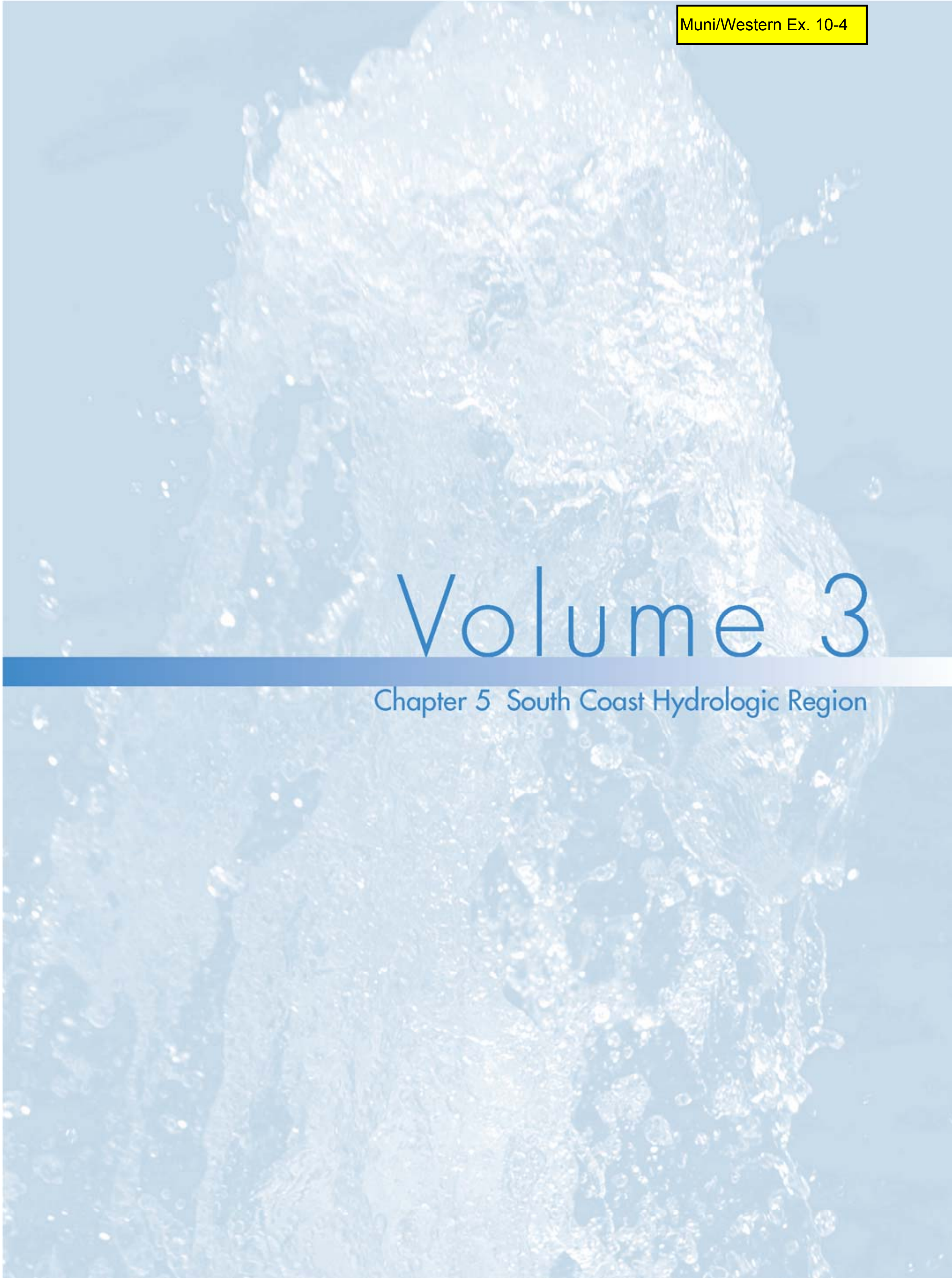
# MUNI/WESTERN EXHIBIT 10-4

## 2005 CALIFORNIA WATER PLAN UPDATE, VOLUME 3, CHAPTER 5,

## SOUTH COAST HYDROLOGIC REGION

Muni/Western Ex. 10-4



# Volume 3

## Chapter 5 South Coast Hydrologic Region

# Chapter 5 South Coast Hydrologic Region

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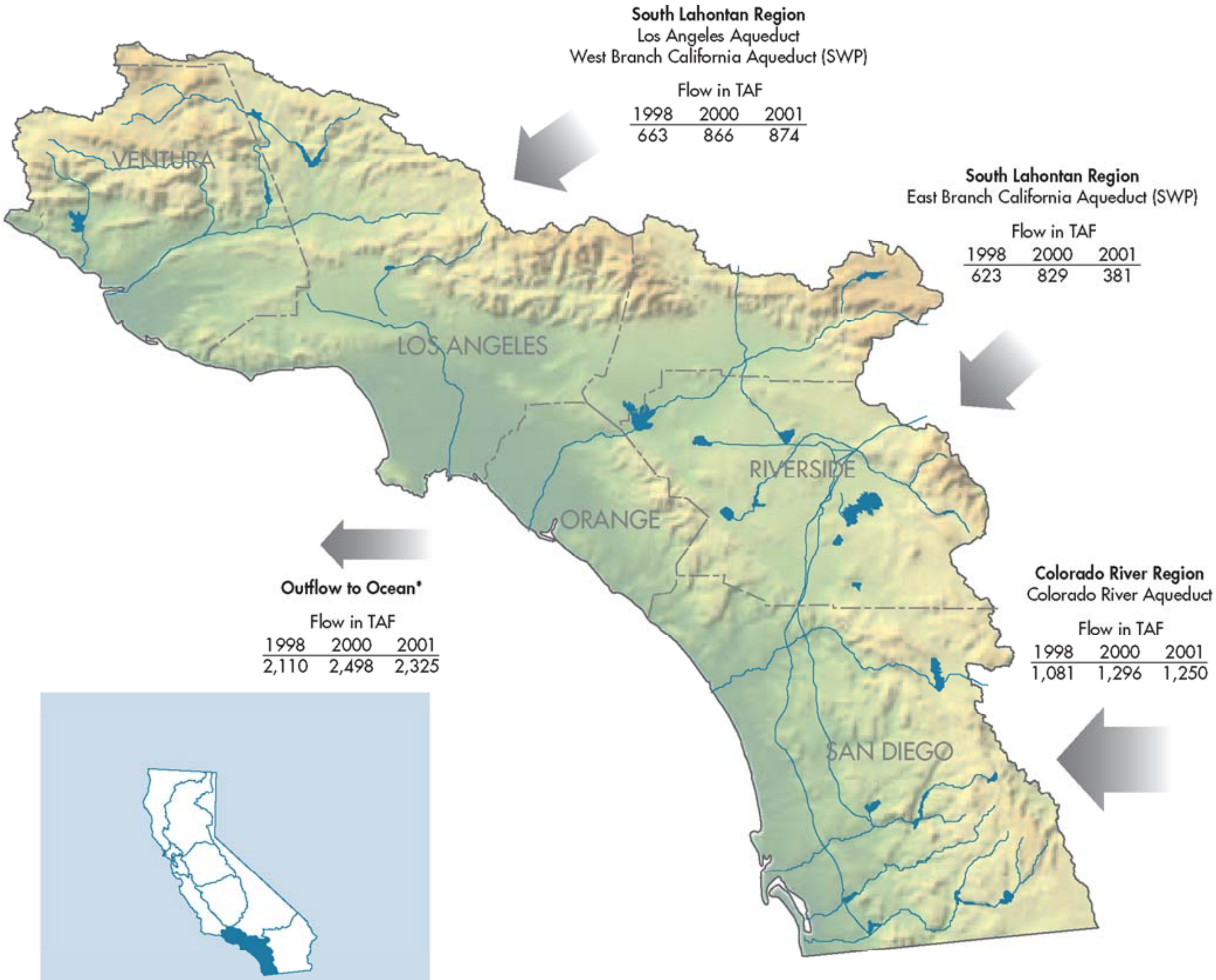
**Figure 5-1 South Coast Hydrologic Region**




**Some Statistics**

- Area - 110,925 square miles (6.9% of State)
- Average annual precipitation - 17.6 inches
- Year 2000 population - 18,223,425
- 2030 population projection - 23,827,075
- Total reservoir storage capacity - 3,059 TAF
- 2000 irrigated crop area - 280,260 acres

The South Coast Hydrologic Region in the southwestern corner of California is the most urbanized and populous region. Arrows indicate annual water flows entering and leaving the region for water years 1998, 2000, and 2001.

**Outflow to Ocean includes Wild and Scenic Rivers, regulated flows, and estimated wastewater outflows.*

# Chapter 5 *South Coast Hydrologic Region*

Within the South Coast Hydrologic Region, water wholesalers and retailers, groundwater agencies, and watershed planners and managers are becoming increasingly successful in working together to implement a large and diverse array of local water supply and water quality projects. In turn, this increased level of cooperation and integrated planning is making the region more flexible and less dependent on imported water, particularly during dry years (see Box 5-1).

This regional profile, after describing the characteristics of the region, provides examples of the South Coast's challenges, accomplishments, and plans to meet the water needs of the future. There are many more examples of water issues and accomplishments than are presented in this chapter. It is important to note that in the highly developed South Coast region there are now many major water interest groups and agencies with important roles to fulfill in providing reliable, affordable, high quality water. The jurisdictions and common areas of interest for these stakeholder interest groups often overlap, such that shared communication and integrated regional planning are becoming increasingly important to successful water planning and management.

## Setting

The South Coast Hydrologic Region comprises the southwest portion of the state and is California's most urbanized and populous region. It contains slightly more than half of the state's population (54 percent) but covers only 7 percent of the state's total land area. The topography includes a series of nearly flat coastal plains and valleys, many broad but gentle interior valleys, and several mountain ranges of low and moderate elevation.

The region extends about 250 miles along the Pacific Coast from the Ventura-Santa Barbara County line in the north to the international border with Mexico in the south (Figure 5-1). The region includes all of Orange County and portions of Ventura, Los Angeles, San Bernardino, Riverside, and San Diego counties.

There are several prominent rivers in the region including the Sespe, Ventura, Santa Clara, Los Angeles, San Gabriel, Santa Ana, San Jacinto, Santa Margarita, San Luis Rey, San Dieguito, Sweetwater, and Otay rivers. Segments of some of these rivers have been extensively lined and in other ways modified for flood control. Natural runoff of the region's streams and rivers averages about 1.2 million acre-feet annually.

### Box 5-1 Integrated Resource Planning

The Metropolitan Water District of Southern California adopted its Integrated Resource Plan in 1996 and recently has revised that plan with the adoption of the 2004 Update. The new 2004 Update accomplishes the three objectives of reviewing goals and achievements of the 1996 Integrated Resource Plan, identifying changed conditions for water resource development, and updating the resource targets through 2025.

The Santa Ana Water Project Authority recently completed its 2002 Integrated Water Resource Plan. It provides information on water demand and supply planning, water resource plans from member agencies, balancing and integrating available resources, and identifying regional problems and issues and potential long-term solutions.

The South Coast region comprises the southwest portion of the state and is California's most urbanized and populous region. The photo depicts the Los Angeles skyline. (DWR Photo)

## Climate

The region has a mild, dry subtropical climate where summers are virtually rainless, except in the mountains where late summer thunderstorms sometimes occur. About 75 percent of the region's precipitation falls from December through March. The coastal plains and the interior valleys receive on average 12 to 18 inches of annual precipitation, depending on location, but the climate allows for a much wider variation from year to year. Much of the 20 to 40 inches of annual average precipitation in the higher mountains falls as snow.

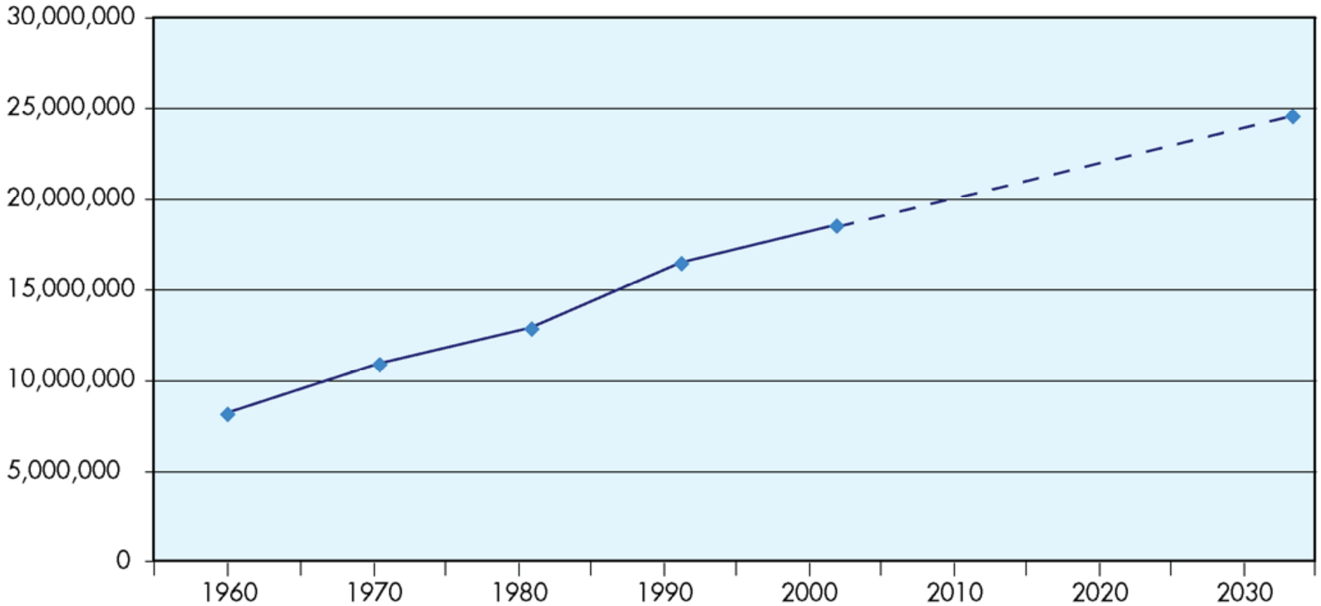
## Population

The region's 2000 population was 18,223,000. The fastest growing portion of the South Coast region is that known as the Inland Empire, which includes the inland valleys of Riverside and San Bernardino counties. The region contains seven of the state's fastest-growing cities, in terms of percentage change in growth (Temecula, Chula Vista, Irvine, Riverside, Fontana, Rancho Cucamonga, and Murietta). The city of Los Angeles is the state's biggest city. Its population grew from 3,486,000 in 1990 to 3,645,000 in 2000. The population in San Diego County is concentrated along the coastal terraces and valleys, and south of CampPendleton, the U.S. Marine base. In 2000, the city of San Diego was America's seventh largest city, and California's second largest, with 1,223,000 persons. Figure 5-2 provides a graphical depiction of the South Coast region's total population from 1960 through 2000, with current projections to year 2030.

## Land Use

The mild climate and ample expanse of gentle landscapes in the South Coast region have encouraged a variety of land uses since the first great development boom of the late 1880s. The expansion of new single- and multi-family homes, commercial services, businesses, and highway systems into the warmer

**Figure 5-2 South Coast Hydrologic Region population**




Data from California Department of Finance provide decadal population from 1960 to 2000 and population projection for 2030 for the South Coast region.

sections of the region continues onto lands that were historically pastoral, if not agricultural. Although pockets of open space and agricultural uses still exist, the urban area now extends southward from Ventura County to the international border with Mexico and eastward from the coast to beyond Riverside and San Bernardino. Irrigated agriculture now occupies only one-seventh as much land as urban uses. Environmental water uses are mostly limited to relatively small, managed wetland areas, wildlife areas, lakes, and riparian habitats.

Although the acreage has continued to decline in recent years, agriculture is still economically important for the region. In 2000, the total value of agricultural products in San Diego County was $1.3 billion. The total crop acreage in year 2000 was about 280,000 acres, which produced a variety of crops that included high-valued citrus and subtropical fruits, fresh-market vegetable crops, and assorted nursery products. Although agricultural uses occur throughout the region, the major areas continue to be the Oxnard Plain (for vegetables) and the adjacent hills and valleys (for citrus and subtropical fruits) in Ventura County; the coastal (for nursery) and interior valleys (for citrus and avocado fruits) in San Diego County; and the Chino area (for dairies) in San Bernardino County.

## Water Supply and Use

The region has developed a diverse mix of both local and imported water supply sources. Local water resources development over the last 15 years has included water recycling, groundwater storage and conjunctive use, conservation, brackish water desalination, water transfer and storage, and infrastructure enhancements to complement imported water supplies. The region imports water through the State Water Project (SWP), the Colorado River Aqueduct (CRA), and the Los Angeles Aqueduct (LAA) (see Box 5-2 for acronyms used in this report). This diverse mix of sources provides flexibility in managing supplies and resources in wet and dry years. Figure 5-3 provides a graphical presentation of all of the water supply sources that are used to meet the developed water uses within this hydrologic region for 1998, 2000, and 2001. Figure 5-3 also presents a bar chart that summarizes all of the dedicated and developed urban, agricultural and environmental water uses within this hydrologic region for 1998, 2000 and 2001.

The Metropolitan Water District of Southern California (MWD) imported an average of 703,000 acre-feet per year of water from the SWP from 1972 to 2003 (the contracted amount is currently 1,811,000 acre-feet per year; actual imports have been closer to this amount for the last few years), and 680,000 acre-feet or more of water from the CRA (depending on the availability of surplus water). MWD wholesales the water to a consortium of 26 cities, water districts, and a county authority that serve 18 million people living in six counties stretching from Ventura to San Diego.

Fifteen percent of the region's water supply is developed by water agencies located outside of the service area of MWD and its members agencies. These agencies also import water from the SWP, or use local supplies, usually groundwater. Agencies that import SWP water include Castaic Lake Water Agency, San Bernardino Valley Municipal Water District (SBVMWD), Ventura County Flood Control District, San Gorgonio Pass Water Agency, and the San Gabriel Valley Municipal Water District.

Groundwater and groundwater agencies are important to the water supply picture of the region, meeting about 23 percent of water demand in normal years and about 29 percent in drought years (see Box 5-3). There are 56 groundwater basins in the region. In some California groundwater basins, as the demand for groundwater exceeded supply, landowners and other parties turned to the courts to determine how much groundwater can rightfully be extracted by each user. In a process known as court adjudication, the courts study available data to arrive at a distribution of groundwater that is available each year, usually based on the California law of overlying use and appropriation. There are 19 court adjudications for groundwater basins in California, mostly in Southern California. In 15 of these adjudications, the court judgment limits the amount of groundwater that can be extracted by all parties based on a court-determined safe yield of the basin. The basin boundaries are also defined by the court.

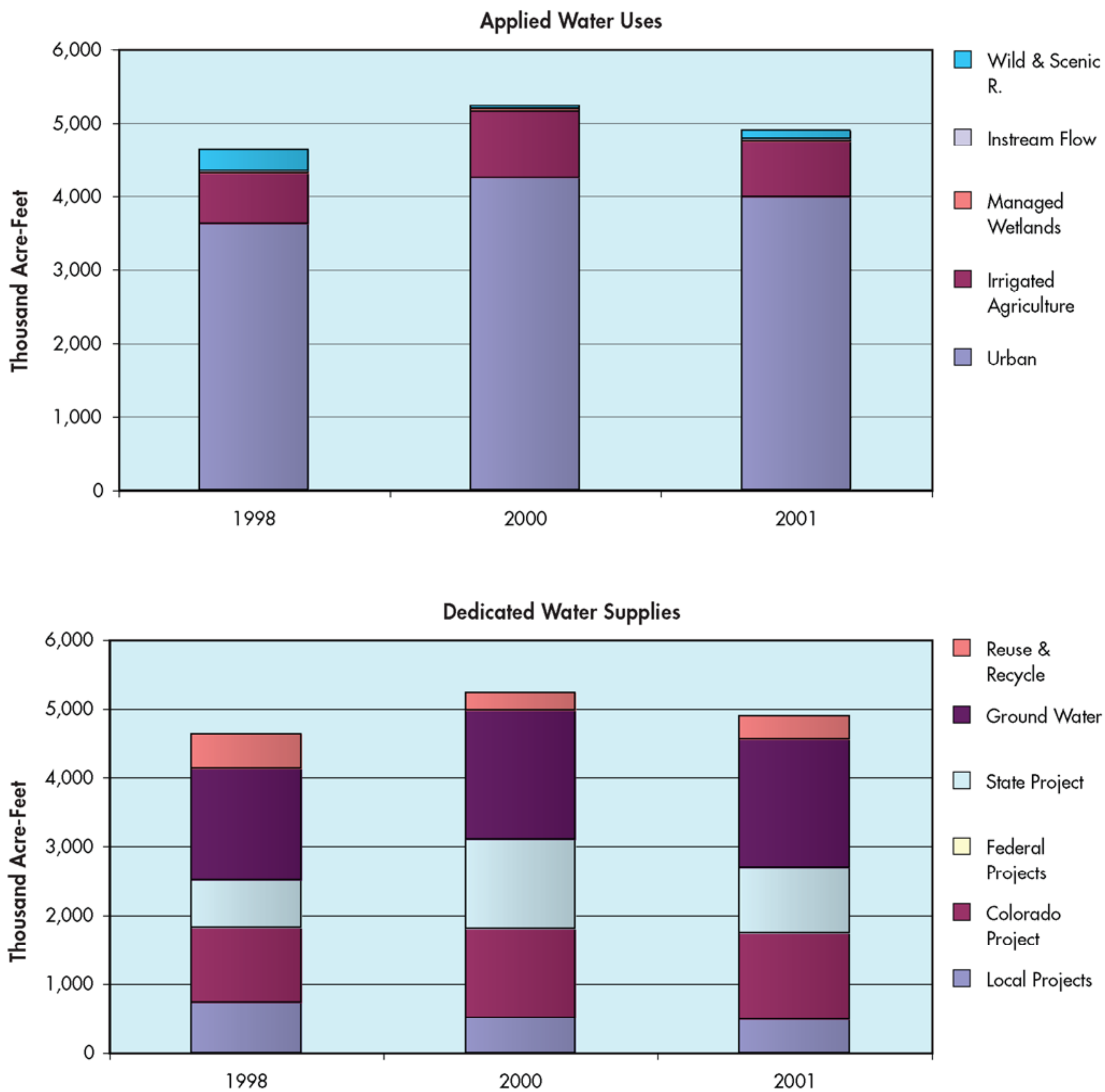
Most basin adjudications have resulted in either a reduction or no increase in the amount of groundwater extracted. As a result, agencies often import surface water to meet increased demand. The original court decisions provided watermasters with the authority to regulate extraction of the quantity of groundwater; however, they omitted authority to regulate extraction to protect water quality or to prevent the spread of contaminants in the groundwater. Because water quantity and water quality are inseparable, watermasters are recognizing that they must also manage groundwater quality.

The use of recycled water, which brings wastewater agencies into partnerships with surface and groundwater managers, is playing an increasingly significant role in meeting the region's water needs. The best recent data is from the 2002 Statewide Recycled Water Survey by the State Water Resources Control

## Box 5-2 Acronyms Used in the South Coast Regional Report

| | |
|---|---|
| CBDA | California Bay-Delta Authority |
| CRA | Colorado River Aqueduct |
| CVWD | Coachella Valley Water District |
| DBPs | disinfection byproducts |
| DWR | California Department of Water Resources |
| IID | Imperial Irrigation District |
| LAA | Los Angeles Aqueduct |
| LACDPW | Los Angeles County Department of Public Works |
| LADWP | Los Angeles Department of Water and Power |
| mgd | million gallons per day |
| MTBE | methyl tertiary butyl ether |
| MWA | The Mojave Water Agency |
| MWD | The Metropolitan Water District of Southern California |
| NDMA | nitrosodimethylamine |
| OCWD | Orange County Water District |
| QSA | Quantification Settlement Agreement |
| RWQCB | Regional Water Quality Control Board |
| SAWPA | Santa Ana Water Project Authority |
| SBVMWD | San Bernardino Valley Municipal Water District |
| SCCWRRS | Southern California Comprehensive Water Reclamation and Reuse Study |
| SWRCB | State Water Resources Control Board |
| SDCWA | San Diego County Water Authority |
| SWP | State Water Project |
| TDS | total dissolved solids |
| USBR | United States Bureau of Reclamation |
| VOCs | volatile organic compounds |
| WBMWD | West Basin Municipal Water District |

Figure 5-3 South Coast region water balance for water years 1998, 2000, 2001




Three years show a marked change in the amount and relative proportions of water delivered to South Coast region's urban and agricultural sectors and water dedicated to the environment (applied water, top chart), where the water came from, and how much water was reused among sectors (dedicated water supplies, bottom chart).

Board (SWRCB), which estimated that recycled municipal water delivery was about 275,000 acre-feet per year in Southern California. According to the MWD's 2003 Annual Progress Report, about 204,000 acre-feet of recycled water was developed within its service area in fiscal year 2003. By the year 2010, MWD expects that its service area will produce about 410,000 acre-feet of water through water recycling, groundwater recovery, or seawater desalination.

West Basin Municipal Water District (WBMWD), the largest water recycler in the region, has developed more than 31,000 acre-feet of recycled water. Within the San Diego County Water Authority (SDCWA) service area there is roughly 13,000 acre-feet per year of incidental groundwater recharge resulting from wastewater disposal operations, of which 95 percent is used for agriculture and landscape irrigation.

Water use efficiency measures, which are partnering wastewater treatment agencies with wholesale and retail water districts, will continue to have important impacts on the region's supplies and demands. A combination of active and passive measures has contributed to decreases in urban demands in the region. Recent examples of active water use efficiency programs include the installation of ultra-low-flush toilets and other water efficient appliances for residential, industrial, and institutional uses and the promotion of water efficient landscaping and irrigation. Even greater water supply savings are being achieved from passive water use efficiency measures. Passive water measures involve changes in the water code that require manufacturers to offer customers water-saving devices. MWD reports that its member agencies have urban programs that conserve about 65,000 acre-feet annually through active programs, and inclusion of passive conservation measures would make the total savings much larger.

About 15 percent of the South Coast region's developed water is used for agricultural activities. The sources of water supplies that are available for irrigation operations differ throughout the region. Groundwater is the primary source of water for the agricultural activities on the coastal plain of Ventura County. In the middle segment of the region, combinations of groundwater and imported water are used. In the southern portion, primarily San Diego County, imported water supplies and a small amount of local surface water are the primary sources.

MWD initiated several agricultural water conservation and transfer programs, including a program with the Imperial Irrigation District (IID) that conserved 105,130 acre-feet in 2003 and a crop rotation and water supply program with Palo Verde Irrigation District that saved about 186,000 acre-feet of water from 1992 through 1994. In addition, SDCWA is in the initial stage of an agreement with IID in which IID delivers conserved water to SDCWA. SDCWA received 10,000 acre-feet in 2003 and 20,000 acre-feet in 2004. Thirty thousand acre-feet will be delivered in 2005, and deliveries will increase annually toward 200,000 acre-feet of conserved water by 2021.

In the major agricultural areas in the region, most on-farm irrigation operations remain very efficient. Farmers are continuing to use the latest equipment to handle crop irrigations and conserve water. Micro-jet sprinklers and drip emitters are being used for the irrigation operations of most citrus and subtropical fruit orchards in San Diego and Ventura counties. Although furrow systems are still in use, drip irrigation systems are also used to irrigate the fresh market vegetables produced in Ventura County.

The regional water balance table (Table 5-1) provides a detailed accounting for all of the water that enters and leaves the South Coast region. As shown in the table, the nonquantifiable water uses (Evaporation, Evapotranspiration of Native Vegetation, Groundwater Subsurface Outflows, etc.) are about the same as total precipitation, and outflows to the ocean are relatively small. Imports are a large part of the applied water in the region. For comparison, Table 5-2 presents information on

## Box 5-3 Water Use During Latter Stages of 1987-1992 Drought

During the latter stages of the 1987-1992 drought and for several years afterward, water supply deliveries and municipal and industrial uses for many retail water districts in the South Coast Hydrologic Region were slightly less than in the late 1980s. The City of Los Angeles, exemplifies this trend. For water year 1990, the city used 677.1 thousand acre-feet (taf) of water from various supplies. In 1998 and 2000, the totals were 596.7 taf and 679.5 taf, respectively. The increase in water supplies in 2000 was less than 1 percent over the 1990 quantities despite a net increase in the population served of more than 400,000.

**Table 5-1 South Coast Hydrologic Region Water Balance Summary - TAF**

Water Entering the Region – Water Leaving the Region = Storage Changes in Region

| | Water Year (Percent of Normal Precipitation) | | |
|---|---|---|---|
| | 1998 (205%) | 2000 (72%) | 2001 (92%) |
| **Water Entering the Region** | | | |
| Precipitation | 20,873 | 7,522 | 9,327 |
| Inflow from Oregon/Mexico | 0 | 0 | 0 |
| Inflow from Colorado River | 1,081 | 1,296 | 1,250 |
| Imports from Other Regions | 1,286 | 1,695 | 1,255 |
| **Total** | **23,240** | **10,513** | **11,832** |
| **Water Leaving the Region** | | | |
| Consumptive Use of Applied Water * (Ag, M&I, Wetlands) | 1,468 | 1,819 | 1,628 |
| Outflow to Oregon/Nevada/Mexico | 0 | 0 | 0 |
| Exports to Other Regions | 0 | 0 | 0 |
| Statutory Required Outflow to Salt Sink | 0 | 0 | 0 |
| Additional Outflow to Salt Sink | 2,110 | 2,498 | 2,325 |
| Evaporation, Evapotranspiration of Native Vegetation, Groundwater Subsurface Outflows, Natural and Incidental Runoff, Ag Effective Precipitation & Other Outflows | 20,514 | 7,441 | 8,947 |
| **Total** | **24,092** | **11,758** | **12,900** |
| **Storage Changes in the Region** [+] Water added to storage [–] Water removed from storage | | | |
| Change in Surface Reservoir Storage | 372 | 128 | 332 |
| Change in Groundwater Storage ** | -1,224 | -1,373 | -1,400 |
| **Total** | **-852** | **-1,245** | **-1,068** |

| | | | |
|---|---|---|---|
| **Applied Water *** (compare with Consumptive Use) | 4,184 | 5,041 | 4,633 |

***Footnote for applied water**

Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows.

****Footnote for change in Groundwater Storage**

Change in Groundwater Storage is based upon best available information. Basins in the north part of the state (North Coast, San Francisco, Sacramento River and North Lahontan regions and parts of Central Coast and San Joaquin River regions) have been modeled – spring 1997 to spring 1998 for the 1998 water year and spring 1999 to spring 2000 for the 2000 water year. All other regions and year 2001 were calculated using the following equation:

GW change in storage =
intentional recharge + deep percolation of applied water + conveyance deep percolation - withdrawals

This equation does not include the unknown factors such as natural recharge and subsurface inflow and outflow.

**Table 5-2** South Coast Hydrologic Region water use and distribution of dedicated supplies - TAF

| | 1998 | | | 2000 | | | 2001 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Applied Water Use | Net Water Use | Depletion | Applied Water Use | Net Water Use | Depletion | Applied Water Use | Net Water Use | Depletion |
| **WATER USE** | | | | | | | | | |
| **Urban** | | | | | | | | | |
| Large Landscape | 165.7 | | | 242.8 | | | 187.5 | | |
| Commercial | 699.5 | | | 914.1 | | | 885.5 | | |
| Industrial | 186.0 | | | 209.8 | | | 209.8 | | |
| Energy Production | 39.8 | | | 39.8 | | | 39.8 | | |
| Residential - Interior | 1,593.9 | | | 1,795.9 | | | 1,654.3 | | |
| Residential - Exterior | 776.1 | | | 891.8 | | | 860.0 | | |
| Evapotranspiration of Applied Water | | 941.8 | 941.8 | | 1,134.6 | 1,134.6 | | 1,047.5 | 1,047.5 |
| E&ET and Deep Perc to Salt Sink | | 518.1 | 518.1 | | 594.5 | 594.5 | | 570.1 | 570.1 |
| Outflow | | 1,678.1 | 1,678.1 | | 1,976.7 | 1,976.7 | | 1,850.2 | 1,850.2 |
| Conveyance Applied Water | 160.0 | | | 154.6 | | | 153.0 | | |
| Conveyance Evaporation & ETAW | | 160.0 | 160.0 | | 154.6 | 154.6 | | 153.0 | 153.0 |
| Conveyance Deep Perc to Salt Sink | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Conveyance Outflow | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| GW Recharge Applied Water | 0.0 | | | 0.0 | | | 0.0 | | |
| GW Recharge Evap + Evapotranspiration | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| **Total Urban Use** | **3,621.0** | **3,298.0** | **3,298.0** | **4,248.8** | **3,860.4** | **3,860.4** | **3,989.9** | **3,620.8** | **3,620.8** |
| **Agriculture** | | | | | | | | | |
| On-Farm Applied Water | 691.9 | | | 908.4 | | | 758.4 | | |
| Evapotranspiration of Applied Water | | 494.8 | 494.8 | | 645.8 | 645.8 | | 542.9 | 542.9 |
| E&ET and Deep Perc to Salt Sink | | 11.2 | 11.2 | | 15.0 | 15.0 | | 12.3 | 12.3 |
| Outflow | | 100.1 | 100.1 | | 135.1 | 135.1 | | 110.1 | 110.1 |
| Conveyance Applied Water | 0.0 | | | 0.0 | | | 0.0 | | |
| Conveyance Evaporation & ETAW | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Conveyance Deep Perc to Salt Sink | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Conveyance Outflow | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| GW Recharge Applied Water | 0.0 | | | 0.0 | | | 0.0 | | |
| GW Recharge Evap + Evapotranspiration | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| **Total Agricultural Use** | **691.9** | **606.1** | **606.1** | **908.4** | **795.9** | **795.9** | **758.4** | **665.3** | **665.3** |
| **Environmental** | | | | | | | | | |
| Instream | | | | | | | | | |
| Applied Water | 3.5 | | | 3.5 | | | 3.5 | | |
| Outflow | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Wild & Scenic | | | | | | | | | |
| Applied Water | 284.2 | | | 34.3 | | | 108.2 | | |
| Outflow | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Required Delta Outflow | | | | | | | | | |
| Applied Water | 0.0 | | | 0.0 | | | 0.0 | | |
| Outflow | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Managed Wetlands | | | | | | | | | |
| Habitat Applied Water | 31.2 | | | 38.1 | | | 37.2 | | |
| Evapotranspiration of Applied Water | | 31.2 | 31.2 | | 38.1 | 38.1 | | 37.2 | 37.2 |
| E&ET and Deep Perc to Salt Sink | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Outflow | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Conveyance Applied Water | 0.0 | | | 0.0 | | | 0.0 | | |
| Conveyance Evaporation & ETAW | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Conveyance Deep Perc to Salt Sink | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Conveyance Outflow | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 |
| Total Managed Wetlands Use | 31.2 | 31.2 | 31.2 | 38.1 | 38.1 | 38.1 | 37.2 | 37.2 | 37.2 |
| **Total Environmental Use** | **318.9** | **31.2** | **31.2** | **75.9** | **38.1** | **38.1** | **148.9** | **37.2** | **37.2** |
| **TOTAL USE AND OUTFLOW** | **4,631.8** | **3,935.3** | **3,935.3** | **5,233.1** | **4,694.4** | **4,694.4** | **4,897.2** | **4,323.3** | **4,323.3** |
| **DEDICATED WATER SUPPLIES** | | | | | | | | | |
| **Surface Water** | | | | | | | | | |
| Local Deliveries | 292.1 | 292.1 | 292.1 | 211.4 | 211.4 | 211.4 | 217.1 | 217.1 | 217.1 |
| Local Imported Deliveries | 442.0 | 442.0 | 442.0 | 294.0 | 294.0 | 294.0 | 272.0 | 272.0 | 272.0 |
| Colorado River Deliveries | 1,081.3 | 1,081.3 | 1,081.3 | 1,296.0 | 1,296.0 | 1,296.0 | 1,250.5 | 1,250.5 | 1,250.5 |
| CVP Base and Project Deliveries | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Other Federal Deliveries | 4.2 | 4.2 | 4.2 | 0.6 | 0.6 | 0.6 | 0.0 | 0.0 | 0.0 |
| SWP Deliveries | 687.7 | 687.7 | 687.7 | 1,300.1 | 1,300.1 | 1,300.1 | 958.7 | 958.7 | 958.7 |
| Required Environmental Instream Flow | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Groundwater** | | | | | | | | | |
| Net Withdrawal | 1,223.5 | 1,223.5 | 1,223.5 | 1,372.5 | 1,372.5 | 1,372.5 | 1,400.0 | 1,400.0 | 1,400.0 |
| Deep Percolation of Surface and GW | 408.8 | | | 500.9 | | | 462.2 | | |
| **Reuse/Recycle** | | | | | | | | | |
| Reuse Surface Water | 287.7 | | | 37.8 | | | 111.7 | | |
| Recycled Water | 204.5 | 204.5 | 204.5 | 219.8 | 219.8 | 219.8 | 225.0 | 225.0 | 225.0 |
| **TOTAL SUPPLIES** | **4,631.8** | **3,935.3** | **3,935.3** | **5,233.1** | **4,694.4** | **4,694.4** | **4,897.2** | **4,323.3** | **4,323.3** |
| ***Balance = Use - Supplies*** | ***0.0*** | ***0.0*** | ***0.0*** | ***0.0*** | ***0.0*** | ***0.0*** | ***0.0*** | ***0.0*** | ***0.0*** |

the developed and dedicated components of the total supply, which is a summary of water that is actively stored, managed and used for urban, agricultural and environmental purposes.

## State of the Region

Over the past decade, the region has improved water supply reliability in the face of reduced imported supplies from the Owens Valley and Mono Basin and reduced uncertainty regarding the amount of imports available from the SWP (see Box 5-4). Water agencies have been proactive in continuous planning to manage the changing water supply and demand conditions in the region. While dependent on imported water for at least 50 percent of its water supplies, the region's water agencies have compiled a wide range of water management tools and water planning practices designed to improve and optimize local water resources in relation to the imported water needs.

### Challenges

Like many regions in the state, water quality and water supply challenges are intertwined. The South Coast region must manage for uncertainties caused by population and economic growth. Growth will not only affect demand, but it will add contamination challenges from increases in wastewater discharges and urban runoff, as well as increased demand for water-based recreation. Outside the region, environmental and water quality needs in the Delta and Owens River/Mono Basin systems affect imported water supply reliability and quality. The region must also assess and plan for impacts of climate variations and global climate change, as well as the cost of replacing aging infrastructure.

Given the size of the region and the diverse sources of water supply, the challenges to the region's water quality are varied. Surface water quality issues in the South Coast are dominated by storm water and urban runoff, which contribute contaminants (including trash) to local creeks and rivers. These pollutant sources, as well as sanitary sewer overflows, ocean outfalls, tidal input, and even wildlife, can degrade coastal water quality, closing beaches and increasing the health risks from swimming. These sources also specifically affect water quality in the major bays—Santa Monica, Newport, and San Diego. Newport Bay, for instance, suffers from algal blooms (due to excess nutrients), toxicity to aquatic life, high bacterial counts, and sedimentation. Shipping can also influence water quality, especially at the U.S. Navy base in San Diego Bay and the Long Beach and Los Angeles harbors, where there are toxic sediment hot spots. Harbors, marinas, and recreational boating threaten water quality via ballast water discharges, which can introduce invasive species, petroleum and sewage discharges and spills, biocides from boat hulls, boat cleaning and fish wastes, trash, and reduced water circulation. The South Coast Wetlands Recovery Project works to restore wetland habitat and eradicate exotic species in many watersheds of the region. Several dedicated wildlife and ecological reserves are located along the South Coast as well.

Constructed wetland projects in Hemet/San Jacinto, San Diego Creek, and Prado Basin remove large loads of nitrogen from wastewater and urban runoff. Salinity, nitrogen, and microbes are the major contaminants in the Santa Ana River, affecting downstream beneficial uses such as swimming and groundwater recharge for domestic use. Because of upstream irrigation diversions, flows in the middle and lower Santa Ana River are composed mostly of recycled water, creating a year-round flow that is high in salinity. The Santa Ana River suffers as well from an invasive exotic species, the giant reed Arundo donax. Other nonnative, invasive species of concern in this region include the marine alga Caulerpa taxifolia along the San Diego coast, and salt cedar (Tamarix sp.) in various streams and rivers; both, like Arundo donax, have the potential to wreak havoc with native ecosystems (see Box 5-5).

### Box 5-4 SWRCB Decision 1631

In 1994, State Water Resources Control Board adopted Water Right Decision 1631 amending the City of Los Angeles' water rights for diverting water from the Mono Basin. The decision restricts diversions from the basin in order to increase and maintain Mono Lake's level to 6,391 feet above sea level. During the period of Mono Lake's transition to the 6,391-foot level (estimated to take about 20 years), the maximum amount of water that Los Angeles can divert from the basin is 16 thousand acre-feet per year. Long-term Los Angeles diversions from the Mono Basin are projected to be about 31 thousand acre-feet per year after Mono Lake has reached the 6,391-foot level, or one-third of the city's historical diversions from the Mono Basin.

Lake Elsinore, the largest natural freshwater lake in southern California, experiences nuisance algae blooms from excess nutrients, impairing its ecological and recreational beneficial uses. Local groups have implemented many wetland and river restoration projects to improve water quality, for example, at Bolsa Chica and in Ballona Creek, as well as along the Los Angeles and San Gabriel rivers. The United States and Mexico jointly built the International Wastewater Treatment Plant to treat a portion of the sewage from Tijuana, which flows across the international boundary into the San Diego Basin.

The Chino Basin hosts the highest concentration of dairy animals in the United States. In a 40 square-mile area, well over 300,000 animals are maintained on about 300 dairies. Because of a lack of sufficient land to dispose of manure, as well as flooding from expanding suburban development, dairy runoff contributes nitrate, salts, and microorganisms to groundwater as well as surface water. Since 1972, the Santa Ana Regional Water Quality Control Board (RWQCB) has issued waste discharge requirements to the dairies in this basin. In addition, pilot projects to develop sewer systems for dairies and for treating dairy wash water have also recently been completed. Water utilities can use desalters to recover groundwater from brackish aquifers such as the Chino Basin, but only if they have access to a regional brine line (the Santa Ana River Interceptor in this area). Groundwater quality in this basin is integrally related to the surface water quality downstream in the Santa Ana River, which in turn serves as a source for groundwater recharge in Orange County. Orange County Water District and to the north West Basin Municipal Water District operate groundwater injection programs to form hydraulic barriers, to protect aquifers from seawater intrusion.

Public health and environmental and economic concerns have grown with the expansion of water recycling programs in the South Coast region. Some concerns are related to the total dissolved solids (TDS) content of wastewater and the presence in treated wastewater of pharmaceuticals, household products, and other emerging contaminants. The high salinity of imported Colorado River water limits the number of times water can be reused before the salt content becomes too high and wastewater can only be discharged to the ocean. Increased use of recycled water and marginal quality groundwater supplies during droughts can result in water quality problems for some local supplies that endanger future water management projects. For instance, groundwater recharge potential may be restricted because the RWQCB has established TDS requirements for recharge water in some groundwater basins in order to protect existing basin water quality.

The average TDS concentration of MWD's CRA water is about 600 to 700 mg/L, and the average TDS content of SWP supplies is about 300 mg/L. The water supply from the LAA has a significantly lower TDS concentration, typically about 160 mg/L. TDS levels in local groundwater supplies in the region vary considerably, ranging from 200 mg/L (Cucamonga Basin near Upland) to more than 1,000 mg/L (Arlington Basin near Corona). Local water uses also contribute significantly to overall salinity levels. For example, municipal and industrial use of water adds between 250 and 500 mg/L of TDS to wastewater. Key sources of local salts include water softeners (typically contributing from 5 to 10 percent of the salt load) and industrial processes.

The long-term salt balance of the region's groundwater basins is an increasingly critical management issue. Smaller basins like the Arlington and Mission groundwater basins were abandoned as municipal supplies because of high salinity levels. Some of these basins have only recently been restored through brackish water desalting projects. The Mission Basin has not been restored, but water is being recovered and treated to drinking water standards by the City of Oceanside's Mission Basin Groundwater Repurification Facility. Blending SWP and CRA supplies, or using the SWP's relatively low TDS supplies for groundwater replenishment, is a strategy in some areas. However, some inland water districts that use recycled water

### Box 5-5 Two Examples of Ongoing Ecosystem Restoration

The Matilija Dam Ecosystem Restoration Feasibility Study evaluated alternatives and has provided a draft recommendation for removing the 160-foot high dam, including stored sediment, to restore the Ventura River ecosystem. The Public Draft Report was released in July 2004.

The Santa Ana River Trail and Parkway Project includes planning of recreational uses that showcase the river and provide a place for people to enjoy this important resource.

have salt accumulation problems in their groundwater basins because they lack an ocean outfall or stream discharge. To dispose of these salts, some districts have developed access to a brine pipeline that exports salt and concentrated wastes to a coastal treatment plant and ocean outfall. However, there are situations where agencies have not constructed a brine pipeline due to the high cost of this alternative.

Beyond salinity, several established and emerging contaminants of concern to the region's drinking water supplies include disinfection byproducts (DBPs), perchlorate, arsenic, nitrosodimethylamine (NDMA), hexavalent chromium, and methyl tertiary butyl ether (MTBE). Historically, industrial solvents have extensively impacted the groundwater underlying the San Gabriel Valley. Imported water from the Owens Valley is of excellent water quality, and imported Delta water quality is generally good. Nonetheless, arsenic is a concern in the Owens Valley supply, and Delta water can contain precursors (such as organic carbon and bromide) of potentially carcinogenic DBPs, if treated with certain disinfection processes necessary to inactivate pathogens in drinking water.

Perchlorate, a component of rocket fuel that can disrupt thyroid gland function, has particularly impacted the groundwater in Pasadena and the Rialto-Colton-Fontana region. Perchlorate is also a concern in Colorado River water, largely due to contamination from inactive ammonium perchlorate manufacturing facilities in Nevada. Perchlorate contamination of wells in the San Gabriel Valley, which resulted in the deactivation of many of these wells, has led to testing of ion exchange technologies for the removal of this constituent.

Naturally occurring arsenic, a known human carcinogen, is another contaminant of concern, present in the LAA supply as well as local aquifers. The City of Los Angeles currently manages arsenic concentrations in the LAA water through treatment. In Southern California, local water sources with high arsenic levels are found in Los Angeles, San Bernardino, and Riverside counties.

NDMA, a probable human carcinogen, is associated with the production of rocket fuel and the manufacture of explosives, paints, and other industrial goods. Contamination of surface water and groundwater by NDMA at missile and rocket fuel manufacturing and storage sites is a significant concern, particularly for groundwater supplies. NDMA can also be formed during the treatment of wastewater, which is a threat to aquifers that are recharged with reclaimed wastewater and later used for drinking water.

Groundwater contamination by hexavalent chromium, a suspect carcinogen better known as chromium 6, in the Los Angeles basin and elsewhere, has resulted from its use in various industries including aerospace and plating. In Los Angeles County, Los Angeles RWQCB staff is overseeing the ongoing assessment and cleanup of sites impacted by hexavalent chromium at defense-related businesses and manufacturing and other industrial sites.

MTBE and other oxygenates have been added to gasoline in areas with severe air pollution to help gasoline burn more cleanly and comply with federal law. Unfortunately, MTBE can also contaminate groundwater supplies when pipelines, fuel tanks, and other containers or equipment leak, when fuel is spilled, and when unburned fuel is discharged from watercraft. The high mobility and low biodegradability of MTBE present a significant risk to aquifer supplies. MTBE has been widely detected in South Coast groundwater, surface water, and imported water supplies. In particular, MTBE contamination forced the closure of more than half of Santa Monica's water supply wells and made the city more dependent upon imported water supplies and treatment systems. California has recently phased out MTBE from its gasoline supplies. As of January 1, 2004, California refineries no longer blend MTBE into gasoline. Ethanol is now used as the primary oxygenate in areas requiring oxygenate additives under federal law.

The 198-foot-high Matilija Dam in Ventura County has lost most of its water supply and flood control benefits due to sediment deposits. Originally built in 1947 to store up to 7,018 acre-feet of water, siltation has reduced its effective storage capacity to about 500 acre-feet. Moreover, the Matilija Dam has had adverse effects on the ecosystem of the Ventura River watershed, which supports several threatened and endangered species. The structure blocks riparian and wildlife corridors between the Ventura River and Matilija Creek. By trapping sediment that would otherwise be carried downstream, the dam also contributes to the long-term erosion of estuaries and beaches along the Ventura River.

The Matilija Dam Ecosystem Restoration Feasibility Study, a joint study by the Ventura County Watershed Protection District and the U.S. Army Corps of Engineers, is one of the largest dam removal studies ever undertaken in the United States. The study recommended the dam's removal in its July 2004 public draft report and environmental impact statement/environmental impact report. However, there are disputes over rights to the remaining water supply. The Casitas Municipal Water District, which leases the dam, pipeline, and rights to the dam's water from the Ventura County Watershed Protection District, is concerned with how this lost water supply to Casitas will be recovered once the Matilija Dam and reservoir are removed. Studies and discussions are continuing in order to develop solutions for the water supply impacts that could result from removal of this dam.

California's use of Colorado River water is being managed to ensure that the state reduces the use of this water from a high of 5.3 million acre-feet in previous years to its 4.4 million acre-feet annual apportionment. Until 2016, California may receive interim surplus water from the river depending on the storage level in Lake Mead. The Colorado River Board of California developed the basic plan, called California's Colorado River Water Use Plan or the "4.4 Plan," that outlines steps to reduce the state's use of Colorado River water. Those steps include a water transfer of conserved water from IID to SDCWA, the lining of the All-American and Coachella Canals, water storage and conjunctive use programs, water exchanges, improved reservoir management, salinity control, watershed protection, water reuse, and other measures. The signing of the Quantification Settlement Agreement (QSA) in 2003 enabled implementation of the 4.4 Plan (see Box 5-6).

Drought is a constant concern for water districts in the region. This has led to an emphasis on the development of local supplies and demand management strategies. Today, about 50 percent of Southern California's demand is being met through such local supplies as water conservation, recycling, and groundwater recovery. The uncertainty caused by scientific findings on climate change also has caused water agencies to question the reliability of imported sources.

Groundwater overdraft and lower groundwater levels are challenges to the region. Historically, agricultural, industrial, and urban development has led to increased groundwater pumping from many of the region's basins. In some basins over-extraction of groundwater has caused seawater intrusion, contributed to land subsidence, and resulted in legal disputes over pumping rights within specific basins.

## Accomplishments

The region has developed a diverse water portfolio that is balanced between local and imported supplies. The primary objectives of the region's water agencies are to provide high quality, reliable, and affordable water. To achieve these objectives, local water districts have built additional facilities to increase surface storage and water transmission capacities. They have also implemented a variety of resource management strategies to increase the efficiencies of agricultural and urban water uses, utilize recycled water, groundwater conjunctive use, groundwater remediation, brackish water desalination, drinking water treatment, watershed management, groundwater banking, and water transfers from outside the region.

### Box 5-6 Key Elements of California's Colorado River Quantification Settlement Agreement

The California Colorado River Quantification Settlement Agreement and related agreements will have the following effects:

- Permit the utilization of interim surplus water.
- Transfer as much as 30 million acre-feet of water from farms to cities in Southern California for up to the 75 year term of the agreement.
- Settle potential lawsuits between the Imperial Irrigation District and the U.S. Department of the Interior.
- Obligate California with the sole responsibility for restoration of the Salton Sea ecosystem.
- Provide for cooperation on the environmental review and mitigation for the Imperial Irrigation DistrictIID/ San Diego County Water AuthoritySDCWA Transfer Agreement, IID/ Coachella Valley Water DistrictCVWD Acquisition Agreement, and Salton Sea habitat conservation plan/natural community conservation plan.
- Fund a $200 million project to line with concrete a portion of the earthen All-American Canal and a portion of the earthen Coachella Canal. Water conserved by reducing seepage will be transferred to San Diego and the San Luis Rey Indian tTribes, who will pay proportionally for operation and maintenance costs.
- Quantify, for the first time, the total Colorado River apportionments in California.

These diversified strategies guide the management of available resources in a manner that allows greater flexibility when adapting to water quality and supply challenges.

MWD built Diamond Valley Lake in the late 1990s to better manage water supplies between wet and dry years. Located near Hemet in southwestern Riverside County, the 800,000 acre-foot reservoir nearly doubles the region's existing surface storage capacity and provides increased terminal storage for SWP and Colorado River water. Diamond Valley Lake can also provide the MWD service area with a six-month emergency water supply after an earthquake or other disaster. It also provides water storage for drought protection and to meet peak summer demands.

The SDCWA finished construction of Olivenhain Reservoir in 2003 and completed filling its 24,000 acre-foot capacity with imported water in 2005. The reservoir, just southwest of Escondido in northern San Diego County, is designed to provide water to the San Diego region during natural or man-made emergencies. It is the first project completed in the SDCWA Emergency Storage Program.

The Inland Feeder is a conveyance facility for delivery of SWP water made available by the enlargement of the East Branch of the California Aqueduct (Figure 5-4). When it is completed, the Inland Feeder will deliver water by gravity to Diamond Valley Lake through 43.7 miles of tunnels and pipeline that start at Devil Canyon afterbay and tie into the CRA and Eastside Pipeline. The Inland Feeder will provide system reliability by linking the SWP and Colorado River systems and will improve water quality by allowing greater blending of SWP and Colorado River waters.

A recent agreement between MWD and SBVMWD allows MWD to purchase additional SWP water for blending with Colorado River water, and to store this water in the San Bernardino groundwater basin. This new groundwater supply also helps to resolve long-standing groundwater issues in the basin. The San Gorgonio Pass Water Agency recently extended the pipeline east from Mentone bringing SWP water to Beaumont.

On Oct. 10, 2003, representatives from MWD, SDCWA, IID, and Coachella Valley Water District (CVWD) signed the Quantification Settlement Agreement (QSA) and several other agreements that will execute several key components of the Colorado River Water Use Plan including establishing water budgets from IID and CVWD and making water transfers

**Figure 5-4 MWD inland feeder**


The Inland Feeder will provide system reliability by linking the State Water Project and Colorado River systems and will improve water quality by allowing greater blending of SWP and Colorado River waters.

viable (see Box 5-5). The QSA includes a water transfer from IID to SDCWA, which began in 2003 and eventually will provide up to 200,000 acre-feet per year to San Diego County. The transfer will help increase water supply reliability for the South Coast Region.

In 2003, the SDCWA and IID consummated the largest water transfer agreement in the history of the United States. This transfer, which will eventually move 200,000 acre-feet of conserved water by farmers in the Imperial Valley annually to San Diego County, has helped reduce SDCWA's dependence on MWD and diversified its sources of imported water. The initial term of the agreement is for 45 years; a 30-year extension is possible with the mutual consent of both parties. In addition, SDCWA will gain an additional 77,000 acre-feet of water per year through projects it will undertake to line the All-American and Coachella canals to stop water loses that occur because of seepage. This program has a 110-year term.

State agencies, including DWR, SWRCB, and the California Bay-Delta Authority (CBDA), and the U.S. Bureau of Reclamation (USBR) are making major statewide investments in urban and agricultural water conservation programs, which regional and local agencies leverage with their own investments to reduce demands. As discussed in previous sections, additional demand reduction is achieved through passive conservation measures as a result of changes in manufacturing codes.

An example of this regional leveraging is MWD's water conservation program with its member agencies. Since 1992 Metropolitan has invested more than $191 million in conservation programs and related activities. In 2003 MWD implemented a new rate structure that includes a funding source dedicated to water conservation, recycling, groundwater recovery, and other local projects. The backbone of MWD's conservation program is the Conservation Credits Program, initiated in 1988, that contributes $154 per acre-foot of water conserved to assist member agencies in pursuing conservation opportunities. In tandem with these urban conservation efforts, MWD and IID entered into the 1988 IID/MWD Water Conservation Agreement and Approval Agreement. This agricultural water savings program began in 1990, and to date MWD has invested more than $200 million to construct, operate, and maintain projects with IID intended to conserve more than 100,000 acre-feet of water every year which can be transferred to MWD. In 2005 water savings from this program were calculated at 101,900 acre-feet.

Palo Verde Irrigation District and MWD have a 35-year agreement for a land management, crop rotation, and water supply program, under which Palo Verde farmers will stop irrigating between 7 to 29 percent of their land, on a rotating basis. This land fallowing program is estimated to produce between 24,500 acre-feet per year up to 110,000 acre-feet per year for use in Southern California. MWD will provide an estimated $6 million to local community improvement programs to counter potential negative economic impacts to communities in the Palo Verde region.

More than $440 million, primarily from State Propositions 13 and 50 and federal Title XVI grants, have been invested in water recycling programs in the region, resulting in over 500,000 acre-feet of water available per year, including Orange County Water District's (OCWD) current reuse of Santa Ana River water. The growth in recycled water is expected to be about 400,000 acre-feet over the next decade.

OCWD and Orange County Sanitation District's new Groundwater Replenishment System is designed to increase current water reuse by taking treated sewer water that is currently being released into the ocean and purifying it through microfiltration, reverse osmosis, and ultraviolet light with hydrogen peroxide advanced oxidation treatment. The purified water will then be injected into a seawater barrier and pumped to percolation ponds to seep into deep aquifers and blend with Orange County's other sources of groundwater. This Groundwater Replenishment System is projected to begin delivery of purified water in 2007, with potential for future expansion as needed.

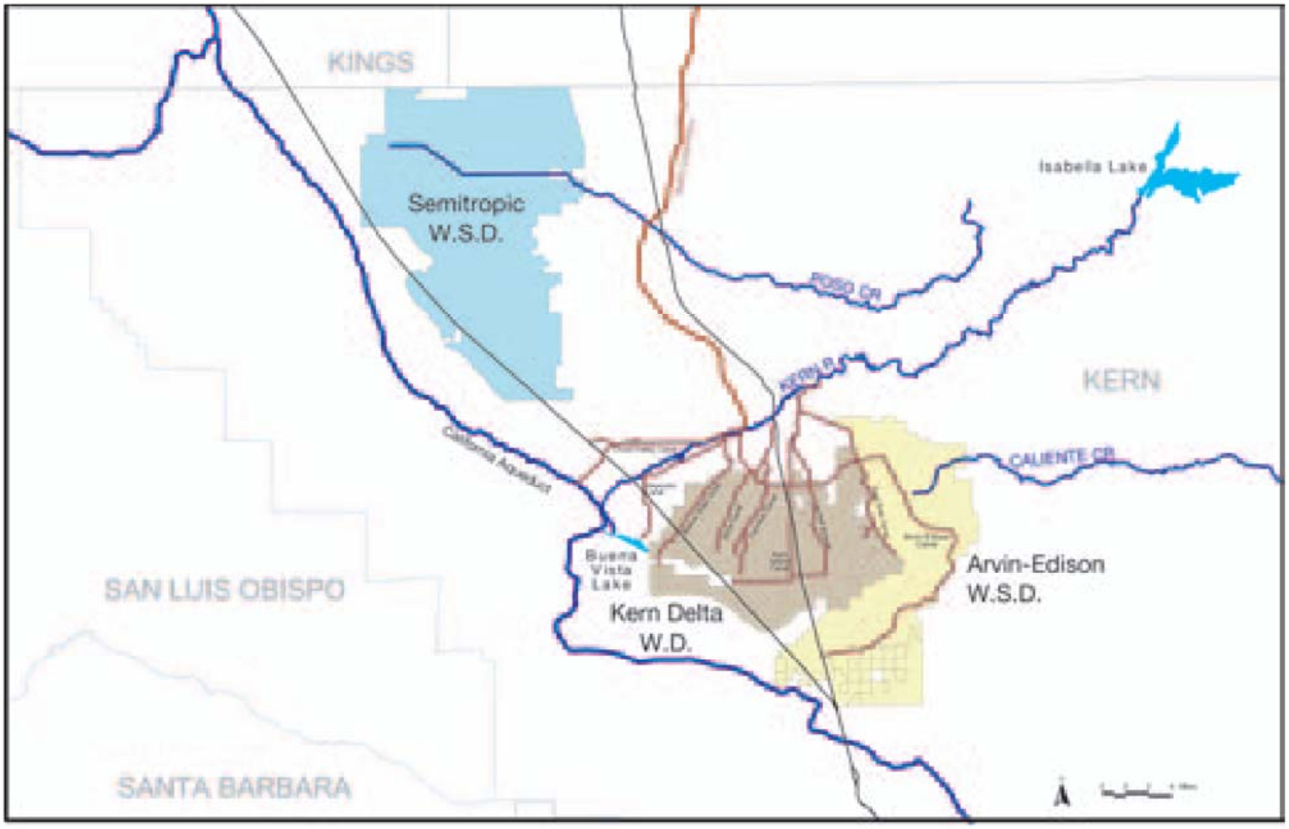
The development of groundwater storage and conjunctive use programs has improved the region's water supply reliability and overall water quality. A 2000 study by the Association of Groundwater Agencies indicates that existing conjunctive use programs in the region provide an estimated 2.5 million acre-feet of water per year, which is a fraction of the region's conjunctive use potential. It is estimated that more than 21.5 million acre-feet of additional water could be stored and used in Southern California groundwater basins with the resolution of institutional, water quality, and other issues. State agencies have supported the development of 34 groundwater management and storage projects throughout the region.

As a result of MWD's replenishment services pricing program, local agencies are implementing conjunctive use programs. They are storing imported water in groundwater basins and increasing their groundwater use during the summer and during drought years. It is estimated that an average of 100,000 acre-feet per year of groundwater supply is now produced as a result of MWD's discount pricing of water deliveries. MWD has identified the potential for 200,000 acre-feet of additional groundwater production during drought years. To accomplish this additional drought year production, about 600,000 acre-feet of dedicated storage capacity within the local basins may be required.

An example of this type of conjunctive use program is the Las Posas Basin Aquifer Storage and Recovery Project. The Calleguas Municipal Water District, in cooperation with MWD, has initiated a conjunctive use program in the Las Posas Groundwater Basin of Ventura County. The project is designed to store a maximum of 210,000 acre-feet of SWP water supplies that can be used during water supply shortages. The project will be phased into operation with full operation anticipated by 2010. To date, 18 wells have been constructed and about 50,000 acre-feet of water is in groundwater storage.

Recent groundwater storage agreements allow additional storage in wet years. Groundwater agreements to be implemented in the region have the potential to put more than 53-billion gallons of water into storage in Orange County, the west San Gabriel Valley, and the Inland Empire area. Groundwater storage can also be accumulated outside of the South Coast Hydrologic Region. MWD has recently developed water storage agreements with the Kern-Delta Water District, the Mojave Water Agency, and the North Kern Water Storage District, all located outside of the region. These groundwater storage programs are in addition to existing exchange agreements with the Semitropic Water Banking and Exchange Program

**Figure 5-5 MWD storage agreements with San Joaquin Valley agencies**




MWD recently developed water storage agreements with the Kern-Delta Water District, the Mojave Water Agency, and the North Kern Water Storage District, all located outside of the region. These groundwater storage programs are in addition to existing exchange agreements with the Semitropic Water Banking and Exchange Program in Kern County, the Arvin-Edison Water Storage Program in Kern County, and the Kern-Delta Storage Program

in Kern County, the Arvin-Edison Water Storage Program in Kern County, and the Kern-Delta Storage Program (see Figure 5-5). Castaic Lake Water Agency has also entered into a short-term groundwater banking arrangement with Kern County.

Groundwater quality issues are being identified and addressed at many locations throughout the region. In the San Gabriel Valley, the Main San Gabriel Basin Watermaster, San Gabriel Basin Water Quality Authority, Upper San Gabriel Valley Municipal Water District, and a number of water suppliers have actively pursued technical remedies for the groundwater quality problems. Several treatment facilities for removal of volatile organic compounds (VOCs) were first constructed in the 1990s. As of June 2002, 18 treatment facilities are operational. Groundwater supplies with high nitrate levels are either blended with other supplies or not used at all. Similar cleanup efforts are being pursued in the San Fernando Basin by the Los Angeles Department of Water and Power (LADWP) and the cities of Burbank and Glendale. Several groundwater desalting plants are currently operated by the Santa Ana Water Project Authority (SAWPA), Chino Basin Desalting Authority, city of Corona, Eastern Municipal Water District, Irvine Ranch Water District, the city of Oceanside, West Basin MWD, and the Sweetwater Authority. Brackish groundwater desalting currently delivers about 100,000 acre-feet of water per year, and will increase to about 250,000 acre-feet during the next decade. State Proposition 13 water bond funding is being utilized to expand desalting capacity in the region.

The SAWPA is a joint powers authority in the eastern portion of the region. It represents five agencies in the counties of Orange, Riverside, and San Bernardino and covers a watershed area of 2,650 square miles. It provides effective and focused watershed planning on a regional basis.

SAWPA operates a brine disposal line and the Arlington Desalter, which facilitates disposal of waste brine from regional desalting plants. SAWPA has been particularly successful in recent years in assisting its member agencies in implementing several new water resources projects that enhance groundwater recovery, groundwater storage, water quality improvement and water recycling through the use of Proposition 13 Water Bond funding. About 20 potential groundwater recovery projects have been evaluated with a potential net water yield of 95,000 acre-feet per year.

The Port Hueneme Water Agency was formed to develop and operate a brackish water desalting demonstration facility for its member agencies in western Ventura County. Its goals are to improve the quality and reliability of local groundwater supplies and decrease seawater intrusion in the Oxnard Plain. The facility will provide a full-scale demonstration of side-by-side operation of three brackish water desalting technologies: reverse osmosis, nanofiltration, and electrodialysis reversal.

Increasingly, the region's water wholesalers, such as Castaic Lake Water Agency, SBVMWD, Mojave Water Agency (MWA), MWD, and SDCWA are acquiring part of their future supplies from water marketing or exchange arrangements, using the CRA and California Aqueduct to convey the exchanged or purchased water.

An agreement in late 2003 between MWA and MWD calls for the exchange of 75,000 acre-feet of SWP flow from the California Aqueduct. Under this accord, MWA received about 23,000 acre-feet of MWD's State-authorized flow through the California Aqueduct at the end of year 2003. Additional water exchanges through this agreement will depend on the amount of rain or snowfall available to the SWP. Water will be stored in the high desert's underground aquifers to help replenish the water table, prevent well-deepening by residents, and meet future needs.

The South Coast region has placed an increased emphasis on improving watershed management and protection. Local, State, and federal agencies and nonprofit organizations have invested in several management efforts, including watershed education, monitoring, and wetlands management and protection. More than 40 entities are generating new partnerships and coalitions among various stakeholders in attempts to integrate elements of flood hazard mitigation, groundwater and storm water conservation, and management of the quality of storm water runoff, to better manage resources. Below are a few examples of the region's watershed programs:

- SAWPA, the largest watershed organization, was established to protect and enhance the quality and supply of the watershed and protect the environment by implementation of its watershed plan.
- Under the guidance of the Los Angeles County Department of Public Works, watershed management plans are being developed for five coastal watersheds within Los Angeles County. Eleven watershed and subwatershed plans have been completed with eight pending or proposed plans under way, making Los Angeles County the most productive county in the state in terms of watershed planning.
- The Hemet/San Jacinto Multipurpose Constructed Wetlands is a collaborative project between the USBR and Eastern Municipal Water District. The wetland is nearly 60 acres with five interconnected marshes. It provides nitrogen removal of secondarily treated recycled water and habitat for migratory waterfowl, shore birds, and raptors along the Pacific Flyway.
- The San Diego Creek Watershed is operated by the Irvine Ranch Water District. The watershed program helps sustain a restored marsh and treats contaminated urban runoff water from San Diego Creek before it enters into Newport Bay in Orange County.
- OCWD operates the Prado Basin Wetland in Riverside County. In cooperation with the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service, OCWD operates 465 acres of constructed freshwater wetlands to reduce the nitrogen concentration of river water.

## Looking to the Future

The region's water agencies generally have solid plans for adapting to changing conditions and meeting future water needs. For example, the 2004 Report on MWD's water supplies states, "Metropolitan has a comprehensive supply plan to provide sufficient supplemental water supplies and to provide a prudent supply reserve over the next 20 years and beyond." SAWPA has begun a 10-year integrated program to help, among other things, drought-proof the watershed, so it can roll off imported water for up to three years during drought years. The Chino Basin is one area that has developed an integrated conjunctive management program with the potential to develop 500,000 acre-feet of new storage over the next 20 years, including new yield from storm water management, SWP and recycled water recharge, and the implementation of aggressive water use efficiency programs. Water districts in the Santa Clarita Valley of Los Angeles County are engaged in integrated urban water management planning, collaborative data collection, and a new groundwater plan. These and other ongoing planning programs are important to manage changing conditions facing the region. Water conservation programs, water recycling, and groundwater recovery, as well as water marketing and other water supply augmentation responses are being examined and implemented.

The signing of the Quantification Settlement Agreement and related agreements in October 2003 facilitated long-term water transfers from the IID and CVWP in the Colorado River Hydrologic Region to urban water users in the South Coast Hydrologic Region. They will help California reduce its use of Colorado River water to its basic allotment of 4.4 million acre-feet during years of normal supply. They will also make possible the transfer of additional water to be obtained through lining the All American and the Coachella canals. The water transfer between IID and SDCWA will help to stabilize MWD's and CVWD's water supplies, satisfy outstanding miscellaneous and Indian water rights, and provide funding that IID and farmers in the Imperial Valley will use to implement additional water conservation measures once the required fallowing is complete.

MWD will continue its replenishment services water pricing program to encourage local agencies to store imported water in groundwater basins for use during the summer and during drought years. In addition, local agencies in the region are now planning to use water transfers for part of their base supplies, a change from past years when marketing arrangements were viewed as primarily for drought year supplies.

In 2004 MWD updated its Integrated Water Resources Plan with the revised goal of achieving 1.1 million acre-feet of region-wide conservation by year 2025. The plan proposes to achieve this water conservation target utilizing several programs, including 500,000 acre-feet from compliance with new plumbing codes and other laws, 250,000 acre-feet from pre-1990 conservation, and 300,000 from active program-based conservation.

Ocean water desalination is sometimes described as the ultimate solution to Southern California's water supply shortfall. While it has become a more feasible source of supply due to technical advances, the development of desalination facilities still faces many challenges that include high energy requirements, environmental impacts of brine disposal, and plant-siting considerations. State agencies have provided funding for the Desalination Research and Innovation Partnership, which furthered the development of advance reverse osmosis membranes.

MWD and five of its member agencies have planned for the potential development of 126,000 acre-feet of desalinated ocean water. Those member agencies include LADWP, Long Beach Water Department, Municipal Water District of Orange County, WBMWD, and SDCWA. The SDCWA expects desalted ocean water to meet between 6 and 15 percent of the region's needs by 2020 and is conducting an environmental review for building an ocean water desalination facility on the Encina Power Plant property in Carlsbad. SDCWA also is carrying out feasibility studies of desalination facilities at Camp Pendleton and in the southern county. All three sites are on the coast.

Another future water supply option is management of the San Bernardino Basin as a groundwater storage facility. The basin has a capacity of about 5.5 million acre-feet. Pursuant to the January 1969 settlement for Western Municipal Water District et al. vs. East San Bernardino Valley Municipal Water District et al. Superior Court Riverside County Case number 78426, the Western-San Bernardino Watermaster determined that the safe yield of the San Bernardino Basin is about 232,000 acre-feet per year. SBVMWD has been working with the U.S. Geological Survey for many years to develop a groundwater computer model that will enable the agency to determine ways to enhance the safe yield of this basin.

The Groundwater Replenishment System, a high-technology water purification system, is a project under development by the OCWD and the Orange County Sanitation District. It will replace Water Factory 21, which was shut down in January 2004 in anticipation of construction of this new, larger system. The project will take highly treated wastewater and treat it beyond drinking water standards for groundwater recharge and injection into the seawater barriers along the coast. It will provide a second and reliable source of water to recharge the Orange County Basin; protect the basin from further water quality degradation brought on by seawater intrusion; and augment the existing recycled water supply for irrigation and industrial uses. In its first phase, the Groundwater Replenishment System will provide up to 72,000 acre-feet per year and allow for future expansion. It is expected to go online in 2007.

Flood control reservoirs are now being evaluated for their potential to provide some water supply benefits through the modification of their operations to enhance groundwater recharge and provide limited year-round storage. The SBVMWD, for example, has applied to the SWRCB for authorization to store storm water from the Santa Ana River in a reservoir that could be created behind Seven Oaks Dam. Los Angeles County Department of Public Works (LACDPW) is completing a study, in cooperation with the Army Corps of Engineers, to reauthorize four Corps flood control facilities in Los Angeles County for the purpose of capturing and safely storing storm water and then slowly releasing the water to downstream groundwater recharge facilities after storm events.

The Water Augmentation Study is a long-term research project, led by the Los Angeles and San Gabriel Rivers Watershed Council and supported financially by its partners, the USBR, MWD, LACDPW, Los Angeles RWQCB, Water Replenishment District of Southern California, LADWP, City of Los Angeles Watershed Protection Division, DWR, and the city of Santa Monica. The purpose of the study is to explore the potential for increasing local water supplies and reducing urban runoff pollution by increasing the upstream infiltration of storm water runoff. The project began in January 2000 to assess the impact of runoff-transported pollutants on rivers, coastal water, and beaches; the viability of adding these storm water resources to local water supplies, and the challenge of capturing storm water for infiltration, in terms of groundwater quality and quantity.

In 2000, DWR, in cooperation with the USBR and 10 Southern California water and wastewater agencies, undertook the Southern California Water Recycling Projects Initiative to continue the work previously started by the Southern California Comprehensive Water Reclamation and Reuse Study (SCCWRRS). The initiative is a multiyear planning study that evaluates the feasibility of a regional water-recycling plan and assists local water and wastewater agencies in final planning and environmental documentation leading to implementation of projects identified in the SCCWRRS. The initiative is funded on a 50-50 percent cost-sharing among the 12 agencies. The initiative identified short-term projects that could add about 378,000 acre-feet of recycled water for regional use. The 15 short-term projects were identified for the areas of Calleguas, East San Gabriel, West Basin, Central Basin, North Orange County, Central Orange County, Upper Oso, San Juan, Encina, San Pasqual Valley, North City, South Bay, Chino Basin, San Bernardino, and Eastern Basin.

As part of a regional strategy to improve water supply reliability, several agreements with water districts in the Central Valley are providing groundwater storage for the South Coast region:

- Semitropic Water Banking and Exchange Program. This program allows storage of up to 350,000 acre-feet in the groundwater basin underlying the Semitropic Water Storage District in Kern County.
- Arvin-Edison Water Storage Program. MWD and the Arvin-Edison Water Storage District have developed a program that allows Metropolitan to store water in the groundwater basin in the Water Storage District's service area in Kern County. Over the next 25 to 30 years, this groundwater storage program will provide average dry-year withdrawals of about 70,000 acre-feet annually.
- Kern-Delta Storage Program. This 25-year program will allow storage of up to 250,000 acre-feet of available State Water Project supplies.

Other potential management strategies includes interstate groundwater banking in Arizona, drought year land fallowing programs, lining parts of the All-American and Coachella canals, and agricultural water conservation beyond EWMP implementation. In addition, South Coast region water agencies are storing discount-priced imported water during winter months into groundwater basins and increasing their groundwater use during the summer and during droughts.

The Calleguas Municipal Water District operates a conjunctive use program in the Las Posas Groundwater Basin of Ventura County. Identified as the Las Posas Basin Aquifer Storage and Recovery Project, it is designed to store a maximum of 300,000 acre-feet of water supplies that can be used during short-term and long-term water supply shortages. The project calls for the construction of 30 dual-purpose groundwater wells that will be used for both injection and water production. Pipelines will be constructed to connect the wells with CMWD facilities as far away as the Cities of Simi Valley and Thousand Oaks. The source of water supplies would be the State Water Project. The project will be phased into operation with full operation anticipated by 2010. To date, 18 wells have been built and about 50,000 acre-feet of water is in storage.

To improve the reliability of its potable water supplies during droughts, the Western Municipal Water District is moving forward with plans to operate a conjunctive use program in groundwater basins in western San Bernardino and Riverside counties. The project, the Riverside-Corona Feeder, calls for the recharge of water supplies during above-average precipitation years into the groundwater basins in San Bernardino Valley and pumping those supplies during drought years. Sources of water for the recharging operations would be local surface runoff, including releases from the Seven Oaks Reservoir near the community of Mentone in San Bernardino County and the SWP. Recipients of the stored groundwater supplies are the cities of Corona and Riverside and the Elsinore Valley Water District. When completed, 20 wells and 28 miles of pipeline will have been constructed. About 40,000 acre-feet of groundwater supplies could be achieved through this project.

Most of the projects described above are designed to improve water quality as the way to obtain increased water supplies. These include watershed activities, such as the Water Augmentation Study, groundwater desalination, use of highly treated recycled water by the OCWD, reduction of sewage spills and storm water runoff through water conservation, and surface and groundwater storage projects that implement blending and treatment strategies to reduce contaminants in treated drinking water supplies.

In addition, MWD is committed to retrofitting all five of its water treatment plants to use ozone; adding fluoride to treated drinking water supplies; implementing a recreation policy for Diamond Valley Lake that protects drinking water quality; and supporting salinity reduction projects throughout the region. Outside the region MWD also supports efforts to preserve and enhance the Sacramento River watershed and the Delta, which are important to the operation of the SWP system.

## Water Portfolios for Water Years 1998, 2000, and 2001

Hydrologic conditions for water years 1998, 2000, 2001 impacted the water supply and water use characteristics for the South Coast Hydrologic Region. These three years were selected because 1998 represents actual supplies and uses in a very wet year, 2000 presents water uses in a near-average water year (on a statewide basis), and 2001 presents the actual data for supplies and uses in a drier water year. In water year 1998, rainfall totals ranged from 170 percent of average in San Diego County to more than 250 percent of average in Ventura County with more than 50 percent of the annual precipitation in January and February. In comparison, during water year 2000 rainfall totals ranged from 60 percent of average in San Diego County to more than 100 percent of average in Ventura County. Precipitation amounts for the region for water year 2000 were average to moderately below average. Rainfall deficits increased from north to south. Water year 2001 was a dry year statewide, although closer to normal levels of precipitation (92 percent of average) occurred for the South Coast region.

Table 5-1 provides more detailed information about the total water supplies available to this region for these three specific years from precipitation, imports, and groundwater, and also summarizes all of the water uses in the region, including the large amount of evapotranspiration from vegetation and forests. The water portfolio table (Table 5-3) and companion water portfolio flow diagrams (Figures 5-6 and 5-7) provided more detailed information about how all available water supplies are distributed and used throughout this region.

Table 5-3 presents specific information about the developed or dedicated portion of the total available water for years 1998, 2000, and 2001, which summarizes all water that is used for urban, agricultural, and environmental purposes. The South Coast region's relatively high level of urban development is reflected in the data for urban water use patterns. In 1998, 78 percent of all applied water use in the region was urban. In 2000 and 2001, urban use accounted for about 81 percent of total water use in regional. By contrast, agriculture only accounted for 15 percent of all applied water in 1998; 17 percent in 2000; and 15 percent in 2001. Table 5-3 also provides detailed information about the sources of the developed water supplies, which are obtained from a mix of both surface water, groundwater supplies, and recycled water.

## Selected References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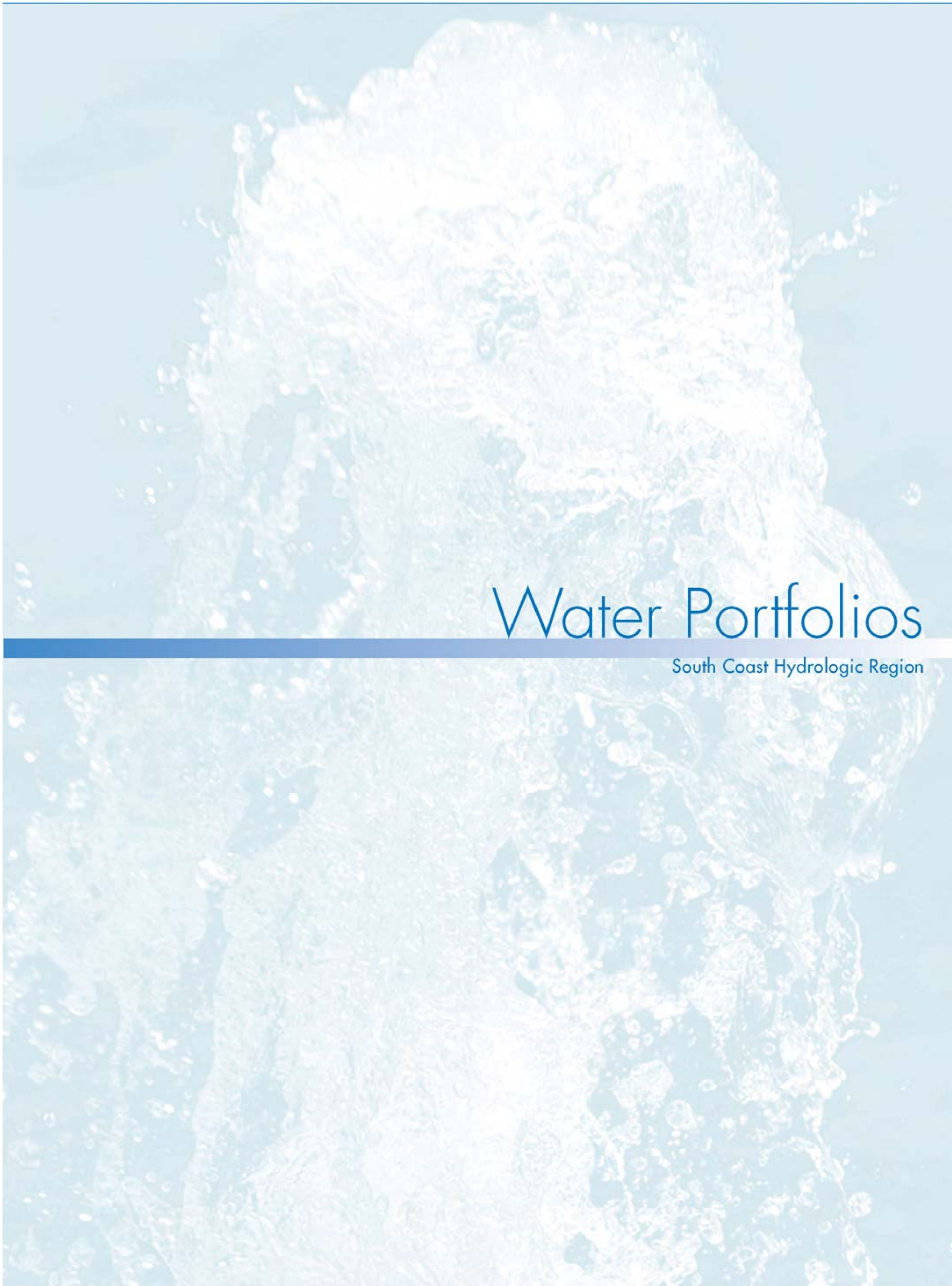


# Water Portfolios

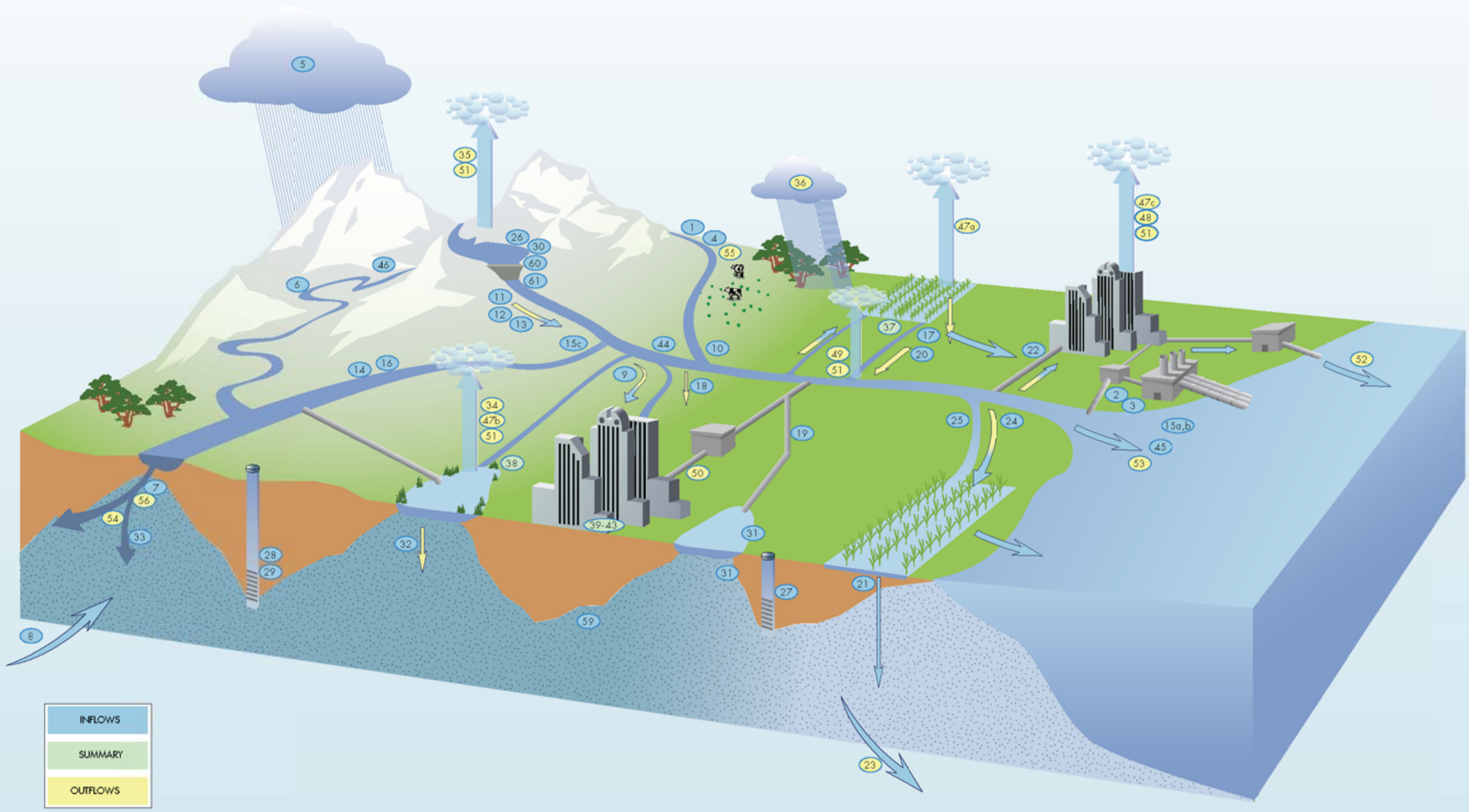
## South Coast Hydrologic Region

**Table 5-3** South Coast Region water portfolio (TAF)

| ID Number: | Flow Diagram Component (see legend) | South Coast 1998 | South Coast 2000 | South Coast 2001 |
|---|---|---|---|---|
| 1 | Colorado River Deliveries | 1,081.3 | 1,296.0 | 1,250.5 |
| 2 | Total Desalination | - | - | - |
| 3 | Water from Refineries | - | - | - |
| 4a | Inflow From Oregon | - | - | - |
| b | Inflow From Mexico | - | - | - |
| 5 | Precipitation | 20,873.0 | 7,522.1 | 9,327.0 |
| 6a | Runoff - Natural | N/A | N/A | N/A |
| b | Runoff - Incidental | N/A | N/A | N/A |
| 7 | Total Groundwater Natural Recharge | N/A | N/A | N/A |
| 8 | Groundwater Subsurface Inflow | | | N/A |
| 9 | Local Deliveries | 292.1 | 211.4 | 217.1 |
| 10 | Local Imports | 442.0 | 294.0 | 272.0 |
| 11a | Central Valley Project :: Base Deliveries | - | - | - |
| b | Central Valley Project :: Project Deliveries | - | - | - |
| 12 | Other Federal Deliveries | 4.2 | 0.6 | - |
| 13 | State Water Project Deliveries | 687.7 | 1,300.1 | 958.7 |
| 14a | Water Transfers - Regional | - | - | - |
| b | Water Transfers - Imported | - | - | - |
| 15a | Releases for Delta Outflow - CVP | | | |
| b | Releases for Delta Outflow - SWP | | | |
| c | Instream Flow Applied Water | 3.5 | 3.5 | 3.5 |
| 16 | Environmental Water Account Releases | - | - | - |
| 17a | Conveyance Return Flows to Developed Supply - Urban | - | - | - |
| b | Conveyance Return Flows to Developed Supply - Ag | - | - | - |
| c | Conveyance Return Flows to Developed Supply - Managed Wetlands | - | - | - |
| 18a | Conveyance Seepage - Urban | - | - | - |
| b | Conveyance Seepage - Ag | - | - | - |
| c | Conveyance Seepage - Managed Wetlands | - | - | - |
| 19a | Recycled Water - Agriculture | - | - | - |
| b | Recycled Water - Urban | 202.4 | 182.7 | 188.8 |
| c | Recycled Water - Groundwater | 2.1 | 37.1 | 36.2 |
| 20a | Return Flow to Developed Supply - Ag | - | - | - |
| b | Return Flow to Developed Supply - Wetlands | - | - | - |
| c | Return Flow to Developed Supply - Urban | - | - | - |
| 21a | Deep Percolation of Applied Water - Ag | 87.2 | 114.4 | 95.2 |
| b | Deep Percolation of Applied Water - Wetlands | - | - | - |
| c | Deep Percolation of Applied Water - Urban | 321.6 | 386.5 | 367.0 |
| 22a | Reuse of Return Flows within Region - Ag | - | - | - |
| b | Reuse of Return Flows within Region - Wetlands, Instream, W&S | 287.7 | 37.8 | 111.7 |
| 24a | Return Flow for Delta Outflow - Ag | - | - | - |
| b | Return Flow for Delta Outflow - Wetlands, Instream, W&S | - | - | - |
| c | Return Flow for Delta Outflow - Urban Wastewater | - | - | - |
| 25 | Direct Diversions | | | |
| 26 | Surface Water in Storage - Beg of Yr | 1,380.6 | 1,515.5 | 1,643.3 |
| 27 | Groundwater Extractions - Banked | - | - | - |
| 28 | Groundwater Extractions - Adjudicated | 786.0 | 865.0 | 841.3 |
| 29 | Groundwater Extractions - Unadjudicated | 846.3 | 1,008.4 | 1,020.9 |
| 23 | Groundwater Subsurface Outflow | N/A | N/A | N/A |
| 30 | Surface Water Storage - End of Yr | 1,752.5 | 1,643.3 | 1,975.6 |
| 31 | Groundwater Recharge-Contract Banking | - | - | - |
| 32 | Groundwater Recharge-Adjudicated Basins | - | - | - |
| 33 | Groundwater Recharge-Unadjudicated Basins | - | - | - |
| 34a | Evaporation and Evapotranspiration from Native Vegetation | | | |
| b | Evaporation and Evapotranspiration from Unirrigated Ag | | | |
| 35a | Evaporation from Lakes | 18.5 | 18.5 | 17.9 |
| b | Evaporation from Reservoirs | 149.1 | 164.2 | 160.8 |
| 36 | Ag Effective Precipitation on Irrigated Lands | 256.8 | 150.2 | 166.1 |
| 37 | Agricultural Water Use | 691.9 | 908.4 | 758.4 |
| 38 | Managed Wetlands Water Use | 31.2 | 38.1 | 37.2 |
| 39a | Urban Residential Use - Single Family - Interior | 990.7 | 1,252.8 | 1,144.3 |
| b | Urban Residential Use - Single Family - Exterior | 670.2 | 752.1 | 709.0 |
| c | Urban Residential Use - Multi-family - Interior | 603.2 | 543.1 | 510.0 |
| d | Urban Residential Use - Multi-family - Exterior | 105.9 | 139.7 | 151.0 |
| 40 | Urban Commercial Use | 699.5 | 914.1 | 885.5 |
| 41 | Urban Industrial Use | 186.0 | 209.8 | 209.8 |
| 42 | Urban Large Landscape | 165.7 | 242.8 | 187.5 |
| 43 | Urban Energy Production | 39.8 | 39.8 | 39.8 |
| 44 | Instream Flow | - | - | - |
| 45 | Required Delta Outflow | - | - | - |
| 46 | Wild and Scenic Rivers | - | - | - |
| 47a | Evapotranspiration of Applied Water - Ag | 494.8 | 645.8 | 542.9 |
| b | Evapotranspiration of Applied Water - Managed Wetlands | 31.2 | 38.1 | 37.2 |
| c | Evapotranspiration of Applied Water - Urban | 941.8 | 1134.6 | 1047.5 |
| 48 | Evaporation and Evapotranspiration from Urban Wastewater | - | - | - |
| 49 | Return Flows Evaporation and Evapotranspiration - Ag | 11.2 | 15 | 12.3 |
| 50 | Urban Waste Water Produced | 1824.8 | 2156.8 | 2015.9 |
| 51a | Conveyance Evaporation and Evapotranspiration - Urban | 346.5 | 362.5 | 358.5 |
| b | Conveyance Evaporation and Evapotranspiration - Ag | - | - | - |
| c | Conveyance Evaporation and Evapotranspiration - Managed Wetlands | - | - | - |
| d | Conveyance Outflow to Mexico | | | |
| 52a | Return Flows to Salt Sink - Ag | 100.1 | 135.1 | 110.1 |
| b | Return Flows to Salt Sink - Urban | 2009.7 | 2363.3 | 2214.8 |
| c | Return Flows to Salt Sink - Wetlands | - | - | - |
| 53 | Remaining Natural Runoff - Flows to Salt Sink | - | - | - |
| 54a | Outflow to Nevada | - | - | - |
| b | Outflow to Oregon | - | - | - |
| c | Outflow to Mexico | - | - | - |
| 55 | Regional Imports | 2,367.0 | 2,991.0 | 2,505.0 |
| 56 | Regional Exports | 0.0 | 0.0 | 0.0 |
| 59 | Groundwater Net Change in Storage | -1,223.5 | -1,372.5 | -1,400.0 |
| 60 | Surface Water Net Change in Storage | 371.9 | 127.8 | 332.3 |
| 61 | Surface Water Total Available Storage | 2,112.7 | 3,058.8 | 3,058.8 |

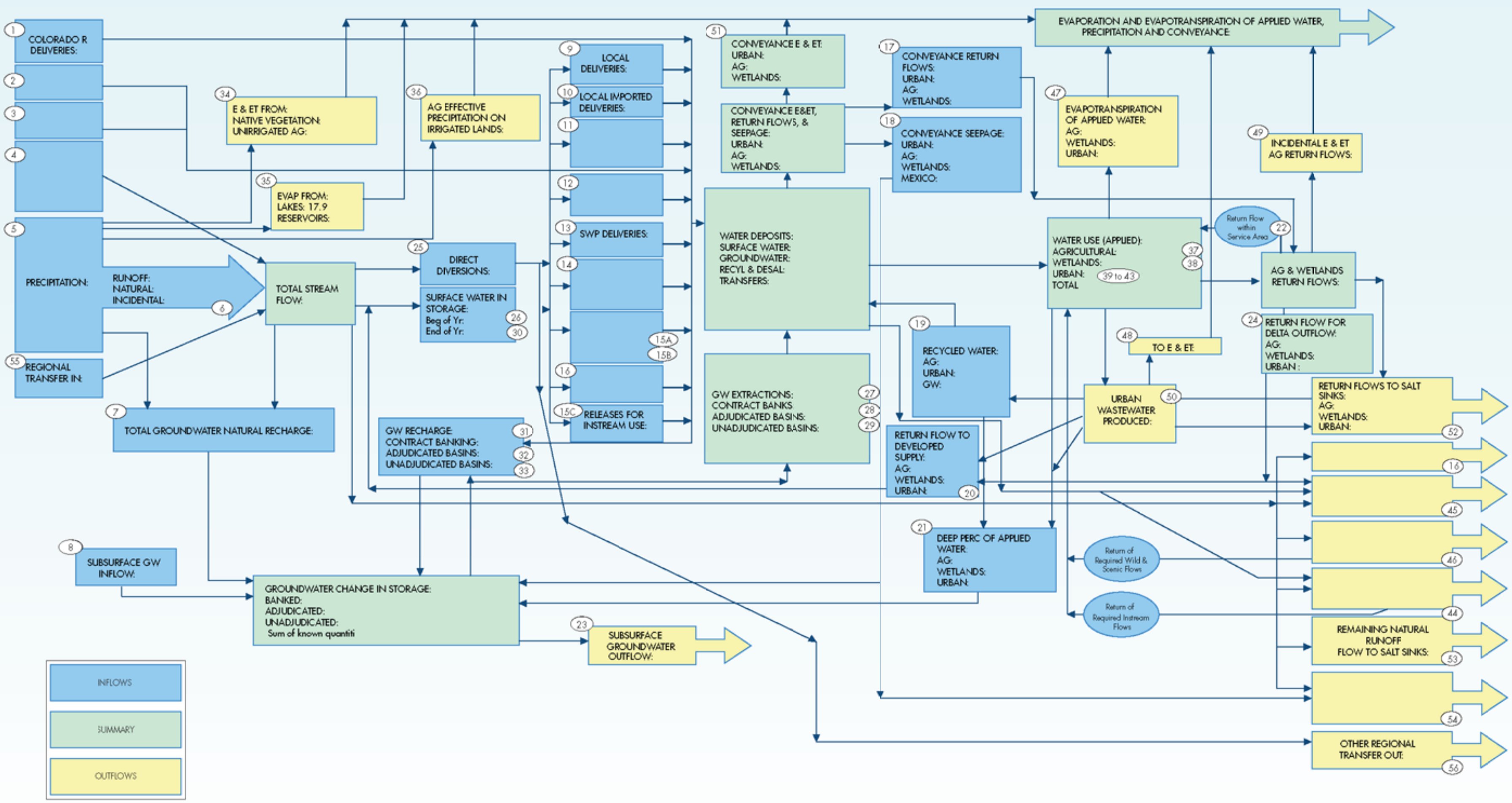
Inflows | Outflows | Green number signifies included in summary boxes

Figure 5-6 South Coast region - illustrated water flow diagram




In this illustration of Table 5-3, key components of the flow diagram are shown as characteristic elements of the hydrologic cycle. Circled numbers correspond to the identification number of flow diagram components in the table; its color indicates whether the component is water input, output, or summary.

Figure 5-7 South Coast region - schematic flow diagram




In schematic of Table 5-3, key components of the flow diagram are shown as boxes and connectors in a flow chart. Circled numbers correspond to the identification number of flow diagram components in the table; box color indicates whether component is water input, output, or summary. Blank boxes are flow diagram components not relevant to the region.