells near the central part of the subbasin indicate water-bearing gravels to depths of only 700 to 1,000 feet (DPW 1934).

The Banning and Cherry Valley faults and two unnamed faults in the northeast part of the subbasin offset impermeable basement rocks, stepping down to the south (DWR 1965a, 1967b). Water levels change across the Banning fault, dropping 100 to 200 feet to the south (DWR 1967b, Dutcher and Fenzel 1972). In the western part of the subbasin, water levels drop to the south about 75 feet across the Loma Linda fault and about 50 feet across the San Timoteo barrier (Dutcher and Fenzel 1972). In the northeastern part of the subbasin, water levels drop to the south across two unnamed faults (DWR 1965a, 1967b). Each of these faults appears to disrupt groundwater movement in the subbasin.

Groundwater is replenished by subsurface inflow and percolation of precipitation, runoff, and imported water. Runoff and imported water are delivered to streambeds and spreading grounds for percolation (DWR 1967a, 1970). Groundwater is found in alluvium in the San Timoteo Formation. Estimated specific yields in the subbasin range from 3 percent for fine materials to 35 percent for coarser materials (DWR 1970), with an average of about 11 percent (DWR 1967b).

Yucaipa Subbasin (DWR 8-02.07)

The Yucaipa subbasin underlies the southeast part of San Bernardino Valley. It is bounded on the northeast by the San Andreas fault, on the northwest by the Crafton fault, on the west by the Redlands fault and the Crafton Hills, on the south by the Banning fault, and on the east by the Yucaipa Hills. The average annual precipitation ranges from 12 to 28 inches. This part of the San Bernardino Valley is drained by Oak Glen, Wilson, and Yucaipa Creeks south and west into San Timoteo Wash, a tributary to the SAR.

Groundwater is found chiefly in alluvium, with lesser quantities in the San Timoteo Formation and fractured bedrock beneath the alluvium (Moreland 1970). Specific yield is estimated to vary from less than 4 percent northeast of Yucaipa, to a maximum of about 10 percent in the southeastern part of the subbasin (DPW 1934). Alternatively, specific yield is estimated to range from about 6 to 22 percent (DWR 1967a), with the average for the subbasin being about 10 percent (DWR 1979).

Alluvial deposits in the subbasin are divided into older and younger units. The Holocene-age younger alluvium consists of unconsolidated boulders, gravel, sand, silt, and clay (Moreland 1970). This unit forms a thin veneer and is mostly above the water table (Moreland 1970). The middle to late Pleistocene age older alluvium consists of boulders, gravel, sand, silt, and clay (Moreland, 1970), and holds the primary source of groundwater in the subbasin. Clays present in this section are due to weathering and soil formation during accumulation of the deposits (DPW 1934).

The Pliocene-Pleistocene age San Timoteo Formation consists of alluvial deposits that have been folded and eroded. These deposits are widely distributed and principally composed of gravel, silt, and clay, with comparatively small amounts of calcite-cemented conglomerate. The clasts are chiefly granitic, with lesser amounts of volcanic and metamorphic pebbles and cobbles (DPW 1934). The total thickness of the San Timoteo Formation is estimated to be between 1,500 and 2,000 feet, but logs of deep wells near the central part of the subbasin indicate water-bearing gravels to depths of only 700 to 1,000 feet (DPW 1934).

Dominant recharge to the subbasin is from percolation of precipitation and infiltration within the channels of overlying streams, particularly Yucaipa and Oak Glen Creeks; underflow from the fractures within the surrounding bedrock beneath the subbasin; and artificial recharge at spreading grounds. Four artificial recharge facilities with a total capacity of about 56,500 acre-feet per year were noted in 1967 (DWR 1967b). By increasing the spreading acreage along Oak Glen Creek by 25 to 50 acres, the capability exists to spread 7,000 to 14,000 acre-feet of surface water annually to recharge the Yucaipa subbasin (Yucaipa Valley Water District (YVWD) 2000a).

2.8.1.2 Lytle Creek Subbasin

Lytle Creek subbasin is adjoined on the west by the Rialto-Colton subbasin along the Lytle Creek fault, and on the east and southeast by the Bunker Hill subbasin along the Loma Linda fault and Barrier G. The northwestern border of the subbasin is delineated by the San Gabriel Mountains, and runoff from the mountains flows south/southeast through Lytle and Cajon Creeks into the basin.

The Lytle Creek tributary to the Santa Ana River contributes significantly to groundwater recharge.

Lytle Creek subbasin is not mapped in DWR Bulletin 118-2003; however, the subbasin is an integral part of the Upper Santa Ana Valley Groundwater Basin and a major recharge area for both the Bunker Hill and Rialto-Colton subbasins. Historically, local agencies have recognized Lytle Creek subbasin as a distinct groundwater subbasin. It is important to note that the water rights in Lytle Creek are set forth in long-standing court judgments governing the rights of the parties in that basin. For purposes of this report, the Bunker Hill and Lytle Creek subbasins are generally considered as one groundwater basin—the SBBA. However, the three separate water-bearing zones and intervening confining zones of the Bunker Hill subbasin are not observed in the Lytle subbasin. Sediments within the Lytle subbasin are, for the most part, highly permeable, and the aquifer has a high specific yield. High permeability and specific yield tend to result in an aquifer that responds rapidly to changes in inflow (precipitation and streamflow) and outflow (groundwater pumping, streamflow, and subsurface outflow).

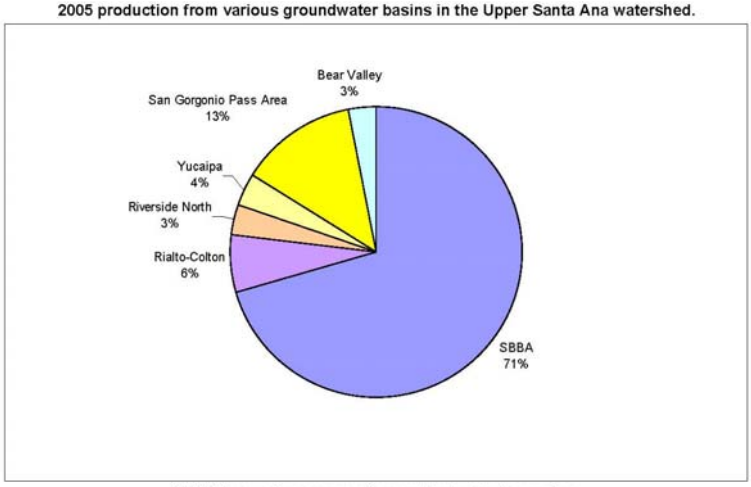
Numerous groundwater barriers are present within Lytle Creek subbasin, resulting in six compartments within the subbasin. Barriers A through D divide the northwestern portion of the subbasin into five sub-areas and the southeastern

portion of the subbasin comprises the sixth sub-area. Barrier F divides the northwestern sub-areas from the southeastern sub-area. Studies have shown that the groundwater barriers are less permeable with depth (Dutcher and Garrett 1963). When groundwater levels are high during wet years, more leakage occurs across the barriers than when groundwater levels are lower (i.e., during dry years). The amount of pumping in each sub-area, in large part, controls the movement of groundwater across the barrier within the older alluvium but not the younger alluvium (Dutcher and Garrett 1963).

2.8.1.3 San Bernardino Basin Area

The 1969, Western-San Bernardino Judgment defines an area known as the SBBA. This area is defined as the "…area above Bunker Hill Dike [San Jacinto fault], but excluding certain mountainous regions and the Yucaipa, San Timoteo, Oak Glen and Beaumont Basins" (Figure 2-10). The SBBA is the focus of this IRWM Plan and plays a central role in the water supply for communities within the Region. The SBBA traditionally refers to two groundwater subbasins—Bunker Hill and Lytle Creek. The Western-San Bernardino Watermaster provides a careful accounting of the SBBA on an annual basis. If pumping in the area exceeds the safe yield of the basin, then water must be imported to offset the amount exceeding the safe yield. If pumping in the area is below the safe yield, then the basin accrues "credits" in a like amount.

2005 production from various groundwater basins in the Upper Santa Ana watershed.

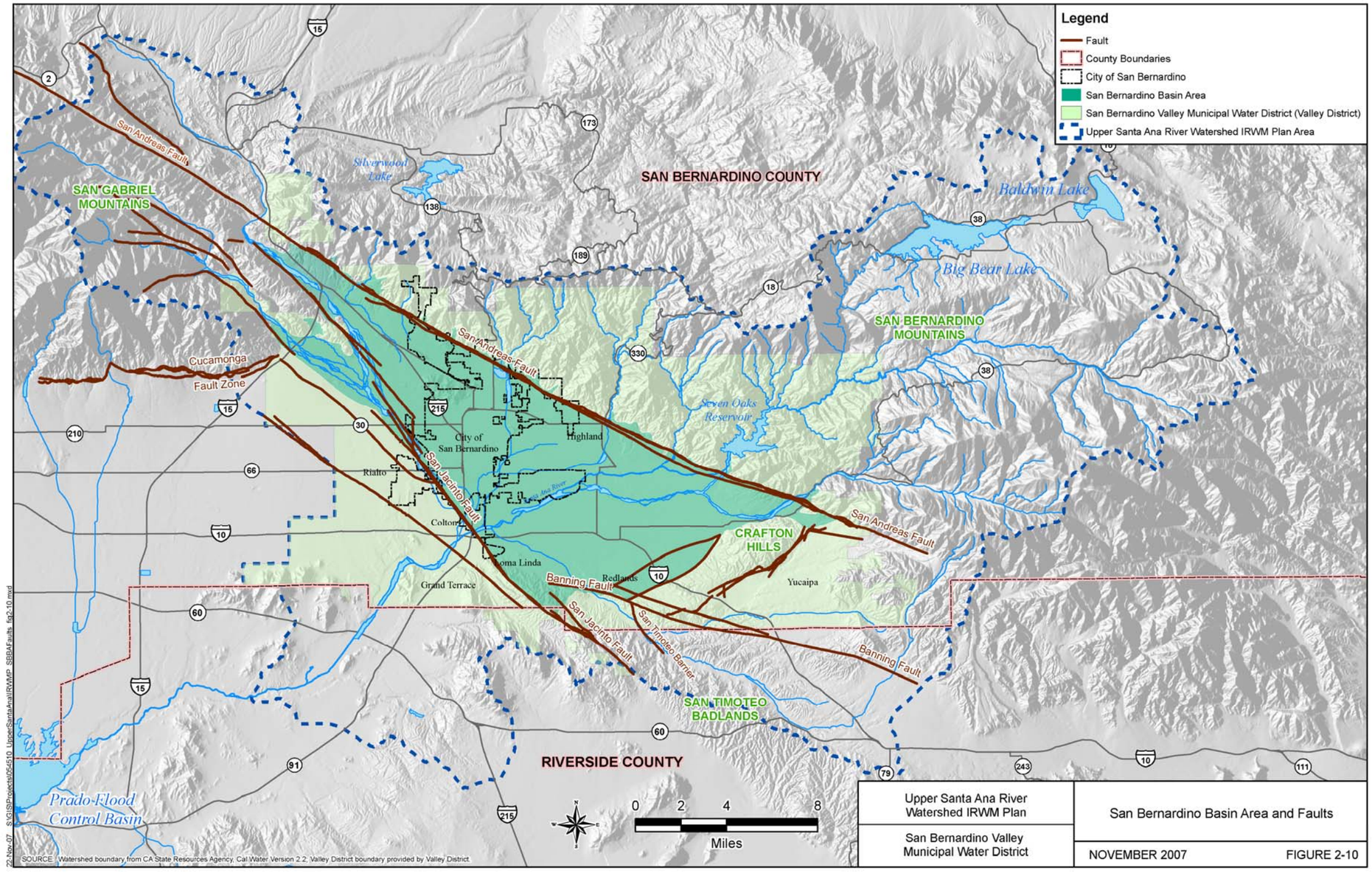


SBBA is a major source of groundwater for the region.

The SBBA has a surface area of approximately 140.6 square miles and lies between the San Andreas and San Jacinto faults. The basin is bordered on the northwest by the San Gabriel Mountains and Cucamonga fault zone; on the northeast by the San Bernardino Mountains and San Andreas fault zone; on the east by the Banning fault and Crafton Hills; and on the south by a low, east-facing escarpment of the San Jacinto fault and the San Timoteo Badlands. Alluvial fans extend from the base of the mountains and hills that surround the valley and coalesce to form a broad, sloping alluvial plain in the central part of the valley. The Pressure Zone, which is within the SBBA, is described in more detail in this chapter because of high groundwater levels that historically have been of concern in the Region.

Per the provisions of the Western-San Bernardino Judgment, Valley District and Western are responsible for managing the SBBA. The judgment does not allow extractions to exceed the long-term natural safe yield without replacing the incremental amount over the safe yield with water from an outside source.

Figure 2-10
San Bernardino Basin Area



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Geologic Structure of SBBA

Although mountain belts tend to be associated with the uplift of rock material to several miles in height, they are bordered by regions of subsidence called foreland sedimentary basins. These basins are wedge shaped in the cross-section, with a depth that gradually increases away from the mountain front. The SBBA is a foreland basin and receives sediment eroded from the San Bernardino Mountains. The foreland basin refers to the area of intake or recharge where most recharge occurs by direct percolation of SAR water. The SBBA foreland basin is characterized by highly permeable sands and gravel with few clay and silt deposits.

The San Andreas fault zone impedes movement of groundwater, producing springs and a groundwater-level change that marks the fault trace along the northern boundary of the subbasin. The San Jacinto fault forms a strong barrier to the lateral southwest flow of groundwater. The water table rises on the upstream side of the San Jacinto fault nearly to the surface below the course of the SAR. The combination of alluvial material with a high water table in a seismically active area creates a hazard for liquefaction. The Redlands and Banning faults also impede groundwater movement along the borders of the subbasin (DWR 1986).

Geologic Units of SBBA

The water-bearing material in the subbasin consists of unconsolidated alluvial deposits and consolidated sediments. Most municipal and agricultural supply wells obtain water from the unconsolidated alluvial deposits. Figure 2-11 shows the relationship of the sediments in the basin (USGS 2006).

The unconsolidated alluvial deposits consist of sand, gravel, and boulders interspersed with deposits of silt and clay. The deposits are divided into older (Pleistocene) and younger (Holocene) alluvium and Holocene river-channel deposits. Near the mountain front, the unconsolidated deposits tend to be coarse-grained and poorly sorted, becoming finer-grained and better sorted downstream. The older alluvium consists of continental, fluvial deposits, ranging in thickness from some tens of feet to more than 800 feet. The younger alluvium is about 100 feet thick, composed mainly of floodplain deposits. The relatively recent river channel deposits are less than 100 feet thick but are among the most permeable sediments in the SBBA and contribute to large seepage losses from streams (Danskin et. al. n.d.). Wells yield up to 5,000 gallons per minute (gpm) and average about 1,245 gpm. Specific yield of these deposits ranges from 7 to 21 percent and averages 13 percent (WE 2000).

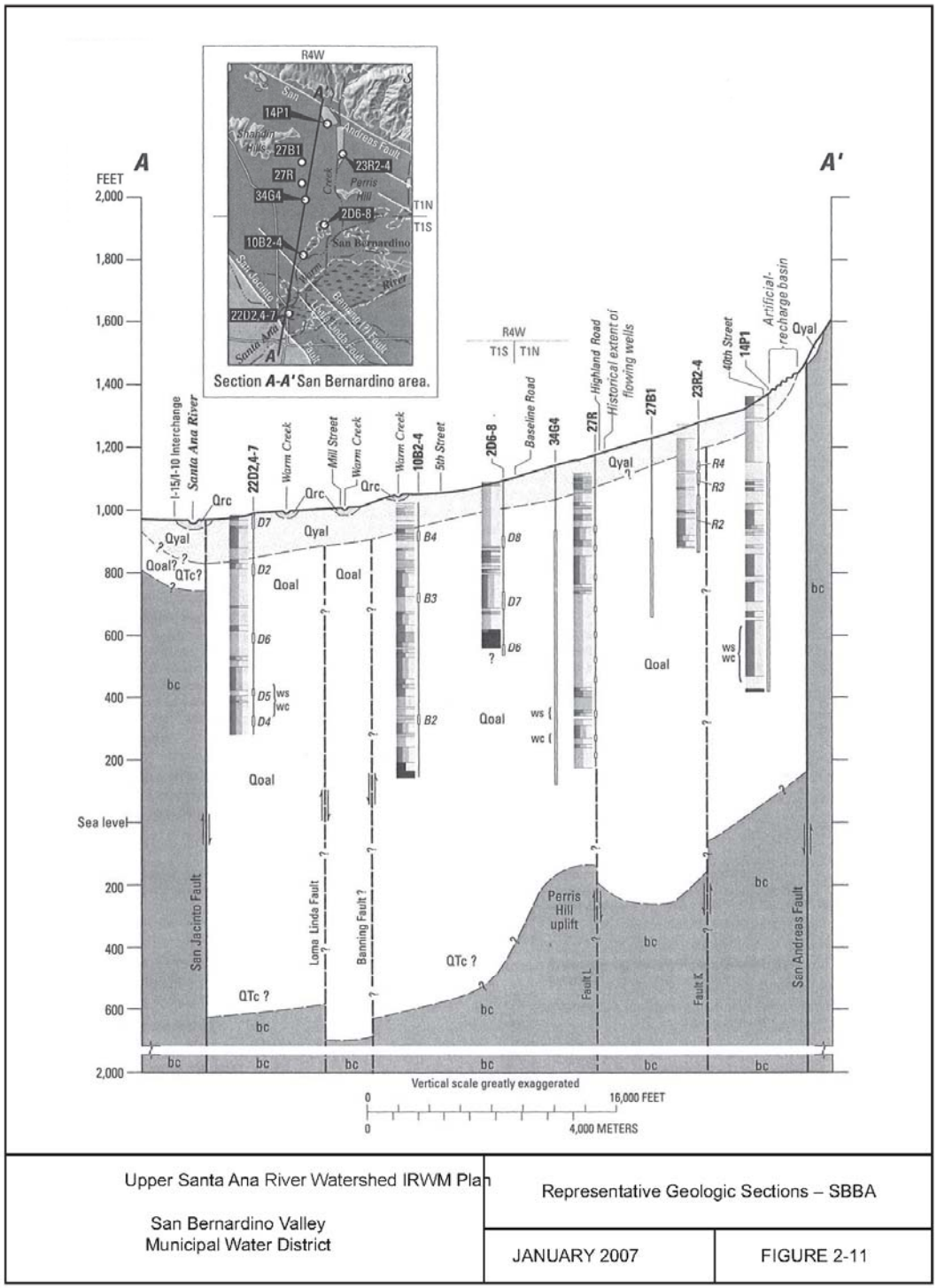
Within the unconsolidated alluvial deposits are three (upper, middle, and lower) fine-grained sequences that are separated by coarse-grained sediment. Both the

upper and middle fine-grained layers are present in the central portion of the valley and cover about 25 square miles. The upper fine-grained deposits (clay and silt) are part of the younger alluvium and are exposed on ground surface near the San Jacinto fault but, to the north, are covered by coarser-grained sediments. The clay layer may be locally eroded and replaced with coarse sand and gravel. Boreholes drilled in the vicinity of the SAR and the San Jacinto fault indicate a predominance of coarse sand and gravel, not fine-grained silt and clay. The middle fine-grained sequence is part of the older alluvium and is present at a depth of about 350 feet below ground surface (bgs). The sequence is as much as 300 feet thick and consists of interbedded silt, clay, and sand and thins towards the margins of the basin. Although previously conceived as a moderately clay unit, geophysical logs show this fine-grained sequence to consist of relatively continuous zones of silt and sand (Danskin 2006). Little is known about the lower fine-grained interval because most production wells do not penetrate to that depth.

The consolidated sedimentary rocks crop out mainly in the southern part of the San Bernardino area between the San Jacinto fault and Crafton Hills and underlie unconsolidated deposits throughout most of the valley. In the badlands, these sedimentary rocks are referred to as the San Timoteo Formation and are composed of partly lithified, non-marine alluvial and lacustrine sediments ranging in age from late Tertiary to early Quaternary. Well yields are moderate from the more permeable layers and are generally less than 500 gpm (Dutcher and Garrett 1963). Both the unconsolidated and consolidated sediments rest on and abut basement complex, which, for the purposes of this report, are considered to be essentially non-water bearing.

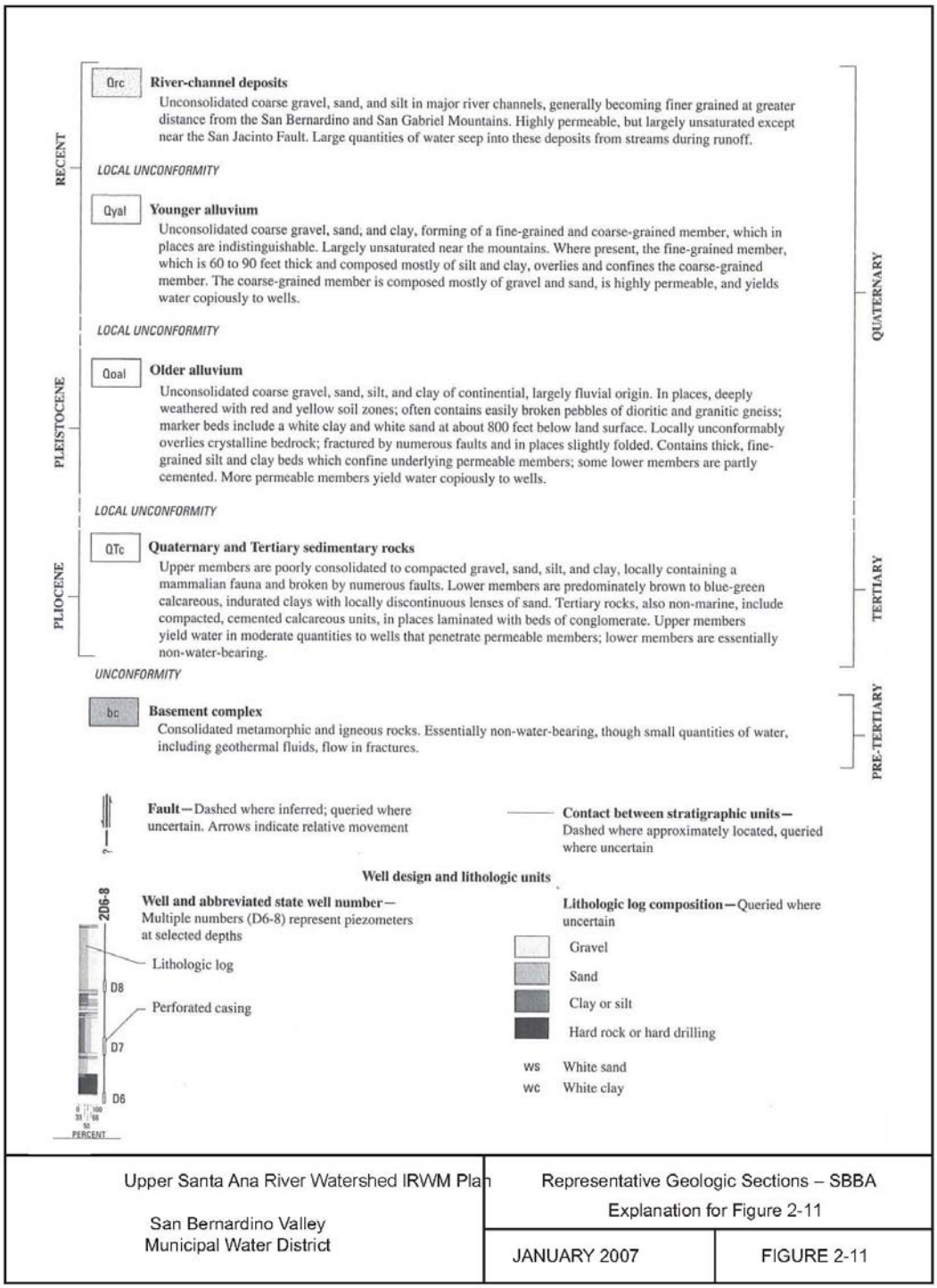
Faults in the area have both vertically and horizontally offset these geologic units.

Figure 2-11
Representative Geologic Sections – SBBA



Upper Santa Ana River Watershed IRWM Plan San Bernardino Valley Municipal Water District	Representative Geologic Sections – SBBA	
	JANUARY 2007	FIGURE 2-11

Source: USGS, 2002, Water Resources Investigative Report 02-4243



Upper Santa Ana River Watershed IRWM Plan San Bernardino Valley Municipal Water District	Representative Geologic Sections – SBBA Explanation for Figure 2-11
	JANUARY 2007 / FIGURE 2-11

Aquifer Systems of SBBA

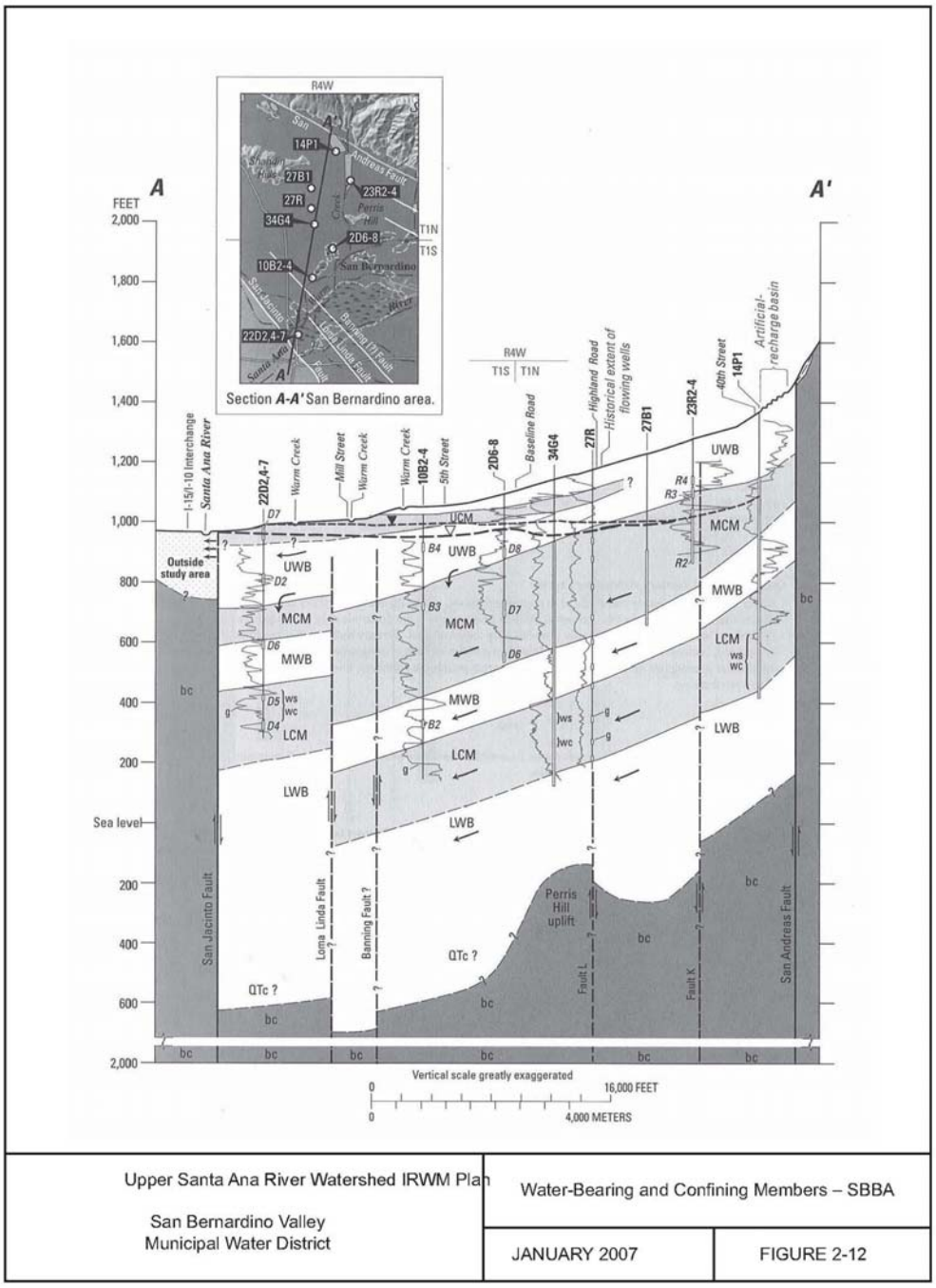
Dutcher and Garrett (1963) divided the SBBA alluvial sediments into the upper, middle, and lower water-bearing members that are separated by the upper, middle, and lower confining members (fine-grained sequences). Figure 2-12 shows a profile of the water-bearing and confining members (Danksin et. al., 2006). The aquifer system of the SBBA is generally unconfined, however, with water moving vertically between the multiple water-bearing layers. The confining members are more accurately described as very leaky aquitards[1] of finer-grained sediments.

The upper confining member is a near-surface deposit with low hydraulic conductivity. The upper confining member extends over a relatively large area from the San Jacinto fault to Highland Road, but only produces confining conditions in a relatively small area referred to as the "Pressure Zone" (see Figure 2-13). As shown in Figure 2-12, the upper confining member is effectively at land surface between the San Jacinto fault and Banning fault and would prevent recharge from precipitation from reaching the upper water-bearing member. In the area between Warm Creek and the SAR, the upper confining member acts to restrict vertical flow causing semi-confined conditions within the upper water-bearing member. North of the Banning fault to about Highland Road, the upper confining member is covered with coarse sediments. Perched water may occur in these areas and springs or seeps may occur where the contact is exposed at ground surface. In the vicinity of the SAR and San Jacinto fault, the upper confining member appears to have been eroded and replaced with coarse sand and gravel. In these areas, the coarse-grained sediments are essentially part of the upper water-bearing member and allow recharge or discharge of water from the upper water-bearing member.

The upper water-bearing member is not usually filled with groundwater. Near the foothills, as shown in Figure 2-12, the member is essentially dry as the groundwater levels are below the base of the unit. Localized areas of perched groundwater may be present as recharge percolates through the sediments. Within the central portions of the valley, the member becomes fully saturated as water moves from the upper portions of the valley to lower elevations. The upper water-bearing aquifer is likely full along the course of the SAR.

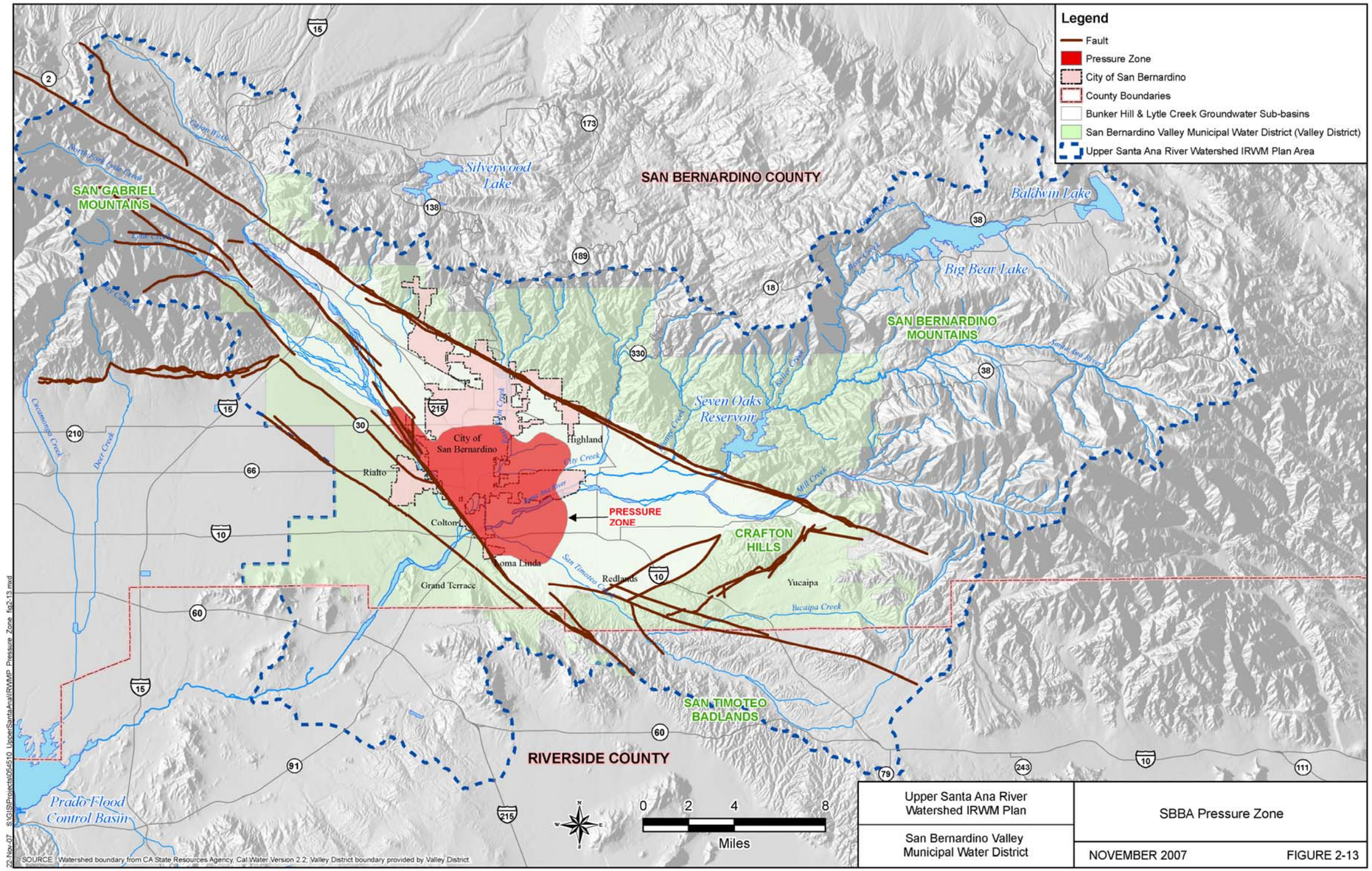
[1] An aquitard is a low-permeability sedimentary unit that can store groundwater and also transmit it slowly from one aquifer to another (Fetter 1988). An aquitard is generally considered to be a barrier or partial barrier to movement of groundwater because water tends to move substantially slower through aquitards than aquifers.

Figure 2-12
Water-Bearing and Confining Members – SBBA



Source: USGS, 2002, Water Resources Investigative Report 02-4243

Figure 2-13
SBBA Pressure Zone



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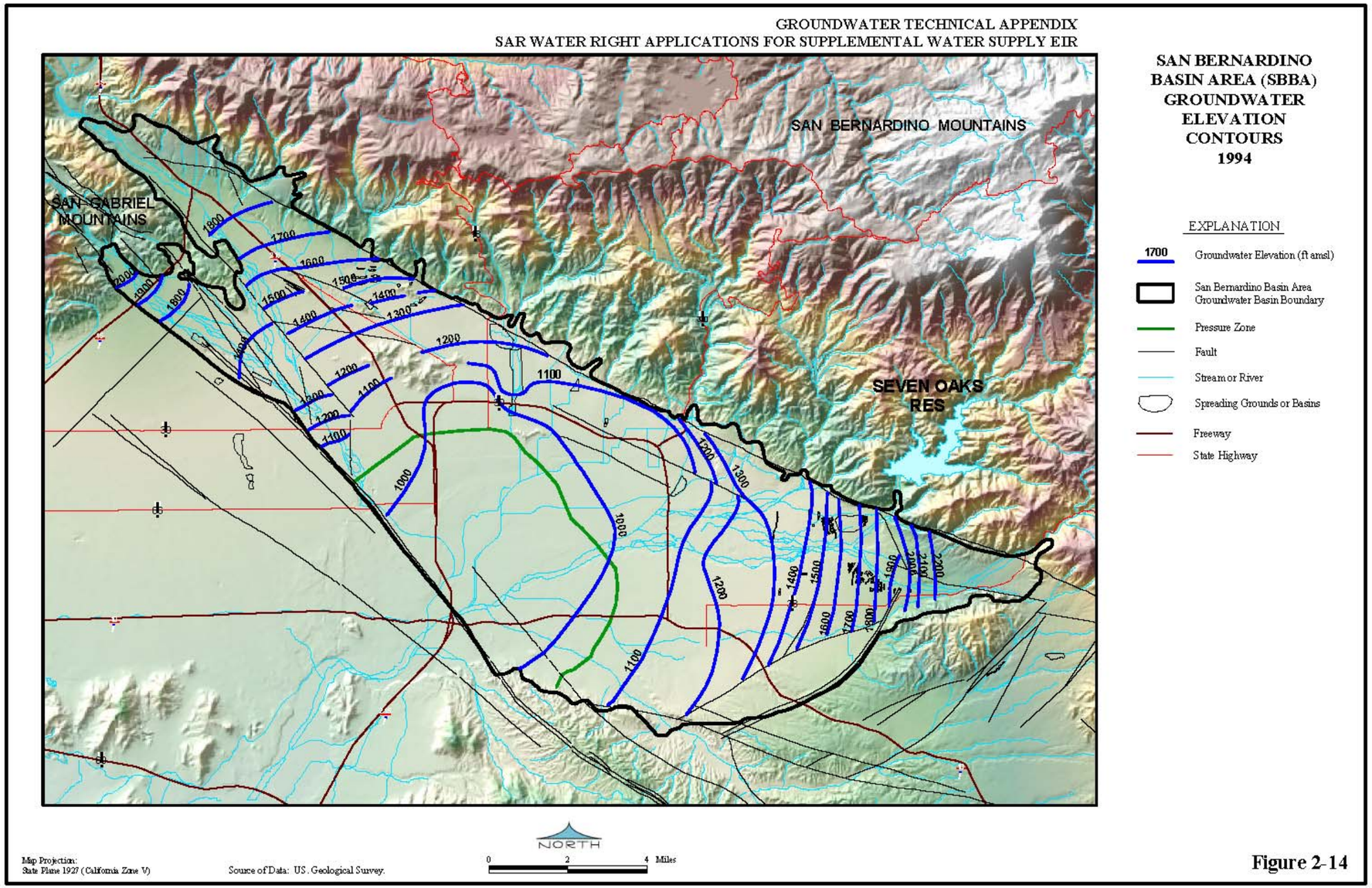
The upper and middle water-bearing members provide most of the water to municipal and agricultural wells. Flow meter testing in three production wells shows that most of the water is extracted from the shallow, younger deposits (Izbicki et. al., 1998). In the central part of the SBBA, these water-bearing members are separated by as much as 300 feet of interbedded silt, clay, and sand (the middle confining member). This middle confining member produces confined conditions over the central part of the basin (referred to locally as the "confined area"), but thins and becomes less effective toward the margins of the basin (Dutcher and Garrett 1963). As shown in Figure 2-12, USGS shows that the middle confining bed extends to the northern edge of the basin. Other sections prepared for the basin show that the middle confining member pinches out before reaching the edge of the basin (Numeric Solutions 2006). Although the middle confining member is not as permeable as the adjacent water-bearing zones, this unit consists primarily of continuous sand and silt (not silt and clay as is found in most aquitards), and there is water production from this zone in many wells (Danskin et al. 2006). It appears that groundwater recharge to the middle water-bearing aquifer is from vertical leakance through the middle confining member and near the fringes of the valley where the upper and middle aquifers may merge.

The lower confining and lower water-bearing members are not typically penetrated by most production wells and play a smaller role in the valley-fill aquifer, mainly due to deeper depth and generally lower permeability. The lower water-bearing member may be consolidated older alluvium or part of the consolidated sediments (Danskin, et. al. 2006).

The areal pattern of groundwater flow is from areas of recharge along the base of the mountains to areas of discharge where the SAR crosses the San Jacinto fault and has remained relatively unchanged over the period of record. Groundwater elevation contours shown in Figure 2-14 illustrate this flow regime in the Bunker Hill subbasin. However, vertical groundwater movement has changed through time due to groundwater extraction and artificial recharge. Groundwater pumping has occurred from increasingly deeper depths, altering the natural vertical movement of groundwater by progressively draining deeper zones of groundwater (Danskin et. al. n.d.).

Recharge to the Bunker Hill subbasin historically has resulted from infiltration of runoff from the San Gabriel and San Bernardino Mountains in areas where the upper confining member is absent or from the forebay. The SAR, Mill Creek, and Lytle Creek contribute more than 60 percent of the total recharge to the groundwater system (USGS 1989). Lesser contributors include Cajon Creek, San Timoteo Creek, and most of the creeks flowing southward out of the San Bernardino Mountains. The subbasin is also replenished by deep percolation of

Figure 2-14
SBBA Groundwater Contours



Percolation from streams, such as Devil Canyon Creek above, is the major source of recharge in the SBBA.

water from precipitation and resulting runoff, percolation from delivered water, and water spread in streambeds and spreading grounds.

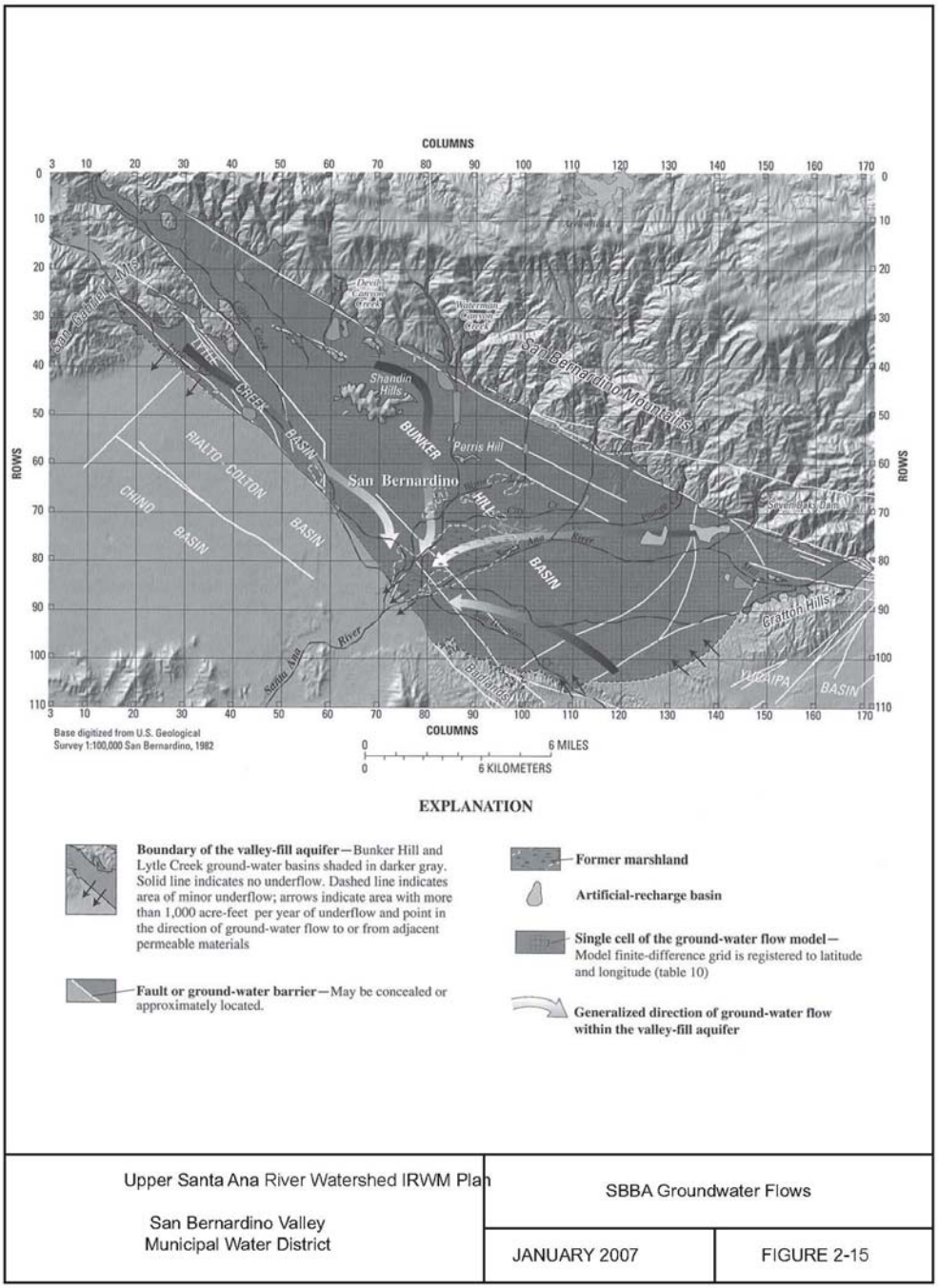
Percolation from streams (such as the SAR, Lytle Creek, Cajon Creek, Devil Canyon Creek, East Twin Creek, Warm Creek, City Creek, Plunge Creek, and Mill Creek) is the major source of recharge in the SBBA. Recharge occurs both in the stream channels and in nearby artificial recharge basins. As a result of the highly permeable river channel deposits and the artificial recharge operations, nearly all of the flow in the smaller streams (Devil Canyon, Waterman, East Twin, Plunge, and San Timoteo Creeks) is recharged to the upper and middle aquifers close to the mountain front.

During floods, the major streams (SAR, Mill Creek, and Lytle Creek) transmit large volumes of water over a short period, resulting in some surface water exiting the basin without contributing to groundwater recharge. Recharge to the SBBA also results from underflow (subsurface inflow), direct infiltration of precipitation, return flow, infiltration from underground sanitary sewer lines and storm drains, and artificial recharge of imported water. Subsurface inflow to the SBBA occurs across the Crafton fault and through the poorly transmissive materials comprising the Badlands, across a small section of unconsolidated deposits north of the Crafton Hills, and through materials beneath the Cajon Creek and Lytle Creek channels. Figure 2-15 shows the areas of underflow into the basin. Total underflow for 1945 to 1998 averaged about 5,000 acre-feet per year (Danskin et. al. 2006). Annual values have declined from a maximum of about 7,000 acre-feet in 1945 to about 4,000 acre-feet in 1998, predominately as a result of declining water levels in the Yucaipa subbasin. With the exception of unusually wet years, recharge from direct precipitation on the valley floor is minimal. An additional source of recharge is that derived from return flow of water pumped from and used locally within the SBBA. Hardt and Hutchinson (1980) estimated return flow to be 30 percent of total extractions, except for wells that export groundwater directly out of the San Bernardino area.

Subsurface outflow from the basin occurs only in the upper 100 feet of the younger alluvium through a breach in the San Jacinto fault, carved by the SAR (Danskin, et. al. 2006). Outflow also occurs through Barrier E at two locations, near the SAR and near Barrier J where Lytle Creek emerges from the San Gabriel Mountains. Subsurface outflow near the Barrier J fault is into the Rialto-Colton

subbasin. Figure 2-15 shows the location of the subsurface outflow from the basin.

Figure 2-15
SBBA Groundwater Flows



Upper Santa Ana River Watershed IRWM Plan San Bernardino Valley Municipal Water District	SBBA Groundwater Flows	
	JANUARY 2007	FIGURE 2-15

Source: USGS, 2002, Water Resources Investigative Report 02-4243

2.8.1.4 Bear Valley Groundwater Basin 8-9

This groundwater basin underlies Bear Valley and is bound by crystalline rocks of the San Bernardino Mountains in southern San Bernardino County. Big Bear Lake, which lies in the western portion of the valley, receives runoff from Grout Creek to the northwest, Van Dusen Canyon to the northeast, Sawmill Canyon and Sand Canyon to the southeast, Knickerbocker and Metcalf Creek to the south, and North Creek to the southwest. Baldwin Lake, which is typically dry, lies in the northeast portion of the valley and receives occasional runoff from Van Dusen Canyon to the northwest and Shay Creek to the south (GEOSCIENCE 2001). Average annual precipitation to the valley ranges from 23 to 29 inches.

Groundwater in the Bear Valley Groundwater Basin is found primarily in the unconsolidated alluvial deposits. The water-bearing deposits in the valley have been separated into upper, middle, and lower aquifers (GEOSCIENCE 1999). The upper and middle aquifers are the primary water producers. In addition, wells completed in underlying bedrock produce as much as 300 gpm (GEOSCIENCE 1999).

A groundwater divide exists between Big Bear Lake and Baldwin Lake in the vicinity of the Big Bear Airport (GEOSCIENCE 1999). Faults are mapped cutting Pleistocene alluvium but it is not known if these are barriers to groundwater movement.

Recharge of this basin is likely from percolation of precipitation and runoff and underflow from fractured crystalline rocks.

2.8.1.5 Big Meadows Valley Groundwater Basin 8-7

This basin underlies a mountain valley in the upper reach of the SAR. The basin is bounded on the west by Seven Oaks Valley Groundwater Basin along the Slide Peak fault (Rogers 1967) and elsewhere by impermeable crystalline rocks of the San Bernardino Mountains. The valley is drained by the SAR and receives an average annual precipitation ranging from 24 to 36 inches. Groundwater in the basin is found in alluvium that typically consists of clay, silt, sand, and gravel. Alluvial material appears to reach about 400 feet in thickness in some parts of the basin. The Slide Peak, Santa Ana, and San Gorgonio faults are mapped as cutting through basin materials (Rogers 1967); however, it is not known whether these faults impede groundwater movement.

2.8.1.6 Seven Oaks Valley Groundwater Basin 8-08

This basin underlies a mountain valley in the upper reach of the SAR. The basin is bounded on the east by Big Meadows Valley Groundwater Basin along the Slide Peak fault (Rogers 1967) and elsewhere by impermeable crystalline rocks

of the San Bernardino Mountains. The valley is drained by the SAR and receives an average annual precipitation ranging from 24 to 36 inches. Groundwater in the basin is found in alluvium that typically consists of clay, silt, sand, and gravel that reaches at least 50 feet thick. The Slide Peak and Santa Ana faults are mapped as cutting through basin materials (Rogers 1967); however, it is not known whether these faults impede groundwater movement.

Recharge is probably derived principally from percolation of precipitation and streamflow in the SAR.

2.9 Groundwater Management in the Region

Conjunctive use of surface water and groundwater is a long-standing practice in the Region. Part of the potable water used in the Region is imported from sources in the Sierra and Northern California through the SWP. Several reservoirs are operated primarily for the purposes of storing surface water for domestic and irrigation use, but groundwater basins are also recharged from the outflow of some reservoirs. The concept is to maintain streamflow over a longer period of time than would occur without regulated flow and thus provide for increased recharge of groundwater basins. Most of the larger basins in this Region are managed with many conjunctive use projects being developed to optimize and manage water supply. Numerous groundwater spreading grounds have been developed to recharge the groundwater basins when adequate surface water supply is available. Management of the water level in the SBBA, in general, and the Pressure Zone, in particular, is a focus of the groundwater management of this IRWM Plan. Management of the SBBA is discussed in more detail in Chapter 4.

Numerous groundwater spreading grounds have been developed to recharge the groundwater basins.

2.9.1 Recharge Area Programs

The SBVWCD and its predecessors have conducted groundwater recharge activities since 1912 in the Bunker Hill groundwater subbasin. Artificial recharge of imported water to the SBBA began in 1972. Because of the extremely permeable sand and gravel deposits, maximum instantaneous recharge rates are high. Based on a recharge efficiency rate of 95 percent, the total quantity of artificial recharge in the basin averaged about 7,400 acre-feet per year from 1972 to 1992. Because of the size of several of the recharge basins and exceptionally permeable material, a larger quantity of water could be imported and recharged along the base of the San Bernardino Mountains, if necessary (i.e., recharge basin capacity and infiltration rates are not currently limiting the amount of imported water recharged). Any additional recharge and extraction should be carefully planned and implemented to avoid liquefaction and unacceptable decreases in groundwater levels in the basins.

Numerous existing groundwater recharge facilities (spreading grounds or spreading basins) are located in the SBBA, Rialto-Colton, and Yucaipa subbasins. The locations of these facilities are shown in Figure 2-16, and selected characteristics are summarized in Table 2-11. Existing turnouts serve each recharge facility, with the exception of the Cactus Spreading and Flood Control Basins, which would be served by the Cactus Basins Pipeline proposed by Valley District. A description of each spreading ground follows.

Figure 2-16
Location of Spreading Grounds in the Region

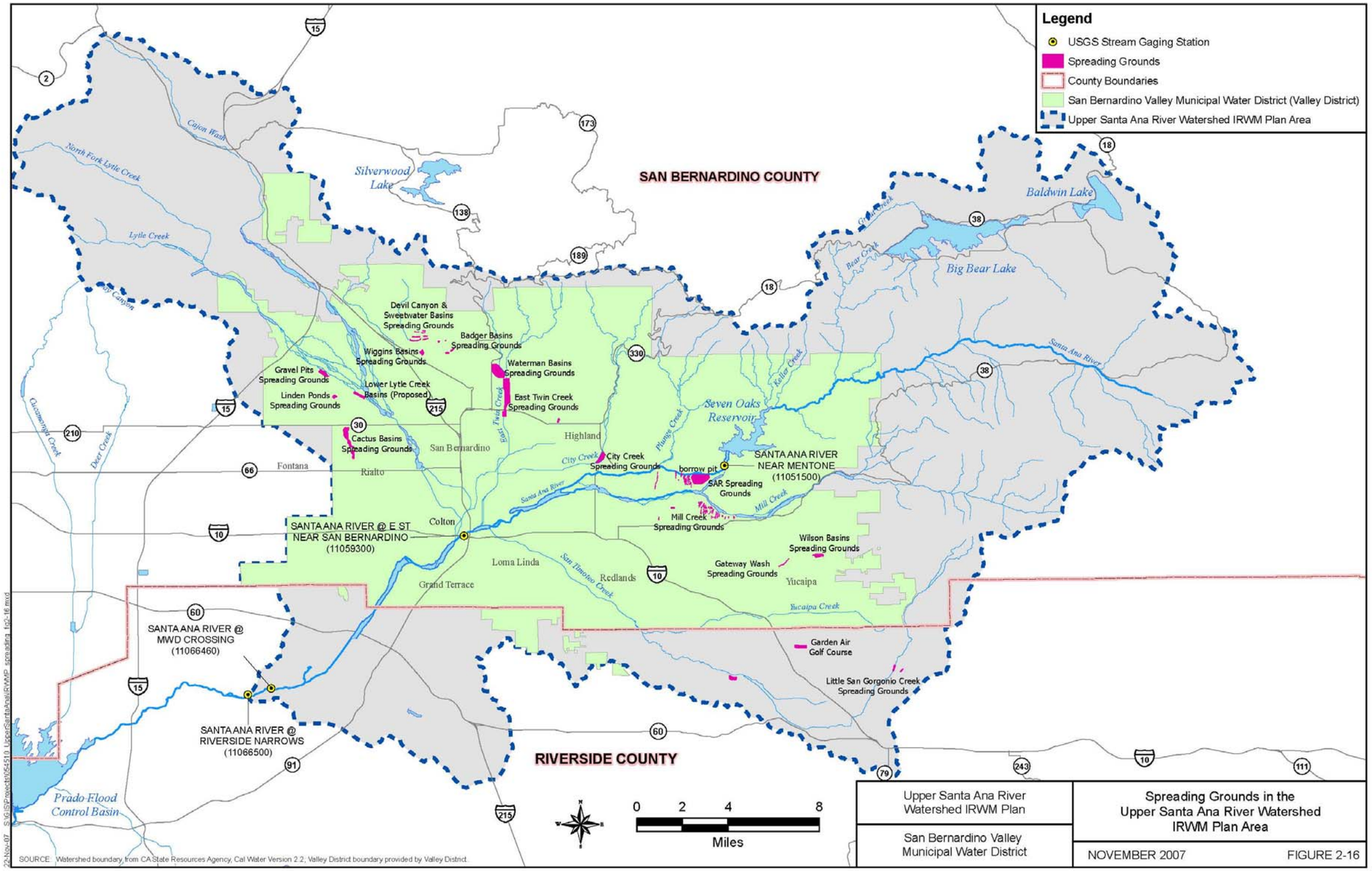


Table 2-11
Recharge Facilities

Facility Name	Owner or Operator	Conveyance Used to Serve Facility: Turnout Name & Capacity (cfs)	Recharge Facility Characteristics[a]: Active Recharge Facility Area[b] (acres)	Percolation Rate[c] (feet/day)	Monthly Capacity (acre-feet)	Groundwater Basin (and Subbasin) Recharged[d]
SAR Spreading Grounds	SBVWCD	Foothill Pipeline Santa Ana Low Flow (288) Santa Ana Intake (200 Max)	64[d]	3	12,000	SBBA (Bunker Hill)
Devil Canyon and Sweetwater Basins	SBCFCD[f]	Foothill Pipeline Sweetwater (37)	30	1.5	1,350	SBBA (Bunker Hill)
Lytle Basins	Lytle Creek Water Conservation Association	Fontana Power Plant Constructed drainage channel	Variable	1.5	Variable	SBBA (Lytle Creek)
City Creek Spreading Grounds	SBCFCD	Foothill Pipeline City Creek (60)	75	1.5	3,375	SBBA (Bunker Hill)
Patton Basins	SBCFCD	Foothill Pipeline Patton (12)	3	0.3	27	SBBA (Bunker Hill)
Waterman Basins	SBCFCD	Foothill Pipeline Waterman (135)	120	0.5	1800	SBBA (Bunker Hill)
East Twin Creek Spreading Grounds	SBCFCD	Foothill Pipeline Waterman (135)	32	1.5	1440	SBBA (Bunker Hill)
Badger Basins	SBCFCD	Foothill Pipeline Sweetwater (22)	15	0.5	225	SBBA (Bunker Hill)
Mill Creek	SBVWCD	Greenspot Pipeline Mill Creek Spreading (50) Mill Creek Intake (110)	66	3	6,000	SBBA (Bunker Hill)
Cactus Spreading and Flood Control Basins	SBCFCD	San Gabriel Valley MWD Lytle Pipeline Lower Lytle Creek (55)	46	1.5	2,070	Rialto-Colton
Wilson Basins	SBCFCD	East Branch Exten. Wilson Basins (30)	12	1	360	Yucaipa subbasin
Garden Air Creek	Valley District	East Branch Exten. Garden Air Creek (16)0	n/a	n/a	n/a	San Timoteo subbasin

[a] Values are from tabulation on map contained in Water Right Application by Valley District and Western to appropriate water from the SAR or by engineering evaluation of spreading grounds.

[b] Recharge facility area is the geographical extent of each basin that can be inundated for recharge.

[c] Estimated percolation rate. This is the estimated rate at which water can percolate into the ground through the basin, expressed in feet per day. The values used have generally been computed from the annual recharge capacity. These rates are typically about one-half of the percolation rates presented by the USGS (1972). The use of the small percolation rates is reasonable in that it would involve longer-term percolation rates that are typically smaller than short-term rates.

[d] Note that there may be flow out of the subbasin or basin identified. For example, a report by Geoscience Support Services, Inc. (1992) estimated that only 36 percent of the water recharged in the upper Lytle Creek area remains in the Lytle Creek subbasin, while most of it flows to the Rialto-Colton subbasin.

[d]Recharge facility area based upon 4/11/03, SBVWCD Report: "SBVWCD Basin Storage Capacity for SAR and MC." Or by estimating using GIS.

2.9.1.1 SAR Spreading Grounds

The SAR spreading grounds, located downstream of Seven Oaks Dam on the alluvial fan of the SAR, are operated by the SBVWCD. The SAR spreading grounds include a borrow pit that was a source of materials used in the construction of Seven Oaks Dam.

The percolation rate for the SAR spreading grounds is approximately 3 feet per day, which results in a recharge rate (based on 64 acres) of about 6,000 acre-feet per month, or about 97 cubic feet per second (cfs). Absorptive capacity is estimated by multiplying the active area of the recharge facility by the estimated percolation rate. Water delivered to the SAR spreading grounds recharges the Bunker Hill subbasin of the SBBA (Table 2-11).

2.9.1.2 Devil Canyon and Sweetwater Basins

The Devil Canyon and Sweetwater Basins, located northwest of the California State University, San Bernardino campus, are operated by the SBCFCD and have an active spreading area of 30 acres. The estimated long-term percolation rate for the site is about 1.5 feet per day, which results in a recharge rate of about 1,350 acre-feet per month, or about 23 cfs. The Devil Canyon and Sweetwater Basins recharge the Bunker Hill subbasin of the SBBA (Table 2-11).

2.9.1.3 Lytle Creek Subbasin

Gravel Pits and spreading grounds have been used for recharge of the subbasin for over 80 years. Significant groundwater recharge occurs in the gravel pits adjacent to Lytle Creek. However, evaluating recharge potential can be more complicated for recharge in a gravel pit than in a spreading facility dedicated to recharge.

2.9.1.4 The City Creek Spreading Grounds

The spreading grounds located along City Creek, between State Highway 30 and Boulder Avenue, are operated by SBCFCD. These spreading grounds have an active spreading area of about 75 acres and an estimated percolation rate of about 1.5 feet per day, which results in a recharge rate of about 3,375 acre-feet per month, or about 57 cfs. The City Creek spreading grounds recharge the Bunker Hill subbasin of the SBBA.

2.9.1.5 Patton Basins

The Patton Basins are located along Sand Creek, north of East Highland and west of the Patton State Hospital. The Patton Basins have an active spreading area of about 3 acres and an estimated percolation rate of about 0.3 foot per day. This

equates to a recharge rate of about 27 acre-feet per month, or about 1 cfs. Recharge at this site contributes to the Bunker Hill subbasin of the SBBA.

2.9.1.6 Waterman Basins

The Waterman Basins are located northeast of Wildwood Park and north of 40th Street in the City of San Bernardino. These basins are operated by SBCFCD, have an active spreading area of about 120 acres, and have an estimated percolation rate of about 0.5 foot per day. This percolation rate equates to a recharge rate of about 810 acre-feet per month, or about 14 cfs. However, the absorptive capacity used in the Allocation Model is 30 cfs, based on historic use. The Waterman Basins recharge the Bunker Hill subbasin of the SBBA (Table 2-11).

2.9.1.7 East Twin Creek Spreading Grounds

The East Twin Creek spreading grounds are located south of 40th Street, immediately south of the Waterman Basins, and are operated by SBCFCD. These spreading grounds have an area of about 32 acres and an estimated percolation rate of about 1.5 feet per day, which results in a recharge rate of about 225 acre-feet per month, or about 4 cfs. However, the absorptive capacity used in the Allocation Model is 24 cfs, based on historic use. The East Twin Creek spreading grounds recharge the Bunker Hill subbasin of the SBBA (Table 2-11).

2.9.1.8 Badger Basins

The Badger Basins, located in the Sycamore Flood Control Basin immediately east of the California State University, San Bernardino campus, are operated by the SBCFCD and have an active spreading area of about 15 acres. The estimated percolation rate for this site is 0.5 foot per day, which results in a recharge rate of about 225 acre-feet per month, or about 4 cfs. The Badger Basins recharge the Bunker Hill subbasin of the SBBA (Table 2-11).

2.9.1.9 Mill Creek Spreading Grounds

The Mill Creek spreading grounds are located south of the main channel of Mill Creek, about one mile upstream of the confluence with the SAR, and are operated by the SBVWCD. The Mill Creek spreading grounds have an active spreading area of about 66 acres and an estimated percolation rate of about 3 feet per day. This equates to a recharge rate of about 6,000 acre-feet per month. Recharge at this site contributes to the Bunker Hill subbasin of the SBBA (Table 2-11).

2.9.1.10 Cactus Spreading and Flood Control Basin

The Cactus recharge basins are located within the central portion of the Rialto-Colton subbasin. The basins are operated by the SBCFCD. Artificial recharge operations have an active spreading area of about 46 acres. The estimated percolation rate for this site is 1.5 feet per day.

2.9.1.11 Wilson Basins

The Wilson Basins are located northeast of the intersection of Oak Glen Road and Bryant Street, just north of the City of Yucaipa, and are operated by SBCFCD. The Wilson Basins have an active spreading area of about 12 acres and an estimated percolation rate of about 1 foot per day, which results in a recharge rate of about 360 acre-feet per month, or about 6 cfs. The Wilson Basins recharge the Yucaipa Basin.

2.9.1.12 Garden Air Creek

Garden Air Creek is a tributary of San Timoteo Canyon Creek. There are no plans for a formal spreading facility at this location and recharge will be accomplished by percolation from existing natural channels, up to a rate of 16 cfs. Although the turnout is outside Valley District and inside the boundary of SGPWA, the recharge area is in the San Timoteo Canyon region, and thus inside the Valley District service area boundary. This delivery will recharge the San Timoteo Basin.

2.9.1.13 Linden Ponds

Though no longer in existence the Linden Ponds were located between the San Jacinto fault and an unnamed fault in the northeastern portion of the Rialto-Colton subbasin. The basins were operated by the SBCFCD. Imported water was recharged between 1982 and 1994. Artificial recharge operations had an active spreading area of about 46 acres. The estimated percolation rate for this site was 1.5 feet per day.

2.9.2 SAR Natural Recharge

Most groundwater recharge occurs in the natural channels of the Upper SAR. However, evaluating the actual recharge potential for a natural channel is more complicated. The recharge rate depends on the wetted area, which varies substantially in a natural channel depending on flow conditions. The area of the “active” channel of the SAR (defined by the area on aerial photographs with limited vegetation) has been estimated to be about 79 acres, while the area from the mouth of the canyon to Sterling Avenue (i.e., to about the San Bernardino International Airport or former Norton Air Force Base), including overflow lands, is about 2,110 acres (Danskin et al. n.d.).

Danskin et al. estimated the potential percolation rate to be about four feet per day. Consistent with the percolation rates for spreading grounds included in the applications, a percolation rate of two feet per day is used here as the long-term percolation rate that might be achieved in the channel. Using the two-feet–per-day rate, the recharge rate may be about 4,740 acre-feet per month (or about 80 cfs) for the active channel from the mouth of the canyon to Sterling Avenue, and about 126,600 acre-feet per month (or about 2,128 cfs) if the overflow lands are included. Percolation in the river could recharge the Bunker Hill subbasin of the SBBA and the Rialto-Colton subbasin. In a similar analysis, USACE (1997) estimated that recharge in the active channel to Sterling Avenue would be approximately one cfs per wetted acre, which approximates to 79 cfs.

The maximum recharge area (including overflow lands) for SAR reaches from Sterling Avenue to Lower Warm Creek and from Lower Warm Creek to the San Bernardino/Riverside County line (Danskin et al. n.d.). No recharge rate is provided, however, because those reaches overlie an area where the upward flow of groundwater into the stream channel is greater than the downward recharge of streamflows. It was estimated that there was a net recharge of approximately 95 cfs from Sterling Avenue to Prado Dam (USACE 1997).

2.9.3 Groundwater Discharge from SBBA

Groundwater discharge from the SBBA occurs from (1) rising water, (2) subsurface outflow, and (3) groundwater extractions. Rising water primarily occurs in the lower reaches of Warm Creek, when groundwater rises above the level of the ground surface or channel bottom and contributes to surface flows. The quantity of groundwater discharge into the creek for the period 1945 to 1992 was determined to be highly variable, with a maximum discharge exceeding 40,000 acre-feet per year and a minimum discharge of zero for 16 consecutive years, from 1963 to 1978 (Danskin et al. n.d.).

Subsurface outflow occurs across the San Jacinto fault and Barrier E at two locations, in the vicinity of the SAR at the Colton Narrows and where Lytle Creek emerges from the San Gabriel Mountains north of Barrier J. In the vicinity of the SAR at the Colton Narrows, subsurface outflow occurs in the younger alluvium. For the period 1936 to 1949, subsurface outflow in this area was estimated to range from 14,300 to 23,700 acre-feet per year (Dutcher and Garrett 1963). Subsurface outflow north of Barrier J was estimated to be approximately 4,000 acre-feet per year (Dutcher and Garrett 1963) and between 2,700 and 4,200 acre-feet per year during water years 1935 to 1960 (DWR 1970b).

While streamflow and subsurface outflow contribute to basin discharge, groundwater extraction is the primary discharge of groundwater from storage. Extracted water is used for agricultural, municipal, and industrial purposes. Most

pumping is located near major streams, including the SAR, Lytle Creek, Warm Creek, and East Twin Creek. This areal distribution of pumpage reflects the exceptionally permeable deposits that underlie the stream channels and the abundant nearby recharge (Danskin et al. n.d.). As the area has become urbanized, the quantity of agricultural pumpage has declined considerably, presently accounting for less than 20 percent of the gross pumpage (Danskin et al. n.d.). However, overall pumpage has increased in the basin due to increased pumping for municipal and industrial purposes. Prior to 1940, gross pumpage in the basin was less than 110,000 acre-feet per year, while current pumping has reached as high as about 200,000 acre-feet per year (Western-San Bernardino Watermaster 2002).

2.9.4 Groundwater Storage

Estimates of the change in groundwater volume, or storage, in the SBBA are made annually by both Valley District and the SBVWCD from which a cumulative change in basin storage is calculated. The approach employed by Valley District calculates the change in storage for nine sub-areas: Cajon, Devil Canyon, Lytle Creek,, Pressure Zone, City Creek, Redlands, Mill Creek, Reservoir, and Divide. Calculating the change in storage for the SBBA is accomplished by summing the individual values for each of the sub-areas (Table 2-12).

Table 2-12
Summary of Groundwater Storage Capacities and Basin Surface Area

Basin	Storage Capacity (af)	Surface Area (acres)
SBBA	5,976,000	90,000
Rialto–Colton	2,517,000	30,100
Yucaipa	783,000 – 1,230,000	25,300
San Timoteo	2,010,000	73,100
Source: DWR, 2003b.		

The first change in storage calculation was completed for the years 1934 to 1960 by DWR (DWR 1970b). The values were calculated using the Specific Yield Method and a mathematical model developed by TRW, Inc. (TRW 1967). In 1980, Valley District updated the change in storage calculation to include the years 1961 to 1980. In the early 1990s, Valley District created a new change in storage model using software developed by Environmental Systems Research Institute (ESRI). In years of low precipitation, infiltration (direct from precipitation and surface streams) decreases while groundwater extractions increase, thereby causing the cumulative storage to decrease. The cumulative change in storage is cyclical based upon weather conditions. For example, 1934

through 1949 and 1979 through 1987 were wet periods, which produced increases in storage, while 1950 through 1978 was a dry period, resulting in decreased storage.

In general, the far eastern and northwestern portions of the Bunker Hill subbasin show the largest decreases, while the rest of the subbasin shows mostly stable or increasing groundwater elevations.

Groundwater in the Bunker Hill subbasin generally flows in a southwesterly direction from the San Bernardino Mountains to the Colton Narrows. The San Jacinto fault generally runs perpendicular to the groundwater flow and acts as a partial barrier resulting in water level differences across the fault. This phenomenon also contributes to the high groundwater located within the City of San Bernardino, commonly referred to as the Pressure Zone. Figure 2-13 depicts depth to groundwater contours throughout the SBBA, Rialto-Colton subbasin, and Yucaipa subbasin, including those reflecting shallow groundwater conditions in the Pressure Zone. In the past, water levels in the Pressure Zone were raised high enough to cause artesian conditions.[1]

For the basin as a whole, there can be wide fluctuations in the average depth to groundwater from year to year, with annual changes as high as almost 40 feet. However, for the most part, annual changes register less than 20 feet (+ or -), with only six years exceeding this range. There are, however, noticeable variations in behavior across subbasins.

The Lytle Creek subbasin (Figure 2-6) contains Lytle Creek, with extensive headwaters in the adjacent mountain areas and a river channel comprised of deep, porous alluvial deposits. Due to the presence of Lytle Creek and its relatively small size, this subbasin exhibits far greater and more extreme changes than any other subbasin of the SBBA. In 40 of 68 years, the annual average change in depth to groundwater exceeds 20 feet, with 8 years showing changes greater than 50 feet, and 3 years showing changes greater than 100 feet.

The Bunker Hill and Lytle Creek subbasins are generally considered as one groundwater basin, the SBBA. However, the three separate water-bearing zones and intervening confining zones of the Bunker Hill subbasin are not observed in the Lytle Creek subbasin. Sediments within the Lytle Creek Basin are, for the most part, highly permeable and the aquifer has a high specific yield. High permeability and specific yield tend to result in an aquifer that responds rapidly to changes in inflow (precipitation and streamflow) and outflow (groundwater pumping, streamflow, and subsurface outflow). Water levels in the Lytle Creek subbasin have fluctuated in excess of 200 feet over relatively short periods (less than 5 years) and in select wells (e.g., FWC's Well F34A). From 1934 to 2002,

depth to groundwater as measured in various wells in the basin has ranged from approximately 8 feet in the south-central portion of the basin to over 500 feet in the north-central portion of the basin (SBVMWD 2003).

Lytle Creek subbasin is adjoined on the west by the Rialto-Colton subbasin, along the Lytle Creek fault, and on the east and southeast by the Bunker Hill subbasin, along the Loma Linda fault and Barrier G. The northwestern border of the subbasin is delineated by the San Gabriel Mountains, and runoff from the mountains flows into the Rialto-Colton subbasin. Numerous faults that act as barriers to groundwater flow create six compartments within the basin. Barriers A through D divide the northwestern portion of the basin into five sub-areas and the southeastern portion of the basin comprises the sixth sub-area. Barrier F divides the northwestern sub-areas from the southeastern sub-area. Studies have shown that the groundwater barriers are less permeable with depth (Dutcher and Garrett 1963). When groundwater levels are high during wet years, more leakage occurs across the barriers than when groundwater levels are lower (i.e., during dry years). The amount of pumping in each sub-area, in large part, controls the movement of groundwater across the barriers (Dutcher and Garrett 1963).

2.9.5 Groundwater Quality

Groundwater quality varies among the subbasins of the Upper SAR due to geology and faulting patterns and recharge points, and from anthropogenic sources of contamination.

Perchlorate treatment facilities, similar to the West Valley Water District plant above, treat groundwater for use in the Region.

2.9.5.1 San Bernardino Basin Area

Groundwater in the SBBA is generally a calcium-bicarbonate type, containing equal amounts (on an equivalent basis) of sodium and calcium in water near the land surface and an increasing predominance of sodium in water from deeper parts of the valley-fill aquifer. A TDS range of 150 to 550 mg/L, with an average of 324 mg/L, is found in public supply wells (DWR 2003). Electrical conductivity (EC) is a measure of total dissolved ionic constituents. EC has been measured within a range of 95 to 2,920 microMhos (µMhos) with an average of 523 µMhos.

The inorganic composition of the groundwater may be affected by geothermal water emanating from faults and fractures in the bedrock surface underlying the aquifer. For example, concentrations of fluoride that exceed the public drinking

[1] Conditions where groundwater levels rise above the land surface in confined aquifers.

water standard have limited the use of groundwater extracted near some faults and from deeper parts of the aquifer.

In some public supply well locations in the SBBA, some inorganics (primary and secondary), radiological constituents, nitrates, pesticides, Volatile Organic Compounds (VOCs), Synthetic Organic Compounds (SOCs), and Perchlorate were found above the maximum contaminant level (MCL) (Table 2-13).

Table 2-13
Prevalence of Contaminants in SBBA Wells

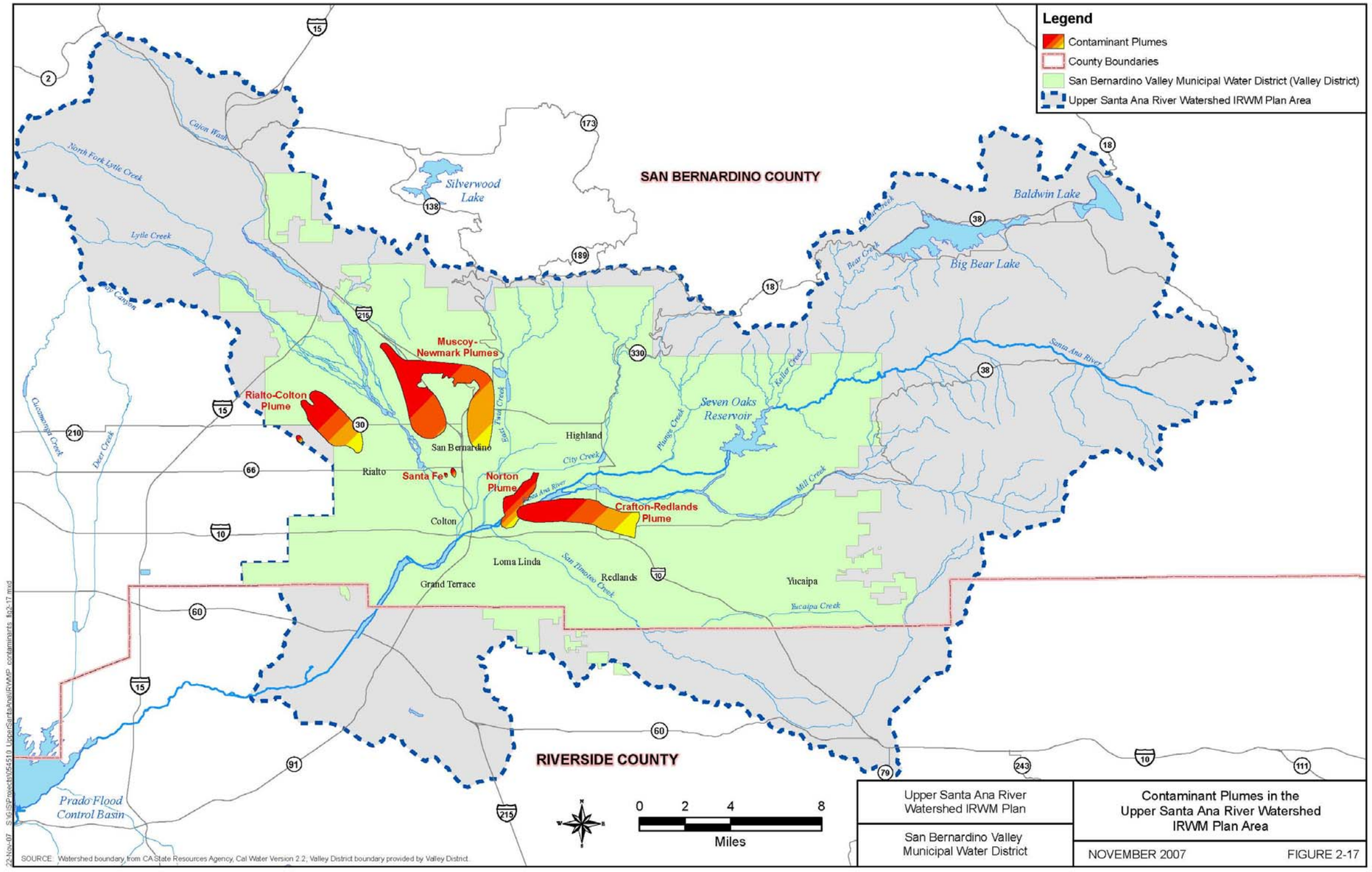
Constituent	No. Wells Sampled	No. of Wells with a Concentration Above MCL
Inorganics (primary)	212	13
Radiological	207	34
Nitrates	214	34
Pesticides	211	20
VOCs and SOCs	211	32
Inorganics (secondary)	212	25
Perchlorate	369	156 (1)

Source: DWR 2003. and Geoscience
1. No MCL has been established for Perchlorate. But “action level” is 4ug/l.

The SBBA is affected by five major groundwater contaminant plumes (Figure 2-17). Plumes in the basin include (1) the Crafton-Redlands plume, with TCE and lower levels of perchloroethylene (PCE) and debromochloropropane (DBCP); (2) the Norton Air Force Base TCE and PCE plume, stretching 2.5 miles from its source and contaminating 100,000 acre-feet of groundwater; (3 and 4) the Muscoy and Newmark plumes near the Shandon Hills, which are Superfund sites with TCE and PCE; and (5) the Santa Fe plume with PCE, TCE, and 1,2 dichloroethylene (1,2-DCE) contamination.

Within the City of San Bernardino, the Newmark plume and the Muscoy plume consist primarily of PCE. The plumes have impacted San Bernardino water supply wells. Under the federal Superfund Program, the U. S. Environmental Protection Agency (EPA) has implemented cleanup of these plumes, including use of groundwater extraction and treatment using granulated activated carbon. The treated water is then used to supplement the City of San Bernardino’s potable water supply. It appears that cleanup efforts will be adequate to protect 32 down-gradient water supply wells (Santa Ana River Watershed Project Authority (SAWPA) 2002). However, groundwater model simulations suggest that containment of the plume will need additional extraction wells that will result in pumping of at least 14,000 acre-feet per year (Danskin, et al 2006).

Figure 2-17
Contaminant Plumes in SBBA



The Norton Air Force Base plume, located just to the southwest of the former installation in the City of San Bernardino, is a major contaminant plume, consisting primarily of TCE and PCE. The plume has impaired 10 wells owned by the City of Riverside and the City of San Bernardino. Cleanup efforts by the Air Force, consisting of soil removal, soil gas extraction, and groundwater treatment, have significantly reduced this plume. The treatment plants now operate in a standby mode (SAWPA 2002).

Two commingled plumes, comprising the Crafton-Redlands plume, have impacted water supply wells for the cities of Riverside, Redlands, and Loma Linda, including Loma Linda University wells. One plume contains TCE and the other perchlorate; both are in the upper 300 to 400 feet of groundwater. TCE has been measured in water supply wells at over 100 parts per billion (ppb), over 20 times the MCL of 5 ppb. Currently, however, water supply well concentrations are around 7 ppb. Perchlorate is present in water supply wells at concentrations up to 77 ppb.

As required by the SARWQCB, the Lockheed Martin Corporation (Lockheed) has prepared contingency plans to address impacts of the plume on water supply wells. These include blending, treatment, and/or providing alternative water supply sources. The plumes are currently being captured by the City of Riverside's Gage Well Field. Lockheed has installed granular activated carbon treatment units at some of the gage wells to remove TCE and has installed ion exchange units on some of these wells for the removal of perchlorate (SAWPA 2002).

The Santa Fe groundwater plume consists primarily of 1,2-DCE, TCE, and PCE; this plume is currently being monitored (ERM 2001).

Separately from the foregoing remediation efforts, FWC currently operates and maintains a groundwater remediation project at its Plant F10 pursuant to a long-term agreement with San Bernardino County, the owner and operator of the Mid Valley Sanitary Landfill and corresponding Clean-Up and Abatement Order issued to San Bernardino County by the RWQCB. The 5,000 gpm treatment plant utilizes liquid phase granular activated carbon to treat for volatile organic compounds including, but not limited to, PCE, TCE, 1,1-DCE, and cis-1,2-DCE. The plant treats and removes those contaminants from groundwater extracted from both the Rialto-Colton and No-Mans Land subbasins.

2.9.5.2 Rialto-Colton Groundwater Subbasin

In public supply well samples in the Rialto-Colton subbasin, the average TDS is 264 mg/L, with a range of 163 to 634 mg/L (DWR 2003). Other source samples show an average TDS of 230 mg/L and a range of 201 to 291 mg/L. This is a

lower TDS range than the groundwater in the Bunker Hill subbasin, where TDS levels from 1995 through 1997 ranged as high as 1,000 mg/L along the SAR. The San Jacinto fault markedly affects the groundwater chemistry in the basin. The TDS in groundwater downstream from the San Jacinto fault is greater than that in the surface water found in the Bunker Hill outflow area.

Of 38 public supply wells sampled, two were over the MCL for nitrates, and in three wells, secondary inorganics, VOCs, and SOCs exceeded the MCL (Table 2-14). Most reported NO_3 concentrations are less than 22.5 mg/L, with a few samples ranging from 45 to 90 mg/L. Most of the wells sampled did not contain constituents over the MCL concentration.

More than 143 water source wells in Riverside and San Bernardino Counties alone now exceed 4 ppb of perchlorate contamination (California Department of Health Services 2003a). In the Valley District service area, the City of Rialto, the City of Colton, West Valley, and FWC have shut down or restricted the use of 20 wells due to perchlorate contamination in the Rialto-Colton subbasin, where concentrations reach above 4 ppb (SARWQCB 2003b).

Table 2-14
Prevalence of Contaminants in Rialto–Colton Subbasin Wells

Constituent	No. Wells Sampled	No. Wells with a Concentration Above an MCL
Inorganics (primary)	38	0
Radiological	40	0
Nitrates	38	2
Pesticides	40	0
VOCs and SOCs	40	3
Inorganics (secondary)	38	3
Perchlorate	38	7 (1)

Source: DWR 2003 and Geoscience.
1 No MCL has been established for Perchlorate. But “action level” is 4 ug/L

2.9.5.3 Riverside-Arlington Groundwater Subbasin

The Riverside subbasin contains groundwater that is predominantly calcium or sodium bicarbonate. Of the water sampled from 46 wells, TDS ranged from 210 to 889 mg/L, with an average of 463 mg/L (see Table 2-15) (DWR 2003). From other sources, TDS has been found to range from 320 to 756 mg/L. This is a higher TDS range than in the Rialto–Colton and Bunker Hill subbasins.

In some of the sampled public supply wells, MCLs were exceeded for inorganics (primary and secondary), radiological constituents, nitrates, pesticides, VOCs, and SOCs. Nitrate (as NO_3) concentrations of greater than 20 mg/L were detected as early as the 1940s, probably due to historical land use, including citrus production. NO_3 was the constituent found most frequently in the sampled wells, followed by pesticides. Only a few wells were found to have concentrations of primary and secondary inorganics.

Table 2-15
Prevalence of Contaminants in Riverside Subbasin Wells

Constituent	No. Wells Sampled	No. Wells with a Concentration Above an MCL
Inorganics (primary)	48	2
Radiological	48	11
Nitrates	51	21
Pesticides	50	19
VOCs and SOCs	50	8
Inorganics (secondary)	38	3
Source: DWR 2003		

2.9.5.4 Yucaipa Groundwater Subbasin

Most of the recent groundwater samples from the Yucaipa subbasin indicate a calcium bicarbonate-type groundwater, generally meeting drinking water standards, with little variation across the basin. Groundwater has higher mineral concentrations, but otherwise is similar to the surface water in the area. The average TDS from public supply wells is 322 mg/L, with a range of 200 to 630 mg/L. This is similar to average TDS values of 343 mg/L and 334 mg/L estimated from other sources (DWR 2003). The TDS estimates in the Yucaipa subbasin are lower than the Riverside subbasin and slightly higher than the Rialto-Colton and Bunker Hill subbasins.

Table 2-16 contains data from wells sampled for various pollutants (DWR 2003). Some samples contained concentrations above the MCL. This was true for one sample with primary inorganics, VOCs, and SOCs; four samples with pesticides and secondary inorganics; and 12 samples with nitrates. As in the Riverside subbasin, nitrates were found more than any other constituent in the sample well set.

Table 2-16
Prevalence of Contaminants in Yucaipa Subbasin Wells

Constituent	No. Wells Sampled	No. Wells with a Concentration Above an MCL
Inorganics (primary)	43	1
Radiological	44	1
Nitrates	46	12
Pesticides	43	4
VOCs and SOCs	44	1
Inorganics (secondary)	43	4
Source: DWR 2003.		

2.9.5.5 San Timoteo Groundwater Subbasin

The mineral character of groundwater beneath San Timoteo Canyon is sodium bicarbonate; calcium bicarbonate in the alluvium of Little San Gorgonio Creek; calcium bicarbonate in younger alluvium near Beaumont; and sodium bicarbonate in older deposits. Water samples from 24 public supply wells have an average TDS content of approximately 253 mg/L, with a range of 170 to 340 mg/L. The TDS range is lower than in the Riverside, Bunker Hill, and Yucaipa subbasins and comparable to the Rialto–Colton subbasin. Out of 27 sampled wells, one well contained secondary inorganics above the MCL (Table 2-17). Otherwise, no contaminants were found (DWR 2003).

Table 2-17
Prevalence of Contaminants in San Timoteo Subbasin Wells

Constituent	No. Wells Sampled	No. Wells with a Concentration Above an MCL
Inorganics (primary)	27	0
Radiological	26	0
Nitrates	28	0
Pesticides	27	0
VOCs and SOCs	27	0
Inorganics (secondary)	27	1
Source: DWR 2003.		

2.9.5.6 Cajon Subbasin

The mineral character of groundwater within the Cajon subbasin has an average TDS content of about 130 mg/L, with a range of 99 to 155 mg/L. The TDS range is lower than in the Riverside, Bunker Hill, and Yucaipa subbasins, and comparable to the Rialto–Colton subbasin. Only two public supply wells have been sampled. No exceedance of MCL in drinking water has been reported.

2.10 Ecological and Environmental Resources

2.10.1 San Bernardino National Forest Land and Resource Management Plan

The U.S. Forest Service (USFS) has jurisdiction over land uses in the San Bernardino National Forest. The *San Bernardino National Forest Land and Resource Management Plan of 1988* (USDA Forest Service 1988) directs the management of the forest. Its goal is to provide a management program that reflects a mix of activities that allows both the use and protection of forest resources; fulfills legislative requirements; and addresses local, regional, and national issues.

The San Bernardino National Forest is divided into 15 management areas based on (1) combinations of watersheds that have similar characteristics, (2) wilderness areas, and (3) potential wilderness areas. The Seven Oaks Dam and adjacent areas are located in the Central Section of the San Gorgonio District of the Santa Ana Management Area. Much of the area in this district is classified as the Santa Ana Recreation Area, a designation designed to provide continued protection of the recreation values for which it was established.

The management for this area emphasizes (1) fire management, (2) recreation (dispersed recreation opportunities in the lower SAR area), and (3) other integrated activities (including wildlife management and non-motorized recreation).

2.10.2 U.S. Bureau of Land Management (BLM) Area of Critical Environmental Concern

The BLM designated an Area of Critical Environmental Concern (ACEC) in the SAR in 1994. The purpose of the ACEC designation is to protect and enhance the habitat of federally listed species occurring in the area while providing for the administration of valid existing rights (BLM 1996). The species of concern in the SAR area include the SAR wooly-star, the Slender-Horned spineflower, and the San Bernardino kangaroo rat. The BLM manages over 1,100 acres that are part of the ACEC. Although the establishment of the ACEC is important in regard to conservation of sensitive habitats and species in this area, the administration of valid existing rights supersedes BLMs conservation abilities in this area. Existing rights include a withdrawal of federal lands in this area for water conservation through an act of Congress, February 20, 1909 (Pub. L. 248). The entire ACEC is included in this withdrawn land and may be available for water conservation measures such as the construction of percolation basins, subject to compliance with the act.

The San Bernardino Kangaroo rat is a species of concern in the SAR area. (Photo, courtesy of NPS).

2.10.3 U.S. Army Corps of Engineers Wooly-Star Preserve Area

To protect significant populations of the SAR wooly-star (a federally protected plant species), lands within the corridor of the SAR and portions of the alluvial fan terraces were set aside as a conservation area. The Wooly-Star Preserve Area (WSPA) is a 764-acre area located west of the Greenspot Bridge that crosses the SAR. The WSPA was established by mitigation in the 1990s by the USACE and local sponsors to address impacts related to the construction of Seven Oaks Dam.

2.10.4 Western Riverside County Multi-Species Habitat Conservation Plan

The Multi-Species Habitat Conservation Plan (MSHCP) is a comprehensive, multi-jurisdictional plan that focuses on the conservation of species and their habitats in western Riverside County. The plan area includes all unincorporated land in Riverside County west of the crest of the San Jacinto Mountains to the Orange County line, as well as the jurisdictional areas of a number of cities. The MSHCP established a conservation area of more than 500,000 acres and focuses on the conservation of 146 species.

2.10.5 SAR Corridor

The SAR corridor is defined as the area located within the incised channel of the river. Persistent aquatic and riparian habitats are present immediately downstream of the Seven Oaks Dam plunge pool; in oxbows; in fault zones; in areas with manmade or natural water sources, such as a tributary confluence or a storm drain outfall; in areas with perched water tables; and downstream of river mile (RM) 54.5, where groundwater emerges and flows on the surface of the riverbed (USACE 2000). Much of the habitat within the project area provides optimal foraging opportunities and several areas provide adequate breeding areas for raptors. Trees found in the riparian woodlands provide perches for foraging over the scrub and grassland.

Except during the winter months of December through March, surface flows in the SAR between Seven Oaks Dam and the San Bernardino International Airport are generally absent, and the riverbed is a braided, dry channel. Riparian habitat from Cuttle Weir to the airport is uncommon and limited to a few patches.

Downstream from the airport, surface flows are more prevalent and large areas of contiguous, well-developed riparian habitat as well as giant reed (*Arundo donax*) infestations along the banks of the SAR are common. Just downstream of the region are Prado Flood Control Basin and Prado Dam. Approximately 2,150 acres of land upstream of Prado Dam are owned by Orange County Water District (OCWD), the local sponsor for Prado Dam. Within this area are

approximately 465 acres of constructed wetlands as well as large areas of mature riparian habitat, naturally occurring wetlands, and deepwater habitats.

The vegetation communities discussed above provide wildlife habitat throughout most of the SAR corridor. In general, wildlife within the area is extremely diverse and abundant due to the amount of natural open space and diversity of habitat types from the active river channels to the uppermost flood terraces. While a few wildlife species depend entirely on a single habitat type, the mosaic of all the vegetative communities within the study area and adjoining areas constitutes a functional ecosystem for a variety of wildlife species.

The SAR contains a variety of riverine conditions and habitat types that support a number of fish species throughout nearly the entire river when winter and spring flows are present. Portions of the SAR, such as the segment that traverses the alluvial fan, are dry during most of the year and, consequently, offer only temporary habitat for fish.

The scrub, woodland, and riparian habitats in the SAR corridor provide foraging and cover habitat for song birds including year-round residents, seasonal residents, and migrating individuals. The overall condition of these communities in the corridor is good and mostly undisturbed. In addition, portions of the SAR and its tributaries provide a perennial water source for birds.

The SAR wash is a state-designated Significant Natural Area. Approximately 27 sensitive plant and animal species are known to occur in the wash. About 760 acres of BLM land within the Upper SAR wash area downstream from the Greenspot Bridge have been designated by BLM as an ACEC because of the presence of the federally listed species, SAR wooly-star, and the San Bernardino kangaroo rat (U.S. Fish and Wildlife Service (USFWS) 1988).

Wildlife corridors link areas of suitable habitat that are separated by unsuitable habitat such as rugged terrain, development, or changes in vegetation. Riverbeds often provide a favorable passageway for wildlife movement to otherwise disconnected areas. Historically, the SAR bed was likely to have supported substantial regional wildlife movement. In addition, the SAR floodplain may have acted as a hub for wildlife movement with many major tributaries converging in a relatively short section of the river. In recent years, however, loss of habitat due to development on the floodplain and surrounding lowlands, as well as construction of Seven Oaks Dam, are likely to have greatly reduced the amount of regional movement through the corridor.

3 Water Budget for Integrated Regional Water Management Plan Region

The water budget for the Integrated Regional Water Management Plan (IRWM Plan) Area (Region) compares the supply and demand for the Region. The water supply and water demand data that comprise the water budget are used in the development of integrated water management strategies that will be used to manage both supplies and demands into the future.

The data presented in this report are based upon water demand figures provided by each water agency in the Region. Actual demand figures for each agency may be different based upon the water agency's water right(s) recognized by the State of California (State).

3.1 Review of Previously Published Water Budgets

The San Bernardino Valley Municipal Water District (Valley District) compiled a water budget for its 352-square-mile service area in its Regional Water Facilities Master Plan (1995). The original Valley District water budget, with some modifications, was used by the Santa Ana Watershed Project Authority (SAWPA) as the basis for water budget tables in the SAWPA Integrated Water Resources Plan (2002). In 2004, Valley District and Western Municipal Water District (Western) updated the water budget by incorporating projections from the 2000 Urban Water Management Plans (UWMPs) in the Valley District/Western Santa Ana River (SAR) Water Right Application Draft Environmental Impact Report (DEIR) (2004).

3.2 Data Sources

The IRWM Plan water budget relies primarily on the 2005 update of the UWMPs within the Region. Table 3-1 provides a list of the water agencies within the Region and the UWMPs that were used in this analysis. Not all water agencies have completed the update of their UWMPs, and not all agencies are required to publish a UWMP (agencies that provide water to less than 3,000 connections and less than 3,000 acre-feet per year are not required to publish a UWMP). For these agencies, the necessary data for the water budget were obtained from the Western-San Bernardino Watermaster Report (see Chapter 2). For the purpose of preparing the water demands and supplies, the Region's water agencies were divided into four groups: (1) Non-Plaintiffs (water agencies in San Bernardino County of the Western Judgment (Western Municipal Water District of Riverside County v. East San Bernardino County Water District, Case No. 78426),

(2) Plaintiffs of the Western Judgment (water agencies in Riverside County), (3) water agencies outside the Western Judgment and located in the San Gorgonio Pass Water Agency (SGPWA) service area, and (4) water agencies outside the Western Judgment and located in the San Bernardino Mountains area.

Table 3-1
Data Utilized in the Water Budget

Water Agency	2005 UWMP	Other Documents
Non-Plaintiffs of the Western Judgment		
Colton, City of		Watermaster, SCAG
East Valley Water District	X	
Fontana Water Company	X	2005 Master Plan, Pers. Comm.
Loma Linda, City of		2002 UWMP
Marigold Mutual WC		Rialto, WVWD 2005 UWMP
Muscoy Mutual WC		2005 Community Plan
Redlands, City of - Water Utility	X	
Rialto, City of	X	Updated in 2006
San Bernardino MWD	X	
Terrace Water Co.		Watermaster
West Valley Water District	X	Personal Communication
Yucaipa Valley Water District[1]	X	
Other/Private[2]		Watermaster
Plaintiffs of the Western Judgment		
Meeks and Daley WC		Watermaster
Riverside-Highland WC	X	Watermaster
Riverside Public Utilities	X	Watermaster
San Gorgonio Pass Area		
Beaumont Cherry Valley WD	X	2006 LAFCO Report
Banning, City of[3]	X	2006 LAFCO Report
Cabazon Water District[3]		2006 LAFCO Report
South Mesa Water Company	X	2006 LAFCO Report
Yucaipa Valley Water District[1]	X	2006 LAFCO Report
San Bernardino Mountains Area		
Big Bear City CSD		2000 UWMP
City of Big Bear Lake DPW	X	
Big Bear Municipal WD		Personal Communication

[1]Yucaipa Valley Water District overlies the SGPWA and the Valley District. Yucaipa Valley WD includes Western Heights WC and Oak Valley.
[2]Includes Devore WC, Crafton WC, Inland Valley Development Company, Mount Vernon WC, Pioneer Mutual WC, Pharaoh-Powell Mutual WC, Redlands WC, Tennessee WC, California Portland Cement Company, Corridor Land Company, El Rivino Country Club, and Elsinore Valley MWD.
[3]Agencies outside of the Santa Ana River Watershed but inside the SGPWA service area.

3.2.1 Applied Water Demands

The applied water demands developed for the water budget are based on the demand projections provided by each individual agency. If demand projections were unavailable for an agency, a per-capita applied water demand was calculated using Southern California Association of Governments (SCAG) data along with the water demands published by Western-San Bernardino Watermaster. Projections for the water users that do not belong to a city or water agency are based on historical demand trends using historical data compiled by the Watermaster. The applied water demands from 2005 to 2030 are summarized in Table 3-2.

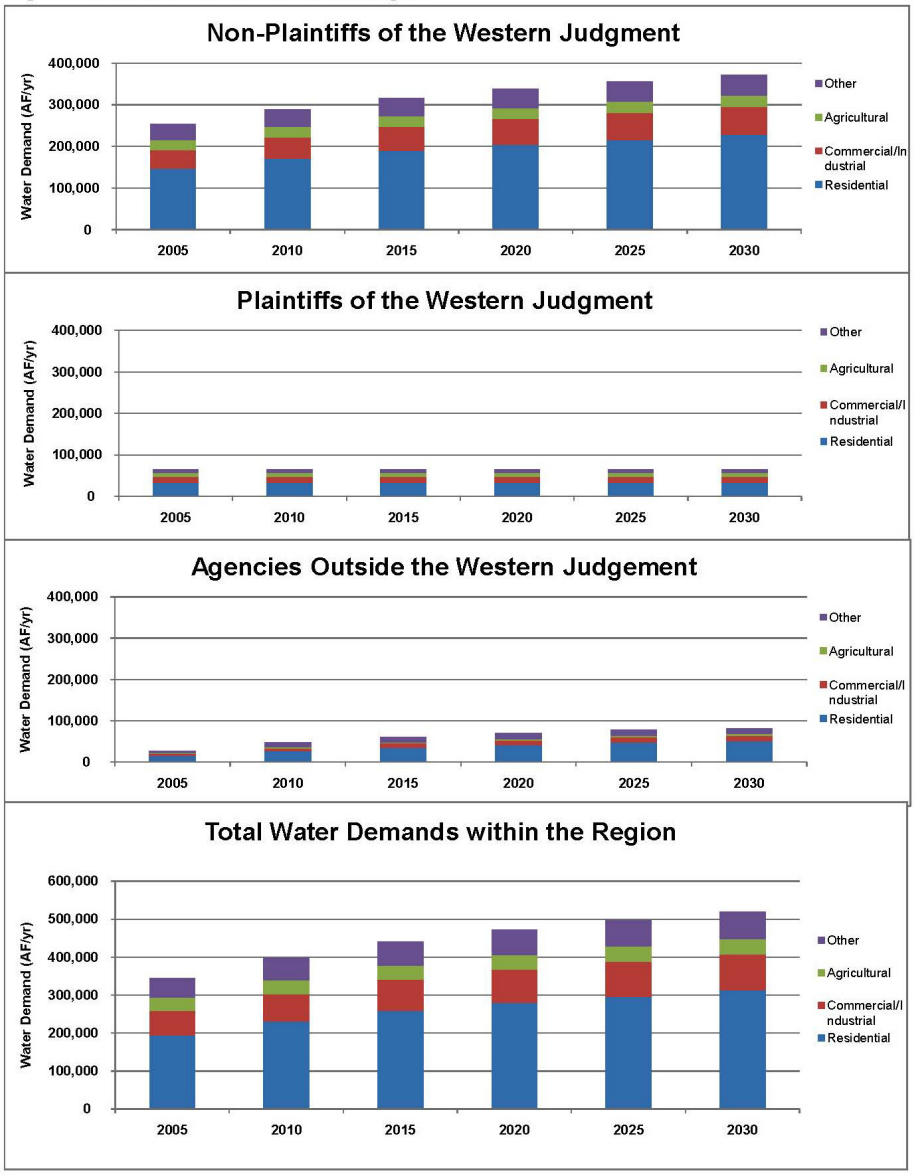
The Urban Water Management Planning Act requires that water demands be broken down into water use categories. The categories selected for this Region are Residential, Commercial/Industrial, Agricultural, and Other. The Other category includes uses such as unaccounted-for system losses, water sales to other agencies, and water used in construction. Figure 3-1 displays the total water demands in the region and breaks them down by water use. The projected total demand in the Region is expected to increase by about 50 percent from 349,200 acre-feet in 2005 to 519,700 acre-feet in 2030 (See Table 3-2).

Table 3-2
Future Applied Water Demands in the Region (Acre-Feet per Year)

Water Agency	2005	2010	2015	2020	2025	2030
Non-Plaintiffs of the Western Judgment						
Colton, City of	11,900	13,500	14,800	16,100	17,300	17,300
East Valley Water District	27,000	30,400	34,200	35,900	35,900	35,900
Fontana Water Company[1]	31,300	37,200	39,600	39,600	39,600	39,600
Loma Linda, City of	7,600	8,800	9,400	9,900	10,200	10,600
Marygold Mutual WC	0	0	1,500	1,500	1,500	1,500
Muscoy Mutual WC	2,100	2,100	2,100	2,100	2,100	2,100
Redlands, City of - Water Utility	45,500	50,600	55,000	59,500	61,500	65,300
Rialto, City of	14,300	13,300	13,900	13,900	13,900	13,900
San Bernardino MWD	47,500	54,800	61,900	67,700	73,500	73,500
Terrace Water Co.	900	900	900	900	900	900
West Valley Water District	25,300	30,000	33,700	39,000	45,000	56,400
Yucaipa Valley Water District[2]	13,900	13,200	15,600	17,300	19,400	20,000
Other/Private[3]	28,600	28,300	28,000	27,700	27,400	27,100
Subtotal	**255,900**	**283,100**	**310,600**	**331,100**	**348,200**	**364,100**
Plaintiffs of the Western Judgment[4]						
Meeks and Daley WC	7,800	7,800	7,800	7,800	7,800	7,800
Riverside-Highland WC	4,300	4,300	4,300	4,300	4,300	4,300
Riverside Public Utilities	52,200	52,200	52,200	52,200	52,200	52,200
Regents of California	500	500	500	500	500	500
Subtotal	**64,800**	**64,800**	**64,800**	**64,800**	**64,800**	**64,800**
San Gorgonio Pass Area						
Beaumont Cherry Valley WD	8,800	22,300	27,900	29,300	30,000	30,500
Banning, City of	9,500	12,500	15,500	18,500	21,600	24,600
Cabazon Water District	1,000	4,000	8,000	12,000	16,000	16,000
South Mesa Water Company	2,500	2,700	3,200	3,600	3,700	4,300
Yucaipa Valley Water District[2]	1,800	5,400	6,100	7,100	7,300	8,600
Subtotal	**23,600**	**46,900**	**60,700**	**70,500**	**78,600**	**84,000**
San Bernardino Mountains Area						
Big Bear City CSD	1,300	1,400	1,500	1,600	1,600	1,600
City of Big Bear Lake DPW	2,600	2,900	3,200	3,500	3,900	4,200
Big Bear Municipal Water District	1,000	1,000	1,000	1,000	1,000	1,000
Subtotal	**4,900**	**5,300**	**5,700**	**6,100**	**6,500**	**6,800**
TOTAL	**349,200**	**400,100**	**441,800**	**472,500**	**498,100**	**519,700**

[1]The demands shown for Fontana Water Company are their projected supplies from the Region, not FWC total demand. Portions of the supplies will be delivered outside the Region.
[2]Includes Western Heights WC and Oak Valley and overlies both SGPWA and Valley District.
[3]Includes Bear Valley Mutual WC, Devore WC, Crafton WC, Inland Valley Development Company, Mount Vernon WC, Pioneer Mutual WC, Pharaoh-Powell Mutual WC, Redlands WC, Tennessee WC, California Portland Cement Company, Corridor Land Company, El Rivino Country Club, Elsinore Valley MWD, San Gabriel Valley Water Company, and Reche Canyon Mutual WC.
[4]The demands for the Plaintiffs are their adjusted rights to the SBBA, not the total demand of the Plaintiff water agencies

Figure 3.1. Water Demands within the Region



3.2.1.1 Increase in Water Demand in Dry Years

During drought periods, water demands increase due to the increased irrigation demands for agriculture and landscaping. The demands outlined in Table 3-2 and Figure 3-1 are the average water demands projected by the water agencies. For the purposes of the modeling of the San Bernardino Basin Area (SBBA) analysis, water demands were assumed to increase in "critically dry" years by four percent (California Department of Water Resources (DWR) Bulletin

160-93). Critically dry years were defined to be the driest 20 percent of years using the SAR annual flows near Mentone from 1962 to 2000.

3.2.1.2 Reduced Demand Due to Conservation

Conservation reduces water demand in ways that are not easily measured. Demand is reduced through changed consumer behaviors and more water-efficient fixtures like ultra-low-flow toilets and showerheads. These savings happen gradually over time as non-conserving fixtures are replaced with newer water-efficient models. The agencies within the Region implement a prescribed set of urban water conservation best management practices (BMPs) according to the Urban Water Planning Act. The current water demands reflect the effect of water conservation projects that are implemented by the purveyors. However, in general, demand projections of the UWMPs do not include estimates of conservation due to the implementation of future water conservation programs.

3.2.2 Water Supplies

The following sections provide a description of each water supply within the Region, the projected demands on each supply, and an estimate of the available water supply based on data presented in UWMPs and the Western-San Bernardino Watermaster report. The majority of the groundwater basins in the Region are adjudicated. The projected demands on each water supply were based on the UWMPs. The projected water supplies of water purveyors were scaled to meet the projected demand. This was necessary to make a realistic projection of demand on shared water supplies within the Region.

3.2.2.1 San Bernardino Basin Area

The San Bernardino Basin Area (SBBA) was adjudicated by the Western Judgment in 1969. The judgment established the natural safe yield of the SBBA to be a total of 232,100 acre-feet per year for surface water diversions and groundwater extractions. Surface water is diverted from Mill Creek, Lytle Creek, and the SAR. The average surface water diversions in the SBBA for direct use from 1968 to 2000 were 39,000 acre-feet per year. It was determined in the Western Judgment that the Plaintiffs have a 64,862 acre-feet per year share of the safe yield, which equates to 27.95 percent of the safe yield. The Plaintiffs include the City of Riverside (the successor to the Riverside Water Company and the Gage Canal Company), Riverside Highland Water Company, Meeks & Daley Water Company, and the Regents of the University of California (Regents).

The Non-Plaintiffs' (agencies within San Bernardino County) rights are 167,238 acre-feet which equates to 72.05 percent of the safe yield. If the Non-Plaintiff extractions exceed the safe yield of the SBBA, Valley District is obligated to import and recharge a like amount of water into the SBBA. The Western-San Bernardino Watermaster produces an annual report calculating the total

extractions and comparing it to the safe yield. If the total extractions are less than the safe yield, it results in a "credit." If the total extractions are more than the safe yield, it results in a replenishment obligation. Table 3-3 and Figure 3-2 outline the projected increase in demands for the local surface water and groundwater in the SBBA and provide an estimate of how much replenishment will be needed in the future. According to the 2006 Annual Western-San Bernardino Watermaster Report, Valley District has 256,000 acre-feet of credit accumulated in the SBBA.

The SBBA is forecasted to supply over 60 percent of the future water demand within the Region. Computer models were used to help determine whether the available surface water (local surface water and imported water) and groundwater supplies would meet ultimate demands (2030). Based on the modeling results (described in Chapter 4.3), if the State Water Project (SWP) is as reliable as DWR estimated in 2005 (77%) and the Valley District's water rights application on the SAR is approved, the SBBA storage can be maintained to meet the 2030 demands.

Table 3-3
Projected SBBA Local Surface Water Diversions and Groundwater Extractions
(Acre-Feet per Year)

Water Agency	2005[1]	2010	2015	2020	2025	2030
Non-Plaintiffs						
Colton, City of	5,600	*7,000*	*7,700*	*8,300*	*9,000*	*9,000*
East Valley Water District	26,100	21,400	25,200	27,000	27,000	27,000
Fontana Water Company	17,300	*18,000*	*18,000*	*18,000*	*18,000*	*18,000*
Loma Linda, City of	6,600	8,800	9,400	9,900	10,200	10,600
Marygold Mutual WC	*0*	*0*	*1,500*	*1,500*	*1,500*	*1,500*
Muscoy Mutual WC	2,100	2,100	2,100	2,100	2,100	2,100
Redlands, City of - Water Utility	*37,500*	*39,100*	*42,000*	*45,000*	*47,000*	*50,300*
Rialto, City of	*11,400*	*9,300*	*9,900*	*9,900*	*9,900*	*9,900*
San Bernardino MWD	49,900	53,900	61,000	66,900	72,700	72,700
Terrace Water Co.	*800*	*900*	*900*	*900*	*900*	*900*
West Valley Water District	*10,900*	*12,800*	*14,800*	*17,600*	*21,100*	*30,700*
Other/Private[2,3]	*22,200*	*20,200*	*19,900*	*19,600*	*19,300*	*19,000*
Subtotal	**190,400**	**193,500**	**212,400**	**226,700**	**238,700**	**251,700**
Plaintiffs (Based on Adjusted Rights[5])						
Meeks & Daley WC	7,800	7,800	7,800	7,800	7,800	7,800
Riverside-Highland WC	4,300	4,300	4,300	4,300	4,300	4,300
Riverside Public Utilities	52,200	52,200	52,200	52,200	52,200	52,200
Regents of California	500	500	500	500	500	500
Subtotal	**64,800**	**64,800**	**64,800**	**64,800**	**64,800**	**64,800**
Total Groundwater and Surface Water Demand	**255,200**	**258,300**	**277,200**	**291,500**	**303,500**	**316,500**
Safe Yield	**232,100**	**232,100**	**232,100**	**232,100**	**232,100**	**232,100**
Extractions above Safe Yield	**23,200**	**26,300**	**45,200**	**59,500**	**71,500**	**84,500**
Return flow from Extractions above the Safe Yield[6]	**8,400**	**9,500**	**16,300**	**21,400**	**25,700**	**30,400**
Replenishment Obligation[7]	**14,800**	**16,800**	**28,900**	**38,100**	**45,800**	**54,100**

Italic = Estimated value. Projected demands in the SBBA were not specified in UWMPs.

[1]The extractions for 2005 are based on the Western-San Bernardino Watermaster 2006 Annual Report.
[2]Includes Devore WC, Crafton WC, Inland Valley Development Company, Mount Vernon WC, Pioneer Mutual WC, Pharaoh-Powell Mutual WC, Redlands WC, and Tennessee WC.
[3]In 2005 Other/Private includes a portion a Bear Valley Mutual Water Company (BVMWC) demands. BVMWC stock is owned by the City of Redlands and East Valley WD. After 2005 it was assumed that BVMWC are included in the City of Redlands and East Valley WD projections, as they purchase rest of the shares.
[4]Adjusted rights are based on the natural safe yield of the SBBA and were effective in 1972. Prior to 1972, extractions were limited to the "base rights," which were the average extractions during the base period from 1959 to 1963.
[5]The Western Watermaster assumes a 36 percent return flow from extractions above the safe yield.
[6]The Replenishment Obligation is the Extractions above the Safe Yield minus the Return Flow from the extractions. above the Safe Yield.

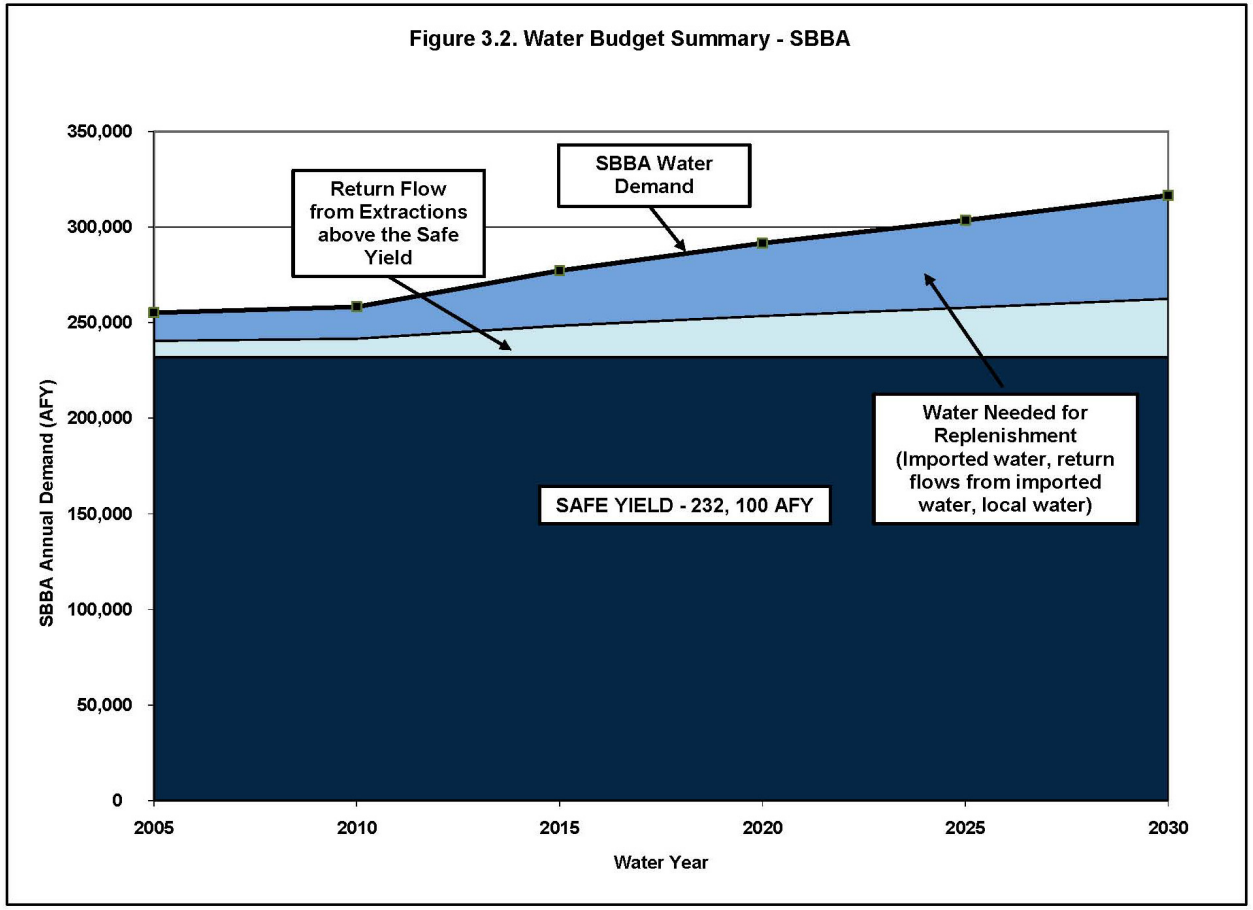


Figure 3.2. Water Budget Summary - SBBA
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
SBBA Annual Demand (AFY)
2005
2010
2015
2020
2025
2030
Water Year
Return Flow from Extractions above the Safe Yield
SBBA Water Demand
Water Needed for Replenishment (Imported water, return flows from imported water, local water)
SAFE YIELD - 232, 100 AFY

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3.2.2.2 Colton Basin Area

The groundwater extractions in the Colton Basin Area are governed by the Rialto Basin Decree and the Western Judgment. The Western Judgment uses the terminology "Colton Basin Area"; however, this basin is also known as the Rialto-Colton Basin. Fontana Water Company (FWC), City of Rialto, City of Colton, and West Valley Water District are subject to the Rialto Basin Decree, entered on December 22, 1961, by the Superior Court for the County of San Bernardino. Entitlement extractions for any given water year (October 1 to September 30) are affected by groundwater elevations between March and May for three specific "index" wells (Duncan Well, Willow Street Well, and Boyd Well). Under specified conditions, groundwater extractions may be limited during certain months.

The Western Judgment requires Valley District to maintain the average lowest static water levels in three index wells in the Colton Basin Area and Riverside North Basins above 822.04 feet mean sea level (msl). If the water levels fall below 822.04 feet msl, Valley District is obligated to recharge the basin with imported water or reduce extractions. Extractions for use in Riverside County are limited to 3,381 acre-feet per year.

The safe yield for the Colton Basin Area was not defined by the Western Judgment or the Rialto Basin decree. Extractions during the five-year base period of the Western Judgment, 1959 to 1963, were, on average, 11,731 acre-feet per year. Extractions have averaged 17,300 acre-feet per year from 1996 to 2005. Since 1971, when the Watermaster reports began, the water levels in the three index wells have never fallen below 822.04 feet. In 2006, the average lowest static level was 878.74 feet msl for the three index wells. Projected extractions in the Colton Basin Area are found in Table 3.4.

Since the safe yield has not been determined for the Colton Basin Area, the average extraction from 1996-2005 of 17,300 acre-feet per year was used as the available supply from the Colton Basin Area in the water budget summary.

Table 3-4
Projected Extractions in the Colton Basin Area (Acre-Feet per Year)

Water Agencies	**2005[1]**	**2010**	**2015**	**2020**	**2025**	**2030**
Colton, City of	4,100	4,100	4,500	4,900	5,300	5,300
Rialto, City of	1,600	2,000	2,000	2,000	2,000	2,000
West Valley Water District	2,200	3,500	4,500	5,900	8,200	10,000
Fontana Water Company	7,300	8,000	8,000	8,000	8,000	8,000
Other/Private[2]	2,100	2,100	2,100	2,100	2,100	2,100
Total	17,300	17,600	19,000	20,800	23,500	25,300
Historical Average (1996-2005)	17,300	17,300	17,300	17,300	17,300	17,300

[1]The extractions for 2005 are based on the 2006 Western-San Bernardino Watermaster Annual Report.
[2]Includes San Gabriel Valley WC and Reche Canyon Mutual WC.

3.2.2.3 Riverside North Basin

Groundwater extractions in the Riverside North Groundwater Basin (the portion of the Riverside Basin in San Bernardino County) are governed by the Western Judgment. Extractions for use in San Bernardino County are unlimited, provided that water levels at three index wells in the Rialto-Colton and Riverside North Basins stay above 822.04 feet msl. (Extractions from the Riverside North Basin for use in Riverside County are limited to 21,085 acre-feet per year.)

Total extractions during the five-year base period of the Western Judgment, 1959 to 1963, were, on average, 33,729 acre-feet per year. Historically, average static low measurements have never been below 822.04 feet and in 2006 were 878.74 feet msl. Because the safe yield of the Riverside North Basin has not been determined, the average historical extraction from 1996 to 2005 of 30,100 acre-feet per year was used as the available supply of the Riverside North Basin. Because the agencies in Riverside County are limited to 21,085 acre-feet per year, the available supply used in the water budget summary is the amount for the Non-Plaintiffs of 9,000 acre-feet per year. Table 3-5 lists the projected demands on the Riverside North Basin. If this increased production causes the water levels to drop, water agencies would have to either restrict use or Valley District would need to recharge the basin with imported water.

Table 3-5
Projected Extractions in the Riverside North Basin (Acre-Feet per Year)

Water Agencies	**2005[1]**	**2010**	**2015**	**2020**	**2025**	**2030**
Colton, City of	2,100	2,400	2,700	2,900	3,100	3,100
Rialto, City of	-0	1,000	1,000	1,000	1,000	1,000
West Valley Water District	1,300	2,900	3,700	4,800	5,000	5,000
Agencies in Riverside County[2]	11,200	21,100	21,100	21,100	21,100	21,100
SBMWD – RIX Overextraction[3]	5,000	6,000	6,000	6,000	6,000	6,000
Other/Private[4]	5,000	6,000	6,000	6,000	6,000	6,000
TOTAL	**29,100**	**38,400**	**39,500**	**40,800**	**41,200**	**41,200**
Historical Average (1996-2005)	30,100	30,100	30,100	30,100	30,100	30,100

[1]The extractions in 2005 are based on the 2006 Western-San Bernardino Watermaster Report
[2]Agencies in Riverside County have the adjusted right of 21,085 AF in the Riverside North basin.
[3]The Rapid Infiltration and Extraction (RIX) facility overlies the Riverside North Basin. In order to ensure that the secondary effluent applied to ground does not percolate to the groundwater and it is fully recovered, it is necessary that extractions exceed the amount of water applied. At present, this water is discharged from the RIX outfall into the SAR. In the long-term, the over-extractions rates will be approximately 10 percent more than that recharged (Watermaster 2003 pg. 14).
[4]Includes California Portland Cement Company, Corridor Land Company, El Rivino Country Club, and Elsinore Valley MWD.

3.2.2.4 Yucaipa Groundwater Basin

Yucaipa Valley Water District (YVWD) estimates the safe yield of the Yucaipa Groundwater Basin to be 10,000 acre-feet per year (YVWD 2005 pgs. 2-6). YVWD accounts for the majority of the demand on the Yucaipa Groundwater Basin. The City of Redlands Municipal Utilities Department and South Mesa Water Company also extract water from the Yucaipa groundwater basin to a lesser extent. YVWD demands are projected to increase from 15,700 acre-feet in 2005 to 28,600 acre-feet by 2030. In order to meet demands above the groundwater safe yield, YVWD plans to recycle water and import surface water from Mill Creek, SAR, and the SWP through transfer and exchange agreements with the City of Redlands and Valley District. YVWD's new water treatment plant became operational in 2007. There is potential to increase spreading of water in the Wilson Creek spreading grounds and also to utilize the Oak Glen Creek stream channel for additional recharge. By maximizing the existing spreading grounds and expanding spreading acreage along Oak Glen Creek (25 to 50 acres), the capability exists to spread from 7,000 to 14,000 acre-feet of surface water annually into the Yucaipa Basin.

Table 3-6
Projected Extractions in the Yucaipa Basin (Acre-Feet per Year)

Water Agencies	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Redlands, City of – Municipal Utilities Department	1,000	1,000	1,000	1,000	1,000	1,000
South Mesa Water Company	2,500	2,700	2,000	2,300	1800	1,800
YVWD	12,600	7,800	7,800	7,800	7,800	7,800
TOTAL	**16,100**	**11,500**	**10,800**	**11,100**	**10,600**	**10,600**
Safe Yield	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**

3.2.2.5 Other Groundwater and Surface Water Supplies

3.2.2.5.1 San Gorgonio Pass Area Groundwater Basins

The supplies available in the SGPWA are based on the "2006 Report on the Water Supply Conditions in the San Gorgonio Pass Region" submitted to LAFCO by SGPWA and the San Timoteo Watershed Management Authority (STWMA). This report concluded that the retail agencies in the region will be able to supply the projected demands to 2030 as long as the agencies aggressively develop local supplies and recycled water, complete the East Branch extension, and secure additional supplies outside the SGPWA service area.

The available groundwater supplies in the San Gorgonio Pass region are found in Table 3-7. The available supplies were based on Table 7 of the 2006 LAFCO report.

Table 3-7
Projected Extractions of Other Groundwater and Surface Water Supplies (Acre-Feet per Year)

Water Agencies	2005	2010	2015	2020	2025	2030
San Gorgonio Pass Area Groundwater Supplies[1]						
Edgar Canyon Basin	1,800	1,800	1,800	1,800	1,800	1,800
Beaumont Basin	24,700	24,700	8,700	8,700	8,700	8,700
Banning Storage Unit	2,500	2,700	3,000	3,200	3,500	3,700
Banning Canyon	5,000	5,000	5,000	5,000	5,000	5,000
Cabazon Storage Unit	1,000	6,000	6,000	6,000	6,000	6,000
Local Enhancements	700	8,100	10,100	11,500	12,900	13,600
Supplies	**35,700**	**48,300**	**34,600**	**36,200**	**37,900**	**38,800**
Big Bear Valley Groundwater						
City of Big Bear Lake D.W.P	2,500	2,800	2,200	2,500	2,800	3,100
Big Bear City C.S.D	1,300	1,400	1,500	1,600	1,600	1,600
BBV Groundwater Subtotal	**3,800**	**4,200**	**3,700**	**4,100**	**4,400**	**4,700**
Big Bear Lake						
Big Bear Municipal W.D.[2]	1,000	1,000	1,000	1,000	1,000	1,000
No Man's Land Groundwater						
Fontana Water Company	3,700	3,600	3,600	3,600	3,600	3,600
Rialto, City of	1,200	1,000	1,000	1,000	1,000	1,000
TOTAL PROJECTED SUPPLIES	**44,400**	**57,100**	**42,900**	**44,900**	**46,900**	**48,100**

[1]The SGPA groundwater available supplies are based on Wildermuth Demand and Supply data LAFCO 2006, Table 7.

[2]Surface water from Big Bear Lake used for snow making

3.2.2.5.2 Big Bear Valley Groundwater

Big Bear Community Services District (BBCSD) supplies all its water from groundwater in Big Bear Valley. The City of Big Bear Lake Department of Water and Power (BBLDWP) also produces groundwater in Big Bear Valley. The projected extractions from Big Bear Valley groundwater are found in Table 3-7. The reduction in demand in 2015 is due to the planned additional recycled water supply becoming available after 2010.

Water from Big Bear Lake is used for snowmaking at local ski resorts. Most of the melted snow from the resorts flows back into the lake.

3.2.2.5.3 Big Bear Lake

Big Bear Municipal Water District has a contract with Bear Mountain/Snow Summit to sell water from Big Bear Lake for snowmaking. The contract allows the sale of up to 1,300 acre-feet per year and no more than 11,000 acre-feet for any 10-year period. Currently, the sales of water for snowmaking have not exceeded 1,000 acre-feet per year. The projected extractions from Big Bear Lake are found in Table 3-7.

3.2.2.5.4 No Man's Land

FWC and City of Rialto extract water from a small unadjudicated groundwater basin between the Chino Basin and the Colton Basin Area known as "No Man's Land." FWC plans to extract 3,600 acre-feet per year from the basin. The City of Rialto plans also extract water from No Man's Land. Projected extractions from "No Man's Land" are found in Table 3-7.

3.2.2.6 State Water Project Water

SWP water is delivered from Northern California to Valley District. Valley District has the fifth largest SWP contract, with a maximum Table A amount of 102,600 acre-feet per year through 2035. To help assess the reliability of SWP supplies, DWR published the 2005 State Water Project Delivery Reliability Report. In this report, various hydrologic studies were conducted on the expected deliveries (expressed as percentage of entitlement) that would be available during different hydrologic years from 1922 to 1994. DWR ran two modeling studies, Study 4 and Study 5. Study 4 estimated the SWP deliveries based on 2005 demand levels with a repeat of the hydrology from 1922 to 1994. Study 4 estimated that, on average, 68 percent of the Table A SWP amounts would be delivered based on 2005 demand levels. Study 5 estimated SWP deliveries based on 2025 demand (which was assumed to be the full Table A amount). Study 5 estimated that, on average, 77 percent of the Table A SWP amounts would be delivered based on 2025 demand levels. The existing facilities and environmental constraints are the same between the two studies; the difference in reliability is the result of not limiting the deliveries to the 2005 demand levels for Study 5. (Example: in a repeat of the hydrology in 1956, Study 4 estimates the 2005 demand to be 3,639 thousand acre-feet (TAF).

Therefore, the deliveries are limited to 3,639 TAF. In 1956, with Study 5, the deliveries are not limited by the demands and the full amount of 4,133 TAF could be delivered). For this analysis, the reliability of the SWP is based on Study 5, which reflects the projected availability of SWP water not limited by 2005 demand levels. Therefore, Valley District's Table A amount of 102,600 acre-feet is estimated to be 77 percent reliable, or, on average, Valley District could receive 79,000 acre-feet per year of the Table A amount.

The water agencies in the Valley District service area forecast approximately 34,200 acre-feet per year for SWP deliveries in 2030, outlined in Table 3-8, based upon UWMP projections. Valley District is estimated to need approximately 54,100 acre-feet per year to meet the replenishment obligations in the SBBA with the projected demands in 2030 (Table 3-3). Replenishment may also be required for the Colton Basin Area and the Riverside North groundwater basins depending on the future water levels. Valley District would have 44,800 acre-feet per year of available SWP water to use for replenishment from its Table A amount after the SWP deliveries in 2030. The shortfall in 2030 may be met by the Valley District's water rights application on the SAR.

The other state water contractor in the Region is SGPWA. SGPWA has a contracted Table A amount of 17,300 acre-feet per year but is currently limited to importing 8,650 acre-feet per year until the next phase of the East Branch Extension is completed. Beaumont-Cherry Valley Water District and the City of Banning plan to purchase additional water from SGPWA and are investigating acquiring SWP water from other contractors' Table A amounts through SGPWA. The need for SWP water in the San Gorgonio Pass to meet the projected demands is higher than the current SGPWA Table A amount. Table 3-8 summarizes the forecasted demand for direct deliveries of SWP water and Table 3-9 is the available SWP supplies to the Region based on state water contractors' Table A amounts. Crestline-Lake Arrowhead Water Agency (CLAWA) is outside of the Region but provides 66 acre-feet per year water to the City of Big Bear Lake Department of Water and Power.

Table 3-8
Projected Deliveries of State Water Project (Acre-Feet per Year)

Water Agencies	2005	2010	2015	2020	2025	2030
SBVMWD						
East Valley WD	800	9,000	9,000	9,000	9,000	9,000
Fontana Water Company	3,000	5,000	5,000	5,000	5,000	5,000
Redlands, City of, Water Utility	0	3,000	4,000	5,000	5,000	5,000
San Bernardino MWD	2,000	2,000	2,000	2,000	2,000	2,000
West Valley Water District	1,300	7,000	7,000	7,000	7,000	7,000
Yucaipa Valley Water District	0	2,900	4,000	4,500	6,100	6,200
Subtotal	**7,100**	**28,900**	**31,000**	**32,500**	**34,100**	**34,200**
SGPWA (Portions of the SGPWA deliveries will be delivered for recharge)						
Banning, City of	0	4,000	8,800	9,300	9,300	9,300
Beaumont-Cherry Valley	0	6,000	6,800	6,800	6,900	6,900
Cabazon Water District	0	0	2,000	6,000	10,000	10,000
South Mesa Water Company	0	0	1,100	1,100	1,700	2,200
Yucaipa Valley Water District	500	2,300	3,600	4,700	4,800	6,100
Subtotal	**500**	**12,300**	**22,300**	**27,900**	**32,700**	**34,500**
CLAWA						
City of Big Bear Lake DWP	100	100	100	100	100	100
Subtotal	**100**	**100**	**100**	**100**	**100**	**100**
Total Deliveries	**7,700**	**41,300**	**53,400**	**60,500**	**66,900**	**68,800**

Table 3-9
Available State Water Supplies Based on Table A Amounts (AFY)

Water Agencies	Table A Amount	Average Reliability (77%)	Multi-Year Drought Reliability (39%)	Single-Year Drought Reliability (21%)
Valley District	102,400	79,000	40,000	21,500
SGPWA[1]	17,300	13,300	6,700	3,600
CLAWA to BBLDWP[2]	100	100	100	100
Total	**119,800**	**92,400**	**46,800**	**25,200**

[1]SGPWA plants to acquire an additional 21,000 AF of Table A amount for City of Banning and BCVWD.
[2]Crestline-Lake Arrowhead Water Agency supplies 66 acre-feet per year to BBLDWP.

3.2.2.7 Recycled Water

The projected use of recycled water is summarized by water agency in Table 3-10. Recycled water use is forecasted to increase from 9,200 acre-feet per year in 2005 to 35,700 acre-feet per year in 2030. The Orange County Judgment

(Orange County Water District v. City of Chino, et al., Case No. 117628) stipulated that Valley District shall be responsible for the delivery of an average annual supply of 15,250 acre-feet of "base flow" at the Riverside Narrows. Valley District has an agreement with the City of San Bernardino that at least 16,000 acre-feet of treated wastewater effluent will continue to discharge from its sewage treatment plant into the Santa Ana River to meet Valley District's obligation under the Orange County Judgment.

The City of Rialto delivers 85 acre feet per year of recycle water to the California Department of Transportation (Caltrans) (not shown on the table) and may increase to 2,260 acre feet in the future.

Table 3-10
Projected Use of Recycled Water (Acre-Feet per Year)

Water Agencies	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Banning, City of	0	1,500	1,800	2,200	2,500	2,800
Beaumont Cherry Valley WD	0	5,800	7,000	7,100	7,200	7,200
City of Big Bear Lake DWP	0	0	1,000	1,000	1,000	1,000
Fontana Water Company	0	2,600	5,000	5,000	5,000	5,000
Redlands, City of – Water Utility[6]	7,000	7,500	8,000	8,500	8,500	9,000
San Bernardino MWD	0	800	800	800	800	800
South Mesa Water Company	0	0	100	100	200	200
Yucaipa Valley WD	1,300	2,500	3,800	5,000	5,500	6,000
West Valley Water District	900	3,700	3,700	3,700	3,700	3,700
Total	**9,200**	**24,400**	**31,200**	**33,400**	**34,400**	**35,700**

[1]The recycled water by the City of Redlands would otherwise percolate into the SBBA. In the water budget summary this was not counted as a new supply. The recycled water that would otherwise discharge into surface streams and flow out of the Region was counted as new supply.

3.2.3 Water Budget Summary

The current balance between supply and applied demand for the Region is presented as the summary of the water budget in Table 3-11 to 3-15 and Figure 3-3. Based on this analysis, the water supplies within the Valley District and San Bernardino Mountains area are adequate to meet the demands through 2025. This is assuming the SWP reliability published in the 2005 State Water Project Delivery Reliability Report and the Valley District/Western Municipal Water District water rights applications for the SAR are approved. Additional water from the water rights applications is denoted as Seven Oaks Supply in Table 3-11. The amount available from the water rights application may be higher or lower and depends on the conditions placed on the applications by the State Water Resources Control Board. Additional conservation of 8,400 acre-feet will be needed to ensure supply reliability for 2030.

Table 3-11
Water Budget Summary for Valley District and San Bernardino Mountains (Acre-Feet per Year) for an Average Year

	2005	2010	2015	2020	2025	2030
SBBA Surface Water	39,000	39,000	39,000	39,000	39,000	39,000
Big Bear Surface Water	1,000	1,000	1,000	1,000	1,000	1,000
Seven Oaks Supply	0	0	10,800	10,800	10,800	10,800
Surface Water	**40,000**	**40,000**	**50,800**	**50,800**	**50,800**	**50,800**
SBBA Groundwater	193,100	193,100	193,100	193,100	193,100	193,100
SBBA Return Flows from Extractions above safe yield[2]	8,400	9,500	16,300	21,400	25,700	27,000
SBBA return flow from SWP deliveries[3]	1,000	5,000	5,400	5,800	5,800	5,800
Rialto-Colton Groundwater	17,300	17,300	17,300	17,300	17,300	17,300
Riverside North Groundwater	9,000	9,000	9,000	9,000	9,000	9,000
Yucaipa Groundwater	10,000	10,000	10,000	10,000	10,000	10,000
Other Groundwater	8,700	8,800	8,300	8,700	9,000	9,300
Groundwater	**247,500**	**252,700**	**259,400**	**265,300**	**269,900**	**271,500**
Imported Water[4]	**34,600**	**48,400**	**52,800**	**65,400**	**77,300**	**79,100**
Recycled Water[5]	**3,500**	**12,100**	**18,100**	**20,500**	**21,500**	**22,500**
Additional Conservation[6]	**0**	**0**	**0**	**0**	**0**	**8,400**
Total Supplies	**325,600**	**353,200**	**381,100**	**402,000**	**419,500**	**435,700**
Total Demands	**-325,600**	**-353,200**	**-381,100**	**-402,000**	**-419,500**	**-435,700**
Shortfall	**0**	**0**	**0**	**0**	**0**	**0**

[1]Water rights applications are pending. The supplies of the project depend on conditions placed on the applications by the State Water Resources Control Board. The 15,000 acre-feet are estimated based on the agreements in the Seven Oaks Accord and the Conservation District Settlement and are only preliminary estimates until the applications are approved. The Water Rights EIR estimates the average annual diversions could range from 10,000 to 27,000 acre-feet per year. The Plaintiffs portion is 27.95% and the Non-Plaintiffs portion is 72.05% or 10,800 acre-feet per year.
[2]The watermaster estimates 36% return flows from extractions above the safe yield of the SBBA. This is estimated in Table 3-3.
[3]The Watermaster estimates a 36% return from the direct deliveries of SWP in the SBBA. Only the direct deliveries to East Valley Water District and the City of Redlands were used in the calculations, as the other agencies that project to receive SWP water do not overly the SBBA.
[4]The amount of SWP water used in the given year is the minimum between (a) the difference between the applied demand and the surface water, groundwater, recycled water, and future Seven Oaks Supply and (b) the available Table water found in Table 3-10.
[5]The recycled water supply does not include recycled water from the City of Redlands, because it would otherwise percolate into the basin. The recycled water included would otherwise be discharged into surface streams and out of the Region, and therefore can be counted as new supply.
[6]Additional conservation was limited to five percent of the total demand.

Table 3-12
Water Budget Summary for San Gorgonio Pass Water Agency Area

	2005	2010	2015	2020	2025	2030
Groundwater	22,700	25,500	24,500	24,700	25,000	25,200
Imported Water	200	6,000	13,300	13,300	13,300	13,300
Recycled Water	0	7,300	8,900	9,400	9,900	10,200
Local Enhancement Projects	700	8,100	10,100	11,500	12,900	13,600
Additional Conservation[1]	0	0	3,000	3,500	3,900	4,200
Total Supplies	**23,600**	**46,900**	**59,800**	**62,400**	**65,000**	**66,500**
Total Demands	**-23,600**	**-46,900**	**-60,700**	**-70,500**	**-78,600**	**-84,000**
Shortfall	**0**	**0**	**-900**	**-8,100**	**-13,600**	**-17,500**

[1]Additional conservation was limited to five percent of the total demand.

Table 3-13
Region-Wide Water Budget Summary for Average Year (Acre-Feet per Year)

	2005	2010	2015	2020	2025	2030
Surface Water	40,000	40,000	50,800	50,800	50,800	50,800
Groundwater	270,900	286,300	294,000	301,500	307,800	313,700
Imported Water	34,800	54,400	66,100	78,700	90,600	92,400
Recycled Water	3,500	19,400	27,000	29,900	31,400	32,700
Additional Conservation	0	0	3,000	3,500	3,900	12,600
Total Supplies	**349,200**	**400,100**	**440,900**	**464,400**	**484,500**	**502,200**
Total Demands	**-349,200**	**-400,100**	**-441,800**	**-472,500**	**-498,100**	**-519,700**
Shortfall	**0**	**0**	**-900**	**-8,100**	**-13,600**	**-17,500**

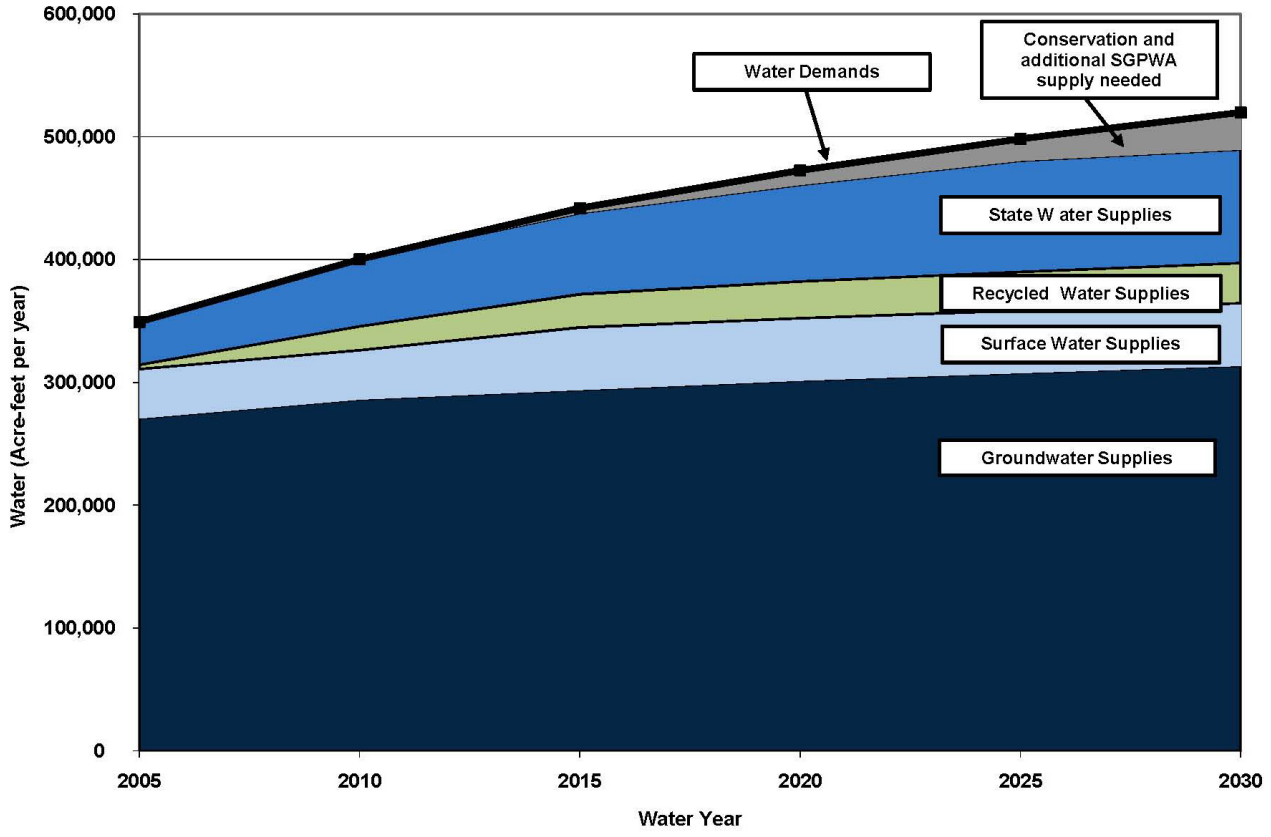
Table 3-14
Region-Wide Water Budget Summary for Multi-Year Drought (Acre-Feet per Year)

	2005	2010	2015	2020	2025	2030
Surface Water	30,000	30,000	30,000	30,000	30,000	30,000
Groundwater	289,700	304,000	335,100	362,400	371,000	372,200
Imported Water	26,000	46,700	46,700	46,700	46,700	46,700
Recycled Water	3,500	19,400	27,000	29,900	31,400	32,700
Additional Conservation	0	0	3,000	3,500	3,900	12,600
Total Supplies	**349,200**	**400,100**	**438,800**	**469,000**	**479,100**	**481,600**
Total Demands	**-349,200**	**-400,100**	**-441,800**	**-472,500**	**-498,100**	**-519,700**
Shortfall	**0**	**0**	**-3,000**	**-3,500**	**-19,000**	**-38,100**

Table 3-15
Region-Wide Water Budget Summary for a Single-Dry Year (Acre-Feet per Year)

	2005	2010	2015	2020	2025	2030
Surface Water	20,000	20,000	20,000	20,000	20,000	20,000
Groundwater	300,600	335,600	366,700	378,000	380,000	381,200
Imported Water	25,100	25,100	25,100	25,100	25,100	25,100
Recycled Water	3,500	19,400	27,000	29,900	31,400	32,700
Additional Conservation	0	0	3,000	3,500	3,900	12,600
Total Supplies	**349,200**	**400,100**	**438,800**	**453,000**	**456,500**	**459,000**
Total Demands	**-349,200**	**-400,100**	**-441,800**	**-472,500**	**-498,100**	**-519,700**
Shortfall	**0**	**0**	**-3,000**	**-19,500**	**-41,600**	**-60,700**

Figure 3.3. IRGMP Region - Water Budget Summary

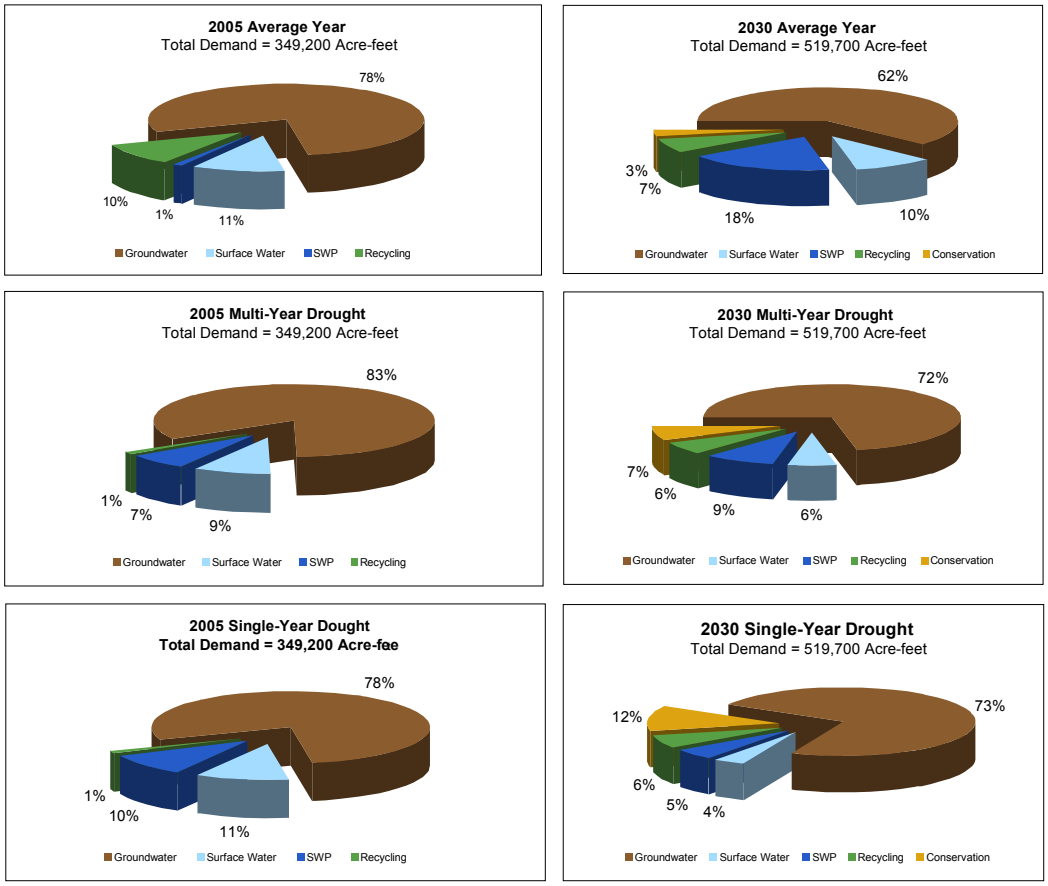


Most of the shortage after 2015 shown in the overall water budget in Table 3-13 is within the SGPWA. In Table 3-13, the supply and demands for the SGPWA area are broken out separately. SGPWA is attempting to purchase supplemental water to meet their projected shortage in supply. By 2030, it is estimated that demands may outpace the current supplies by about 21,700 acre-feet per year.

During multi-year and single-year droughts, the Region is more reliant upon the groundwater. Based on groundwater modeling of the SBBA (described in Chapter 4), during a dry period, agencies typically increase their groundwater extractions to overcome any deficiency in local surface water and imported water supplies. Computer modeling suggests that groundwater extractions in the SBBA can increase by 40 percent (190,000 to 280,000 acre-feet) to meet the demands in drought years if imported water is captured and stored when it is available in "wet years."

Figure 3-4 below shows the percentage of supply used to meet the demand in an average year, single-year drought, and multiple-year drought for the entire region. The breakdown of the amount of supplies by category is found in Tables 3-13 to 3-15.

Figure 3-4
Water Supply Summary



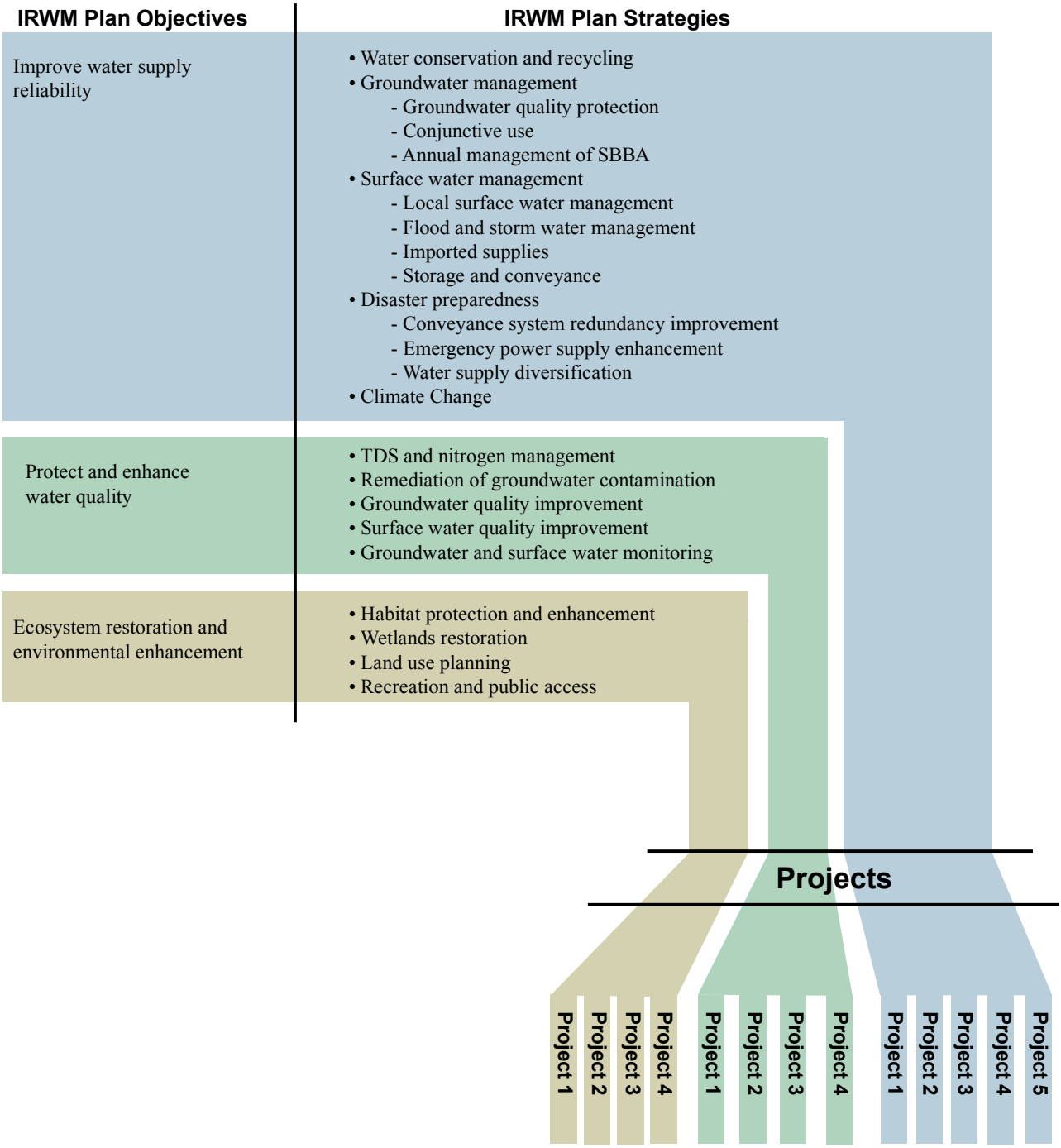
4 Develop Integrated Regional Water Management Plan

4.1 Introduction

This chapter provides the planning framework for water management activities in the Upper Santa Ana River (SAR) watershed region. The Integrated Regional Water Management Plan (IRWM Plan) is a roadmap for the management of water resources to ensure long-term, reliable water supply availability for the region. The first step in developing this roadmap is the formulation of water management objectives. The water management objectives are the overarching statements that define water management goals for the region. The objectives define the desired outcome from implementation of the plan. Specific objectives for management of water resources have been developed and will be discussed in this chapter.

Upon formulation of the objectives, specific water management strategies are examined and evaluated in support of the objectives. Water management strategies are the action plans and the ways of achieving the stated objectives. Evaluation of various water management strategies results in formulation of related feasible projects that would be implemented in the region to achieve the region's water management objectives. Figure 4-1 illustrates the process. This figure also summarizes water management objectives and strategies considered in this IRWM Plan. For the IRWM Plan, water management strategies and specific projects will be further optimized to eliminate undesired effects from implementing the projects on water resources of the region. It should be mentioned that some of the water management strategies listed by the California Department of Water Resources (DWR) under IRWM Plan Guidelines are considered as not being applicable in the region and have not been discussed in the plan. This includes the sea water desalting strategy. The following sections describe this planning process in more detail.

Figure 4-1
Objectives and Strategies



4.2 Water Management Objectives, Strategies, and Projects (California Water Code §§ 79562.5 and 79564)

The water management objectives are broad statements that drive the water management planning in the region. As stated earlier, water management in the study area is currently governed by a complex set of constraints, court decisions, judgments, and agreements. However, the IRWM Plan process facilitated a cooperative environment in which the existing institutional constraints do not limit the water managers from implementing decisions that optimize the use of available resources. In other words, the water management objectives for the study area must be consistent with the objectives stated in these historic documents, while meeting the vision of the water leaders in the region for managing their water resources. Other considerations in formulating the water management objectives for the region include California Water Code, Section 7956.2.5(b), which requires an Integrated Water Management Plan to address the objectives and conflicts of the region covered by the plan.

Groundwater is a major source of water supply for the Upper Santa Ana Region.

Because groundwater is a major source of water supply and plays a significant role in meeting water needs of the region, groundwater management has been blended into the IRWM Plan to ensure a balanced approach to management of the water resources of the region, while seeking solutions that benefit all stakeholders. Consistent with the Groundwater Management Planning Act, Basin Management Objectives (BMOs) have been formulated for the groundwater basins and for the San Bernardino Basin Area (SBBA).

The consulting team and the Technical Advisory Group (TAG) have reviewed various court judgments and water management agreements currently in place within the region to formulate objectives that are consistent with the existing water management framework. The TAG evaluated a broad range of objectives over several bi-weekly meetings to ensure consistency with the existing objectives of the agencies that have a vested interest in the water resources of the Upper Santa Ana River watershed. The comprehensive list of objectives was categorized into the broader set of objectives that are intended to be as follows:

- Consistent with the governing laws, judgments, and agreements that govern the water management in the region. These laws, agreements, and judgments were discussed in Chapter 2.

- In harmony with the vision of water leaders for management of the region's water resources.
- Consistent with local agencies' water management objectives.
- Fulfilling the planning standards of the California Water Code.

Two sets of objectives have been identified and discussed by the TAG and other water leaders in the region. These objectives are as follows:

- A set of broad water management objectives to guide a wide range of water management activities of the region. Formulation of these objectives is also required by the Integrated Regional Water Management Planning Act.

    1. **Water Supply Reliability Improvement.** Because surface water management and groundwater resources management of the region are critical and inseparable components of water supply reliability**, surface water management and groundwater management** are considered a subset of the broader water supply reliability objective,

    2. **Water Quality Protection.**

    3. **Ecosystem Restoration and Environmental Improvement.**

- A set of **BMOs** for management of the groundwater basins and, particularly, for the SBBA. Establishment of the BMOs for groundwater basins is one of the requirements of the Groundwater Management Planning Act. These BMOs include **reducing the risk of liquefaction** in the pressure Zone and **avoiding impacts to and from the contaminant plumes**.

The objectives, water management strategies, and associated programs and projects to achieve the above objectives are described in detail in this chapter. It should be noted that most of the strategies and projects discussed below serve more than one objective and provide multiple benefits. For the purpose of organizing these strategies, however, they are categorized under one specific objective.

4.2.1 Improve Water Supply Reliability

Improving water supply reliability is the primary objective of the IRWM Plan. This objective is formulated to ensure that a reliable water supply is available for the region through 2030. As mentioned earlier, an important subset of this

objective is surface water and groundwater management. Given the variability of the State Water Project (SWP) supplies, another of the region's water supply reliability goals is to optimize the use of SWP supplies to be able to reduce its reliance on the SWP during drought periods. Various water management strategies and projects are identified and evaluated to achieve water supply reliability objectives.

To evaluate the performance of the water management strategies (as they are implemented) in achieving the water supply reliability goal of the region, the TAG considered the "performance criteria" for water supply reliability as established in the Urban Water Management Plan (UWMP) Act. These criteria include evaluation of the following:

- Reliable water supply for a minimum of a 25-year period,
- Meeting average year water demands through 2030,
- Meeting single-year drought water demands,
- Meeting multi-year drought water demands,
- Preparing a water shortage (up to 50 percent loss) contingency plan, and
- Preparing for catastrophic interruption in water supplies.

The Upper SAR watershed has adequate water resources to accommodate most hydrologic events and water agencies have substantially invested in facilities and institutions to protect those resources. Local agencies have been planning and implementing facilities needed to improve water supply reliability by improving management of water resources of the region as demonstrated by the ongoing implementation of the San Bernardino Valley Municipal Water District (Valley District) Regional Water Facilities Master Plan and Santa Ana Watershed Project Authority's (SAWPA's) IRWM Plan for the watershed. That said, those resources are subject to a number of challenges, including drought, contamination, climate change, and aging infrastructure. Furthermore, substantial residential and commercial growth in the region is increasing the demands placed on available water, requiring careful planning and management of the region's water resources.

The following sections will describe water management strategies for meeting the region's water supply reliability objective.

4.2.1.1 Water Conservation Strategies and Projects

Over the past 30 years, water conservation and water demand management has grown to be a significant sector of California's water supply picture. Indeed, new technology and application of other proven technologies have "produced" substantial real water savings for both the agricultural and urban sectors. In many communities in Southern California, per capita water use has decreased, allowing the same water supply to serve more people and industries.

Today, many water conservation measures are cost-effective for agencies, especially those that depend on imported water supplies. Furthermore, when one considers energy usage and the current incentives to save energy through water-energy conservation partnerships, even more water saving efforts become cost-effective.

4.2.1.1.1 Irrecoverable vs. Recoverable Water Savings

Depending upon the water conservation measure and its relative location, a water conservation measure can actually reduce real water use. Real water is saved when discharges are reduced to a salt sink or ocean, or actual water consumption is reduced (i.e., through reduction of evapotranspiration) by managing landscape irrigation or changing irrigated lawn with more water-saving plants. In this case, the real water savings would be made through reduction of an irrecoverable loss (evapotranspiration).

On the other hand, in a system where excess water and treated wastewater are discharged to a river and potentially used again by downstream municipal, agricultural, or industrial users, there may not be significant system-wide water savings from water conservation. In such situations, the overall water demand may not be significantly reduced. Replacing older or less efficient toilets with more efficient ones and reducing the effluent discharge to the river where it would have been reused is a good example. Saving recoverable water, however, has a number of benefits. Improving water supply reliability for local purveyors, implementing the conservation project, saving energy on transportation, reducing the cost of water treatment, and improving water quality are all substantial benefits of water conservation in a recoverable system.

4.2.1.1.2 Best Management Practices

In 1991, nearly 100 urban water agencies and environmental groups signed a Memorandum of Understanding (MOU), pledging to develop and implement a series of Best Management Practices (BMPs) for water conservation. The California Urban Water Conservation Council (CUWCC) was thus created to increase efficient water use statewide through partnerships among urban water agencies, public interest organizations, and private industry. There are now 384 members and signers to the MOU (www.cuwcc.com). CUWCC members

voluntarily pledge to implement a series of BMPs within a reasonable time frame and coverage. Members must periodically report the status of their BMP work to the CUWCC for verification. Only those BMPs that are cost-effective for the water retailer or wholesaler need to be implemented. Members have tools to estimate and show that a measure would not be as cost-effective and can receive a pass on that particular BMP. Thus, successful implementation of all BMPs and credit for actively participating in the CUWCC process need not be a "complete" implementation of all BMPs.

The table in Figure 4-2 shows the 14 BMPs that the CUWCC currently endorses. The CUWCC is constantly reviewing new technologies and strategies to improve water conservation. New BMPs are added for new water saving methods and existing BMP requirements are adjusted for effectiveness. This active BMP review and adoption process has kept this list the state-of-the-art in proven water saving measures.

The CUWCC maintains a self-reporting database on the status of BMP implementation by water agency member. This information includes recorded use and results of each BMP, the money invested in each BMP, and the estimated or calculated water savings for each of those measures by water purveyor. This information is then summarized and aggregated to present a total water conservation picture for the collective membership on an annual basis. The CUWCC database can be accessed at http://bmp.cuwcc.org.

Not all BMPs are such that their benefits are quantifiable or measurable. For example, BMP #12 requires the water agency to designate a staff member to manage the agency's water conservation programs (water conservation coordinator). BMPs #1, #2, #5, #6, #9, #9A, and #14 are generally considered to have measurable benefits. (BMP #9A is the installation of ultra-low-flush toilets within the Commercial, Industrial, and Institutional sectors).

Figure 4-3, data compiled by CUWCC, estimates the statewide current net annual water savings from those BMPs that can be quantified. These values have also accounted for plumbing code changes. Since the MOU only requires participation when water conservation measures are cost-effective, the resultant water savings shown in Figure 4-3 represents substantial savings that is within the economic reach.

Figure 4-2
Best Management Practices

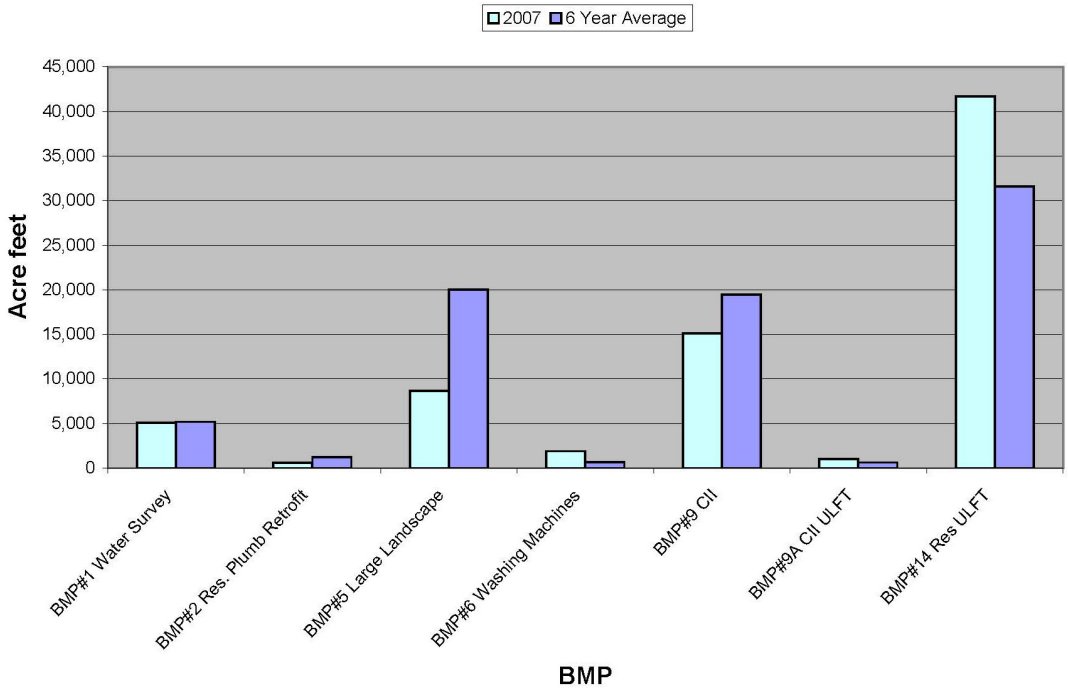
California Urban Water Conservation Council
Annual Report Year 2005

Table 1: Council MOU Urban Water Conservation Best Management Practices

#	BMP	Requirements
1	Water Survey Programs for Single and Multi Family Residential Customers	Survey 15% of residential singe-family and 15% of multi-family customers within 10 years.
2	Residential Plumbing Retrofit	Retrofit 50% of residential housing constructed prior to 1992 with low-flow showerheads, toilet displacement devices, toilet flappers and aerators; or achieve 75% saturation of the water agency service area and be able to prove it statistically.
3	System Water Audits, Leak Detection and Repair	Audit the water utility distribution system regularly and repair any identified leaks; check yearly to see that water loss is less than 10%.
4	Metering with Commodity Rates for All New Connections and Retrofit of Existing Connections	Install meters in 100% of existing unmetered accounts within 10 years; bill by volume of water use; assess feasibility of installing dedicated landscape meters.
5	Large Landscape Conservation Programs and Incentives	Prepare water budgets for 90% of commercial and industrial accounts with dedicated landscape meters; provide irrigation surveys to 15% of mixed-metered customers.
6	High-Efficiency Washing Machine Rebate Programs	Provide cost-effective customer incentives, such as rebates, to encourage purchase of machines that use 40% less water per load. Number of clothes washers required is based on the total dwelling units x .048; up to a third fewer machines required if all of them are super high-efficiency (6.0 or less water factor).
7	Public Information Programs	Water utilities to provide active public information programs to promote and educate customers about water conservation.
8	School Education Programs	Provide active school education programs to educate students about water conservation and efficient water uses.
9	Conservation Programs for Commercial, Industrial, and Institutional Accounts	Provide a water survey of 10% of these customers within 10 years and identify retrofitting options; OR reduce water use by an amount equal to 10% of the baseline use within 10 years.
10	Wholesale Agency Assistance Programs	Provide financial incentives to water agencies and cities to encourage implementation of water conservation programs
11	Conservation Pricing	Eliminate non-conserving pricing policies and adopt pricing structure such as uniform rates or inclining block rates, incentives to customers to reduce average or peak use, and surcharges to encourage conservation.
12	Conservation Coordinator	Designate a water agency staff member to have the responsibility to manage the water conservation programs.
13	Water Waste Prohibition	Adopt water waste ordinances to prohibit gutter flooding, single-pass cooling systems, non-recirculating systems in all new car wash and commercial laundry systems, and non-recycling decorative water fountains.
14	Residential Ultra-Low-Flush Toilet Replacement Programs	Replace older toilets for residential customers at a rate equal to that of an ordinance requiring retrofit upon resale.

Source: California Urban Water Conservation Council

Figure 4-3
Statewide Annual Water Savings from Implementation of Selected BMPs



Source: California Urban Water Conservation Council

4.2.1.1.3 Urban Water Management Plans

In 1983, the California legislature enacted the Urban Water Management Planning Act (Water Code Sections 10610-10658). It states that every retail water supplier providing 3,000 acre-feet of water annually or supplying water to 3,000 customers or more must file a UWMP with DWR. The requirement is designed to ensure thoughtful planning for future water reliability. Water purveyors must submit an updated plan and have that plan deemed complete by DWR every five years. The statute requires quite a detailed assessment, including an analysis of Demand Management Measures (DMMs). DMMs are the **same actions** as BMPs under the CUWCC MOU. UWMP reporting under the Act is actually simplified for CUWCC members reporting their progress in implementation of BMPs.

4.2.1.1.4 Potential Water Conservation Strategies for Upper Santa Ana River

Table 4-1 summarizes the general implementation of DMMs for the water purveyors in the Upper SAR watershed, and thus, which water conservation measures are, at least at some level, being used within each agency. The data for this table have been compiled from agency UWMPs. The table does not show the magnitude of the investment or the level of effort involved in the measure.

Table 4-1
Upper Santa Ana River Water Agencies Implementation of BMPs

Water Agency	2005 UWMP	Demand Management Measure Implementation													
		Residential Water Surveys	Residential Plumbing Retrofits	System Water Audits Leak Detection and Repair (2)	Metering (2)	Large Landscape Conservation Program	High Efficiency Washing Machine Rebate Program	Public Information Program	School Education Program	Conservation Program (3)	Wholesale Agency Program	Conservation Pricing	Water Conservation Coordinator	Water Waste Prohibition	Residential Ultra-low flush Toilet Replacement
East Valley Water District	X	N	N	Y	Y	N	N	Y	Y	Y	N	N	N	Y	N
Fontana Water Company	X	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y
Loma Linda, City of	2002 UWMP	N	Y	Y	Y	N	N	Y	Y	N	N	Y	N	Y	N
Redlands, City of - Water Utility	X	Y	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y
Rialto, City of	X	N	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y
San Bernardino MWD	X	Y	N	Y	Y	N	N	Y	Y	N	N	N	N	Y	N
West Valley Water District	X	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Yucaipa Valley Water District	X	N	N	Y	Y	N	N	Y	N	N	N	Y	Y	Y	N
Riverside Public Utilities	X	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Beaumont Cherry Valley W.D.	X	N	N	Y	Y	Y	N	Y	Y	Y	N	Y	N	N	N
Big Bear City C.S.D.	2000 UWMP	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
City of Big Bear Lake D.P.W.	X	Y	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y
Crestline-Lake Arrowhead W.A.	X	N	N	Y	Y	N	N	Y	Y	Y	N	Y	Y	Y	N
Rubidoux C.S.D.	X	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y

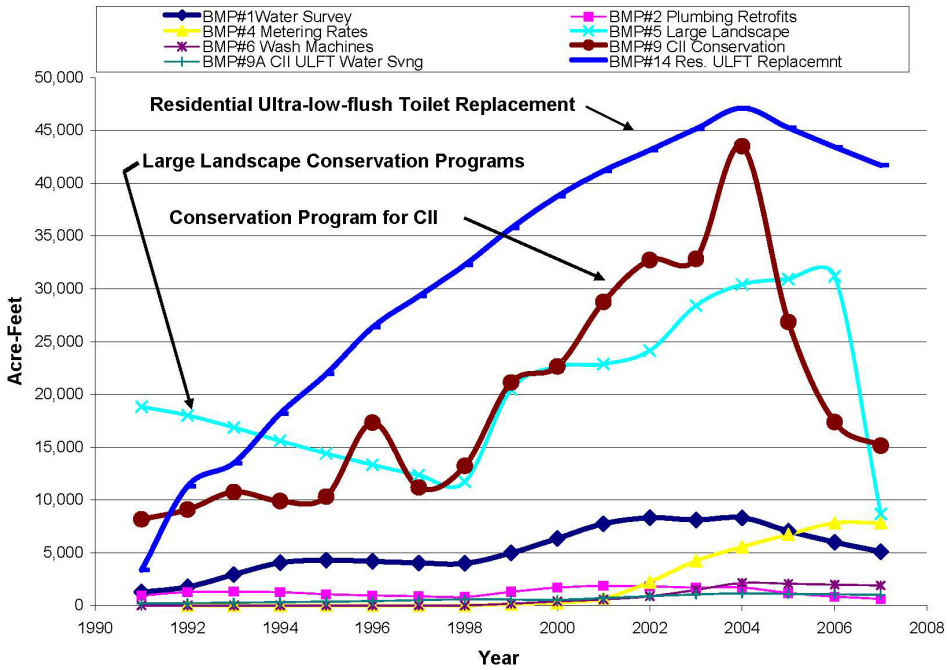
Each agency is implementing some of the measures, but some agencies are implementing most of the measures. There is potential to further enhance water savings efforts within the Upper SAR watershed communities and improve water supply reliability within the region.

Two factors are important in evaluating the feasibility of water use efficiency measures: the quantity of the potential water savings and the cost-effectiveness of the water saving measures. Both factors must be considered to determine when a particular BMP is cost-effective for implementation.

Figure 4-4 shows the annual water savings for quantifiable or measurable BMPs from 1991 through 2007 using the CUWCC data.

While the magnitude of the water savings would clearly be a function of the effort or investment in the particular BMP, the graph indicates three or four BMPs have produced some significant water over the past several years: BMP #14 – Residential Ultra-Low-Flush Toilet Replacement, BMP #9 – Conservation Programs for Commercial Industrial and Institutional Accounts, BMP #5 – Large Landscape Conservation Programs, and BMP #1 – Water Survey Programs. For areas with less aggressive water conservation efforts, further review may suggest that investment in these BMPs could have potential for significant conservation.

Figure 4-4
Annual Estimated Water Savings from BMPs

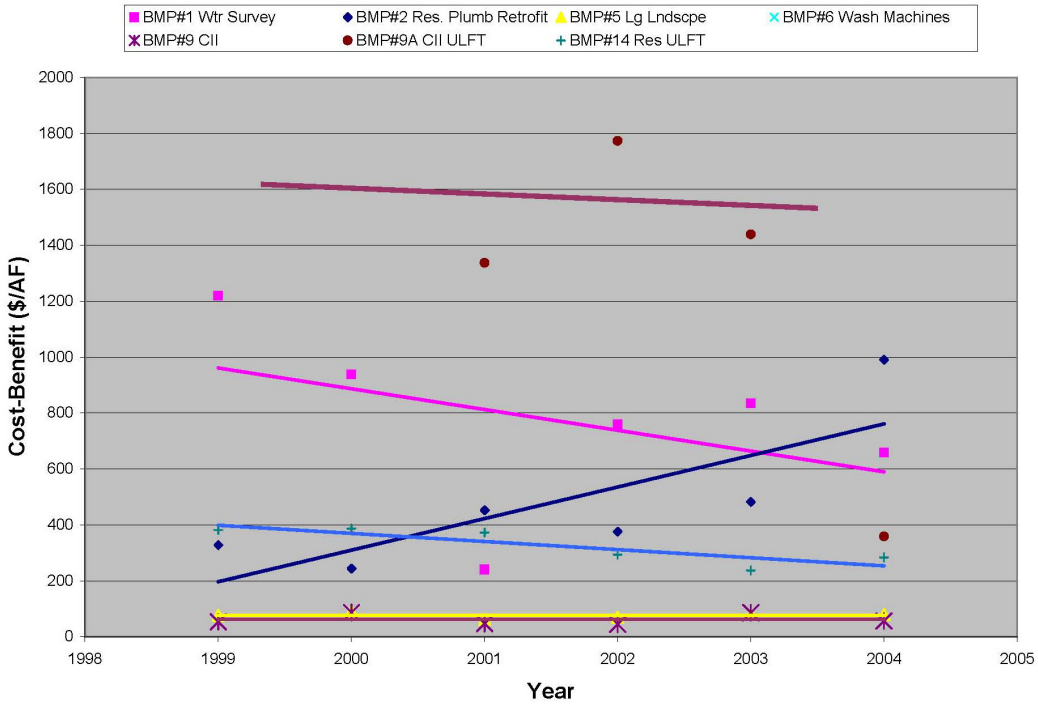


Source: California Urban Water Conservation Council

One should note that BMP #14, Ultra-Low-Flush Toilet Replacement, may be even more efficient by the recent trend during the past few years in using High-Efficiency Toilets (HETs), those that require 1.3 gallons per flush instead of 1.6 gallons. This change in technology would make the general process of toilet and/or water fixture replacement more efficient but not necessarily alter the methodology of the BMP.

To examine which water conservation measures would be most cost-effective to implement, one can compare the CUWCC data summaries on total expenditures for a particular BMP with the total estimated water savings from that BMP. Figure 4-5 shows the ratio of total dollar investment (cost) over the total annual estimated water savings for the measurable BMPs for the period 1999 through 2004.

Figure 4-5
BMP Cost per Acre-Foot



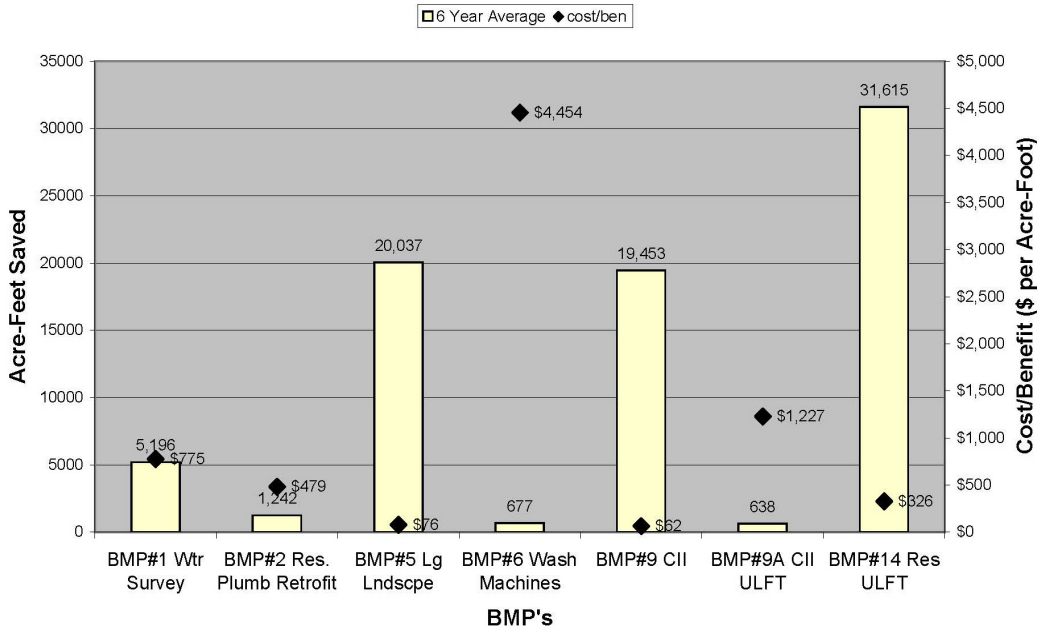
Source: California Urban Water Conservation Council

The lower lines on the graph suggest the more cost-effective water saving measures. The higher points on the graph show measures that are comparably more expensive to implement. BMPs #5 – Large Landscape Conservation Programs, #9 – Conservation Programs for Commercial, Industrial, and Institutional Accounts, #14 – Residential Ultra-Low-Flush Toilet Replacement

Program, and #2 – Residential Plumbing Retrofit, appear to be the most cost-effective measures based on the aggregated CUWCC data.

Figure 4-6 combines both quantity and cost-effectiveness (the information from Figures 4-4 and 4-5) on one graph. Clearly, the past investments in BMPs #5, #9, and #14 seem to carry the best rewards both in quantity of water and cost.

Figure 4-6
BMP Benefit and Cost/Benefit



Source: California Urban Water Conservation Council

4.2.1.1.5 Examples of Successful Water Conservation Programs

Evidence about which program would be beneficial is often best characterized by the case study experiences of other water purveyors. Water conservation programs for The Metropolitan Water District of Southern California (Metropolitan) have been reviewed to examine its current water conservation program activities.

Metropolitan Water District of Southern California – Metropolitan is a water wholesaler for a majority of the Southern California area. Metropolitan submits an annual report of its activities, including water conservation programs and accomplishments, to the State Legislature. From its February 2007 report, Metropolitan offers the following current water conservation programs:

- **High-Efficiency Toilets** – Metropolitan offers a $165 incentive for HETs, which use even less water than Ultra-Low-Flow Toilets (ULFTs). It has provided incentives for about 14,000 HETs to date. (Related to BMP #14.)

- **High-Efficiency Clothes Washers** – Metropolitan retrofitted more than 175,000 residential clothes washers since the incentive program began in 1995. As a direct result of grant funding and an increased incentive, high-efficiency clothes washers are currently being installed at a rate of about 30,000 retrofits per year. (BMP #6.)

- **"Smart" Irrigation Controller Rebate** – This year Metropolitan also had a concerted effort to reach residential customers with water-saving technology tips. "Smart" irrigation controllers, many of which use a combination of weather and historical data to automatically adjust irrigation schedules, have been a particular focus. Nearly 5,000 residential controllers have been retrofitted since the inception of the program. (This irrigation efficiency measure relates to BMP #5.)

- **Synthetic Turf Program** – Metropolitan continues to seek turf alternatives to conventional warm season grasses through a pilot program for large landscape areas. (This also relates to BMP # 5.)

- **Commercial/Industrial/Institutional Progra**m – To address this niche of water saving opportunities, Metropolitan developed its current CII program, which includes two components (BMP #9):

    - **Rebates --** fixed rebates for common fixture retrofits or installations.

    - **Process Improvements** – customized financial incentives for water-use process improvements on a pay-for-performance basis, which is typically applied to manufacturing and industrial applications.

- **California Friendly Landscape Program** encourages native and drought-resistant plants within landscapes to reduce water consumption. (BMP #5.)

4.2.1.1.6 Conclusions and Recommendations

The following conclusions and recommendations have been formulated based on the water conservation data gathered by CUWCC and other agencies' experiences.

Water Conservation projects have significant water and energy saving benefits, both in recoverable and non-recoverable water systems.

BMPs #5, #9, and #14 appear to be the most attractive to water agencies because of potential significant water saving measures and high benefit-cost ratio. Current programs of other water agencies generally support activities in BMPs #5, #9, and #14.

Other BMPs with non-measurable water savings should be considered on a case-by-case basis if they could support other tangible benefits, including a balanced water conservation approach.

Water purveyors in the Upper SAR Region should consider developing a program for evaluation and implementation of feasible water conservation strategies. Initial program steps should focus on large-scale implementation of BMPs #5, #9, and #14.

Water purveyors in Upper Santa Ana should consider obtaining a water use efficiency grant for a feasibility study of regional water conservation programs.

These conservation strategies are essential for better stewardship of our resources and would improve water supply reliability, reduce energy use and cost, and provide a means for dealing with potential climate changes.

4.2.1.1.7 Planned Water Conservation Projects in Upper Santa Ana Region

As discussed above the following BMPs may have the greatest conservation potential in the region:

- BMP #5 - Large Landscape Conservation Programs
- BMP #9 - Conservation programs for Commercial, Industrial, and Institutional
- BMP #14 - Residential Ultra-Low Flush Toilet replacement

The degree of effectiveness of the conservation programs varies by communities. It is therefore recommended that the following conservation projects be undertaken in the region to better scope the scale and size of potential conservation projects:

- **Regional Water Conservation Feasibility Study** to document the feasibility of implementation of various BMPs in the region and to develop conservation programs for implementation. It is suggested that Valley District take a lead role on this project.

- **Water Conservation Demonstration Garden** to educate and encourage citizens in low water use California Friendly landscape. This is a cooperative program between Valley District and the Water Resources Institute - California State University, San Bernardino (WRI-CSUSB).

- **Smart Irrigation Controller Program** currently being developed by Valley District.

- **Model institutional water conservation makeover** to demonstrate water conservation in various institutions in the region. This is a cooperative program between Valley District and the WRI-CSUSB.

4.2.1.2 Water Recycling Strategies and Projects

Water recycling projects improve water supply reliability and can contribute to improvement of water quality of the streams. To the extent that treated wastewater from the water treatment facilities in the Upper SAR watershed is currently released to the SAR and used by downstream water users, water recycling may not add to the overall water supplies of the SAR watershed. Tangible local water supply reliability and water quality benefits could be realized, however, through implementation of water recycling strategies. These benefits include the following:

- Recycled water is available throughout the year and is independent of hydrologic cycles. Improved water supply reliability will be achieved at the local level by the agency that is implementing the project by substituting potable water used for non-potable purposes with recycled water.

- Water recycling reduces the release of treated wastewater (and generally warmer water) to the streams and therefore reduces the nutrient load of the receiving water. This contributes to improvement of water quality and water temperature in the stream.

- Depending on the purveyor's source water, water recycling may reduce energy use for conveyance (i.e., conveyance of SWP or Colorado River water) and water treatment. This may also reduce the water delivery system's cost to the customers.

Costs associated with water recycling include additional treatment and separate conveyance and distribution systems. Water purveyors generally conduct a feasibility study to evaluate the costs and benefits of water recycling projects prior to commitment of funding and design of the facilities for water recycling projects.

A number of water purveyors in the Upper SAR watershed are planning to expand or construct new water recycling facilities. Summaries of the planning efforts for water recycling programs are presented below.

4.2.1.2.1 Beaumont-Cherry Valley Water District

The City of Beaumont treats all its wastewater to meet Title 22 regulations for recycled use. As of 2005, about two million gallons per day (mgd) (all flows) were discharged to Cooper Creek, which is a tributary to San Timoteo Creek. In partnership with the Beaumont-Cherry Valley Water District (BCVWD), Beaumont is upgrading its wastewater treatment plant (WWTP) capacity to four mgd and installing a recycled water pumping station and recycled water

pipelines. Also as of 2005, about 18 to 20 miles of recycled water pipeline were "in the ground." These lines serve irrigation systems in parks and common areas in Pardee Sundance, Three Rings Ranch, Oak Valley Greens, Pardee Tournament Hills, and elsewhere. Pipelines also extend to the Oak Valley and the two PGA West golf courses. The district is in a unique position, as there is more demand for recycled water than available supply.

BCVWD intends to serve recycled water, to the extent possible, for non-potable uses and as permitted by law. This would make potable water, now used for irrigation, available for new development. As new development occurs, the new projects would include appropriate piping systems to permit the use of recycled water for irrigation of street medians, greenbelts, schools, parks, and common areas. In the future, the recycled water system could be expanded to irrigate cherry and other fruit orchards. This concept then envisions limiting the use of quality potable water to potable water purposes to the extent practical. Surplus recycled water will be available during certain times of the year when normal irrigation demands are reduced. During these times, the surplus will be piped to spreading basins for surface spreading of recycled water for groundwater recharge.

4.2.1.2.2 City of Big Bear Lake Department of Water and Power and Big Bear Community Services District

Currently, neither City of Big Bear Lake Department of Water and Power (BBLDWP) nor Big Bear Community Services District (BBCSD) use recycled water within their service areas; however, this is slated to change. In 2004 and 2005, the Big Bear Area Regional Wastewater Agency (BBARWA), working along with BBLDWP and BBCSD, cooperated in the preparation of a Draft Recycled Water Master Plan for the Big Bear Valley. The Master Plan, whose implementation will result in benefits to all three agencies, includes reduction of the valley's dependence on limited groundwater supplies, extension of available water resources, and provision of valuable economic and environmental benefits to the valley's communities.

The objective of the Recycled Water Master Plan is to investigate the feasibility of using recycled water throughout Big Bear Valley. It provides a comprehensive planning document that outlines a phased road map for incremental implementation of facilities to achieve the listed benefits. The recycled water supply implementation is divided into four improvement phases at the WWTP, each phase in 500 acre-foot increments. The plan has identified numerous opportunities for recycled water use, with emphasis placed on groundwater recharge. It is anticipated that this plan will be implemented such that completion of the first phase and deliveries of recycled water will occur in 2011.

4.2.1.2.3 Fontana Water Company

Currently, Fontana Water Company (FWC) is working cooperatively with the City of Fontana for FWC to design and construct the first phase of a recycled water program. Once recycled water becomes available and the necessary infrastructure is constructed, FWC will be the purveyor of recycled water to those customers within its service area who can make use of such water. In the first phase of the recycled water program, FWC will provide approximately 1,700 acre-feet of recycled water to schools, parks, commercial customers, and Community Facilities Districts' landscape irrigation locations in the southern portion of the City of Fontana within FWC's service area. Ultimate build-out in FWC's service area will enable FWC to provide approximately 5,000 acre-feet of recycled water. FWC supports the use of recycled water where its use is appropriate and where recycled water is available.

Recycled water will be supplied by the Inland Empire Utilities Agency's (IEUA) RP-4 regional WWTP. This plant produces disinfected and filtered tertiary-treated recycled water suitable for outdoor irrigation, industrial uses, and groundwater recharge. RP-4 has a current capacity of 7 mgd and is being expanded to 14 mgd (scheduled for completion in mid-2007). Not all of the plant's production will be available for purchase by FWC because other users are also served by the WWTP.

4.2.1.2.4 City of Redlands Municipal Utilities Department

Beginning in 2005, most effluent from the City of Redland's WWTP has met Title 22 standards for recycled water. In 2005, approximately 60 percent of the recycled water was used for industrial purposes, with the remainder used for groundwater recharge. The City of Redlands requires some new commercial development to provide dual plumbing for irrigation systems and to accommodate the use of recycled water as it becomes available. Through the use of financial incentives, the city expects industrial recycled water use to reach 6000 acre-feet per year by 2010.

4.2.1.2.5 City of Rialto and West Valley Water District

The City of Rialto is investigating the expansion of its existing tertiary treatment plant and reclaimed water system as a way to supplement the city's water supply. The existing tertiary treatment plant wastewater flows are approximately 7.5 mgd (9,000 acre-feet per year). The city currently discharges the majority of its flows to the SAR, but is under no obligation to continue this practice.

The City of Rialto has constructed a hydropneumatic booster station and approximately 7,000 feet of 10-inch-diameter transmission water line to provide the California Department of Transportation (Caltrans) with recycled water for 42,000 feet of landscape irrigation for Interstate-10. Caltrans has been using 1.0

mgd of recycled water during the summer months and 0.5 mgd during the winter for an annual total of 850 acre-feet. Currently, there are no other users of the recycled water.

Rialto recently prepared a Wastewater Master Plan that investigated recycled water systems as a way to supplement the city's water supply and reduce the need to purchase water. The plan analyzed the feasibility of converting a currently unused water main that extends several miles up Riverside Avenue and identified potential landscape irrigation customers (San Bernardino Park, Convalescent Hospital, the Senior Center, a baseball field, and a recreation center). A Proposition 50 grant funded the construction of recycled water lines that tie into the unused water main. The city is also investigating the use of package plants in the north end of the city and has identified potential users of recycled water that could result in approximately 2,250 acre-feet of annual demand.

All of the wastewater collection and treatment within the West Valley Water District (West Valley) is handled by the City of Rialto. West Valley utilizes non-potable raw SWP water and decanted backwash water from the Oliver P. Roemer Water Filtration Facility to supply the El Rancho Verde Golf Course. Records show that the golf course consumed 1,357 acre-feet in 2003. West Valley identified other additional potential users of recycled water that could result in approximately 3,700 acre-feet of annual demand. Most of these new users are currently supplied with potable water.

4.2.1.2.6 City of Riverside

The City of Riverside Public Works Department operates and maintains the Riverside Regional Water Quality Control Plant (RRWQCP). The daily average wastewater inflow to the RRWQCP is 33 mgd. The plant capacity is 40 mgd, with the ultimate planned capacity of 60 mgd. The service area of the RRWQCP extends beyond the Riverside Public Utilities (RPU) service area to include the areas served by Jurupa, Rubidoux, and Edgemont Community Services District. Tertiary-treated effluent (recycled water) is discharged into the SAR and the Hidden Valley Wetlands (the wetlands provide additional nitrogen removal.) RRWQCP is required to discharge 15,250 acre-feet per year, adjusted for quality, to meet downstream obligations to Orange County Water District (OCWD). Some recycled water is used for landscape irrigation and commercial purposes.

RPU petitioned the State Water Resources Control Board (SWRCB) for a wastewater change to reduce permitted discharge to the SAR by 11,000 acre-feet per year in connection with the citywide recycled water program. The envisaged recycled water program includes landscape irrigation, agriculture irrigation, and other commercial and industrial purposes. Under its proposed Recycled Agricultural Water Program, RPU would design and construct a distribution

system to serve existing agricultural operations, wholesale users, and other agencies.

4.2.1.2.7 San Bernardino Municipal Water Department

The San Bernardino Municipal Water Department (SBMWD) operates the San Bernardino Water Reclamation Plant serving the cities of San Bernardino, Highland, and Loma Linda, property that was formerly Norton Air Force Base, East Valley, Patton State Hospital, and portions of the unincorporated areas of San Bernardino County. All the wastewater at the San Bernardino Water Reclamation Plant is treated to the secondary level. The secondary-treated effluent is sent to the Rapid Infiltration Extraction (RIX) Facility and treated to tertiary levels, then released into the SAR. In mid-2006, the San Bernardino Water Reclamation Plant re-activated its tertiary treatment facility and diverts approximately 0.75 mgd or 840 acre-feet per year of water from the influent stream to RIX for treatment to Title 22 standards for landscaping applications at the City of San Bernardino Municipal Golf Course and Caltrans located adjacent to Interstate 215. SBMWD estimates that in the future the reclamation plant's service area will be able to potentially recycle an additional 2.25 mgd or 2,519 acre-feet per year of water for use within its service area (SBMWD 2005). Valley District and SBMWD are initiating a master plan study to evaluate the treatment of more secondary effluent at the existing water reclamation plant, reducing flows to the RIX. For additional planned recycling by San Bernardino, see the RIX Facility section below.

4.2.1.2.8 Yucaipa Valley Water District

Yucaipa Valley Water District (YVWD) treats recycled water meeting Title 22 requirements through its Henry N. Wochholz Wastewater Treatment Facility. The facility has a rated capacity of 4.5 mgd and is undergoing an expansion and upgrade to a capacity of 6.7 mgd. Currently, treated effluent is conveyed through a land outfall and discharged to San Timoteo Creek. Three customers along the existing land outfall are receiving recycled water for irrigation purposes. Dual plumbing is being installed in new developments. Delivery amounts are expected to grow to about 6,700 acre-feet by 2020 or about 24 percent of total agency water demands. Ultimately, YVWD expects to deliver about 8,000 acre-feet per year of recycled water (YVWD 2005).

In addition, a new water reclamation plant (WRP) is planned to serve the Oak Valley development. This WRP will provide both wastewater treatment and a source of recycled water for the Oak Valley area. The Yucaipa Wastewater Master Plan identifies the capacity of the new WRP at 4 mgd required to serve the needs of Oak Valley and other areas of the district from where wastewater could flow by gravity to the new WRP. Based on the projected capacities

contained in the Yucaipa Wastewater Master Plan for both treatment plants, there are approximately 11 mgd of wastewater available for recycling (YVWD 2005).

4.2.1.2.9 Rapid-Infiltration Extraction Facility

The RIX facility treats secondary-treated wastewater from the Colton and San Bernardino plants. The RIX facility treats the wastewater to tertiary levels for release into the SAR. The RIX facility was designed as a 40-mgd plant, but as of 2005, operates at 27 mgd. The RIX facility releases 16,000 acre-feet per year in agreement with Valley District to meet the downstream obligations to Orange County. In 2003, SBMWD released a Programmatic Environmental Impact Report evaluating the sale of up to 18,000 acre-feet per year of excess effluent to potential buyers downstream. SBMWD has previously determined that the use of recycled water from the RIX facility to offset water demands within its service area is not feasible at this time. The RIX facility is located at an elevation and distance from SBMWD's service area that makes it economically impractical to utilize recycled water (SBMWD 2005). This could change if the water is not sent to the RIX facility.

Table 4-2 summarizes the proposed water recycling projects of the region.

Table 4-2
Upper Santa Ana River Water Agencies Recycling Water Programs

Water Agency	Recycling Plant	Recycled Water Production Capacity	Description
Beaumont Cherry Valley WD	City of Beaumont WWTP	2 MGD	Current expansion will upgrade production to 4 mgd.
City of Big Bear Lake DWP & Big Bear City CSD	Big Bear Area Regional Wastewater Agency Plant	1.63 MGD	Future construction plans aim to produce 500AFY by 2011, and 1000AFY by 2015.
Fontana Water Company	IEUA Regional treatment Plant 4	7 MGD	FWC needs additional infrastructure to deliver recycled water in its service area.
City of Redlands Municipal Utilities Department	City of Redlands WWTP	6 MGD	Recycled water used for basin recharge and industrial purposes.
Rialto, City of & West Valley WD	City of Rialto Water Treatment Plant	12.0 MGD	Recycled water used for landscape irrigation on the I-10. City plans to expand use of recycled water.
Riverside Public Utilities	Riverside Regional Water Quality Control Plant	40 MGD	Applied for a change in permit to recycle up to 41,400 ac-ft/yr.
San Bernardino MWD	San Bernardino Water Reclamation Plant	0.75 MGD	Construction of a tertiary plant at the existing San Bernardino Water Reclamation Plant to recycle water for landscape irrigation.
Yucaipa Valley Water District	Henry N. Wochholz WWTP	6.7 MGD	New plant at Oak Valley will increase total recycled water availability to 12,000 ac-ft/yr.
San Bernardino MWD, City of Colton, City of Loma Linda, County of San Bernardino, and East Valley Water District	Rapid Infiltration and Extraction	40 MGD	All the water from the RIX is currently released into the Santa Ana River. The City of San Bernardino is exploring selling part of its portion of the recycled water.

4.2.1.3 Groundwater Management Strategies and Projects

Improving groundwater management will significantly contribute to the sustainability of water resources in the region. The IRWM Plan is intended to provide strategies to improve management of the groundwater resources of the Upper SAR watershed. Management of groundwater resources includes conjunctive use of surface water and groundwater resources as well as management of groundwater levels and water quality. Three BMOs have been considered for management of groundwater basins as described below.

Maximize Conjunctive Use and Increase Ability to Collect and Recharge Storm and Flood Water

Integration of flood and stormwater management strategies with recharge and conjunctive use opportunities contributes to water supply reliability in the region. The San Bernardino Valley area has been significantly urbanized over the past several decades and the area continues to grow with numerous in-fill development projects. As the amount of impervious surface increases with urbanization, the runoff, and, therefore, storm and flood flows are also increasing. Without adequate flood control systems to capture and contain these surface waters for recharge, the opportunities for water supply, water quality, and environmental improvement are greatly lessened or lost. Therefore, formulating strategies to capture storm runoff and use it for recharge of the groundwater basins will provide both flood management and water supply benefits to the region.

Some of the water-related judgments and agreements in the region, including the Western Judgment (Western Municipal Water District of Riverside County v. East San Bernardino County Water District, Case No. 78426), Orange County Judgment (April 17, 1969 Orange County Superior Court Judgment), and the Rialto Decree focus on ensuring the reliability of the water supply by controlling and carefully monitoring annual groundwater extractions. If a certain "threshold" is exceeded, some of these judgments and agreements require that the groundwater basin(s) be recharged from an "outside" source such as the SWP. A key to increasing future water supply reliability will be to increase conjunctive management of the surface water and groundwater resources of the region.

Reduce the Risk of Liquefaction

The most significant considerations in groundwater management in the SBBA are reducing the risk of liquefaction in the Pressure Zone due to high groundwater levels and avoiding impacts to and from the various groundwater contaminant plumes. Those two considerations are recognized as BMOs for the basin. All management strategies must satisfy these two constraints.

A significant portion of the SBBA—generally, the downtown and southern portions of the City of San Bernardino—is an area of historically high groundwater. This high groundwater combined with the thick layer of sand in the aquifer may create a risk of liquefaction in an earthquake. Liquefaction occurs only during an earthquake in areas of water-saturated, sandy soil. Given the large extent of sandy soils under the City of San Bernardino, the most practical way to reduce this risk is to reduce groundwater levels through basin management. Many of the facilities in the San Bernardino Valley Municipal Water District's (Valley District) Master Plan (CDM 1995) and some of the Santa Ana watershed Project Authority (SAWPA) proposed facilities are intended to assist in managing groundwater levels in this liquefaction-susceptible area. Due to the public safety threats associated with liquefaction, reducing the risk of liquefaction has been recognized within the BMOs for the SBBA. The objective of managing groundwater levels to reduce the risk of liquefaction is consistent with the Groundwater Management Planning Act and the California Water Code requirement that BMOs should be developed to manage water levels in the basin.

The Cuttle Weir is a concrete and rock diversion structure owned by the San Bernardino Valley Water Conservation District and is used to divert water from the Santa Ana River to the Conservation District's Santa Ana River Spreading Grounds for artificial recharge of the SBBA. The Seven Oaks Dam can be seen in the background. The good quality Santa Ana River water is used to recharge SBBA, hence improving water supply reliability and improving SBBA groundwater quality.

To meet this objective, strategies were identified and evaluated during the planning process. Most of these strategies serve multiple objectives and contribute to groundwater management, water quality objectives, and water supply reliability for the region. The region generally relies on local surface water, groundwater, recycled water, and the SWP for its water supplies.

Groundwater basins, in general, and the SBBA, in particular, are the primary sources of water supply for most of the water purveyors in the region. It is noteworthy to mention that the local agencies in the region have limited surface storage facilities for carryover storage and they rely on groundwater storage for seasonal as well as year-to-year water storage and regulation. Therefore, management of surface water, groundwater, groundwater quality improvement, and imported water are intrinsically interrelated and interconnected. It was recognized early in the planning process that water supply reliability, groundwater management, and the water quality objectives

of the plan can be met by performing a comprehensive evaluation and developing conjunctive water management.

Protect Groundwater Quality

The goal of this BMO is to protect the quality of the region's groundwater resources. Groundwater management is currently influenced by the presence of contamination plumes. Most of these plumes resulted from historic military and industrial operations in the region. The following plumes have been identified:

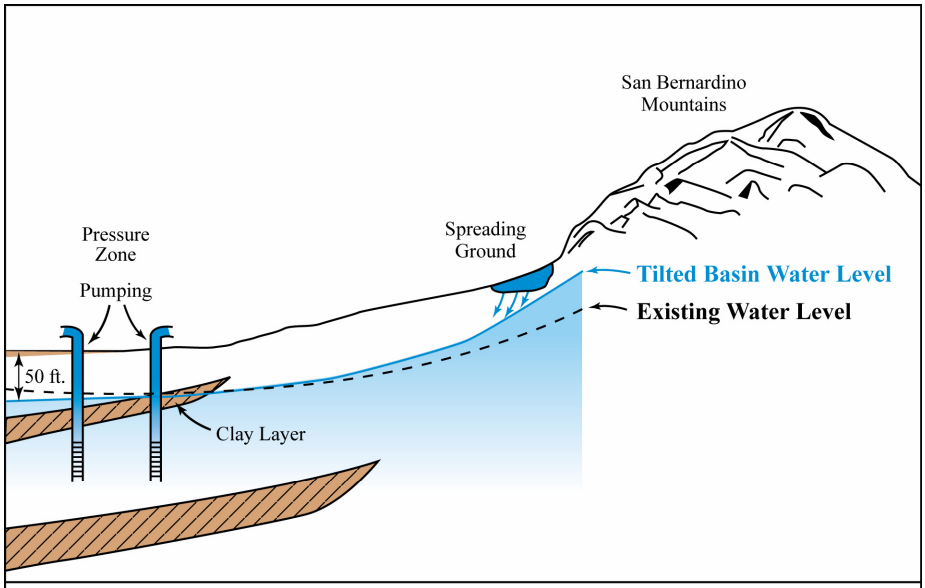
1. Newmark-Muscoy Superfund (trichloroethylene [TCE])
2. Redlands-Crafton (TCE, Perchlorate)
3. Santa Fe Plume (TCE)
4. Former Norton Air Force Base (TCE)
5. Rialto-Colton Subbasin (PCE, TCE, 1,1-DCE, cis-1,2-DCE, perchlorate)
6. No-Mans Land (PCE)

Management strategies are developed to not only avoid any adverse impacts that would cause these plumes to spread further but also to develop projects that will accelerate the cleanup of these plumes. These strategies are evaluated using computer models. Avoiding any impacts to and from the plumes, and their removal when possible, is considered a BMO for the region. This BMO is also consistent with the Groundwater Management Planning Act requiring BMOs to be formulated to address groundwater quality issues of the basin.

4.2.1.3.1 Groundwater Management Strategies

The region currently relies primarily on groundwater to meet its water needs and will continue to do so in the future. The SBBA is by far the largest source of groundwater for the region. When the basin is too full, high groundwater conditions occur in the Pressure Zone. The high groundwater levels are a concern because they increase the risk of liquefaction. High groundwater conditions also limit opportunities for recharge and/or groundwater banking in the basin. A "tilted basin" concept (see Figure 4-7) was suggested by some of the water leaders in the region as a way to maximize groundwater banking and manage the water levels in the SBBA.

Figure 4-7
Tilted Basin



Tilted Basin Concept

Management of groundwater levels under the tilted basin concept consists of recharging the basin at the "rim spreading grounds" and shifting the pumping, to the degree possible, to the Pressure Zone. The rim spreading grounds are located at the base of the San Bernardino Mountains and have high permeability soil. The "travel time" for the water to move from the rim recharge basins to the Pressure Zone is long enough to allow for seasonal regulations as well as conjunctive management of the basin. Under the tilted basin concept, groundwater levels could be generally higher in areas outside the Pressure Zone, while the water levels may be lower within the Pressure Zone. Considerable technical activities were undertaken during the planning process to:

- Develop analytic tools for basin management such as groundwater and surface water models. These models are discussed in Appendix C.
- Assess "baseline" conditions.
- Develop operational strategies for management of the groundwater basins, including groundwater levels and quality considerations.
- Develop groundwater production and artificial recharge strategies.
- Develop a process for management of the SBBA. This process is discussed in detail in this chapter.

- Develop a groundwater monitoring plan for collection, storage, and use of groundwater level and quality data, as well as assessment of the groundwater management strategies and their impacts on groundwater levels.

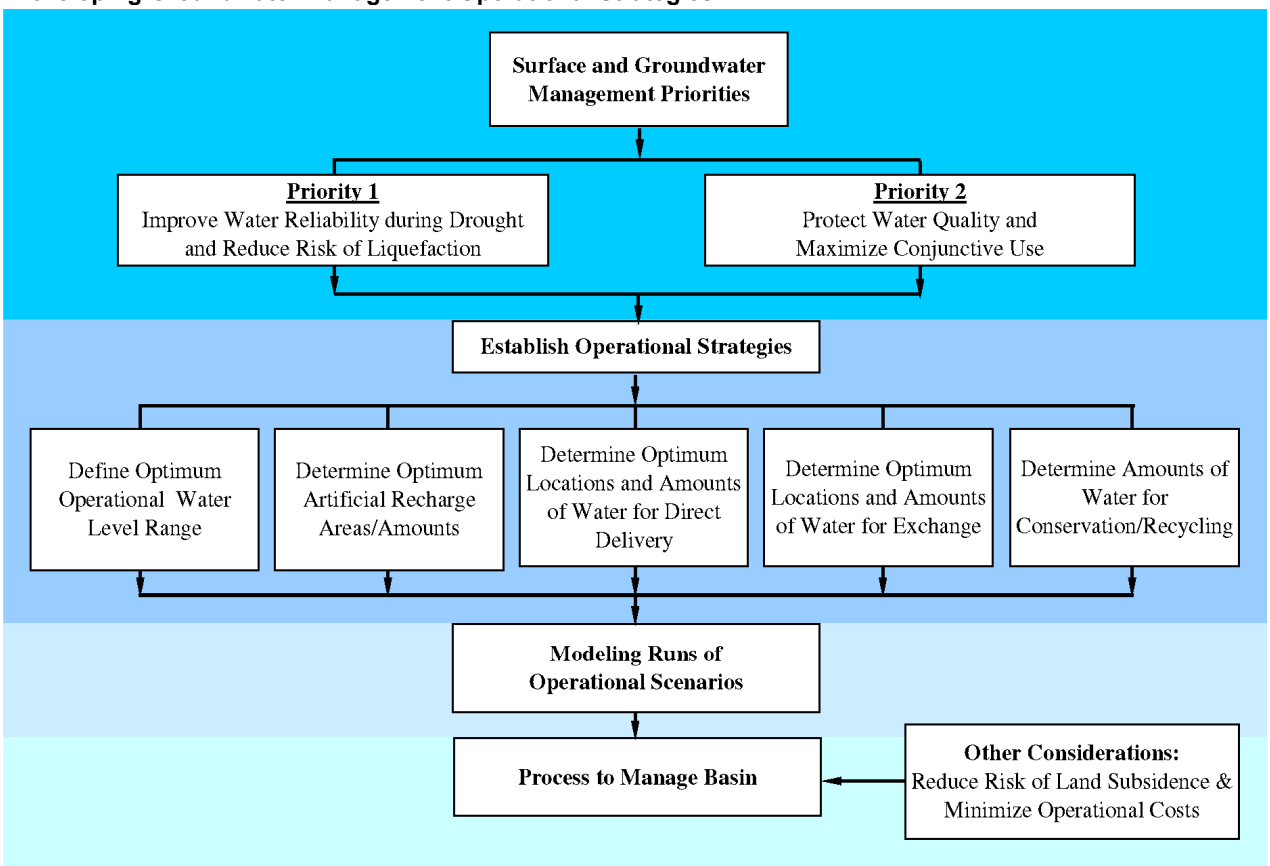
As stated earlier, management of the groundwater levels to reduce the risk of liquefaction and protect groundwater quality are key BMOs. Figure 4-8 shows operation strategies for managing groundwater resources of the SBBA. As shown, operational strategies are established during the planning process to ensure established BMOs (listed as Priority 1 and Priority 2) are met and that planned projects and programs are consistent with the goals of the BMOs and will contribute to attainment of the objectives. Considerable resources were used to develop tools for understanding and management of this basin. A groundwater model has been developed and further refined to simulate the behavior of the aquifers under different operational scenarios. A detailed discussion of groundwater modeling efforts is presented in Appendix C.

The key model outputs include groundwater levels and resulting groundwater directions. The model is used to design appropriate levels of groundwater conjunctive management strategies while meeting stated BMOs. The model runs were to identify the range ("book-ends") and provide information such as the following:

- Suitable places for managed groundwater recharge;
- Amount of water to be recharged in each managed recharge area;
- Key groundwater monitoring locations;
- Groundwater pumping, including location and number of the production wells; and
- Programs and projects to facilitate pumping, treatment, and the use of contaminated groundwater.

Development of the water management strategies and associated projects to meet the BMOs requires a clear understanding of the SBBA hydrogeology and groundwater flows and directions under various operational scenarios. Groundwater modeling studies are performed and water level contours are prepared for operation of the basin assuming a range of conjunctive use operations. Operations of existing and future recharge facilities and production wells can be further refined through these modeling studies. Using modeling study results, additional facilities are formulated to implement the conjunctive use strategies.

Figure 4-8
Developing Groundwater Management Operational Strategies



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Two specific BMOs mentioned earlier must be met as the IRWM Plan is being implemented. These BMOs are specifically designed for management of the water level and water quality in the Bunker Hill and Lytle Creek Basins.

To achieve the objective of reducing the risk of liquefaction, the groundwater level(s) in the Pressure Zone would be reasonably managed to maintain at least 50 feet below ground surface (bgs). This objective will be implemented through optimization of groundwater recharge and groundwater production activities and monitoring of key "index wells" throughout the year. Implementation strategies may include increasing production in the Pressure Zone and reducing recharge in the areas that may contribute to the speedy rise of the water level in the Pressure Zone.

4.2.1.3.2 Groundwater Quality Protection Strategies

A key water quality objective in the Bunker Hill Basin is minimizing adverse impacts from and to groundwater contaminant plumes. The IRWM Plan recommends specific strategies that would facilitate and expedite clean up while meeting the above water quality objective. These strategies consist of (1) formulating and implementing a program to increase groundwater pumping and cleanup in the plume areas, and (2) designing conjunctive use strategies that ensure avoidance of impacts to and from the contaminant plumes.

Bunker Hill Basin Regional Water Supply Program

In the mid-1990s, Valley District completed a Regional Water Facilities Master Plan for its service area that identified a regional transmission system to deliver high groundwater from the Bunker Hill Basin Pressure Zone to the surrounding communities. Since then, Valley District has constructed some of these facilities. Facilities within the City of San Bernardino have been incorporated into the SBMWD's Lower Zone distribution system. The SBMWD may then operate Valley District's facilities as a part of the city's Lower Zone.

The proposed Bunker Hill Regional Water Supply Program consists of design and construction of facilities for regional production, treatment, and distribution of treated water in the basin. Groundwater from the Newmark plume would be conveyed to treatment facilities and distributed to interested agencies within and outside the Valley District's service area. This program will provide water supply reliability by accelerating the cleanup of groundwater plumes, and improve the management of the groundwater levels in the Pressure Zone.

Facilities needed to implement this program include:

- Groundwater production wells and collection system;
- Regional wellhead treatment facilities; and
- Potable water storage, transmission, and pumping facilities.

Additional detailed discussion of this program and associated facilities can be found in Appendix E.

4.2.1.3.3 Conjunctive Use Strategies

As mentioned previously, the design of conjunctive use programs should ensure avoidance of impacts to and from the contaminant plumes and minimize the increased risk of liquefaction. With this criterion and the "tilted basin" concept in mind, four conjunctive use scenarios have been evaluated for this plan. The first scenario is the base level conjunctive use. The baseline level conjunctive

use is intended to demonstrate how conjunctive management of the region's surface and groundwater resources (groundwater, local, and imported surface water supplies) will help the region meet its water demand through 2030. The next three scenarios are designed to examine the response of the basin when an additional 40 thousand acre-feet (TAF), 90 TAF, and 140 TAF conjunctive use programs are implemented. The intent of these studies is to characterize the book-ends for water banking in the SBBA under the "tilted basin" concept. The model runs were prepared with consideration of the following:

- Hydrologic base period is from 1962 through 2000.
- Basin storage must be maintained to comply with existing adjudications, i.e., no long-term storage depletion—basin storage at the end of the modeling run period would be "equivalent" to the storage at the start of the modeling period.
- Water levels within the Pressure Zone would be within acceptable ranges.
- Water levels outside the Pressure Zone may be higher.
- Avoiding impacts to and from known groundwater contaminant plumes.

Conjunctive use operation of the SBBA should also comply with numerous other agreements and MOUs. Compliance with these documents will be verified during real-time operation of the SBBA and are discussed in more detail in Section 4.2.1.3.5.

Modeling studies were conducted for the four scenarios and are described below. A summary of the assumptions of the four modeling studies is presented in Figure 4-9.

The groundwater model developed as part of this planning effort does not include the terms and conditions set forth in the Seven Oaks Accord and the Riverside Agreement. The modeling runs developed for the IRWM Plan provide valuable information, however, on how to manage the groundwater basins within the framework of all existing legal constraints. Future proposed conjunctive use projects will be analyzed using a groundwater model to ensure their compliance with the terms and conditions of the various legal agreements in the basin.

Baseline Scenario – The baseline scenario assumes compliance with the existing adjudication constraints and includes the diversion rights of Senior Water Right Claimants, Valley District's Replenishment Obligations, and SBVWCD. Future water demand within

Figure 4-9
Groundwater Modeling Assumptions

Scenario	Hydrologic Base Period	Model Assumptions							
		Groundwater Pumping[1]	Valley District's Replenishment Obligation[2]	SBVWCD Diversion[3]	Diversion by Senior Water Rights Claimants[4]	SAR Water Right Applications[5]	Maximum Additional Yield		
							40,000 acre-ft/yr	90,000 acre-ft/yr	140,000 acre-ft/yr
Baseline 1	1962-2000 (wet, avg, dry)	x	x	x	x	x			
A		x	x	x	x	x	x		
B		x	x	x	x	x		x	
C		x	x	x	x	x			x

1 Based on 2005 Urban Water Management Plans pumping data

2 Replenishment obligation is based on Western Judgment and is safe yield minus annual production

3 SBVWCD diversions are based on Valley District/SBVWCD settlement agreement

4 Limited to 88 cfs, see Seven Oaks Accord

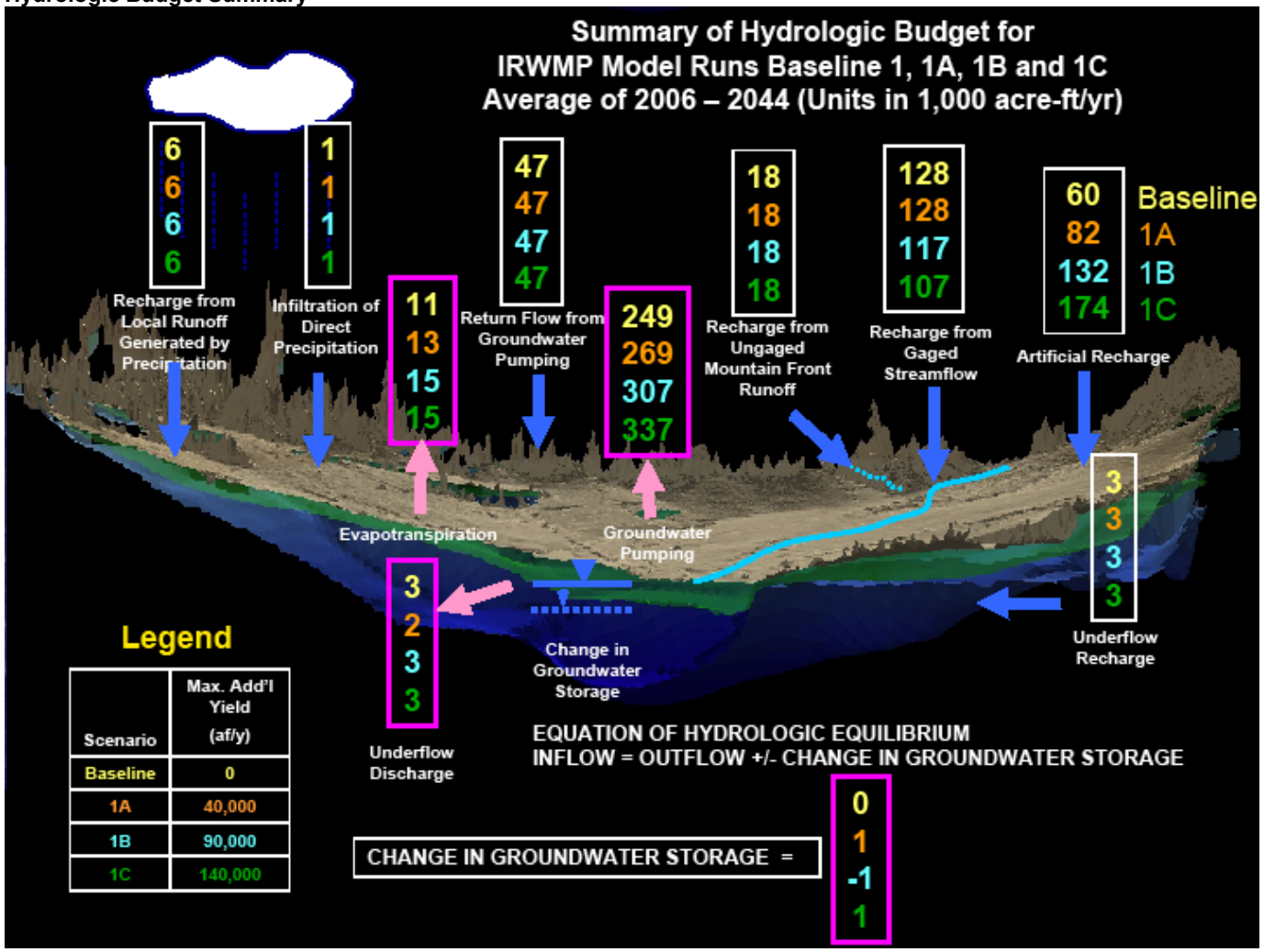
5 Assumes SAR water rights applications are approved by SWRCB

the region is estimated using data presented in UWMPs prepared by the water purveyors as presented in Chapter 3. To meet the water demand, it is assumed that Valley District will use newly conserved SAR water, as is defined in water right applications, and its SWP Table A allotment, as available, for recharge and direct delivery to the treatment plants.

The modeling studies have been conducted to document the performance of the basin when local surface water and SWP supplies are used to replenish the basin by Valley District as required by the adjudication. Modeling studies are designed to cover a 39-year period (1962-2000), which includes the wet years such as 1969 and 1980 and the driest period of 1987 through 1992. This modeling scenario is intended to show how the base conjunctive use project can be used to meet future water needs of the region. This scenario was used in preparation of the water budget (Chapter 3).

The results of the base scenario suggest that the region can meet its water needs through 2030, while achieving the BMOs. The results also indicate that the available surface water for recharge and the SWP supplies, assuming a 77 percent allocation, are adequate to offset the pumping demand on SBBA, and that at the end of the 39-year modeling run the basin storage is the same as the beginning of the period (see Figures 4-9 and 4-10) The IRWM Plan consulting team has evaluated any potential impact of conjunctive use operation upstream of the SBBA (U.S. Forest Service (USFS) land) to ensure the operation will not impact the groundwater level and associated ecosystem of the USFS land. Facilities needed to implement the base conjunctive use scenario include those that are necessary to bring SAR water to the treatment facilities and spreading grounds and are discussed in the Local Surface Water Management section.

Figure 4-10
Hydrologic Budget Summary



Scenario A – This scenario is intended to show the performance of a project with potential 40 TAF additional conjunctive use per year. The level of conjunctive use presented with this scenario is intended to evaluate the feasibility of a 40 TAF conjunctive use project. The other modeling run assumptions used for this scenario were similar to the base scenario.

The modeling studies indicate that this level of conjunctive use operation is feasible and the stated BMOs are also met. The facilities needed to implement this level of conjunctive use include:

- A well field consisting of 20 production wells and connecting pipeline,
- Treatment facilities,
- Pipeline to connect the well field to the treatment and distribution facilities, and
- Improvement in existing groundwater managed recharge basins.

Scenario B – This scenario is for an additional 50 TAF per year conjunctive use opportunity (for a total of 90 TAF per year over the Base Scenario). Additional facilities needed to implement this level of conjunctive use include:

- A well field consisting of 30 additional production wells (50 total),
- Treatment facilities for production wells pumping from the plumes, and
- Conveyance facilities.

Scenario C – This scenario is for an additional 50 TAF per year of conjunctive management over Scenario B for the total conjunctive use of 140 TAF per year. Additional facilities needed to implement this incremental level of conjunctive use include:

- A well field consisting of 30 additional production wells (80 total),
- Treatment facilities for production wells pumping from the plumes,
- Conveyance facilities, and
- Additional spreading grounds.

4.2.1.3.4 Yield of Conjunctive Use Strategies

The yield of conjunctive use strategies listed above is calculated using the groundwater model based on water demands for the basin. Model runs A, B, and

C represent the conjunctive use scenarios discussed in the previous section. Table 4-3 below shows the yield of three conjunctive use scenarios for a single drought year and a three-year drought period (1990 year type is used for Upper SAR watershed as the driest single year and 1988 to 1990 is used as the three-year drought period).

Table 4-3
Summary of Potential Additional Yield for the SBBA

Terms	Period	Baseline Run [acre-ft]	Run A [acre-ft]	Run B [acre-ft]	Run C [acre-ft]
Groundwater Pumping	2032	271,987	301,987	381,987	421,987
	2033	277,330	307,330	367,330	387,330
	2034	289,105	329,105	409,105	449,105
	Total	838,422	938,422	1,158,422	1,258,422
Conjunctive use Additional Yield	Single Year Drought 2034 (1990)	N/A	40,000	120,000	160,000
	3-Year Drought 2032-2034 (1088-1990)	N/A	100,000	320,000	420,000

Single-year drought 2034 (hydrologic year 1990)
Three-year drought 2032-2034 (hydrologic years 1988-1990)

As shown in the above table, for the single drought year, the additional yield for the conjunctive use would be 40,000 acre-feet, 120,000 acre-feet, and 160,000 acre-feet for Model Runs A, B, and C, respectively. The yield during a three-year drought would be 100,000 acre-feet (or 33 TAF per year), 320,000 acre-feet (or 106 TAF per year), and 420,000 acre-feet (or 140 TAF per year) for Model Runs A, B, and C, respectively.

Specific facilities needed to implement the conjunctive use program discussed above are summarized in Table 4-4.

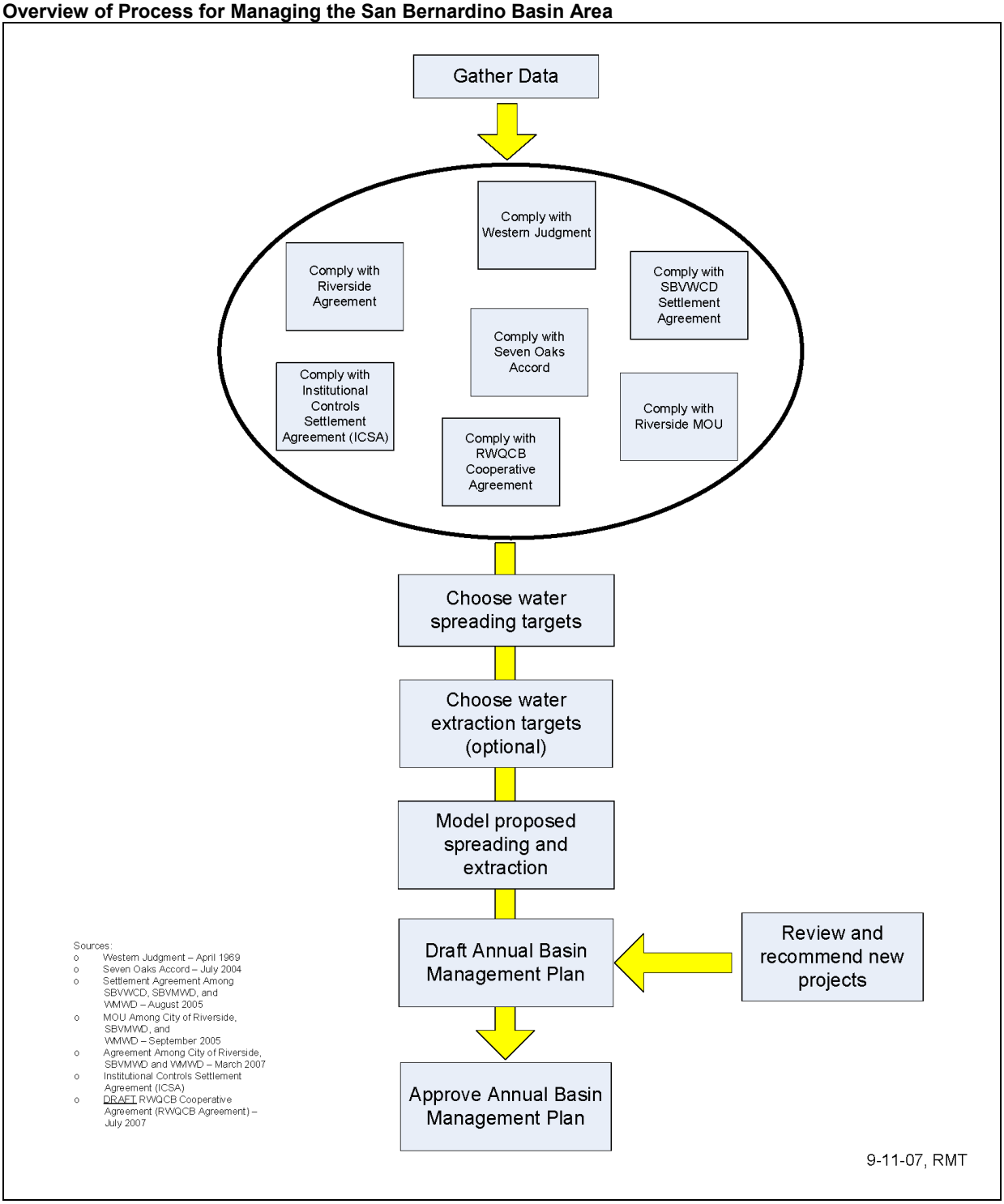
Table 4-4
Facilities Needed to Implement Various Conjunctive Use Program Scenarios

Conjunctive Use Scenario	Facilities Needed
Baseline	Facilities to divert SAR water per water rights application
1A	20 new extraction wells and conveyance facilities
1B	30 additional extraction wells (in addition to 1A) and conveyance facilities
1C	30 additional extraction wells (in addition to 1B) and conveyance facilities

4.2.1.3.5 Process for Managing the SBBA

Implementation of the conjunctive use operation in the SBBA must meet the requirements of various judgments, agreements, and MOUs developed and agreed upon by water entities in the region. To effectively manage the SBBA in real time, the TAG drafted a basin management process for a coordinated and comprehensive management plan of the SBBA. This process will be submitted to the Board of Directors of Valley District and Western Municipal Water District (Western) for review and approval. The process is outlined in Figure 4-11.

Figure 4-11
Overview of Process for Managing the San Bernardino Basin Area



Governance

The Western Judgment identifies regional representative agencies to be responsible, on behalf of the numerous parties bound thereby, for implementing the replenishment obligations and other requirements of the judgment. The representative entities for the Western Judgment are Valley District and Western. Valley District is solely responsible for providing replenishment of the SBBA if extractions exceed the safe yield of the basin. The court-appointed Watermaster includes representatives from Valley District and Western. The proposed basin management process could be under the authority of the Valley District and Western Boards of Directors with inputs from other significant producers. (See Figure 4-12.)

Basin Technical Advisory Committee

The annual basin management plan for any given year will be formulated by a Basin Technical Advisory Committee (BTAC) and forwarded onto the Valley District and Western Boards of Directors for review and approval. The BTAC will be comprised of staff representatives from plaintiffs and non-plaintiffs of the Western Judgment, as listed below:

BTAC Membership

i) Western

ii) City of Riverside

iii) Valley District

iv) Bear Valley Mutual Water Company (Bear Valley Mutual)

v) East Valley Water District (East Valley)

vi) City of Loma Linda

vii) City of Redlands

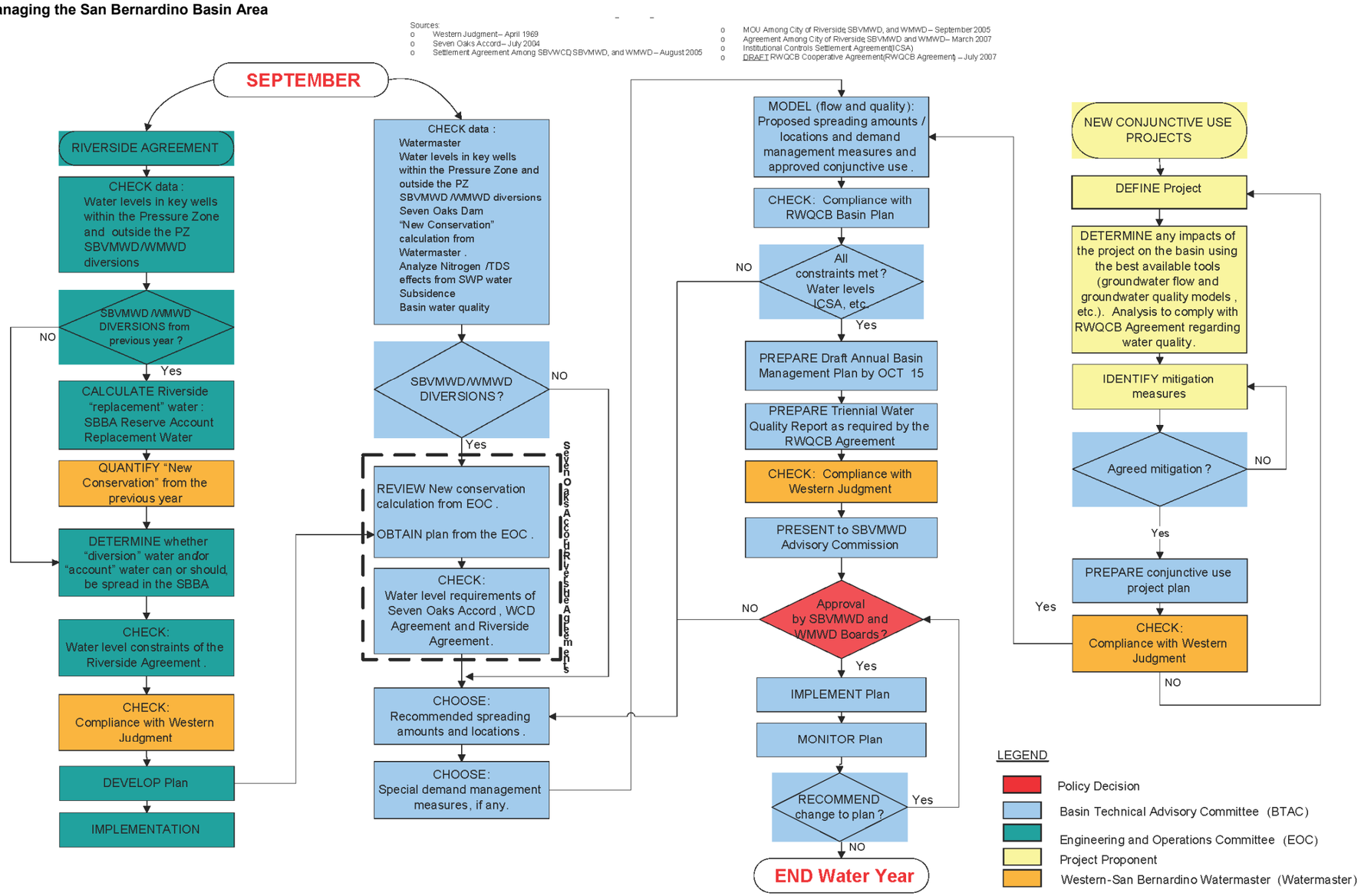
viii) San Bernardino Municipal Water Department

ix) SBVWCD

x) West Valley Water District (West Valley)

The BTAC will meet as needed to effectively operate the SBBA on a real-time basis and to address technical issues related to basin management. The BTAC members will cooperatively work together and will strive to make decisions by consensus.

Figure 4-12
Process for Managing the San Bernardino Basin Area



Overall Basin Management Strategy

The BMOs formulated for the SBBA are the driving force in developing strategies for the basin management plan. The BMOs are as follows:

- Improve water supply reliability during droughts,
- Protect water quality,
- Reduce risk of liquefaction, and
- Avoid impact from and to the contaminant plumes.

To ensure adequate reliable water supply for the communities in the Upper SAR watershed during a prolonged drought, the overall basin management strategy will be to operate the basin under the "Tilted Basin Concept" such that the basin would begin a drought period in "as full as possible" condition. Keeping the basin relatively full and operating a conjunctive management program according to the "Tilted Basin Concept" also provides the added flexibility to reduce imports from the SWP when water quality is less desirable. This overarching management strategy will be followed by the BTAC as they draft the basin management plan. Some of the specific management strategies that could contribute to improving water supply reliability during a drought are as follows:

- Retailers could take direct deliveries of SWP water when available instead of producing water from their wells. This reduces the amount of water withdrawn from the groundwater basin, which is equivalent to recharging the basin. This strategy will require participation by the water agencies and may require the construction of new water treatment plants or upgrades to existing plants.
- Recharge as much SWP water as possible when available. This will likely result in spreading water in wet years, which has not occurred as much in the past. It may also require upgrading the existing spreading grounds.
- Prepare, to the extent possible, for the high groundwater condition that may be created by maintaining a "full basin" when a wet year arrives.
    - Implement an agreement(s) with groundwater producers within the Pressure Zone to maximize production from the Pressure Zone as much as practicable during unacceptably high groundwater level conditions.

- Construct additional facilities to pump and convey large quantities of water from the Pressure Zone for use outside the Pressure Zone.

The San Bernardino Basin Area Management Plan will be developed in consideration of this overall management strategy and the BMOs.

Basin Management Requirements

The annual basin management plan for the SBBA will meet the requirements identified in the following legal documents:

1. Western Judgment – April 1969
2. Seven Oaks Accord – July 2004
3. Settlement Agreement between SBVWCD, Valley District, and Western – August 2005
4. MOU between City of Riverside, Valley District, and Western – September 2005
5. Agreement between City of Riverside, Valley District, and Western – March 2007
6. Institutional Controls and Settlement Agreement (ICSA) Agreement and its subsequent amendments

A summary of the pertinent basin management information from each of these documents is provided below.

1) Western Judgment

a) **Natural Safe Yield** - established at 232,100 acre-feet per year. The Plaintiffs' (Western entities) rights are capped at 27.95 percent of the natural safe yield, or 64,862 acre-feet, notwithstanding any Additional Extraction Agreements or "new conservation," as defined in the judgment. The Non-Plaintiffs' (Valley District entities) rights are unlimited provided that an equal amount of basin replenishment occurs to offset any amount that the Non-Plaintiff production exceeds—72.05 percent of the natural safe yield, or 167,238 acre-feet. An annual report, entitled *Annual Report of the Western-San Bernardino Watermaster*, provides an "accounting" of basin extractions.

b) **Replenishment** – Valley District is responsible for replenishing the SBBA for that amount of Non-Plaintiff extractions exceeding 167,238 acre-feet. The replenishment obligation may be met by any of the following means:

i) Return flow from excess extractions;

ii) Replenishment provided in excess of that required;

iii) Amounts extracted without replenishment obligations (i.e., Additional Production Agreement);

iv) That amount of water extracted below the natural safe yield; and

v) Return flow from imported water.

c) **New Conservation** is defined in the 1969 Judgment as "any increase in replenishment from natural precipitation which results from operation of works and facilities not now in existence." The judgment contemplated that the parties would develop facilities that would result in the capture of more natural runoff. Construction of the Seven Oaks Dam within the SAR has provided such an opportunity, and Valley District and Western are seeking to obtain a water right from the SWRCB and to construct the facilities necessary to capture SAR water that was not historically captured. The parties under the Western Judgment will have their adjusted extraction rights increased to include a proportionate share of any New Conservation, provided that each Plaintiff party pays its proportionate share of the costs to develop said New Conservation.

2) Seven Oaks Accord

a) **Groundwater Spreading/Management Program** (GMP) – Requires Valley District and Western to develop and manage 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." Specific requirements of the Seven Oaks Accord are as follows:

i) GMP 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.

ii) Thresholds of significance in terms of SAR water diverted by Valley District and Western and spreading by all parties should be observed (see sidebar). See Appendix I of the Accord.

iii) The determination as to whether a certain groundwater management action will "worsen" high groundwater levels in the Pressure Zone is made through the use of the integrated surface and groundwater models.

iv) GMP must be "adopted" within five years of the date the SWRCB grants a permit to Valley District/Western. To date, Valley District and Western have not received the permit.

v) Redlands, East Valley, and Bear Valley Mutual agree to limit spreading to conform to the annual GMP.

3) San Bernardino Valley Water Conservation District Settlement Agreement

a) Annual Groundwater Management Plan – Valley District and Western will consult with SBVWCD in the development of the GMP.

b) An interim GMP could be developed prior to the completion of the model being developed for the San Bernardino Basin Area.

c) GMP objectives to be achieved simultaneously include:

i) Maximize the quantity of water spread in the SAR spreading grounds.

ii) Establish and maintain a shallowest target of 50 feet depth to water within the Pressure Zone.

iii) Maintain groundwater levels in the Forebay Area within 10 feet of the levels that would have occurred in the absence of SAR diversions by Valley District and Western. Quantifying the difference between diversions and no diversions will be accomplished using the groundwater flow model developed for the SBBA.

iv) Otherwise avoid significant impacts on the environment.

d) Set as a goal to coordinate the San Bernardino Consent Decree management plan with the GMP.

e) No spreading will take place without authorization by the GMP.

4) Riverside MOU

a) Basin Management Account – Established with funds and future revenues from the SBVWCD "to fund recharge efforts in the basin."

b) Valley District and Western are required to exercise SBVWCD water rights in a manner that:

Thresholds of Significance and Mitigation Measures to be Included in Applicants' EIR

1. Threshold of Significance: Reduction in Groundwater Levels at Index Wells Outside the Pressure Zone

A reduction in groundwater levels outside the Pressure Zone is significant if the analysis in this EIR, using the integrated surface water and groundwater model developed by the project proponents, predicts that the project would reduce static groundwater levels at one or more index wells, on average, by more than 10 feet during a repetition of the 39-year base period hydrology, as compared to static water levels in the absence of the project.

2. Threshold of Significance: Increase in Groundwater Levels at Index Wells Within the Pressure Zone

An increase in groundwater levels in the Pressure Zone is significant if the analysis in this EIR, using the integrated surface water and groundwater model developed by the project proponents, predicts that the project would increase static groundwater levels at one or more index wells in the Pressure Zone, on average, by more than 10 feet during a repetition of the 39-year base period hydrology, as compared to static water levels in the absence of the project.

3. Mitigation Measure: Targeted Spreading to Maintain Groundwater Levels

To avoid a significant effect on groundwater levels at one or more index wells located outside the Pressure Zone, the project proponents shall spread sufficient water to maintain static groundwater levels at the affected index wells to reduce this project impact to a less-than-significant level.

4. Mitigation Measure: Limitation on Spreading to Prevent High Groundwater Levels

To avoid a significant effect on groundwater levels in the Pressure Zone, the project proponents shall curtail their spreading or direct other parties engaged in the spreading of water to replenish the San Bernardino Basin to curtail their spreading to reduce this project impact to a less-than-significant level.

i) Maintains groundwater levels for the benefit of the production wells in the geographic area historically served by the SBVWCD at relatively constant levels.

ii) Maximizes the use of native water supplies to replenish the SBBA without causing high groundwater problems in the artesian zone and without causing the migration of contaminant plumes that would result in significant degradation of the water quality in any domestic well.

c) Valley District will spread sufficient water to ensure that groundwater supplies necessary to support the safe yield of the SBBA are maintained pursuant to the Western Judgment.

5) Riverside Agreement

a) This agreement establishes the Seven Oaks Dam Water Diversions Engineering and Operations Committee (EOC) to develop and implement procedures to:

i) Maintain the groundwater levels in the Index Wells at relatively constant levels, in spite of fluctuations due to hydrologic variation.

ii) Minimize such fluctuations (reduce highs and lows).

iii) Provide water "accounts" to Riverside to offset the loss of recharge to the SBBA and/or Riverside North due to Western/Valley District SAR water diversions.

(1) "Reserve Account" is initially established as 38 percent of the total volume of water diverted from the SAR by Valley District and Western pursuant to the SWRCB water right permit. To be recharged in the SBBA either directly or through an exchange.

(2) "Replacement water" varies from 0 to 6 percent of the flow at the E Street Bridge. Water to be recharged into the Riverside North basin.

iv) Develop recommendations to the Western Judgment Watermaster regarding the classification of diverted SAR water as either New Conservation or existing safe yield of the SBBA.

b) EOC will meet no later than six months after the SWRCB grants permits to Valley District and Western to develop the initial procedures. Ongoing, the EOC will meet no later than October 1 of each year. The EOC shall meet on a regular basis to effectively operate, on a real-time basis, a program to achieve the objectives listed above. EOC decisions will be implemented once approved by the EOC and will be provided to the BTAC for inclusion in the Annual San Bernardino Basin Area Management Plan. The tasks of the EOC could be covered at the BTAC

meetings, realizing that most of the members of the BTAC have no standing in this agreement and the decisions of the EOC are not subject to review by BTAC or any of the BTAC members.

c) Water levels at the index wells outside the Pressure Zone must be maintained at no lower than 10 feet, on average, during a repeat of the 39-year base period. Valley District will commence spreading to maintain these levels.

d) If the 12-month rolling averages of the Backyard Well ports D4, D5, and D6 are 50 feet bgs or greater, Valley District and Western will recharge water from the Reserve Account.

6) Consent Decree, City of San Bernardino March 23, 2005

a) The City of San Bernardino Municipal Water Department (SBMWD) is a party to a consent decree lodged with the United States District Court, Central District of California, Western Division (Court), on August 18, 2004. The Consent Decree obligates the 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 TCE and perchloroethylene (PCE).

b) The 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 Environmental Protection Agency (EPA).

7) City of San Bernardino Ordinance No. MC-1221 and Institutional Controls Settlement Agreement (ICSA)

a) Ordinance No. MC-1221 – This ordinance establishes the management zone boundaries within the City of San Bernardino for water spreading and water extraction activities.

i) The Consent Decree requires that the City of San Bernardino adopt and enforce an ordinance to ensure that activities occurring in the management zone, including, but not limited to, development, digging, drilling, boring or reconstruction of wells, extraction of groundwater from wells, and spreading of recharge water, do not interfere or cause pass-through of contaminants from the Newmark and Muscoy Operable Units. The ordinance was approved on March 20, 2006, by the Mayor and City Council.

ii) 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 of California (State) and federal permits and requirements for drinking water.

iii) Unless a permit issued by the SBMWD pursuant to the provisions outlined in the ordinance is first obtained, it shall be unlawful for any person, as principal, agent, or employee to spread (artificial recharge) or extract (well pumping) within the Management Zones as defined in the ordinance.

b) Institutional Controls Settlement Agreement (ICSA)

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

(1) City of San Bernardino Municipal Water Department

(2) San Bernardino Valley Municipal Water District

(3) Western Municipal Water District

(4) City of Riverside

(5) West Valley Water District

(6) East Valley Water District

(7) City of Colton

(8) Riverside Highland Water Company

ii) The parties identified 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.

Development of Annual San Bernardino Basin Area Management Plan

Considering the provisions of the above judgments and agreements, the following process is suggested for the preparation of an Annual SBBA Management Plan. This process is intended to be flexible and changed as needed. The main purpose in suggesting a process is to ensure that the SBBA Management Plan is in compliance with the provisions of the applicable judgment and agreements and to provide a cooperative forum among the water agencies to engage in developing solutions.

As part of the first annual SBBA Management Plan, BTAC will work toward defining the term “conjunctive use” and draft a conjunctive use policy that may be used for the basin. The policy will define issues such as (1) imported water, (2) imported water delivery, (3) the groundwater recharge system, (4) usable groundwater storage capacity, (5) “water loss factor,” (6) expiration date for the

imported water, (7) groundwater recovery rights, (8) groundwater extraction capacity, and (9) recovered water delivery.

A. **Prepare** Annual SBBA Management Plan. The plan will be prepared considering the following:

   a. **Review** the Watermaster data:

      i. Recharge

      ii. Extractions

      iii. Credits

The BTAC may have to rely on preliminary production information compiled by the Watermaster because the Watermaster reports typically lag the calendar year.

   b. **Analyze** nitrogen and TDS effects from imported water. Prepare conjunctive use operation criteria to ensure the use of SWP water for recharge will not cause water quality degradation in Bunker Hill Basin.

   c. **Quantify** "new conservation."

      i. Develop recommendations to the Western Judgment Watermaster regarding the classification of diverted SAR water as either New Conservation or existing safe yield of the SBBA.

   d. **Check** Valley District/Western/Riverside SAR diversions from the previous year.

   e. **Check** Seven Oaks Dam operations data.

      i. Debris pool.

      ii. Current elevation.

   f. **Check** water levels.

      i. Check water levels in the Pressure Zone (establish and maintain 50 feet to water level in the Pressure Zone).

      ii. Check water levels outside the Pressure Zone. Ensure water levels at the index wells outside the Pressure Zone are maintained at no lower than 10 feet, on average, during a repeat of the 39-year base period.

   g. **Review** the amount of "replacement" water agreed to by the EOC to be "deposited" into the Riverside "accounts" based upon the Valley District/Western/Riverside diversions from the previous year.

i. SBBA Reserve Account: 38 percent of the total volume of water diverted from the SAR by Valley District and Western pursuant to a SWRCB permit or license. To be recharged in the SBBA either directly or through an exchange.

ii. Replacement water volume calculation: Replacement water is the lost recharge opportunities in Riverside North Basin due to diversion of New Conservation water from SAR. This replacement water is estimated to vary, depending on SAR hydrology, from 0 to 6 percent of the flow at the E Street Bridge. Replacement water to be recharged into the Riverside North Basin.

h. **Determine** whether water will be spread from the SBBA Reserve Account in the coming year.

i. Calculate the 12-month rolling averages of the Backyard Well ports D4, D5, and D6. If it is 50 feet bgs or deeper, Valley District/Western will recharge water from the Riverside Reserve Account in the coming year.

i. **Review** constraints of various agreements on Valley District/Western/Riverside diversions. If SAR diversions were made in the previous year, check the following:

i. Maintain groundwater levels in the forebay area (use wells from Seven Oaks Accord and Riverside Agreement, "Index Wells") within 10 feet of the levels that would have occurred in the absence of SAR diversions by Valley District/Western**.**

ii. Maintain groundwater levels in the Seven Oaks Accord, Valley District, and Riverside Agreement wells at relatively constant levels, in spite of the inevitable fluctuations due to hydrologic variation.

1. Identify target water level ranges for the Seven Oaks Accord index wells subject to the requirement that such spreading will not worsen high groundwater levels in the Pressure Zone.

2. Review Seven Oaks Accord thresholds of significance.

3. Maintain water levels in the Riverside Agreement wells outside the Pressure Zone at no lower than 10 feet, on average, during a repeat of the 39-year base period.

4. Minimize fluctuations (highs and lows).

j. **Review** spreading amounts and locations chosen by the EOC and choose other spreading amounts and locations based upon the following:

   i. Maximize the quantity of water spread in the SAR spreading grounds.

   ii. Water spread for conjunctive use projects, if any.

      1. Water banking.

      2. Exchange.

      3. Establish "accounts" in the basin.

         a. Expiration?

         b. Define assumed losses due to evaporation and evapotranspiration.

   iii. Riverside Reserve Account (see 2 and 3 above).

k. **Choose** special demand management measures (if any).

   i. Extra pumping to dewater a particular area.

   ii. Extra pumping to dewater due to a wet year.

   iii. Suggest conservation measures.

      l. **Check compliance with the Regional Water Quality Control Board (RWQCB) Agreement**

B. **Model:** The groundwater models for the SBBA can be used to model the proposed SBBA Management Plan developed above to ensure that all of the constraints are met.

a. Maintain 50 feet to water level in the Pressure Zone.

b. Check target water level ranges in the Seven Oaks Accord index wells.

c. Check water level requirements from Riverside Agreement.

d. Check water level requirements from SBVWCD Agreement.

e. Determine any impacts on the environment.

f. Prepare groundwater flow map to determine any impacts on the Consent Decree.

g. Determine any impacts on any other contamination cleanup projects.

h. Determine if there are any subsidence impacts.

i. Adjust SBBA Management Plan, as necessary, in an attempt to remove any impacts and re-run model. Continue this trial-and-error process until all of the constraints are met.

C. **Prepare** triennial water quality report.

D. **Adopt** Annual SBBA Management Plan. The Annual SBBA Management Plan must be adopted by the Board of Directors of the Valley District and Western.

E. **Monitor** plan throughout the year. The operation of the SBBA will be monitored and groundwater level and quality data will be collected and reviewed throughout the year to ensure basin behavior is consistent with the SBBA Management Plan desired outcome(s). If unexpected impact is observed, the conjunctive use operation will be modified to ensure the impact is mitigated.

F. **Review** implementation of the Annual SBBA Management Plan at the end of the year. Compare the anticipated water levels with actual field observations. This would provide valuable information for developing an adaptive management plan for development of the basin management plan for the following year.

G. **Adapt** the process, as necessary, to maintain its effectiveness.

Suggested Calendar for Preparation and Implementation of the Annual Basin Management Plan (water year)

MONTH	ACTION ITEM(S)
OCT	1) Collect water levels from the Forebay Area, the Seven Oaks Accord wells, and the Riverside Agreement wells. **2) <u>BTAC MEETING</u>** o Develop recommendation regarding the classification of diverted SAR water as either New Conservation or existing safe yield of the SBBA. o Review Watermaster data. o Check water levels in the Pressure Zone. o Calculate Riverside Reserve Account. o Determine whether water will be spread from Reserve Account in the coming year. o Check groundwater levels in the Forebay Area. o Check water levels in the Seven Oaks Accord wells. o Check water levels in the Riverside Agreement wells. o Review Valley District Change in Storage Calculation. o Review SBVWCD Change in Storage Calculation. o Review hydrologic index (SBVWCD Engineering Investigation). o Choose spreading amounts and locations. o Choose demand management measures. o Model spreading amounts for the year.
NOV	1) Collect water levels from the Forebay Area, the Seven Oaks Accord wells, and the Riverside Agreement wells. **2) <u>BTAC MEETING</u>** o Finalize/Implement Groundwater Management Plan. o Present to Valley District and Western Boards of Directors.
DEC	Collect water levels from the Forebay Area, the Seven Oaks Accord wells, and the Riverside Agreement wells.
JAN	Collect water levels from the Forebay Area, the Seven Oaks Accord wells, and the Riverside Agreement wells.
FEB	Collect water levels from the Forebay Area, the Seven Oaks Accord wells, and the Riverside Agreement wells.
MAR	1) Collect water levels from the Forebay Area, the Seven Oaks Accord wells, and the Riverside Agreement wells. **2) <u>BTAC MEETING</u>** o Review water levels and plan. o Review Valley District Change in Storage Calculation.
APRIL-SEPT.	Collect water levels from the Forebay Area, the Seven Oaks Accord wells, and the Riverside Agreement wells.

4.2.1.3.6 The Potential Impact of the Agreement on Cooperating Agencies' Ability to Beneficially Use SWP Water for Groundwater Recharge

Background

The Santa Ana Regional Water Quality Control Board (SARWQCB) is charged by statute with adopting water quality objectives as may be required to protect the beneficial uses of water within the region. In particular, the long-term conjunctive use of groundwater requires that the quality of water in groundwater basins be managed to meet the water quality objectives for nitrogen and total dissolved solids (TDS) [collectively, the "Salinity Objectives" adopted by the SARWQCB in the 1995 Water Quality Control Plan for the Santa Ana River Basin as amended in 2004 by R8 2004-0001 (Basin Plan)].

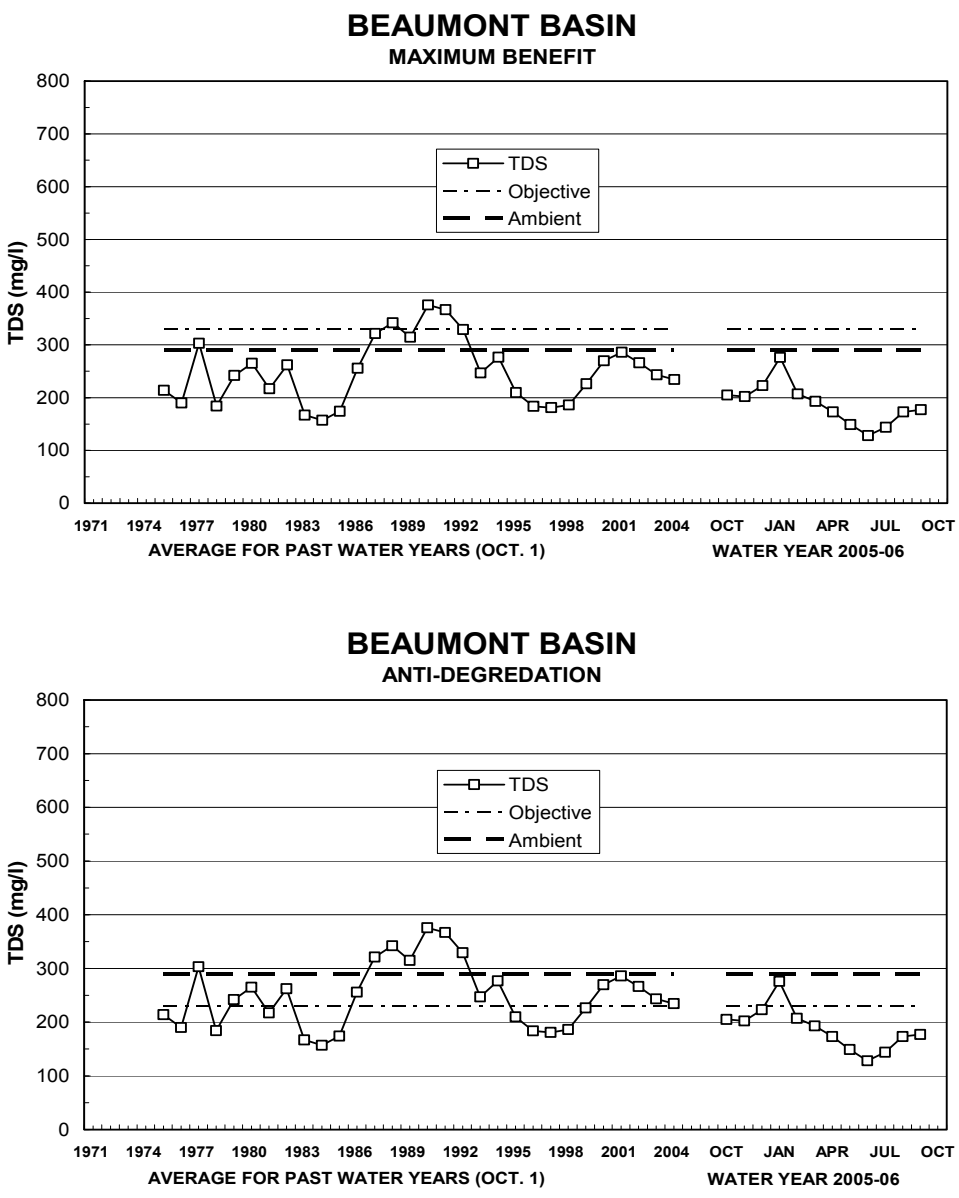
In June 2007, water entities in the Upper SAR watershed (cooperating agencies) and the SARWQCB entered into the Cooperative Agreement to "Protect Water Quality and Encourage the Conjunctive Uses of Imported Water in the Santa Ana River Basins." This Agreement is intended to allow the water entities to monitor and improve water quality within the Santa Ana region in a manner that is consistent with both adopted water quality objectives and the needs of the inhabitants of the region for a reliable supply of water. Specifically, the Agreement addresses the use of imported water for groundwater recharge and compliance with Basin Plan Salinity Objectives for individual groundwater management zones.

Implementation of the Agreement could prevent the groundwater recharge of SWP water in some groundwater basins when TDS of imported water is too high. The purpose of this section is to evaluate the potential impact of this draft Agreement on cooperating agencies' ability to beneficially use SWP water for groundwater recharge. The analysis below qualitatively estimates potential impacts. Actual conjunctive use operations and potential impact of the Agreement will be based on annual monitoring and preparation of the Triennial Water Quality Report as required by the Agreement.

Potential Impact

To estimate the potential impact of the Agreement on use of SWP for recharge, TDS and nitrate of SWP water is compared with the TDS and nitrate of the groundwater management zones. Figures 4-13 through 4-16 compare Basin Plan Salinity Objectives to SWP annual TDS levels. For this analysis, it is assumed that SWP water can be utilized for recharging groundwater basins when the level of TDS or nitrate nitrogen of SWP water is equal to or less than the ambient level of a specific groundwater management zone. In other words, this analysis enables us to understand when and to what extent SWP water can be used for groundwater recharge without treatment in any of the six groundwater management zones with the limited available data.

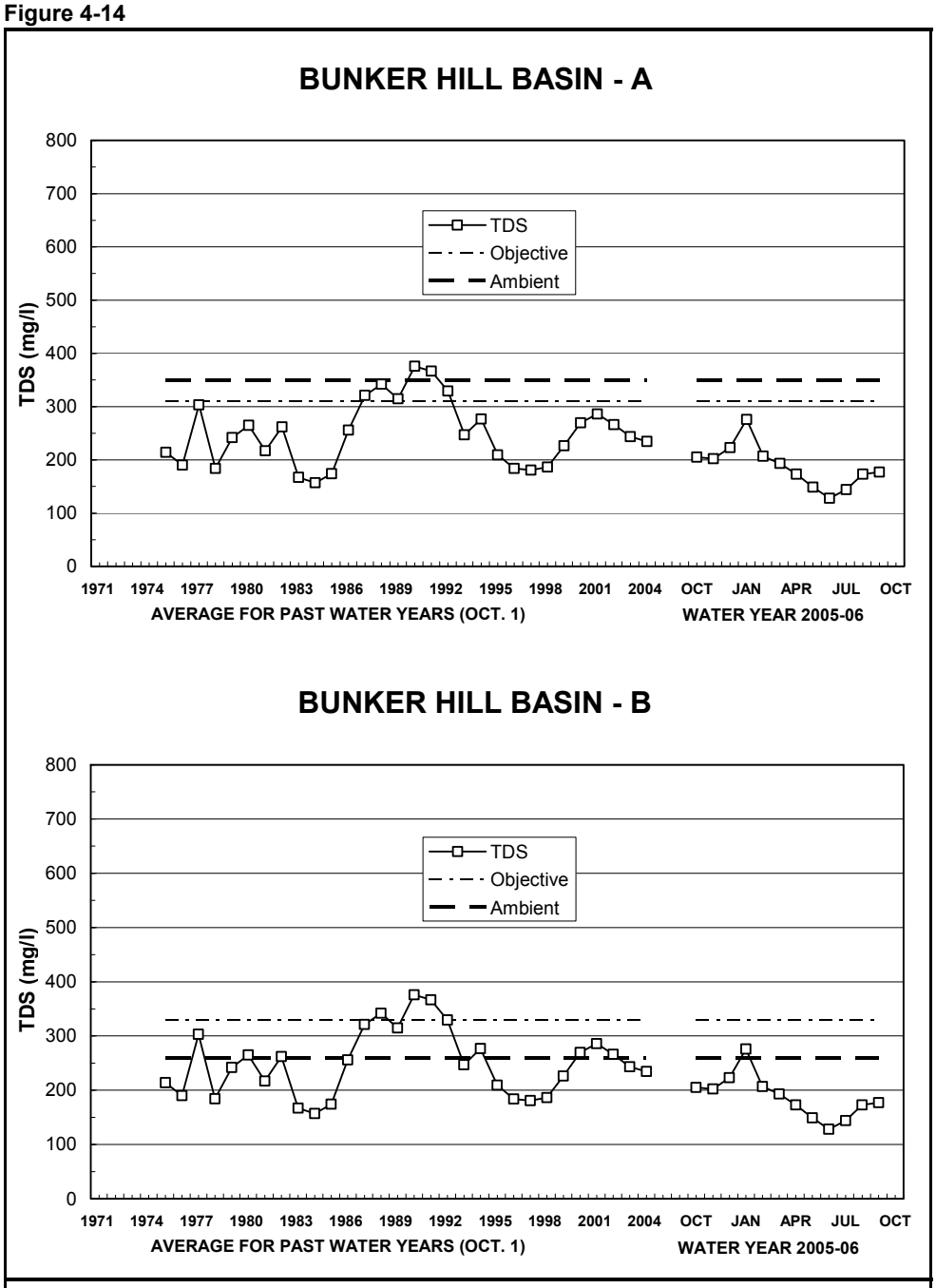
Figure 4-13



HISTORICAL TDS FOR EAST BRANCH AT SILVERWOOD LAKE AND BASIN OBJECTIVES

GEI / B-E AUGUST 2007

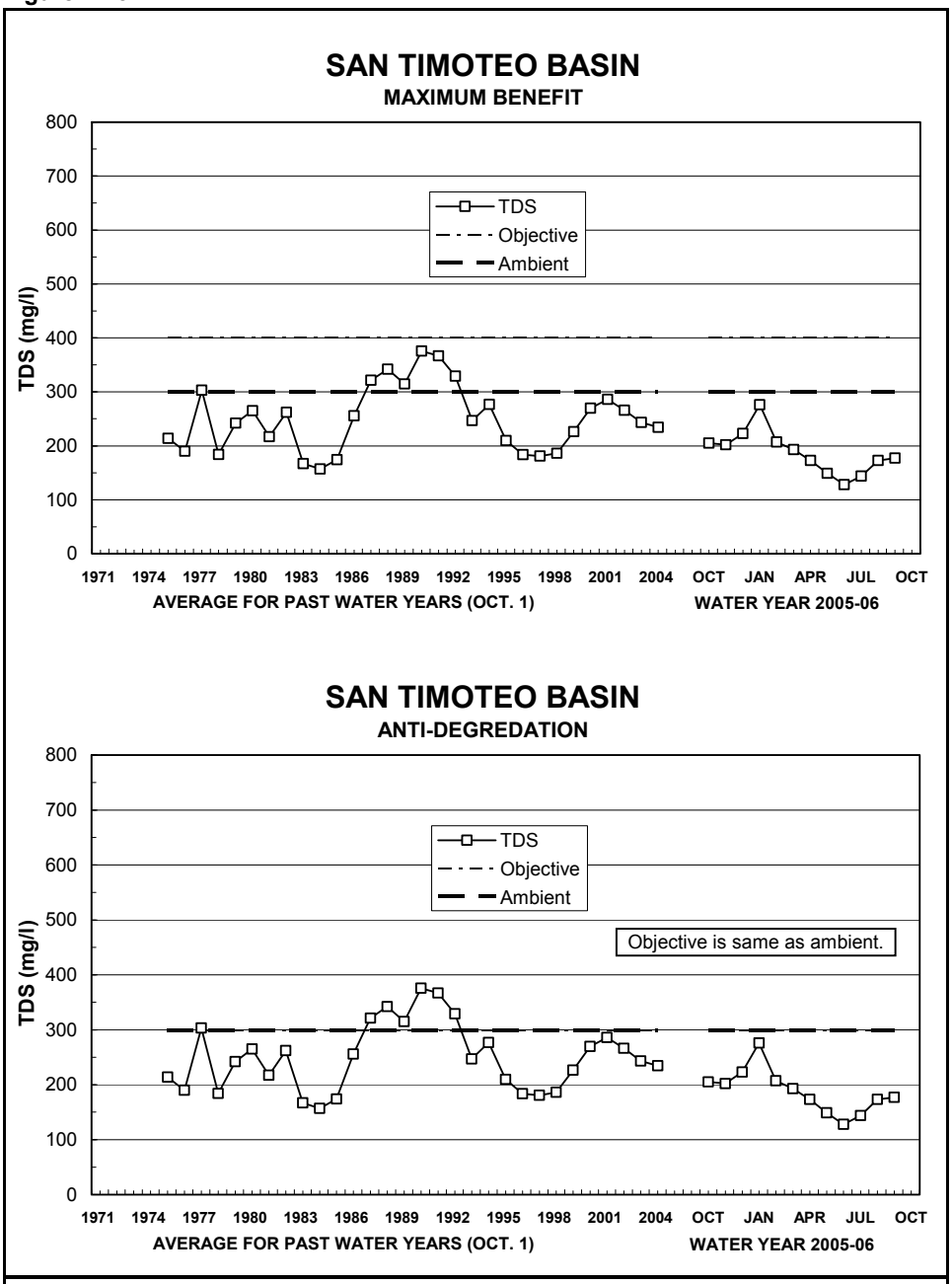
Figure 4-14



HISTORICAL TDS FOR EAST BRANCH AT SILVERWOOD LAKE AND BASIN OBJECTIVES

GEI / B-E AUGUST 2007

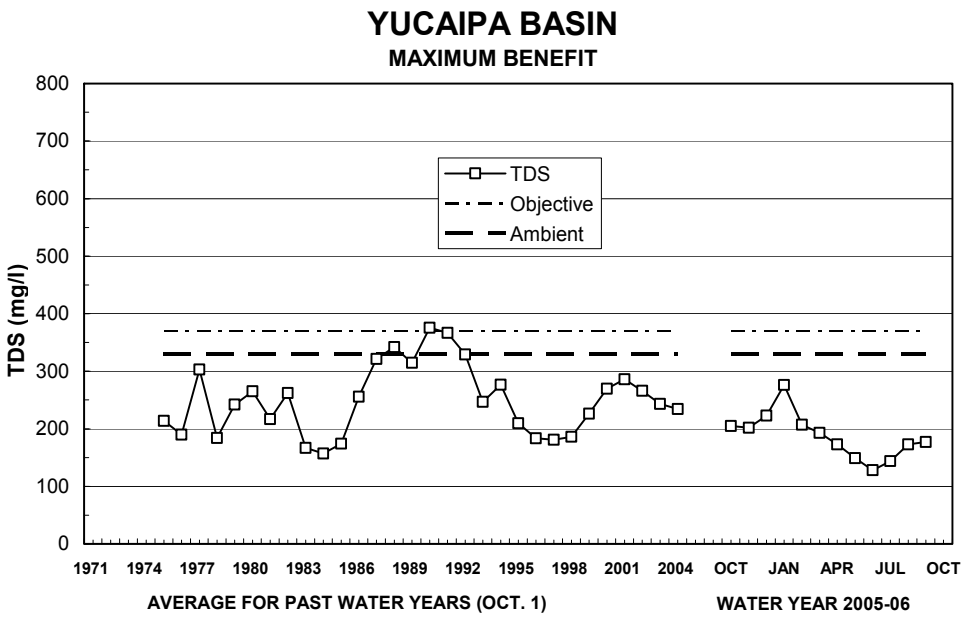
Figure 4-15

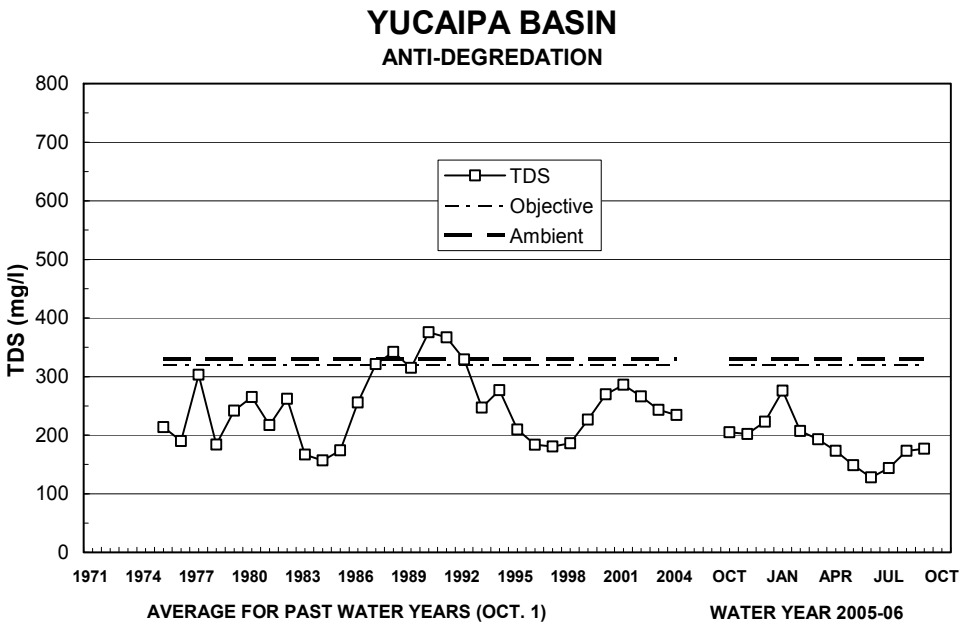


HISTORICAL TDS FOR EAST BRANCH AT SILVERWOOD LAKE AND BASIN OBJECTIVES

GEI / B-E AUGUST 2007

Figure 4-16





HISTORICAL TDS FOR EAST BRANCH AT SILVERWOOD LAKE AND BASIN OBJECTIVES

GEI / B-E AUGUST 2007

The Basin Plan delineates six groundwater management zones in the San Bernardino Valley and Yucaipa/Beaumont Plains: Bunker Hill – A, Bunker Hill – B, Lytle, San Timoteo, Yucaipa, and Beaumont. For each groundwater management zone, TDS and nitrogen nitrate Water Quality Objectives, ambient water quality, and estimated assimilative capacities are defined. [Basin Plan (Tables 5-3 and 5-4)].

Untreated SWP East Branch water quality data (TDS and nitrogen nitrate) are available from 1975 through 2005. The data are collected by Metropolitan at the Devil Canyon Afterbay Turnout. Ambient TDS and nitrogen nitrate data are available for the six groundwater management zones.

A review of historic yearly and monthly SWP water quality information indicates that the level of nitrogen-nitrate found in SWP water does not limit or otherwise control the ability to use SWP water to recharge any of the six groundwater management zones since the highest recorded nitrogen level found in SWP water is less than the lowest ambient level found in all six groundwater management zones. The Beaumont Groundwater Management Zone has the *lowest* measured ambient nitrogen nitrate level at 2.6 mg/L. This is substantially higher than the highest recorded nitrogen nitrate level of 0.7mg/L measured in SWP water.

Although nitrogen nitrate is not expected to impact the ability to use SWP water, the level of TDS in SWP water could limit the use of the water for groundwater recharge.

Figures 4-13 through 4-16 compare yearly SWP water TDS levels (for the period 1975 through October 2006) with 2004 ambient basin conditions. The analysis of yearly data reveals that during some dry-year and multiple dry-year periods, all basins, to varying degrees, would exceed the TDS limits set by the RWQCB. Likewise, the analysis of monthly data reveals that all basins, to varying degrees, could exceed the TDS limits during summer and fall months. The two basins that could exceed the limits the most are the Bunker Hill Basin – B and Lytle Basin. Bunker Hill Basin - A would exceed the TDS limits only in limited conditions such as a period similar to 1990 to 1992.

4.2.1.3.7 Findings and Recommendations

Findings

Review of Figures 4-13 through 4-16 indicates the following:

- The basins exceed the TDS limits during dry, or drought, periods. During the 1975 to 2004 period, SWP water TDS exceeded the ambient TDS in 1977 and during the 1987 to 1992 drought period or about 23 percent of the study period. These are the dry years when SWP

deliveries typically are substantially cut. Computer modeling indicates that the SWP can deliver only four percent of its Table A amount in a drought year such as 1977. In a drought period such as 1987 to 1992, the SWP reliability is about 46 percent. Assuming that the limited amount of SWP water available during drought periods could be used by direct delivery, there may be little impact to groundwater recharge operations.

- During the late summer and fall months of some years, TDS of the SWP water may exceed the TDS limits.

Recommendations

1. Since, historically, the TDS of SWP water rarely exceeds the TDS limits, the region may want to consider suggesting that the RWQCB allow the region to maintain a "salt account" for the basins. When the TDS of SWP water is lower than the limit, a credit would be given. When the TDS of SWP water is higher than the limit, a debit would be taken. As long as the balance of the account is greater than, or equal to, zero, no mitigation would be required. If the account were to fall below zero, the region would have to implement some sort of mitigation measures to get the account back to a positive balance.

2. The SWP contractors in the region could attempt to use the SWP water for recharge in the winter, spring, and early summer months when the TDS is its lowest and try to maximize direct deliveries in late summer and fall when TDS is the highest.

The above recommendation strategies will considerably limit the impacts of implementation of the cooperative agreement on conjunctive use and groundwater recharge in the region. The above strategies will be implemented and their effectiveness will be examined periodically. There may be times in the future that SWP supplies must be used for groundwater recharge with the likelihood of significant degradation from TDS, and there may also be impacts to wastewater treatment plants. In such cases, other strategies such as desalting plants should be evaluated.

4.2.1.3.8 Facilities Needed for Dewatering the Pressure Zone

This evaluation was conducted to determine if additional pumping and conveyance facilities are needed to dewater the SBBA Pressure Zone in extreme wet years to avoid risk of liquefaction in the area. Liquefaction typically occurs in recent (Holocene to late Pleistocene) deposits of silt, sand, and gravel. Most liquefaction occurs where the depth to groundwater is less than 50 feet; this depth is traditionally considered adequate for most investigations of liquefaction potential (Martin and Lew 1999). For purposes of this investigation, areas with

depth to groundwater of less than 50 feet in the Pressure Zone were evaluated. Groundwater model runs were conducted for this evaluation.

Areas where depth to groundwater was less than or equal to 50 feet below the land surface were delineated using the groundwater model results from Baseline Run 1. Annual potential liquefaction area as a percentage of the Pressure Zone area ranges from zero in a dry year (hydrologic year 1992) to 6.0 percent in a wet year (hydrologic year 1986), with an annual average of 2.3 percent. The area with potential for liquefaction in a wet year such as 1986 (year with the greatest potential liquefaction area) was mapped. This area is located in the eastern portion of the Pressure Zone near the Santa Ana River and City Creek areas, and is away from the City of San Bernardino. Therefore, potential liquefaction, even in the extreme wet years, is considered minimal.

During the model simulation period from 2006 through 2044, groundwater pumping from the Pressure Zone area was assumed to be 117,434 acre-feet in year 2010 to 149,717 acre-feet in 2044, with an annual average of 133,959 acre-feet per year. The greatest historical pumping from the Pressure Zone was 141,892 acre-feet in year 2000. A review of existing operational production wells and apparatus in the Pressure Zone indicates that the sum of the instantaneous pumping rate in the Pressure Zone is 180,526 gallons per minute (gpm). Assuming these wells can pump 70 percent of their instantaneous pumping rates, they would yield 184,000 acre-feet per year. This amount is significantly higher than the historic pumping and the pumping assumed for Baseline Run 1. Therefore, it can be concluded that there are enough existing wells and apparatus in the Pressure Zone to control the water levels given the conditions assumed for Baseline Run 1.

4.2.1.4 Surface Water Management Strategies and Projects

Improving surface water management will significantly contribute to the sustainability of water resources in the region. Management of surface water resources includes strategies such as use of SAR conservation water, use of water from the local streams, and flood and stormwater management. Integration of flood and stormwater management strategies with recharge and conjunctive use opportunities contributes to surface water and groundwater management as well as water supply reliability in the region as discussed below.

4.2.1.4.1 Local Surface Water Management

This strategy outlines the use of local surface water from the SAR and tributaries such as Mill Creek. Completion of the Seven Oaks Dam on the SAR provided the opportunity for Valley District and Western to jointly file two applications with the SWRCB to appropriate water from the SAR. The applications seek the right to divert up to 200,000 acre-feet per year of local water to help improve the water supply reliability of the region. In support of water right applications and associated facilities, Valley District and Western have prepared and completed an environmental documentation for the project. Seven Oaks Dam is a flood control structure with limited carryover storage. Because the SAR hydrology is highly variable, the available water will vary in any year from zero to 200,000 acre-feet. Therefore, efficient use of SAR water will require conjunctive management and groundwater banking in the region. Other possible uses of the SAR water include direct delivery and exchange with outside agencies. The use of seasonal storage at the Seven Oaks Dam will not affect flood protection provided by the facilities to downstream communities.

Valley District, Western, and City of Riverside financed the costs of feasibility studies, design, and construction of improvements to the Seven Oaks Dam to allow conservation storage. Implementation of conservation storage projects, which include modification of the intake structure and relocation of the access road, would require compliance with the National Environmental Policy Act in order to evaluate any potential impact of proposed conservation pool on the USFS lands.

To implement this strategy, existing facilities would be used, to the extent possible, to divert and convey newly appropriated water from the SAR. However, additional facilities are needed to connect existing facilities to diversion facilities and recharge areas so that supplemental water supplies can efficiently be used in the region. New project-related facilities will be constructed in four construction areas, as described below.

The SAR. Water diverted from the SAR should be conveyed to areas of use. Additional facilities will be needed to connect diversion points to the existing

facilities. Most of the water diverted from the SAR would be conveyed through the proposed Plunge Pool Pipeline, Low Flow Connector Pipeline, or the Morton Canyon Connector II Pipeline. The Plunge Pool Pipeline will connect the SAR to Valley District's Foothill Pipeline and then to the Metropolitan's Inland Feeder Pipeline in the next phases of the project.

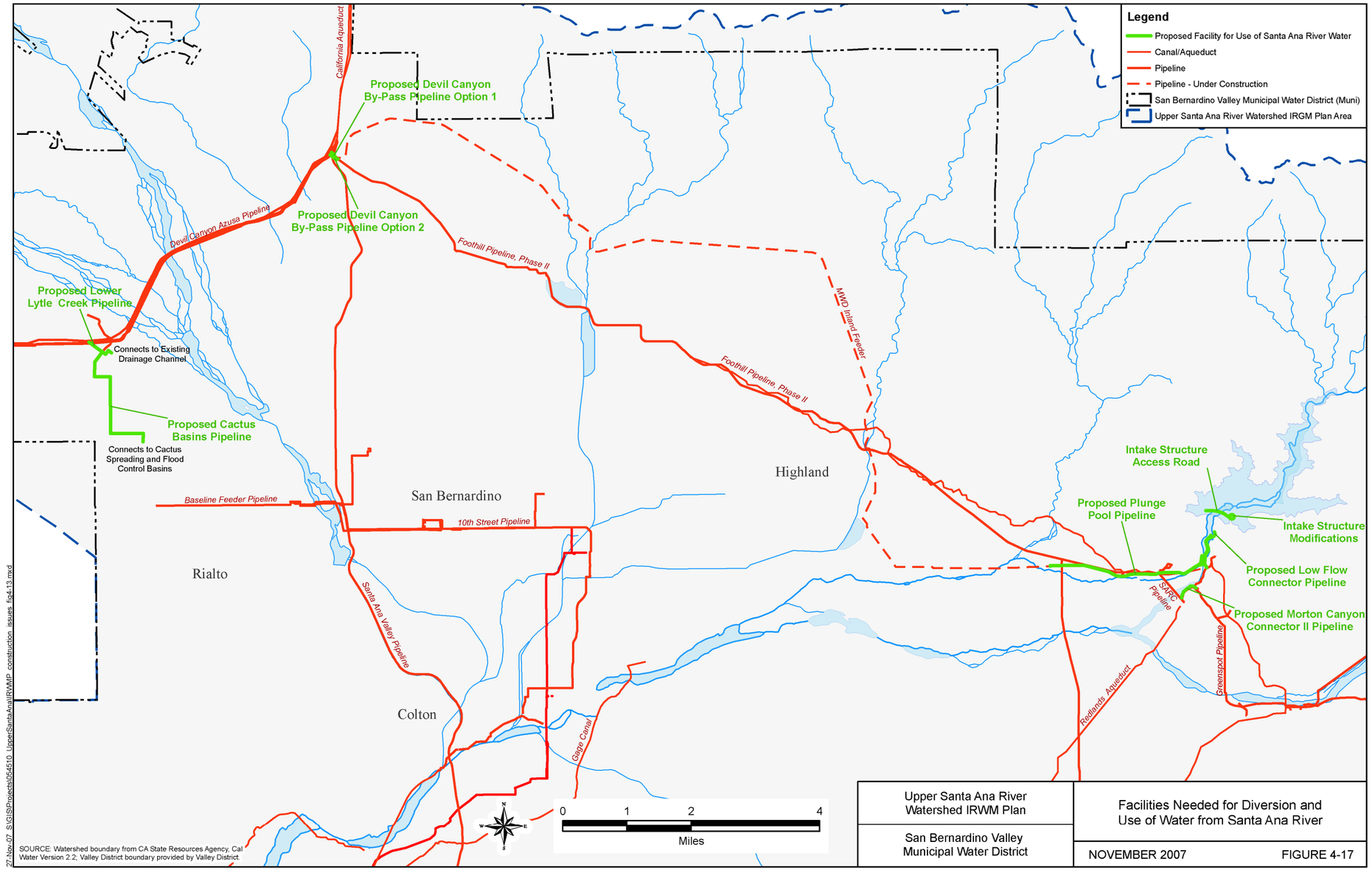
The Devil Canyon. The SAR water conveyed by Valley District's Foothill Pipeline will enter the Devil Canyon Bypass Pipeline. This pipeline will connect to both the Lytle Pipeline and the California Aqueduct.

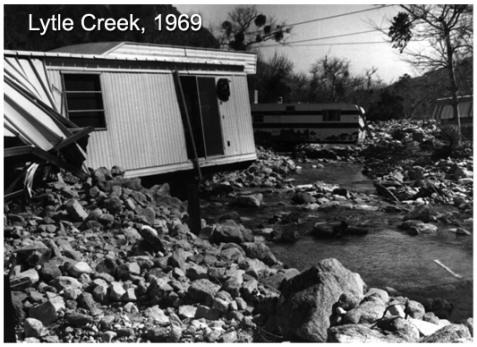
The Lytle Creek. The SAR water conveyed through the Lytle Pipeline will reach Lytle Creek basins. The water could also be conveyed to West Valley and FWC water treatment facilities, as well as to the Cactus Spreading and Flood Control Basins through the Cactus Basin Pipeline.

The Seven Oaks Dam and Reservoir. The specific facilities in this area include modification of the intake structure of the Seven Oaks Dam and relocation of the access road serving the intake structure. Modification of the intake structure is needed to allow for proper regulation of the flood flows. A Technical Feasibility Study for these facilities is underway. It appears that the above modifications can marginally increase the yield of the SAR. The feasibility study is intended to show the benefit-cost ratio of these facilities.

The facilities listed above will make possible conveyance of water from the Seven Oaks Dam to groundwater spreading grounds and the water treatment facilities in the region. Figure 4-17 shows the location of the construction areas and the proposed facilities for the use of native water in the region. Detailed descriptions of the facilities can be found in Appendix E.

Figure 4-17
Proposed Facilities for the Use of Santa Ana River Water





It is critical to explore strategies to improve flood protection and manage stormwater. (Photos courtesy of the San Bernardino County Museum.)

4.2.1.4.2 Flood and Stormwater Management Strategies

Historically, the SAR Wash was a natural floodplain and alluvial fan that provided a place to convey frequent devastating flood waters and to deposit sediment. The alluvial deposit provided excellent conditions for establishing settling basins for percolating surface water to the groundwater basin, providing a significant source of water supply for the Upper SAR watershed. Substantial new commercial and residential development has occurred in the region and significant additional development is forecasted for the Upper SAR watershed. In anticipation of this development and the potential loss of open space and increase in impervious surfaces such as roads and buildings that accompany such development, it is critical to explore strategies to improve flood protection and manage stormwater. Flood and stormwater management strategies are designed to:

- Reduce peak flood flow in the streams,
- Improve groundwater recharge within the channel,
- Provide additional recharge through improvement of the detention basins, and
- Increase channel capacities of stormwater management facilities to safely convey stormwater.

The stormwater strategies can reduce flood damage, increase groundwater recharge and water supply, and improve water quality of the streams by reducing discharge of debris, sediment, and urban pollutants to the streams. The San Bernardino County Flood Control District (SBCFCD) operates and maintains a system of channels and detention basins to manage stormwater throughout the region. SBCFCD's objective is to provide 100-year flood protection for the communities in the region. Significant improvements to the regional facilities are needed to ensure the flood control system can provide 100-year protection today and in the future as additional development occurs in the area.

Two types of strategies have been formulated to address the flood and stormwater management issues of the Upper SAR watershed.

Strategies to Reduce Flood Flows in the SAR and Tributaries

Construction of the Seven Oaks Dam contributes significantly to management and control of flood flows in the SAR. Additional facilities are planned for

diversion and conveyance of the flows to spreading grounds. Construction of these facilities and improvement of the spreading grounds to accept additional flood flows are considered the next step for reducing flood flows downstream. The facilities required to implement this strategy are described in Section 4.2.1.5.1.

Strategies for Management of Stormwater

Stormwater management strategies consist of programs to improve and expand the detention basins and improve the flood control channels.

SBCFCD plans and designs the improvements needed for flood detention facilities. These improvements include excavation and removal of the sediment from the existing basins, expansion of the existing basins, and design and construction of new retention basins. The objective is to increase the holding capacity of the basins in order to increase recharge and reduce peak flood flows downstream. Projects to achieve this objective include Randall Basin Project; Cactus Basins 3, 4, and 5; and Cable Creek Debris Basin.

SBCFCD plans to improve flood control channels to increase channel capacity, increase opportunities for recharge, and maintain the integrity of the system. These improvements include channel enlargement, channel works, and channel lining. Projects formulated under this strategy include Sand/Warm Confluence and Upper Warm Channel. Other channel improvement projects are planned in the Upper SAR watershed area, but they do not have the multiple benefits expected from the Sand/Warm Confluence and Upper Warm Creek project since they would be concrete-lined conveyance systems.

SBCFCD is also developing plans to certify and potentially improve flood control levees in order to maintain the integrity of the system. These improvements include hard lining, rebuilding, lengthening, and repairing levee facilities. Projects are currently being formulated in conjunction with the Federal Emergency Management Agency (FEMA) certification effort.

A detailed description of the stormwater management projects is presented in Appendix E.

State Water Project water is treated and distributed to some urban areas in the Upper Santa Ana Region.

4.2.1.5 Imported Supplies

Imported supplies to the region include the SWP supply. Imported water is delivered directly or through Metropolitan. Western receives SWP supplies through Metropolitan. San Gorgonio Pass Water Agency (SGPWA) has a "Table A" allotment of 17,300 acre-feet, and Valley District has a SWP "Table A" allotment of 102,600 acre-feet per year. Reliability of the SWP supplies varies considerably from about 5 percent to 100 percent depending on the water-year type. To evaluate the SWP water supply reliability, the SWP Delivery Reliability Report (Public Review Draft, November 15, 2005) was reviewed. The report presents the results of five operational studies that simulate the SWP operations under 2003 and 2025 water demand scenarios. For the purpose of this water supply reliability discussion, the updated study with 2025 level of demand is used (Study 5). These studies were conducted specifically to document the SWP delivery reliability. SWP water supply available to Valley District for direct delivery and recharge for each year was calculated based on reliability values presented in Study 5. On average, SWP water supply reliability is presented as 77 percent of the Table A allotment to as low as 4 percent. However, SWP delivery may vary from full Table A allotment. For example, the Valley District Table A delivery capability may vary from 102,600 acre-feet in wet years to 5,100 acre-feet in dry years, such as 1997.

As mentioned earlier, to improve water supply reliability, Valley District is planning for conjunctive management of groundwater as well as banking of SWP supplies when available. Strategies for the use of Valley District's SWP supplies include direct delivery of SWP water to water treatment facilities and use of water for groundwater recharge.

A key to improving long-term water supply reliability is for all SWP contractors in the region to fully utilize their SWP supplies when available and store or bank to build reserves for drought periods. Facilities required for the use of SWP water include additional conveyance to water treatment facilities in the region.

As a component of the water supply reliability study, Valley District is also conducting sensitivity analyses for SWP and local surface water supply reliability. The analyses include:

- SWP reliability of 60 percent and 50 percent of Table A allotment (instead of 77 percent).
- SAR flows of 90 percent of long-term average flows.

Modeling studies were conducted to document the potential impacts of reduced SWP and local supply reliability on groundwater levels. The purpose of the sensitivity analyses was to provide general information to water managers as to the potential impacts of hydrologic (climate change) and operational changes in water supply facilities on the region's water supply reliability.

Major regional conveyance facilities connect purveyors' water supply systems.

4.2.1.5.1 Conveyance, Storage, and Emergency Interties

Conveyance, storage, and interties are essential elements of water supply reliability. Conveyance strategies are needed to convey the water supply to the place of use. Storage feasibilities provide operational flexibility for daily and seasonal operation of the water system. Interties are essential to providing for system redundancy and emergency operations. The elements of conveyance, storage, and intertie strategies include the following:

- **Regional conveyance facilities** are major pipelines, pump stations and turnouts, and associated facilities critical to water supply reliability of water purveyors in the region. A number of additional conveyance facilities are planned for the region, including Central Feeder Pipeline Phase 2, City Creek Crossing, Riverside Corona Feeder, associated pumping stations, and Waterman Pump Station.
- **Interties** are planned to improve supply reliability through integration of water supply and distribution systems and to have conveyance redundancy for water supply during major catastrophic failure of a conveyance system. Planned interties include Raub Emergency Supply Intertie and Waterman-Gage Intertie.

Storage reservoirs regulate water production and distribution while providing emergency storage for the communities.

Storage facilities are planned for seasonal and operational storage and system flexibility and to provide water during emergencies and major disasters. Planned storage projects include:

- San Bernardino Reservoir
- Citrus Reservoir (Mentone Reservoir)
- Sunrise Ranch Emergency Reservoir
- Zanja Emergency Storage
- Redlands Reservoir

4.2.1.6 Performance Evaluation of Water Supply Reliability Strategies

This section evaluates the performance of the water supply reliability strategies (when implemented) in improving the region's water supply reliability. In evaluating performance of the water supply reliability strategies, criteria established for development of the UWMP have been considered. These criteria, listed below, are intended to be used to examine the performance of water supply reliability strategies and to ensure water supply needs of the region are met:.

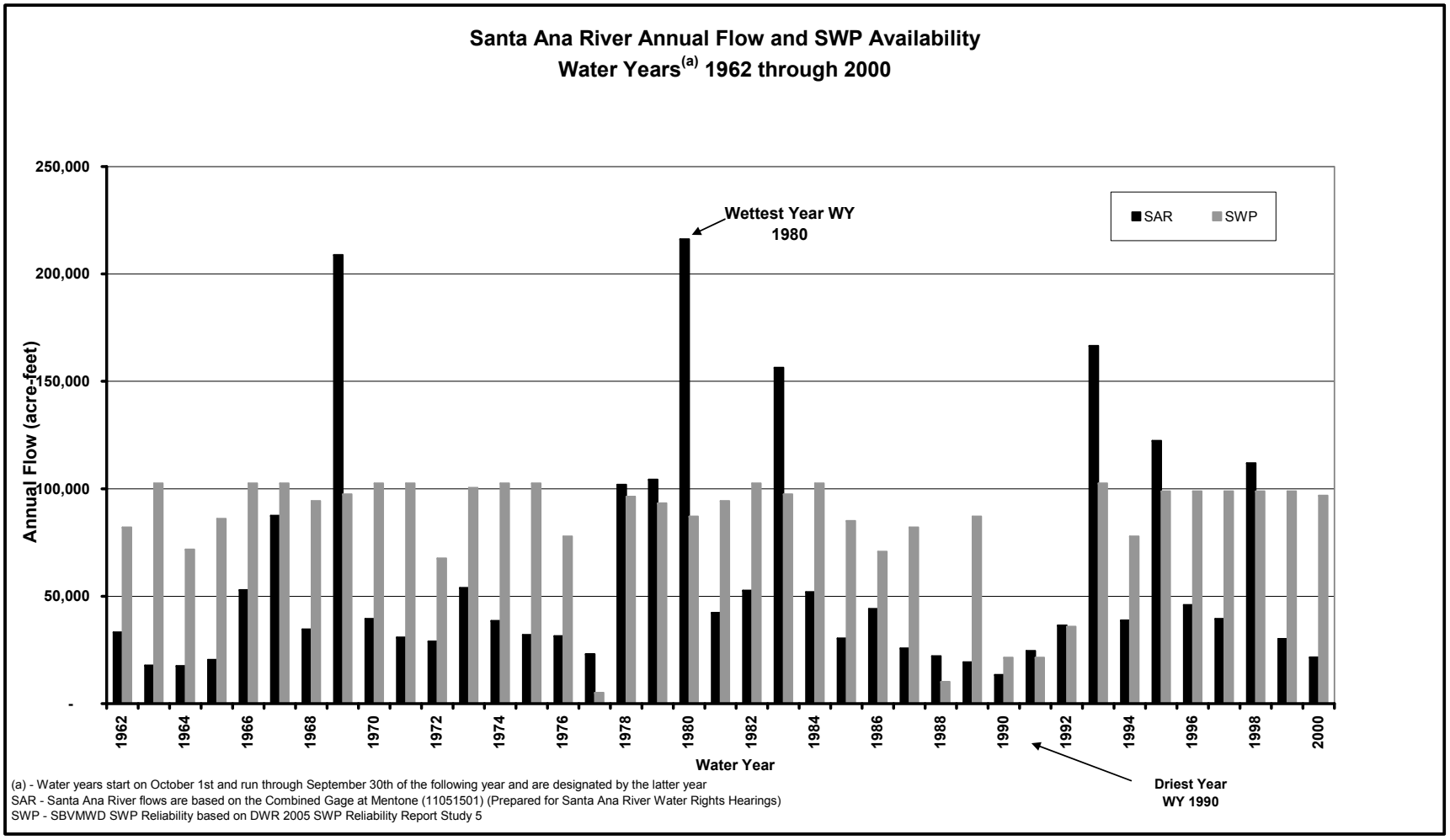
- Meeting average water year for the next 25 years,
- Meeting water needs during a single-year drought,
- Meeting water needs during a multi-year drought,
- Water shortage (up to 50 percent loss) contingency plan, and
- Catastrophic interruption in water supplies.

In addition to the above criteria, meeting peak demand water needs of the local purveyors within the Valley District service area may also be evaluated. Valley District initiated a study to review and evaluate how the above requirements can be met within the region. Below is a summary discussion to demonstrate how the region will meet its water needs as characterized above during the next 25 yearss.

As stated earlier, SAR flows are highly variable. Figure 4-18 shows the annual flows of the river from 1962 through 2000 and its range from over 200,000 acre-feet per year in 1980 to less than 15,000 acre-feet per year in 1992. The Seven Oaks Dam is operated as a flood control facility. Therefore, timely capture and use of SAR flows for recharge of the groundwater basin would provide significant water supply reliability benefits.

Chapter 3 presents the water budget for the region through 2030. The water budget assumed that SAR and SWP water will be used conjunctively with existing supplies used by the purveyors. Modeling studies were conducted for the water budget (base scenario) to examine how the water demand can be met using the SBBA as a reservoir to store, bank, and regulate the water resources of the region. The results of the modeling indicate the following:

Figure 4-18
Santa Ana River Annual Flow and SWP Availability



Note: Graph prepared for Valley District/Western Water Rights Applications Hearings

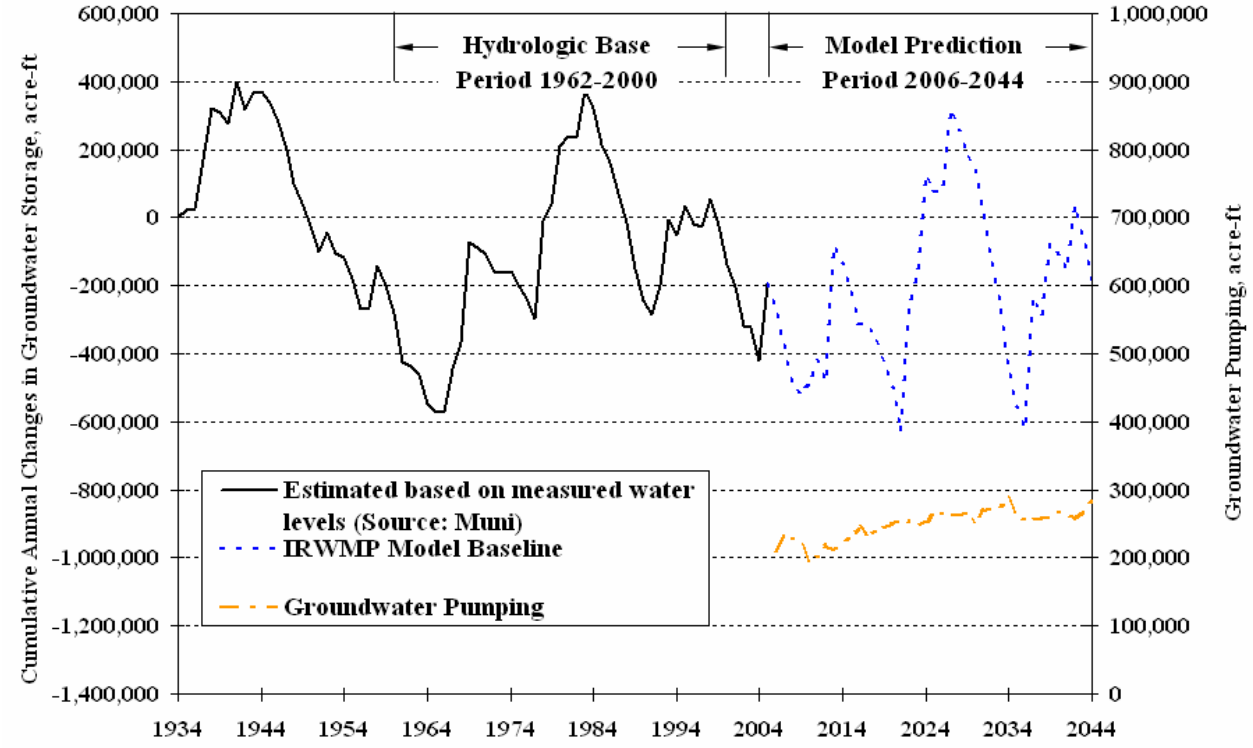
- **Average Year**: Modeling studies assumed that the SAR conservation water will be available to the region (Water Right Applications will be approved by the SWRCB), and SWP water supply reliability is as defined by DWR studies. Under the baseline conjunctive use operation scenario and water demand through 2030, the groundwater storage at the beginning and end of the 39-year study period was 200,000 acre-feet below the full basin (for this discussion, full basin is defined as storage at the 1993 level). This means on average the existing water supply is adequate to meet the demand in the region during the next 20 years, assuming published SWP reliability of 77 percent and that there will not be any long-term depletion of storage in the SBBA. This study was conducted for the Valley District service area and does not include the SGPWA service area, which will have a shortage in 2030.

- **Multi-Year Drought Period**: The modeling studies mimic the 1962 to 2000 period. The period of 1987 to 1992 is the driest recorded period for the SAR. During this period, maximum draw down of the SBBA occurred at approximately 600,000 acre-feet (see Figure 4-19). However, the storage in the basin recovered after the drought period (by 2000). The storage reduction during the multi-year drought period is approximately 10 percent of total groundwater storage.

- **Single-Year Drought**: The driest year of the period was 1992, which coincides with the last year of the multi-year drought period. The cumulative storage change in 1992 was about 600,000 acre-feet. Considering that SBBA storage is over 5 million acre-feet and the water levels recovered by the year 2000, the region can meet its water demand during the single-year drought as well as the multi-year drought period.

It should be mentioned that the modeling studies assumed that the newly conserved SAR water will be available for use and banking in the region (water rights applications are approved by the SWRCB). In order to take advantage of new SAR water, the facilities listed in Section 4.2.1.4.1 should be prioritized and implemented based on cost-effectiveness. This plan also assumes the current water quality problems at Seven Oaks Dam will be resolved by United States Army Corps of Engineers (USACE).

Figure 4-19
Cumulative Annual Changes in Groundwater Storage for Baseline Conjunctive Use Scenario



4.2.1.6.1 Water Shortage Contingency Plan

The water shortage contingency plan provides a framework for implementing specific measures to deal with water shortages during emergencies. A water shortage contingency plan has been drafted for the region and should be adopted and implemented during severe water shortages. The plan provides specific actions that should be taken to ensure critical water needs of the region are met during a period in which water supplies are cut by 50 percent. A copy of the plan is presented in Appendix F.

4.2.1.6.2 Meeting Daily Peak Demands of Water Purveyors

This section examines the Valley District's ability to deliver water to meet the purveyors' service area peak day demand on SWP supplies. The purpose of this evaluation is to determine the adequacy of the conveyance capacity of Valley District's facilities to make direct deliveries of SWP water during peak demand, today and in the future.

Valley District direct deliveries are to surface water treatment plants that were generally built to treat local surface water and for artificial recharge. The District deliveries are required when local surface water supplies are insufficient.

The peak day water demands for the following purveyors are examined by review of their UWMP:

- City of San Bernardino
- City of Redlands
- City of Rialto
- East Valley Water District
- West Valley Water District
- Yucaipa Valley Water District
- Fontana Water Company

Purveyors may have multiple sources of water to meet their peak demands. Groundwater supplies are generally used by the purveyors in the region to augment other sources of water. After discussion with agencies' staff and review of their UWMP data, Table 4-5 was prepared to show the future peak day demand on SWP supplies and the use of Valley District facilities.

In general, it is assumed for this analysis that there are no local surface water supplies available to meet peak demands. This is a conservative but reasonable assumption, since in some dry years local surface water may be severely limited on summer days; therefore, it is reasonable to examine peak day demands on the facilities when local surface water is not available. It is also assumed that SGPWA is obtaining its full Table A amount. Based on this cursory examination, all turnouts have adequate capacity for delivery of peak day demand on SWP water. The following Valley District's Pipelines, and pumping plants may be undersized for the future peak demands; however, the proposed East Branch Extension Phase II would alleviate all of these undersized facilities. It would provide parallel conveyance to the SARC Pipeline, Greenspot Pump Station, and Morton Canyon Connector I. It includes an annex to the Crafton Hills Pump Station that would contain three new 25 cfs pumps.

- If it is assumed that all Purveyors peak day demands coincide, the SARC Pipeline has a total future peak day demand of 144 cfs. Delivery to spreading grounds for the City of San Bernardino is 15 cfs, which can be

interrupted and rescheduled for when peak day demands on the pipeline do not exceed its capacity. SARC has a capacity of 72 cfs

- The Greenspot Pump Station has a future peak day demand of 100 cfs under these assumptions. It has a current capacity of 80 cfs.
- The Morton Canyon Connector has a future peak day demand of 100 cfs under these assumptions. It has a current capacity of 70 cfs.
- The Greenspot Pipeline has a future peak day demand of 100 cfs under these assumptions. It has a current capacity of 70 cfs.
- The Crafton Hills Pump Station has a future peak day demand of 77 cfs. It has a current capacity of 135 cfs.

A more detailed discussion of meeting peak day water demands of the purveyors is presented in Appendix F.

Table 4-5
Future Peak Day SWP Demand for SBVMWD

		Peak Day SWP Demand(cubic-feet per second)												
		SWP East Branch Extension												
Delivery Point (Turnout)	**Turnout Capacity**	**Foothill Pipeline**	**SARC Pipeline**	**Greenspot Pump Station**	**Morton Canyon Connector**	**Greenspot Pipeline**	**Crafton Hills PS**	**Crafton Hills Reservoir**	**EBX Reach 1 Pipeline**	**EBX Reach 2 Pipeline**	**EBX Reach 3 Pipeline**	**Tate Pump Station**	**Yucaipa Pipeline**	**Devil Canyon - Azusa Pipeline**
City of San Bernardino (Sweetwater (16 in) and Waterman (30 in) Spreading Ground Turnouts)	35 cfs and 135 cfs, respectively	15.0												
East Valley WTP (Northfork Turnout (two 12in), City Creek (20in) Turnout (alternate))	16 cfs and 65 cfs, respectively	12.4	12.4											
Bear Valley - Northfork Irrigation (Northfork Turnout	16 cfs	4.0	4.0											
Mentone Reservoir (SARC – Bear Valley Sandbox Turnout)		6.0	6.0											
City of Redlands - Hinckley WTP (SARC – Bear Valley Sandbox (two parallel 30 in) Turnout)	40 cfs	21.7	21.7											
Bear Valley Highline (Bear Valley Highline Connector and/or Bear Valley Highline – Bouillioun Box Turnout)	20 cfs	4.0	4.0	4.0	4.0	4.0								
Greenspot Grove (Bear Valley #1 Turnout, _ cfs)	6 cfs	1.5	1.5	1.5	1.5	1.5								
Crafton Water Company (Crafton - Unger Turnout) (20 in)	25 cfs	6.0	6.0	6.0	6.0									
City of Redlands - Tate WTP (Tate Treatment Plant Turnout) (24 in) Tate Pump Station	32 cfs	27.9	27.9	27.9	27.9							27.9		
Yucaipa Regional Park (Yucaipa Regional Park Turnout) (8 in)	6 cfs	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5					
Yucaipa Non-potable system, untreated SWP (Yucaipa Valley Water District #1	60	25.6	25.6	25.6	25.6	25.6	25.6	25.6	25.6	25.6				
Yucaipa WTP (Yucaipa Valley Water District #1 Turnout)		18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6				
San Gorgonio Pass Water Agency - Current		16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0			
San Gorgonio Pass Water Agency - Future		16.0					16.0	16.0	16.0	16.0	16.0			
West Valley Water District – Oliver P. Roemer WFF (Lytle Creek Turnout)	32 cfs													40.9
West Valley Water District - North Villages WFF (Glen Helen (30 in)	10 cfs													2.6
Fontana Water Company (Lytle Creek Turnout, 14 cfs)	14 cfs													18.7
Facility Peak Day Demand:		175.2	144.2	100.1	100.1	100.1	76.7	76.7	76.7	76.2		27.7	0.0	67.5
Facility Conveyance Capacity		288.0	72	70	70	80	135	104	104	104				110

4.2.1.7 Disaster Preparedness Strategies and Projects

This section addresses vulnerability of the region's water supply system to catastrophic events that may interrupt the water supply system in the Region. While not the only cause for catastrophic water supply interruption, the postulated Magnitude 8+ Earthquake certainly will be the predominant example in the region. Since a large magnitude earthquake is generally considered the most significant event for the region, this section concentrates on earthquake effects as the primary water supply interruption, knowing that other events would be treated similarly. Literature reviewed for this section include post-earthquake surveys of water system damage, earthquake planning reports included in purveyor's UWMPs, and available reports prepared by the State and federal agencies. Other catastrophic interruptions caused by regional power failure, terrorist attack, or other man-made or natural catastrophic event could cause similar conditions and issues to water supply systems in the region. For purposes of this report, a major earthquake is defined as an earthquake on the San Andreas Fault (SAF) on the order of 8.0.

The work conducted for this section is intended to be the fist step and is at the conceptual level. Additional detailed work should be conducted in the future to further evaluate options to effectively address water supply system vulnerabilities. Details on water supply system vulnerability can be found in Appendix F and is summarized below. Appendix F includes a discussion of the following:

- An earthquake literature search of major earthquake events and what has been learned from such events.
- Evaluation of catastrophic interruption of regional facilities.
- Vulnerabilities of the region's water supply system to SWP supply interruption.
- Vulnerably of local purveyors' systems to an earthquake.
- Summary of Findings and Recommendations including a Water Shortage Contingency Plan.
- Water Shortage contingency planning.

4.2.1.7.1 Findings and Recommendations

Findings

The region is located in a seismically active area of Southern California. Four major fault zones are found in the region, including the San Jacinto Fault, the

Chino-Corona segment of the Elsinore Fault, the Cucamonga Fault, and the SAF. Numerous other minor faults associated with these larger fault structures may also present substantial hazards.

In Southern California, the SAF runs along the southern base of the San Bernardino Mountains, crosses through Cajon Pass, and continues northwest along the northern base of the San Gabriel Mountains. Historical records indicate that massive earthquakes have occurred in the central section of the SAF in 1857 and in the northern section in 1906 (the San Francisco Earthquake). In 1857, an estimated magnitude 8+ earthquake occurred on the San Andreas Fault rupturing the ground for 200 to 275 miles, from near Cholame to Cajon Pass and possibly as far south as San Gorgonio Pass. The recurrence interval for a magnitude 8 earthquake along the total length of the fault is estimated to be between 50 and 200 years. It has been 147 years since the 1857 rupture. A study completed by Yuri Fialko (2005) suggests that the SAF in Southern California has been stressed to a level sufficient for an earthquake of magnitude 7.0 or greater.

These findings have been developed from a search of literature reporting the impacts of major earthquakes and limited work by water purveyors. More detailed, site-specific analyses are needed to better quantify and identify impacts from major earthquakes or other catastrophic outages.

- **Reliability of Groundwater Wells.** Review of post-earthquake lifeline performance reports reveals little discussion of groundwater well failure. However, loss of commercial power, damage to electrical equipment and aboveground appurtenances, or damage to the distribution system may effectively put the well out of service. Liquefaction, especially in areas where there is high groundwater levels between depths of 5 to 50 feet, may cause ground settlement and interfere with continued well operation.

  No discussion of the performance of well head treatment systems during earthquakes was found. This may be due to the limited amount of well head treatment in place during prior earthquakes. As well head treatment typically includes purchased equipment installed in a field location, there is significant opportunity for lapses in the seismic design.

  The groundwater basin and the groundwater production wells are a reliable part of the water supply system for the San Bernardino area.

- **Reliability of Pipelines**. Pipelines are generally the most fragile part of a water system. Generally, damage is a function of displacement rather than shaking. Empirical algorithms have been developed to predict seismic reliability of pipelines.

- **Reliability of Pump Stations**. Past earthquakes indicate that the structural and mechanical elements of a pump station are highly resistant to earthquake damage. The most likely failures are to the electrical equipment and loss of commercial power.

- **Reliability of Surface Water Treatment Facilities**. The major elements of a surface water treatment system are typically concrete structures that are very resistant to damage. However, these facilities include a large variety of mechanical equipment, much of it long and lightweight and subject to damage not only from the direct force of an earthquake, but also from the wave action created by the earthquake. Similar to a pump station, power supply and electrical equipment are fragile.

- **Reliability of the State Water Project**. While little specific information was found on anticipated damage to the SWP, the high susceptibility of the Santa Ana Valley Pipeline is recognized. Major vulnerability of the SWP includes the Sacramento-San Joaquin Delta and the California Aqueduct. The SWP does have a Business Resumption Plan and an Emergency Operations Plan.

- **Length of Outages.** Length of water service outages vary by earthquake and by purveyor. The Loma Prieta earthquake affected a large number of separate systems. The San Jose Water Company serves most of San Jose and all of Los Gatos. Los Gatos was hard hit and half of the water customers lost water service. In San Francisco, the worst hit area was the Marina District. Both fires and liquefaction affected the district. East Bay Municipal Water District serves 1.1 million customers and suffered $3.7 million in damage. Damage included a break in a 60-inch raw water line.

  After the Northridge earthquake, the Los Angeles Aqueducts Nos. 1 and 2 were in and out of service for temporary and permanent repairs over several months; these facilities were not critical at that time. Alternate supplies were available and drought conditions limited supply to these aqueducts.

  Valley District's Emergency Operations Plan includes estimates for repair of Valley District facilities. Electrical and pipe repairs are estimated to take 35 to 77 days. Pump repairs are estimated to take 168 to 273 days.

  Table 4-6 shows how interruption in each of the Valley District facilities may impact water deliveries for the local purveyors. Interruption in

Table 4-6
Valley District Facilities Used to Deliver Water to Retail Agencies

Agency	Foothill Pipeline	SARC Pipeline	Morton Canyon Connector	Green-spot Pipeline	Green-spot Pump Station	Devil Canyon - Azusa	Tate Pump Station	Crafton Hills PS	Crafton Hills Reservoir	EBX[1] Reach 1 Pipeline	EBX Reach 2 Pipeline	Yucaipa Pipeline	Baseline Feeder
San Bernardino Municipal Water Department	✓	✓	✓	✓[2]	- -	- -	- -	- -	- -	- -	- -	- -	- -
East Valley Water District	✓	✓	✓	✓[2]	- -	- -	- -	- -	- -	- -	- -	- -	- -
City of Redlands – Hinckley	✓	✓	✓	✓	✓	- -	- -	- -	- -	- -	- -	- -	- -
City of Redlands – Tate	✓	✓	✓	✓	✓	- -	✓	- -	- -	- -	- -	- -	- -
Bear Valley MWC - In lieu obligation and irrigation	✓	✓	✓	✓	✓	- -	- -	- -	- -	- -	- -	- -	- -
Yucaipa Valley Water District	✓	✓	✓	✓	✓	- -	- -	✓	✓	✓	✓	✓	- -
Fontana Water Company	✓	✓	✓	✓[2]	- -	✓	- -	- -	- -	- -	- -	- -	- -
West Valley Water District	✓	✓	✓	✓[2]	- -	✓	- -	- -	- -	- -	- -	- -	✓
City of Rialto	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	✓

Notes:

[1]EBX: East Branch Extension of the California Aqueduct

[2] Required only if Mill Creek water is being delivered in a westerly direction.

Valley District's conveyance system is used to implement the Santa Ana-Mill Creek Cooperative Water Project and effect deliveries of local surface water and exchanges of local surface water and State Project water.

The Devil Canyon - Azusa Pipeline is owned by San Gabriel Valley Municipal Water District. Valley District has conveyance capacity of the pipeline from Devil Canyon to the Lytle Creek area and uses this capacity to convey water to West Valley, Rialto, and Fontana. It could be used to convey local surface water if the SWP were to fail and if the legal issues were resolved.

The Baseline Feeder is used to convey groundwater to Rialto and West Valley. The groundwater is produced by the City of San Bernardino on behalf of Valley District and by Rialto for Rialto.

Valley District deliveries to San Bernardino Municipal Water Department are for recharge. Changes in recharge impact well hydrographs in six to seven months.

Foothill Pipeline, Santa Ana River Connector Pipeline, Morton Canyon Connector, and Greenspot Pipeline affect every purveyor that receives water from Valley District.

4.2.1.7.2 Recommendations for Disaster Preparedness

This section includes recommendations based on the literature review, review of the Valley District facilities, and discussions with District staff and purveyors. Some of the projects already included in the IRWM Plan that would enhance disaster preparedness have also been reviewed in this section.

General Recommendations

- Valley District should consider a Seismic Improvement Program/Water Infrastructure Reliability Project to review the adequacy of Valley District facilities to withstand an earthquake. East Bay Municipal Utilities District and Santa Clara Valley Water District (Santa Clara Valley Water District, 2005) are two agencies that have performed such studies. High priority facilities include Foothill Pipeline, Santa Ana River Connector, Morton Canyon Connector, and Greenspot Pipeline.

- Valley District should consider the opportunities that Big Bear Lake presents as an emergency source of water after an earthquake that interrupts SWP deliveries for many weeks.

- Valley District should consider using the existing MWD agreements to allow the use of Metropolitan Water District facilities to bypass failed Valley District facilities (and the reverse).

- Review the ability to provide drinking water immediately following an earthquake. Arrangements to provide bottled water may be appropriate.

- The USGS Multi-hazards Demonstration Project (MHDP) is leading an effort to create a scenario document for a future M7.8 southern San Andreas Fault earthquake. The document will describe in detail the effects of the earthquake. It will form the basis for a November 2008 statewide earthquake response exercise. This document should be reviewed when it is ready, as useful information for disaster preparedness planning will come out of this effort.

Proposed Projects to Provide Conveyance System Redundancies for the Regional Facilities

Implementation of the following projects (included in the IRWM Plan) may be of particular benefit during major disasters by providing redundancies for the conveyance system.

Project 12 - Central Feeder Pipeline

The Central Feeder System, including projects 12.1 through 12.7, provides the ability to convey Bunker Hill Basin groundwater to purveyors. This project is particularly important because it provides redundancy for the Foothill Pipeline.

Project 36 - West End Pump Station

By conveying Bunker Hill Basin groundwater to the west, provides redundancy to the Baseline Feeder West Extension and the Lytle Creek Pipeline.

Foundation for the Redlands Pump Station which will deliver water into the Central Feeder, Phase 1 Pipeline.

Project 37 - 9th Street Feeder

This project conveys Bunker Hill Basin groundwater as an alternative water supply to East Valley.

Project 39.1 - Mentone Pipeline

Mentone Pipeline may be constructed as the East Branch Extension Phase II to provide additional conveyance capacity to the east—YVWD and SGPWA.

Project 54 - Bunker Hill Regional Water Supply

This project improves the ability to produce groundwater and place that groundwater into regional transmission systems.

Project 57 - Bunker Hill Basin Water Supply Reliability Project

This project improves the ability to convey Bunker Hill Basin groundwater to the west and provides alternative conveyance to the Baseline Feeder and Lytle Creek Pipeline. This project also provides redundancy for Project 54.

Project 60 - Baseline Feeder West Extension

This project provides a method to deliver Bunker Hill Basin Groundwater west beyond West Valley's service area, providing an alternative supply to Fontana Water Company.

4.2.1.7.3 Alternative Local Supplies

This section is intended to initiate a discussion of options that would improve the water supply reliability in case of a catastrophic failure of portions of the Valley District water system.

Interties between Retail Agencies

Table 4-7 lists interconnections between purveyors. These interties could be used to balance supplies between purveyors during an emergency. An interconnection between the City of San Bernardino and East Valley is currently being used to facilitate blending. This use is anticipated to end in the near future. FWC has historically depended on supplies delivered through its interconnection with Cucamonga Valley to meet peak day demand.

Table 4-7
System Interties between Retail Agencies

Agencies	Direction	Capacity (MGD)	Remarks/data source
City of San Bernardino/East Valley	Either	4	Three interties. One currently used to facilitate blending.
City of San Bernardino/Riverside	To San Bernardino	2	(San Bernardino UWMP, Pg 2-10)
City of San Bernardino/West Valley	Either	3	(San Bernardino UWMP, Pg 2-10)
City of San Bernardino/Loma Linda	Either	5	(San Bernardino UWMP, Pg 2-10)
City of San Bernardino/Colton	To Colton	3	(San Bernardino UWMP, Pg 2-10)
City of San Bernardino/Rialto	Either	3.6	(San Bernardino UWMP, Pg 2-10)
City of San Bernardino/ Riverside Highland	To Riverside/ Highland	3	(San Bernardino UWMP, Pg 2-10)
Fontana/Cucamonga Valley	Either	3.6	Fontana UWMP (2500 gpm)
West Valley/Fontana	Either		West Valley UWMP.
West Valley/Rialto	Either		West Valley UWMP.
West Valley/Colton			West Valley UWMP.
Redlands/Loma Linda	To Loma Linda		Greg Gage
Rialto/Marygold	To Marygold		Rialto has historically conveyed 1,500 afy of groundwater to Marygold. The agreement under which this was accomplished is expiring.
Sources: San Bernardino Municipal Water Department 2005 UWMP; Jack Nelson, Yucaipa Valley; Ron Buchenwald, East Valley; Greg Gage, Valley District, West Valley 2005 UWMP. Based on the limited sources of data, this list may be incomplete.			

Big Bear Lake

Big Bear Lake has a capacity of over 70,000 acre-feet, most of which is owned by the Bear Valley Mutual Water Company. An agreement could be written that might make water from the lake available for municipal use in case of a catastrophe.

Increased Groundwater Production Capacity and Reliability

If the catastrophe is an earthquake, the most likely impact on groundwater production capacity will be damage to the electrical system of the well or to the electricity supplier's system.

Thus, providing emergency generators for "key" wells would help improve the area's ability to operate after a catastrophic failure.

4.2.1.7.4 Alternative Conveyance of Surface Water

Alternatives to Foothill Pipeline System

The following systems could provide some alternative conveyance of surface water should portions of the Foothill Pipeline System fail.

A segment of the 78-inch-diameter Central Feeder, Phase 1 pipeline is lowered into place.

- Metropolitan's Inland Feeder can convey water stored in Diamond Valley north to the SBVMWD service area. The conveyance capacity of the Inland Feeder operating from Diamond Valley Lake to the north is reported to be 250 cfs.
- Once completed, the tunnel portion of the Inland Feeder, with proper interties, will be able to convey SWP water from Devil Canyon Afterbay into the Foothill Pipeline.
- The Central Feeder, portions of which are under construction, would increase the ability to convey groundwater between agencies following a catastrophe. Connecting the Central Feeder to the Santa Ana Valley Pipeline and to the Crafton Hills Pump Station would provide redundancy for the Foothill Pipeline.
- The proposed East Branch Extension Phase II will convey SWP water from the eastern portion of the Foothill Pipeline to Crafton Hills Pump Station. This will provide increased capacity for the SARC Pipeline, Greenspot Pump Station, Morton Canyon Connector I, and Greenspot Pipeline.
- The proposed State Water Project Extension (previously called the Desert Aqueduct) contemplates extension of the State Water Project to Coachella Valley. Depending on the alignment chosen, this project could provide an alternative for conveying SWP water to portions of the Valley District service area or to San Gorgonio's service area.

Alternatives to the Lytle Pipeline

- Metropolitan's Foothill Feeder, the Rialto Pipeline segment, parallels the Devil Canyon-Azusa Pipeline east for approximately nine miles. With turnouts, it could provide alternative conveyance to West Valley's and FWC's surface water treatment plants.

- The Baseline Feeder conveys groundwater to West Valley and Rialto. This groundwater is an alternative to SWP water conveyed by the Lytle Pipeline.

Alternatives to Baseline Feeder System

- The Devil Canyon-Azusa Pipeline conveys SWP water to West Valley, FWC, and Rialto. This surface water is supplemental to groundwater conveyed by the Baseline Feeder.

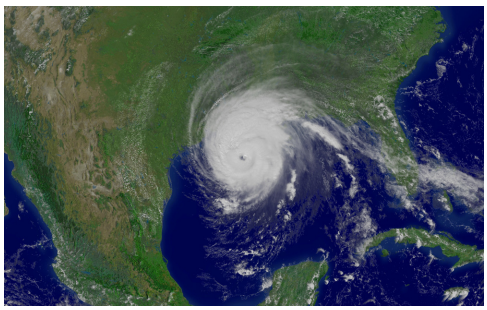
4.2.1.7.5 Back-Up Power Supplies

Power Supplies for Pumping Plants and Groundwater Wells

A catastrophic earthquake may cause loss of electricity for an indeterminate amount of time. In order to ensure water supplies in the immediate aftermath and weeks following a major earthquake, it is critical to have back-up generators or internal combustion engines for key pumping stations and production wells throughout the region.

Similar evaluations should be conducted for other facilities such as water treatment plants and the key pumping plants, and back-up power generation should be put in place for use during emergencies.

4.2.1.7.6 Climate Change



Climate change may have a considerable impact on management of water supply and flood control systems in the state.

Climate change may have considerable impact on the management of water supply and flood control systems in the State. Climate change impacts may include changes in the following:

- Temperature and its effect on timing of snow melt,
- Precipitation variation and intensity, and
    - Snow pack and snow-covered areas in the watershed.

In July 2006, DWR issued a Technical Memorandum Report entitled "Progress on Incorporating Climate

Change into Management of California's Water Resources." The study presented in the report focused on the four climate change scenarios selected by the Climate Action Team, which was appointed in response to the Governor's Executive Order SB3-05 on climate change. Four climate change simulations represent two greenhouse gas emission scenarios and two different models that were used to evaluate the climate effects. The two gas emission scenarios were developed by the Intergovernmental Panel on Climate Change representing low and high emission scenarios. Each scenario was then examined by two models, the Geophysical Fluid Dynamic Lab model (GFDL) and the Parallel Climate Model (PCM). The results of the study indicate the following:

- By 2050, the PCM model predicts a one-degree Celsius increase in temperature for both gas emission scenarios, while the GFDL model predicts a 2.25-degree increase for both scenarios. Increases up to 5 degrees Celsius occur by 2100 in the GFDL model.

- Climate model projections for changes in total annual precipitation in California through the end of this century are mixed. Models predicting the greatest amount of warming generally predicted moderate decreases in precipitation. Models projecting smaller increases in temperature tend to predict moderate increases in precipitation.

- Changes in runoff associated with climate change can be related to the changes in watershed response due to the modification of the seasonal snow pack. Increasing temperatures will likely push the snow level in watersheds to higher elevations, leaving more of the watershed available to contribute to direct winter runoff processes. In addition, higher elevation snow levels decrease the available watershed area for snow pack to develop.

- Increased temperatures are likely to lead to increased elevations for snow pack formation, which leads to a greater contributing area for winter storm runoff. In addition, warming temperatures may lead to early melting of snow pack. The combination of earlier melt time, greater variability, and greater potential for direct storm runoff may challenge the current flood and water supply system in California.

For Southern California, the GFDL model predicts a 10 percent decrease in precipitation after 2050 for both gas emission scenarios, while the PCM model predicts a 1 percent decrease in precipitation for both scenarios. By 2100, however, the PCM model predicts a 10 percent increase in precipitation for both scenarios. (See Table 4-8.)

Table 4-8
PCM Model of Precipitation

Southern CA	1961-1990 Average	2035-2064 Average	Difference
Historical	14.24	N/A	N/A
GFDL A2	17.92	17.70	-0.22
GFDL B1		16.15	-1.77
PCM A2	11.36	12.06	0.70
PCM B1		11.28	-0.08

Historically, average snowline elevations in California have ranged from about 4,500 feet in the north to above 6,000 feet in the southern Sierra mountains. DWR staff estimates that the average snow-covered area totals about 13,200 square miles in the water-supply-producing basins of the Central Valley and the Trinity River above Lewiston. This is about 8 percent of the State's total land surface. The northern Sierra and Trinity mountains account for about 7,000 square miles of the 13,200 square mile total. The west slope of the southern Sierra accounts for the remainder. Rising temperatures will cause reductions in the State's snow pack by raising snowline elevations and reducing the area where annual snow pack accumulates. A rudimentary analysis of the impact of rising temperatures on snow pack shows that a 3 degree Celsius rise will likely cause snowlines to rise about 1,500 feet, based on a moist lapse rate of 500 feet per 1 degree Celsius. This would cause a significant reduction in the amount of snow-covered area in the State and an estimated average annual loss of about 5 million acre-feet of effective water storage in snow pack. Climate model studies support projections for continued reductions in the State's snow pack as a result of warming. Simulations under various amounts of temperature rise indicate that California's snow pack is very vulnerable to warming.

Generally, there is great uncertainty in the magnitude, timing, and location of precipitation and runoff changes associated with climate change. However, it is generally understood that climate change would decrease snow runoff and therefore reduce the level of water supply reliability of the existing projects, including the SWP. It is also understood by the water managers that additional data sets, research, and studies will be needed to more accurately bracket the potential impacts of the climate change on the State water supply and flood control system.

There is also a great level of uncertainty in magnitude of reduction in water supply due to climate change for Southern California and for Upper Santa Ana, in particular. Considering uncertainty about the water supply impact of climate change in the Upper Santa Ana Region at this time, the TAG has acknowledged the need for additional studies. Because of the uncertainty about the magnitude

of climate change impact on the water supply, it is premature to plan for expensive infrastructures in Upper Santa Ana to deal with associated impacts. Instead, the TAG has decided to first conduct a sensitivity analysis to determine what range of impact climate change may have on water supply availability and groundwater storage in the region and then plan for strategies to deal with the potential impacts. The sensitivities analysis is followed by formulation of appropriate strategies to deal with potential future water shortage associated with climate change.

The sensitivities analyses indicate that the impact of reduction of SWP reliability and the reduction of the long-term local surface supply by 10 percent will result in a reduction of about 20,000 acre-feet of water supplies in the region. Assuming reduction of SWP and local supplies will occur as stated above, the region will need about 20,000 acre-feet to offset the impact of climate change.

To deal with the changes in water supply associated with climate change, it is recommended that a series of additional aggressive water conservation and recycling programs be developed for the Upper Santa Ana Region. Because these conservation and recycling programs are in addition to 40 TAF conservations projects envisioned to be implemented to meet 2030 water needs, additional studies should be conducted to develop feasible projects. A detailed discussion of water conservation and water recycling strategies is presented under the water management strategy section of this plan.

4.2.2 Protect and Enhance Water Quality Objective

The goal of this objective is to protect the quality of the region's surface water and groundwater resources. To ensure reasonable protection, the water management strategies for the basin should be consistent with and contribute to the water quality objectives for the region, such as the Santa Ana Regional Water Quality Control Plan and the SAWPA IRWM Plan. The water quality objective is designed to address issues specific to the region.

Groundwater management is currently influenced by the presence of contamination plumes. Most of these plumes resulted from historic military and industrial operations in the region. The following plumes have been identified:

1. Newmark-Muscoy Superfund (trichloroethylene (TCE)
2. Redlands-Crafton (TCE, Perchlorate)
3. Santa Fe Plume (TCE)
4. Former Norton Air Force Base (TCE)
5. Rialto-Colton Subbasin (PCE, TCE, 1,1-DCE, cis-1,2-DCE, perchlorate)
6. No-Mans Land (PCE)

Management strategies will be developed to not only avoid any adverse impacts that would cause these plumes to spread further but also to develop projects that will accelerate the cleanup of these plumes. These strategies will be evaluated using computer models. Avoiding any impacts to and from the plumes, and their removal when possible, is considered a BMO for the region. This BMO is also consistent with the Groundwater Management Planning Act requiring BMOs to be formulated to address groundwater quality issues of the basins.

Federal and State law, the Orange County and Western Judgments, and sound water management practices require compliance with specific water quality standards. The Clean Water Act is the federal law requiring that water quality standards be established and, as appropriate, revised. The Porter-Cologne Act is the State law that established both the SWRCB and the present system of nine RWQCBs. This law directs that each Regional Board formulate a water quality control plan for its region that complies with the requirements of federal and State law and also regularly update these plans. The Upper SAR watershed is subject to the jurisdiction of the Basin Plan.

The Basin Plan establishes water quality standards for all the ground and surface waters in the watershed. It identifies a total of 19 beneficial uses of water in the

SAR Basin and the levels of water quality that must be met and maintained. Examples of these beneficial uses include Municipal and Domestic Supply, Groundwater Recharge, and Wildlife Habitat. The Basin Plan also includes narrative and specific numeric objectives for inland surface waters and groundwater and regulatory plans to achieve these objectives. Dissolved minerals, generally expressed as TDS; nitrogen levels, largely in the form of nitrate; and the presence of groundwater contamination, for example, PCE and TCE contaminants, are primary concerns.

With respect to surface water quality, the Federal Clean Water Act Section 303(d) requires that states identify waters that do not or are not expected to meet water quality standards (beneficial uses, water quality objectives, and the anti-degradation policy) with the implementation of Best Available Technology. Once a water body has been placed on the 303(d) list of impaired waters, states are required to develop a Total Maximum Daily Load (TMDL) to address each pollutant causing impairment.

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; runoff from homes, forested lands, agriculture, streets, or highways; contaminated soils/sediments and legacy contaminants such as dichlorodiphenyltrichloroethane (DDT) and polychlorinated biphenyls (PCBs); on-site disposal systems (septic systems); and deposits from the air. Federal regulations require that the TMDL, at a minimum, account for contributions from point sources (permitted discharges) and nonpoint sources, including natural background.

In addition to accounting for past and current activities, TMDLs allocate allowable pollutant loads for each source, and identify management measures that, when implemented, will ensure that water quality standards are attained. The Basin Plan (described above) must include an implementation plan that describes how the water quality standards established in the Basin Plan will be met. TMDLs, with their associated implementation plans, are adopted into the Basin Plans through the Basin Planning process.

The ability to protect water quality has a direct bearing on the viability of many IRWM Plan objectives and strategies. This section describes strategies and projects for (1) TDS and Nitrogen Management, (2) Remediation of Groundwater Contamination, (3) Water Supply, (4) Surface Water Quality Improvement, and (5) Groundwater and Surface Water Quality Monitoring.

4.2.2.1 Total Dissolved Solids and Nitrogen Management Strategy

Groundwater quality in the Upper SAR watershed is generally good; however, long-term historic land-use practices, particularly agriculture, have resulted in an

accumulation of salts that are now in the unsaturated soils overlying groundwater subbasins (now defined in the Basin Plan as groundwater management zones). These salts will, over time, degrade groundwater quality.

Watershed stakeholders have invested significant resources to better understand and resolve questions concerning the build-up of dissolved minerals in the watershed. These initiatives are in response to water quality monitoring and computer modeling of groundwater indicating that the levels of dissolved minerals, generally expressed as TDS, were exceeding water quality objectives or would do so in the future in some groundwater subbasins unless appropriate controls were implemented. Nitrogen levels, largely in the form of nitrate, were likewise projected to exceed objectives.

In 1996, a Nitrogen and Total Dissolved Solids (TIN/TDS) Task Force was formed in the watershed to conduct scientific investigations regarding the then existing TDS and nitrogen and water quality objectives of the 1995 Basin Plan. This Task Force, administered by SAWPA, was comprised of 22 water supply and wastewater agencies.

In 2003, a Final Technical Memorandum was completed that reported the results of this scientific investigation, *The TIN/TDS Study – Phase 2B of the Santa Ana Watershed Wasteload Allocation Investigation*. In 2004, as a result of this work, the Basin Plan was amended. As amended, the Basin Plan implements new water quality monitoring and reporting requirements. One such requirement is the preparation of an *Annual Report of Santa Ana River Water Quality.*

In June 2007, the third *Annual Report of Santa Ana River Water Quality* was prepared. The report provides water quality information that will be utilized to develop and implement a surface water monitoring program, which, in turn, will enable watershed stakeholders to determine compliance with the nitrogen and TDS objectives of the SAR, and, thereby, the effectiveness of wasteload allocations prescribed in the Basin Plan.

The Basin Plan establishes new TDS and nitrogen water quality objectives for both surface water and groundwater. It also establishes new surface water monitoring commitments associated with certain agencies' "maximum benefit" programs. This is a comprehensive monitoring program implemented by some Task Force members that includes an evaluation of compliance with the TDS and nitrogen objectives for Reaches 2, 4, and 5 of the SAR.

SAR Reach 5 is located in the Upper SAR watershed. The Basin Plan specifies water quality objectives for SAR Reach 5 for TDS, hardness, sodium, chloride, TIN, sulfate, and COD. Along SAR Reach 5, the OCWD monitors a single site, *SAR-WATERMAN-01*. In 2006, this site was monitored by OCWD only once in

August. Based upon analysis of the limited available data collected by OCWD, no constituents were shown to exceed Basin Plan objectives.

Non-tributary discharges to SAR Reach 5 include recycled water inflows from the City of San Bernardino Water Reclamation Facility and potential inflows from San Timoteo Creek produced at Yucaipa Valley Water District (YVWD) Wastewater Reclamation Facility and City of Beaumont's WWTP No. 1. As demonstrated in previous years' measurements of streamflow conducted by YVWD, during dry-weather conditions, the City of Beaumont's recycled water discharge completely infiltrates into the streambed in Cooper's Creek, a tributary of San Timoteo Creek. Prior to San Timoteo Creek's confluence with SAR, almost all of YVWD's recycled water discharge infiltrated the nearby streambed. The U.S. Geological Survey (USGS) maintains two gaging stations for this segment of the SAR—Station 11059300, located along the SAR at E Street near San Bernardino, and station 11057500, located along San Timoteo Creek near Loma Linda.

The water quality strategy for TDS and Nitrogen Management includes the following:

- Continue to work collaboratively with stakeholders throughout the entire Santa Ana watershed, including the RWQCB and the TDS/TIN Task Force to develop sound water management solutions that are responsive to site-specific hydrologic characteristics. Implement the signed agreement between the RWQCB and certain water agencies to "Protect Water Quality and Encourage the Conjunctive Uses of Imported Water in the Santa Ana River Basins." The agreement does not restrict the beneficial uses of SWP water for groundwater recharge, with the acknowledgement that the RWQCB could consider regulatory actions to restrict the use of SWP water for groundwater recharge in the future.

- **YVWD Desalter and Brine Disposal Project** – The construction and operation of groundwater desalters to extract and treat poor quality groundwater has been and continues to be an essential component of salt management in the Upper SAR watershed. Such projects will be increasingly important in the watershed to protect local water supplies and provide supplemental, reliable sources of potable supplies.

  In the San Timoteo watershed areas, the YVWD anticipates that demineralization of groundwater or recycled water will be necessary in the future. YVWD is committed to constructing and operating desalting and brine disposal facilities according to terms and conditions described in the Basin Plan. The construction of these facilities will be in accordance with a plan and schedule submitted by YVWD and

approved by the RWQCB. These facilities should be designed to stabilize or reverse the degradation trend evidenced by effluent and/or management zone quality.

- **City of Beaumont and the San Timoteo Watershed Management Authority (STWMA) Desalter and Brine Disposal Project** – The construction and operation of groundwater desalters to extract and treat poor-quality groundwater has been and continues to be an essential component of salt management in the Santa Ana watershed. Such projects will be increasingly important in the Upper SAR watershed to protect local water supplies and provide supplemental, reliable sources of potable supplies.

  The City of Beaumont and STWMA will construct and operate desalting facilities and brine disposal facilities according to terms and conditions described in the Basin Plan. The construction of these facilities will be in accordance with a plan and schedule submitted by the City of Beaumont and STWMA and approved by the RWQCB. These facilities shall be designed to stabilize or reverse the degradation trend evidenced by effluent and/or management zone quality.

- **Santa Ana Regional Interceptor (SARI) Improvement Project** – The SARI is primarily a utility for non-reclaimable wastewater. Its highest and best use is the removal of salts from the watershed to keep them from degrading water quality and thereby allowing better long-term and sustainable use of groundwater resources and expansion of the region's ability to reclaim water. The long-term goal of achieving salt balance within the region can be accomplished through the use of local desalters, selective use of imported water in combination with exporting salts from the watershed through the SARI pipeline.

  In the Upper SAR watershed, the SARI extends into the cities of Riverside and San Bernardino. The SARI faces challenges such as the deferral of system maintenance and high capital costs for on-going improvements, repairs, refurbishment, and capacity management. Projects will be developed to fully utilize the capacity of the SARI system and to ensure its viability as a means to remove salts from the watershed.

4.2.2.2 Remediation of Groundwater Contamination Strategy

Several contaminant plumes are present throughout the region. These plumes limit the use of groundwater in some areas as well as management of the groundwater basins. Clean-up activities are undertaken for some plumes as discussed below and specific strategies are being developed to expedite

remediation in others. The SBBA is impacted by five major groundwater contamination plumes. Remediation of these plumes is underway. For example, remediation of the Newmark-Muscoy and former Norton Air Force Base Plumes is progressing under the EPA Superfund Program.

The proposed Bunker Hill Regional Water Supply Project is another measure to facilitate and expedite remediation of the Newmark Plume while accomplishing other important purposes—to provide a new source of water supply, improve water supply reliability during dry periods, develop a conjunctive use project that would optimize the capture and storage of imported water in strategic locations within the Bunker Hill Basin, facilitate in-lieu groundwater storage in adjacent groundwater basins, and improve regional water supply reliability during dry periods.

The project is the development of a well field to extract contaminated groundwater from the Newmark Plume and deliver it to a water treatment plant where it would be treated to remove PCE and TCE contaminants. After treatment, the water would be conveyed to Bunker Hill Basin groundwater purveyors for municipal and domestic use. The amount of water to be extracted and supplied ranges from 20,000 to 60,000 acre-feet per year. Annual production from the project could not exceed the quantities previously recharged under the program. In order to sustain these extraction rates, it is assumed that a similar amount of imported water, supplemented by stormwater, would be used to recharge the groundwater basin located upgradient of the proposed well field. This strategy was discussed in detail in Section 4.2.1.3.2 under Bunker Hill Basin Regional Water Supply Program.

FWC currently operates and maintains a groundwater remediation project at its Plant F10 pursuant to a long-term agreement with San Bernardino County, the owner and operator of the Mid Valley Sanitary Landfill, and a corresponding Clean-Up and Abatement order issued to San Bernardino County by the RWQCB. The 5,000 gpm treatment plant utilizes liquid phase granular activated carbon to treat for volatile organic compounds including but not limited to PCE, TCE, 1,1-DCE, and cis-1,2-DCE. The plant treats and removes those contaminants from groundwater extracted from both the Rialto-Colton and No-Mans Land subbasins.

Other projects to protect groundwater quality within the region include septic system conversion for the Highgrove Area and the Pellesier Ranch Barrier wells and water treatment plant.

4.2.2.3 Improving Groundwater Quality by Recharge of the Basins with Good Quality Water

The quality of water supply impacts the multiple beneficial uses of water. For example, the quality of water supply impacts the extent to which wastewater can be reused and recycled without resulting in adverse impacts on affected receiving waters as well as discrete industrial discharges, returns to groundwater from homes using septic tank systems, returns from irrigation of landscaping in sewered and unsewered areas, and returns to groundwater from commercial irrigated agriculture.

Imported SWP water is an important part of the region's water supply. The use of higher quality SWP water, with a long-term TDS average of less than 300 milligrams per liter (mg/L), together with the capture of flood/stormwater for groundwater recharge can also be an important part of the region's strategy to protect water quality.

The use of SWP water can allow for maximum reuse of water supplies without aggravating the watershed mineralization. It can also be utilized for direct and in-lieu recharge of groundwater basins to improve long-term and dry-year period water supply reliability. Under certain circumstances, such as the Bunkerhill Regional Water Supply Project (see "Remediation of Groundwater Contamination Strategy"), it can be utilized to facilitate and expedite groundwater remediation. Therefore, the use of high-quality SWP water in the Upper SAR watershed can provide multiple benefits that extend beyond direct water supply.

Likewise, the use of flood water/stormwater for groundwater recharge is an important part of an overall strategy to improve water quality. Most groundwater recharge occurs in the natural channels of the Upper SAR watershed. The San Bernardino County Flood Control District (SBCFCD), the SBVWCD, and other agencies in the region operate extensive recharge facilities that enhance the capture and recharge of high-quality stormwater.

Fully utilizing higher quality SWP water and flood water/stormwater for groundwater recharge will be accomplished through operation of existing facilities to maximize recharge during periods of optimal water quality (e.g., during wet periods) and through the planning, design, and construction of new groundwater recharge facilities and multi-purpose flood control district facilities such as soft-bottom flood control channels. This strategy will also require the planning and development of conveyance facilities and new institutional arrangements to share and coordinate use of facilities that are owned and operated by multiple agencies.

Facilities are planned by STWMA to recharge imported water and stormwater. Facilities are also planned as part of "maximum benefit" proposals by the YVWD, STWMA, and the City of Beaumont. Such proposals include efforts to import and recharge high quality SWP water when it is available. These activities increase both the quantity and quality of available groundwater resources.

4.2.2.3.1 Cooperative Agreement to Protect Water Quality and Encourage the Conjunctive Uses of Imported Water in the Santa Ana River Basin

The Cooperative Agreement to Protect Water Quality and Encourage the Conjunctive Uses of Imported Water in the Santa Ana River Basin was signed in 2007 by the Santa Ana Regional Water Quality Control Board (SARWQCB), and the City of Corona, City of Riverside, Eastern Metropolitan Water District, Elsinore Valley Metropolitan Water District, OCWD, Valley District, SGPWA, and Western (Recharge Parties).

The RWQCB is charged by statute with adopting water quality objectives as may be required to protect the beneficial uses of water within the region. In particular, the long-term conjunctive use of groundwater in the region requires that the quality of water in groundwater basins in the region be managed to meet the water quality objectives for nitrogen and TDS (collectively, the Salinity Objectives) adopted by the RWQCB in the 1995 Water Quality Control Plan for the Santa Ana River Basin, as amended in 2004 by R8 2004-0001 (Basin Plan).

The Salinity Objectives presently included in the Basin Plan are the result of a multi-year, multi-million dollar cooperative effort among many of the parties. The Salinity Objectives are a product of the best scientific and technical information available.

The parties that intentionally recharge imported water within the Santa Ana Region (the Recharging Parties) agree voluntarily to collect, compile, and analyze the TIN/TDS water quality data necessary to determine whether the intentional recharge of imported water in the region may have a significant adverse impact on compliance with the Salinity Objectives within the region. To that end, the Recharging Parties will collect, compile, and analyze such TIN/TDS water quality data and prepare, within 18 months from the effective date of the agreement and every three years thereafter, a report containing the following information:

a. A summary of the then-current ambient water quality in each groundwater management zone and a comparison of that ambient water quality with the Salinity Objectives. The Recharging Parties shall calculate ambient water quality for each groundwater management zone

in a manner that allows for a technically valid comparison with the Salinity Objectives.

b. A summary of the amount and quality of imported water recharged in each groundwater management zone during the previous three-year period.

c. The initial report and each report prepared at six-year intervals thereafter will include a projection of ambient water quality in each groundwater management zone for the subsequent 20 years.

    (1) The projection of ambient water quality for each groundwater management zone will be based upon professionally accepted modeling techniques, will reasonably account for surface fluxed of salt input, will reflect the effects of all existing and reasonably foreseeable recharge projects for which there is a certified environmental document, and will compare baseline ambient water quality with the Salinity Objectives.

    (2) The projections for different groundwater management zones may be based on different modeling techniques.

    (3) Each report that includes a 20-year projection of ambient water quality will also present a comparison of then-current water quality in each groundwater management zone with the ambient water quality projection made six years earlier, together with an evaluation of the reason(s) for any differences.

The Recharging Parties agreed among themselves regarding the manner in which they will prepare the report and the manner in which they will share the cost of preparing the report. The Recharging Parties will circulate a draft version of each report to all other parties for review and written comments for at least a 45-day period prior to completing the final report and submission to the RWQCB.

Each Recharging Party also agreed that, when it serves as a lead agency under the California Environmental Quality Act (CEQA) for a proposed project involving the recharge of imported water within the region, the environmental document will include the water quality data compiled in the most recent triennial report to the RWQCB in the analysis of the potential impacts of the proposed project. The environmental document will also incorporate professionally acceptable modeling techniques.

This agreement provides a framework for groundwater recharge of imported water and will facilitate conjunctive management in the region while protecting water quality. A copy of the agreement is presented in Appendix A.

4.2.2.4 Surface Water Quality Improvement Strategy

The Basin Plan, pursuant to California state law (Porter-Cologne Water Quality Control Act, California Water Code Section 13000 et. seq.) and federal law (Clean Water Act 303(d)), must include an implementation plan that describes how the water quality standards established in the Basin Plan will be met. TMDLs, with their associated implementation plans, are adopted into the Basin Plans through the Basin Planning process. This strategy addresses TMDL implementation with respect to impaired (303(d)) bodies of water located in the Big Bear Lake watershed and consists of developing and implementing plans and projects to improve the water quality of impaired surface water bodies that do not or are not expected to meet water quality standards for beneficial uses pursuant to the 303(d) list of impaired waters.

The Big Bear area watershed is located in the San Bernardino Mountains. Major water bodies in this watershed include Big Bear Lake, Baldwin Lake, Stanfield Marsh, Shay Meadows, Rathbone (Rathbun) Creek, Summit Creek, and Grout Creek. Pursuant to the Clean Water Act Section 303(d), the following water bodies are impaired: Big Bear Lake, due to nutrients, copper, mercury, metals, and siltation; Grout Creek, for metals and nutrients; Summit Creek, due to nutrients; Knickerbocker Creek, for pathogens and metals; and Rathbone Creek, due to nutrients and siltation. The problem pollutants have been identified as coming from nonpoint sources. In conjunction with local stakeholders, the RWQCB has adopted TMDLs for these pollutants (Resolution R8-2006-0023).

A program has been formulated to identify a coordinated and comprehensive plan for management of the lake and surrounding watershed to protect the lake's beneficial uses. The Big Bear Municipal Water District (Big Bear Municipal) will serve as the sponsoring agency, with significant participation of Big Bear Lake watershed stakeholders. The plan will include data collection, modeling and analysis of data, and reporting. It will include a plan and schedule for short-term and long-term in-lake sediment nutrient reduction for Big Bear Lake. The plan will also include an evaluation of the applicability of various in-lake treatment technologies to support development of a long-term strategy for control of nutrients from the sediment, noxious and nuisance aquatic plants, and many other features.

Another water quality improvement project for Big Bear Lake is a phosphorous treatment plant. Based on existing data, phosphorus is the primary nutrient problem within Big Bear Lake. For example, past studies have shown that Big Bear Lake is eutrophic (meaning a body of water whose oxygen content is depleted by organic nutrients) and that the limiting nutrient is phosphorous. The phosphorous treatment project is intended to meet several water quality objectives identified in the Basin Plan, including those related to phosphorous,

dissolved oxygen, and excess algae. The high nutrient levels are causing impairment to beneficial uses. Reducing phosphorous concentrations will restore aquatic habitat by reducing excess algae growth and inhibiting the spread of invasive plant species. In addition to improving water quality, this project will improve access and navigability for swimmers and boaters, particularly along the shallower shoreline of the lake.

The proposed project will expand successful pilot demonstrations supported by previous Proposition 13 grant funds. It will include the broad application of liquefied alum that will establish an ionic bond with dissolved phosphorous, forming an inert mineral salt that rapidly precipitates out of the water column. This project is co-sponsored by Big Bear Municipal, SBCFCD, and the City of Big Bear Lake as a joint effort to implement the water quality management strategies specified in the Basin Plan, the RWQCB's watershed Management Initiative, the Nutrient TMDL, BBMWD's Lake Management Plan, the County's Stormwater Management Plan, and the City's Stormwater Management Plan.

4.2.2.5 Groundwater and Surface Water Quality Monitoring Strategy

Groundwater and surface water quality monitoring and assessment information enables water resource managers to understand the effectiveness or needs for improvement of their water quality management practices. For example, water quality objectives for the SAR for TDS and nitrogen are set forth in the Basin Plan and water rights judgments. In order to ensure compliance, water quality is monitored on the SAR at a point just below Prado Dam. The USGS maintains a gaging station at this location to measure instantaneous flow and a water quality recorder provides continuous measurements of specific conductance. Surface water grab samples are taken by the RWQCB staff, the USGS, and others, and analyzed to determine compliance with water quality objectives. This information is used to assess the effectiveness of water management practices over time.

A comprehensive surface and groundwater monitoring and assessment program is currently underway in the region. Such a program provides information needed to evaluate the effectiveness of a water quality management practice and, as appropriate, modify management practices. Management of groundwater basins in general and the proposed process to manage the SBBA requires extensive monitoring to ensure the annual operation of the basin is in compliance with requirements of existing agreements and judgments and that operation of the basin will result in the expected outcome. A comprehensive groundwater monitoring plan has been prepared for this IRWM Plan and is presented in Appendix B.

4.2.2.5.1 Surface Water Ambient Monitoring Program

In general, the RWQCB's surface water monitoring program is not strictly formalized. Other than monitoring at the location just below Prado Dam (described above), the sampling frequency, locations, constituents, and other details vary from year to year depending on identified problems and needs and on staff and funding availability. In addition to these efforts, a number of other agencies conduct surface water monitoring programs in the region, including water purveyors, wastewater dischargers, and flood control agencies.

The Surface Water Ambient Monitoring Program (SWAMP) is a relatively new statewide program (Water Code Section 13192). The purpose of SWAMP is to create an effective surface water quality ambient monitoring program for all of California's surface waters to ensure that water quality is comprehensively measured to protect beneficial uses and to evaluate protection and restoration efforts. The program also intends to capture monitoring information collected under other State and RWQCB programs, such as the State's TMDL, Nonpoint Source, and Watershed Project Support programs.

All State-funded projects that include a surface water monitoring component are required to develop and implement a SWAMP Quality Assurance Plan approved by the RWQCB as a condition of funding. This is a strategy to (1) implement this requirement, and (2) voluntarily adhere to and implement SWAMP Quality Assurance standards and protocols whenever possible for surface water quality monitoring in the Upper SAR watershed. Note that this does not include projects that include effluent or discharge monitoring, which is covered under National Pollutant Discharge Elimination System permits and Waste Discharge Requirements. The guidelines for preparation of such a plan, the Quality Assurance Project Plan, can be found at http://www.swrcb.ca.gov/swamp/qapp.html.

4.2.3 Ecosystem Restoration and Environmental Improvement Objective

Protecting and restoring, where possible, the ecological functions of the watershed is an objective for the region. This IRWM Plan provides a framework for the integration and coordination of ecosystem and environmental improvement strategies relating to flood management, recreation and public access, and land use planning. The purpose of this framework is to enable stakeholders to coordinate and advance strategies to improve the ecological health of the watershed and, in the process, improve public awareness, access, stewardship, and enjoyment of this region's most valued water resources.

This section begins with a definition and description of Ecosystem Restoration and Environment Improvement followed by three broad strategies to achieve this objective. The role of watershed stakeholders and the importance of collaboration to achieve this objective are also described. The section concludes with a more detailed explanation of the strategies and the projects to implement them.

Restoration means the reestablishment of structure and function of the Santa Ana watershed ecosystems. The restoration process is used to reestablish the general structure, function, dynamic, and self-sustaining behavior of the ecosystem. As this is accomplished, the natural biological attributes of the system return, such as native plants, fish, birds, and other wildlife, which enriches the quality of life for everyone.

It is not possible, nor would it be desirable, to restore the Upper SAR watershed ecosystem to a pre-disturbance condition. Human activity and use of the landscape has precluded many options and has altered natural ecosystem processes; for example, vegetation is changed and hardscape increased. A return to a more natural, self-sustaining system, however, can lower infrastructure costs, raise property values, and reconnect people with the natural wildland beauty of the Santa Ana watershed.

Many stakeholders, such as federal and state resource agencies; regional, county, and city governments; public and private non-governmental organizations; and the public, are actively engaged in Ecosystem Restoration and Environment Enhancement projects. Accordingly, the strategies described in the IRWM Plan are intended to serve as a framework for the integration and coordination of the projects to be performed by stakeholders. The foundation of this framework is collaboration. Through increasing collaboration, stakeholders are able to more effectively integrate and coordinate their resources to protect, restore, and enhance the environment; institute land use policies that protect the watershed

values; and establish and maintain public access to open space, parks, trails, and other recreational amenities.

While the focus of these strategies is the Upper SAR watershed, it is recognized that all stakeholders within the watershed are linked to one another and to State and national resource management priorities. Accordingly, the Ecosystem Restoration and Environment Enhancement strategies described in this plan are intended to be consistent with broader watershed plans and strategies, such as the strategies described in the "Santa Ana Watershed Project Authority (SAWPA) Integrated Watershed Plan, 2005 Update," and the "2002 SAWPA Integrated Watershed Plan, Volume 2: Environmental and Wetlands Component."

The strategies for Ecosystem Restoration and Environment Improvement are (1) Habitat Protection, Restoration, and Enhancement; (2) Land Use Planning; and (3) Recreation and Public Access. Taken together, these strategies will enable stakeholders to advance the objective of ecosystem restoration and environment improvement. These strategies will also provide other benefits to the watershed, such as improved water quality, increased water supply, increased dry-year water supply reliability, increased groundwater storage, improved flood control and stormwater management, and greater public education and awareness that is critical for the long-term stewardship of the watershed.

4.2.3.1 Habitat Protection, Restoration, and Enhancement Strategy

The Upper SAR watershed is home to extraordinary natural resources. The headwaters of the watershed are located in the San Bernardino National Forest. The San Bernardino Valley is home to six unique habitat types, six state endangered species, 13 federally endangered or threatened species, and over 53 species of special concern. Riparian corridors thread through the watershed and provide important habitat.

The San Bernardino National Forest is home to extraordinary natural resources.

This strategy reflects the value of the watershed's natural resources. It addresses the economic benefits of natural systems; for example, the use of erosion control measures to reduce sediment loading and thereby improve water quality. It also strives to reduce conflict associated with human activity.

This strategy addresses policy, planning, projects, and project initiatives to protect, restore, and enhance Upper SAR watershed habitats. These initiatives

are organized into three categories of projects: (1) Land Management and Habitat Conservation Planning Projects, (2) Habitat Improvement and Environmental Enhancement Projects, and (3) Non-Native Plant Removal Projects.

4.2.3.1.1 Land Management and Habitat Conservation Planning Projects

Land Management and Habitat Conservation Planning projects are policy and planning initiatives that recognize that wildlife habitat is often in direct competition with other land uses and strive to resolve these conflicts in a manner that protects and enhances the ecosystem value of the Upper SAR watershed as habitat for sensitive, threatened, and endangered species.

4.2.3.1.2 Habitat Improvement and Environmental Enhancement Projects

The second category of projects—Habitat Improvement and Environmental Enhancement Projects—are projects to improve habitat and enhance the environment. These are multi-faceted projects that range from property acquisition and construction of facilities, to oversight monitoring, maintenance of land and facilities, public education, and outreach. The benefits of these projects include ecosystem restoration, flood and stormwater management, water quality improvement, public access and recreation, and public outreach and education.

An example of an existing Habitat Improvement and Environmental Enhancement project is the Bear Creek Fishery Project. Located in the San Bernardino National Forest, this project was implemented to sustain the aquatic health of Bear Creek. Big Bear Municipal administers this program, which consists of monitoring and managing carefully controlled releases of water to the creek from Big Bear Lake. An example of a partially completed project is the 145-acre wildlife preserve, the Stanfield Marsh. This project, when completed, will restore and enhance habitat for aquatic species, wetland species, wildlife to include wintering and breeding waterfowl, wintering bald eagles, osprey, and summer residents, and potentially nesting pelicans. An example of a new project initiative is the Lytle Creek Watershed Assessment and Restoration Project. This is a proposed, multi-purpose program to advance ecosystem restoration and improve water quality and local water supply reliability. It also includes public outreach and education, addressing wildfire prevention, non-point pollution prevention, and public outreach targeted to Lytle Creek recreational users.

Upper Santa Ana River Wash Land Management and Habitat Conservation Plan (Project) – Historically, the Santa Ana River Wash was a natural floodplain and alluvial fan that provided a place to convey frequent devastating flood waters depositing sediment percolate surface water to the groundwater basin, providing a significant source of water supply for the Upper SAR watershed. It is also habitat for a variety of sensitive, threatened, and endangered species. Its ecosystem value has become more apparent due to several factors, including the decrease in this type of habitat throughout Southern California.

The proposed project is Land Management, Mining and Reclamation, Water Management and Conservation, and Habitat Conservation Plan for the Upper Santa Ana River Wash Area. The plan is being prepared under the guidance and direction of many stakeholders, with the SBVWCD serving as lead agency. The plan area encompasses approximately 4,500 acres and is generally bounded by the SAR on the south, Alabama Street on the west, Plunge Creek and Green Spot Road on the north, and Mill Creek on the east.

When completed, the plan would directly contribute to all three strategies for ecosystem restoration and environmental improvement presented in this IWRM Plan: (1) habitat protection, restoration, and enhancement; (2) land use planning; and (3) recreation and public access. Habitat preservation would be strategically located in large inter-connected areas with intact natural habitat. A trails system would be maintained, expanded, and improved. Water conservation (groundwater recharge) and flood control activities will continue in areas historically utilized for these activities. Through land use planning and land exchanges, it would confine and minimize mining activities to one area on land currently disturbed by mining or land adjacent to disturbed areas.

San Bernardino National Forest Watershed Management Planning – The upper reaches of the Santa Ana watershed are located in the San Bernardino National Forest. The San Bernardino National Forest is one of 18 national forests in California, collectively referred to as Region 5 of the United States Forest Service (USFS). In 1981, Region 5 entered into a Management Area Agreement with the SWRCB pursuant to Clean Water Act Section 208. This agreement designates Region 5 as the Water Quality Management Agency (WQMA) for the San Bernardino National Forest.

As the WQMA, Region 5 is responsible for the proper installation, operation, and maintenance of State- and EPA-approved BMPs in the San Bernardino National Forest. Region 5 is tasked with the responsibility of (1) correcting water quality problems in National Forests; (2) perpetually implementing BMPs; and (3) carrying out identified processes for improving or developing BMPs. In the Upper SAR watershed, the San Bernardino National Forest works conjunctively with the RWQCB on water quality issues such as TMDLs.

Currently, Region 5 is working with the State and RWQCBs to re-certify the Management Area Agreements pursuant to recent changes in State law, such as the new Nonpoint Source Implementation and Enforcement Policy. The process of revising the WQMP and Management Area Agreements will be a joint SWRCB and Region 5 effort. This will be a collaborative effort to develop a plan that identifies, prioritizes, and annually updates site-specific issues. In addition to re-certification of the Management Area Agreements, the San Bernardino National Forest (SBNF) will be implementing its 2006 Forest Plan. The Forest Plan describes the strategic direction at the broad program-level for managing the SBNF, including watershed management initiatives over the next 10 to 15 years.

Water Resources Institute Watershed Management Internship Program (Project) – Local governments in the Upper SAR watershed are facing major challenges with water quality, stormwater runoff, flood damage liability, and concerns about whether there will be enough water for new development. The long-term protection and management of the watershed will require the development and training of a new generation of water resources professionals.

The WRI- CSUSB is collaborating with the Natural Resource Conservation Service, SAWPA, local resource conservation districts, and other watershed groups to provide multi-disciplinary internships on watershed management projects related to increasing population, changing land use patterns, and expanding urbanization in the Santa Ana watershed. This program is funded by the United States Department of Agriculture. Under this program, up to 30 under-represented students will be selected for paid internships to conduct scientific research on real-world problems in the Santa Ana watershed. This program will also train students in the latest Internet-based information-sharing systems.

Lytle Creek Watershed Assessment and Restoration Project – Lytle Creek is an impaired stream on the 303(d) list with an existing pathogen impact. Because of increasing visitor traffic and recreational use, the condition of Lytle Creek will become worse if corrective actions are not taken.

The Lytle Creek Watershed Assessment and Restoration Project is a multi-faceted program to advance ecosystem restoration and improve water quality and local water supply reliability. Program elements include a water quality assessment and a biological assessment. The program includes bilingual (English and Spanish) public outreach and education and addressing wildfire prevention and non-point pollution prevention. Public outreach will be targeted to Lytle Creek recreational users. This program is sponsored by the WRI-CSUSB.

4.2.3.1.3 Non-Native (Arundo donax) Plant Removal Maintenance Project

Non-native plants can drive out native vegetation and species.

The third and final project category under this strategy is Non-Native Plant Removal Projects. The removal of non-native plants is a specific type of habitat restoration—for example, Giant Reed or *Arundo donax* consumes large amounts of water and clogs up streams and waterways. Because *Arundo donax* spreads so rapidly, it pushes out native vegetation and the species that inhabit it. These Non-Native Plant Removal projects remove non-native plants and maintain such areas in order to restore native habitats and maintain the quality of restored habitat.

A number of projects to remove non-native plants, especially *Arundo donax,* or giant reed, in order to restore and maintain native habitats have been implemented in the Upper SAR watershed. Some projects are located in environmentally sensitive areas; for example, along important biological corridors that are habitat for threatened and endangered species. Projects require continued vegetation management to maintain restored habitats and monitoring to prevent the establishment of invasive weed species. Many of these areas where removal has been successful, such as the least Bell's vireo, provide important habitat for federal- and State-listed species.

The Inland Empire Resource Conservation District (IERCD), together with Santa Ana Watershed Association (SAWA), removed approximately 2,800 acres of *Arundo donax* within the Upper SAR watershed. *Arundo donax* removal and maintenance is imperative with regards to water resources quantity and quality. An acre of *Arundo donax* is estimated to consume three times more water than an acre of native vegetation within the Santa Ana watershed. If the *Arundo donax* is not managed, it would result in reduced streamflow, reduced groundwater recharge, reduced availability of water for native species, and eventual replacement of native riparian vegetation with *Arundo donax*. Native species naturally hang over rivers and streams, creating shade and keeping water temperatures lower. Streams infested with *Arundo donax* have little shade, which raises water temperature and changes water chemistry. These changes, due to increased sunlight, promote algal growth and raise pH.

Past invasive species removal efforts have been very successful. Eradication contracts have included the initial physical removal of the non-native plants with hand tools or machinery followed by five years of monitoring and spraying with EPA-approved herbicide. IERCD wants to ensure these areas remain free of

Arundo donax in perpetuity and proposes to monitor and maintain these removal project areas to ensure re-infestation does not occur. *Arundo donax* removal maintenance will assist in accomplishing the following objectives: improve surface water and groundwater management, protect water quality, improve water supply reliability, and restore and sustain riparian ecosystems.

City of San Bernardino Warm Creek Restoration Project – The proposed project consists of restoration activities along Warm Creek in the City of San Bernardino. This area consists of approximately three acres of a highly degraded stream channel that runs through private property. Typically, Warm Creek has contained mostly 100 percent invasive non-native vegetation, including *Arundo donax*.

In the spring of 2006, the project sponsor, the IERCD, obtained landowner approval to remove invasive species, including *Arundo donax* and castor bean, and substantial work has been completed. To complete the restoration and rehabilitation of this urban stream, IERCD will continue to remove additional invasive species such as Mexican fan palm (*Washingtonia robusta)* and Date palm (*Phoenix canariensis*), and actively re-vegetate the riparian areas with native species like Mulefat (*Baccharis salicifoli)* and willow.

Restoring Warm Creek in the City of San Bernardino will allow for the return of native riparian habitat in this highly urban and economically disadvantaged area. In addition, this restoration will save water, increase streamflow, improve instream flow timing, and improve water quality. Restoring native riparian habitat to Warm Creek will also allow for native plant and animal species to occupy the area. The riparian zone may support threatened, endangered, or migratory birds, fish, or other aquatic species.

Stanfield Marsh Wetlands Habitat Restoration Project – Stanfield Marsh is habitat for numerous wet meadow species; the southern Bald Eagle and its roosting, perching, and foraging sites; thousands of wintering waterfowl; numerous breeding waterfowl and upland birds in summer; and a large population of white pelicans. It is also considered the most amenable valley in the Big Bear Lake watershed for ecological enhancement, sensitive land acquisition, education, recreation, and scenic beauty.

The habitat value of the marsh was reduced as the result of construction of Stanfield Cutoff, a causeway (land bridge) built during the 1920s that largely separated the marsh from Big Bear Lake. The history of this site, the presence of wetland species, and hydrologic conditions make this an exceptional site for wetland enhancement. Partial wetlands enhancement has been completed.

The proposed project, when completed, would maintain a more consistently wet marsh area and a permanent wet habitat. When needed, for example, during dry periods, up to several hundred gallons of water per minute would be pumped from Big Bear Lake to the marsh. Pumped water not consumptively used in the marsh would return to the lake through the culverts under Stanfield Cutoff, with lower nutrient concentration and higher dissolved oxygen concentration. In addition to improving habitat and restoring wetlands, this project would improve lake water quality by reducing nutrients and increasing dissolved oxygen. It would also provide numerous public education and public outreach benefits in conjunction with other programs administered by the project sponsor, Big Bear Municipal.

4.2.3.2 Land Use Planning Strategy

Land use in the Upper SAR watershed is regulated by county and city government General Plans and Zoning Ordinances. Within the San Bernardino National Forest, land use planning is guided by the Forest Service Land Management Plan.

The Upper SAR watershed is one of the fastest growing regions in the United States. Substantial new development is forecast for the Upper SAR watershed. Stakeholders are taking into consideration the impacts of growth, such as the potential loss of open space and increase in impervious surfaces such as roads and buildings, and are exploring strategies to efficiently manage land and water resources.

This strategy addresses water resource-efficient land use principles and stewardship actions that can be implemented by local governments and other watershed stakeholders to protect and restore, where possible, the ecological functions of the watershed as well as improve the reliability and quality of the region's water resources. An example is the Ahwahnee Water Principles for Resource Efficient Land Use (Principles) developed by the Local Government Commission to improve the stewardship of local water resources.

The Principles encourage the identification of natural resources in the watershed, such as wetlands, floodplains, recharge zones, open space, and native habitat, to preserve and protect as many valued assets as possible to augment flood protection, improve water quality, recharge groundwater, restore habitat, and sustain overall long-term water resources. For example, as development occurs, its impact to the watershed would be mitigated, in part, by incorporating water holding areas such as creek beds, recessed athletic fields, ponds, cisterns, and other features that allow for natural groundwater recharge, reduce stormwater runoff, and decrease local flooding.

The Principles seek to reduce water demand through water conservation measures and efficient land use practices. For example, all aspects of landscaping, from the selection of plants to soil preparation and the installation of irrigation systems, are addressed to reduce water demand, retain runoff, decrease flooding, and allow for groundwater recharge. Impervious surfaces such as driveways, streets, and parking lots are minimized so that land is available to absorb (recharge) stormwater and reduce polluted urban runoff. Dual plumbing that allows grey water from showers, sinks, and washers to be reused for landscape irrigation is included in the infrastructure for new development. The Principles advocate maximum use of recycled water for appropriate applications, including outdoor irrigation, toilet flushing, and commercial and industrial processes. Urban water conservation technologies such as low-flow toilets, efficient clothes washers, and more efficient water-using industrial equipment are encouraged to be incorporated in all new construction and retrofitted in remodeled buildings.

The Principles also encourage the preservation of water supplies and water quality by promoting growth in the form of compact, mixed-use, transit-oriented development.

4.2.3.2.1 Inland Empire Sustainable Watershed Program Project

The Inland Empire Sustainable Watershed Program is a multi-faceted program to inform and empower local communities to become effective watershed stewards to re-establish sustainable ecological function in the Upper SAR watershed. The program builds regional capacity for community-based watershed management by reaching out to residents, including children, municipalities, water districts, resource agencies, businesses, land developers, and other stakeholders that impact watershed function in their daily activities. California Resource Connection serves as the program manager. This is a CALFED watershed-funded program that began in December 2006 and will be completed in December 2008. The program activities summarized below will support IWRM Plan Ecosystem Restoration and Environment Improvement.

Upper Santa Ana River Watershed Management Opportunities Atlas and Green Map – This is a public outreach and education tool that attractively identifies watershed assets for community stakeholders to visualize open spaces serving areas for groundwater recharge, sensitive habitat needing to be protected, impaired waterways needing to be restored, that trails systems and parks can green the urban landscape, and water management facilities bringing water supplies to homes and businesses.

Model Ordinance Program – This program is assessing regulations in the municipal code and development codes in the Upper SAR watershed that prevent the implementation of the resource-efficient land use practices, such as the

Ahwahnee Water Principles for Resource Efficient Land Use, that were developed by the Local Government Commission with funding from the SWRCB. Model Ordinances will be drafted for local adoption in a form that cities or the county can use in a manner that best fits local conditions.

Green Development Initiative – This is an educational forum for developers, land use planners, architects/engineers, and nurseries in the Upper SAR watershed to promote "green" development practices during this period of rapid development.

Watershed U-Inland Empire – This is an educational program with forums on topics such as ecosystem function, urban greening and design, water-efficient landscaping, and local restoration projects to encourage the public to live and work with fewer impacts on the watershed and to get involved in local projects.

Think River! – This is a hands-on watershed education program for teachers and youth on water sustainability, water quality, geology, plants and wildlife, and other environmental science topics relevant to the Upper SAR watershed.

4.2.3.2.2 LIDS for KIDS (Low Impact Development for a Healthy Watershed) Project

Urban development in the Upper Santa Ana Region has increased impermeable surface acreage and, as a result, increased the amount of stormwater runoff. This stormwater runoff collects and carries pollutants that decrease the quality of water. The land use planning process can utilize the standards described in "Low Impact Development Design Strategies – An Integrated Design Approach" prepared by the Department of Environmental Resources, June 1999, and other sources to reduce the amount of permeable surface, reduce ecosystem impacts, and improve water quality.

The Lids for Kids project is a public demonstration and public outreach project that will assist with retrofitting existing structures and educating key stakeholders, such as land developers and homebuilders who design and build in the Upper SAR watershed. The project sponsor, IERCD, has been conducting public outreach within the Upper SAR watershed for many years. The objectives of this project are to improve stormwater management practices, encourage environmentally sensitive development practices, reduce construction and maintenance costs associated with the current stormwater control methods, encourage the public to utilize low-impact development methods, and increase "green zones" for wildlife and people of the region.

4.2.3.2.3 Low Impact Development Guidance and Training Project for Southern California

San Bernardino County's Low Impact Development (LID) Guidance and Training Project for Southern California is aimed at facilitating the incorporation

of LID into National Pollutant Discharge Elimination System (NPDES) and TMDL programs at the local government level. LID employs construction, design, and landscape architecture features that reduce hydro-modification and, in turn, the water pollution caused by stormwater discharges. A Request for Qualifications (RFQ) was issued to compete for a multi-year project that will create a database of performance results for various BMPs by measuring and monitoring the effectiveness of these features at actual LID projects that have been constructed in Southern California.

The project is sponsored by the SBCFCD in cooperation with the Stormwater Monitoring Coalition made up of the three Southern California RWQCBs (Los Angeles, Santa Ana, San Diego), the SWRCB, the municipal permittees (the County of Ventura, Los Angeles, San Bernardino, Riverside, Orange, and San Diego), Heal the Bay, and the Southern California Coastal Water Research Project (SCCWRP).

The project will evaluate a LID pilot site with a combination of BMPs to identify the BMPs to integrate LID into existing design, construction, and maintenance programs. The project will develop a model program for localities in California that are interested in adopting LID strategies and techniques. It will produce a manual and provide training to local government and private planners to balance the needs of development while addressing the environmental concerns associated with urban runoff. Materials developed for the project will provide a foundation and benchmarks for local governments to incorporate LID techniques into their site design and construction and post-construction BMP design process.

4.2.3.2.4 Alluvial Fan Task Force

DWR is utilizing the knowledge and expertise of the WRI-CSUSB to coordinate the activities of an Alluvial Fan Task Force. Alluvial fans are prevalent throughout Southern California where alluvial fan flooding has occurred. The principle hazards associated with alluvial fan flooding at the base of mountain bases are high-velocity, debris-laden flows resulting from a series of storms, particularly following wildfires common in semi-arid regions. Alluvial fans are most prevalent in San Bernardino, Riverside, Los Angeles, Ventura, Santa Barbara, San Luis Obispo, Kern, Orange, Imperial, and San Diego Counties.

The task force will be comprised of stakeholders in areas affected by rapid growth on alluvial fans with broad representation from developers, elected officials, flood control districts, stormwater managers, water suppliers, water quality regulators, Native Americans, and the environmental community. The members of the Alluvial Fan Task Force are charged by the Legislature with reviewing the state of knowledge of alluvial fan flooding and developing a Model Ordinance that will reduce long-term flood damages on alluvial fans and provide land use guidelines for sustainable development on alluvial fans. The ordinance

will be developed collaboratively by the members of the proposed task force, under the guidance of a professional facilitator, and is intended for voluntary adoption by local governments. The findings of the proposed Alluvial Fan Task Force will be reported to the Legislature.

Funding for the task force was provided by FEMA under the Pre-Mitigation Disaster Planning Grant Program with a 25 percent match from DWR Division of Flood Management.

4.2.3.2.5 WRI Watershed Management Internship Program

The WRI-CSUSB is collaborating with the Natural Resource Conservation Service (Redlands office), SAWPA, local resource conservation districts, and other watershed groups to provide multi-disciplinary internships on watershed management-related projects regarding increasing population, changing land use patterns, and expanding urbanization in the Santa Ana watershed.

Funded by the United States Department of Agriculture, the project will select up to 30 underrepresented students for paid internships to conduct scientific research in the Santa Ana watershed on real-world problems and trains students in the latest Internet-based information sharing systems.

4.2.3.4 Recreation and Public Access Strategy

This is a strategy to maintain and create new opportunities for the public to enjoy the area's waterways and other recreational amenities; enhance the watershed's natural features; and ensure access to the region's wetlands, lakes, and streams. In anticipation of further growth in the region, this strategy reflects the need for a balance between growth of urban areas and the environment to maintain a viable habitat for native plant and wildlife species, and to maintain a high quality of life for watershed residents and visitors. An effective means of establishing this balance is the development of open space corridors that allow for multiple species habitat, wetlands, storm flow capture and aquifer recharge, water quality improvements, and passive and active recreational facilities and open spaces.

When completed, the Santa Ana River Trail System will extend from Huntington Beach to the crest of the San Bernardino Mountains.

The development of the Santa Ana River Trail System (SART) trail tread and the integration of the trail tread with other (federal, state, regional, and local) planning initiatives is the backbone of this strategy. The SART is a 110-mile walking/biking/recreational trail system along the SAR. When completed, the trail will extend from the ocean in the City of Huntington Beach to the Crest of the San Bernardino Mountains. It will connect the many trails,

recreation, and open space amenities into one cohesive park and trail system. At the trailhead in the San Bernardino Mountains it will connect to the USFS system of trails and to the Pacific Crest Trail.

Because SART involves many different governmental agencies and would cross many different landowners and water management facilities, it is critical that it be fully integrated with related plans. For example, SART is being planned in coordination with the Upper Santa Ana Wash Habitat Conservation Plan and the land use planning of the Cities of Highland and Redlands and the County of San Bernardino. Through this coordinated approach, the development of SART will advance multiple species habitat, wetlands, storm flow capture and groundwater recharge, water quality improvements, and passive and active recreational open spaces.

In the Upper SAR watershed, the SART will traverse a total of approximately 26 miles, the first eight miles of which are completed. This segment is located entirely in Riverside County beginning at Riverside Narrows and ending at the San Bernardino County line.

In San Bernardino County, the SART will traverse approximately 18 miles, primarily along the south levee of the river. A master plan for the SART was approved by the San Bernardino County Board of Supervisors in July 1990, and two initial phases of trail construction, a total of 6.7 miles, are completed. Planning, design, and permitting are currently underway for the final two phases of the SART, described below.

SART Phase III Project – SART Phase III is a 3.5-mile segment of the SART that will extend from Waterman Avenue in the City of San Bernardino to California Street in the City of Redlands. The trail tread width will be 18 feet, made up of 10 to 12 feet of asphalt and 6 to 8 feet of non-paved shoulder. The trail tread will be designed to Caltrans standards. The sponsor of this project is the County of San Bernardino Parks Department.

SART Phase IV Project – SART Phase IV is the final 7.8-mile segment of the SART system trail tread that will extend from California Street in the City of Redlands to Greenspot Road in the community of Mentone. The trail tread width will be 18 feet, made up of 10 to 12 feet of asphalt and 6 to 8 feet of non-paved shoulder. The trail tread will be designed to Caltrans standards. The sponsor of this project is the County of San Bernardino Parks Department.

5 Integrated Regional Water Management Plan Implementation

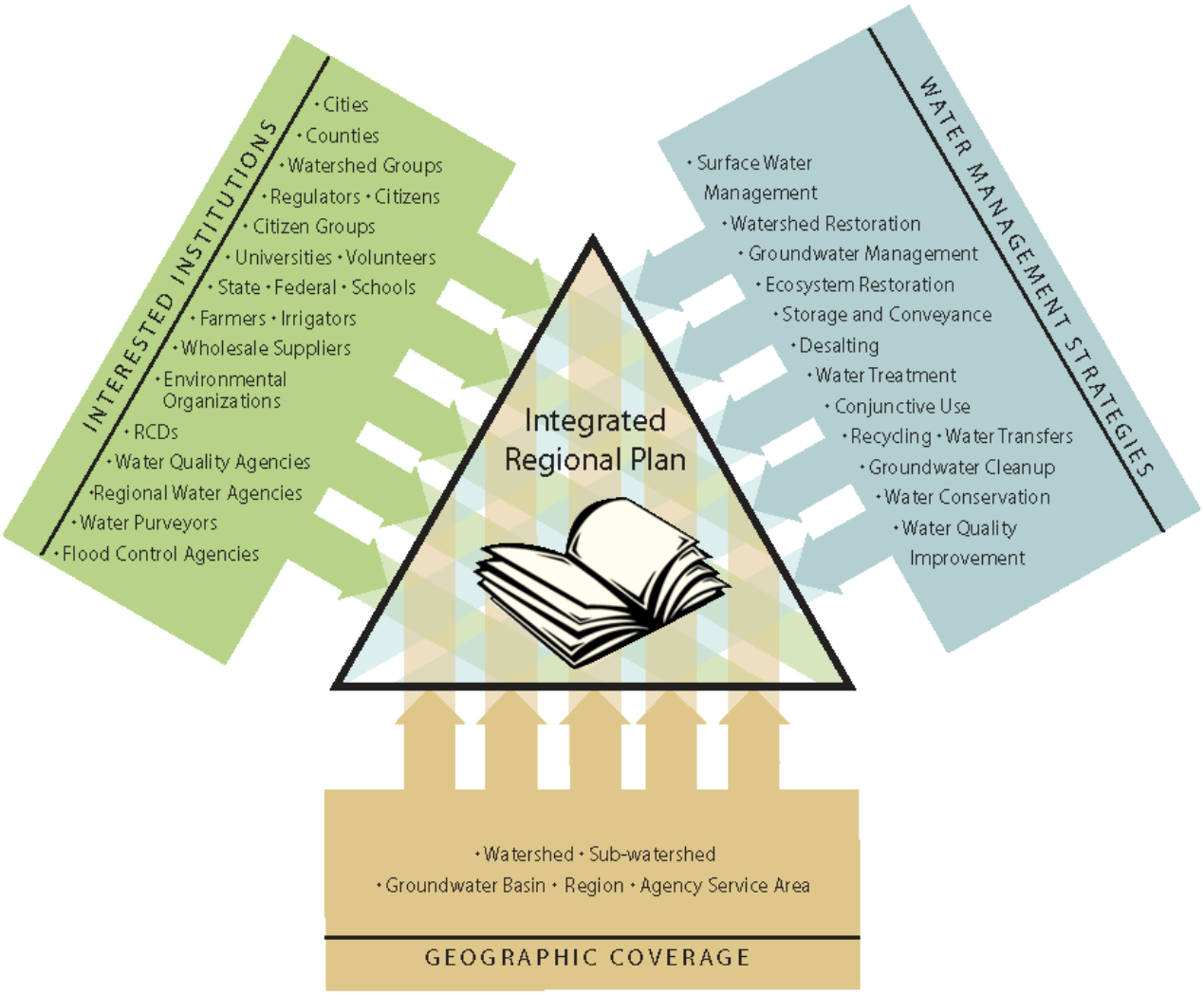
5.1 Integration of Water Management Strategies

Regional planning is a process in which regional agencies and stakeholders come together to develop a plan that serves the individual agencies involved as well as serving the region as a whole. Regional planning promotes sharing of resources and facilities and implementation of strategies that have benefits for multiple agencies.

Integrated planning encourages broad investigation of the interrelated strategies and implementation of projects that provide multiple benefits and serve a wide range of strategies. The investigation is designed to help develop water management strategies that contribute to achievement of multiple objectives. Integrated regional water management planning brings various water interests, stakeholders, and institutions together to plan for future management and use of resources in a large geographic area (Figure 5-1). With the above concept in mind, the Upper Santa Ana River Watershed Integrated Regional Water Management Plan (IRWM Plan) has been developed to prepare a road map for management of the water resources in the region. The Technical Advisory Group (TAG) recognized from the beginning that management of groundwater resources, surface supplies, stormwater, and imported water are inseparable and intrinsically interrelated. It is also recognized that water quality plays a critical role in management of groundwater basins and groundwater conjunctive use implementation.

During the planning process, interrelated water management strategies are identified and planned so that they work together in an integrated fashion. Some examples of such integrated planning are discussed below.

Figure 5-1
Integrated Regional Water Management Planning



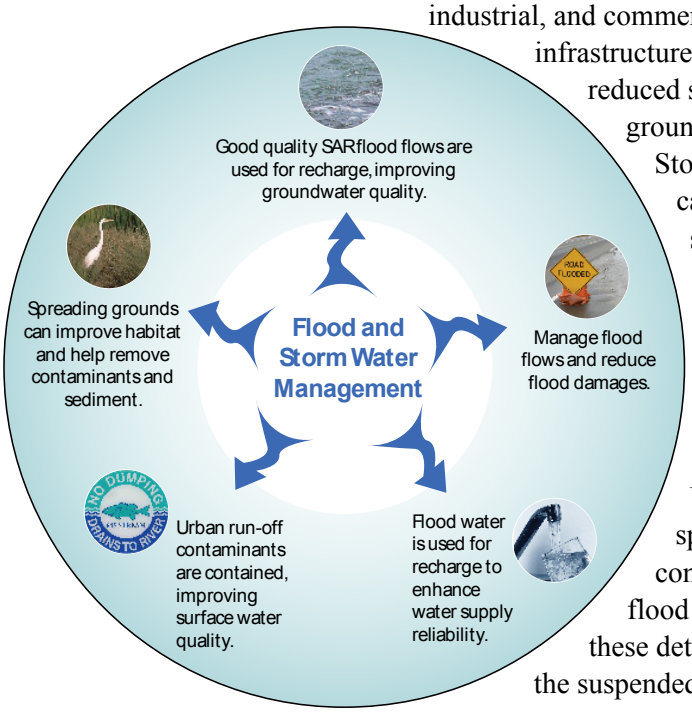
5.1.1 Integration of Surface Water and Groundwater Resources Strategies

Today, groundwater provides 79 percent of the water supply to the region and groundwater basins are used for water storage to regulate the highly variable local surface water and imported supplies. In order to continue to regulate the highly variable surface water in the region, surface water and groundwater resources must be integrated and optimized. When surface water is available it should be used for recharge as well as direct use. In addition, the region should work to limit the amount of high flows that go to the ocean in any given year.

These goals can be achieved through integration of surface water and groundwater.

5.1.2 Integration of Stormwater Management, Flood Management, Water Supply Reliability, and Surface and Groundwater Quality

The Upper Santa Ana River (SAR) Watershed is heavily developed. Housing, industrial, and commercial development, roads, and other urban infrastructure have replaced natural vegetation, which has reduced soil absorption capacity, reduced groundwater recharge, and increased urban runoff. Stormwater can cause flood damage and can carry sediment and urban pollutants into streams. Although stormwater can cause flooding, with proper management it could provide a source of water supply to this arid region. Improvement in the management of stormwater can help the region achieve multiple objectives while integrating a number of strategies in the Upper Santa Ana Region. Generally speaking, stormwater is captured and conveyed to detention basins to reduce peak flood flows and reduce flood damage. However, these detention basins can also be designed to settle the suspended sediment and pollutants out of the water, increase groundwater recharge, and possibly provide wildlife habitat. Use of stormwater for groundwater recharge and use of flood control detention basins for groundwater recharge during the non-flood seasons are strategies that have been used within the region and should be further enhanced to improve water supply reliability and groundwater quality in the Upper Santa Ana Region.



Integration of Water Management and Flood Management Strategies in the Upper Santa Ana River Watershed

5.1.3 Integration of Water Supply Reliability and Water Quality Strategies

Contamination plumes present a challenge and constraint for management and use of groundwater resources. An integrated approach has been taken to clean the plumes, which will eventually remove them as a constraint and improve water supply reliability for water users in the region. The Bunker Hill Basin Regional Water Supply Project is an example of a project that seeks to speed the cleanup of a contamination plume by pumping and treating water from the "heart" of the plume. This type of strategy can expedite the clean-up process and

facilitate conjunctive use of the basins while providing reliable water supplies for the water purveyors.

5.1.4 Integration of Imported Water and Local Water Supplies Strategies

The region has a significant public investment in and is dependent upon imported water to meet the region's water needs into the future. However, the State Water Project (SWP) can be unreliable. To improve the reliability of SWP water supply, the region should take delivery of its entire Table A amount each year and store any "leftover" amount that is not used directly by the local water agencies. The water could be stored within local groundwater basins or in a "water bank." By storing as much SWP water as possible during "wet" years, the region will have that water available during drought periods.

5.2 Projects Identified for IRWM Plan Implementation

To implement the water management strategies identified in this plan, over 100 projects have been proposed. Project descriptions have been developed for these projects and are presented in Appendix E.

The focus of these projects is driven by the Water Management Objectives as well as Basin Management Objectives (BMOs) formulated during the planning process. These objectives include improving surface water and groundwater management, water supply reliability, water quality protection, ecosystem improvement, and environmental enhancement.

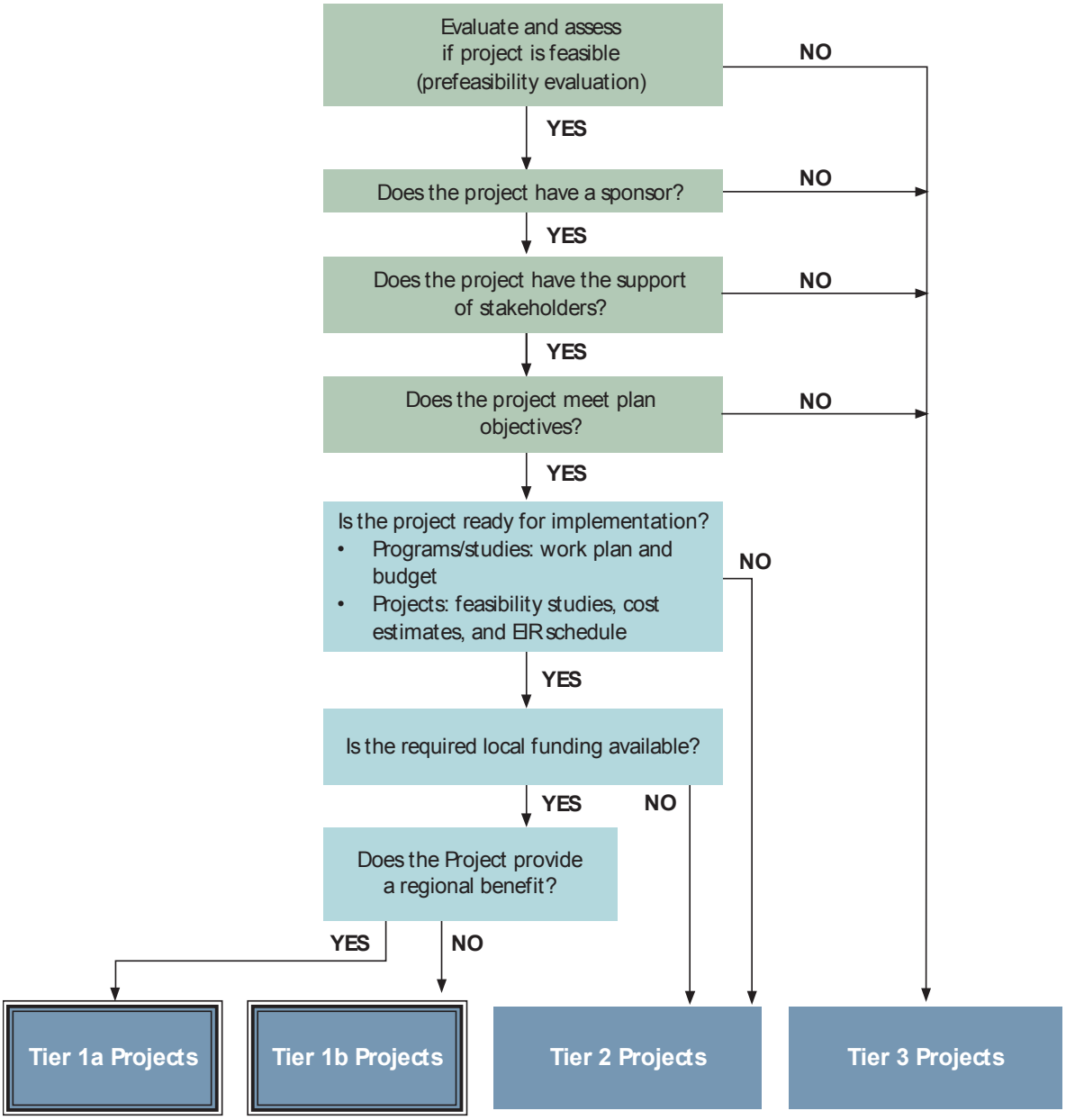
Some of the projects were taken from previous planning efforts such as the San Bernardino Valley Municipal Water District's (Valley District) Master Plan. The list also includes projects that will allow the region to capture and use SAR floodwater. The City of San Bernardino, the largest pumper in the Bunker Hill Basin and the key local agency with responsibility for mitigation of groundwater contamination, is the lead agency for the Bunker Hill Regional Water Supply Project, which involves several other agencies. Projects included in previous Santa Ana Watershed Project Authority (SAWPA) planning studies and Urban Water Management Plans (UWMPs) were also evaluated to identify specific projects that could achieve the objectives of the region and are incorporated into the plan.

In a series of TAG meetings starting in March 2006 and continuing through 2007, the TAG members reviewed the list of projects and provided additional input. Water agencies within the area that are not part of the TAG were also encouraged to participate in development of the list. Most of these projects are integrated and serve multiple strategies. Together, these projects help develop a regional system that would integrate the use of groundwater, SWP water of the State of California (State) contractors in the region, flood and stormwater, and local surface water to meet the Water Management Objectives.

5.2.1 Project Prioritization and Screening Process

The primary purpose of project prioritization and ranking is to provide a process for water leaders in the region to review the proposed projects and collectively decide the region's priorities for the construction of facilities. To facilitate this task, a prioritization and ranking process was developed and is presented in Figure 5-2. The project prioritization and ranking is a two-step process. The first step is to ensure that the project has a sponsor and meets the planning objectives and strategies. The projects that do not pass the first step will be ranked as Tier 3 projects until additional information is gathered that would suggest that it have a higher priority. The second step is to prioritize the projects that pass the first step. It is important to note that project ranking and prioritization is a

Figure 5-2
Planning Process for Project Screening and Ranking



"snapshot in time" and that projects will move from tier to tier as they meet the criteria requirements.

5.2.1.1 Definitions

5.1.2.1.1 Tier 1 Projects

Tier 1a and 1b projects are currently ready for construction per the following criteria:

- Projects have completed or will complete environmental documentation and feasibility studies and cost estimates by July 1, 2008, and will be ready for implementation by July 1, 2009 (design will be completed).
- Studies that are needed to improve water management in the region have developed a detailed scope of work and study cost estimate.
- Projects have necessary local funding for implementation.
- Projects serve the region and reduce regional water supply system vulnerability.

The only difference between Tier 1a and Tier 1b projects is that Tier 1a projects are regional (serve more than three communities).

5.1.2.1.2 Tier 2 Projects

Tier 2 projects include those projects that may not be ready for implementation or do not have local funding. Once a Tier 2 project meets all of the necessary criteria, it can become a Tier 1a or Tier 1b project.

5.1.2.1.3 Tier 3 Projects

Tier 3 projects are conceptual in nature as defined by the following:

- Technically, economically, or financially not feasible at this time (through a pre-feasibility evaluation of the project).
- Lack of local support/sponsor.
- Inconsistent with current water management goals and objectives of the region.
- Inconsistent with existing regulatory or institutional setting.

Once a Tier 3 project meets all of the necessary criteria, it will become a Tier 2 or Tier 1 project.

To prioritize and rank the project, a set of scoring criteria were developed and reviewed by the TAG. The criteria were then applied to all projects to prioritize implementation. A detailed description of the project ranking and scoring criteria is shown in Appendix E. A list of the projects and the results of the project prioritization and ranking is shown in Table 5-1. Table 5-2 shows how projects meet the region's objectives and their relation to water management strategies.

Figure 5-3 shows the locations of the proposed projects.

Table 5-1
Upper Santa Ana IRWM Plan Project Ranking

STRATEGY	PROJECT NO	PROJECTS	Agency/ Project Sponsor	Project Effectiveness: Meets IRWMP Objectives: SGM	WSR	WQP	ESR	Supports Integration and Multiple Water Management Strategies	Provides Public Safety and Emergency Needs	Serves Disadvantaged Communities	Project commitment: Readiness for Implementation	Availability of Local Funds	Regional Benefit: Serves the Region	Reduce Water Supply Vulnerability	Overall Project Implementation Priority	Tier
Tier 1a - Regional Projects that are "Ready"																
	54	Bunker Hill Regional Water Supply	City of SB	2	1	1	0	5	0	5	5	5	5	5	34	1a
	90.3	City Creek Crossing	SBVMWD	0	2	0	0	5	0	5	5	5	5	5	32	1a
	15	Seven Oaks Dam Borrow Pit Groundwater Recharge and Habitat	Conservation	2	1	0	1	5	0	2	5	5	5	5	31	1a
	12	Central Feeder:	SBVMWD	1	2	0	0	5	0	2	5	5	5	5	30	1a
	12.1	Central Feeder Pipeline	SBVMWD	See Project 12												
	12.3	San Bernardino Pump Station #2	SBVMWD	See Project 12												
	1.1	Enhance Spreading	SBVMWD	2	1	0	0	5	0	2	5	5	5	5	30	1a
	4.0	Santa Ana River Construction Area - Plunge Pool Pipeline	SBVMWD	2	1	0	0	5	0	2	5	5	5	5	30	1a
	80.2	Alabama Street Connector Pipeline	SBVMWD	1	2	0	0	5	0	2	3	5	5	5	28	1a
	80.3	Alabama Street Wellfield	SBVMWD	1	2			5	0	2	3	5	5	5	28	1a
	46	Pellesier Ranch Barrier Wells and Water Treatment Plant	RPU	1	2	0	0	5	3	0	3	3	5	5	27	1a
	19	Riverside-Corona Feeder	WMWD	1	2	0	0	5	0	2	5	1	5	5	26	1a
	12.7	Riverside Pump Station (Raub Emergenecy Supply Intertie)	RPU, SBVMWD, WMWD	1	2	0	0	3	3	0	3	3	5	5	25	1a
Tier 1b - Non-Regional Projects that are "Ready"																
	9	Lytle Creek and Glen Helen Turnout	SBVMWD	1	2	0	0	5	0	0	5	3	3	2	21	1b
	11	LIDS for Kids- Low Impact Development	IERCD	1	0	0	2	5	0	2	3	3	5	0	21	1b
	18	San Timoteo Creek Aquatic Restoration	Redlands	1			2	5	0	2	3	3	5	0	21	1b
	42	Oak Valley WRP	Yucaipa Valley WD	0	2	1	0	5	0	0	5	5	1	2	21	1b
	48	Muscoy Spreading Basins	City of SB	1	2			5	0	5	3	5	0	0	21	1b
	97	Erwin Lake/Sugarload Fire Flow & Water Transmission Improvement	BBLDWP	0	2	0	0	3	5	0	5	5	1	0	21	1b
	99	Fontana Water Company Recycled Water Project	FWC	0	2	1	0	5	0		5	5	3	0	21	1b
	110	San Timoteo Canyon State Park Acquisition and Restoration Project	WRI-CSUSB	0	0	1	2	5	0	2	5	3	3	0	21	1b
	118	Lytle Creek Watershed Assessment and Restoration	R.L.C.	0	1	1	2	5	0	2	5	5	0	0	21	1b
	127	Rialto Direct Connection to State Water Project	Rialto		2			5	0	5	3	3	1	2	21	1b
	6	Inland Empire Sustainable Watershed Program	IERCD	1		1	2	3	0	2	5	3	5	0	22	1b
	23	Installation of Groundwater Monitoring Wells in Santa Ana River	Conservation	2	0	0	0	5	0	2	5	3	5	0	22	1b
	28	Tertiary Treatment Plant and Reclaimed Water Expansion Study	Rialto	0	2	1	0	5	0	5	3	3	3	0	22	1b
	51	Groundwater Reclamation Interagency Project (GRIP)	City of Redlands	1	2	1	0	5	0	0	3	5	5	0	22	1b
	53	Medical Center No. 2 Reservoir and Pump Station to Lower Zone	City of SB	0	2	0	0	3	3	5	5	3	1	0	22	1b
	58	City of San Bernardino Water Recycling - RIX	City of SB	0	2	1	0	5	0	5	3	3	3	0	22	1b
	98	Waterman-Gage Intertie	RPU	1	2	0	0	5	3	0	3	3	3	2	22	1b
	113	Removal of Invasive Plant Maintenance	IERCD	1	1	0	2	3	0	0	5	5	5	0	22	1b
	124	SAR Trail - Phase III	SBCPD	0	0	0	2	5	0	2	3	5	5	0	22	1b
	125	SAR Trail - Phase IV	SBCPD	0	0	0	2	5	0	2	3	5	5	0	22	1b
	128	Characterization Study of the Contaminant Plume in the Rialto-	Rialto		1	2		5	0	5	3	3	1	2	22	1b
	129	Groundwater Production and Perchlorate Removal Treatment	Rialto		2	1		5	0	5	3	3	1	2	22	1b
	131	Groundwater Remediation - Capture High-Concentration Perchlorate	Rialto		1	2		5	0	5	3	3	1	2	22	1b
	132	Long-Term Remediation Plan for Rialto-Colton Basin	Rialto		1	2		5	0	5	3	3	1	2	22	1b
	16	Recycled Water Program	BBARWWA	0	2	1	0	5	0	0	5	5	3	2	23	1b
	22	City of Beaumont WWTP	City of Beaumont	0	2	1	0	5	0	0	5	5	3	2	23	1b
	27	Rialto -Colton Basin Groundwater Recharge Study	WVWD, Rialto	2	1	0	0	5	0	5	5	5	0	0	23	1b
	102	Big Bear Lake - Lake Management Plan	Multiple Agencies	0	0	2	1	5	0	0	5	5	5	0	23	1b
	126	North Village Water Treatment Facility	WVWD	1	2	1		3	3	0	5	5	3	0	23	1b
	130	Extension of the Baseline Feeder Agreement	Rialto		2			5	0	5	3	5	1	2	23	1b
	13	Riverside North Recharge Basin	RPU	2	1	1	0	5	0	0	5	5	5	0	24	1b
	25	North Lake Project	SBVMWD	0	2	0	1	3	5	2	3	3	5	0	24	1b
	114	Warm Creek Restoration Project	IERCD	1	1	0	2	3	0	2	5	5	5	0	24	1b
	31	Randall Basin	FCD	2	1	0	0	3	3	5	5	5	1	0	25	1b
	33	Sand/Warm Confluence	FCD	2	1	0	0	5	3	5	5	3	1	0	25	1b
	36	West End Pump Station	SBVMWD	1	2	0	0	5	0	2	5	5	5	0	25	1b
	121	Alluvial Fan Development Guideline	WRI-CSUSB	2	1	1	1	5	0	2	5	3	5	0	25	1b
	10	Wash Land Management Habitat Conservation Plan	Conservation	1	1	0	2	5	0	2	5	5	5	0	26	1b
	120	Water Conservation Demonstration Garden	SBVMWD	1	2	0	1	5	0	2	5	5	5	0	26	1b
	123	Regional W. C. Feasibility Study	SBVMWD	1	2	0	1	5	0	2	5	5	5	0	26	1b
	8	Lytle Creek Construction Area	SBVMWD	2	1	0	0	5	0	2	5	5	5	2	27	1b
	119	Model Institutional WC Makeover	SBVMWD, WRI-CSUSB	1	2	1	1	5	0	2	5	5	5	0	27	1b
	29	Cactus Basins #4 and #5	FCD	2	1	1	1	5	3	5	5	5	1	0	29	1b
	30	Cactus Basin #3	FCD	2	1	1	1	5	3	5	5	5	1	0	29	1b

Notes: Project readiness include completion of pre-feasibility study, environemental documenetation, project design, and expected implementation date

Tier: 1a - If Regional Benefit is 10 and Total Score is more than 20.
1b - If Total Score is more than 20
2 - If Regional Benefit is less than 10 and Total Score is less than 21
3 - If score for Project Commitment is 4 or less

Terms:
SGM Surface Water and Groundwater Management
WSR Water Supply Reliability
WQP Water Quality Protection
ESR Ecosystem Restoration

Agencies:
BBARWWA Big Bear Area Regional Wastewater Agency
BBLDWP Big Bear Lake Department of Water and Power
IERCD Inland Empire Resource Conservancy District
RPU City of Riverside Public Utility Department
RLD Riverside Land Conservancy
SBVMWD San Bernardino Valley Municipal Water District
City of San Bernardino San Bernardino Municipal Water Department
SBCPD San Bernardino County Parks Department
WRI-CSUSB Water Resources Institute - California State University San Bernadino
WVWD West Valley Water District
Conservation San Bernardino Valley Water Conservation District
WMWD Western Municipal Water District
FWC Fontana Water Company

Scoring Criteria

1 Meets Objectives: Score 2 for one objective. Add 1 point for each additional objective met.
2 Supports Strategies: Score 1 for single strategy. Score 3 if integrated. Score 5 if integrated and supports multiple strategies.
3 Provides for Public Safety and Emergency Needs: Project is needed for either, score 3. Project is needed for both, score 5.
4 Serves Disadvantaged Communities: Provides regional benefit including disadvantaged communities, score 2. Provides specific benefit to disadvantaged communities and addresses environmental justice concerns, 5 points.
5 Ready for Implementation: Score 1 point for limited information. Score 3 points for a completed feasibility study or pre-design documents and a preliminary scope of work and budget estimate. Score 5 points if environmental documentation and feasiblity study is complete and has a detailed scope of work and budget.
6 Available Local Funds: No funds, 0 point. 10%, 2 points. 50%, 3 points. 90% or more, 5 points.
7 Serves the Entire Region: Serves single agency, 1 point. Serves up to three agencies, 3 points. Serves multiple communities and agencies and is a regional project, 5 points.
8 Reduces Water Supply System Vulnerability: For single community, 2 points. For the region, 5 points.

Table 5-1
Upper Santa Ana IRWM Plan Project Ranking

STRATEGY / PROJECT NO	PROJECTS	Agency/ Project Sponsor	Project Effectiveness: Meets IRWMP Objectives: SGM	WSR	WQP	ESR	Supports Integration and Multiple Water Management Strategies	Provides Public Safety and Emergency Needs	Serves Disadvantaged Communities	Project commitment: Readiness for Implementation	Availability of Local Funds	Regional Benefit: Serves the Region	Reduce Water Supply Vulnerability	Overall Project Implementation Priority	Tier
Tier 2 - Projects Needing Additional Work															
45	Septic System Conversion Highgrove Area - Phase II	RPU	1	1	2	0	5	0	0	3	3	3	2	20	2
70.3	Yucaipa Connector	SBVMWD	1	2	0	0	3	3	0	3	3	5	0	20	2
43	Riverside Regional Water Quality Control Plant		0	2	1	0	5	0	0	3	3	3	2	19	2
20	Regional Water Supply Renewal	YVWD	0	1	2	0	5	0	0	3	3	3	0	17	2
26	City of Redlands WWTP	City of Redlands	0	2	1	0	5	0	0	3	3	1	2	17	2
24	Security Fencing of Groundwater Recharge Facilities	Conservation	2	1	0	0	5	0	2	3	3	0	0	16	2
57	Bunker Hill Basin Water Supply Reliability	WVWD	1	2	0	0	5	0	0	3	3	1	0	15	2
21	Horace P. Hinckley WTP	City of Redlands	0	2	1	0	3	0	0	3	3	1	0	13	2
Tier 3 - Projects Further Out on the "Planning Horizon," Need More Implementation Commitment															
39.1	Mentone Pipeline	SBVMWD	1	2	0	0	5	0	2	1	3	5	5	24	3
39.2	Mentone Feeder	SBVMWD	1	2	0	0	5	0	2	1	3	5	5	24	3
39.3	Citrus Pump Station (Mentone Pump Station)	SBVMWD	1	2	0	0	5	0	2	1	3	5	5	24	3
39.4	Citrus Reservoir (Mentone Reservoir)	SBVMWD	1	2	0	0	5	0	2	1	3	5	5	24	3
40.1	DWR Pump Station Alternative 1	SBVMWD	1	2	0	0	5	0	2	1	3	5	5	24	3
40.2	DWR Pump Station Alternative 2 (only count cost of 40.1 as these are alternatives)	SBVMWD	1	2	0	0	5	0	2	1	3	5	5	24	3
7	Devil Canyon Construction Area	SBVMWD	2	1	0	0	5	0	2	1	3	5	2	21	3
12.6	Redlands Reservoir	SBVMWD	0	2	0	0	5	0	2	1	3	5	2	20	3
35	Existing Pilot Dewatering and Phased Dewatering Project	SBVMWD	2	1	0	0	5	3	5	1	3	0	0	20	3
37	9th Street Feeder	SBVMWD	1	2	0	0	5	0	5	1	3	1	2	20	3
14	Surface Water Treatment Plants	SBVMWD	1	2	1	0	3	0	5	1	1	5	0	19	3
59	Lytle Creek Reservoir	City of SB	0	2	0	0	3	0	5	1	3	5	0	19	3
60.1	Baseline Feeder West Extension	SBVMWD	1	2	0	0	5	0	2	1	3	5	0	19	3
80.1	Orange Street Connector Pipeline	SBVMWD	1	2	0	0	5	0	2	1	3	5	0	19	3
12.4	Redlands Pump Station	SBVMWD	0	2	0	0	3	0	2	1	3	5	2	18	3
70.2	Yucaipa Pump Station	SBVMWD	1	2	0	0	3	3	0	1	3	5	0	18	3
1	Seven Oaks Dam and Reservoir Construction Area	SBVMWD	1	2	0	0	5	0	2	1	1	5	0	17	3
32	Constructed Wetlands	WRI-CSUSB	0	0	1	2	5	0	5	1	3	0	0	17	3
38.1	South End Feeder	SBVMWD	1	2	0	0	5	0	0	1	3	5	0	17	3
38.2	South End Pump Station	SBVMWD	1	2	0	0	5	0	0	1	3	5	0	17	3
60.2	Baseline Feeder Pump Station (East and/or West Alternative)	SBVMWD	0	2	0	0	3	0	5	1	3	3	0	17	3
34	Cable Creek	FCD	2	1	0	0	3	3	2	3	1	1	0	16	3
55	Medical Center to Virginia Street Connector	City of SB	0	2	0	0	3	0	5	1	3	1	0	15	3
100	Foothill Pipeline Enlargement	SBVMWD	0	2	0	0	3	0	2	1	3	1	3	15	3
61	Waterman Pump Station to Lower Zone	City of SB	0	2	0	0	3	0	5	1	3	0	0	14	3
12.2	San Bernardino Pump Station #1	SBVMWD	0	2	0	0	3	0	0	1	3	1	2	12	3
70.1	Yucaipa Lakes Pipeline	SBVMWD	0	2	0	0	3	0	0	1	3	1	0	10	3
4.1	Morton Canyon Hydroelectric Gen. Plant	SBVMWD	0	0	0	0	0	0	0	0	0	0	0	0	3
DWR Projects															
39.5	East Branch Extension of the SWP, Phase 2	DWR	1	2	0	0	5	0	2	3	3	5	5	26	1a
39.6	DWR Pump Station Expansions	DWR	0	2	0	0	5	0	2	3	3	5	5	25	1a
39.8	Zanja Reservoir	DWR	1	2	0	0	5	5	2	1	3	3	3	25	3
39.7	Sunrise Ranch Reservoir	DWR	1	2	0	0	5	5	2	1	3	5	0	24	3
Back Burner Projects															
	BCV Forest Land Reserved														
	Bogart Park Wetlands														
	City of Beaumont Desalter	City of Beaumont													
	Sari Improvement Project														
	Stanfield Marsh														
122	Numeric Groundwater Model for Riverside/Arlington Groundwater Basins	RPU, WMWD													

Notes: Project readiness include completion of pre-feasibility study, environemental documenetation, project design, and expected implementation date

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WQP Water Quality Protection
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BBLDWP Big Bear Lake Department of Water and Power
IERCD Inland Empire Resource Conservancy District
RPU City of Riverside Public Utility Department
RLD Riverside Land Conservancy
SBVMWD San Bernardino Valley Municipal Water District
City of San Bernardino San Bernardino Municipal Water Department
SBCPD San Bernardino County Parks Department
WRI-CSUSB Water Resources Institute - California State University San Bernardino
WVWD West Valley Water District
Conservation San Bernardino Valley Water Conservation District
WMWD Western Municipal Water District
FWC Fontana Water Company

Scoring Criteria

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Table 5-2
Upper Santa Ana IRWMP Prioritization and Cost

OBJECTIVES	STRATEGY PROJECT NO	PROJECTS	Agency/ Project Sponsor	Project Ranking/ Tier	Objectives SGM	WSR	WQP	ESR	Strategies	Funding Opportunities	Projected Costs
IMPROVE WATER SUPPLY RELIABILITY	WATER TREATMENT AND RECYCLING										
	14	**Surface Water Treatment Plants**	SBVMWD	3	✓	✔	✓		**WS, SWQ**	**PROP 84**	
	16	**Big Bear Area Regional Wastewater Agency Plant**	BBARWWA	2		✔	✓		**WTR, SWQ, WS**	**SWRCB**	$42,600,000
	21	**Horace P. Hinckley WTP**	City of Redlands	2		✔	✓		**WTR, SWQ, WS**	**SWRCB, DPH**	
	28	**Tertiary Treatment Plant and Reclaimed Water Expansion Study**	Rialto	1b		✔	✓		**WTR, SWQ, WS**	**SWRCB**	$165,000
	58	**City of San Bernardino Water Recycling - RIX**	City of SB	1b		✔	✓		**WTR, SWQ, WS**	**SWRCB**	$67,800,000
	22	**City of Beaumont WWTP**	City of Beaumont	1b		✔	✓		**WTR, SWQ, WS**	**SWRCB, DPH**	
	26	**City of Redlands WWTP**	City of Redlands	2		✔	✓		**WTR, SWQ, WS**	**SWRCB, DPH**	
	42	**Oak Valley WRP**	Yucaipa Valley WD	1b		✔	✓		**WTR, SWQ, WS**	**SWRCB, DPH**	
	43	**Riverside Regional Water Quality Control Plant**		2		✔	✓		**WTR, SWQ, WS**	**SWRCB, DPH**	
	126	**North Village Water Treatment Facility**	WVWD	1b		✔	✓		**WTR, SWQ, WS**	**SWRCB**	$14,540,000
	99	**Fontana Water Company Recycled Water Project**	FWC	1b		✔	✓		**WTR, SWQ, WS**	**SWRCB**	$7,547,352
	WATER CONSERVATION										
	123	**Regional W. C. Feasibility Study**	SBVMWD	1b	✓	✔		✓	**WC, WS, EHE**	**PROP 84 CH 2, PROP 50**	$250,000
	120	**Water Conservation Demonstration Garden**	SBVMWD	1b	✓	✔		✓	**WC, WS, EHE**	**PROP 50, PROP 84**	$120,000
	119	**Model Instutional WC Makeover**	SBVMWD, WRI-CSUSB	1b	✓	✔		✓	**WC, WS, EHE**	**PROP 50, PROP 84**	$350,000
	CONVEYANCE AND INTERTIE										
	9.1 & 9.2	**Lytle Creek and Glen Helen Turnout**	SBVMWD	1b	✓	✔			**CI, WS**	**PROP 84 CH 2**	$4,160,000
	12.1	**Central Feeder Pipeline**	SBVMWD	1a	✓	✔			**CI, WS**	**PROP 84 CH 2**	$117,000,000
	12.2	**San Bernardino Pump Station #1**	SBVMWD	3		✔			**CI, WS**	**PROP 84 CH 2**	$2,900,000
	12.3	**San Bernardino Pump Station #2**	SBVMWD	1b		✔			**CI, WS**	**PROP 84 CH 2**	$10,000,000
	12.4	**Redlands Pump Station**	SBVMWD	3		✔			**CI, WS**	**PROP 84 CH 2**	$55,000,000
	12.7	**Riverside Pump Station (Raub Emergenecy Supply Intertie)**	RPUD	1a	✓	✔			**CI, WS**	**PROP 84 CH 2**	$8,000,000
	19	**Riverside-Corona Feeder**	WMWD	1a	✓	✔			**CI, WS**	**PROP 84 CH 2**	$176,000,000
	36	**West End Pump Station**	SBVMWD	1b	✓	✔			**CI, WS**	**PROP 84 CH 2**	$10,000,000
	37	**9th Street Feeder**	SBVMWD	3	✓	✔			**CI, WS**	**PROP 84 CH 2**	$24,100,000
	38.1	**South End Feeder**	SBVMWD	3	✓	✔			**CI, WS**	**PROP 84 CH 2**	$11,500,000
	38.2	**South End Pump Station**	SBVMWD	3	✓	✔			**CI, WS**	**PROP 84 CH 2**	$1,090,000
	39.1	**Mentone Pipeline**	SBVMWD	3	✓	✔			**CI, WS**	**PROP 84 CH 2**	$11,700,000
	39.2	**Mentone Feeder**	SBVMWD	3	✓	✔			**CI, WS**	**PROP 84 CH 2**	$18,800,000
	39.3	**Citrus Pump Station (Mentone Pump Station)**	SBVMWD	3	✓	✔			**CI, WS**	**PROP 84 CH 2**	$13,800,000
	39.5	**EBX Phase 2 (Pipeline, PS & Reservoirs)**	DWR	1a	✓	✔			**CI, WS**	**PROP 84 CH 2**	$196,000,000
	39.6	**DWR Pump Station Expansions (Crafton Hills PS, Greenspot PS, Cherry Valley PS)**	DWR	1a		✔			**CI, WS**	**PROP 84 CH 2**	$5,000,000
	40.1	**DWR Pump Station Alternative 1**	SBVMWD	3	✓	✔			**CI, WS**	**PROP 84 CH 2**	$23,300,000
	40.2	**DWR Pump Station Alternative 2 (only count cost of 40.1 as these are alternatives)**	SBVMWD	same as above	Same as	above			**CI, WS**	**PROP 84 CH 2**	See 40.1
	55	**Medical Center to Virginia Street Connector**	City of SB	3		✔			**CI, WS**	**PROP 84 CH 2**	$3,475,000
	60.1	**Baseline Feeder West Extension**	SBVMWD	3	✓	✔			**CI, WS**	**PROP 84 CH 2**	$30,300,000
	60.2	**Baseline Feeder Pump Station (East and/or West Alternative)**	SBVMWD	3		✔			**CI, WS**	**PROP 84 CH 2**	$3,100,000
	61	**Waterman Pump Station to Lower Zone**	City of SB	3		✔			**CI, WS**	**PROP 84 CH 2**	$1,010,000
	70.1	**Yucaipa Lakes Pipeline Replacement**	SBVMWD	3		✔			**CI, WS**	**PROP 84 CH 2**	$760,000
	70.2	**Yucaipa Pump Station**	SBVMWD	3	✓	✔			**CI, WS**	**PROP 84 CH 2**	$12,900,000
	70.3	**Yucaipa Connector**	SBVMWD	2	✓	✔			**CI, WS**	**PROP 84 CH 2**	$4,500,000
	80.1	**Orange Street Connector Pipeline**	SBVMWD	3	✓	✔			**CI, WS**	**PROP 84 CH 2**	$4,900,000
	80.2	**Alabama Street Connector Pipeline**	SBVMWD	1a	✓	✔			**CI, WS**	**PROP 84 CH 2**	$8,800,000
	80.3	**Alabama Street Well Field**	SBVMWD	1a	✓	✔			**CI, WS**	**PROP 84 CH 2**	$4,500,000
	90.3	**City Creek Crossing**	SBVMWD	1a		✔			**CI, WS**	**PROP 84 CH 2**	$5,200,000
	97	**Erwin Lake Fire Flow**	BBLDWP	1b		✔			**CI, WS**	**PROP 84 CH 2**	$1,600,000
	98	**Waterman-Gage Intertie**	RPUD	1b	✓	✔			**CI, WS**	**PROP 84 CH 2**	$5,300,000
	100	**Foothill Pipeline Enlargement**	SBVMWD	1b		✔			**CI, WS**	**PROP 84 CH 2**	$25,000,000
	127	**Rialto Direct Connection to State Water Project**	Rialto	1b		✔			**CI, WS**	**PROP 84 CH 2**	$12,119,379
	130	**Extension of the Baseline Feeder Agreement**	Rialto	1b		✔			**CI, WS**	**PROP 84 CH 2**	
	STORAGE										
	12.5	**San Bernardino Reservoir**	SBVMWD	1b		✔			**STO, WS**	**PROP 84 CH 2**	$4,500,000
	12.6	**Redlands Reservoir**	SBVMWD	3		✔			**STO, WS**	**PROP 84 CH 2**	$5,700,000
	25	**North Lake Project**	SBVMWD	1b		✔		✓	**STO, WS**	**PROP 84 CH 2**	$133,000,000
	39.4	**Citrus Reservoir (Mentone Reservoir)**	SBVMWD	3	✓	✔			**STO, WS**	**PROP 84 CH 2**	$91,000,000
	39.7	**Sunrise Ranch Emergency Reservoir**	DWR	3	✓	✔			**STO, WS**	**PROP 84 CH 2**	$133,000,000
	39.8	**Zanja Emergency Storage**	DWR	3	✓	✔			**STO, WS**	**PROP 84 CH 2**	$130,000,000
	53	**Medical Center No. 2 Reservoir**	City of SB	1b		✔			**STO, WS**	**PROP 84 CH 2**	$18,100,000
	59	**Lytle Creek Reservoir**	City of SB	3		✔			**STO, WS**	**PROP 84 CH 2**	$16,100,000

✔ Denotes Primary Objective
✓ Denotes Secondary Objective

Strategies in **bold** are primary
Strategies not in bold are secondary

Notes: Project readiness include completion of pre-feasibility study, environemental documenetation, project design, and expected implementation date

Tier:
1a - If Regional Benefit is 10 and Total Score is more than 20.
1b - If Total Score is more than 20
2 - If Regional Benefit is less than 10 and Total Score is less than 21
3 - If score for Project Commitment is 4 or less

Terms:
SGM Surface Water and Groundwater Management
WSR Water Supply Reliability
WQP Water Quality Protection
ESR Ecosystem Restoration

Strategy Abbreviations

WTR Water Treatment and Recycling
WC Water Conservation
CI Conveyance and Intertie
STO Storage
GWM Groundwater Management
GQP Groundwater Quality Protection
CU Conjunctive Use
WS Water Supply
SWM Surface Water Management
FSW Flood and Storm Water Management
TNM TDS and Nitrogen Management
SWQ Surface Water Quality Improvement
EHE Ecosystem Protection and Habitat Enhancement
WR Wetlands Restoration
LU Land Use
RPA Recreation and Public Access
WR Water Recycling

Table 5-2
Upper Santa Ana IRWMP Prioritization and Cost

OBJECTIVES	STRATEGY / PROJECT NO	PROJECTS	Agency/ Project Sponsor	Project Ranking/ Tier	Objectives: SGM	Objectives: WSR	Objectives: WQP	Objectives: ESR	Strategies	Funding Opportunities	Projected Costs
IMPROVE SURFACE WATER AND GROUNDWATER MANAGEMENT	**GROUNDWATER MANAGEMENT**										
	15	**Seven Oaks Dam Borrow Pit Groundwater Recharge and Habitat Restoration Project**	Conservation	1a	✔	✓		✓	**GWM, CU, EHE**	**PROP 84 CH 2, PROP 84 CH 5**	$9,700,000
	23	**Installation of Groundwater Monitoring Wells in Santa Ana River Forebay**	Conservation	1b	✔				**GWM**	**AB 303**	$640,000
	27	**Rialto -Colton Basin Groundwater Recharge Study**	WVWD	1b	✔	✓			**GWM, CU**	**PROP 84 CH 2 NON-IRWMP, AB303**	$280,000
	121	**Alluvial Fan Development Guideline**	WRI-CSUSB	1b					**GWM, LU, FSW**	**PROP 84 CH 3, 1E**	$630,000
	122	**Numeric Groundwater Model for Riverside/Arlington Groundwater Basins**	RPUD, WMWD		✔	✓			**GWM, CU**	**AB 303**	
	GROUNDWATER QUALITY PROTECTION										
	35	**Existing Pilot Dewatering and Phased Dewatering Project**	SBVMWD	3	✔	✓			**GWM, GQP, WS**	**PROP 84 CH 2**	Unknown
	45	**Septic System Conversion Higrove Area- Phase II**	RPUD	2	✓	✓	✔		**GQP, WS**	**PROP 84 CH 2, DPH**	$9,730,000
	46	**Pellesier Ranch Barrier Wells and Water Treatment Plant**	RPUD	1a	✓	✔			**GQP, WS, CI**	**PROP 84 CH 2, PROP 84 CH 2 NON-IRWMP, DPH**	$17,700,000
	51	**Groundwater Reclamation Interagency Project (GRIP)**	City of Redlands	1b	✓	✔	✓		**GQP, WS, WR**	**PROP 84 CH 2**	$9,100,000
	54	**Bunker Hill Regional Water Supply**	City of SB	1a	✔	✓	✓		**GQP, WS, GWM**	**PROP 84 CH 2, PROP 84 CH 2 NON-IRWMP, DPH**	$86,300,000
	57	**Bunker Hill Basin Water Supply Reliability**	WVWD	2	✓	✔			**GQP**	**PROP 84 CH 2**	$13,000,000
	128	**Characterization Study of the Contaminant Plume in the Rialto-Colton Basin**	Rialto	1b	✔	✓			**GQP, WS**	**AB 303**	$6,490,561
	129	**Groundwater Production and Perchlorate Removal Treatment**	Rialto	1b	✔	✓			**GQP, WS**	**PROP 84 CH 2, DPH**	$6,060,000
	131	**Groundwater Remediation - Capture High-Concentration Perchlorate Contamination in the Rialto-Colton Basin**	Rialto	1b	✔	✓			**GQP, WS**	**PROP 84 CH 2, DPH**	$14,500,000
	132	**Long-Term Remediation Plan for Rialto-Colton Basin**	Rialto	1b	✔	✓			**GQP, WS**	**PROP 84 CH 2, DPH**	$250,000
	CONJUNCTIVE USE										
	1	**Seven Oaks Dam and Reservoir Construction Area**	SBVMWD	3	✓	✔			**SWM, CU, WS**	**PROP 84 CH 2**	$29,000,000
	1.1	**Enhance Spreading**	SBVMWD	1a	✓	✔	✓		**SWM, CU, WS**	**PROP 84 CH 2**	$8,000,000
	4.0	**Santa Ana River Construction Area**	SBVMWD	1a	✔	✓			**SWM, CU, WS**	**PROP 84 CH 2**	$122,000,000
	4.1	**Morton Canyon Hydroelectric Gen. Plant**	SBVMWD	3					**CU**	**OTHER**	$38,000,000
	7	**Devil Canyon Construction Area**	SBVMWD	3	✔	✓			**SWM, CU, WS**	**PROP 84 CH 2**	$1,720,000
	8	**Lytle Creek Construction Area**	SBVMWD	1b	✔	✓			**SWM, CU, WS**	**PROP 84 CH 2**	$13,500,000
	13	**Riverside North Recharge Basin**	RPUD	1b	✔	✓	✓		**CU, SWM, WS**	**PROP 84 CH 2**	$13,400,000
	48	**Muscoy Spreading Basins**	SBVMWD	1b	✔	✓	✓		**CU, SWM**	**PROP 84 CH 2**	$5,227,200
	FLOOD AND STORM WATER MANAGEMENT										
	29	**Cactus Basins #4 and #5**	FCD	1b	✔	✓	✓	✓	**FSW, SWM, CU, SWQ**	**PROP 84 CH 3, PROP 84 CH 5, 1E**	$21,300,000
	30	**Cactus Basins #3**	FCD	1b	✔	✓	✓	✓	**FSW, SWM, CU, SWQ**	**PROP 84 CH 3, PROP 84 CH 5, 1E**	$21,300,000
	31	**Randall Basin**	FCD	1b	✔	✓			**FSW, SWM, CU, SWQ**	**PROP 84 CH 3, PROP 84 CH 5, 1E**	$1,460,000
	34	**Cable Creek Debris Basin**	FCD	3	✔	✓			**FSW, SWM, CU, SWQ**	**PROP 84 CH 3, PROP 84 CH 5, 1E**	$38,000,000
	33	**Sand/Warm Confluence**	FCD	1b	✔	✓			**FSW**	**PROP 84 CH 3, PROP 84 CH 5, 1E**	$2,600,000
PROTECT WATER QUALITY	**TDS AND NITROGEN MANAGEMENT**										
	20	**Desalter and Brine Disposal**	YVWD	2		✓	✔		**TNM, WS**	**PROP 84 CH 2, PROP 84 CH 2 NON-IRWMP**	$9,600,000
		City of Beaumont Desalter	City of B.	0					**TNM, WS**	**PROP 84 CH 2**	
		Sari Improvement Project		0					**TNM, WS**	**PROP 84 CH 2**	
	SURFACE WATER QUALITY IMPROVEMENT										
	24	**Security Fencing of Groundwater Recharge Facilities**	Conservation	2	✔	✓			**SWQ, GQP**	**PROP 84 CH 2, PROP 84 CH 2 NON-IRWMP**	$1,140,000
	102	**Big Bear Lake Management Plan**	Multiple Agencies	1b			✔	✓	**SWQ, WS, EHE**	**PROP 84 CH 2, PROP 84 CH 2 NON-IRWMP, PROP 84 CH 5**	$260,000
ECOSYSTEM RESTORATION AND ENVIRONMENTAL ENHANCEMENT	**ECOSYSTEM PROTECTION AND HABITAT ENHANCEMENT**										
	10	**Wash Habitat Conservation Plan**	Conservation	1b	✓	✓		✔	**EHE, CU**	**PROP 84 CH 5, PROP 84 CH 9, AB 303**	$300,000
	110	**Lytle Creek Watershed Assessment and Restoration**	WRI-CSUSB	1b		✓	✓	✔	**EHE**	**PROP 84 CH 5, PROP 84 CH 9**	$260,000
	118	**San Timoteo Canyon State Park Acquisition and Restoration**	R.L.C.	1b			✓	✔	**EHE**	**PROP 84 CH 5, PROP 84 CH 9**	$5,500,000
	113	**Removal of Invasive Plant**	IERCD	1b	✓	✓		✔	**EHE**	**PROP 84 CH 5, PROP 84 CH 9**	$300,000
	114	**Warm Creek Restoration Project**	IERCD	1b	✓	✓		✔	**EHE**	**PROP 84 CH 5, PROP 84 CH 9**	$63,000
	WETLANDS RESTORATION										
		Stanfield Marsh							**WR, EHE**		
		Bogart Park Wetlands							**WR, EHE**		
	LAND USE										
		BCV Forest Land Reserved							**LU, SWQ**		
	6	**I.E. Sustainable Watershed Project**	IERCD	1b	✓		✓	✔	**LU, SWQ**	**CALFED**	$115,000
	11	**LIDS for Kids- Low Impact Development**	IERCD	2	✓			✔	**EHE, SWQ**	**PROP 84 CH 5, PROP 84 CH 9**	$237,000
	RECREATION AND PUBLIC ACCESS										
	18	**San Timoteo Creek Aquatic Restoration**	Redlands	1b							$5,500,000
	32	**Constructed Wetlands**	WRI-CSUSB	1b			✓	✔	**RPA**	**PROP 84 CH 8, PROP 84 CH 9**	Unknown
	124	**SAR Trail - Phase III**	SBCPD	1b				✔	**RPA**	**PROP 84 CH 5**	
	125	**SAR Trail - Phase IV**	SBCPD	1b				✔	**RPA**	**PROP 84 CH 5**	
									Total:		$1,989,749,492

✔ Denotes Primary Objective
✓ Denotes Secondary Objective

Strategies in **bold** are
Strategies not in bold are secondary

Notes: Project readiness includes completion of pre-feasibility study, environmental documentation, project design, and expected implementation date

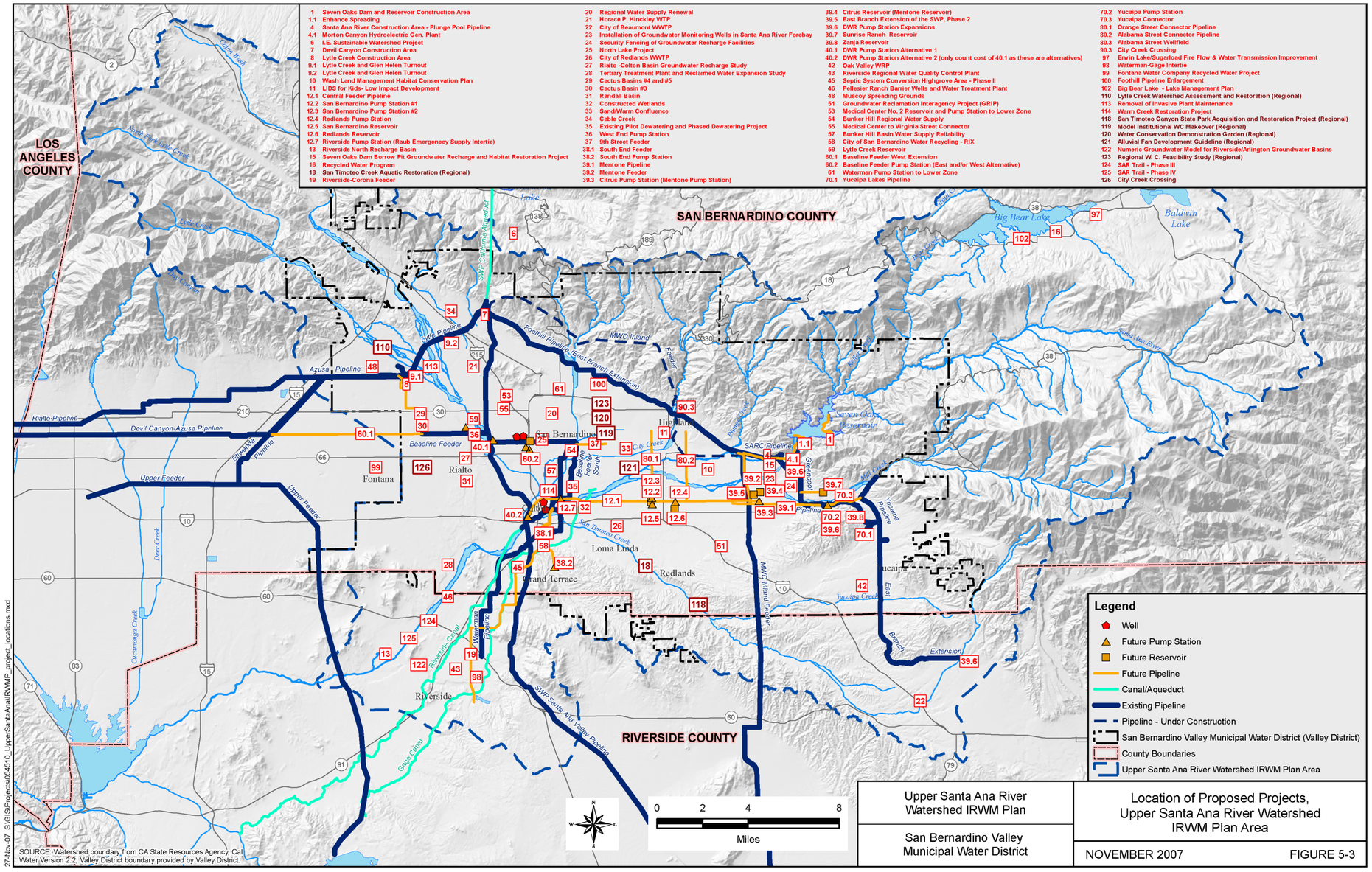
Tier:
1a - If Regional Benefit is 10 and Total Score is more than 20.
1b - If Total Score is more than 20
2 - If Regional Benefit is less than 10 and Total Score is less than 21
3 - If score for Project Commitment is 4 or less

Terms:
SGM Surface Water and Groundwater Management
WSR Water Supply Reliability
WQP Water Quality Protection
ESR Ecosystem Restoration

Strategy Abbreviations

WTR Water Treatment and Recycling
WC Water Conservation
CI Conveyance and Intertie
STO Storage
GWM Groundwater Management
GQP Groundwater Quality Protection
CU Conjunctive Use
WS Water Supply
SWM Surface Water Management
FSW Flood and Storm Water Management
TNM TDS and Nitrogen Management
SWQ Surface Water Quality Improvement
EHE Ecosystem Protection and Habitat Enhancement
WR Wetlands Restoration
LU Land Use
RPA Recreation and Public Access
WR Water Recycling

Figure 5-3
Project Locations



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5.2.2 Economic and Technical Feasibility of the Projects

As stated above, a pre-feasibility evaluation of the projects is conducted to assess technical and economical feasibility of the projects. Those projects that are deemed not feasible at this time (based on a pre-feasibility evaluation) are ranked as Tier 3 and considered not ready for implementation. These projects will be evaluated in the future as additional information is developed and becomes available.

The projects that pass the above test are ranked as Tier 1 or Tier 2. Tier 1 projects are considered to be ready for implementation. These projects must have or should have a completed feasibility study, pre-design documents, and environmental documents by mid-2008. Therefore, only those projects that are deemed economically and technically feasible will move forward for implementation. The project's sponsoring agency is responsible for meeting the stated schedule for conducting the feasibility evaluations.

5.3 Implementation Considerations

5.3.1 Institutional Structures Needed for Plan Implementation

The responsibility for implementation of the IRWM Plan will be shared among the individual entities that participated in the planning process and prepared this plan. The implementation responsibility is based upon the jurisdiction of each responsible entity. The following summarizes the proposed implementation approach for those projects, programs, and investigations that have been formulated to date, and identifies recommendations to assist in future program and project formulation and direction.

5.3.1.1 Management of San Bernardino Basin Area

The Basin Technical Advisory Committee (BTAC) will develop the annual operation plan for managing the San Bernardino Basin Area (SBBA). The annual basin management plan will then be forwarded on to the applicable elected officials for review and approval. The BTAC will be comprised of staff representatives from plaintiffs and non-plaintiffs of the Western Judgment (Western Municipal Water District of Riverside County v. East San Bernardino County Water District, Case No. 78426). A detailed discussion of the process for managing the SBBA and BTAC responsibility is presented in Chapter 4.

5.3.1.2 Management of the Groundwater Basins

Most of the groundwater basins in the Upper SAR Watershed are adjudicated by pumpers or adjudicated "in gross" and are overseen by "Watermasters" who keep an accounting of recharge and extractions.

5.3.2 Project Implementation

Implementation of the projects is the responsibility of the project sponsor(s). For projects funded through the grant programs, the TAG will work with regional agencies as well as SAWPA to coordinate, apply, receive, and distribute the grant funding for project implementation. Projects formulated for this plan must periodically be updated and reprioritized, and new projects may be introduced for screening and prioritization. These activities will also be the responsibility of the TAG, which will be coordinated by Valley District. Project implementation responsibilities include coordination with the appropriate local, State, and federal agencies to prepare and complete necessary environmental documents and to pursue opportunities to fund the projects that are under their jurisdiction, consistent with the IRWM Plan.

5.3.3 Periodic Review and Update of the IRWM Plan

In order to keep the IRWM Plan current, it should be refined as necessary. These refinements will be the result of knowledge gained through the use of the plan.

Valley District will assume responsibility for making updates to the plan on an interval agreed upon by the TAG. Reviews and updates will focus on analyzing new information developed since the adoption of the previous plan and the need for specific water management actions. The reviews would identify areas where the plan has been successfully implemented, as well as areas where deficiencies are apparent.

Valley District will continue to coordinate the regional planning activities of the TAG as needed, and coordinate with other IRWM Plan planning activities in the region and with State and federal agencies.

5.3.3.1 Monitoring and Data Management

Implementation of monitoring programs and data management and coordination is the responsibility of the entities managing the basins, as summarized below.

- The BTAC will be responsible for monitoring, data management, and coordination for the SBBA, Rialto-Colton Basin, and North Riverside Basin as defined in the monitoring program developed for this plan.
- San Timoteo Watershed Management Authority is responsible for data collection, management, and coordination activities related to the San Timoteo Basin.
- Big Bear MWD is responsible for data collection, storage, and monitoring coordination activities associated with the Big Bear Lake Basin.

5.3.4 Implementation Schedule

The IRWM Plan will be implemented during the next 25 years. The first step in implementation is to prepare a capital improvement plan to identify funding sources for proposed projects. It is anticipated that feasible Tier 1a and 1b projects will be implemented during the next 20 years. Tier 2 and 3 projects will be periodically reviewed and as additional project information becomes available, will move up for implementation. Additional projects may be identified for implementation. Implementation schedules for individual projects will also be prepared along with feasibility studies. Figure 5-4 is a snap shot (as of December 2007) of the Plan implementation schedule. This schedule will be updated as additional information is developed and full feasibility of the projects is completed.

Figure 5-4
Implementation Schedule

Upper Santa Ana River Watershed Integrated Regional Water Management Plan
Implementation Schedule.– Dec. 2007

	Year																													
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Adoption of the IRWMP																								
SBVMWD																								
SBVWCD																								
City of San Bernardino																								
Other Partners																								
Implementation of Strategies (Project Rankings 1a and 1b)																								
Capital Improvement Program (by Valley District)																								
Water Conservation Strategy																								
Alternative Refinement																								
Alternative Implementation																								
Water Recycling Strategy																								
Alternative Refinement																								
Alternative Implementation																								
Surface Water Management Strategy																								
Local Water Supplies																								
Alternative Refinement																								
Alternative Implementation																								
Imported Water Supplies																								
Identify storage alternatives																								
Implement storage																								
Groundwater Management Strategy																								
Identify Stormwater Recharge Opportunities																								
Alternative Refinement																								
Alternative Implementation																								
Implement Process for Managing the SBBA		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Protect Water Quality																								
Monitor Water Quality																								
Identify Water Quality Improvement Opportunities																								
Alternative Refinement																								
Alternative Implementation																								
Ecosystem Restoration and Improvement																								
Identify Opportunities for Ecosystem Restoration and Improvement																								
Alternative Refinement																								
Alternative Implementation																								
Disaster Preparedness																								
Adaptive Management																								
Monitor IRWMP Effectiveness																								
Update IRWMP																								
Identify New Alternatives																								
Re-evaluate Projects (Previously Ranked as 2 or 3)																								
Implementation of Additional Strategies (Previously Ranked as Teir2 and 3) and new projects																								
Alternative Refinement																								
Alternative Implementation																								

Notes:

Alternative Refinement: Includes activities associated with project development, project feasibility, project design.

Alternative Implementation: Includes activities associated with: permitting and environmental review, plans and specifications, and project implementation.

* Annual SBBA Operation Plan

IRWMP activities and long-term monitoring.

Activities associated with Implementation of 1a and 1b ranked projects.

Activities associated with implementation of projects previsouly ranked as 2 or 3.

5.3.5 Regional and Statewide Priority and Issues of State Significance

Improving water supply reliability and reducing reliance on the SWP during droughts is considered an issue of Statewide significance. Environmental and fishery issues of the Sacramento-San Joaquin Delta (Delta), including endangered species, vulnerability of Delta levees, and Delta water quality issues, significantly reduce reliability of the SWP supplies. Recently, State water leaders and the Governor's Office have had renewed discussion of an "Isolated Facility" around the Delta as an alternative to the current "broken" operations in the Delta. The isolated facility has the potential to improve fishery issues, reduce the impact of water diversions on listed species, and improve drinking water quality (less total dissolved solids (TDS), trihelimethane, and bromide) for millions of Californians. This translates into increased reliability for the SWP supplies. The resolution of Delta conveyance issues, therefore, will benefit the region and its water supply, and will significantly contribute to water supply reliability and water quality improvement in the Upper Santa Ana Region.

It should also be noted that a major consideration and a regional priority for formulation of this IRWM Plan is to improve water supply reliability and optimize the use of imported water to reduce reliance on imported water during droughts. Implementation of water management strategies of this plan, therefore, will reduce stresses on SWP supplies, especially during drought periods, and will provide statewide water supply benefits.

5.4 Capital Improvement Funding

Implementation of the projects listed in Table 5-1 requires an estimated investment of over $2 billion. This level of funding is beyond the financial abilities of local agencies of the region at this time. Therefore, it is important for the water leaders to develop a capital improvement plan that identifies funding sources and further refines priorities for project implementation. In addition, the agencies should actively engage in obtaining grant funding to assist in project implementation.

Depending on the characteristics and scope of a particular project, some activities and projects currently identified in this IRWM Plan and future activities will likely be in some part contingent on securing funding from federal, State, and/or local sources. The following summarizes project funding approaches to date, as well as anticipated funding strategies.

5.4.1 Federal Funding

The federal grant funding sources are currently limited. The U.S. Bureau of Reclamation's (Reclamation) 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. Reclamation also provides funding for water recycling programs in Southern California. The Environmental Protection Agency (EPA) provides funding for environmental improvement projects. In addition, funding can be directed for implementation of projects under the IRWM Plan, through the Federal Energy and Water Development Appropriations legislation.

5.4.2 State Grant Funding

State funding may be a significant source of funding for implementation of the IRWM Plan. Current key State funding sources include the following:

- The Water Use Efficiency Program, which is currently administered by DWR and is funded through various bond initiatives, and provides grant funding for agricultural and urban water conservation programs.
- DWR's AB 303 Local Groundwater Assistance Program funds groundwater management, data collection, modeling, monitoring, and assessment programs. AB 303 is a potential source of funding for a range of groundwater management projects.
- The Integrated Regional Water Management Grant Program is well suited for funding of the projects developed for the IRWM Plan. Proposition 84 allocated $114 million for the Santa Ana Region integrated regional plans, which is a small fraction of the funding needed for the region's projects.

- The passage of Proposition 84 in the November 2006 election allocated $800 million for flood control projects in which $180 million is allocated for the subvention program to help local agencies outside the Central Valley to implement local flood control projects.
- Proposition 1E provides $300 million in funding for stormwater management and other projects outside of the Central Valley.
- Proposition 84 allocated $45 million in funding to expand and improve the Santa Ana River Parkway.

5.4.3 Local Agency Funding

Local entities for years have been implementing cost-effective projects and programs at the local level. In the past, local funding has been used in part or in total to fund local water projects. Today, however, a major constraint in implementing many of the projects in this IRWM Plan is the lack of financial capacity and funding availability at the local level. Some of the communities in the Upper Santa Ana Region are economically disadvantaged (i.e., their median income is less than 80 percent of the average) and they may not be able to finance costly projects. Bond laws (i.e., Chapter 8 of Proposition 50) generally require local agencies to share the cost of implementing their project unless the project is benefiting an economically disadvantaged community, in which case, the community could be qualified for exemption from local cost-sharing requirements.

5.5 Obstacles to Implementation

The most significant obstacle to implementation of the IRWM Plan is funding of capital improvement projects. Considering the limited financial capacity of the agencies in the Upper Santa Ana Region, it would be very difficult to fund projects with an estimated cost of $2 billion. Steps that can be taken to remedy funding obstacles include development of a capital improvement plan, implementation phasing, obtaining grant funding, and forging partnerships to fund major projects. No other insurmountable obstacles to implementation of the IRWM Plan have been identified. As described earlier, the agencies within the Plan Area have successfully worked together in the past on the development and implementation of projects and programs to improve the water resources management within the region. Working together, these agencies have developed a successful relationship, enabling them to accomplish things that satisfy the varied interests within the Upper SAR Watershed. Developing these initial relationships, trust, and accountability among the participating groups is one of the biggest challenges to any regional cooperation. The stakeholders and interested parties within the Upper Santa Ana Region can continue to successfully work together to implement future projects to improve the water resources management for the citizens of the region.

5.6 Impacts and Benefits of the Upper Santa Ana IRWM Plan

5.6.1 IRWM Plan Benefits

Probably the most significant benefit of the Upper Santa Ana River Watershed IRWM Plan is the planning process itself. The process has created a cooperative environment among all agencies in the region. They meet on a regular basis to discuss the water management issues and plan for meeting future water needs of the region. The agencies worked together to develop solution-oriented programs, they forged agreements, and they work together to provide the most basic and essential service to the communities—serving water. The planning process provided a framework for developing regional and integrated solutions.

Full implementation of the Upper Santa Ana River Watershed IRWM Plan will result in multiple benefits associated with meeting the objectives identified in Chapter 4 of this IRWM Plan. Key public and overall benefits from implementation of the plan elements include the following:

- Significant improvement in water supply reliability during drought periods while reducing reliance on imported water.
- Improved and coordinated management of the region's surface water and groundwater resources, including conjunctive management of groundwater and surface water resources and recharge of groundwater basins.
- Improved water quality through effective management of groundwater resources, expediting clean up process of contaminant plumes in the region, and improving stormwater management.
- Enhancement of water-dependent environmental assets.
- Improved water-related education, recreation, and public access opportunities in the region.
- Improved understanding of the region's water resources, including focused regional monitoring to ensure groundwater is used in a sustainable manner.
- Improved coordination of water management activities of the region through sharing of ideas and mutually beneficial management of project opportunities.
- Coordinated development of water management strategies and associated projects.

5.6.2 IRWM Plan Impacts

The potential negative impacts from implementing most of the projects in the Upper Santa Ana River Watershed IRWM Plan are anticipated to be primarily short-term facility construction impacts. It is proposed that conjunctive water management projects include a monitoring and assessment element to evaluate the impacts of project implementation. Monitoring and assessment elements will provide tools to evaluate and modify project operation to mitigate potential impacts. Further discussion of project monitoring and assessment is presented in Chapter 6.

5.6.2.1 Environmental Documentation and County Ordinance Compliance

Permitting and environmental documentation will be required for many of the new project facilities in accordance with federal, State, and local laws and ordinances. The project-specific environmental compliance will be performed by project sponsors on a case-by-case basis prior to project construction. Impacts and benefits of the proposed actions will be further assessed. All actions and investigations will be coordinated with local, State, and federal agencies to share information and ensure compliance with applicable laws and ordinances.

6 Data Management and Monitoring, Technical Analyses, and Plan Performance

This chapter summarizes the technical analyses, data management, and performance of the Integrated Regional Water Management Plan (IRWM Plan). The chapter is organized in two parts. Part I describes data management and monitoring as well as technical analyses conducted during plan preparation. Part II examines monitoring, data management, and plan performance during plan implementation. This chapter also describes how the performance data will be used to adapt the IRWM Plan and its management tools in response to plan implementation success and its performance.

6.1 Part I: Data Management and Technical Analyses for Plan Preparation

6.1.1 Use of Available Information to Develop the IRWM Plan

The Upper Santa Ana River (SAR) IRWM Plan documents the results of a comprehensive two-year effort of over 20 agencies with varying water management and flood control responsibilities in the region focused on developing a coordinated approach to water resources management. The IRWM Plan was prepared using information and guidance from the Technical Advisory Group (TAG) and the local agencies involved in water resources management and can, in turn, be used by these same agencies to guide and support their future water management efforts.

Prior to the preparation of the IRWM Plan, the water management agencies within the region often worked on an agency-by-agency basis to define their individual needs, and collectively to address water management issues that affect regional issues. During this time, extensive information and data were collected, compiled, and evaluated, including numerous agreements, memorandums of understanding (MOUs), and court judgments. This information served as the foundation for the development of this plan, as described below.

6.1.2 Existing Information and Reports

The IRWM Plan is a document that is intended to provide a common vision for water resources management within the Upper Santa Ana Watershed. A considerable amount of available information was used to develop this plan. Following is a general description of the existing reports that were extensively used in the IRWM Plan and their main contributions.

- Information in local water purveyors' 2005 **Urban Water Management Plans** was used in preparing the water budget for the region. Information analyzed included water demand projections through 2030, water supply reliability strategies in general, and water conservation and water recycling strategies in particular.

- **Master Plans** prepared by local water and flood control agencies were used to estimate water use, supplies, and existing and planned facilities, and for development of the conveyance and recharge strategies for the region.

- **County and City General Plans** were reviewed to ensure that land use assumptions and information used in the IRWM Plan are consistent with the Master Plans.

- **Court Judgments and Agreements** between or among water agencies were used as the basis of groundwater and surface water management activities and to develop surface water and groundwater management strategies that include developing a process to manage the San Bernardino Basin Area (SBBA) (Figure 4-12). These documents were reviewed to ensure the groundwater and surface water management strategies prepared for the Plan are consistent with these documents.

- **Environmental Impact Report for Santa Ana River Water Rights Applications for Supplemental Water Supply** information was used for water supply analyses, water supply reliability strategies, and background information about the region and its water resources.

- A number of other reports and data sources (Western Watermaster Reports, water level data, U.S. Geological Survey (USGS) models and reports, contaminant plume(s) data, and Conservation District Engineering Investigations) were used in a minor role to prepare this plan. A detailed list of reports used in the preparation of the IRWM Plan is included in Section 8, *References*.

6.1.3 Data Management and Monitoring

An extensive network of groundwater and surface water monitoring is in place in the region. Data from these monitoring sites were used extensively in the Operation Model, Allocation Model, Groundwater Model, and other studies conducted for the IRWM Plan. Surface water and groundwater data collected throughout the region by various agencies were used for preparation of the plan. The data are used in various models to evaluate water management strategies and potential benefits of the proposed projects. The majority of the data used in the preparation of the IRWM Plan are available to the public through the local agencies. The existing data and new data collected as a result of the preparation of the IRWM Plan are available to the TAG, stakeholders, interested parties, California Department of Water Resources (DWR), and other state agencies.

The Upper SAR Watershed IRWM Plan is nested within the larger Santa Ana Watershed Project Authority's (SAWPA) IRWM Plan, which serves as an umbrella plan. The information developed as part of the Upper SAR Watershed IRWM Plan is provided for inclusion in the umbrella watershed plan.

6.1.4 Technical Analyses to Develop the IRWM Plan and Projects

The initial efforts in preparing the IRWM Plan focused on identifying the key water resources goals and objectives of the Plan Area. Once the objectives were identified, a considerable amount of time, resources, and technical effort was allocated during a period of 18 months to evaluate surface water and groundwater

resources of the region and define water management strategies that would meet plan objectives. A brief summary of the key technical analyses for the IRWM Plan is presented below.

- **Development and Use of Operations Model (OPMODEL).** OPMODEL was developed to estimate the quantity of unappropriated SAR water available for diversion by the San Bernardino Valley Municipal Water District (Valley District) and Western Municipal Water District (Western) after accounting for diversions by prior water rights holders and environmental flows. This model provides basic water supply data needed to evaluate the feasibility of conjunctive use strategies using local surface water supplies.

- An **"Allocation Model**" was developed and used to evaluate the use and allocation of local surface water and State Water Project (SWP) supplies throughout the service area, including direct deliveries to existing water treatment plants and spreading grounds.

- **Use of Groundwater Model.** A detailed and enhanced groundwater model was developed for the SBBA. Upon completion and calibration of the model, it was extensively used to evaluate potential conjunctive use projects and to define the locations and sizes of the recharge basins and the location and number of groundwater production wells needed for each conjunctive use scenario. The model is a tool that can be used for operation and management of the groundwater basin and for management of water levels and water quality in the SBBA.

- The surface and groundwater data collected in the SBBA were extensively used for development and calibration of the models and for the analysis of the conjunctive use scenarios.

- Preliminary engineering analyses were conducted for evaluation of diversion and conveyance facilities to convey water to the spreading basins.

- Water demand and supply analyses were conducted to understand water demands in the region and how future demands will be met.

- Detailed analyses of water demands and supplies included the ability of the purveyors to meet water demands during a single-year drought and a multiple-year drought scenario. In addition, water needs for the peak day demand of water purveyors within the Valley District service area were studied.

- A sensitivity analysis was conducted to determine the significant level of impact on meeting future water needs, assuming reduced local surface water and reduced reliability in SWP supplies. This analysis intended to capture uncertainties related to SWP future water supply reliability and/or uncertainties of local surface water supplies due to climate change.

- Conceptual engineering analyses were conducted to evaluate the impact of water supply interruption during major disasters and its impact on meeting customers' water needs as well as evaluation of the facilities needed to provide redundancies for infrastructures.

- Pre-feasibility evaluations were conducted of individual projects identified in response to water management strategies and to determine project benefits and associated costs.

The agencies began identifying individual projects that may contribute to meeting the planned water management strategies and objectives. Each project and program included in the Upper SAR IRWM Plan were identified by a local lead agency (project sponsor) that was primarily responsible for the project's description and technical evaluation, as well as the project's integration into the IRWM Plan. The project's sponsor will be responsible for any further project refinement, pursuit of funding, project implementation, and assessment of project performance.

The project description and available supporting information were used to evaluate and rank the individual projects and programs. There was a large range of available supporting information for the projects that tended to reflect the maturity of the planning process and previous efforts made to define project details and establish a project's readiness to proceed. Compared to other projects, the highest ranked projects (Tier 1a and 1b projects) typically had considerable supporting information such as feasibility studies, cost estimates, and preliminary design information. Completion of required additional studies and investigations needed for some of the other projects could improve ranking of such projects in the future.

6.2 Part II: Monitoring, Data Management, Plan Performance, and Adaptive Process during Plan Implementation

6.2.1 Data Collection and Monitoring

As stated earlier, an extensive network of data collection is already in place in the region. A monitoring plan was also developed for the region as a component of this IRWM Plan to formalize and standardize data collection procedures. The objectives of the monitoring plan are to:

- Provide a standard methodology for the collection, storage, and reporting of hydrologic data.
- Document the collection of data needed for management of the groundwater basin to meet the requirements of various judgments. In the SBBA and other adjudicated basins, the Watermaster is responsible for collection, review, and compilation of the data needed for management of the basin and for providing a level of coordination among many water users.
- Provide the data needed for developing the "Annual Operation Plan" for management of the SBBA.
- Provide standardized procedures to collect source water data that agencies use to meet requirements of the California Department of Public Health (CDPH) (formerly the California Department of Health Services) drinking water standards.

The monitoring plan is presented in Appendix B. Currently, the following hydrologic data are being collected in the region:

- **Groundwater data:** Groundwater monitoring is in place for measuring groundwater production, water quality, and water levels representative of the various subbasins. Groundwater level data were used to evaluate the groundwater level trends as well as to evaluate the groundwater flows and included the following:
    - USGS multi-level monitoring wells.
    - Target wells used in the groundwater model. A list of these wells, as well as a map showing the location of the targeted modeling wells, is presented in Appendix B.

- Groundwater monitoring wells identified in various agreements (e.g., Seven Oaks Accord, Riverside Agreement). Monitoring of these wells is required to ensure full compliance with the terms of the agreements. A list of these wells is presented in Appendix B.

- Environmental Protection Agency (EPA)/City of San Bernardino Newmark-Muscoy plume(s) monitoring wells.

- Local purveyors' water production data required by judgments and provided to the Watermaster. All purveyors of wells that pump groundwater are required to report the annual production of the wells to the Watermaster. Production data are then presented in an annual report prepared by the Watermaster.

- Water quality data collected by water purveyors for each well. These data are periodically monitored according to Title 22 and are required by the CDPH.

- **Stream gage data:** Stream gages in the region are operated by either the USGS or the San Bernardino County Flood Control District (SBCFCD).

- **Subsidence monitoring**: During the period from 1944 to 1969, at least one foot of subsidence occurred in the Pressure Zone immediately north of Loma Linda between the San Jacinto and Loma Linda faults. Currently, there is no subsidence monitoring station in place. No evidence of any significant subsidence is present in the subbasins at this time.

6.2.2 Data Gaps/Additional Monitoring Requirements

Although vast amounts of data are currently collected for management of the basin's water resources, there is always opportunity to collect additional data to fill necessary gaps. One such gap could be the lack of subsidence monitoring data in the region. The following additional data collection activities would be needed to fulfill the data gaps of the region:

- A network of benchmarks in the Pressure Zone area could be helpful in monitoring subsidence. Each benchmark should be established and surveyed by a California-licensed land surveyor. Locations of the benchmarks are dependent upon permitting from the appropriate agency. (This task should be coordinated with USGS to ensure there is not any duplication of efforts. USGS may collect some of these data.)

- If proven necessary, some extensometer wells could be installed on the basis of periodic land surveys within the Pressure Zone area where the

highest probability of subsidence may occur. Extensometers could be installed to measure non-recoverable compaction of fine-grained materials interbedded within the aquifer systems.

6.2.3 Management of the Data

As part of the USGS program for disseminating water data, the USGS maintains a distributed network of computers for the acquisition, processing, review, and long-term storage of water data. This distributed network of computers is called the National Water Information System (NWIS). Many types of data are stored in the NWIS, including comprehensive information for site characteristics, well construction details, time-series data for gage stage, streamflow, groundwater level, precipitation, and physical and chemical properties of water. Data collected by the USGS in the region are available to stakeholders and the public through the NWISWeb (http://nwis.waterdata.usgs.gov/nwis).

Data collected as part of the IRWM Plan will be stored, organized, and secured in an electronic database. Valley District is developing a comprehensive database that will be utilized to house the data needed for management of surface and groundwater resources of the region.

The database created for storing all monitoring data will be maintained by Valley District. Valley District will provide a central storage location for data and documentation. Valley District will coordinate with all agencies collecting data to facilitate exchanges in a consistent manner.

Data collected in the region will be available to the stakeholders, DWR, and other local and state agencies. Data collected in support of state-funded water quality-related projects will be made available to the State Water Resources Control Board's (SWRCB) Surface Water Ambient Monitoring Program and Groundwater Ambient Monitoring and Assessment Program.

Monitoring data collected each year will be summarized in an Annual Monitoring Report. This report will incorporate the past year's data in tabular and electronic format.

6.2.4 Adaptive Management and Plan Performance for the Upper Santa Ana River Watershed IRWM Plan

The Upper SAR Watershed IRWM Plan presents the current state of water resources planning in the region, based upon available information, and recognizes that water management strategies will continue to evolve in response to changing conditions. In recognition of the fluid nature of water management in the region, the IRWM Plan incorporates an adaptive management approach that is intended to allow the IRWM Plan to stay current in light of changing

conditions, such as local and regional water needs and changing regulatory requirements.

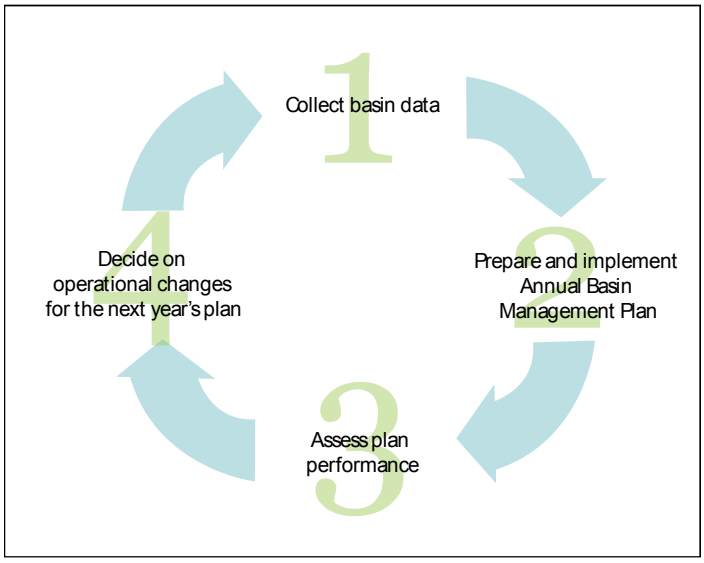
In that sense, the planning process is continually evolving in response to these changing conditions and the development of additional data that improve our understanding, which may redefine our objectives and priorities to respond to these changing conditions.

The adaptive management framework is based on an iterative process of:

- Collecting information and data regarding the conditions within the IRWM Plan Area,
- Evaluating the new data to determine plan/project performance, and
- Formulating a plan in response to these changing conditions.

For this IRWM Plan, adaptive management will primarily occur in the following areas:

Performance Evaluation and Adaptive Process For Preparing the SBBA Annual Basin Management Plan



1. Preparation of the Annual Basin Management Plan for the SBBA. The process for updating the annual plan is discussed in detail in Chapter 4 and illustrated in Figure 4-12. This process is designed to manage the basin considering basin conditions especially in the preceding year. Performance is characterized by meeting specific water level and water quality objectives established for the basin. The data collected for specified key stations are reviewed. The groundwater levels and water quality data are compared with established performance criteria. Based on conditions of the groundwater basin, an annual basin management plan is prepared and adopted for implementation in the subsequent year. This process for management of the SBBA is continuous and adaptive.

2. Periodic review of the water management strategies and reprioritization of project implementation based on availability of funding, readiness of the projects to proceed, and changing conditions.

3. Continuous refinement of the IRWM Plan process in an adaptive management framework to proactively manage the available resources, including making a significant investment in the planning and implementation of new projects and programs. This includes preparation of periodic updates of the IRWM Plan as needed to respond to changing conditions and through a continued working relationship with the TAG and other means, and to inform project participants and stakeholders about changes to the IRWM Plan.

The performance evaluation activities will be conducted for the IRWM Plan in association with the implementation of projects identified in the Upper SAR Watershed IRWM Plan. Some form of performance evaluation criteria, such as a Project Assessment and Evaluation Plan (PAEP), could be developed for projects that include public funding prior to implementing the project. PAEP was developed by the SWRCB to measure the effectiveness of a project. The goals of a PAEP are as follows:

- To provide a framework for assessment and evaluation of project performance,
- To maximize the value of public expenditures to achieve results,
- To identify measures that can be used to monitor progress towards achieving project goals, and
- To provide information to help improve current and future projects.

The PAEP will be based on project-specific information, which may be included in the implementation of a funding contract agreement to:

- Describe project characteristics and the project sponsor,
- Demonstrate consistency with local planning documents such as the IRWM Plan,
- Identify project goals and link goals with desired outcome,
- Select performance indicators,
- Identify expected benefits and impacts,

- Determine outcome indicators (site-specific, regional, and system-wide),
- Identify/implement monitoring needed to evaluate a project's performance,
- Analyze and assess data,
- Evaluate overall success of the project, and
- Communicate the results to the TAG.

Table 6-1 presents an example of a project performance indicator that can be used for evaluation of overall success of the proposed projects for the Upper SAR Watershed IRWM Plan.

Table 6-1
Example of Project Performance Indicator to Assess Project Success

Projects/Programs	Project Goal	Desired Outcome	Outcome Indicators	Target
Project #1				
Project #2				

Implementation of projects that support one or more of the water management strategies identified in the Upper SAR Watershed IRWM Plan may have several monitoring efforts. These monitoring efforts will provide tools for evaluation of project performance. As mentioned earlier, the most significant performance evaluation will be the process for managing the SBBA. The annual operation of the SBBA must comply with a series of conditions set forth in judgments, agreements, and MOUs between signed parties for operation of the basin. The operation of the basin is examined every year to ensure the performance requirements are met or that specific adaptive management actions will be put into place as part of the annual plan for basin operation.

7 Abbreviations and Acronyms

ABBREVIATIONS AND ACRONYMS

Accord	Seven Oaks Accord
ACEC	Area of Critical Environmental Concern
Advisory Commission	San Bernardino Valley Municipal Water District Advisory Commission on Water Policy
AHHG	Area of Historic High Groundwater
Association	Upper Santa Ana Water Resources Association
Banning	City of Banning
Basin Plan	1995 Water Quality Control Plan for the Santa Ana River Basin as amended in 2004 by R8 2004-0001
BBARWA	Big Bear Area Regional Wastewater Agency
BBCSD	Big Bear Community Services District
BBLDWP	City of Big Bear Lake Department of Water and Power
BCVWD	Beaumont-Cherry Valley Water District
Bear Valley Mutual	Bear Valley Mutual Water Company
Beaumont	City of Beaumont
bgs	below ground surface
Big Bear Municipal	Big Bear Municipal Water District
BLM	Bureau of Land Management
BMO	Basin Management Objectives
BMP	Best Management Practice
BTAC	Basin Technical Advisory Committee
Caltrans	California Department of Transportation
CDPH	California Department of Public Health
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CLAWA	Crestline-Lake Arrowhead Water Agency
Colton Public Utilities	City of Colton Public Utilities Department

ABBREVIATIONS AND ACRONYMS

CRA	Colorado River Aqueduct
CSUSB	California State University at San Bernardino
CUWCC	California Urban Water Conservation Council
DBCP	debromochloropropane
DDT	dichlorodiphenyltrichloroethane
Declaration	Declaration of Fully Appropriated Streams
DEIR	Draft Environmental Impact Report
Delta	Sacramento-San Joaquin Delta
DMM	Demand Management Measures
DWP	Department of Water and Power
DWR	California Department of Water Resources
East Valley	East Valley Water District
EC	electrical conductivity
EOC	Engineering and Operations Community
EPA	Environmental Protection Agency
ESRI	Environmental Systems Research Institute
Exchange Plan	Santa Ana River-Mill Creek Cooperative Water Project Agreement
FEMA	Federal Emergency Management Agency
FWC	Fontana Water Company
GFDL	Geophysical Dynamic Lab
GIS	Geographic Information System
GMP	Groundwater Management Program
gpm	gallons per minute
HET	High-Efficiency Toilet
ICGMP	Institutional Controls Groundwater-Management Program
ICSA	Institutional Controls and Settlement Agreement
IEUA	Inland Empire Utilities Agency
IRWM Plan	Integrated Regional Water Management Plan
IWP	Integrated Watershed Plan
LID	Low Impact Development
Lockheed	Lockheed Martin Corporation
Marygold	Marygold Mutual Water Company
MCL	maximum contaminant level

ABBREVIATIONS AND ACRONYMS

Metropolitan	Metropolitan Water District of Southern California
mg/L	milligrams per liter
mgd	million gallons per day
MOU	memorandum of understanding
MPD	Master Plan of Drainage
MSHCP	Multi-Species Habitat Conservation Plan
msl	mean sea level
Muscoy	Muscoy Mutual Water Company
Newmark Site	Newmark Groundwater contamination Superfund Site
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NWIS	National Water Information System
OCWD	Orange County Water District
OPMODEL	operations model
Orange County Judgment	April 17, 1969 Orange County Superior Court Judgment
PAEP	Project Assessment and Evaluation Plan
PCB	Polychlorinated Biphenyls
PCE	perchloroethylene
PCM	Parallel Climate Model
ppb	parts per billion
Reclamation	U.S. Bureau of Reclamation
Regents	Regents of the University of California
Region	Integrated Regional Water Management Plan Area
RFQ	Request for Qualifications
Rialto	City of Rialto
Riverside Highland	Riverside Highland Water Company
RIX	Rapid Infiltration Extraction
RM	river mile
RPU	City of Riverside Public Utilities Department
RRWQCP	Riverside Regional Water Quality Control Plant
RWQCB	Regional Water Quality Control Board
SAR	Santa Ana River

ABBREVIATIONS AND ACRONYMS

SARI	Santa Ana Regional Interceptor
SARRWQCB	Santa Ana River Regional Water Quality Control Board
SART	Santa Ana River Trail
SAWA	Santa Ana Watershed Association
SAWPA	Santa Ana Watershed Project Authority
SAWPA Plan	Santa Ana Watershed Project Authority Plan
SBBA	San Bernardino Basin Area
SBCFCD	San Bernardino County Flood Control District
SBMWD	San Bernardino Municipal Water Department
SBNF	San Bernardino National Forest
SBVWCD	San Bernardino Valley Water Conservation District
SCADA	Supervisory Control and Data Acquisition
SCAG	Southern California Association of Governments
SCCWRP	Southern California Coastal Water Resource Project
SGPWA	San Gorgonio Pass Water Agency
SOC	synthetic organic compound
State	State of California
STWMA	San Timoteo Watershed Management Authority
STWMP	San Timoteo Watershed Management Program
SWAMP	Surface Water Ambient Monitoring Program
SWP	State Water Project
SWRCB	State Water Resources Control Board
TAF	thousand acre-feet
TAG	Technical Advisory Group
TCE	trichloroethylene
TDS	total dissolved solids
TMDL	total maximum daily load
UCR	University of California Riverside
ULFT	Ultra-Low-Flow Toilet
USACE	U.S. Army Corps of Engineers
USFS	U.S. Forest Service
USGS	U.S. Geological Survey

ABBREVIATIONS AND ACRONYMS

UWMP	Urban Water Management Plan
Valley District	San Bernardino Valley Municipal Water District
VOC	volatile organic compound
West Valley	West Valley Water District
Western	Western Municipal Water District
Western Judgment	Western Municipal Water District of Riverside County v. East San Bernardino County Water District, Case No. 78426
WQMA	Water Quality Management Agency
WQO	water quality objectives
WRI	Water Resources Institute
WRP	Water Reclamation Plant
WSPA	Wooly-Star Preserve Area
WWTP	waste water treatment plant
YVWD	Yucaipa Valley Water District

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Ron Buchwald, East Valley, August 2007
Tom Crowley, West Valley, August 2007. Email on August 28.
Chris Diggs, Redlands, August 2007
Jack Nelson, Yucaipa Valley, August 2007
Matt Litchfield, August 2007

2005 Urban Water Management Plans:

East Valley Water District
Fontana Water Company
City of Redlands
West Valley Water District
Yucaipa Valley Water District

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Prepared by GEI Consultants, Inc., in association with SAIC and GEOSCIENCE Support Services, Inc.

2005 URBAN WATER MANAGEMENT PLAN

Irvine Ranch Water District
15600 Sand Canyon Avenue
Irvine, CA 92618

NOVEMBER 2005

IRVINE RANCH WATER DISTRICT

2005 URBAN WATER MANAGEMENT PLAN
CONTACT SHEET

Date Submitted to Department of Water Resources	December 1, 2005
Name of person responsible for this plan	Richard A. Diamond
Phone	(949) 453-5594
Fax	(949) 453-0228
E-mail address	diamond@irwd.com
The water supplier is a	Special District
The water supplier is a	Retailer
Utility services provided by the water supplier	Water, sewer, recycled water
Is this agency a Bureau of Reclamation Contractor?	No
Is the Agency a State Water Project Contractor?	No

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Appendix C……..Letters to Cities and County within the Irvine Ranch Water District Service Area

Appendix D…….. Best Management Practices Annual Reports 2003-2004

Appendix E……..Best Management Practices Annual Report Coverage Reports 2003-04

Appendix F…..…..…..1) IRWD Resolution No. 1987-52
2) Water Shortage Contingency Plan

Law

> 10617 "Urban water supplier" means a supplier, either publicly or privately owned, providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually.
>
> 10620 (a) Every urban water supplier shall prepare and adopt an urban water management plan in the manner set forth in Article 3 (commencing with Section 10640).
>
> 10620 (d) (2) Each urban water supplier shall coordinate the preparation of its plan with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies, and relevant public agencies, to the extent practicable.

Irvine Ranch Water District ("IRWD", "District") is a multi-service agency responsible for providing domestic water service, sewage collection, advanced wastewater treatment and water recycling for a 133-square mile service area in south central Orange County. IRWD provides water service to approximately 316,000 county residents.

This Urban Water Management Plan (UWMP) of the Irvine Ranch Water District has been prepared in response to the Urban Water Management Planning Act (Water Code), Water Code Sections 10610 through 10656, which were added by Statute 1983, Chapter 1009, and became effective on January 1, 1984. The sections of this UWMP correspond to the outline of the Act, specifically Articles 2, 2.5 and 3 (Appendix A). Several sources of information were referenced in preparation of this UWMP as listed under Appendix B and are referred to throughout the UWMP.

I. Agency Coordination

A. Coordination with Appropriate Agencies (§ 10620(d))

IRWD is the largest constituent agency of the Municipal Water District of Orange County (MWDOC). MWDOC is a member agency of the Metropolitan Water District of Southern California (MWD), the regional imported water wholesaler. MWDOC serves all of Orange County except for the cities of Anaheim, Fullerton and Santa Ana. IRWD coordinated the development of this UWMP with MWDOC. In accordance with the Act, IRWD provided its imported water needs (demands) to MWDOC and MWDOC and MWD have documented available imported supplies for retailers in their respective Regional Urban Water Management Plans (RUWMP). References are made in a more general aspect to the RUWMPs prepared by both the MWD and MWDOC.

Table 1 shows IRWD's UWMP coordination with appropriate agencies.

Table 1
Coordination with Appropriate Agencies

Agency	Participated in developing the plan	Contacted for assistance	Attended public meetings	Opportunity to comment on the draft	Sent notice of public hearing
MWD		X		X	X
MWDOC	X	X	X	X	X
City of Irvine		X		X	X
City of Tustin		X		X	X
City of Lake Forest		X		X	X
City of Newport Beach		X		X	X
City of Orange		X		X	X
City of Costa Mesa		X		X	X
County of Orange		X		X	X
Santa Margarita Water District				X	X
Orange County WD				X	X
The Irvine Company				X	X

B. UWMP Preparation (§ 10620(e))

IRWD's staff prepared the 2005 UWMP in coordination with the other agencies as indicated in Table 1. In preparing the UWMP, IRWD staff utilized the *Guidebook to Assist Water Suppliers in the Preparation of a 2005 Urban Water Management Plan* prepared by the California Department of Water Resources.

C. Water Management Tools (§ 10620(f))

IRWD's principal water management planning tool is its "Water Resources Master Plan" ("WRMP") which describes both the potable and non-potable systems and provides a basis for future IRWD water resource planning [1]. The WRMP is a comprehensive document compiling data and analysis, including current and future land uses, which IRWD considers necessary for its planning needs. The WRMP provides identification of an optimum mix of water recourses to meet normal and emergency requirements prioritizing local supplies vs. imported supplies. As a submember agency of MWD, IRWD is aware of future challenges with imported water and it is within this context that IRWD's future water resource development plan has been fashioned. For many years, IRWD's potable water system relied on imported water supplies from MWD; however, in an effort to increase local supplies IRWD developed the Dyer Road Wellfield. To further offset the need for imported water for non-potable uses, IRWD expanded its recycled

water program to meet future non-potable demands. IRWD utilizes its WRMP to implement its water resources program, which puts emphasis and planning on maximizing local supplies to meet demands through increased recycled water use, increased groundwater development, groundwater treatment, and investigating supplemental supply options such as groundwater banking. The WRMP describes IRWD's plans to reduce reliance on imported supplies including assumptions to maximize groundwater development, full expansion of IRWD's Michelson Water Reclamation Plant to 33 mgd treatment capacity or larger as required; and the conversion of the San Joaquin Reservoir to an IRWD recycled water seasonal storage reservoir, which was recently completed in 2005.

D. Plan Updated in Years Ending in Five and Zero (§ 10621(a))

IRWD's 2005 Urban Water Management Plan was prepared in accordance with the requirement under the Act that urban water purveyors submit a UWMP to the Department of Water Resources addressing water supply and demands, conservation measures, and water recycling among other things. IRWD prepared previous UWMPs in 1985, 1990, 1995 and 2000. Several legislative amendments have been made to the Act since IRWD's last submission of 2000 and this UWMP update incorporates all of the new requirements.

Senate Bills 610 and 221

The passage of Senate Bills 610 and 221 in 2002 required additional information be included in the UWMP and also identified the UWMP as a source document that may be used by water agencies to fulfill the water supply assessment and verification requirements. The UWMP Act requires a 20-year projection (through 2025 for the 2005 UWMP) for supply and demand information required in the UWMP. Some water agencies preparing an assessment or verification between 2006 and 2010 will utilize the UWMP data to comply with these requests and therefore provide data to the year 2030. IRWD, however, prepares separate water supply assessments and verifications based upon its principle planning document, the Water Resources Master Plan. Although not required, IRWD included supply and demand data to the year 2030 in this 2005 UWMP.

E. City and County Notification and Participation (§ 10621(b))

During the preparation of the UWMP, IRWD notified all of the cities within IRWD's service area and the County of Orange of the opportunity to submit comments regarding the UWMP during the update process. IRWD received a letter from the County of Orange (see copy under Appendix C) which provided planning information for IRWD's unincorporated areas. IRWD acknowledged receipt of the letter and noted the information was previously incorporated into

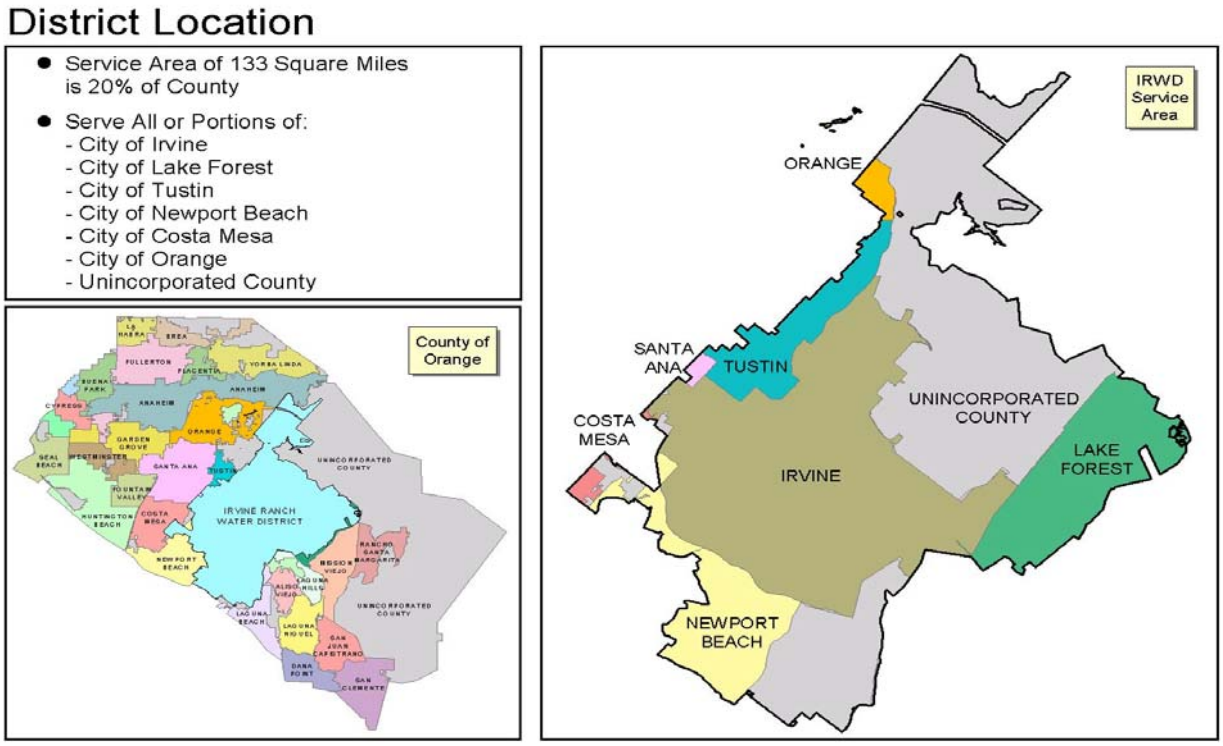
IRWD's demand projections. As indicated in Table 1 above, IRWD sent draft UWMPs to the cities and county, and provided notification of IRWD's public hearing (held on November 28, 2005) and opportunity for comments on the draft. Copies of all letters notifying the cities and county of Orange of IRWD's UWMP update process are included under Appendix C.

Law

10630. It is the intention of the Legislature, in enacting this part, to permit levels of water management planning commensurate with the numbers of customers served and the volume of water supplied.

II. Contents of UWMP

The Irvine Ranch Water District, a California Water District, was formed in 1961 and is located in the south central portion of Orange County. IRWD provides potable and non-potable water supply, wastewater collection, treatment and disposal, and wastewater reclamation. IRWD overlies much of the old Irvine Ranch property and includes all of the City of Irvine and portions of the surrounding jurisdictional agencies such as the cities of Tustin, Santa Ana, Orange, Costa Mesa, Lake Forest, Newport Beach, and unincorporated areas of the County of Orange. Currently, IRWD encompasses a 133-square mile service area with an estimated population of 316,000.



In 1997, IRWD acquired neighboring Santa Ana Heights Mutual Water Company with approximately 2,800 connections. In 2001, IRWD merged on the east boundary with the Los Alisos Water District with approximately 12,400 connections. IRWD's current records show approximately 92,800 connections serve approximately 56,000 acre-feet of potable water and 30,000 acre-feet of non-potable water annually.

Law

> 10631. (a) Describe the service area of the supplier, including current and projected population, climate, and other demographic factors affecting the supplier's water management planning. The projected population estimates shall be based upon data from the state, regional, or local service agency population projections within the service area of the urban water supplier and shall be in five-year increments to 20 years or as far as data is available.

A. Population (§ 10631(a))

IRWD, once largely an agricultural community, is continuing to undergo municipal and industrial development with approximately 400 acres of vacant land and farmland being urbanized each year. IRWD's current population of 316,000 is approximately 73% of the ultimate projected population estimated at 434,511 for 2030. IRWD's population projections are shown in Table 2.

Table 2
IRWD Population Projections

	2005	2010	2015	2020	2025	2030
Service Area Population	316,000	366,192	384,502	403,727	423,914	434,511

The majority of the development within the IRWD service area follows the City of Irvine General Plan first adopted in 1973 and amended several times since then. The most recent plan was issued in February 1996. The remainder of the service area follows the appropriate jurisdictional agency's General Plan or projections from the County of Orange. These plans establish a guideline for land use development within the IRWD service area and serve to coordinate the timing of future growth. The model used to forecast IRWD water demands calculates existing and future population estimates by multiplying the number of dwelling units in each density category by the number of persons per dwelling unit for that category [1]. The major characteristic of IRWD's service area includes the concept of residential villages with a wide range of housing products and densities; and very low-density residential development in the rugged, more environmentally sensitive foothills.

IRWD's Lake Forest service area (formerly Los Alisos Water District) is zoned for approximately 2/3 residential and 1/3 commercial development. Existing development is primarily single-family residential with some multi-family residential, office space, commercial industrial and open space. The industrial and commercial development provide a wide range of services such as manufacturing, assembly, research and development, high technology, aerospace, professional services, biomedical and warehouse operations among others. Currently,

the City of Lake Forest is proposing to develop 950 acres (commercial and residential) of vacant land which is adjacent to the former Marine Corps Air Station at El Toro.

B. Climate (§ 10631(a))

IRWD's service areas have a generally mild and relatively uniform climate with an average rainfall of approximately 14.2 inches. Table 3 below shows average climate characteristics for the IRWD service area.

Table 3
IRWD Average Climate

	Jan.	Feb	March	April	May	June
Monthly Average ETo	2.12	2.26	3.42	4.65	4.98	5.59
Average Rainfall	2.997	4.3	2.36	1.08	0.47	0.1
Average Temperature	56.1	56.9	57.8	59.0	65.8	65.5
	July	Aug	Sept	Oct	Nov	Dec
Monthly Average ETo	6.03	6.06	4.55	3.49	2.43	2.13
Average Rainfall	0.0	0.005	0.22	0.27	1.39	1.66
Average Temperature	69.9	68.9	71.2	62.0	56.7	56.2

ET and Rainfall are reported in inches; Temperature is degrees in Fahrenheit.

C. Other demographic factors (§ 10631(a))

Industrial and Commercial Activities
Industrial and commercial development within IRWD is concurrent with residential development. Again, the jurisdictional agencies' General Plans define industrial and commercial development within the IRWD service area. These developments consist of regional commercial centers with high-rise buildings, major business and industrial complexes located along the eastern and western edges of IRWD [1].

In late 2001, the Irvine Company (the major land owner in IRWD) announced the planned dedication of a large area as permanent open space. The majority of this land is located in the northwestern portion of IRWD (City of Orange sphere of influence), with an additional area near Laguna Canyon Road. Based on this change, IRWD has made appropriate reductions in its demand calculations.

Institutional and Others

(1) University of California, Irvine and its inclusion area

The University of California, Irvine (UCI) main campus occupies 1,489 acres within the south-central part of IRWD. The present student population is about 24,100 with approximately 9,500 faculty and staff. There is a projected UCI build-out population of approximately 35,000 students and 14,000 faculty and staff. IRWD participates with UCI on its Subarea Master Planning to determine the effects of planned improvements on IRWD's water, reclamation and sewer systems.

(2) Marine Corps Air Stations, El Toro and Tustin

In 1999, the Marine Corps stations located at the eastern (El Toro) and western (Tustin) portion of IRWD closed as part of the Federal Base Realignment and Closure process. Redevelopment and reuse alternatives have been prepared for both bases and IRWD has prepared various levels of planning studies for these plans. For the Tustin base property, IRWD is relying on land use plans prepared by the City of Tustin as the redevelopment authority. The El Toro base property, formerly within the unincorporated County of Orange, was annexed to the City of Irvine and IRWD prepared and approved a water supply assessment (approved January 27, 2003) on the City's proposed land use plan for the base property.

D. Land Use and Water Resource Planning

The foundation for IRWD's WRMP is the compilation of land use data. For IRWD, this required interfacing with multiple jurisdictions and developing a land use database using GIS. Computerized GIS for the master planning process enables a more detailed categorization of residential land use by jurisdictional agency. Land use data was used in conjunction with updated water use factors to estimate water requirements through development of a "demand forecasting tool." Appropriate GIS layers were established to segregate demands for system and storage evaluations. These evaluations were based on system criteria, which were reviewed in detail and updated as part of the planning effort.

Included in the WRMP, IRWD employs water use factors to enable it to assign water demands to various land use types and aggregate the demands. The water use factors are based on average water use and incorporate the effect of IRWD's tiered-rate conservation pricing and its other water conservation programs. The factors are derived from historical usage (billing data) and a detailed review of water use factors within the IRWD service area conducted as part of the WRMP.

Law

> 10631 (b) Identify and quantify, to the extent practicable, the existing and planned sources of water available to the supplier over the same five-year increments [to 20 years or as far as data is available.]

E. Current and planned Water Supplies (§ 10631(b))

IRWD is a constituent agency of the MWDOC, a member agency and wholesale importer of water from MWD and, as such, is entitled to receive water from the available sources of MWD. Groundwater is used as an additional source of water and its use is anticipated to increase in the future. In addition, recycled water currently meets a large portion of the landscape irrigation demands within IRWD's service area.

Table 4 below shows IRWD's variety of current and projected planned water supplies. The water supplies projected here do not represent the total supply capacity available to IRWD but rather the projected supplies to meet the projected demands.

Table 4
IRWD Current and Planned Water Supplies (AFY)

	2005	2010	2015	2020	2025	2030
Potable Supplies:						
Purchased MWD treated	19,306	25,318	31,508	35,477	37,395	38,161
Clear groundwater	29,960	28,000	28,000	28,000	28,000	28,000
Treated groundwater	7,200	22,988	25,066	27,306	29,459	29,753
Non-potable Supplies:						
Recycled water	15,296	26,203	26,091	27,948	29,231	29,523
Purchased MWD untreated	5,304	6,303	4,556	3,434	3,225	3,225
Native (surface water)	7,251	4,000	4,000	4,000	4,000	4,000
Non-potable groundwater	2,285	3,898	3,898	3,898	3,898	3,898
Total	86,602	116,710	123,119	130,063	135,208	136,560

Imported Water Supplies. Currently, approximately 34% of IRWD's potable water needs are met by water imported by MWD through MWDOC. The majority of imported potable water is supplied from a single source; the MWD Diemer Filtration Plant (DFP) located north of Yorba Linda. Typically, the DFP receives a blend of Colorado River water from Lake Matthews through the MWD lower feeder and State Water Project (SWP) water through the Yorba Linda Feeder.

The two major transmission pipelines that deliver DFP water to the service areas are the Allen-McColloch Pipeline (AMP) and East Orange County Feeder No. 2 (EOCF #2). IRWD owns 64.7 cfs capacity in the AMP, 41.4 cfs capacity in all reaches of the EOCF #2 down to Coastal Junction. In addition to DFP imported water, IRWD also receives potable water from the Weymouth Filtration Plant via the Orange County Feeder (OCF) 18 cfs acquired through its consolidation with Santa Ana Heights Mutual Water Company. IRWD has over 124 cfs of connected capacity to MWD's system which is sufficient capacity to meet its potable demands. The MWD supplies listed in Table 4 do not represent the total supplies that could be delivered to IRWD through all of its connected capacities, but rather the supplies IRWD would most likely utilize to meet demands. IRWD prefers to diversify and rely less on imported and more on local supplies, and has therefore developed extensive groundwater pumping capacities to meet potable demands in addition to MWD supplies as discussed below under "Groundwater Sources".

Non-Potable Water Supplies. IRWD's non-potable water system meets the majority of the landscape irrigation and agricultural water demands. The sources of the non-potable system consist of recycled water, untreated imported water, surface water and low-quality groundwater.

Recycled Water. IRWD has an extensive dual distribution system, which delivers recycled water from the Michelson Water Reclamation Plant (MWRP) and the Los Alisos Water Reclamation Plant (LAWRP). The recycled water system currently serves agricultural and non-agricultural irrigation demands and other non-potable uses. The quality of wastewater effluent used for landscape irrigation and agriculture complies with Title 22, Division 4 of the California Administrative Code, Department of Health Services (DOHS). The MWRP has permitted treatment capacity of 18 mgd and LAWRP has permitted capacity of 7.5 mgd for secondary treatment and 5.5 mgd for recycled water production.

Untreated Imported Water. Untreated imported water is used primarily to meet agricultural demands and supplement landscape irrigation demands. Agricultural demands within IRWD are expected to reduce in future years as development occurs. The untreated water is imported from the MWD system. The Irvine Lake Pipeline (ILP) conveys MWD untreated water and local runoff from Irvine Lake to Lambert Reservoir (Irvine Company owned). Connections along the ILP serve Irvine Company irrigation system and the IRWD recycled water distribution system. IRWD owns 80.0 cfs in the ILP. The Baker Aqueduct also delivers MWD untreated water to central and south Orange County. Utilization of the Baker Pipeline has reduced due to the use of AMP and decline of area agriculture. IRWD's capacity in the Baker Pipeline includes the capacity it subleases as successor to LAWD, as well as capacity rights IRWD acquired. IRWD has 52.70 cfs in the first reach, 12.50 cfs in each of the second, third and fourth reaches and 7.51 cfs in the fifth reach of the Baker Pipeline.

Native Surface Water. An average of about 8,000 AFY of Santiago Creek local runoff is captured in the Irvine Lake. IRWD and Serrano Water District have the right to 28,000 AY from the Lake under license. Since the base flow from the catchment is very low, the annual yield from the reservoir may be extreme, from a few hundred acre-feet per year to overflow conditions. On average, IRWD uses about 4,000 AFY for agricultural irrigation and the remainder is treated for domestic use by Serrano Water District, which owns 25% of the capacity in the Irvine Lake. During single or multiple dry years, IRWD's annual use of local runoff is about 1,000 AFY.

F. Groundwater Sources (§ 10631(b)(1)-(2))

Orange County Groundwater Basin

The source of IRWD's groundwater supply is the Lower Santa Ana River Basin. IRWD is an operator of groundwater-producing facilities in the Orange County Groundwater Basin ("Basin"). Although the rights of the producers within the Basin vis a vis one another have not been adjudicated, they nevertheless exist and have not been abrogated by the Orange County Water District Act, Water Code App., Ch 40 ("Act"). The rights consist of municipal appropriators' rights and may include overlying and riparian rights.

The Basin is managed solely by the Orange County Water District (OCWD) under the Act and is described at pages 3-1 through 3-14 of the OCWD Master Plan Report, dated April 1999 ("MPR") [4]. OCWD manages the Basin for the benefit of municipal, agricultural and private groundwater producers and is responsible for the protection of water rights to the Santa Ana River in Orange County as well as the management and replenishment of the Basin. Current groundwater production from the Basin was 336,789 AF for 2003-2004 [5]. OCWD's Groundwater Management Plan was most recently updated in March 2004 [6].

Irvine Subbasin

Within the Basin, degraded groundwater from the Irvine Subbasin provides non-potable water for agricultural and landscape use. The groundwater in this Subbasin is high in total dissolved solids, color and nitrates. This Subbasin has a perennial groundwater yield estimated at 13,000 AF. The Irvine Company ("TIC"), the major landowner in IRWD, has historically pumped agricultural water from the Irvine Subbasin. (As in the rest of the Basin of which this Subbasin is a part, the groundwater rights have not been adjudicated, and OCWD provides governance and management under the Act.) By agreement between TIC and IRWD, the TIC production capability, wells and other facilities and associated rights have been transferred IRWD. A portion of the existing Subbasin produces water which is of potable quality. IRWD is currently

constructing facilities to treat some of the water produced for potable use, by means of the Irvine Desalter Project.

Los Alisos Water District (LAWD) Wells
IRWD also currently operates six wells within the unadjudicated Lake Forest area, however, this area does not overlie the Basin and therefore currently has much less groundwater production capability. The majority of these wells produce poor quality supply which supplements the tertiary reclamation plant production in order to meet peak seasonal demand. IRWD is presently evaluating the future use of these wells.

Allowable Groundwater Pumping. OCWD manages the amount of production in the basin through financial incentives. The framework for the financial incentives is based on establishing the Basin Production Percentage (BPP). The BPP is the ratio of groundwater production to total water demands expressed as a percentage. Pumping below the BPP is charged a fee on a per acre-foot basis, the Replenishment Assessment (RA). Groundwater production above the BPP is charged the RA and the Basin Equity Assessment (BEA), which is set so that the cost of groundwater pumping above the BPP is similar to the cost of imported water. Section 31.5 of the Act empowers OCWD Board to annually establish the BPP. It has been OCWD's goal to maintain and/or raise the BPP as high as possible to allow pumpers as much groundwater as possible [6]. The BPP remained at 75% from 1993 to July 2003 when it was reduced to 66%, and for the current fiscal year, OCWD adopted a BPP of 64%. This is anticipated by IRWD to be a temporary measure employed by OCWD to encourage lower pumping levels as OCWD implements other measures to reduce the current accumulated overdraft in the Basin. This reduction is not expected to affect any of IRWD's currently available groundwater supplies listed herein, which are subject to a contractually-set equivalent basin production percentage or are exempt from the basin production percentage.

Producers may install and operate production facilities under the Act; OCWD approval is not required. The potable groundwater supply to IRWD is produced from the Dyer Road Well Field (DRWF) located in the City of Santa Ana, which is connected to IRWD's system through a 54-inch pipeline in Dyer Road. The DRWF was developed starting in 1984 as a result of an agreement among IRWD, OCWD and the City of Santa Ana. The DRWF consists of 16 wells with 80.0 cfs pumping capacity, pumping from the non-colored water zone of the Basin and two wells (with colored-water treatment facilities) pumping from the deep, colored-water zone of the Basin (the colored-water portion of the DRWF is sometimes referred to as the Deep Aquifer Treatment System or "DATS".) Under agreement, an "equivalent" BPP has been established for the DRWF, currently 28,000 AFY of non-colored water and 8,000 AFY of colored water, provided any amount of the latter 8,000 AFY not produced results in a matching reduction of the

28,000 AFY BPP. Although typically, IRWD production from the DRWF does not materially exceed the equivalent BPP, the equivalent BPP is not an extraction limitation; it results in imposition of monetary assessments on the excess production.

As stated, no pumping restrictions exist in the Basin, however, OCWD manages the production through financial disincentives for production above the BPP. Table 5 provides IRWD's allowable production under the OCWD Act and IRWD's agreements.

Table 5
Allowable Groundwater Pumping - AFY

Basin Name	Allowable Pumping – AFY
Lower Santa Ana River Basin	28,000 AFY through DRWF agreement
Lower Santa Ana River Basin	7,200 AFY through 3rd Amendment to DRWF agreement
Lower Santa Ana River Basin	Currently approximately 6,000 AFY
Lower Santa Ana River Basin (Irvine Subbasin)	11,592 AFY (both potable and non-potable)

Basin overdraft
The Department of Water Resources has not identified the Basin as overdrafted in its most current bulletin that characterizes the condition of the Basin, Bulletin 118 (2004). OCWD's Act defines annual basin overdraft to be the quantity by which production exceeds the natural replenishment of groundwater supplies during a water year. The efforts being under taken by OCWD to eliminate long-term overdraft in the Basin are described in the OCWD MPR, including in particular, Chapter 4, 5, 6, 14 and 15 of the MPR and also in the OCWD Groundwater Management Plan [6].

The accumulated overdraft is defined by the Act to be the quantity of water needed in the groundwater basin forebay to prevent landward movement of seawater into the fresh groundwater body. However, seawater intrusion control facilities have been constructed and others are under construction or planned by OCWD since the Act was written, and have been effective in preventing landward movement of seawater into the fresh groundwater body. These facilities allow greater utilization of the Basin's storage capacity. Based on these opportunities, a "target" dewatered storage of 200,000 AF has been implemented for the past several years as the appropriate accumulated overdraft level of the Basin [5].

G. Groundwater Pumped Past Five Years (§ 10631(b)(3))

Table 6 shows amounts of groundwater pumped by source over the past five years.

Table 6 *Amount of Groundwater Pumped (AFY)*					
Location	2000	2001	2002	2003	2004
Orange County Groundwater Basin	20,580	20,377	25,855	24,040	30,265
Irvine Subbasin (IRWD)	2,890	1,687	2,533	2,132	1,938
Irvine Subbasin (TIC)	4,862	3,967	5,075	4,234	3,079
Lake Forest wells	346	543	744	598	357
% of Total Water Supply	34%	32%	39%	37%	41%

H. Groundwater Projected to be Pumped (§ 10631(b)(4))

IRWD is constructing the Irvine Desalter Project treatment plants in the Irvine Subbasin which is projected to produce both potable and non-potable water supplies starting in 2007. IRWD is also pursuing the installation of additional production facilities in the west Irvine portion of the Basin. This supply is considered to be under development, however, one well has been drilled, a site for an additional well and treatment facility has been acquired by IRWD, and IRWD is in negotiation for the purchase of a third well site. The production facilities can be constructed and operated under the OCWD Act, no statutory or contractual approval is required to do so.

IRWD, as well as other producers, are discussing principles related to the annexation of remaining land within each agency's respective service areas into OCWD. Of the 84,610 acres in the IRWD service area, approximately 33,400 acres are presently within OCWD. IRWD and OCWD are negotiating terms and conditions for annexation of additional area within IRWD into OCWD. This includes approximately 14,400 acres of land with the Natural Community Conservation Plan Reserve that is not subject to development. Annexation of areas within IRWD, but outside the OCWD watershed boundary, is not contemplated. Table 7a shows the amount of groundwater projected to be pumped without annexation of additional IRWD service area into the OCWD and Table 7b presents the amounts of groundwater projected to be pumped with annexation. These amounts assume pumping within BPP and no BEA assessments.

Table 7a

Amount of Groundwater Projected to be Pumped (AFY) without annexation

Location	2010	2015	2020	2025	2030
Orange County Groundwater Basin	43,294	45,372	47,612	49,765	50,059
Irvine Subbasin (Irvine Desalter)	11,592	11,592	11,592	11,592	11,592
% of Total Water Supply	47%	46%	45%	45%	45%

Table 7b

Amount of Groundwater Projected to be Pumped (AFY) with annexation

Location	2010	2015	2020	2025	2030
Orange County Groundwater Basin	63,580	67,529	70,783	73,436	74,170
Irvine Subbasin (Irvine Desalter)	11,592	11,592	11,592	11,592	11,592
% of Total Water Supply	64%	64%	63%	63%	63%

Law

> 10631. A plan shall be adopted in accordance with this chapter and shall do all of the following:
>
> 10631 (c) Describe the reliability of the water supply and vulnerability to seasonal or climatic shortage, to the extent practicable, and provide data for each of the following:
> (1) An average water year.
> (2) A single dry water year.
> (3) Multiple dry water years.
>
> For any water source that may not be available at a consistent level of use, given specific legal, environmental, water quality or climatic factors, describe plans to supplement or replace that source with alternative sources or water demand management measures.

I. Reliability of Supply (§ 10631(c))

IRWD has taken an integrated approach to developing a diversity of supply sources to achieve a reliable and economical water supply system operation. Development of groundwater, both untreated and treated; and expanded recycled water, is projected to reduce the reliance on imported water supply. Imported water supplies remain a source to provide supplemental supply, as well as provide redundancy in the event of shutdowns or emergency outages. [1].

IRWD's water supply management program is aimed at maximizing the efficient use of existing supplies and to assure adequate supplies will be available to meet future water demands for its entire service area. Under IRWD's supply criteria model, adequate supplies exist to meet demands. As part of its WRMP, IRWD forecasts minimum water supply availability for each of its sources of supply and projects total water supply for subsequent years [1].

Imported Water Management. The management of imported water supplies to IRWD is performed by MWD, the regional wholesale agency. The imported supply IRWD receives from MWD is contractually subject to availability. Due to reliability on imported supplies, IRWD also relies on MWD to carefully manage supplies. The MWD planning initiatives to manage supplies are addressed in MWD's 2005 Regional Urban Water Management Plan (RUWMP) [3].

MWD has undertaken a number of planning initiatives over the past ten years. To assist local water providers that are reliant in whole or in part on MWD's imported supply, MWD provides information concerning the availability of the supplies to its entire service area. MWD's RUWMP summarizes these efforts which also include the Integrated Resources Plan (IRP), the IRP Update, the Water Surplus and Drought Management Plan, Strategic Plan and Rate Restructure. Together these provide a policy framework, guidelines and resource targets for MWD to follow into the future [3].

In 1996, MWD completed its Integrated Resource Plan ("IRP") to establish regional targets for the development of water resources and a preferred resource mix which would ensure MWD would meet the region's present and future needs for dependable supplies without interruption through 2025. In 2004 MWD completed its IRP Update with three objectives 1) to review the goals and achievements of the 1996 IRP, 2) to identify changed conditions for water resource development and 3) to update the resource targets through 2025. MWD made revisions to the IRP including any changed conditions, which serve as the foundation for planning assumptions used in the RUMWP.

Demands on MWD

Estimates of demands on MWD for the RUWMP were derived by first estimating the total retail demands for the region and then factoring in impacts of conservation. MWD uses the "MWD-Main Water Use Forecasting System" that is a combination of statistical and end-use methods that has been adapted to conditions in Southern California. MWD also uses projections of local supplies and expected local supply programs to arrive at total demands on MWD. MWD estimates demands for single dry year, multiple dry years and average years. MWD's RUWMP shows that the region can provide reliable water supplies under both the single driest year and the multiple dry year hydrologies that have existed in past dry periods throughout the period 2010 through 2030. MWD's RUWMP provides detailed justifications for the sources of supply used for the reliability analyses. MWD has also identified buffer supplies, including additional groundwater storage and transfers that could serve to supply additional water needs [3].

Groundwater Supply Management. As stated under the "Groundwater Source" section above, OCWD is required to annually investigate the condition of the Basin, assess overdraft and accumulated overdraft, and determine the amount of water necessary for replenishment. OCWD has studied the Basin replenishment needs and potential projects to address growth in demand until 2020. This is described in detail in the OCWD MPR and Groundwater Management Plan. OCWD's Groundwater Management Plan describes OCWD's general management approach to the Basin. OCWD has historically sought to increase supply rather than restrict demand. No pumping restrictions exist and producers can obtain 100 percent of their water needs from the Basin, which greatly enhances water reliability [6].

OCWD has invested over $250 million in seawater intrusion control (injection barriers), recharge facilities, laboratories, and Basin monitoring to effectively manage the Basin. Consequently, although the Basin is currently in an "overdraft" condition, it is actually managed to allow utilization of up to 500,000 acre-feet of storage capacity of the basin during dry periods, acting as an underground reservoir and buffer against drought. OCWD also operates the basin to keep the target dewatered basin storage at 200,000 acre-feet as an appropriate accumulated

overdraft. If the Basin is too full, artesian conditions can occur along the coastal area, causing rising water and water logging, an adverse condition. Since the formation of OCWD in 1933, OCWD has made substantial investments in facilities, Basin management and water rights protection, resulting in the elimination and prevention of adverse long-term "mining" overdraft conditions. OCWD's efforts include ongoing replenishment programs and planned capital improvements. It should be noted under OCWD's management of overdraft to maximize its use for annual production and recharge operations, overdraft varies over time as the Basin is managed to keep it in balance over the long term. The Basin is not operated on an annual safe-yield basis [4].

Non-Potable Water Management. Water recycling has proven to be an effective "drought-proof" reliable supply. Water recycling within IRWD consists of using treated wastewater from the MWRP and LAWRP. Recycled water produced from MWRP during the winter months, which is not immediately used for irrigation, is delivered to seasonal storage reservoirs for use during higher demand periods. IRWD is considering expansion of its MWRP to provide additional recycled water as demands and sewage flows increase in the future.

As with the potable system, having several sources of supply provides reliability in the recycled water system—recycled water from the MWRP, untreated water from MWD, local runoff and some local groundwater. Non-potable water system reliability is further enhanced by seasonal storage capacity in Rattlesnake Reservoir, Sand Canyon Reservoir, San Joaquin Reservoir and Irvine Lake.

Given the dependence of native water on rainfall for Irvine Lake, for purposes of water supply reliability, only a small portion of IRWD's share of 28,000 AFY of native water rights (4,000 AFY in normal years and 1,000 AFY in dry years) is shown in available supplies, based on averaging of historical data. However, IRWD's ability to supplement Irvine Lake storage with its imported untreated water supplies offsets the uncertainty associated with the native surface water supply.

Table 8 below shows the Supply Reliability for IRWD for Normal Water Year, Single-Dry and Multiple Dry Water Years. The water supplies projected here do not represent the total supply capacity available to IRWD but rather the projected supplies to meet the projected demands. Table 9 shows the basis of the water year data which was provided by MWDOC's 2005 RUWMP. Table 10 shows the Factors Resulting in Inconsistency of Supply.

Table 8 ***Supply Reliability for IRWD***					
		Multiple Dry Water Years			
	Normal Water Year (2010)	Single Dry Year	Year 1	Year 2	Year 3
Potable Supplies					
Purchased MWD treated	25,318	25,318	25,318	25,318	25,318
Clear groundwater	28,000	28,000	28,000	28,000	28,000
Treated groundwater	22,988	22,988	22,988	22,988	22,988
Non-potable Supplies					
Recycled water	26,203	26,203	26,203	26,203	26,203
Purchased MWD untreated	6,303	9,303	9,303	9,303	9,303
Native (surface water)	4,000	1,000	1,000	1,000	1,000
Non-potable groundwater	3,898	3,898	3,898	3,898	3,898
Total	116,710	116,710	116,710	116,710	116,710
% of Normal	100%	100%	100%	100%	100%

Table 9 ***Basis of Water Year Data***			
Water Year Type			
Normal Water Year	(Average)		
Single Dry Water Year	1961		
Multiple Dry Water Years	1959	1960	1961

Table 10 ***Factors Resulting in Inconsistency of Supply***	
Source of Supply	Climatic
Non-potable Native	Native water stored in the Santiago Dam (Irvine Lake) results from local runoff from the Santiago Creek which is dependent upon annual rainfall.

As noted in Table 8, IRWD expects 100% of normal supply reliability under single-dry and multiple-dry years. Although, native local runoff from Santiago Creek is reduced during single-dry and multiple dry-years, if needed, IRWD could purchase supplemental supplies from MWD.

J. Transfer and Exchange Opportunities (§ 10631(d))

Over the past four years, IRWD has been evaluating the potential of participating in water banking to bank exportable, wet year surplus water at lower costs, which will enhance IRWD's supplemental dry year water supply reliability. Over the past 15 years, water districts in Kern County have been in the forefront of the development of groundwater banking programs.

In 2003, IRWD reviewed potential opportunities for water banking and subsequently purchased approximately 600 acres of agricultural land in Kern County for this purpose. This property is intended to be developed for water banking purposes in cooperation with local Kern County water agencies. IRWD is in the process of working with local Kern County agencies to develop the property for water banking, and a program is contemplated, however, not in place at this time. It is anticipated that such a cooperative project will increase IRWD's water supply reliability by providing redundancy to its existing water supplies.

In 2004, IRWD entered into a preliminary agreement with Semitropic Water Storage District (Semitropic) located in Kern County on a "water banking" program. This program will make it possible for IRWD to store excess water during "wet" hydrologic periods for use during "dry" periods in order provide additional reliability in water supplies. The water would be stored in an underground aquifer in Kern County.

The storage capacity contemplated under IRWD's participation in the water bank is between 50,000 AF to 75,000 AF and the recovery capabilities are intended to be between 10,000 AFY and 20,000 AFY depending on the banked supplies available. It is expected that an exchange of stored supplies for exportable State Water Project supplies would occur between State Water Project contractors MWD, on IRWD's behalf, and Kern County Water Agency, on Semitropic's behalf.

Table 11
Transfer and Exchange Opportunities

Source of Transfer Agency	Transfer or Exchange	Short term	Proposed Quantities AFY	Long term	Proposed Quantities AFY
Semitropic Water Storage District (Kern County Water Agency)	Exchange	X	17,500	X	17,500

Law

10631. A plan shall be adopted in accordance with this chapter and shall do all of the following:

10631 (e) (1) Quantify, to the extent records are available, past and current water use, over the same five-year increments described in subdivision (a), and projected water use, identifying the uses among water use sectors including, but not necessarily limited to, all of the following uses:

(A) Single-family residential; (B) Multifamily; (C) Commercial; (D) Industrial; (E) Institutional and governmental; (F) Landscape; (G) Sales to other agencies; (H) Saline water intrusion barriers, groundwater recharge, or conjunctive use, or any combination thereof; and (I) Agricultural.

K. Water Use by Customer-type – Past, Current and Future (§ 10631(e))

Past, current and projected data on water use within IRWD from 2000 to 2030 is provided in Table 12. The current information is based on monthly records of water sales throughout the service area.

Table 12
Past, Current and Future Water Uses

Year	Water Use Sectors	Single family	Multi-family	Com-mercial	Indust-rial	Instit/ Gov	Land-Scape	Agric.	Total
2000	# of accts.	42,300	26,551	3,308	885	154	4,574	73	77,845
	AFY	23,014	4,884	6,986	6,816	2,645	27,052	16,677	88,074
2005	# of accts.	47,650	30,147	3,973	1,054	223	5,306	81	88,434
	AFY	26,103	4,868	7,663	6,047	2,842	23,371	8,801	79,696
2010	# of accts.	68,409	34,947	4,631	1,141	224	5,923	38	115,313
	AFY	36,475	6,300	9,584	8,615	3,769	34,332	8,615	107,690
2015	# of accts.	74,937	44,723	5,385	1,204	254	6,308	41	132,851
	AFY	39,156	7,901	10,922	8,904	4,183	35,829	9,295	116,190
2020	# of accts.	82,896	48,076	6,017	1,347	272	6,841	31	145,479
	AFY	42,665	8,366	12,020	9,813	4,416	38,272	7,115	122,668
2025	# of accts.	86,363	52,698	6,694	1,433	329	7,102	21	154,641
	AFY	43,783	9,033	13,173	10,287	5,269	39,141	4,767	125,453
2030	# of accts.	91,053	54,966	7,011	1,504	343	7,431	18	162,326
	AFY	45,468	9,280	13,590	10,635	5,405	40,339	4,008	128,725

All connections for IRWD are metered. Each single-family dwelling unit and many townhouses and condominiums have individual meters. Apartments and some condominiums average 15 - 20 units per meter. The majority of irrigation use within IRWD is served with recycled water; and irrigation uses throughout the IRWD service area such as school sites, parks, greenbelts, medians, homeowner association common areas, and front yard common areas are classified under Landscape.

Sales to Other Agencies

IRWD and the City of Orange entered into a water service agreement for a future development area where both IRWD and the City have jurisdiction. Development planning is currently underway and projected demands for this future area are included in "Projected Future Water Use" in Table 12.

IRWD has an agreement with neighboring Santa Margarita Water District (SMWD) to deliver excess recycled water. Annually, IRWD wholesales approximately 1,500 AF of surplus recycled water to SMWD on an as needed basis to help meet its growing recycled water demand. IRWD also wholesales recycled water to the Orange County Water District (OCWD) Green Acres Project (GAP). During the months from October through March, IRWD delivers approximately 2,500 AF of surplus recycled water to GAP. Table 13 shows IRWD's projected wholesale water sales for past, current and projected years.

Table 13

Sales to Other Agencies (AFY)

Water Distributed	2000	2005	2010	2015	2020	2025	2030
GAP	1,782	2,651	2,500	0	0	0	0
Santa Margarita WD	1,915	443	1,500	1,500	1,500	1,500	1,500

Table 14 shows IRWD's past, current and projected unaccounted for water.

Table 14

Unaccounted for Water Loss (AFY)

Water Use	2000	2005	2010	2015	2020	2025	2030
Domestic	4,008	2,863	3,800	4,100	4,400	4,600	4,650
Recycled/Untreated	289	850	1,100	1,200	1,350	1,500	1,525
Other unbilled	96	99	120	130	145	155	160
Total	4,393	3,812	5,020	5,430	5,895	6,255	6,335

IRWD's total water use including customer demands, wholesale to other agencies and unaccounted for water use for past, current and projected years is shown in Table 15.

Table 15 ***Total Water Use (AFY)***							
Water Use	2000	2005	2010	2015	2020	2025	2030
Sum of Tables 12, 13, 14	96,164	86,602	116,710	123,119	130,063	135,208	136,560

L. Demand Management Measures (§ 10631(f)-(j))

It is stated under Water Code Section 10631 (j), "Urban water supplies that are members of the California Urban Water Conservation Council and submit annual reports to that council in accordance with the "Memorandum of Understanding Regarding Urban Water Conservation in California," dated September 1991, may submit the annual reports identifying water demand management measures currently being implemented, or scheduled for implementation, to satisfy the requirements of subdivisions (f) and (g)."

California Urban Water Conservation Council

IRWD became a signatory to the Memorandum of Understanding Regarding Water Conservation in California (MOU) in August 1991 and therefore implements a prescribed set of urban water conservation Best Management Practices (BMPs). The urban water conservation practices are intended to reduce long-term urban demands and are in addition to programs that may be instituted during occasional water supply shortages and IRWD is very committed to water use efficiency. IRWD provides the detail of its water demand management activities either implemented or scheduled to be implemented in its 2003 and 2004 Annual Report filed with the California Urban Water Conservation Council (CUWCC). Under Appendix D is a copy of IRWD's 2003 and 2004 filed Annual Report to the CUWCC.

IRWD's Rules and Regulations

IRWD's adopted Rules and Regulations [7] state:

> "it is the desire of the District to effect conservation of water resources whenever possible, such measures being consistent with legal responsibilities to utilize the water resources of the State of California and the District.
>
> Facilities for irrigation of new or existing parks, median strips, landscaped public areas or landscaped areas, lawns or gardens surrounding single family homes, condominiums, townhouses, apartments and industrial parks shall be designed and installed in such a way as to conserve water.
>
> Recycled water is considered a water resource by the District, therefore, the same restrictions shall apply for all uses of recycled water as for potable water.

Rate and extent of application of water shall be controlled by the user so as to minimize run-off from irrigated areas.
All water closets installed after January 1, 1991, must flush with 1.6 gallons of water or less. Whenever reasonably possible, water closets in existence before the effective date must be fitted with retrofit devices, such as, but not limited to, devices set into the toilet tank, which decrease the amount of water used to flush such water closets."

IRWD Rate Structure. IRWD uses a five-tiered rate structure which rewards conservation. The tiered rate billing system, based on a water budget allocation, was established to encourage conservation and discourage substandard irrigation systems. Water allocations are based on number of residents, landscape square footage and actual daily weather and evapotranspiration (ET) data for the respective area. Allocations contain more than enough water to meet the demands of landscaping and indoor use. Inefficient use is penalized with higher rates. Since the introduction of this rate structure, water consumption has dropped significantly, while the health of the landscapes within IRWD's service area has improved.

Enforcement of 1981 and 1992 California Plumbing Code. The cities within the IRWD's service jurisdiction provide for the enforcement of the 1981 and 1992 California Plumbing Code requiring all houses built or remodeled after these years to include water conserving fixtures such as low-flush toilets with maximum capacity of 1.6 gallons per toilet per flush. As noted this is included in IRWD's Rules and Regulations [7].

Landscaping Ordinance. The City of Irvine adopted an ordinance in October 1990, which provides policies, standards, and guidelines for efficient landscaping. This ordinance applies to new landscaping within commercial, industrial, and multi-family complexes. IRWD provides selected plan checking for new landscape sites at the City's request and provides assistance to all landscape users to encourage the efficient use of landscape irrigation. The Lake Forest City Council and the Orange County Board of Supervisors adopted the Comprehensive Zoning Codes guiding the design and utilization of new landscape irrigation systems in common areas of residential communities and commercial developments within the service area. On June 5, 1990 the Orange County Board of Supervisors amended the Ordinance addressing conservation of water utilized for landscape irrigation.

Free Distribution and/or Installation of Water-Saving Devices. A large number of water-saving devices have been distributed and/or installed by IRWD free-of-charge. The main devices consist of low flow showerheads, faucet aerators, toilet dams, flow restrictors, and sprinkler nozzles. (The implementation of these devices is included in IRWD's annual BMP reporting to the California Urban Water Conservation Council under Appendix D.)

Lawn Watering Guide. IRWD offers a lawn-watering guide to its customers free-of-charge. The guide is designed to help customers determine the volume of water needed to adequately irrigate lawns.

Home Water Audit Program. Home water audits are available at no charge to assist IRWD customers who maintain exterior home landscaping. The audit takes about one hour to complete. A trained auditor visits the customer's home and gives instruction on how to read the water meter, evaluate the landscaping and irrigation system, check for leaks, and install low flow showerheads, faucet aerators and toilet displacement devices. (The home water audit program is documented in IRWD's annual BMP reporting to the California Urban Water Conservation Council under Appendix D.)

Public Education Program. IRWD's public education program is aimed at promoting voluntary water conservation. The program consists of making the general public understand what the situation is, what actions are proposed, what needs to be achieved, and how to implement the program. IRWD informs its customers through billing inserts, mailers, water conservation booths, newsletters, bumper stickers, community association meetings, and local public events. Literature provided informs customers of any drought conditions that may exist, conservation methods, and their impact on water reduction. This program appeals for voluntary conservation from IRWD's customers.

Regional Conservation Efforts. The MWD and the MWDOC implement a number of conservation activities in Southern California at a regional level. These conservation activities are addressed at length in MWDOC's and MWD's RUWMPs [2], [3].

Incentive Pricing. In an effort to promote water conservation, IRWD provides untreated and recycled water supplies at lower rates than potable water. The untreated water pricing does not include a service charge, only a commodity charge to recover the cost of water purchases. The recycled water pricing policy includes a monthly service charge identical to the potable system and a lower commodity rate to encourage the use of recycled water. Moreover, as an incentive to reduce water consumption, IRWD provides a reduced sewer service charge for residential customers who use less domestic water.

IRWD prepares monthly reports, which outline water use by customer type. These reports are used to evaluate water use trends and track conservation efforts. This information may be shared with customers that exceed water use allocations and IRWD staff works closely with customers on curtailing water use to stay within set allocations.

M. Evaluation of DMMs Not Implemented (§ 10631(g))

IRWD does not have any demand management measures (DMMs) that are not currently being implemented or are not scheduled for implementation. Table 16 below indicates that the cost of non-implemented and non-scheduled DMMs is not applicable. IRWD does implement several of the BMPs using an As Least As Effective As option, as described below.

Table 16 ***Unit cost of water resulting from non-implemented DMMs and planned water supply project and programs***	
Non-implemented/Not Scheduled DMM/Planned Water Supply Project	Per-AF Cost ($)
Not applicable	

As Least As Effective As DMM Implementation

BMP 1: Water Surveys for Residential Customers

IRWD implemented a water-budget based tiered rate structure in 1991 that is at least as effective as BMP 1. In 2004, IRWD's residential per account water use still remains 6.86 % below the pre- water-budget rate structure, or 19.45 gpd. The rate structure allocates each account an indoor and outdoor water budget. Customers are penalized for any usage that exceeds the allocated budget, as follows:

Tier	Percent of Allocation	Rate
Low Volume	Up to 40%	Low Volume Discount
Conservation Base	41-100%	Base
Inefficient	101-150%	2 x Base Rate
Excessive	151-200%	4 x Base Rate
Wasteful	201%+	8 x Base Rate

This approach also encourages customers with above-allocation usage to contact the District for assistance. Those customers receive targeted water surveys that include all of the elements required in BMP 1. Due to financial impact of over-use with IRWD's rate structure, IRWD's As Least As Effective As implementation does not result in deterioration of savings over time, as is the case with standard water survey savings.

BMP 5: Large Landscape Conservation Programs and Incentives

IRWD implemented a water-budget based tiered rate structure for all accounts in 1991 that penalizes customers for inefficient use. BMP 5 is designed to achieve a 15% reduction in

landscape use. IRWD's rate structure is As Least As Effective As BMP 5, and in fact has resulted in a greater level of savings as shown below. Landscape water use decreased 56% from 1991 to 2004, and 18.75% from 1997 to 2004. The CUWCC estimates landscape savings from water use surveys at only 15%. The Table below shows the acre-feet savings per acre of landscape from IRWD's tiered rate structure.

Acre Ft/Acre/Year Water Savings from IRWD's Tier Rate Structure													
1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
4.4	3.5	3.3	3.2	2.5	2.4	2.4	1.9	2.0	2.1	2.0	2.2	1.93	1.95

BMP 9: Conservation Programs for Commercial, Industrial and Institutional (CII) Accounts

IRWD is implementing an As Least As Effective As program for BMP 9. IRWD assigns water budget allocations to all commercial, industrial and institutional customers. Customers exceeding the water budget allocation due to inefficient water use incur penalty rates, thus providing a financial incentive for CII customers to conserve water resources. BMP 9 allows agencies to implement combined programs, and agencies are considered on track if the percent of water savings when added together equals or exceeds 2.4% from 1997 baseline year use. In 1997, IRWD's total CII use was 17,249 AF for a total of 3,077 CII accounts. In 2004, total CII use had dropped to 16,835.1 AF, but the number of CII accounts increased to 4,761. IRWD's CII water use reduction from the 1997 baseline year to 2004 is 2.3%, however the number of accounts increased by 55%. Additionally, IRWD's largest single customer is the University of California, Irvine (UCI), one of the fastest growing campuses in the UC system. Therefore, the baseline comparison data is somewhat skewed, however, on a per account basis, water use has reduced from 5.6 AF per CII account in 1997 to 3.54 AF per CII account in 2004, a per account reduction of 36%.

BMP 11: Conservation Pricing

IRWD's rate structure assigns a water budget allocation to every account: residential, landscape and CII consistent with BMP 11. Customers are penalized for exceeding any use above the allocation with rates that double each tier. This rate structure was instituted to promote the efficient use of water and provide customers with economic signals as their use increased. The rate structure has provided the foundation for IRWD's water conservation programs since the early 1990's. Revenue from higher tier water use is reinvested to promote long-term improvements in water use efficiency and support IRWD's environmental programs.

IRWD's water-budget based tiered rate structure is often cited as a model for water conservation, and the results are well-documented. Residential usage dropped by an average of 12% per meter, or a total of 1,074 AF in the first year, despite a 5% growth rate and after usage had

already dropped in response to the drought. Although the average usage has increased since the drought ended, it remains below the pre-budget structure average. Landscape usage has dropped from an average of 4.4 AF per acre per year on 3,361 acres in 1991 to 1.95 AF per acre per year on 12,000 acres in 2004 (See Table under BMP 5 above).

Law

> 10631. A plan shall be adopted in accordance with this chapter and shall do all of the following:
>
> 10631 (h) Include a description of all water supply projects and water supply programs that may be undertaken by the urban water supplier to meet the total projected water use as established pursuant to subdivision Section 10635(a). The urban water supplier shall include a detailed description of expected future projects and programs, other than the demand management programs identified pursuant to paragraph (1) of subdivision (f), that the urban water supplier may implement to increase the amount of the water supply available to the urban water supplier in average, single-dry, and multiple-dry water years. The description shall identify specific projects and include a description of the increase in water supply that is expected to be available from each project. The description shall include an estimate with regard to the implementation timeline for each project or program.

N. Planned Water Supply Projects and Programs (§ 10631(h))

In general, IRWD's supplies that are planned or under development may necessitate the preparation and completion of environmental documents, regulatory approvals and/or contracts prior to full construction and implementation. As outlined in the WRMP, prudent water supply and financial planning dictates that development of supplies be phased over time consistent with the growth in demand.

Imported Water. Planned water supply projects related to IRWD's imported supply is addressed in detail in MWD's and MWDOC's 2005 RUWMPs [2, 3] and may include improvements associated with the "Central Pool Augmentation Project" including a new pipeline tunnel supply to South Orange County. MWD has done extensive planning over the past decade to develop new supplies to meet its IRP reliability goals.

Groundwater. IRWD's potential sources for increased local groundwater supplies in the future include the following:

West Irvine Wells. IRWD is pursuing the installation of production facilities in the west Irvine portion of the Basin. This supply is considered to be planned and under development, however, one well has been drilled, a site for an additional well and treatment facilities has been acquired by IRWD, and IRWD is in negotiation for the purchase of a third well site. The production facilities can be constructed and operated under the Act; no statutory or contractual approval is required to do so. (See discussion of the Act under Groundwater Section above.)

Irvine Desalter Project. The Irvine Desalter Project (IDP) is a groundwater quality restoration project that is currently being constructed to clean groundwater in the vicinity of the former Marine Corps Air Station El Toro base. Because of past chemical disposal and waste handling practices at the former base, volatile organic compounds (VOC) such as trichloroethylene have entered both the shallow and principal aquifers on and adjacent to the former base. In addition, areas just outside the plume of contamination contain elevated salts and nitrates caused by natural geology and past agricultural drainage which make the water unsuitable for drinking. The IDP proposes to pump and treat groundwater containing salts and nitrates to stop its migration from the Irvine Subbasin into the Main Orange County groundwater basin and to also prevent VOC-contaminated groundwater from spreading into the Main Orange County aquifer.

The IDP will consist of three water purification plants with separate wells and pipeline systems. One plant of the IDP will produce drinking water and the other will produce non-potable water. The drinking water purification plant will use reverse osmosis and disinfection and the non-drinking water plants will purify the VOC contamination water using air stripping and carbon absorption. By providing reliable new sources of local potable and non-potable water, the project will reduce dependency on imported water sources and enhance IRWD's reliability. The IDP will yield approximately 7,700 AFY of potable drinking water and 3,900 AFY of non-potable water which will supplement IRWD's non-potable system.

Recycled Water Supply.

Upgrades to Recycled Water System: IRWD produces tertiary-treated recycled water through the District's MWRP and LAWRP. IRWD is currently in the process of upgrading both of these treatment plants to allow for increased production to meet growing recycled water demands. The MWRP's upgrade will allow for production to increase from 15 mgd to the permitted 18 mgd. The LAWRP treatment system will be upgraded and tertiary capacity to accommodate flows up to 7.3 mgd. The project includes pumping and piping facilities to allow LAWRP recycled water to be delivered to Zone B of the IRWD system and to Zone A areas in the Lake Forest service area. These upgrades are within existing permit authorizations and CEQA compliance.

Expansion to Recycled Water Treatment Capacity: Future increases in sewage within IRWD will require an increase in wastewater treatment capacity at IRWD's MWRP or require additional discharges to the Orange County Sanitation District. IRWD is considering an increase of the current MWRP rated capacity of 18 mgd to as high as 33 mgd to produce additional recycled water. IRWD is also currently undergoing the evaluation of future expansion of the MWRP to serve IRWD's ultimate recycled water demands. IRWD plans to increase the capacity of the existing plant site to produce sufficient recycled water to meet the projected demand at full build out.

Table 17 includes the estimated normal-year supply, single dry-year supply and multiple dry-year supplies from IRWD's planned water supply projects.

Table 17
Planned Water Supply Projects (AFY)

Project Name	Start Date	Completion Date	Normal Year	Single Dry Year	Multiple Dry Years
IDP-Potable	2005	2007	7,694	7,694	7,694
IDP-Non-potable	2005	2007	3,898	3,898	3,898
West Irvine Wells	2008	2009	12,700	12,700	12,700
Recycled Water System Upgrades	2005	2007	8,500	8,500	8,500
Recycled Water Expansion	2010	2013	9,107	9,107	9,107

In addition, there may be an opportunity in the future for IRWD to receive recycled water from the El Toro Water District Wastewater Treatment Plant which could serve portions of IRWD's service area. This is a proposed joint project with IRWD, Moulten Niguel Water District and El Toro Water District that is under review.

O. Ocean Desalination (§ 10631(i))

A number of sites in Southern California are currently being considered for ocean water desalination facilities. Since IRWD could someday receive potable water produced by one or more of these facilities, staff has been tracking the development of these projects. Most recently, an ocean water desalination facility is being proposed at a site in Huntington Beach. The proposed project consists of the construction and operation of a 50 million gallon per day ocean water desalination facility within the City of Huntington Beach. Currently as proposed, IRWD would not be receiving any potential supplies from this plant to meet future water demands. MWD addresses seawater desalination on a regional basis in its 2005 RUWMP and it is included in the IRP Update target under local water production [3]. Table 18 shows opportunities for ocean desalination supplies for IRWD.

Table 18
Opportunities for ocean desalination

Source	Yield AFY	Start Date	Type of Use	Other
Ocean Water	Unknown	Unknown	Potable	Unknown

Planned projects including any groundwater desalination are included above in Table 17.

P. Current or Projected Supply Includes Wholesale Water (§ 10631(k))

In coordination with MWDOC, IRWD provided projected water demands up to the year 2030. MWDOC coordinated with MWD on the amount of water MWDOC, on behalf of its member agencies, wishes to purchase over the next 25 years. According to MWDOC, all of MWDOC's member agencies methodologies and assumptions underlying demand projections may differ, therefore MWDOC performed its own projection of retail demands for its service area using MWD's MWD-Main model which combines statistical and end-use methods that are adapted to conditions in Southern California. MWDOC found that projections were close to its member agencies' projections and selected using member agencies' projections because:

1. They yield to a higher water demand projection and, hence, is a more conservative approach;
2. Consistent with Water Code Section 10631(k) for MWDOC address the reliability of MWD's supply to meet the demand of items member agencies; and
3. To maintain "consistency" in regional planning.

In MWD's RUWMP, MWD presents its supply availability at the regional level, rather than at the member-agency level. In the MWD RUWMP, MWD is able to demonstrate that it can maintain 100% reliability in meeting direct consumptive demand under a normal hydrologic year, the single-driest hydrologic year, and a series of multiple dry years through 2030. By inference, MWDOC determined the availability of its imported supplies should equate to its projected imported demand. Thus MWDOC concludes that MWD will meet all of the imported demand for direct consumption projected by MWDOC [2]. Table 19 provides the imported demand projections IRWD provided to MWDOC during preparation of the UWMP and Table 20 provides the wholesale supplies via MWDOC planned for IRWD. MWD's 2005 RUWMP includes the detailed description identifying the existing and planned sources of water available regionally to the member agencies it serves [3]. Table 21 shows the reliability of wholesale supplies to IRWD as a percentage of normal.

Table 19

IRWD imported water demand projections provided to wholesaler (AFY)

Wholesaler	2010	2015	2020	2025	2030
MWD	37,203	34,519	38,680	29,748	41,520

Table 20
Wholesaler identified & quantified existing and planned sources for IRWD (AFY)

Wholesaler	2010	2015	2020	2025	2030
MWD	37,203	34,519	38,680	29,748	41,520

Table 21
Wholesale Supply Reliability - % of Normal (AFY)

		Single Dry	Multiple Dry Years		
Wholesaler Sources		1961	Year 1 (1959)	Year 2 (1960)	Year 3 (1961)
MWD	2010	100%	100%	100%	100%
MWD	2015	100%	100%	100%	100%
MWD	2020	100%	100%	100%	100%
MWD	2025	100%	100%	100%	100%
MWD	2030	100%	100%	100%	100%

Through the IRP process, MWD has analyzed the supply reliability using historical hydrology under normal and dry year scenarios to develop estimates of water surplus and shortage over the 30-year planning horizon. MWD has estimated its demands for single dry year, multiple dry years and average years. MWD's reliability analysis from the IRP Update, shows that MWD can maintain reliable supplies under the conditions that have existed in past dry periods, throughout the period 2010 through 2025. The RUWMP shows that level of reliability extends through 2030 [3]. Although climatic factors could affect MWD's surface supplies, MWD has identified buffer supplies, including groundwater storage and transfers that could serve to supply the additional water needed. Table 22 shows factors that may result in inconsistency of MWD's supply.

Table 22
Factors Resulting in Inconsistency of Wholesaler's Supply

Source	Legal	Environmental	Water Quality	Climatic
MWD				x

Law

> 10631.5 The department shall take into consideration whether the urban water supplier is implementing or scheduled for implementation, the water demand management activities that the urban water supplier identified in its urban water management plan pursuant to Section 79163. The urban water supplier may submit to the department copies of its annual reports and other relevant documents to assist the department in determining whether the urban water supplier is implementing or scheduling the implementation of water demand management activities.

III. Demand Management Measures Implementation (§ 10631.5)

IRWD is a signatory to the Memorandum of Understanding Regarding Water Conservation in California (MOU) and therefore implements a prescribed set of urban water conservation Best Management Practices (BMPs). IRWD provides the details of the water demand management activities either implemented or scheduled to be implemented in its 2003-2004 Annual Report filed with the CUWCC in January 2005. Under Appendix D is a copy of IRWD's 2003-2004 filed Annual Report to the California Urban Water Conservation Council (CUWCC), which provides the demand management activities implemented by IRWD.

Under Appendix E is a copy of IRWD's Coverage Report (filed with CUWCC) which shows IRWD's compliance with implementing the BMPs. IRWD is in compliance will all BMPs unless indicated that it is implementing an "at least as effective as" program implementation. See additional description of IRWD's demand management activities and implementation of its programs including "at least as effective as" program implementation under Section II subsections L and M.

Law

> 10632. The plan shall provide an urban water shortage contingency analysis which includes each of the following elements which are within the authority of the urban water supplier:
>
> 10632 (a) Stages of action to be undertaken by the urban water supplier in response to water supply shortages, including up to a 50 percent reduction in water supply, and an outline of specific water supply conditions which are applicable to each stage.

IV. Water Shortage Contingency Plan

A. Stages of Action (§ 10632(a))

This section presents information on how IRWD manages the water supply and system during a water shortage that could result from an emergency outage or a drought. IRWD's response to inadequate water supplies varies depending on the magnitude of the shortfall.
In the event of a water shortage situation, IRWD would rely on its Water Shortage Contingency Plan (WSCP) adopted in 1987 and recently updated in 2005 (Appendix F). The WSCP provides guidelines for specific responses to specific levels of shortage ranging from Stage 1 to Stage 4 with a series of measures that may be implemented during a water shortage or drought conditions. During varying water supply conditions, IRWD has performed analysis related to reduced supply and efforts to reduce demands accordingly, including voluntary and mandatory demand reduction measures. These stages of action have been included in IRWD's Rules and Regulations (Section 15) in relation to the WSCP, which states, "the measures may be applied singly or in combination and may vary according to the severity and duration of the shortage. Other measures may be applied in lieu of or in addition to those described in the WSCP." IRWD's Board declares the level or stage of shortage based on water supply conditions.

Table 23 below identifies water supply conditions and shortage stages for IRWD.

Table 23
Water Supply Shortage Stages and Conditions

Stage	Water Supply Conditions	% Shortage
Stage 1	drought warning and low level shortage condition	10%
Stage 2	Significant drought condition	10% to 25%
Stage 3	Emergency condition	25% to 40%
Final Stage	Crisis condition of water supply shortage	40%+

B. Estimate of Minimum Supply for Next Three Years (§ 10632(b))

The UWMP Act requires quantification of the minimum water supply available during the next three years (e.g., 2006 to 2008) based on the driest three-year historic sequence for IRWD's water supply. For IRWD's groundwater supplies, the driest three year historic sequence refers to the recorded three-year period with the lowest runoff in the Santa Ana River Watershed. For IRWD's imported supplies, the driest three year historic sequence is based on MWD's RUWMP historic sequence.

Due to the diversity of IRWD's supplies, supplies remain essentially constant between normal, single-dry and multiple dry years. This is due to the fact that groundwater and MWD imported water account for all of IRWD's potable supply, and recycled water, groundwater and some imported water comprise most of IRWD's non-potable supply. Groundwater production typically remains constant or increased in cycles of dry years, even if overdraft of the basin temporarily increases, as groundwater producers reduce their demand on imported supplies to secure reliability. As stated in MWDOC's RUWMP, MWDOC expects to meet all retail consumption during a three-year dry period of 2006-2008 based on the three driest years on record and MWD is expected to be able to supply all of MWDOC's imported water during the same period [2].

The shortages in water supplies experienced during the 1976-77 droughts had only a minor impact on IRWD customers. This was largely the result of efficient management of imported water supplies by MWD. The imported water operations modified by MWD included an increase in pumping from the Colorado River supply. At the time of the drought, IRWD did not operate groundwater wells; however, the agricultural demands in the area were met largely with the local groundwater from privately owned wells.

Table 24 below provides the three-year estimated minimum water supply during normal and multiple dry-year scenarios.

Table 24
Three-Year Estimated Minimum Water Supply (Multiple Dry Years) – AF/Year

	Normal			Multiple Dry Year		
Source	2006	2007	2008	2006	2007	2008
Local	61,472	68,552	69,863	58,472	65,552	66,863
Imported	43,239	38,446	39,508	46,239	41,446	42,508
Total	104,711	106,998	109,371	104,711	106,998	109,371

MWD's Water Shortage Contingency Analysis

MWD developed a Water Surplus and Drought Management Plan (WSDM Plan) in April 1999, which guides MWD's planning and operations during both shortage and surplus conditions to achieve MWD's IRP reliability goals. MWD has undertaken extensive analysis of system reservoirs, forecasted demands and probable hydrologic conditions. The results of the analysis demonstrated the benefit of coordinated management of regional supply and storage resources.

The WSDM Plan recognized the link between surpluses and shortages and integrates planned responses to both conditions. The WSDM Plan identifies the expected sequence of resource management actions MWD will take during surpluses and shortages to minimize the probability of severe shortages that require curtailment of demands. Through effective management of its water supply, MWD fully expects to be 100 percent reliable in meeting all non-discounted, non-interruptible demands throughout the next 25 years. [3].

During water shortages, MWDOC manages its water supply to ensure it meets the demands of its member agencies. During a severe water shortage, MWDOC would use the same principles as identified in MWD's WSDM Plan, subject to any locally developed principles or adjustments found to be relevant and adopted by MWDOC Board. The details of the regional coordination and operation of the water supply during a drought are included in both MWDOC's and MWD's RUWMPs [2, 3].

Groundwater

As previously discussed under the "Groundwater" section, groundwater production typically remains constant or increases in cycles of dry years. Even if overdraft of the basin temporarily increases, the basin serves as a buffer against water shortages as groundwater producers reduce their demand on imported supplies to secure reliability.

Non-Potable

Recycled water production also remains constant, and is considered "drought-proof" as a result of the fact that sewage flows remain virtually unaffected by dry years. Only a small portion of IRWD's non-potable supply, native water captured in Irvine Lake, is reduced in single-dry and multiple-dry years. In addition, significant quantities of "reserve" water supplies (excess of supplies over demands) will be available to serve as a buffer against inaccuracies in demand projections, future changes in land use, or alterations in supply availability. In addition, the potential exists for the treatment and conversion of some reserve non-potable supplies to potable water.

C. Catastrophic Supply Interruption Plan (§ 10632(c))

IRWD's response to a catastrophic interruption of water supply would depend on the cause, severity and anticipated duration of the emergency. Any potential shortage resulting in a reduction of available supplies can be addressed through a combination of alternative supplies and storage. Since IRWD's major water sources include both imported water and groundwater, it is unlikely that both sources would be out simultaneously. IRWD maintains an emergency response plan to provide information necessary to respond to an emergency situation that results in the District's inability to provide water supply.

Interruption in Imported Supplies

Interruption in source water deliveries to IRWD could occur as a result of a planned outage or emergency source outage. IRWD relies on MWD imported water for approximately 40% of all supplies to meet demands. Any possible cutback in deliveries from MWD can be mitigated to some extent (in the short term) for IRWD by the addition of other sources of supply, such as increased groundwater pumping.

The MWD member agencies reference MWD's Administrative Code for member agency outage planning criteria. Each member agency including MWDOC should have a seven-day supply of water in case of an interruption of MWD deliveries. IRWD's potable water system is linked through four existing interconnection valves. In the past, the interconnections have been used to compensate for supply interruptions resulting from scheduled and emergency outages of regional MWD pipelines.

As noted, IRWD owns capacity in the AMP and in EOCF#2 and other transmission mains that could be used to serve demands throughout the District. The availability of these additional sources enhance the reliability of IRWD's distribution system through diversification beyond its current dependence on just the AMP. IRWD is protected from the effects of the unscheduled pipeline outages such as that which occurred on the AMP in December 1999.

A complete outage of imported water from the Diemer Filtration Plant would result in the greatest supply deficiency in the IRWD system. MWD has initiated a study to look at the major water importation facilities in Orange County and the Diemer Filtration Plant (DFP) to assess the likelihood of failures and expected recovery times. This analysis will provide the Orange County retailers like IRWD with a more definitive time frame for an outage of the imported water system[1].

Service Area Interties

IRWD has existing interties between its Lake Forest service area and its main service area, which provide a positive service delivery benefit by increasing availability of supplies of water and the opportunities to share and expand the use of recycled water. The interties provide opportunities to increase regional facility operational efficiency by opening existing "emergency" interconnections on a regular basis. This increases access to water supply and allocates reservoir storage to support all systems thereby allowing flexibility of water operations and reducing the need for redundant storage capacity.

On an intercounty basis, IRWD has emergency water interconnections with several neighboring water purveyors providing a means to exchange and transfer water between agencies. Currently, IRWD has 10 interconnections: four with City of Newport Beach; one with East Orange County Water District; one with Santa Margarita Water District; one with Trabuco Canyon Water District; one with the City of Tustin; one with Mesa Consolidated Water District; and one with the City of Orange.

In the early 1980s, Orange County's regional water agencies formed the Water Emergency Response Organization of Orange County (WEROC) of which IRWD is also a member of. WEROC coordinates emergency response on behalf of all Orange County water agencies, develops an emergency plan to respond to disasters and conducts disaster training exercises for the Orange County water community.

IRWD District personnel have been cross-trained in emergency planning for water, wastewater and recycled water systems. In the potable water system, there will be access to multiple sources of supply and storage facilities. Existing "emergency" interconnections can be opened to regular service, which will increase access and reliability of water supply. Reservoir storage can be allocated to cross support all systems, which will increase reliability and flexibility of water operations and reduce the need for redundant storage capacity.

IRWD plans for and responds to emergency incidents, including power outage, earthquakes, fires, floods and hazardous materials incidents. Table 25 below provides a summary of actions in response to possible catastrophes which are intended to minimize the impacts of supply interruption on IRWD's service area.

Table 25

Preparation Actions for a Catastrophe	
Possible Catastrophe	Summary of Actions
Regional power outage	Request information from So. Cal Edison on estimated down time; if backup generation is available assess ability to supply fuel for extended periods; estimate potable water requirements under emergency condition and determine if needs can be met; increase disinfectant residual as a precaution of potential contamination; notify affected users; issue "Boil Water" or "Do Not Drink" orders as needed; initiate back up portable pumping equipment as needed to serve areas of limited storage. Notify customers, media, state and local authorities if service is disrupted or significant demand management is necessary.
Earthquake	Activate Emergency Operations Center (EOC); Contact emergency assistance (local police, local fire) as necessary; notify customers, media, state and local authorities if service is disrupted or significant demand management is necessary; contact neighboring water agencies for mutual aid arrangements and open connections if needed. Issue "Boil Water" or "Do Not Drink" orders as needed.
Flood	Contact local representative of National Weather Service for information on exact location and probable extent (stage) of flooding relative to utility facilities. Activate EOC; elevate in-place or remove water-sensitive equipment; assemble mobile stand-by generators and auxiliary water pumps; install sewer backflow valves; notify neighboring utilities of emergency response support if help is needed; notify customers, media, city and other authorities that service may be disrupted or that demand reductions may be necessary.
Water Supply Interruption	Depending on the percentage of water reduction needed (i.e. 5% to 50%) IRWD will institute its water prohibitions within its water shortage contingency plan. Take action to provide alternate drinking water supply and fire protection, including local interconnections with neighboring sources, area water haulers, temporary storage options, etc. Chlorine residuals increased temporarily as needed. Valve off portions of the distribution system until above ground storage tanks are refilled. Issue "Boil Water" or "Do Not Drink" orders as needed
Structural damage from explosive device	Perform damage assessment, determine how damage affects the system; isolate damaged area from rest of system and take measures to bypass damaged area. Based on extent of damage consider alternative treatment schemes if necessary Physically secure system and implement security procedures throughout the system. Notify local law enforcement and Department of Health Services (DHS). Issue "Boil Water" or "Do Not Drink" orders as needed.
Threat of or possible contamination to water system	Notify local law enforcement and DHS; take actions to isolate portions of system containing suspect water; issue "Boil Water" or "Do Not Drink" orders as needed; take action to provide alternate drinking water supply and fire protection.

D. Mandatory Prohibitions (§ 10632(d))

The following general prohibitions contained in IRWD's Rules and Regulations, Section 15 are in effect at all times regardless of whether a declared shortage condition is in effect [7]:

(a) **Gutter Flooding -** No person shall cause or permit any water furnished to any property within the District to run or to escape from any hose, pipe, valve, faucet, sprinkler, or irrigation device into any gutter or otherwise to escape from the property if such running or escaping can reasonably be prevented.

(b) **Leaks -** No person shall permit leaks of water that he has the authority to eliminate.

(c) **Waste -** No person shall cause or permit water under his control to be wasted. Wasteful usage includes, but is not limited to, the uses listed in Section 13(a) of Exhibit 1 to the Memorandum of Understanding Regarding Urban Water Conservation in California, dated December 11, 2002, as amended from time to time, or the counterpart of said list contained in any successor document.

In the case of a declared water shortage by the Board, responses to water shortages must be made early on to prevent severe rationing and economic impacts to customers. IRWD recognizes that it is best to caution customers of a water shortage as early as possible, at a minimal level, to encourage voluntary rationing and to gain public support and participation, and reduce the likelihood of more severe shortage levels later.

During Stage or Level 1 water alert conditions are declared and voluntary conservation is strongly encouraged. The water shortage situation is explained to the public and voluntary water conservation is requested. Because a prolonged drought would be a regional water problem covered by the media, it is reasonable to assume that demands would eventually be reduced as a result of the media coverage and attention.

As noted, the IRWD Board adopted a "Prohibition of Water Wastage" as included under Section 15 of IRWD's Rules and Regulations which identifies the prohibition measures, enforcement and penalties, some of which are in effect regardless of water supply conditions. The prohibitions intend to encourage and then mandate water conservation and set policies against water waste. They range from general and voluntary measures to emergency/mandatory. IRWD further defines mandatory restrictions and prohibitions in its WSCP based on declared water shortage level outlined below in Table 26.

Table 26
Mandatory Prohibitions

	Stage When Prohibition is	Stage When Prohibition

Examples of Prohibitions	Voluntarily Requested	Becomes Mandatory
Street/sidewalk cleaning	Stage 1	Stage 4
Washing cars	Stage 1	Stage 4
Pool filling	Stage 1	Stage 4
Landscape irrigation	Stage 1	Stage 4
Non-permanent agriculture	Stage 1	Stage 4
Uncorrected plumbing leaks	Always in effect	Stage 4
Gutter flooding	Always in effect	Stage 4
Waste	Always in effect	Stage 4
Washing Hard-surfaced areas	Always in effect	Stage 4

E. Consumption Reduction Methods (§ 10632(e))

All of IRWD's customers are metered which can measure reductions in water use. Metered water consumption is reported on a monthly basis through the utility billing system. During water shortage conditions, exceptionally high usage is identified and these accounts would be investigated for potential water loss or abuse problems. Imported water connections, groundwater production, and gross consumption are recorded daily and monthly and incorporated into water supply reports. During a water shortage, supplies would be closely monitored and consumption by large users monitored on a more frequent basis. In severe stages of drought, production and consumption data would be evaluated daily.

Public Education Program. IRWD's public education program is aimed at promoting voluntary water conservation. The program consists of making the general public understand what the situation is, what actions are proposed, what needs to be achieved, and how to implement the program. IRWD informs its customers through billing inserts, mailers, water conservation booths, newsletters, bumper stickers, community association meetings, and local public events. Literature provided informs customers of the drought condition, conservation methods, and their impact on water reduction. This program appeals for voluntary conservation from IRWD's customers. During the 1976-77 and 1987-1992 droughts, IRWD's response to reduce demands included public education programs aimed at promoting water conservation, as well as the adoption of a resolution prohibiting water wastage and a conservation surcharge to the water rate.

During water shortage stages 1 and 2, IRWD takes the approach to appeal for voluntary cooperation of all customers to conserve water, to impose restrictions on low priority uses, to enforce prohibitions on nonessential uses, and to initiate a public information and education campaign to achieve the specified conservation goal. During levels 3 and 4, the conservation measures are anticipated to be mandatory, including surcharges and rationing. Rationing for

residential customers and certain irrigation accounts may begin in Stage 3. Business, industrial and other nonresidential customer categories are required to reduce consumption by a certain percentage as a group. Commercial/industrial water customers using recycled water may be exempt from rationing.

It should be noted regarding landscape irrigation, approximately 90% of IRWD's landscape accounts are served with recycled water which is considered to be drought tolerant supply. Therefore, if no shortage of recycled water supplies exists, consumption reduction may only apply to potable water accounts. This, however, may not apply to non-potable water accounts since these may be dependent on imported non-potable supplies which would most likely be reduced in a drought.

Through the adopted resolutions, IRWD has provisions for consumption reduction methods to be implemented if necessary based on the water shortage level declared. The consumption reduction measures used by IRWD and included in the WSCP are summarized in Table 27.

Table 27

Consumption Reduction Methods

Consumption Reduction Method	Stage (Level) When Method Takes Effect	Projection Reduction (%)
Inform public of water shortage through schools, community associations, homeowner associations, business groups and media. Develop the public consciousness for voluntary compliance. Highlight conservation methods and water-saving devices, emphasize changing water use habits; disseminate water conservation and drought literature	Level 1	Level 1 methods are expected to reduce demands up to 10%
Increase commodity rates or reduce allocation, reduce potable landscape irrigation by 50%; activate District Task Force to consult with high-volume users to assist in reducing demands	Level 2	Cumulative levels 1 and 2 methods are estimated to reduce demand by 10-25%
Reduce customer allocations, reduce or eliminate potable landscape irrigation; ban all nonessential use such as car washing, pool filling, hydrant flushing, street cleaning; restrict industrial use	Level 3	Cumulative levels 1, 2 and 3 methods are estimated to reduce demand by 25-40%
Reduce customer allocations further, completely eliminate potable landscape and agricultural irrigation, fine violators and/or install flow restrictors	Level 4	Cumulative levels 1, 2, 3 and 4 methods are estimated to reduce demand by 40% or more

F. Penalties for Excessive Use (§ 10632(f))

As indicated, IRWD's Rules and Regulations (Section 15) provide for enforcement and penalties that may apply to violators specifically during a water shortage. Penalties that may be applied for excessive use are identified based on the shortage stage in Table 28 below.

Table 28
Penalties and Charges

	Stage When Penalty Takes Effect
Excess use charge assessed	Stage 2
Written notice of violation	Stage 2
Fine or surcharge for excess use	Stage 3
Install flow restrictor	Stage 4
Termination of service	Stage 4

Excess use charge and surcharge. In the 1978 drought, IRWD introduced a conservation surcharge of approximately 10% of the then-current commodity rate from July 5, 1977 until March 1, 1978. In its WSCP, IRWD can implement a surcharge, excess use or penalty charge at its level three-drought condition. An excess use charge based upon the ascending block rate structure is sufficient to encourage demand reduction to required levels and would be the most equitable surcharge. IRWD also has the ability to establish restrictions on water use or to discontinue service in the case of repeat violators under the Water Code of the State of California.

At the height of the 1987-1992 droughts, MWD was forced to institute supply cutbacks of 30%. In response, IRWD declared a level two-drought condition and implemented conservation measures outlined in IRWD's WSCP. These measures resulted in water savings averaging 20-25%. In 1991 during the drought, IRWD implemented its Ascending Block Rate Structure, which further improved water conservation and encouraged sound water management by customers. The Ascending Block structure provides incentives to practice water conservation and penalizes excessive water use. The Ascending Block rate structure continues to be used by IRWD to promote conservation during normal conditions and could be tightened (allocations reduced) to further reduce water use and promote conservation as necessary.

Irrigation Restriction. In the event of a serious drought condition (Stage 3 or higher), it may be necessary for IRWD to enforce mandatory consumption reduction methods, in addition to voluntary measures. In addition to excess use penalties, all common area potable water use landscape irrigation and agricultural irrigation would be reduced drastically or eliminated

completely if necessary. Complete elimination could be accomplished by locking off irrigation meters where one meter serves irrigation only, however, significant losses of permanent plantings would result. When one meter serves both internal use and landscaping (small percentage of meters), monitoring and public support would be used to eliminate irrigation. Again as previously noted, most of IRWD irrigation accounts utilized recycled water service, which may or may not require similar consumption reduction methods since this supply is considered to be drought tolerant supply. Therefore, if no shortage of recycled water supplies exist, consumption reduction/penalties may only apply to potable water accounts. This, however, may not apply to non-potable water accounts since these may be dependent on imported non-potable supplies which would most likely be reduced in a drought.

Rationing. A crisis drought condition may require the District to ration water, especially in the event of a cutback by MWDOC through MWD. A rationing may be accomplished by a variable percentage reduction based upon prior year's usage or average year's usage. A modified billing system reflecting the revised allocation would identify violators or those who exceed the rationed amount and penalties would be charged. If violations continued, the District could threaten termination of service. All nonessential uses such as car washing, pool filling, street cleaning, hydrant flushing, washing sidewalks should be banned and industrial use should be restricted as much as possible. Recycled water users may be exempt from rationing during drought.

Flow Restrictors. Under extreme conditions, flow restrictors could be installed in individual service lines.

G. Analysis of Impacts on Revenues and Expenditures (§ 10632(g))

The California Code Section 10632(g) requires an analysis of the impacts of each of the actions taken for conservation and water restriction on the revenues and expenditures of the water supplier. IRWD's WSCP does not provide a detailed analysis of revenue and expenditure impacts of water shortages because IRWD's billing structure is designed to be insulated from revenue swings resulting from deviations between actual and budgeted water sales and from declining or reduced water sales.

Pricing Policy. IRWD's pricing policy is designed to recover its operating cost, as wells as discourage wasteful uses. The pricing policy is evaluated on a yearly basis and adjusted as warranted.

The Ascending Block Rate Structure developed by IRWD is intended to function as a tool to promote water use efficiency commensurate with water supply conditions. The structure includes a tiered system for all customers, and charges progressively higher rates for progressively higher amounts of water used. Usage blocks for residential customers are based upon the type of dwelling unit and incorporate winter and summer allocation periods. Landscape irrigation allocations are based on site acreage and actual weather data.

The pricing policy for potable non-agricultural use consists of three charges:

- Monthly service charge
- Commodity charge
- Pumping Surcharge

The monthly service charge is a fixed meter charge that varies with the size of the water meter connection. Meter charges are set to meet IRWD's fixed costs of operation (e.g. salaries, supplies, etc.). The variable ascending commodity charge is set to match the cost of producing and purchasing water and is based on the number of units of water used. As previously described, this structure establishes an increasing unit cost per 100 cubic feet of water. The pumping surcharge is added to the commodity rate of those users who reside at higher elevation areas. The surcharge is based on prevailing energy costs. Therefore, IRWD can recover all fixed costs regardless of the quantity of water sold, whereas the water sales at any level will cover the costs of providing water. This system has proven to be effective in balancing revenue and expenditures.

The following Tables show components of revenue and expenditure impacts that have been evaluated by IRWD and found no impact on IRWD revenues and expenditures.

Actions and Conditions that Impact Revenues	
Type	Anticipated Revenue Reduction
Reduced sales	no impact
Development of reserves	no impact
Impact of supplier's higher rates (Tier 2)	no impact

Actions and Conditions that Impact Expenditures	
Category	Anticipated Cost
Change in quantity of sales	no impact
Increased staff salaries/overtime	no impact
Increased costs of new supplies/transfers/exchanges	no impact

Tables 29 and 30 below show how IRWD's measures overcome any revenue or expenditure impacts from a severe water shortage.

Table 29 *Proposed Measures to Overcome Revenue Impacts*	
Names of Measures	Summary of Effects
Review of rate adjustment	IRWD can revise its rates during water shortage stages to increase commodity revenues if needed to offset MWD rates.
Reserves	IRWD maintains reserves that can stabilize water rates during times of reduced water sales
Reduce overhead or decreased capital expenditures	If needed, IRWD can reduce overhead and postpone capital expenditures

Table 30 *Proposed Measures to Overcome Expenditure Impacts*	
Names of measures	Summary of Effects
Reserves	IRWD maintains reserves that can be used to overcome expenditure impacts caused by water shortage.
Reduce overhead or decreased capital expenditures	If needed, IRWD can reduce overhead and postpone capital expenditures

H. Water Shortage Contingency Ordinance/Resolution (§ 10632(h))

The IRWD Board adopted Resolution No. 1987-52 and modified Section 15 – Prohibition of Water Wastage – providing the District with a series of options that may be utilized during periods of water shortages (Appendix F). IRWD also prepared its Water Shortage Contingency Plan (WSCP) which provides the specific water supply conditions and District measures that may be implemented during shortage or drought conditions. As indicated, IRWD's Rules and Regulations Section 15 provides IRWD's water shortage contingency ordinance (Appendix G).

All of IRWD customers are metered and water usage is monitored through the tiered rate system. Customers that exceed allocations falling within the highest tiered rates are identified and notified on a regular basis regardless of water supply conditions. If during a drought, water reduction measures are implemented, IRWD can measure reductions by comparing individual

meter usage. Exceptionally high usage during a water shortage condition will be immediately identified and investigated for potential water loss (leak) or abuse problems. The District may impose penalties as noted. During all stages of water shortages, daily production figures are reported to and monitored by the appropriate District departments. IRWD may elect to read larger metered customers on a more frequent basis. Table 31 provides examples of potential mechanisms for measuring reductions of customers' water use.

Table 31
Potential Mechanisms for Reduction Measuring

Examples of Potential Mechanisms	
Use normalized or average water use baseline to determine reductions	X
More frequent review of production	X
More frequent meter reading at larger customers' location	X
More frequent leak detection and repair	X
More frequent meter checking and repair	X
System audit	X
Automated sensors and telemetry	X
Penalties for customers	X

Law

> 10633. The plan shall provide, to the extent available, information on recycled water and its potential for use as a water source in the service area of the urban water supplier. The preparation of the plan shall be coordinated with local water, wastewater, groundwater, and planning agencies that operate within the supplier's service area, and shall include the following:
> (a) A description of the wastewater collection and treatment systems in the supplier's service area, including a quantification of the amount of wastewater collected and treated and the methods of wastewater disposal.
> (b) A description of the quantity of treated wastewater that meets recycled water standards, is being discharged, and is otherwise available for use in a recycled water project.
> (c) A description of the recycled water currently being used in the supplier's service area, including, but not limited to, the type, place, and quantity of use.

V. Recycled Water Plan (§ 10633)

In 1963, IRWD made the decision to provide sewage collection, treatment and production of recycled water. Since 1967, IRWD has provided wastewater collection and tertiary treatment services with a defined purpose of delivering recycled water for non-potable uses. The Michelson Water Reclamation Plant (MWRP) first began delivering recycled water to agricultural users. The District began serving recycled water to agricultural users and expanded to include landscape irrigation (parks, golf courses, school grounds and play fields, community associations, open space area, green belts), and eventually to as well as front and backyard irrigation for large estate-sized residential lots, toilet flushing for large commercial buildings, carpet dying, construction dust control and a cooling tower application. IRWD also owns and operates a tertiary treatment plant called the Los Alisos Water Reclamation Plant (LAWRP) through its merger with Los Alisos Water District. IRWD currently produces approximately 13,000 AFY of recycled water from its MWRP and 2,000 AFY from its LAWRP which meets over 20% of IRWD's total water resource demands.

IRWD's Rules and Regulations, Section 1 state, "The plans for facilities to be constructed within the District are intended to be an integrated part of the District's Water Resources Master Plan, Sewer Master Plan and Sub-Area Master Plans. As it is the mandate of the State of California to effect conservation of water resources whenever possible, these Plans are also directed toward collecting, treating and reclaiming sewage and wastewater and beneficially reusing the resulting recycled water" [7].

IRWD's recycled water plan conserves and optimizes high-quality drinking water supplies for critical public purposes by reducing the use of these supplies for non-potable uses. The program also reduces the quantity of treated wastewater discharged through ocean outfalls. IRWD's program has enhanced local water supply reliability for both IRWD and the region because it

directly offsets the need for firm treated, imported water for municipal irrigation and other non-potable uses.

The use of recycled water and expansion of the system to meet future demands has always been planned by IRWD. Early on in 1986, MWD assisted IRWD's recycled water program through its Local Projects Program (LPP) by providing financial assistance in developing facilities to expand the beneficial uses and yield for recycled water, reduce the need for additional MWD imported water, and minimize disposal of wastewater. The LPP helped to fund the recycled water expansion of the MWRP then from 5,000 AFY to 10,000 AFY. More recently in 2005, MWD and IRWD entered into a Local Resources Program (LRP) agreement for assistance on capital projects to yield and deliver an additional 8,500 AFY of recycled water through MWRP and LAWRP. MWD has played a key role in supporting the growth of IRWD's extensive recycled water program. MWDOC is also a signatory to both of these LRP and LPP agreements and IRWD coordinates with MWDOC on its recycled water plan and program. Table 32 shows agencies that have participated in IRWD's recycled water program expansion.

Table 32
Participating Agencies

MWD and MWDOC	▪ LPP funding assistance (1985) ▪ LRP funding assistance (2005) ▪ Coordinate on Recycled Water Program

IRWD collects and treats the majority of wastewater generated within its service area and also coordinates recycled water production with Orange County Sanitation District and South Orange County Wastewater Authority.

Additionally, IRWD participated in the Bureau of Reclamation's Southern California Comprehensive Water Reclamation and Reuse Study which identified short and long-term recycled water implementation plans including IRWD's plan.

A. Wastewater Quantity, Quality and Current Uses (§ 10633(a)-(c))

IRWD produces tertiary-treated recycled water through the District's MWRP and LAWRP. The treated effluent produced at both plants meets the water quality standards set forth in the California Administrative Code, Title 22, Division 4 (Title 22) for use as recycled water.
The majority of wastewater collected within IRWD is treated at the MWRP and LAWRP using advanced or tertiary treatment. MWRP uses a reclamation method that simulates the process used by nature to biodegrade wastes. The end result is high quality water that earned IRWD the first unrestricted use permit issued in the state, which allows the recycled water to be used for

virtually everything but drinking. The permitted treatment capacity of the MWRP is 18.0 mgd and average flow is approximately 14 mgd. The efficiency of MWRP recycled water production has been estimated to be approximately 86% of the wastewater inflow to the plant.

After the clarification process, most of the sludge settles to the bottom of the primary clarification tanks and is pumped through underground pipes to the Orange County Sanitation District (OCSD) where it undergoes further treatment and ultimate ocean discharge. IRWD joined the OCSD in order to secure an alternate method of sewage treatment and disposal. The remaining primary effluent flows to the next stage of treatment at MWRP.

The LAWRP recycled water system is a separate wastewater collection and treatment system from MWRP, which consists of 105 miles of pipeline and one lift station which delivers wastewater to its 7.5 mgd capacity wastewater treatment plant. Secondary effluent from the wastewater plant is pumped to either the tertiary treatment plant where it is treated for use in the Lake Forest area's non-potable blended water distribution system, or to the South Orange County Wastewater Authority (SOCWA) pumping station which directs flows to the effluent transmission mains and subsequent ocean outfall. As part of the Upgrades project that IRWD is currently undergoing, LAWRP recycled water will be delivered to Zone B of the IRWD distribution system, as well as to the Zone A areas in the Lake Forest service area.

IRWD's overall service area also includes areas not served by MWRP or LAWRP wastewater treatment. Approximately 35% of all wastewater collected within IRWD's service area does not go to MWRP or LAWRP but is currently served by OCSD, Santa Margarita Water District or El Toro Water District. There are future plans to divert some of these other area flows to IRWD's treatment facilities. The following Tables 33 and 34 summarize current and projected wastewater collected by IRWD (tributary to MWRP and LAWRP), treated to recycled water standards and disposal.

Table 33
Wastewater Collected and Treated by IRWD (mgd)

	2000	2005	2010	2015	2020	2025	2030
Wastewater Collected by IRWD	16.71	18.64	22.33	23.63	24.91	26.11	26.37
Water treated to recycled water standard by IRWD	14.81	13.97	16.75	17.73	18.68	19.58	19.78

Table 34
Disposal of Wastewater Collected and Treated by IRWD (mgd)

Method of Disposal	Treatment	2005	2010	2015	2020	2025	2030

	Level						
OCSD outfall	None	1.49	1.56	1.89	2.00	2.09	2.11
SOCWA outfall	Secondary	3.10	3.67	3.67	3.67	3.67	3.70

The following table shows the current and projected wastewater flows from those areas within IRWD service area that are currently served by other agencies. IRWD plans to divert future flows from Portola Hills area to the LAWRP which are currently sent to SMWD.

Wastewater Collected and Treated by Others (mgd)							
	2000	2005	2010	2015	2020	2025	2030
OCSD	9.5	11.3	12.8	13.6	14.5	14.8	14.9
Santa Margarita Water District or El Toro Water District	.9	1.1	.5	.5	.5	.5	.5

IRWD's existing non-potable water system is supplied by three primary sources: recycled water produced at the MWRP, non-potable groundwater, untreated water purchased from MWD, and local runoff into storage reservoirs. The non-potable water system consists of two subsystems: A recycled system that delivers recycled water, supplemental untreated water, and limited non-potable groundwater to landscape, agricultural irrigation customers, estate-sized residential landscape, larger commercial buildings (for non-potable water usage toilets) and various industrial users; and an untreated water system that delivers imported untreated water and local runoff via the Irvine Lake to agricultural customers and to supplement the recycled water system. Irvine Lake provides storage and captures local runoff for the untreated water system and Sand Canyon Reservoir, Rattlesnake Reservoir and San Joaquin Reservoir provide storage for the recycled water system.

IRWD maintains a separate non-potable distribution system in the IRWD's Lake Forest area (formerly LAWD) with a blended water supply system to meet landscape and irrigation demands. The supply is a blend of tertiary treated wastewater and non-potable well water. Three wells are used to supplement the tertiary reclamation plant production in order to meet seasonal peaks in demand. There is also some surplus recycled water produced by LAWRP which is delivered to the Santa Margarita Water District instead of treating it to ocean discharge.

IRWD's non-potable system is an aggregate system consisting of three different types of supplies and it is not possible to break out one supply by user type, therefore non-potable system demands shown in Table 35a below reflect 2005 recycled water uses supplemented by non-potable groundwater and imported supplies. The previous Tables 33 and 34 show merely wastewater flows and tertiary treated supplies as collected and produced by IRWD. Of the total 22,878 AF non-potable water used in 2005, approximately 67% (15,296 AF) was from recycled water produced by IRWD and used by customers. The difference represents supplemental

supplies from non-potable wells (2,285 AF), native supplies (4,241 AF) and supplemental imported water (1,056 AF).

Table 35a ***Recycled Water Uses – Actual (AFY)***		
Type of Use	Treatment Level	2005 AFY
Agriculture	Tertiary or better	1,288
Landscape	Tertiary or better	18,220
Construction	Tertiary or better	219
Commercial/Industrial	Tertiary or better	57
Sales to others	Tertiary or better	3,094
Total		22,878

As stated, in addition to recycled water customers, IRWD serves untreated water to certain agricultural customers that are not on the recycled water distribution system but are served untreated imported supplies and native supplies. The following table represents the billed usage for untreated demands served in 2005.

Untreated Water Uses – Actual (AFY)		
Type of Use	Treatment Level	2005 AFY
Agriculture	Untreated/Runoff	6,301
Total		6,301

Law

> 10633 (d) A description and quantification of the potential uses of recycled water, including, but not limited to, agricultural irrigation, landscape irrigation, wildlife habitat enhancement, wetlands, industrial reuse, groundwater recharge, and other appropriate uses, and a determination with regard to the technical and economic feasibility of serving those uses.
> 10633 (e) The projected use of recycled water within the supplier's service area at the end of 5, 10, 15, and 20 years and a description of the actual use of recycled water in comparison to uses previously projected pursuant to this subdivision.
> 10633 (f) A description of actions, including financial incentives, which may be taken to encourage the use of recycled water, and the projected results of these actions in terms of acre-feet of recycled water used per year.
> 10633 (g) A plan for optimizing the use of recycled water in the supplier's service area, including actions to facilitate the installation of dual distribution systems and to promote recirculating uses to facilitate the increased use of treated wastewater that meets recycled water standards, and to overcome any obstacles to achieving that increased use.

B. Potential and Projected Use (§ 10633(d)-(e))

Master planned communities within the IRWD service area are required to plan and design for recycled water use early in the process as defined by Sub-Area Master Plans prepared for specific development areas. IRWD approves all development plans for master irrigation, which must be served with recycled water. Additionally, IRWD actively pursues potential existing opportunities for recycled water conversions wherever non-potable water can be used in-lieu of potable water. The District continues to assess all potential opportunities for cost-effective recycled water conversions. These new recycled water customers are also committed to recycled water use by contractual agreement with IRWD.

Additionally, IRWD has provided recycled water service to tracts of estate-sized single-family lots for “full yard” irrigation. Most of the lots are approximately 1/2 acre, with an average of 1/4-acre irrigable landscape. IRWD currently serves over 300 estate-sized residential customers and this will continue to grow as the service area develops.

The District began requiring recycled water for larger commercial buildings’ toilet/urinal use in 1990, when IRWD was the first water district in the nation to obtain health department permits for the use of recycled water in interior spaces such as office buildings. Presently, 15 commercial buildings, including IRWD’s Headquarters and Operations Center, use recycled water for toilet and urinal flushing, with two sites using recycled water for cooling towers. The District continues to work closely with the state and county health departments on permitting for expanded uses of recycled water.

To increase utilization of recycled water in lieu of potable, IRWD is investigating potential opportunities for industrial customer uses such as industrial process water, car washing, cooling tower makeup water, boiler feed water, production of ready-mix concrete, carpet and fabric dyeing, electronics manufacturing and use in laundry facilities. IRWD works closely with commercial customers who are considering the use of recycled water, carefully reviewing water quality concerns, safety, treatment, costs, regulatory compliance, and operations. IRWD has found that customers are very encouraged and recognize the benefits that using recycled water for non-potable applications can bring to the service area.

Tables 35b and 36 shows projections of IRWD's potential and future for recycled water demands by type of use through the year 2030. These amounts represent the projected recycled water produced by IRWD's treatment plants.

Table 35b
Recycled Water Uses – Potential AFY

Type of Use	Treatment Level	2010	2015	2020	2025	2030
Agriculture	Tertiary or better	1,800	1,180	1,100	1,000	1,000
Landscape	Tertiary or better	20,088	23,114	25,048	26,441	26,805
Construction	Tertiary or better	250	222	220	200	200
Commercial/Industrial	Tertiary or better	65	75	80	90	90
Sales to others	Tertiary or better	4,000	1,500	1,500	1,500	1,500
Total		26,203	26,091	27,948	29,231	29,595

Table 36
Projected Future Use of Recycled Water in Service Area AFY

Type of Use	2010	2015	2020	2025	2030
Agriculture	1,800	1,180	1,100	1,000	1,000
Landscape	20,088	23,114	25,048	26,441	26,805
Construction	250	222	220	200	200
Commercial/Industrial	65	75	80	90	90
Sales to other agencies	4,000	1,500	1,500	1,500	1,500
Total projected use of recycled water	26,203	26,091	27,948	29,231	29,595

Table 37 shows the comparison of the projected recycled water use in 2000 for the year 2005 and the actual 2005 recycled water use. Again, since IRWD's non-potable customers' demands are met with all non-potable supplies, these projected amounts include recycled water produced by

IRWD, which makes up the majority of non-potable use, but which is supplemented by some non-potable groundwater and imported supplies.

Table 37 ***Recycled Water Uses – 2000 Projection compared with 2005 actual AFY***		
Type of Use	2000 projection for 2005	2005 actual use
Agriculture	868	1,288
Landscape	20,025	18,220
Construction	200	219
Industrial	150	57
Sales to other agencies	2,540	3,094
Total projected use of recycled water	23,783	22,878
Recycled water produced	16,853	15,296

C. Encouraging Recycled Water Use (§ 10633(f))

As previously stated, IRWD's Rules and Regulations Section 1 cover the Districts intent for the use of recycled water and further covers the mandated use under Section 4.12. Section 1 states, "If recycled water service is determined by the District to be feasible in accordance with Section 4.12, the applicant, owner or customer will be required to utilize recycled water service [7].

It is IRWD's intent to provide customers with recycled water in lieu of potable water for approved uses such as landscape irrigation, agricultural irrigation, construction water, industrial process water, cooling tower makeup water, and water for flushing toilets and urinals in larger commercial buildings. IRWD has found there is customer interest in using recycled water for landscape and industrial purposes as a highly reliable source of supply. IRWD offers customers a discount from potable rates for using recycled water service.

Table 38 below shows Methods to Encourage Recycled Water Use for IRWD. Because IRWD already has a requirement for all new construction non-potable uses, these methods may apply to retrofitting potable connections to recycled water use. Over 80% of IRWD's landscape customer use is recycled water and so where opportunities exist to retrofit existing potable customers to recycled, IRWD makes every effort to assist customers in conversions.

Table 38
Methods to Encourage Recycled Water Use

Actions	AF of use projected to result from this action				
	2010	2015	2020	2025	2030
Rate discounts	5	5	5	5	5
Prohibit specific potable use	5	5	5	5	5
Grants/low interest loans	30	50	50	50	50
Dual plumbing standards	10	10	10	10	10
Total	50	70	70	70	70

D. Recycled Water Optimization Plan (§ 10633(g))

Since 1967, IRWD has been providing recycled water for irrigation within its service area. IRWD's reclamation program has evolved from supplying agricultural needs to meeting the majority of landscape irrigation demands within the service area via an extensive dual distribution system. In addition to agricultural crops, other areas such as government facilities, schools, homeowner associations, golf courses, parks, green belts and street medians are currently supplied with recycled water.

Recycled Water Demand

The expansion of IRWD's recycled distribution system is ongoing. In addition to new development areas over the last ten years, older areas within IRWD have been converted from domestic water to recycled water use primarily for irrigation. As stated, IRWD requires that all new office buildings within its service area be dual plumbed to use recycled water for flushing toilets and urinals. Next year, IRWD plans to convert 12 more commercial buildings to recycled water.

IRWD's recycled system demands are expected to nearly double by the 2025. This is due to expansion of the system into new areas and "infill" and retrofit demands in areas currently served. To meet increased demand, IRWD is reviewing an expansion of MWRP treatment capacity. The treatment capacity of MWRP can be expanded depending on sufficient influent wastewater flow into the plant and assurance that the expansion is economically, technologically and environmentally feasible.

IRWD expects the Lake Forest service area to have some growth within its recycled system serving additional landscape irrigation demand. It is anticipated that interconnecting the two separate existing recycled water distribution systems will enhance the reliability and availability of recycled service and potential expansion to areas that are not currently served with recycled water. IRWD is planning to initiate a study which will examine all of the retrofit opportunities to recycled water in the Lake Forest area.

Recycled Water Supply

In 2003, IRWD completed a Wastewater Treatment Master Plan which includes plans to add the Harvard Avenue Trunk Sewer (HATS) wastewater flows to MWRP which are currently going to OCSD. These flows are expected to be 7.9 mgd at build out. This diversion would require an expansion of the MWRP treatment capacity, however, this flow would greatly benefit the recycled water program to meet future demands.

Other potential recycled water supplies included recycled water produced by treatment of sewage flows originating in LAWD and El Toro Water District located adjacent to IRWD along the southeast border. As mentioned under Section II, there may also be an opportunity in the future for IRWD to receive recycled water from El Toro Wastewater Treatment Plan which could serve portions of IRWD's service area. Additionally, IRWD plans to continue to use degraded groundwater to augment supply to the non-potable water system. Although the capacities of these alternatives are not anticipated to be sufficient to offset an expansion of MWRP, their utilization may contribute to optimizing recycled water supply development for the District.

Law

> 10634. The plan shall include information to the extent practicable, relating to the quality of existing sources of water available to the supplier over the same five-year increments as described in subdivision (a) of Section 10631, and the manner in which water quality affects water management strategies and supply reliability.

VI. Water Quality Impacts on Reliability

Groundwater

The OCWD performs extensive groundwater quality management throughout the basin. Overall the Basin has good water quality, however, OCWD Groundwater Management Plan describes some existing water quality concerns in the Basin and the OCWD's management, monitoring and improvement projects to address these concerns. Increasing salinity is a concern for all water sources and is a function of recharge water coming into the Basin and seawater intrusion. OCWD has taken a watershed management approach to avoid the potential loss of water supplies due to increasing salinity. Several management options to reduce salts input include obtaining lower TDS source water for replenishment, constructing desalter facilities (like Irvine Desalter Project) to remediate degraded groundwater, expanding barrier injection facilities to retard seawater intrusion, and maintaining an aggressive water quality monitoring program to assess Basin conditions [6].

OCWD has shown to have an extensive groundwater quality management program to protect the producers and consumers within the Basin. IRWD participates in this management program with its colored water treatment plant (DATS – Deep Aquifer Treatment System) and the Irvine Desalter Project (IDP) which is currently under construction. IRWD and OCWD are implementing the IDP which will remove total dissolved solids (TDS), nitrates and selenium from the Basin and produce quality potable water supplies. In addition, the non-potable component of the IDP will remove a plume of volatile organic compounds and high concentrations of TDS from the portions of the groundwater basin beneath the former El Toro Marine Corps Air Station.

Currently, there are no known water quality concerns affecting the availability or reliability of IRWD's groundwater supplies which cannot be mitigated for, if necessary, in the future.

Imported Water

As stated in MWD's RUWMP and IRP, MWD's planning efforts have acknowledged the importance of water quality and have set specific targets for imported water. Each of MWD's sources has specific quality issues or concerns and to date MWD has not identified any water

quality risk that cannot be mitigated. The only potential effect of water quality on the level of water supplies available could be increases in the salinity of water sources. If diminished water quality caused a need for membrane treatment, MWD could experience water losses of up to 15 percent of the water processed. However, MWD would only process a small proportion of the affected water and reduce total salinity by blending processed water with the remaining unprocessed water. Thus MWD anticipates no significant reductions in water supply availability due to water quality concerns. [3]. Table 39 show water supply changes due to water quality.

Table 39
Current & projected water supply changes due to water quality – percentage

Water source	2000	2005	2010	2015	2020	2025	2030
MWD Imported treated	0%	0%	0%	0%	0%	0%	0%
groundwater	0%	0%	0%	0%	0%	0%	0%

As indicated in Table 39, IRWD does not anticipate any percentage change to current and projected water supplies due to water quality.

Law

> 10635 (a) Every urban water supplier shall include, as part of its urban water management plan, an assessment of the reliability of its water service to its customers during normal, dry, and multiple dry water years. This water supply and demand assessment shall compare the total water supply sources available to the water supplier with the total projected water use over the next 20 years, in five-year increments, for a normal water year, a single dry water year, and multiple dry water years. The water service reliability assessment shall be based upon the information compiled pursuant to Section 10631, including available data from the state, regional or local agency population projections within the service area of the urban water supplier.

VII. Water Service Reliability

A. Projected Normal Water Year Supply and Demand (§ 10635(a))

System supply reliability is the governing factor both during normal operations, water shortage from droughts and emergencies. IRWD's water supply reliability is enhanced through development of multiple sources of supply and adequate storage, pumping and distribution facilities. IRWD is well-positioned with regards to water supply reliability because of the availability of several independent sources of supply. As discussed, strategies to meet emergency situations, such as development of interconnection arrangements, also help to enhance system reliability.

Water Supply Comparison. Tables 40, 41 and 42 below present IRWD's supplies and demands under normal year. During normal conditions, demand does not fluctuate except for projected system growth. Water supplies projected do not represent the total supply capacity available to IRWD but rather projected supplies that would be used to meet projected demands.

Table 40
Projected Normal Water Year Supply AFY

	2010	2015	2020	2025	2030
Supply	164,121	161,421	165,014	166,434	166,434
% of Normal Year*	100%	100%	100%	100%	100%

*from Table 9. Base year for Normal water year.

Table 41
Projected Normal Water Year Demand AFY

	2010	2015	2020	2025	2030
Demand	116,710	123,119	130,063	135,208	136,560
% of year 2005	135%	142%	150%	156%	156%

Table 42 shows that in average demand years, IRWD has sufficient water to meet customer needs through 2030. This is based on a continued commitment to conservation, additional recycled water use and additional groundwater treatment.

Table 42
Projected Normal Year Supply and Demand Comparison AFY

	2010	2015	2020	2025	2030
Supply totals	164,121	161,421	165,014	166,434	166,434
Demand totals	116,710	123,119	130,063	135,208	136,560
Difference (supply - demand)	47,411	38,302	34,951	31,226	29,874
Difference as % of Supply	29%	24%	21%	19%	18%
Difference as % of Demand	41%	31%	27%	23%	22%

B. Projected Single-Dry Year Supply and Demand Comparison (§ 10635(a))

IRWD's water resource mix consists of groundwater, imported water, recycled water and some surface water. The projected supply in IRWD's WRMP assumes new potable groundwater supplies will be developed as planned to greatly reduce reliance on imported water under normal and dry year operating conditions. Imported water deliveries are expected to be reduced in the projected supply mix, only because IRWD is developing local supplies, however, IRWD owns more capacity in the imported supplies than what is projected here. It is anticipated that MWD imported water will be required for supplemental supply as well as peak and emergency conditions. As indicated in Section II, the only inconsistent source within IRWD's water supply portfolio during single dry and multiple dry years is the non-potable native runoff stored in the Irvine Lake, which relies on local runoff from Santiago Creek which is dependent upon annual rainfall. This is estimated to be a shortage of approximately 3,000 AF during single and multiple dry years.

Consistent with dry year demand assumptions from MWDOC's 2005 RUWMP, IRWD's projections reflect a seven percent increase on average in demand during periods of dry weather than during normal weather. Tables 43 through 45 shows water supplies and demands projected for IRWD under a single dry water year under five year increments. The Tables show a percentage of projected normal. As noted, the water supplies projected here do not represent the total supply capacity available to IRWD but rather the projected supplies to meet the projected demands.

Table 43 *Projected Single Dry Year Water Supply AFY*					
	2010	2015	2020	2025	2030
Supply	161,121	158,421	162,014	163,434	163,434
% of projected normal*	98%	98%	98%	98%	98%

*Projected normal from Table 40

Table 44 *Projected Single Dry Year Water Demand AFY*					
	2010	2015	2020	2025	2030
Demand	124,879	131,737	139,167	144,672	146,119
% of projected normal*	1.07%	1.07%	1.07%	1.07%	1.07%

*Projected normal from Table 41

Table 45 *Projected Single Dry Year Supply and Demand Comparison AFY*					
	2010	2015	2020	2025	2030
Supply totals	161,121	158,421	162,014	163,434	163,434
Demand totals	124,879	131,737	139,167	144,672	146,119
Difference (supply - demand)	36,242	26,684	22,847	18,762	17,315
Difference as % of Supply	22%	17%	14%	11%	11%
Difference as % of Demand	29%	20%	16%	13%	12%

In the event of a single dry year, IRWD has sufficient supply to meet demand without requiring any reduction in use. In regards to IRWD's imported supplies, as stated in its 2005 RUWMP, MWD fully expects to be 100 percent reliable throughout the next twenty years through effective management of its water supply. [3]

IRWD's effective water efficiency improvements and additional water supply will help to enhance IRWD's water supply position and ensure IRWD meets projected water demand. The District will continue to assess improving water supplies, including expanding water recycling through conversions, groundwater storage, other groundwater treatment methods or other such water supply alternatives. If necessary, for subsequent dry years, the District would enter into a Stage 1 alert (see Section IV) and emphasize voluntary reduction in water use to all customers, but may not impose any additional restrictions.

C. Projected Multiple Dry Year Supply and Demand Comparison (§ 10635(a))

Tables 46 through 48 provide projections of supply and demand under multiple dry year scenarios occurring between 2006 and 2010. Demands under multiple dry years are assumed to increase by seven percent on average over normal year demands similarly to single dry year conditions. As noted previously, the water supplies projected here do not represent the total supply capacity available to IRWD but rather the projected supplies to meet the projected demands.

Table 46
Projected Supply During Multiple Dry Year P/E 2010 AFY

	2006	2007	2008	2009	2010
Supply	135,950	143,056	143,583	153,534	161,121
% of Projected Normal	98%	98%	98%	98%	98%

Table 47
Projected Demand Multiple Dry Year P/E 2010 AFY

	2006	2007	2008	2009	2010
Demand	114,797	117,244	119,783	122,336	124,879
% of Projected Normal	107%	107%	107%	107%	107%

Table 48
Projected Supply & Demand Comparison During Multiple Dry Year P/E 2010 AFY

	2006	2007	2008	2009	2010
Supply totals	135,950	143,056	143,583	153,534	161,121
Demand totals	114,797	117,244	119,783	122,336	124,879
Difference (supply - demand)	21,153	25,812	23,800	31,198	36,242
Difference as % of Supply	16%	18%	17%	20%	22%
Difference as % of Demand	18%	22%	20%	26%	29%

Tables 49 through 51 provide projections of supply and demand under multiple dry year scenarios occurring between 2011 and 2015.

Table 49
Projected Supply During Multiple Dry Year P/E 2015 AFY

	2011	2012	2013	2014	2015
Supply	161,121	158,204	158,421	158,421	158,421
% of Projected Normal	98%	98%	98%	98%	98%

Table 50 *Projected Demand During Multiple Dry Year P/E 2015 AFY*					
	2011	2012	2013	2014	2015
Demand	126,810	125,987	127,903	129,821	131,737
% of Projected Normal	107%	107%	107%	107%	107%

Table 51 *Projected Supply & Demand Comparison During Multiple Dry Year P/E 2015 AFY*					
	2011	2012	2013	2014	2015
Supply totals	161,121	158,204	158,421	158,421	158,421
Demand totals	126,810	125,987	127,903	129,821	131,737
Difference (supply - demand)	34,311	32,217	30,518	28,600	26,684
Difference as % of Supply	21%	20%	19%	18%	17%
Difference as % of Demand	27%	26%	24%	22%	20%

Tables 52 through 54 provide projections of supply and demand under multiple dry year scenarios occurring between 2016 and 2020.

Table 52 *Projected Supply During Multiple Dry Year P/E 2020 AFY*					
	2016	2017	2018	2019	2020
Supply	159,052	159,872	160,690	161,509	162,014
% of Projected Normal	98%	98%	98%	98%	98%

Table 53 *Projected Supply During Multiple Dry Year P/E 2020 AFY*					
	2016	2017	2018	2019	2020
Demand	133,222	134,709	136,195	137,681	139,167
% of Projected Normal	107%	107%	107%	107%	107%

Table 54 *Projected Supply & Demand Comparison During Multiple Dry Year P/E 2020 AFY*					
	2016	2017	2018	2019	2020
Supply totals	159,052	159,872	160,690	161,509	162,014
Demand totals	133,222	134,709	136,195	137,681	139,167
Difference (supply - demand)	25,830	25,163	24,495	23,828	22,847
Difference as % of Supply	16%	16%	15%	15%	14%
Difference as % of Demand	19%	19%	18%	17%	16%

Tables 55 through 57 provide projections of supply and demand under multiple dry year scenarios occurring between 2021 and 2025.

Table 55 *Projected Supply During Multiple Dry Year P/E 2025 AFY*					
	2021	2022	2023	2024	2025
Supply	162,041	163,434	163,434	163,434	163,434
% of Projected Normal	98%	98%	98%	98%	98%

Table 56 *Projected Demand During Multiple Dry Year P/E 2025 AFY*					
	2021	2022	2023	2024	2025
Demand	140,268	141,369	142,470	143,572	144,672
% of Projected Normal	107%	107%	107%	107%	107%

Table 57 *Projected Supply & Demand Comparison During Multiple Dry Year P/E 2025 AFY*					
	2021	2022	2023	2024	2025
Supply totals	162,041	163,434	163,434	163,434	163,434
Demand totals	140,268	141,369	142,470	143,572	144,672
Difference (supply - demand)	21,773	22,065	20,964	19,862	18,762
Difference as % of Supply	13%	14%	13%	12%	11%
Difference as % of Demand	16%	16%	15%	14%	13%

Tables 58 through 60 provide projections of supply and demand under multiple dry year scenarios occurring between 2026 and 2030. It is anticipated that the District will be built-out by the year 2025 therefore there is no change in the supply and demand projections from 2026 to 2030.

Table 58 *Projected Supply During Multiple Dry Year P/E 2030 AFY*					
	2026	2027	2028	2029	2030
Supply	163,434	163,434	163,434	163,434	163,434
% of Projected Normal	98%	98%	98%	98%	98%

Table 59 *Projected Demand During Multiple Dry Year P/E 2030 AFY*					
	2026	2027	2028	2029	2030

Demand	144,961	145,250	145,540	145,829	146,119
% of Projected Normal	107%	107%	107%	107%	107%

Table 60
Projected Supply & Demand Comparison During Multiple Dry Year P/E 2030 AFY

	2026	2027	2028	2029	2030
Supply totals	163,434	163,434	163,434	163,434	163,434
Demand totals	144,961	145,250	145,540	145,829	146,119
Difference (supply - demand)	18,473	18,184	17,894	17,605	17,315
Difference as % of Supply	11%	11%	11%	11%	11%
Difference as % of Demand	13%	13%	12%	12%	12%

IRWD's overall supply availability contains several margins of safety or buffers:

- Significant quantities of "reserve" water supplies (excess of supplies over demands) will be available to serve as a buffer against inaccuracies in demand projects, future changes in land use, or alterations in supply availability.
- The potential exists for the treatment and conversion of some reserve non-potable supplies to potable water.
- Information provided by MWD, as the imported water supplier, concerning the adequacy of its regional supplies (from its 2005 RUWMP and IRP).
- Conservative estimates of annual potable and non-potable *imported* supplies have been made based on connected delivery capacity; additional supplies are expected to be available from these sources, based on legal entitlements, historical uses and information provided by MWD.

Law

> 10640. Every urban water supplier required to prepare a plan pursuant to this part shall prepare its plan pursuant to Article 2.
>
> 10641. An urban water supplier required to prepare a plan may consult with, and obtain comments from, any public agency or state agency or any person who has special expertise with respect to water demand management methods and techniques.
>
> 10642. Each urban water supplier shall encourage the active involvement of diverse social, cultural, and economic elements of the population within the service area prior to and during the preparation of this plan. Prior to adopting a plan, the urban water supplier shall make the plan available for public inspection and shall hold a public hearing thereon. Prior to the hearing, notice of the time and place of hearing shall be published… After the hearing, the plan shall be adopted as prepared or as modified after the hearing.
>
> 10643. An urban water supplier shall implement its plan adopted pursuant to this chapter in accordance with the schedule set forth in the plan.

VIII. Adoption and Implementation of UWMP

A. Public Participation (§ 10642)

Irvine Ranch Water District (IRWD) has supported community participation in its Urban Water Management Planning efforts since development of its first plan in 1985. IRWD has held hearings inviting the public to attend prior to UWMP adoption in 1985, 1990, 1995 and 2000. IRWD notified customers in its *Pipelines* newsletters (copy following this Section VIII) to all customers information about the UWMP 2005 update and invited interested customers in reviewing the UWMP to review on line at IRWD's website at www.irwd.com or in person at IRWD's headquarters located at 15600 Sand Canyon Avenue, Irvine.

On February 17, 2005, IRWD notified all of the cities within the service area and the County of Orange of the opportunity to submit comments regarding the UWMP during the update process. IRWD received one letter from the County of Orange (See copy of letter under Appendix C) advising the District of unincorporated planning areas within IRWD's service boundary. IRWD was aware of these plans and had previously included these demands for development of these areas because IRWD coordinates closely with the land owner (The Irvine Company) on all planning areas within unincorporated areas. All of the cities within IRWD's service area and the County of Orange received a copy of the draft UWMP mailed on October 28, 2005. Letters to cities and county are included under Appendix C.

A draft of the 2005 update was also made available on the website www.irwd.com and at IRWD's offices in October 2005. Notice of the IRWD public hearing was published in the Orange County Register on October 28, 2005 and November 11, 2005, and notice was posted in

the IRWD's offices on October 28, 2005 (See notice of public hearing following Section VIII). At the public hearing, there were no comments brought forth to the IRWD Board of Directors.

The Resolution to adopt the District's 2005 update to the Urban Water Management Plan was passed by the Board on November 28, 2005. (See Resolution copy following Section VIII). This update was submitted to the California Department of Water Resources within 30 days of approval by the IRWD Board of Directors. Copies of the UWMP were sent to the cities within IRWD's service area and the County of Orange and were made available to the public within 30 days following Board approval.

DWR Review for Completeness Form Checklist

UWMP Act Code	Reference in IRWD 2005 UWMP
Water Code §10620(d) – Agency coordination	Section I-A – page 1
Water Code §10620(e) – UWMP preparation	Section I-B – page 2
Water Code §10620(f) – Water management tools	Section I-C – page 2
Water Code §10621(a) – Plan updated in years ending in five and zero	Section I-D – page 3
Water Code §10621(b) – City and county notification and participation	Section I-E – pages 3-4
Water Code §10631(a) – Population, climate, demographics, land use	Section II-A-C – pages 6-8
Water Code §10631(b) – Current and planned water supplies	Section II-E – pages 9-10
Water Code §10631(b)(1)-(4) – Groundwater sources	Section II-F-H – pages 11-14
Water Code §10631(c) – Supply reliability and vulnerability to seasonal shortage	Section II-I – pages 16-19
Water Code §10631(d) – Transfer and exchange opportunities	Section II-J – page 20
Water Code §10631(e) – Water use by customer type, past, current and future	Section II-K – pages 21-22
Water Code §10631(f)-(g) – Demand management measures	Section II-L-M – pages 23-28
Water Code §10631(h) – Planned water supply projects	Section II-N – pages 29-31
Water Code §10631(i) – Ocean desalination	Section II-O – page 31
Water Code §10631(k) – Current or projected supply includes wholesale water	Section II-P– pages 32-33
Water Code §10631.5 – Determination of demand management measures implementation	Section III – page 34
Water Code §10632(a) – Water shortage contingency stages of action	Section IV-A – page 35
Water Code §10632(b) – Estimate of minimum supply for next 3 years	Section IV-B – pages 36-37
Water Code §10632(c) – Catastrophic supply interruption plan	Section IV-C – pages 38-40
Water Code §10632(d)-(f) – Prohibitions, penalties and consumption reduction methods	Section IV-E-F – pages 41-45
Water Code §10632(g) – Analysis of revenue impacts of reduced sales during shortages	Section IV-G – pages 45-47
Water Code §10632(h)-(i) – Draft ordinance and use monitoring procedure	Section IV-H – pages 47-48
Water Code §10633 – Recycled water plan coordination	Section V – pages 49-50
Water Code §10633(a)-(c) – Wastewater quantity, quality and current uses	Section V-A – pages 50-53
Water Code §10633(d)-(g) – Potential and projected use, optimization plan with incentives	Section V-B-D – pages 54-58
Water Code §10634 – Water quality impacts on reliability	Section VI – pages 59-60
Water Code §10635 – Water service reliability normal year	Section VII-A – page 61
Water Code §10635(a)-(d) – Projected single-dry year	Section VII-B – pages 62-63
Water Code §10635(a)-(d) – Projected multiple-dry year	Section VII-C – pages 64-67
Water Code §10642, §10644(a), §10645 – Public involvement, file with DWR, plan available to public	Section VIII– pages 68-69

Irvine Ranch Water District **Pipelines**

The Newsletter of Irvine Ranch Water District / September 2005
Volume 2005 Number 9

Free Water Awareness Tours

Irvine Ranch Water District (IRWD) offers free Water Awareness Tours to all its customers.

The Fall tours will be held on Friday and Saturday, October 7 and 8.

These tours, open to those who live or work with IRWD boundaries, are an excellent opportunity to gain valuable information about the water system, wastewater treatment, and recycled water use.

The free tours start promptly at 8 a.m. and conclude at approximately 2 p.m. Lunch is provided. The tours fill very quickly and are first-come first-served based on the date we receive your reservation. You will receive a call if your selection is not available. We are unable to accommodate children under 16 years of age.

Customers may register on the IRWD Web site at www.irwd.com or call (949) 453-5500.

FREE Fall Residential Landscape Workshop

WHEN:
Friday, October 28
6:00 to 9:00 p.m.

WHERE:
IRWD Headquarters
15600 Sand Canyon Avenue
Irvine CA, 92618

Fall 2005 brings a new, fun workshop format which features both fact-filled talks and hands-on demonstrations by local irrigation, gardening and landscape specialists. Workshop topics may include:

- How to water for plant health and low water bills
- Irrigation system basics
- Landscape design basics
- How to prepare soil for greater plant success

Limited seating. Reserve your seat(s) online at http://www.irwd.com/FreePrograms/workshops.php

If you do not have internet access, please call 949-453-5327 to make your reservation.

STATE TAKES IRWD PROPERTY TAXES

As you well know, property owners in Orange County pay billions of dollars in basic property taxes each year. These tax revenues are allocated according to a complex formula among local governments and special districts such as IRWD.

While property taxes are assessed, levied, collected and distributed at the local level, in 1978 Proposition 13 made the state the final arbiter in deciding who receives basic property tax monies and how much they receive. Proposition 13 also set the maximum basic tax rate at 1% of assessed property value per year. Thus, it is commonly referred to as the "1% property tax."

How IRWD Uses 1% Property Taxes

IRWD maintains over 1,000 miles of drinking water pipelines, over 300 miles of recycled water pipelines, over 600 miles of sewer pipes, 40 reservoirs and two large wastewater treatment plants. Without these facilities, water could not be supplied or delivered and sewage could not be collected and treated.

IRWD finances facilities needed to provide water and sewer service to our growing customer base by issuing general obligation bonds, much like you finance your home with a mortgage from the bank. IRWD uses the 1% property taxes received from the state to make payments on these bonds. This makes sense - IRWD facilities are paid for by a tax on the property that directly benefits from the service we provide.

State Takes IRWD 1% Property Taxes

In early 2004 we warned you of a possible attempt by the state to change this formula that might result in the elimination or a big reduction in the portion of the 1% property taxes IRWD and many other special districts receive from the state. Unfortunately, this prediction came true. In late 2004, Governor Schwarzenegger asked local governments to help solve the state budget crisis by transferring $1.3 billion in property taxes to the state budget for the next two years. As part of this action special districts statewide lost $350 million a year in local property taxes, with cities and counties making up the difference. In Orange County alone

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STATE TAKES IRWD PROPERTY TAXES

over $59 million was lost.

Early estimates by the California Legislature indicated that an enterprise special district such as IRWD could expect to lose approximately 40% of their property taxes for two years. However during the legislative session, legislators granted special exemptions to fire districts, mosquito abatement districts and transit districts. Enterprise special districts - those that have the ability to charge their customers for service - were required to make up the property taxes lost by these special exemptions. The result was that IRWD lost much more property taxes than the original 40% estimate.

How much did IRWD lose?

IRWD currently receives approximately $13.5 million in 1% property taxes a year from the state, all of which goes to meet debt service for general obligation bonds issued to fund water and sewer infrastructure. For IRWD the state property tax shift translates into a loss of almost 70%, or approximately $10 million dollars a year for a total of over $20 million dollars over the next two years.

IRWD Gets a Double Hit

To make matters worse, IRWD was not the only local agency to lose property tax money to the state. In Orange County, the Orange County Water District manages the groundwater basin. Drinking water pumped by IRWD from local wells is assessed a replenishment fee by OCWD. These fees are incorporated into the rates paid by IRWD customers. As an enterprise special district, the Orange County Water District also lost a significant portion of their property taxes, over $7 million, to the state for the next two years. This loss in funds will be recouped by charging their customers, such as IRWD, a special assessment on the water basin replenishment fee.

Impact on IRWD Customers

The two-year $20 million shift of the District's current 1% property tax distribution will be offset by 1) raising other IRWD taxes assessed to property owners in the District by approximately $.02 per hundred dollars of assessed value (land only) and 2) raising the fees charged for new service connections by approximately 23.5% overall. For example, a median cost home in Orange County valued at $600,000 can expect an increase in taxes of approximately $66 a year.

Over the coming years IRWD customers will continue to pay the same 1% property taxes to the state plus the additional IRWD imposed taxes and fees needed to pay our infrastructure bond payments. In the end, this was roundabout way for the state to quietly raise taxes by forcing IRWD to increase fees and assessments to offset 1% property tax revenues taken by the state.

It's unclear why the true impact of the local government property tax shift was never made public during the lengthy legislative hearings in Sacramento. What is clear is that consequences of this shift are much more dramatic and far-reaching than was ever discussed during the state budget negotiations. Because of the continuing fiscal crisis in Sacramento, we do not expect this shift to end after the two year time period.

IRWD is a non-profit public agency, so we budget to break even every year. Our annual operations costs are funded through the monthly bills paid by our customers and our annual infrastructure bond payments are funded from the basic 1% property taxes we receive each year.

Urban Water Management Plan

Irvine Ranch Water District (IRWD) is currently updating the Urban Water Management Plan (UWMP) to be submitted to the Department of Water Resources (DWR) by December 31, 2005. The UWMP serves as a long-range planning document for water supply and demand and provides an overview of IRWD's water supply and usage, recycled water and conservation programs. In accordance with the California Urban Water Management Planning Act, all California agencies providing water to more than 3,000 customers or more than 3,000 acre-feet of water per year are required to update their Urban Water Management Plan (UWMP) every five years and submit them to the Department of Water Resources.

Customers interested in reviewing the 2000 plan may do so on IRWD's Web site at www.irwd.com. Copies are also available for review at IRWD's headquarters located at 15600 Sand Canyon Avenue, Irvine, 92618.

A draft of the 2005 update will be available for review on IRWD's Web site (www.irwd.com) or at IRWD's headquarters in October 2005. A 30-day public comment period will follow and a public hearing will be held in November 2005 prior to the adoption of the plan.

You may submit comments or questions to Kelly Welch at welch@irwd.com, (949) 453-5604, IRWD, 15600 Sand Canyon Avenue, Irvine, 92618.

IRVINE RANCH WATER DISTRICT 15600 Sand Canyon Ave., P.O. Box 57000, Irvine, CA 92619-7000 (949) 453-5300

October 28, 2005

NOTICE OF PUBLIC HEARING
IRVINE RANCH WATER DISTRICT
ADOPTION OF 2005 URBAN WATER MANAGEMENT PLAN

Notice is hereby given that the Board of Directors of Irvine Ranch Water District will conduct a public hearing at 6:00 p.m. on November 28, 2005, in the District office located at 15600 Sand Canyon Avenue, Irvine, California for the purpose of receiving public comments concerning the proposed adoption of IRWD's 2005 Urban Water Management Plan, as required under the California Urban Water Management Planning Act. Any person desiring to make comments or present information to the Board may make an oral presentation at the public hearing or may submit written comments or information for the Board's consideration by delivering them to the District office prior to the time of the hearing. A draft of the Plan is available for review on IRWD's Web site (www.irwd.com) or at the District office at the above address.

Leslie Bonkowski
District Secretary