Chapter 5 South Coast Regional Report

5-1 Setting .......................................................................................................................................................5-3
   Watersheds ....................................................................................................................................................5-4
   Flooding .....................................................................................................................................................5-8
   Ecosystems ...............................................................................................................................................5-9
   Climate .....................................................................................................................................................5-10
   Demographics .......................................................................................................................................5-11
   Land Use Patterns .................................................................................................................................5-12

5-2 Regional Water Conditions ......................................................................................................................5-13
   Water in the Environment ..........................................................................................................................5-13
   Water Supplies .......................................................................................................................................5-14
   Water Uses .............................................................................................................................................5-22
   Water Quality .........................................................................................................................................5-23
   Project Operations ................................................................................................................................5-25
   Water Governance .................................................................................................................................5-27
   Flood Management ...............................................................................................................................5-28

5-3 Relationship with Other Regions ...........................................................................................................5-32
   Sacramento-San Joaquin Delta ....................................................................................................................5-32
   Colorado River System .............................................................................................................................5-33
   Owens Valley/Mono Basin ..........................................................................................................................5-34
   Other Water Storage and Transfers .........................................................................................................5-33

5-4 Regional Water and Flood Planning and Management .........................................................................5-34
   Integrated Regional Water Management .................................................................................................5-34
   Accomplishments ................................................................................................................................5-36
   Challenges .............................................................................................................................................5-37
   Drought and Flood Planning ..................................................................................................................5-39

5-5 Looking to the Future ..............................................................................................................................5-40
   Future Scenarios .....................................................................................................................................5-41
   Climate Change ....................................................................................................................................5-41
   Response Strategies ...............................................................................................................................5-41
   Implementation Next Steps ....................................................................................................................5-42

5-6 Water Portfolios from 1998–2005...........................................................................................................5-42

5-7 References ..............................................................................................................................................5-42

Appendix

Appendix 5A Flood Management
## Box 5-2 Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AF</td>
<td>acre-feet</td>
</tr>
<tr>
<td>AFY</td>
<td>acre-feet per year</td>
</tr>
<tr>
<td>BDCP</td>
<td>Bay-Delta Conservation Plan</td>
</tr>
<tr>
<td>BMPs</td>
<td>best management practices</td>
</tr>
<tr>
<td>CCP</td>
<td>Conservation Credits Program</td>
</tr>
<tr>
<td>CDFG</td>
<td>California Department of Fish and Game</td>
</tr>
<tr>
<td>Cal Fire</td>
<td>California Department of Forestry and Fire Protection</td>
</tr>
<tr>
<td>CLWA</td>
<td>Castaic Lake Water Agency</td>
</tr>
<tr>
<td>CRA</td>
<td>Colorado River Aqueduct</td>
</tr>
<tr>
<td>CUWCC</td>
<td>California Urban Water Conservation Council</td>
</tr>
<tr>
<td>CVWD</td>
<td>Coachella Valley Water District</td>
</tr>
<tr>
<td>Delta</td>
<td>Sacramento-San Joaquin Delta</td>
</tr>
<tr>
<td>DWR</td>
<td>California Department of Water Resources</td>
</tr>
<tr>
<td>EOCWD</td>
<td>East Orange County Water District</td>
</tr>
<tr>
<td>GMA</td>
<td>Groundwater Management Agency</td>
</tr>
<tr>
<td>IEUA</td>
<td>Inland Empire Utilities Agency</td>
</tr>
<tr>
<td>IID</td>
<td>Imperial Irrigation District</td>
</tr>
<tr>
<td>IPR</td>
<td>indirect potable reuse</td>
</tr>
<tr>
<td>IRWM</td>
<td>Integrated Regional Water Management</td>
</tr>
<tr>
<td>LAA</td>
<td>Los Angeles Aqueduct</td>
</tr>
<tr>
<td>LACFCD</td>
<td>Los Angeles County Flood Control District</td>
</tr>
<tr>
<td>LADWP</td>
<td>Los Angeles Department of Water and Power</td>
</tr>
<tr>
<td>LID</td>
<td>Low Impact Development</td>
</tr>
<tr>
<td>Metropolitan</td>
<td>Metropolitan Water District of Southern California</td>
</tr>
<tr>
<td>MAF</td>
<td>million acre-feet</td>
</tr>
<tr>
<td>MGD</td>
<td>million gallons per day</td>
</tr>
<tr>
<td>MSCP</td>
<td>Multiple Species Conservation Plan</td>
</tr>
<tr>
<td>MWC</td>
<td>Mutual Water Company</td>
</tr>
<tr>
<td>MWDOC</td>
<td>Municipal Water District of Orange County</td>
</tr>
<tr>
<td>NFIP</td>
<td>National Flood Insurance Program</td>
</tr>
<tr>
<td>NPDES</td>
<td>National Pollutant Discharge Elimination System</td>
</tr>
<tr>
<td>NPS</td>
<td>non-point source</td>
</tr>
<tr>
<td>OWCD</td>
<td>Orange County Water District</td>
</tr>
<tr>
<td>OES</td>
<td>Office of Emergency Services</td>
</tr>
<tr>
<td>PUD</td>
<td>Public Utilities District</td>
</tr>
<tr>
<td>QSA</td>
<td>Colorado River Water Delivery Agreement: Federal Quantification Settlement Agreement of 2003</td>
</tr>
<tr>
<td>RWQCB</td>
<td>Regional Water Quality Control Board</td>
</tr>
<tr>
<td>SAWPA</td>
<td>Santa Ana Watershed Project Authority</td>
</tr>
<tr>
<td>SDCWA</td>
<td>San Diego County Water Authority</td>
</tr>
<tr>
<td>SGPWA</td>
<td>San Gorgorino Pass Water Agency</td>
</tr>
<tr>
<td>sq mi</td>
<td>square miles</td>
</tr>
<tr>
<td>SWP</td>
<td>State Water Project</td>
</tr>
<tr>
<td>SWRCB</td>
<td>State Water Resources Control Board</td>
</tr>
<tr>
<td>TMDLs</td>
<td>Total Maximum Daily Loads</td>
</tr>
<tr>
<td>TDS</td>
<td>total dissolved solids</td>
</tr>
<tr>
<td>USACE</td>
<td>U.S. Army Corps of Engineers</td>
</tr>
<tr>
<td>USBR</td>
<td>U.S. Bureau of Reclamation</td>
</tr>
<tr>
<td>USFWS</td>
<td>U.S. Fish and Wildlife Service</td>
</tr>
<tr>
<td>VCWP</td>
<td>Ventura County Watershed Protection District</td>
</tr>
<tr>
<td>WWTP</td>
<td>wastewater treatment plant</td>
</tr>
<tr>
<td>WRD</td>
<td>Water Replenishment District of Southern California</td>
</tr>
<tr>
<td>WSD</td>
<td>Water Storage District</td>
</tr>
</tbody>
</table>
Chapter 5  South Coast Regional Report

Water is truly precious to the naturally arid South Coast Hydrologic Region. Home to more than half of the State’s population and an economy that drives both California and the nation, the region’s water supplies rely on hundreds of miles of aqueducts while maximizing the use of every available local source. The availability of local water supplies, however, is highly variable throughout the coastal and inland areas. Additionally, while the region continues to grow, it also recognizes the need to preserve and restore its local environment and ecosystems. Agencies in the South Coast region work collaboratively using a diverse set of strategies to manage and preserve our water resources.

Water wholesalers and retailers, groundwater agencies, and watershed managers work together to implement a large and diverse array of local water supply and water quality projects to adequately meet the demands of the municipal, industrial, and agricultural users and to sustain the region’s robust economy. This increased level of cooperation and integrated planning has improved the region’s flexibility and has diversified its supply sources.

This Regional Report describes the region’s hydrologic setting, identifies its water sources and uses, and provides examples of the South Coast’s challenges, accomplishments, and plans to meet water demands. It is important to note that in this highly developed region, many water interest groups and agencies play important roles in providing reliable, affordable, high quality water at the local, State, and national levels. The jurisdictions and areas of interest for these stakeholder groups often overlap, such that shared communication and integrated regional planning are becoming increasingly important to successful water planning and management.

5-1 Setting

The South Coast is a largely urbanized region that has produced significant impacts on local water resources. In general, local water supplies long ago proved insufficient for meeting the region’s water supply needs. Additionally, heavy urbanization has brought with it runoff that contaminates many local waterways and beaches, as well as resulted in destruction of significant coastal and riparian habitat systems.

The South Coast region covers 11,000 square miles (sq mi) of densely populated Southern California, extending from the Pacific Ocean east to the Transverse and Peninsular Ranges, and from the Ventura-Santa Barbara County line south to the Mexican border. Four planning areas are defined within the region (Box 5-1 and Figure 5-1). The region includes portions of Ventura, Los Angeles, San Bernardino, Riverside, and Santa Diego counties, and all of Orange County. Though the region comprises only 7 percent of California’s land area, it contains over half of the State’s population (55 percent).

The South Coast is recognized both as an area of intense urbanization and as an area of rich biological diversity. Its 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. Large, gently-sloping coastal plains exist in Los Angeles, Orange, San Diego, and
Ventura counties. Most of the region’s rivers drain into the Pacific Ocean, and many terminate in lagoons or wetland areas that serve as important coastal habitat. Many river segments on the coastal plain, however, have been concrete-lined and in other ways modified for flood control operations. The natural runoff of the region’s streams and rivers averages about 1.2 million acre-feet (MAF) annually (Box 5-2).

Figure 5-1 South Coast Hydrologic Region

Watersheds

There are 19 major watersheds in the South Coast region (Figure 5-2). Many of these watersheds have densely urbanized lowlands with concrete-lined channels and dams controlling flood flows. The headlands areas of many rivers, however, are located within coastal mountain ranges and have remained largely undeveloped.

Santa Clara/Ventura Planning Area

The watersheds of the Santa Clara/Ventura Planning Area (401) provide important habitat and water resources within Ventura County and northern Los Angeles County. In general, they lack the heavy urbanization of other watersheds in the region and thus, efforts are underway to protect remaining ecosystems and water supplies while providing flood protection to existing developments. The planning area has three major watersheds: Ventura River, Santa Clara River, and Calleguas Creek (including Oxnard Plain). These watersheds begin in the Los Padres National Forest located in the Traverse Ranges, and flow to the southwest, draining into the Pacific Ocean. Watershed scale planning efforts include: Ventura River Watershed Protection Plan, Santa Clara River Enhancement and Management Plan, and Calleguas Creek Watershed Management Plan.

The South Coast region’s watersheds vary widely in shape, size and development—from far reaching like the Santa Clara and Santa Ana watersheds to the small coastal watersheds in San Diego and Ventura counties.
The 228-sq mi **Ventura River Watershed** flows from the upper slopes of the Transverse Ranges in a southerly direction to an estuary located at the mouth of the Ventura River. Major tributaries include Matilija, North Fork Matilija, and San Antonio Creeks. Lake Casitas is an important water supply for urban and agricultural users. The watershed’s hilly topography results in drainage with steep gradients at the headwaters. The upper portion of the watershed is minimally developed and provides excellent aquatic habitat. In the lower portion of the watershed, water quality issues have arisen due in part to both point and non-point pollution sources.

The 1,600-sq mi **Santa Clara River Watershed** is the largest river system in southern California that remains in a relatively natural state. The river originates in the northern slopes of the San Gabriel Mountains and traverses in a westerly direction into Ventura County, where it discharges into the Pacific Ocean. Major tributaries include Castaic, San Francisquito, Sespe, Piru, and Santa Paula Creeks. The upper watershed (portion in Los Angeles County) consists of approximately 680 sq mi of mostly natural land with development concentrated in or near the City of Santa Clarita. Although the Santa Clara River typically has an intermittent flow regime in the mainstem, flows can increase rapidly in response to high intensity rainfall with the potential for severe flooding. Controlled releases of water from Lake Piru supplement surface flows in Ventura County.

The 343-sq mi **Calleguas Creek Watershed** drains the Oxnard Plain, which empties into Mugu Lagoon in southeastern Ventura County. Major tributaries include Conejo Creek, Arroyo Santa Rosa, Arroyo Simi, Arroyo Las Posas, and Calleguas Creek. Groundwater supplies are quite extensive in the alluvial aquifers beneath the plain. Urban development and agricultural activities within the watershed have resulted in the degradation of water resources, loss of sensitive ecosystems, flooding, and erosion and sedimentation. Nutrients and other dissolved constituents in irrigation return-flows are seeping into shallow aquifers and degrading groundwater in this basin.

**Los Angeles Planning Area**

The watersheds of the Los Angeles Planning Area (402) cover some of the densest urbanization in California and the associated challenges to the local hydrologic cycle, urban runoff and groundwater contamination, and the loss of major historical ecosystems. However, beneath this heavy urbanization lies valuable waterways and groundwater basins which are in the process of being restored and better managed. The planning area has four major watersheds: Santa Monica Bay, Los Angeles River, Dominguez Channel, and San Gabriel River. These watersheds begin in the surrounding Santa Monica and San Gabriel Mountains and flow south across the coastal plains into the Pacific Ocean. Extensive watershed scale planning has taken place, including: **Santa Monica Bay Restoration Plan, Malibu Creek Watershed Management Plan, Los Angeles River Master Plan, Arroyo Seco Watershed Restoration Feasibility Study, Dominguez Watershed Management Master Plan, and San Gabriel River Master Plan.**

The 200-sq mi **North Santa Monica Bay Watershed** is actually comprised of several smaller sub-watersheds, including Malibu and Topanga Creeks, located in the northwest corner of Los Angeles County. The topography of this area includes steep-slope mountains, coastal sand dunes, and several broad, gently sloping alluvial valleys. Many of the sub-watersheds include relatively healthy riparian habitats because many of the mountainous canyons remain as open space.

The 834-sq mi **Los Angeles River Watershed** is shaped by the Los Angeles River, which flows from its headwaters in the Santa Monica Mountains south through the Glendale Narrows and across the coastal plain into San Pedro Bay. Eight major tributaries intersect with the Los Angeles River, including Burbank Western Channel, Pacoima Wash, Tujunga Wash, Verdugo Wash, Arroyo Seco, Compton Creek, and Rio Hondo. The watershed contains 22 lakes and flood control reservoirs, as well as a number of spreading grounds. The Los Angeles River is hydraulically connected to the San Gabriel River through the Whittier Narrows Reservoir, although this occurs primarily during large storm events. The Los Angeles River, which once flowed freely over the coastal plain, was channelized between 1914 and 1970 to control the runoff and reduce the impacts of major flood events in the region. Today, over 90 percent of the Los Angeles River is concrete-lined. The watershed has impaired water quality in the middle and lower portions of the basin due to urban runoff from dense urbanization.
The 110-sq mi **Dominguez Channel Watershed**, located in the southern portion of Los Angeles County, is defined by a complex network of storm drains and smaller flood control channels. The Dominguez Channel extends from the Los Angeles International Airport to the Los Angeles Harbor and drains a large portion, if not all, of the cities of Inglewood, Hawthorne, El Segundo, Gardena, Lawndale, Redondo Beach, Torrance, Carson and Los Angeles.

The 640-sq mi **San Gabriel River Watershed**, located in the eastern portion of Los Angeles County, flows from the San Gabriel Mountains to the Pacific Ocean. Major tributaries include Walnut Creek, San Jose Creek, and Coyote Creek. Although the watershed contains portions of 37 incorporated cities, only 26 percent of its total land area is developed. Flows in the San Gabriel River are diverted into four different spreading grounds and impounded behind several rubber dams in order to control flow for groundwater recharge.

**Figure 5-2 Watersheds of the South Coast Region**

### Santa Ana Planning Area

The watersheds of the Santa Ana Planning Area (403) have experienced some of the most rapid urbanization in the State over the past 10-15 years, which has created numerous challenges in balancing growth with water supplies, flood protection, and ecosystem preservation. The planning area contains three major watersheds: Santa Ana River, San Diego Creek, and San Jacinto River. These watersheds begin in the San Bernardino and San Jacinto Mountains and flow west to the Pacific Ocean. Watershed scale planning efforts include: **Santa Ana (One Water One Watershed) Integrated Water Resources Management Plan**, **San Diego Creek Watershed Reconnaissance Study**, and **Lake Elsinore and San Jacinto Watersheds Authority Nutrient Removal Plan**.
The 2,800-sq mi **Santa Ana River Watershed** begins in the San Bernardino and San Gabriel Mountains, meanders through the Inland Empire and the coastal plain of Orange County, and terminates at the Pacific Ocean. The 96-mile long Santa Ana River, which flows perennially, generally contains natural channel and banks. The watershed contains several man-made water storage facilities, including Lake Perris, Lake Mathews, Big Bear Lake, Prado Dam, and Seven Oaks Dam. Urbanization in the upper watershed has contributed to degradation of sensitive aquatic and riparian habitats, water quality, and groundwater recharge. Despite urbanization, however, the Santa Ana River watershed still has important areas of riparian, wetland, and other wildlife habitat.

The 112-sq mi **San Diego Creek Watershed** covers 112 square miles in central Orange County, draining into Upper Newport Bay. Urbanization of the watershed continues today, causing creek channels to significantly erode and deposit several hundred thousand cubic yards of material into the bay and channel basins. For years, there have been concerns about declining water quality due to sediments, nutrients, pathogens and toxics. Habitats for many wildlife species are being isolated because new construction has cut off long-used wildlife corridors.

The 765-sq mi **San Jacinto River Watershed** is located in the western margin of Riverside County. From headwaters in the San Jacinto National Forest, the San Jacinto River flows through a series of reservoirs and drains into its natural freshwater terminus, Lake Elsinore. The lower watershed is undergoing rapid urbanization; some agricultural (primarily citrus orchards) activity remains.

**San Diego Planning Area**

The watersheds of the San Diego Planning Area (404) are generally smaller than in other planning areas due to location of the Peninsular Ranges (Santa Ana, Laguna, and Palomar mountains). Similar to other areas of the South Coast, they have been impacted by urban development which has resulted in water quality impairments and loss of ecosystems. However, in contrast other planning areas, local water resources (i.e. rivers and groundwater) are not as significant. The planning area contains nine major watersheds: San Juan, Santa Margarita, San Luis Rey, Carlsbad, San Dieguito, San Diego River, Sweetwater, Otay, and Tijuana. These watersheds generally flow east to west, a majority discharging into lagoons which have been designated as Ecological Reserves. Watershed scale planning efforts include: Santa Margarita Watershed Management Plan, San Dieguito Watershed Management Plan, San Diego River Watershed Management Plan, Otay River Watershed Management Plan, and Tijuana River Binational Vision.

The 134-sq mi **San Juan Creek Watershed** originates in the Cleveland National Forest in easternmost Orange County and drains to the Pacific Ocean. Watershed concerns include channelization, poor surface water quality from urban runoff, loss of floodplain and riparian habitat, decline of water supply and flows, invasive species, and erosion.

The 750-sq mi **Santa Margarita River Watershed** begins in southern Riverside County and flows southwest through unincorporated San Diego County areas and the U.S. Marine Corps Base Camp Pendleton. The lower watershed and estuary have largely escaped the development typical of the South Coast, and are therefore able to support a relative abundance of functional habitats and wildlife. The upper watershed, one of the fastest growing areas in California, faces excessive nutrient inputs, erosion and sedimentation, groundwater degradation and contamination with nitrates and other salts, habitat loss, channelization, and flooding.

The 558-sq mi **San Luis Rey River Watershed** begins in the Palomar Mountains and drains into the Pacific Ocean near the City of Oceanside. Lake Henshaw is the major surface water impoundment. Much of the riverbed remains natural, except for a channelized segment through the City of San Diego. The eastern watershed is owned and managed by governmental agencies, local districts, and Native American tribes. Urban and agricultural land uses, sand mining operations, and septic tanks are factors that have introduced contaminants into the river, causing high chloride, total dissolved solids (TDS), and bacteria levels.

The 210-sq mi **Carlsbad Watershed**, located in the coastal margin of San Diego County, contains six smaller watersheds which all drain separately to the Pacific Ocean. The watershed includes the cities of Oceanside, Carlsbad, Encinitas, Solana Beach, Vista, San Marcos, Rancho Santa Fe, and Escondido. Water quality issues
include toxic substances, nutrients, bacteria and pathogens, and sedimentation. The Agua Hedionda, Buena Vista, and San Elijo lagoons are experiencing excessive coliform bacteria and sediment loading from upstream sources.

The 346-sq mi **San Dieguito River Watershed** extends through a diverse array of habitats from its eastern headwaters in the Volcan Mountains to its outlet at the San Dieguito Lagoon. Over half of the watershed is vacant or undeveloped; however much of this is zoned for future residential development. There are several important natural areas within the watershed that sustain a number of threatened and endangered species. Among these are the 55-mile long, 80,000-acre San Dieguito River Park, the 150-acre San Dieguito Lagoon, and five water storage reservoirs including Lake Hodges, Lake Sutherland, and Lake Poway. The San Dieguito Lagoon is especially sensitive to the effects of pollutants and oxygen depletion from restricted or intermittent tidal flushing.

The 440-sq mi **San Diego River Watershed** drains from the Palomar Mountains to the Pacific Ocean. There are four imported water storage reservoirs within the watershed: El Capitan, San Vicente, Lake Jennings, and Cuyamaca. Famosa Slough is a tidal salt water marsh, which receives water via the San Diego River Flood Control Channel. Beach postings and closures from elevated levels of coliform bacteria were common in the last 10 years due to urban runoff and sewage spills. Excessive groundwater extraction, increasing TDS, and MTBE contamination threatens this limited resource.

The 230-sq mi **Sweetwater River Watershed** drains from the Cuyamaca Mountains to the San Diego Bay. The San Diego Bay, which constitutes the largest estuary along the San Diego coastline, has been extensively developed with port facilities. Similar to other major bays of the region, 90 percent of the original salt marshes have been filled or dredged. Construction of Loveland and Sweetwater reservoirs, as well as extensive local groundwater pumping, has substantially reduced freshwater input to San Diego Bay. Storm water outfalls provide some flows and nutrients to the Bay, but not with natural seasonality, timing, frequency, or content.

The 160-sq mi **Otay River Watershed** is located in southwest San Diego County, also draining to San Diego Bay. Two major hydrologic features, Upper and Lower Otay Lakes, provide water supply, wildlife habitat, and recreational opportunities. Approximately 36 sq mi of the watershed are part of the San Diego Multiple Species Conservation Plan (MSCP) effort that provides habitat for endangered plant and animal species. Other important conservation areas include the San Diego National Wildlife Refuge, Rancho Jamul Ecological Reserve, and vernal pools. Water quality concerns include elevated coliform bacteria in the Pacific Ocean receiving waters near Coronado.

The 1,700-sq mi **Tijuana River Watershed** is a binational watershed (455 sq mi in the U.S. and 1,245 sq mi in Mexico) on the westernmost portion of the U.S./Mexico border. The watershed contains three surface water reservoirs, various flood control works, and a National Estuarine Sanctuary. Major drainages include Cottonwood and Campo Creeks in the U.S., and the Rio Las Palmas system in Mexico. Poor water quality is a major issue in the Tijuana River watershed. Although discharges from the Tijuana River account for only a small percentage of total gauged runoff to the ocean, it contains the highest concentrations of suspended solids and heavy metals among the eight largest creeks and rivers in Southern California. Surface water quality has been affected by urban runoff from Mexico, while groundwater contamination has occurred as a result of seawater intrusion and waste discharges.

### Flooding

Flooding in the South Coast region is predominately from winter storms. Precipitation over short periods can produce large amounts of water in the steep upper watersheds, often leading to very sudden and severe flooding of developed lowland areas. Debris flows are also a common occurrence during the winter months. Seasonal fires denude the watersheds of their vegetation, and can leave steep terrains vulnerable to winter storms. Thunderstorms are infrequent in the region and typically only occur at lower elevations during the winter months. Very little snow makes its way into this region and therefore has a marginal impact on flood events.

The highest storm discharges on record have occurred on the Los Angeles River at Long Beach (128,700 cubic feet per second (cfs)), the Santa Clara River at Montalvo (165,000 cfs), the Santa Ana River at Prado Dam
(100,000 cfs), the San Diego River at Fashion Valley (75,000 cfs), and Sespe Creek near Fillmore (85,300 cfs). Flood parameters for the principal streams in the South Coast region are presented in Appendix 5.

**Ecosystems**

Ecosystems in the South Coast region are host to a wide diversity of special status plants and wildlife. Despite their exceptional value, many of the region’s ecosystems have suffered from over 100 years of human development activities. Rivers, streams, and wetlands have been diked, ditched, filled, and channelized. Dams and flood control channels have been built to contain and direct waterways; fundamentally altering their natural processes. Various flood, vector, and fire districts frequently enter streambeds, wetlands, or riparian buffers to remove vegetation from channels and adjacent habitats. Riparian vegetation is not only important for raptor nesting and other bird species, but vegetation within streambeds and along the edge of streams provides essential cover for aquatic species and fish fry. Removal of riparian vegetation eliminates essential habitat, degrades water quality, causes scour and erosion, and affects the natural flow regime. Loss of vernal pools, seasonally flooded depressions found on hardpan soils, has been extensive; the largest remnant patch in San Diego County occurs on the U.S. Marine Corps Air Station Miramar (Bauder and McMillan 1998). Much of the historic coastal dunes, wetlands, and estuary ecosystems in the region have also been degraded by declines in water quality and ecosystem functionality. The introduction of invasive Quagga mussels in Lake Havasu, the Colorado River Aqueduct (CRA), and multiple San Diego reservoirs threatens to both disrupt the food chain within those aquatic ecosystems and impede the flow of water supply to users. Finally, invasive plant species, such as *Arundo donax*, have further impaired local ecosystems by choking out native plants and competing with other plant and animal species for limited available water.

In recent decades, however, concerted planning efforts and technologies have emerged to restore function and productivity to degraded or destroyed ecosystems. Additionally, important ecological areas have been set aside and designated for protection including: Significant Ecological Areas by County governments; Environmentally Sensitive Habitat Areas by the Coastal Commission; State Water Quality Protected Areas (formerly Areas of Special Biological Significance) by the State Water Resources Control Board (SWRCB); Ecological Reserves by the California Department of Fish & Game (CDFG); and Critical Habitat by the U.S. Fish & Wildlife Service (USFWS) (Figure 5-3).

Key ecosystems in the **Santa Clara/Ventura Planning Area** include the aquatic and riparian habitats along Ventura and Santa Clara Rivers and their tributaries and estuaries. The primary goal of the Watersheds Coalition of Ventura County is to bring together stakeholders to develop integrated watershed management strategies and coordinate ecosystem restoration efforts to achieve long term sustainability of local water resources. Ongoing projects and programs include land acquisition for protection and restoration of habitat areas; ecosystem restoration projects to remove barriers to steelhead passage, restore sediment transport and natural hydrologic regimes on the river, and restore riparian and wetland habitats; and remove the invasive giant reed (*Arundo donax*) from local rivers and tributaries.

Key ecosystems in the **Los Angeles Planning Area** include intermittent canyons in the inland San Gabriel Mountains and coastal Santa Monica Mountains. Due to extensive development in the Los Angeles area, the physical and hydrologic landscape has been irreversibly altered. Nevertheless, opportunities for aquatic and riparian restoration, wetlands enhancement, and habitat creation are being actively pursued. Ecosystem protection efforts are underway in the San Gabriel River headwaters in Angeles National Forest and...
Key ecosystems in the **Santa Ana Planning Area** include the upper Newport Bay and the constructed wetlands behind Prado Dam, Seven Oaks Dam, and Hemet/San Jacinto. The Santa Ana Watershed Project Authority (SAWPA) is responsible for many impressive projects underway or under development within the Santa Ana watershed, including constructed wetlands, wetland expansion, habitat restoration, and wildlife conservation and enhancement. Environmental groups such as the Orange County Coastkeeper are working to restore ecosystem function and improve water quality within coastal marshes. In Orange County’s developed watersheds, restoration activities include the removal of debris and trash; reversion to natural channel configuration; revegetation with native species; and a regional invasive species removal program. Many projects contain a public education component intended to integrate public outreach and education of outlying neighborhoods, as well as of visitors to the restoration site.

Key ecosystems in the **San Diego Planning Area** include the coastal lagoons and wetlands, protected reservoir lands, and the San Dieguito River Park area. The San Diego area’s vegetation communities support a wide array of wildlife species and are home to hundreds of native plant species. However, invasive species are a major threat to native species in the area. The San Diego County MSCP effort is implementing comprehensive programs to protect these resources.

### Climate

The coastal and interior valleys of the South Coast region feature Mediterranean climates – characterized by mild, wet winters and warm, dry summers. The bordering mountains have climates which range from Mediterranean to subtropical steppe, with a greater range of maximum and minimum temperatures and higher precipitation amounts for all seasons. Most of the region’s precipitation (75 percent) falls between December and March. Average precipitation can vary greatly along the South Coast, ranging from over 40 inches annually...
in the mountains to less than 10 inches annually in the valleys. Although generally dry, the eastern and southern portions of the region may be impacted in the late summer by monsoonal thunderstorms which result from low pressure cells in the Southwest. The region generally experiences substantial climactic variability, with periods of higher than normal precipitation followed by lower than normal precipitation. Periodic drought conditions present a challenge to water providers throughout the region as they attempt to meet growing demands for water.

### Table 5-2: Representative Climate Data for South Coast Planning Areas

<table>
<thead>
<tr>
<th></th>
<th>Santa Clara/ Ventura Planning Area</th>
<th>Los Angeles Planning Area</th>
<th>Santa Ana Planning Area</th>
<th>San Diego Planning Area</th>
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<tbody>
<tr>
<td>Rainfall (inches per year)</td>
<td>10 to 46</td>
<td>12 to 47</td>
<td>10 to 53</td>
<td>8 to 38</td>
</tr>
<tr>
<td>Min Temperature (F)</td>
<td>29 to 54</td>
<td>35 to 55</td>
<td>23 to 54</td>
<td>37 to 54</td>
</tr>
<tr>
<td>Max Temperature (F)</td>
<td>55 to 78</td>
<td>52 to 79</td>
<td>48 to 81</td>
<td>63 to 81</td>
</tr>
<tr>
<td>Average Eto (feet per year)</td>
<td>4.6</td>
<td>4.3</td>
<td>4.4</td>
<td>4.5</td>
</tr>
</tbody>
</table>


### Demographics

The South Coast population has grown by over 10 million since 1960. The approximate population of the South Coast region was estimated at over 18.6 million in 2008. This was an increase of over XX million since 2000 (Figure 5-4). Los Angeles County, which consists of 83 cities, contains the largest existing population, reporting 9.5 million in 2008. The greatest increase in the number of people occurred in Riverside County, which added nearly XX people between 2000 and 2008. The highest rate of growth occurred in the region’s Inland Empire, which includes the western portions of Riverside and San Bernardino counties. Ventura, San Diego, Orange, and Los Angeles counties are estimated to have experienced less than one percent growth annually since 2000.

### Table 5-3: Demographic Data for South Coast Region

<table>
<thead>
<tr>
<th>County</th>
<th>2008 Population Estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventura County</td>
<td>606,257</td>
</tr>
<tr>
<td>Los Angeles County</td>
<td>9,471,359</td>
</tr>
<tr>
<td>Orange County</td>
<td>3,121,251</td>
</tr>
<tr>
<td>San Bernardino County</td>
<td>839,792</td>
</tr>
<tr>
<td>Riverside County</td>
<td>1,509,606</td>
</tr>
<tr>
<td>San Diego County</td>
<td>3,047,075</td>
</tr>
<tr>
<td>Total South Coast Region</td>
<td>18,595,339</td>
</tr>
</tbody>
</table>

Source: Metropolitan 2008 (County Population Served by Metropolitan 1/1/08).

There are numerous Native American reservations in the South Coast area. San Diego County alone features 18 Tribal Nation Reservations, including Pala, Pauma-Yuima, Rincon, San Pasqual, Barona, Viejas, and Sycuan. Native Americans in Riverside County and San Diego County comprise four tribal groups: the Luiseño, the Cupeño, the Cahuilla, and the Kameyaay/Diegueno. According to 2000 Census data, the Native American population with all six counties totaled 76,300 people or 0.04 percent of the total population.

### Economic Drivers

Historically dominated by the aerospace and defense industries, the South Coast region has diversified into multiple technological fields. Research and development activities are concentrated within the region’s universities, including UC Los Angeles, University of Southern California, Caltech, UC Irvine, UC Riverside,
and UC San Diego, and their associated research institutes, as well as countless technology-based companies. The top industries in the South Coast, according to the U.S. Census Bureau (2006), are: manufacturing (computers and electronics, transportation equipment, metal fabrication, food, and apparel); healthcare and social assistance; professional, scientific & technical services (legal, accounting, architectural/engineering services); and wholesale trade (grocery, professional and commercial equipment, apparel, machinery).

The tourism industry, which is supported by coastal and beach ecosystems, is a key economic driver in the South Coast region. The region also includes the largest port complex in the U.S., the adjacent 7,500-acre Port of Los Angeles and 3,200-acre Port of Long Beach, as well as several smaller ports and harbors. In 2003, merchandise trade passing through the Port of Long Beach was valued at $96 billion: 12 percent of the value of total U.S. international waterborne trade. Coastal and channel erosion, polluted runoff, and sea level rise are all water resources issues that affect these important industries.

Though not as high in value as the above industries, the agricultural industry still plays an important role in the South Coast economy. The top agricultural products in 2005 include: strawberries, assorted nursery products, and citrus. Major agricultural areas within the region continue to be the Oxnard Plain (vegetables) and the adjacent hills and valleys (citrus and subtropical fruits) in Ventura County; the coastal (nursery and flowers) and interior valleys (citrus and avocado fruits) in San Diego County; and the Chino area (dairies) in San Bernardino County. Although irrigated cropland acreage continues to be on the decline in the region (down 9 percent (20,700 acres) from 2000-2005), the emphasis on high-value specialty and orchard crops on the remaining acreage allows the region to still provide a significant share of the State’s economic return from agriculture.

**Land Use Patterns**

With over half of the State’s population, urbanization and its associated impacts are key challenges to future land use and water resources planning. The mild climate and gentle hillscapes in the South Coast region have encouraged growth since the first great development boom of the late 1880s. Typical land use patterns include urban development in the coastal plains and interior valleys, with open space maintained in the mountains. Nearly 40 percent of the South Coast’s land area is urban and suburban use, which has led to fragmentation of wildlife habitats by urban sprawl and freeways. Recent urban development has occurred on the coastal plains, valleys, and hillsides of Ventura, Orange, and San Diego counties and on the remaining undeveloped land in the Inland Empire. Managed wetlands, reservoirs, and riparian corridors provide pockets of open space within the urban grid. Historical agricultural areas are giving way to urbanization. Although a few larger cropped areas remain in the San Jacinto and Perris valleys, only small pockets of irrigated cropland can be found along the South Coast. Further, the departure of the last major cluster of dairies from the Inland Empire, those operations near Norco, Chino, and Ontario, has apparently begun. These remaining agricultural pockets provide important farmland resources for the South Coast region.

The South Coast’s watersheds typically do not resemble their natural state, due to urbanization and agricultural practices which have modified waterways and surrounding habitats. Numerous waterways have been impacted by hydromodification and channelization. Many stream beds have been encased in concrete to facilitate flood management, thereby decreasing groundwater recharge. This is a particular problem for those groundwater basins which have historically been over-pumped, such as in the Los Angeles River watershed. Bridges and other structures over channelized streams can slow flow velocity and cause adjacent flood damage, as seen in the Calleguas Creek watershed. Due to intense urbanization and loss of natural habitat, there is a focus on conserving the natural areas that remain within the region.

Concern over effective land use planning for reducing wildfire risk and ensuring rapid response strategies have become more urgent as development continues to move into urban interface areas. Brush fires in San Diego County in October 2003 burned about 265,000 acres (Cal Fire 2003). Not only was the loss to wildlands severe during this nightmare, including devastating nearly all of Cuyamaca Rancho State Park, but more than 5,000 homes and other structures were damaged or completely destroyed. San Diego County burned again in October
2007, loosing 347,000 acres and damaging 2,600 structures (Cal Fire 2007). Fires have always been a component of life in California, but the likelihood of fire causing profound damage for local residents has increased with ongoing urbanization. Planners and legislators are increasingly looking to understand and manage the South Coast landscape to reduce such loses.

5-2 Regional Water Conditions

The region has developed a diverse mix of local and imported water supply sources, available in differing amounts throughout the South Coast region. Box 5-3 and the following sections provide an overview of regional water conditions.

Water in the Environment

Given the arid nature of the region and the flashy nature of storm events, the native South Coast environment is generally very sensitive to water. Although numerous structures have been built to alter the natural flows of local water bodies, many efforts are underway to restore these damaged environments, protect existing ones, and develop new ones to replace those that have been lost. In 2005, environmental water demands in the South Coast region were estimated to be XX AFY.

Water supply dedicated to environmental management includes in-stream flows for fisheries, aquatic vegetation, and water quality protection. Although environmental water use is limited in the South Coast region, local agencies have developed beneficial reuse programs for reclaimed water. Managed wetlands – such as Balboa Lake in the Sepulveda Basin area of Los Angeles County, Hemet/San Jacinto Multi-Purpose Constructed Wetlands in Riverside County, San Joaquin Marsh along San Diego Creek in Orange County, and Santee Lakes in San Diego – are maintained through discharge of reclaimed water supplies (Figure 5-3 above). Discharges from upstream wastewater treatment plants (WWTPs) contribute inflows to many of the region’s coastal lagoons and estuaries. Constructed wetlands along the Santa Ana River, including lands behind Prado Dam, have effectively demonstrated the ability to reduce nitrogen levels and recharge the groundwater aquifer. These managed wetlands, fed by Santa Ana River flows, provide for migratory and resident waterfowl and shorebird habitat, wildlife diversity, and public education and recreation opportunities. The source of the wetland flows is assured by the Santa Ana River Stipulated Judgment (overseen by the Santa Ana River Watermaster) which requires minimum average annual flows and guaranteed TDS concentrations within the river.
A 31-mile section of Sespe Creek in the Los Padres National Forest (Ventura County) was designated by USFWS as a Wild and Scenic River in 1992. Unusual geologic formations, gorges, and riparian vegetation provide excellent scenic diversity and recreation opportunities. This stream is considered a rainbow trout fishery and provides critical habitat for the endangered California condor. Sespe Creek and Bear Creek/Bear Valley Dam (impounding Big Bear Lake) are both designated as “wild trout waters” by CDFG and are further regulated to maintain appropriate in-stream habitat conditions (CDFG 2008). These South Coast fisheries are limited by diversions and dams that have cut off important spawning areas through diminished flows and poor water quality. The Matilija Dam Ecosystem Restoration Project involves the decommissioning of the Matilija Dam (constructed in 1947) on the Ventura River. Removal of the dam will restore steelhead passage to Matilija Creek. The project requires construction of flood protection for downstream properties, two bridges, new water wells, desilting basins, sediment slurry and disposal, exotic vegetation removal, and a high flow bypass.

Environmental concerns in the Sacramento-San Joaquin Delta (Delta), namely protection of declining populations of Delta smelt (*Hypomesus transpacificus*), have reduced the amount of water supply available to State Water Project (SWP) contractors. Additionally, the landmark September 28, 1994 decision by SWRCB (Decision 1631) amended the Los Angeles Department of Water and Power (LADWP) water diversion licenses in the Mono Basin. Los Angeles Aqueduct (LAA) diversions are restricted to ensure minimum in-stream flow requirements for Mono Basin tributaries, including Rush, Lee Vining, Walker and Parker creeks.

**Water Supplies**

To meet current and growing demands for water, the South Coast region is leveraging all available water resources: imported water, water transfers, conservation, captured surface water, groundwater, recycled water, and desalination. Given the level of uncertainty about water supply from the Delta and Colorado River, local agencies have emphasized diversification. Local water agencies now utilize a diverse mixture of local and imported sources and water management strategies to adequately meet urban and agricultural demands each year. For example, San Diego is projected to produce approximately 185,000 AFY of local supplies through water recycling, desalination, groundwater, and surface storage programs by 2030. By 2021, the area will receive an additional 277,000 AFY due to SDCWA-IID water conservation, transfer, and canal-lining programs. This diverse mix of sources provides flexibility in managing resources in wet and dry years.

The South Coast contains hundreds of water supply agencies with varied supply sources, serving both municipal and agricultural demands (see Appendix 5). The Metropolitan Water District of Southern California (Metropolitan), the largest recipient of imported water in the region, imported an average of 703,000 AFY from the SWP and 680,000 AFY or more from the CRA (depending on the availability of surplus water) from 1972 to 2007. Metropolitan wholesales the water to a consortium of 26 cities, water districts, and a county authority that in total serve nearly 18 million people that reside in the South Coast.

Various water rights in the South Coast region include Pueblo Rights, appropriative rights (first in time, first in right), riparian rights (English Law), Mutual Prescription (groundwater), and adjudicated rights. Figure 5-5 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 years 1998 through 2005.

**PLACEHOLDER Figure 5-5 South Coast Region Water Balance for Water Years 1998–2005**

**Imported Water**

Imported water is brought into the South Coast region from three major sources: the Sacramento-San Joaquin Delta, Colorado River, and Owens Valley/Mono Basin. All three are facing water supply cutbacks due to climate change and environmental issues. While imported water historically served to help the South Coast region grow, today it is relied upon to sustain the existing population and economy. As such, parties in the South Coast region are working closely with other regions, the State, and federal agencies to address the challenges facing
these imported supplies. Meanwhile, the South Coast region is working to develop new local supplies to meet the needs of future population and economic growth.

**Sacramento-San Joaquin Delta**

The California SWP is a system of reservoirs, pumps and aqueducts that carries water from Lake Oroville and other facilities north of the Delta to central and southern California. SWP contractors in the region include Metropolitan, Castaic Lake Water Agency (CLWA), San Bernardino Valley MWD, Ventura County Watershed Protection District (VCWPD) (formerly Ventura County Flood Control District), San Gorgonio Pass Water Agency (SGPWA), and San Gabriel Valley MWD. Metropolitan’s contract with the California Department of Water Resources (DWR), operator of the SWP, is for 1.91 MAF annually – about half the total project. SWP supplies are delivered to SWP contractors via the California Aqueduct and to retailers through the regional conveyance system.

Environmental concerns in the Delta, however, have recently limited the volume of water that can be delivered through the SWP. The potential impact of further declines in ecological indicators in the Delta system on SWP water deliveries is unclear. Additionally, the SWP is subject to extreme variability in hydrology due to a lack of storage, with full deliveries in only the wettest years. Other obstacles that must be overcome in importing water through the SWP include limitations on the movement of water across the Delta system, constraints related to water quality, and the cost of the water. The Governor’s *Delta Vision Strategic Plan* (2008) recently recommended two co-equal goals and associated actions: 1) restore the Delta ecosystem and 2) create a reliable water supply for California. The plan recommends improving the existing channel through the Delta, developing a second conveyance channel, increasing storage capacity, and expanding local supplies to reduce dependence on imports. The *Bay-Delta Conservation Plan*, under development by a collaboration of State, federal, and local water agencies, will further address the recovery of endangered and sensitive fisheries in the Delta.

**Colorado River System**

California water agencies are entitled to 4.4 MAF annually of Colorado River water. Of this amount, 3.85 MAF are assigned in aggregate to agricultural users and 550,000 AFY is Metropolitan’s entitlement. Until a few years ago, Metropolitan routinely had access to 1.2 MAF annually because Arizona and Nevada had not been using their full entitlement and the Colorado River flow was often adequate enough to yield surplus water. Metropolitan delivers the available water via the 242-mile CRA and the regional conveyance system.

Metropolitan’s CRA supply has been severely cut due to the development of California’s Colorado River Water Use Plan (2000), which forces the State to live within its original entitlement. While the *Colorado River Water Delivery Agreement: Federal Quantification Settlement Agreement of 2003* (QSA) further affirms the State’s right to 4.4 MAF, surplus water allotments from the Colorado River have been reduced as other states increase their diversions in accord with their authorized entitlements. Since 2003, Metropolitan’s CRA deliveries have varied from a low of 633,000 AF in 2006 to a high of 897,000 AF in 2005. The QSA also identifies measures to conserve and transfer water through the lining of existing earthen canals. The SDCWA has further developed conservation and transfer agreements with IID to augment its CRA supply. With full implementation of the programs identified in the QSA, Metropolitan expects to be able to annually divert 852,000 AFY of Colorado River water plus any unused agricultural water that may be available. Additional conjunctive use agreements that Metropolitan has in operation to manage its CRA supply include the Hayfield, Chuckwalla, and Lower Coachella Valley groundwater storage programs.

**Owens Valley/Mono Basin**

High-quality water from the Mono Basin and Owens Valley is delivered through the LAA to the City of Los Angeles. Construction of the original 233-mile aqueduct from the Owens Valley was completed in 1913, with a second aqueduct completed in 1970 to increase capacity. Approximately 480,000 AFY of water can be delivered to the City of Los Angeles each year; however the amount the aqueducts deliver varies from year to year due to fluctuating precipitation in the Sierra Nevada Mountains and mandatory in-stream flow requirements.

Diversion of water from Mono Lake has been reduced following SWRCB Decision 1631 (see discussion above) and exportation of water from the Owens Valley is limited by the Inyo-Los Angeles Long Term Water Agreement (and related MOU) and the Great Basin Air Pollution Control District/City of Los Angeles MOU (to
reduce particulate matter air pollution from the Owens Lake bed). As a result of these restrictions on water transfers, future deliveries are expected to be reduced to an average of 230,000 AFY over the next 20 years.

**Other Water Transfers**

Prior to 1991, water transfers within the South Coast region had been limited to transfers of annual groundwater basin rights (which continue to occur). Recently, municipal population growth and the need for water supply reliability have resulted in the growth of water transfer agreements. Metropolitan participates in multiple water exchange and storage programs, including agreements with Semitropic Water Storage District (WSD), Arvin-Edison WSD, San Bernardino Valley MWD, Kern-Delta Water District, Mojave Water District, and the Governor’s Water Bank. CLWA has executed long-term transfer agreements with the Buena Vista and Rosedale-Rio Bravo WSDs (see *Chapter 3, Relationships with Other Regions*).

In 1998, SDCWA entered into a transfer agreement with Imperial Irrigation District (IID) to purchase conserved agricultural water. Through the agreement, SDCWA received 50,000 AFY in 2007. This quantity will increase in 10,000 AF increments annually up to 200,000 AFY in 2021 and then remain fixed for the duration of the 75-year agreement. Metropolitan conveys the transfer water to SDCWA via an exchange agreement.

As described above, the QSA has further resulted in the movement of supplies between the Colorado River and South Coast regions. In 2003, SDCWA was assigned rights to 77,000 AFY of water to be conserved through the lining of 24 miles of the All-American Canal and 37 miles of the Coachella Canal in Imperial County. Through the agreement, SDCWA received 26,000 AF in 2007. This amount is expected to increase to the full 77,000 AFY by 2010 and then remain fixed for the duration of the 110-year agreement. Another 16,000 AFY of water conserved by lining the All-American Canal will go the San Luis Rey Indian Water Rights Settlement Parties. Metropolitan conveys the transfer water to SDCWA via an exchange agreement.

In 2004, the 35-year Palo Verde Land Management and Crop Rotation Program was established between Metropolitan and Palo Verde Irrigation District. Farmers in the Palo Verde Valley who choose to participate are paid to fallow cropland on a rotational basis in order to conserve irrigation supplies. Estimated water supply for the South Coast each year ranges from 29,500 to 118,000 AF.

**Water Conservation**

Water conservation is a fundamental component of the region’s water diversification plans. Water conservation refers to measures that reduce urban water consumption and/or irrigation-applied agricultural water. Water agencies in the South Coast have been aggressively implementing water conservation since the 1990s. Many local water agencies are signatories to the California Urban Water Conservation Council (CUWCC) MOU for urban water conservation and also have adopted Urban Water Management Plans to ensure water supply reliability during normal, dry, and multiple dry years. These agencies implement the best management practices (BMPs) and demand management measures contained in those documents. The backbone of Metropolitan’s conservation program is the Conservation Credits Program (CCP), initiated in 1988, that contributes $154 per AF of water conserved to assist member agencies in pursuing urban BMPs and other demand management opportunities. All of the region’s water suppliers host citizen conservation programs that feature residential and commercial water saving tips, rebates for water efficient purchases (e.g., low flow toilets, high efficiency clothes washers, weather-based irrigation controllers), and tools for implementing landscape/garden improvements. Local agencies are also developing water conservation master plans and conservation rate structures, as well as working closely through IRWM planning efforts to develop coordinated water efficiency programs. Examples from each planning area in the South Coast follow.

Water conservation programs are coordinated in the *Santa Clara/Ventura Planning Area* by a variety of agencies. Calleguas MWD, the local wholesaler of SWP supplies, administers programs with its member agencies in the southeastern portion of the County. A regional agricultural interest group, the Ventura County Farm Water Coalition, was recently formed to collaborate on implementation of agricultural BMPs. CLWA acts as the information clearinghouse for water conservation efforts in the upper watershed by purchasing advertising time in all media types and funding conservation programs by the local water retailers.
In the **Los Angeles Planning Area**, member agencies implement Metropolitan’s water conservation programs. Additionally, LADWP implements public outreach and school education programs to encourage conservation ethics; seasonal water rates that are approximately 20 percent greater during the summer high use period; and free water conservation kits. Central and West Basin MWDs recently completed water conservation master plans to coordinate and prioritize conservation efforts and identify enforcement protocols.

OCWD implements several water use efficiency programs in the **Santa Ana Planning Area**, including a hotel/motel water conservation program, rebates for water efficient purchases, and water saving tips and tools. Eastern MWD has implemented a new “California Friendly” irrigation system rebate program. IEUA provides a rebate program for water efficient fixtures and a landscape alliance to promote native landscaping among multiple cities. WMWD operates the preeminent water conservation demonstration center in the southland, Landscapes Southern California Style, which has been educating the public about water efficient planting and irrigation for over 15 years.

In the **San Diego Planning Area**, significant SDCWA and member agency funding has been directed toward implementing water conservation programs. Major programs include water efficient purchase incentives, efficiency standards, residential surveys, residential retrofits, landscape/irrigation improvements, and commercial/industrial/institutional retrofits. These programs resulted in 53,400 AF of water savings during 2005; water savings are projected to annually exceed 100,000 AF by year 2025. Numerous partnerships have also been developed to implement retail agency projects supported by external funding. For example, the 2007 Blueprint for Water Conservation is a partnership of SDCWA, member agencies, Cuyamaca College’s Water Conservation Garden, and private stakeholders dedicated to increasing regional water conservation to 80,000 AFY by 2010 and further to 108,000 AFY by 2030.

**Local Surface Water**

Local surface capture plays an important water resource role in the South Coast region. More than 75 impound structures are used to capture local runoff for direct use or groundwater recharge, operational or emergency storage for imported supplies, or flood protection. While precipitation contributes most of the annual volume of streamflow to the region’s waterways, urban runoff, wastewater discharges, agricultural tailwater, and surfacing groundwater are the prime sources of surface flow during non-storm periods. The South Coast has experienced a trend of increasing dry weather flows during the past 30 years as the region has developed, due to increased imported water use and associated urban runoff.

Surface water in the **Santa Clara/Ventura Planning Area** is obtained from Lake Casitas (254,000 AF), Lake Piru (100,000 AF), and from diversion projects along the Santa Clara River, Ventura River, Santa Paula Creek, Piru Creek, Sespe Creek, and Conejo Creek. Natural surface flows from these diversions are also directed to spreading basins to replenish local aquifers. Local surface water provides approximately 8.5 percent of the total water utilized in Ventura County. The most southern reservoir on the West Branch of the SWP California Aqueduct is Castaic Lake (320,000 AF). Metropolitan and CLWA both receive water from Castaic Lake and distribute it to retail water purveyors following treatment. Bouquet Reservoir (33,000 AF) is apart of the LAA system built by the City of Los Angeles in 1934.

Originally, the Los Angeles River was the primary water source for the **Los Angeles Planning Area**. Following several catastrophic floods, the U.S. Army Corps of Engineers (USACE) encased most of the riverbed in concrete and constructed several dams to manage storm flows. The USACE continues to oversee Hansen, Lopez, and Sepulveda Dams in the Los Angeles River watershed, as well as Santa Fe and Whittier Narrows Dams in the San Gabriel River watershed. LACDPW oversees several surface water storage facilities, including Big Tujunga and Pacoima dams, which further improve flood protection and store runoff for subsequent diversion to 27 groundwater spreading basins. Eleven dams were constructed as part of the San Gabriel River and Montebello Forebay water conservation system to impound runoff for groundwater recharge. Three dams in San Gabriel Canyon (Cogswell, San Gabriel, and Morris dams) capture runoff for diversion to the Santa Fe, Rio Hondo, or San Gabriel Coastal Basin spreading grounds. Las Virgenes MWD uses Las Virgenes Reservoir.
(9,800 AF) to store treated water it has purchased from Metropolitan. The Los Angeles Reservoir (10,000 AF),
operated by the LADWP, is a primary water source of the San Fernando Valley area.

The Santa Ana Planning Area has a variety of water storage reservoirs, including Lake Perris (124,000 AF), Lake Mathews (182,000 AF), and Big Bear Lake (74,000 AF). Additionally, several flood control projects, including Prado Dam (383,500 AF) and Seven Oaks Dam (145,600 AF), have been created to retain surface water during storm season. Lake Elsinore is the only natural freshwater lake in the watershed with a surface area of 5 square miles. Surface water accounts for approximately 5 percent of the total water demands in the Santa Ana watershed.

In the San Diego Planning Area, a total of 25 reservoirs with a combined capacity of 594,000 AF are located within the SDCWA’s service territory. Major supply reservoirs include San Vicente (90,200 AF), El Capitan (112,800 AF), Lake Henshaw (50,000 AF), and Lake Morena (50,200 AF). Seventeen (17) of these reservoirs are connected to the SDCWA’s aqueduct system. SDCWA plans to raise the existing dam at San Vicente Reservoir from 220 feet to 337 feet to provide an additional 100,000 AF capacity for carryover storage (63 feet per Carryover Storage Project) and 52,000 AF capacity for emergency storage (54 feet per Emergency Storage Project). The increased reservoir capacity will also require construction of two auxiliary saddle dams and a three-year reservoir draw down. RCWD’s surface storage system is comprised of Vail Lake (51,000 AF). RCWD meets Temecula Gorge flow requirements of 2,500 AFY, as set by the Cooperative Water Resource Management Agreement between Camp Pendleton and RCWD, by discharging untreated imported water into Murrieta Creek, a tributary of the Santa Margarita River. Metropolitan owns and operates Diamond Valley Lake (800,000 AF) and Lake Skinner (44,000 AF) within the planning area.

Groundwater

Groundwater provided the bulk of local water supplies to the South Coast region as it grew during the first half of the 20th Century. Today, groundwater remains a vital resource to the region both as a supply source and as a tool for storage. Conjunctive use is the coordinated operation of multiple water supplies and may be implemented to recharge basins, where imported water is recharged via spreading grounds or injection wells. The South Coast has practiced conjunctive use since the 1950s; imported supplies play an important role in supporting annual groundwater production. It is important to note, however, that groundwater availability varies across the region’s planning areas. Groundwater represents a significant portion of local supplies in the Santa Clara/Ventura, Los Angeles, and Santa Ana planning areas, whereas it is a small resource in the San Diego planning area. Major efforts are underway to improve management of existing supplies, clean up groundwater contamination, and implement conjunctive use projects.

In the South Coast region, natural recharge is typically insufficient to maintain groundwater basin water levels and current pumping levels due to the extent of impervious surfaces and the presence of clay soils. In some groundwater basins, as the demand for groundwater exceeded supply, landowners and other parties have turned to the courts to determine how much groundwater can rightfully be extracted. Most basin adjudications have resulted in either a reduction or no increase in the amount of groundwater extracted. Watermasters are further recognizing that they must also manage groundwater extraction to protect water quality and/or to prevent the spread of contaminants in groundwater. Adjudicated groundwater basins include: Central, Chino, Cucamonga, Main San Gabriel, Puente, Raymond, San Bernardino, Santa Margarita River, Santa Paula, Six Basins, Upper Los Angeles River, and the West Coast. Additional management of groundwater has been afforded through legislation to: Desert Water Agency, Fox Canyon Groundwater Management Agency (GMA), Ojai GMA, Water Replenishment District of Southern California (WRD), and OCWD.

Groundwater production within the greater Metropolitan service area is estimated at 1.6 MAF annually, employing nearly 5,000 acres of spreading basins and 36 injection wells (Metropolitan 2007). The discussion below provides examples of the larger basins, as there are too many small groundwater basins to name.
Groundwater is the largest single source of water in the **Santa Clara/Ventura Planning Area.** The 66,200-acre Upper Santa Clara River Valley basin is comprised of two aquifers (an alluvial aquifer and a Saugus Formation aquifer) totaling approximately 1.9 MAF of storage capacity. Due to extensive pumping by individual well owners and by a majority of the 166 public water surveyors within Ventura County, local groundwater reserves are slowly decreasing though overdrafting. Began in 1982, creation of the Fox Canyon GMA has resulted in a large scale effort to reduce overdraft in the basin. The 125,300-acre Lower Santa Clara River Valley basin is subdivided into five smaller basins: Oxnard, Mound, Santa Paula, Fillmore, and Piru. The largest of the sub-basins is the 58,000-acre Oxnard basin, which contains approximately 7.1 MAF of storage capacity and is managed by the Fox Canyon GMA. Conjunctive use projects underway in Ventura County include Calleguas Conjunctive Use Program (North Las Posas Basin).

Many agencies in the **Los Angeles Planning Area** rely on artificial recharge, by diverting local supplies from rivers or creeks when flow conditions are optimal, to spreading grounds (or basins) which typically contain sandy soils that promote infiltration. In addition, recycled water is infiltrated in spreading grounds and injected (along with imported water) along the coast to form barriers to seawater intrusion at three locations (the Alamitos, Dominguez Gap, and West Coast barriers). On average, about 120,000 AFY of imported supplies from Metropolitan are recharged each year to support groundwater production. The 310,900-acre Coastal Plain of Los Angeles County basin is subdivided into 4 sub-basins: Santa Monica, Hollywood, Central, and West Coast. The Central and West Coast sub-basins, managed by WRD, represent almost 90 percent of the storage of the Coastal Plain basin and are both adjudicated for allowed pumping of up to 281,000 AFY. These sub-basins have a combined total storage capacity estimated at 20.3 MAF and up to 450,000 AF set aside for the development of future conjunctive use projects. Conjunctive use projects underway in Los Angeles County include Long Beach Conjunctive Use Storage Project (Central Basin).

Groundwater continues to be the primary water supply source in the **Santa Ana Planning Area.** Groundwater production is supported by incidental and artificial recharge of recycled water, imported water, and storm water supplies. On average, about 80,000 AFY of imported supplies from Metropolitan are recharged each year to support groundwater production. The 466,900-acre Upper Santa Ana Valley basin has nine sub-basins: Chino, Cucamonga, Rialto-Colton, Riverside-Arlington, Cajon, Bunker Hill, Yucaipa, San Timoteo, and Temescal. Total combined storage of the sub-basins is estimated at 21 MAF. Groundwater pumping operations in the Chino, Bunker Hill, and Rialto-Colton sub-basins are managed under adjudication judgments. The 224,000-acre Coastal Plain of Orange County basin has a storage capacity of 37.7 MAF. The basin, managed by OCWD, provides 75 percent of the water used by north and central Orange County cities. Conjunctive use of surface water and groundwater is a long-standing practice in the region, with numerous spreading grounds developed to recharge the basins. Phase I construction has been completed for OCWD and Orange County Sanitation District’s Groundwater Replenishment System, which purifies 78,000 AFY of wastewater for groundwater storage either by injection along the seawater barrier or by percolation near the Santa Ana River. Conjunctive use programs underway in San Bernardino County include IEUA Cyclic Storage Agreement (Chino Basin) and Three Valley Municipal Water District Cyclic Storage Agreement (Main San Gabriel Basin).

Groundwater production in the **San Diego Planning Area** is limited by lack of storage capacity in local aquifers, availability of groundwater recharge, and degraded water quality. RCWD stores local runoff in Vail Lake via a surface water storage permit (up to 40,000 AF from November 1 to April 30) and then releases available water to spreading basins for groundwater recharge. SDCWA does not utilize groundwater extraction to meet member agency needs. The proposed El Monte Valley Groundwater Recharge project, a joint effort between Padre Dam MWD and Helix WD in San Diego County, would recharge the El Monte Valley Basin using highly treated recycled water. The Santa Margarita Conjunctive Use Project, by the Fallbrook PUD, provides for recharge of the groundwater basin underlying Camp Pendleton through diversions from the Santa Margarita River.

**Recycled Water**

In the South Coast region, recycled water is becoming increasingly valuable given its reliability and cost-effectiveness as compared to tapping other water supplies. In addition to extending conveyance systems to
deliver recycled water for non-potable uses (i.e. purple pipe), the region is leading implementation of groundwater recharge and reservoir augmentation with recycled water (i.e. indirect potable reuse (IPR)).

Within Metropolitan’s service area, there are approximately 355,000 AF of planned and permitted uses of recycled water supplies. Actual use is approximately 209,000 AF, which includes golf course, landscape, and cropland irrigation; industrial uses; construction applications; and groundwater recharge, including maintenance of seawater barriers in coastal aquifers. Metropolitan projects the development of 500,000 AF of recycled water supplies (including groundwater recovery) by 2025 (Metropolitan 2004). A necessary component of water recycling is providing a means of disposal or storage for excess recycled water supplies during wet weather periods (other than discharge via regional ocean outfalls). Discharge of treated wastewater flows into streams and rivers can help satisfy environmental water demands and provide for incidental groundwater recharge. IPR through release of recycled water to groundwater spreading basins or surface storage reservoirs can further augment local drinking water supplies. By utilizing reclaimed water, agencies can more efficiently allocate their potable water and increase the reliability of water supplies in the region.

Recycled water in the Santa Clara/Ventura Planning Area holds great potential as an alternative water source and a means to improve water supply reliability, particularly for agricultural irrigation. Four WWTPs in Ventura County currently reclaim a portion of their effluent. The Camrosa Water District recycles water from its own facilities, the City of Thousand Oaks’ Hill Canyon WWTP, and Camarillo Sanitary District for agricultural and landscape irrigation demands. In the upper watershed, Santa Clarita Valley Sanitation District owns and operates two water reclamation plants (Saugus and Valencia) within the CLWA service area. A third reclamation plant is proposed as part of the Newhall Ranch project. Accordingly, CLWA has constructed an initial phase (Phase 1A) of the recycled water system and proposes to construct an additional phase in the near future.

Current average annual recycled water production in the Los Angeles Planning Area is approximately 225 million gallons per day (MGD), which represents approximately 25 percent of the current average annual effluent flows. Of the recycled water produced, approximately 107 MGD is currently reused for municipal, industrial, and groundwater recharge uses. WRD is permitted to recharge up to 50,000 AFY (45 MGD) of Title 22 recycled water from CSDLAC for replenishment of the Central sub-basin through use of the Montebello Forebay spreading grounds. West Basin MWD’s Edward Little Water Recycling Facility in El Segundo, which produced approximately 24,500 AF in 2004-2005, recently completed its Phase IV Expansion Project. Approximately 12,500 AFY of the water produced at this facility is purchased by WRD and injected into the West Coast Barrier by LACDPW.

Recycled water currently represents approximately 4 percent of the total water demands in the Santa Ana Planning Area. Eastern MWD recycles effluent from four WWTPs. What is not resold is used for groundwater recharge or storage. The Irvine Ranch Water District (IRWD) has developed an extensive recycled water treatment and delivery system and will expand capacity through 2013 to meet expected recycled water demand at buildout. Inland Empire Utilities Agency (IEUA) is expanding their water recycling with a goal of meeting 20 percent of their demand or 50,000 AF with recycled water. Recycled water is also available through the OCWD’s Green Acres Project and the El Toro Water District. As infrastructure is further developed, recycled water is projected to surpass surface water as a water supply source for the planning area. OCWD and Orange County Sanitation District’s Groundwater Replenishment System provides 78,000 AFY of recycled water for groundwater recharge and injection along the seawater barrier.

The San Diego Planning Area contains a number of recycled water facilities. In Riverside County, six water reclamation facilities (Santa Rosa, Temecula Valley, March, Regional, Horsethief, and Railroad Canyon) provide non-potable supplies for local use. Seventeen recycled water tertiary treatment facilities are located within San Diego County. The use of tertiary treated recycled water within the San Diego area is projected to increase from 11,500 AFY in 2005 to 47,600 AFY in 2030 (SDCWA 2007). In September 2008, the City of San Diego
Diego approved funding for an IPR demonstration project that releases advanced treated wastewater to San Vicente Reservoir for blending and subsequent additional treatment prior to redistribution.

**Desalination**

Desalination is being implemented in the South Coast region not only to help meet local water supply needs, but also to manage salinity levels and associated impacts on the environment. In the Santa Clara/Ventura and Santa Ana planning areas, desalination is focused on brackish groundwater treatment. Meanwhile, ocean desalination is being pursued in earnest in the Los Angeles and San Diego planning areas.

Salinity is a significant issue in the South Coast region, as natural conditions result in high dissolved salt levels. In addition, salinity sources include past agricultural practices, imported Colorado River water with high salinity from upstream uses, seawater intrusion, discharge of treated wastewater, and past and existing septic systems in certain local areas. These salts build up in the soil and shallow aquifers, impacting local and regional surface and groundwater resources. In some aquifers, salt levels are so high the water supply requires advanced treatment or blending with other supplies that have a lower salt content to make it usable. TDS levels in local groundwater supplies in the region vary considerably, ranging from 200 mg/L (Cucamonga Basin) to more than 1,000 mg/L (Arlington Basin). To prevent impairment, salts must be removed from degraded water sources and exported from the watershed.

Concerns about drought reliability, population growth, and the desire to reduce dependence on imported water have created a high degree of interest in seawater desalination in southern California. Many proposals for desalination plants along the coast include co-location with power plants in order to utilize existing intake and discharge structures. Seawater desalination is more energy intensive, per AF, than brackish water desalination or water recycling. However, direct benefits include development of additional water supplies, associated reduction of groundwater overdrafting and/or imported supplies, and supply reliability even during drought conditions (DWR 2003). Eight seawater desalination plants are proposed on the South Coast as of early 2008. The capacity of the proposed plants totals approximately 300 MGD.

Brackish water desalination solves both reliability and quality goals in the **Santa Clara/Ventura Planning Area**. The Calleguas MWD Salinity Management Project is a 35-mile brine pipeline that is integral to the construction of a series of brackish groundwater desalters in the Calleguas Creek watershed. The brine pipeline will provide disposal of tertiary treated effluent for several WWTPs (Camrosa, Camarillo, Hill Canyon, Moorpark, and Simi Valley) and brine disposal for numerous brackish groundwater desalters (Camrosa, Camarillo, University Well, Somis, Moorpark and Simi Valley, and potentially Tapo Canyon). The brine pipeline serves as a regional conveyance facility that moves saline water from areas where it is a nuisance to areas where it can be an asset for salt tolerant crops and wetlands restoration.

There are a myriad of desalination projects in the **Los Angeles Planning Area**. LADWP is proposing to co-locate a 12-25 MGD desalination plant at the Scattergood Generating Station in Playa Del Rey to offset water committed from the LAA for environmental restoration in the eastern Sierra Nevada (LADWP 2005). West Basin MWD is proposing to co-locate a 20 MGD desalination plant at the El Segundo Power Plant in El Segundo. The District has operated a 40 gallons-per-minute pilot plant and was awarded Proposition 50 grant funding to build a 0.5 MGD demonstration facility in May 2005 (WBMWD 2005). The Long Beach Water Department is considering a 9 MGD seawater desalination plant in Long Beach. The department, in partnership with LADWP and the U.S. Bureau of Reclamation (USBR), began operating a 0.30 MGD prototype plant at the Haynes Generating Station in early 2006. Operation of the full-scale facility is expected to commence no earlier than 2015 if the project proves to be economically, technically, and environmentally feasible (LBWD 2005b). The 3 MGD Goldsworthy Desalter, owned and operated by WRD, provides brackish groundwater desalination for the dual purposes of remediation of a saline plume located within the West Coast sub-basin and provision of a reliable local water source to Torrance.

The potential for groundwater banking in the **Santa Ana Planning Area** is substantial, but the volume of clean water that can be stored may be hindered by high salt concentrations in the existing groundwater. In the Santa
Ana watershed, three desalination plants have been constructed by SAWPA (in the Arlington and Chino areas) and are producing a total of 24 MGD. The Temescal plant, constructed and operated by the City of Corona, has a capacity of 15 MGD. The Menifee and Perris Desalters, owned and operated by Eastern MWD, are producing 7 MGD. The Irvine Desalter Project, a joint groundwater quality restoration project by IRWD and OCWD, yields 7,700 AFY of potable drinking water and 3,900 AFY of non-potable water. The Tustin Seventeenth Street Desalter, owned and operated by OCWD, yields approximately 2,100 AFY. The Arlington Desalter, managed by Western MWD, delivers approximately 6,400 AF of treated groundwater annually to the City of Norco. Brine from local desalters is effectively transported from the watershed by SAWPA’s 30 MGD capacity Santa Ana Regional Interceptor (SARI) brine pipeline to OCSD for treatment and then discharge to the ocean. Poseidon Resources is proposing to co-locate a 50 MGD seawater desalination plant with the AES Power Plant in Huntington Beach. MWDOC is also considering building a 25 MGD seawater desalination plant in Dana Point.

As described above, groundwater extraction is limited in the San Diego Planning Area. Brackish groundwater desalination facilities in the planning area include the City of Oceanside’s Mission Basin Desalter (6.37 MGD) and Sweetwater Authority’s Reynolds Groundwater Desalination Facility (4 MGD). SDCWA and MWDOC are considering building a 50-100 MGD seawater desalination plant at Camp Pendleton, using the intake and outfall structure from Unit 1 of the San Onofre Nuclear Generating Station, which is being decommissioned. A public-private partnership between the City of Carlsbad and Poseidon Resources, the 50 MGD seawater desalination plant at the Encina Power Station in Carlsbad will begin construction in 2009 and be on-line by 2011. Nine water agencies have entered into long-term water purchase agreements with the Carlsbad desalination plant (Poseidon Resources 2008).

**Water Uses**

The South Coast Hydrologic Region is the most populous and urbanized region in California. In some portions of the region, water users consume more water than is locally available, which has resulted in an overdraft of groundwater resources and increasing dependence on imported water supplies. The total applied water for municipal and industrial uses for the region in water year 2005 was estimated at XX AF. This represented XX percent of the Statewide total applied water for urban uses. The distribution of water uses, however, varies dramatically across the South Coast’s planning areas. For example, in 2005 VCWC’s water use included 22 percent for residential users and 68 percent for agricultural users, while SDCWA’s water use included 58 percent for residential users and 13 percent for agricultural users. Projections show diminished water use by agricultural operations, with the reduction allocated to municipal and industrial users. As a result of recent droughts, South Coast water users have generally become more water efficient. Municipal water agencies are engaged in aggressive water conservation and efficiency programs (described above) to reduce per capita water demand. As a result of changes in plumbing codes, energy and water efficiency innovations in appliances, and trends toward more water efficient landscaping practices, urban water demand has become more efficient.

Despite vast urbanization within the South Coast, about 240,000 acres of irrigated crops were also planted and harvested in 2005. Agricultural activities accounted for approximately XX percent of the overall use in the region. In water year 2005, agricultural demands were estimated to be XX AF. In the main agricultural areas on the South Coast, growers are very conscious about the amount of water needed to produce a marketable crop and strive to be as efficient as possible. The largest area of concentrated row crops (35,000 acres of harvest produce) is in Ventura County. Although sprinkler and furrow irrigation is still used on several truck crops (celery, cabbage and broccoli), drip irrigation is used almost exclusively for other kinds of vegetable crops (lettuce, peppers, and tomatoes). In recent years, improvements in surface drip technology have permitted growers to use drip tape for consecutive years without a decrease in effectiveness. Additionally, many of the large-scale citrus and avocado operations in Ventura and San Diego counties are irrigated with micro-sprinkler systems. Improved technology has allowed growers to more accurately distribute water to the individual trees; pressure compensating valves and emitters have enabled growers to irrigate on steep slopes with better precision. Maximizing agricultural irrigation systems lowers the growers’ irrigation demands.
Water Quality

Because of its sprawling metropolitan areas, water quality remains under ongoing pressure in the South Coast region. Population and economic growth not only affects water demand, but it adds contamination challenges from increases in wastewater and industrial discharges, urban runoff, agricultural chemical usage, livestock operations, and seawater intrusion. Urban and agricultural runoff can contribute sediment from disturbed areas; oil, grease, and toxic chemicals from automobiles; nutrients and pesticides from turf and crop management; viruses and bacteria from failing septic systems and animal waste; road salts; and heavy metals to local surface waters. Three areas that are receiving intense interest are non-point source (NPS) pollution control, salinity management, and emerging contaminants.

Three Regional Water Quality Control Boards (RWQCBs) have jurisdiction in the South Coast: Los Angeles (Region 4), Santa Ana (Region 8), and San Diego (Region 9). Each RWQCB identifies impaired water bodies, establishes priorities for the protection of water quality, issues waste discharge requirements, and takes appropriate enforcement actions within its jurisdiction (Figure 5-6). Specific water quality issues within the South Coast include: beach closures, contaminated sediments, agricultural discharges, salinity management, and port and harbor discharges. Outside the region, high salinity levels and perchlorate contamination contribute to degraded Colorado River supplies, while seawater intrusion and agricultural drainage threatens SWP supplies.

NPS Pollution Control

All NPS pollution is currently regulated through either the National Pollutant Discharge Elimination System (NPDES) Permitting Program or the Coastal Non-point Pollution Control Program. All three RWQCBs issue municipal, industrial, and construction NPDES permits with the goal of reducing or eliminating the discharge of pollutants into the storm water conveyance system. The coastal program requires the U.S. Environmental Protection Agency and National Oceanic and Atmospheric Administration to develop and implement enforceable BMPs to control non-point source pollution in coastal waters. Further, the Los Angeles and San Diego RWQCBs have adopted conditional waivers for discharges from irrigated agricultural lands, which require farmers to measure and control discharges from their property.

South Coast agencies have recently begun to implement Low Impact Development (LID) as a way of improving water quality through sustainable urban runoff management. LID practices include: bioretention and rain gardens, rooftop gardens, vegetated swales and buffers, roof disconnection, rain barrels and cisterns, permeable pavers, soil amendments, impervious surface reduction, and pollution prevention (SWRCB 2008). The Los Angeles and San Diego RWQCBs have both incorporated LID language into Standard Urban Storm Water Mitigation Plan requirements for municipal NPDES permits.

Salinity Management

Surface and groundwater salinity is an ongoing challenge for South Coast water supply agencies. Higher levels of treatment are needed following long-range import of water supplies, as TDS levels are increased during conveyance. Salinity sources in local supplies include concentration from agricultural irrigation, seawater intrusion, discharge of treated wastewater, and recycled water. Metropolitan depends on blending the higher salinity CRA supply at Parker Dam with the lower salinity SWP supply to maintain 500 mg/L TDS or lower. The City of San Diego 2006 Water Quality Report shows average TDS for three water treatment plants using blended supplies ranging from 442 to 465 ppm. Further, seawater intrusion and agricultural drainage threatens to increase the salinity of SWP supplies. Reduced surface water quality would require additional or upgrading existing demineralization facilities. Increased salinity also reduces plumbing fixtures life and consequent increase replacement costs to customers.
Groundwater quality has also been degraded by a long history of groundwater overdrafting and subsequent seawater intrusion. OCWD, WRD, and LACDPW operate groundwater injection programs to form hydraulic barriers that protect aquifers from seawater intrusion. Brackish groundwater treatment occurs throughout the Santa Clara/Ventura and Santa Ana planning areas (see description above). Various local agencies have developed salinity and nutrient management plans to reduce salt loading. For example, the Chino Basin Watermaster developed an Optimum Basin Management Program (1999) to develop the maximum yield of the basin while protecting water quality. Further development of IPR/groundwater recharge programs within the South Coast may exacerbate groundwater salinity and require additional technological advances in desalination.

**Emerging Contaminants**

Chemical and microbial constituents that have not historically been considered as contaminants are increasingly present in the environment due to municipal, agricultural, and industrial wastewater sources and pathways. Established and emerging contaminants of concern to the region’s drinking water supplies include pharmaceuticals and personal care products; disinfection byproducts; those associated with the production of rocket fuel, such as perchlorate and nitrosodimethylamine; those that occur naturally, such as arsenic; those associated with industrial processes, such as hexavalent chromium; and methyl tertiary butyl ether (MTBE), a gasoline additive. Current WWTPs are not currently designed to remove these emerging contaminants. However, Metropolitan, SAWPA, and OCWD are all exploring analytical methods to study human and ecological health impacts, and develop control methods as necessary.
Planning Area Impairments

Water quality issues within the **Santa Clara/Ventura and Los Angeles Planning Areas** (Los Angeles RWQCB) stem from a range of sources, including industrial and municipal operations, flow diversion, channelization, introduction of non-native species, sand and gravel operations, natural oil seeps, dredging, spills from ships, transient camps, and illegal dumping. Over time, these practices have resulted in the bioaccumulation of toxic compounds in fish and other aquatic life, in-stream toxicity, eutrophication, beach closures, and a number of Clean Water Act 303(d) listings. Water bodies within this planning area have been listed for metals, pesticides, nitrates, trash, salinity and pH. The RWQCB is currently focusing on developing Total Maximum Daily Loads (TMDLs) for nutrients, pathogens, trash, toxic organic compounds and metals (Los Angeles RWQCB 1994; 2007).

Key issues within the **Santa Ana Planning Area** (Santa Ana RWQCB) include: nitrogen/TDS due to flow diversion; nitrogen/TDS associated with dairies in the Chino Basin; and pathogen issues at coastal beaches. Water bodies within this planning area typically have nutrient issues, including organic enrichment, low dissolved oxygen, and algal blooms. These are a particular problem in Big Bear Lake and Lake Elsinore. Water quality issues also include pathogens, metals, and toxic organic compounds in the lower watershed due to urbanization. TMDLs have been developed throughout the Santa Ana River and San Jacinto River watersheds for nutrients and pathogens. Along the Newport coast, TMDLs are in place for metals, nutrients, pathogens, pesticides/priority organics, and siltation (Santa Ana RWQCB 1994; 2001).

The Chino Basin, in the upper Santa Ana River watershed, hosts the highest concentration of dairy animals in the U.S. In a 40 square-mile area, well over 300,000 animals are maintained on about 300 dairies. Dairy runoff contributes nitrate, salts, and microorganisms to both surface and groundwater. Since 1972, the Santa Ana RWQCB has issued waste discharge requirements to the dairies in this basin. In addition, pilot projects were recently completed to develop dairy sewer systems and for treating dairy wash water. 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.

The **San Diego Planning Area** (San Diego RWQCB) is primarily concerned with the quality of coastal water bodies. Agricultural operations, urban runoff, marinas and boating, and hydromodification all pose a threat to coastal water quality. Several shorelines within this region are Clean Water Act 303(d) listed for pathogens, while a number of estuaries and lagoons are listed for nutrients, sediments, pathogens, and metals. TMDLs are currently under development for several lagoons for nutrients/eutrophication, sedimentation/siltation, TDS, and bacteria. A shoreline TMDL is been created for indicator bacteria as well. The bays and harbors in the region are Clean Water Act 303(d) listed for sediment toxicity, pathogens, pesticides, benthic community effects, copper, lead, and toxic organics. As with the rest of the South Coast, the lakes and reservoirs within the Region are affected by nutrients, metals and pH, while rivers are streams are commonly listed for nutrients, pathogens, metals, pesticides, toxic organics and salinity (San Diego RWQCB 1994; 2002).

The Tijuana River watershed poses a unique challenge water quality control as the upper watershed lies within Mexico. Urban runoff and untreated wastewater discharges from Mexico have created significant water quality impacts within the lower watershed. The river and its estuary have issues with nutrients, debris, bacteria, low dissolved oxygen, synthetic organics, pesticides, and metals. The Tijuana River Binational Vision is a project meant to identify these water quality issues and define ways to bring the watershed to an ideal state.

**Project Operations**

The South Coast region maintains one of the most far-reaching systems of water management in the world. This includes facilities to convey imported water to the region; capture, store, and treat water supplies within the region; and deliver water throughout the region. The following paragraphs describe major water supply infrastructure that deliver imported water to the South Coast region (Figure 5-7). Protection of this infrastructure from earthquakes and other major catastrophes is an essential component of water management.
The **SWP California Aqueduct** is a 444 mile-long aqueduct, owned and operated by DWR that carries SWP supplies to water agencies throughout California. The aqueduct begins at the Delta and flows by gravity south through the Central Valley to the Edmonston Pumping Plant, where it is pumped 1,926 feet over the Tehachapi Mountains. Once it has crossed the Tehachapis, the aqueduct divides into two branches – the West and the East Branch. The East Branch feeds Lake Palmdale, Lake Perris, and the San Gorgonio Pass area, while the West Branch heads towards Pyramid Lake and Castaic Lake in the Angeles National Forest to supply the western Los Angeles basin. The SWP consists of pumping and power plants (6.5 billion KWh generated annually); 21 reservoirs (5.8 MAF capacity); storage tanks; and canals, tunnels, and pipelines (DWR 2008b).

The **Colorado River Aqueduct** is a 242-mile aqueduct, owned and operated by Metropolitan, which conveys Colorado River water to southern California. The aqueduct diverts water from the Colorado River at Lake Havasu on the California-Arizona border and conveys it through the CRA west across the Mojave and Colorado deserts to Lake Mathews in western Riverside County. The aqueduct was constructed between 1933-1941 to ensure a steady supply of drinking water to Los Angeles. The aqueduct consists of two reservoirs, five pumping plants, 63 miles of canals, 92 miles of tunnels, and 84 miles of buried conduit and siphons.

The **Los Angeles Aqueducts** are comprised of two aqueducts. The First LAA (or the Owens Valley aqueduct) was completed 1913 and the Second LAA was completed 1970. The First LAA was designed to deliver water from the Owens River near Independence to the City of Los Angeles. The Second LAA, which added transport capacity in order to exhaust the City's water rights from the Mono Basin, starts at the Haiwee Reservoir just south of Owens Lake. Running roughly in parallel to the first aqueduct, it carries water 137 miles to the City of Los Angeles.

![Figure 5-7 Statewide Project Operations](image-url)
The San Diego Aqueducts, with two branch lines, make up the backbone of the SDCWA system. The five pipelines in the two aqueducts have a combined capacity of 826 cfs. The First Aqueduct (Pipelines 1 and 2) extends 70 miles from the CRA near San Jacinto to San Vicente Reservoir. Constructed by the Navy Department and USBR from 1945-54, the two pipelines share common tunnels and inverted siphons. The 94-mile Second Aqueduct (Pipelines 3 and 4) were constructed from 1957-79 and are operated separately. Pipeline 3 extends from the CRA to Lower Otay Reservoir, while Pipeline 4 terminates at San Diego's Alvarado Treatment Plant near Lake Murray. Metropolitan owns and operates the northern portions of the pipelines; the delivery point to SDCWA is located six miles south of the San Diego-Riverside county line (USBR 2008a).

**Water Governance**

Water governance is undertaken by various federal and State agencies, the courts, and sanctioned regional organizations to manage critical imported water and groundwater supplies, as well as coordinate flood management. As described above, there are hundreds of water supply agencies within the South Coast region. In addition, regional partnerships have been established by South Coast agencies to further collaborate on strategic water resources planning and implementation.

DWR administers long-term *imported water supply* contracts with 29 agencies for SWP supplies. In return for State financing, operation, and maintenance of SWP facilities, the agencies contractually agree to repay all associated capital and operating costs. The Colorado River is managed and operated by USBR under numerous compacts, federal laws, court decisions and decrees, contracts, and regulatory guidelines collectively known as the “Law of the River.” This collection of documents apportions the water and regulates the use and management of the Colorado River among the seven basin states and Mexico (Table 5-5). LADWP owns and operates the LAAs for conveyance of imported water from the Owens Valley to the City of Los Angeles. Metropolitan, the largest SWP contractor and primary South Coast wholesaler, delivers an average of 1.4 MAF or more of SWP and CRA supplies (depending on the availability of surplus water) to its 26 cities, water districts, and a county authority. SDCWA, the largest of Metropolitan’s members, purchased about 593,500 AFY or about 25 percent of Metropolitan’s deliveries in FY 2007-08.

Groundwater adjudication limits the amount of *groundwater* that can be extracted by all parties based on a Court-determined safe yield of the basin. A Watermaster is then appointed by the Court to administer the judgment. There are 13 court adjudications for groundwater basins in the South Coast, including: Central Basin, Chino Basin, Cucamonga Basin, Goleta Basin, Main San Gabriel Basin, Puente Basin, Raymond Basin, San Bernardino Basin Area, Santa Margarita River Watershed, Santa Paula Basin, Six Basins, Upper Los Angeles River, and the West Coast Basin.

Three RWQCBs manage *water quality* for the region by setting standards, issuing waste discharge requirements, determining compliance with those requirements, and taking appropriate enforcement actions. Each RWQCB identifies impaired water bodies and establishes priorities for the protection of surface water quality.

Land development within the *floodplains* of the South Coast is primarily regulated by local building codes, subdivision regulations, and zoning ordinances. These ordinances regulate development and construction within flood-prone areas to minimize losses due to flood events. Flood management is further supported by the Federal Emergency Management Agency through floodplain mapping and insurance programs. In 2007, three of the five counties in the region participating in the National Flood Insurance Program had community ratings: Los Angeles (Class 7), Orange (Class 9) and San Diego (Class 9).

**Regional planning** has been advanced by the Integrated Regional Water Management (IRWM) paradigm introduced by DWR and SWRCB. Regional planning efforts have brought water supply, wastewater, flood control, and environmental stakeholders together to identify water management challenges, reduce conflicts, and develop the region’s diversified water management portfolios.
Table 5-5  Key Elements of the Law of the Colorado River

<table>
<thead>
<tr>
<th>Document</th>
<th>Date</th>
<th>Main Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorado River Compact</td>
<td>1922</td>
<td>The Upper and Lower Basin are each provided a basic apportionment of 7.5 MAF annually of consumptive use. The Lower Basin is given the right to</td>
</tr>
<tr>
<td></td>
<td></td>
<td>increase its consumptive use by an additional 1.0 MAF annually.</td>
</tr>
<tr>
<td>Boulder Canyon Project Act</td>
<td>1928</td>
<td>Authorized USBR to construct Hoover Dam and the All-American Canal (including the Coachella Canal), and gave congressional consent to the</td>
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<tr>
<td></td>
<td></td>
<td>Colorado River Compact. Apportioned the Lower Basin’s 7.5 MAF among the states of Arizona (2.8 MAF), California (4.4 MAF), and Nevada (0.3 MAF).</td>
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<tr>
<td></td>
<td></td>
<td>Provided that all users of Colorado River water stored in Lake Mead must enter into a contract with USBR for use of the water.</td>
</tr>
<tr>
<td>California Limitation Act</td>
<td>1929</td>
<td>Confirmed California’s share of the 7.5 MAF Lower Basin allocation to 4.4 MAF annually, plus no more than half of any surplus waters.</td>
</tr>
<tr>
<td>California Seven-Party Agreement</td>
<td>1931</td>
<td>An agreement among seven California water agencies/districts to recommend to the Secretary of Interior how to divide use of California’s</td>
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<tr>
<td></td>
<td></td>
<td>apportionment among the California water users.</td>
</tr>
<tr>
<td>U.S.-Mexican Water Treaty</td>
<td>1944</td>
<td>Apportions Mexico a supply of 1.5 MAF annually of Colorado River water, except under surplus or extraordinary drought conditions.</td>
</tr>
<tr>
<td>U.S. Supreme Court Decree in Arizona v.</td>
<td>1964,</td>
<td>Rejected California’s argument that Arizona’s use of water from the Gila River, a Colorado River tributary, constituted use of its Colorado</td>
</tr>
<tr>
<td>California, et al.</td>
<td>supplemented</td>
<td>River apportionment. Ruled that Lower Basin states have a right to appropriate and use tributary flows before the tributary co-mingles with</td>
</tr>
<tr>
<td></td>
<td>1979</td>
<td>the Colorado River. Quantifies tribal water rights for specified tribes, including 131,400 AFY for diversion in California. Quantified</td>
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<tr>
<td></td>
<td></td>
<td>Colorado River mainstream present perfected rights in the Lower Basin states.</td>
</tr>
<tr>
<td>Colorado River Basin Project Act</td>
<td>1968</td>
<td>Authorized construction of the Central Arizona Project. Requires Secretary of the Interior to prepare long-range operating criteria for major</td>
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<tr>
<td></td>
<td></td>
<td>Colorado River reservoirs.</td>
</tr>
<tr>
<td>Criteria for Coordinated Long-Range Operation</td>
<td>1970,</td>
<td>Provided for the coordinated operation of reservoirs in the Upper and Lower Basins and set conditions for water releases from Lake Powell and</td>
</tr>
<tr>
<td>of Colorado River Reservoirs</td>
<td>amended</td>
<td>Lake Mead.</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td></td>
</tr>
<tr>
<td>Colorado River Water Delivery Agreement:</td>
<td>2003</td>
<td>Complex package of agreements that, in addition to many other important issues, further quantifies priorities established in the 1931</td>
</tr>
<tr>
<td>Federal Quantification Settlement Agreement</td>
<td></td>
<td>California Seven-Party Agreement and enables specified water transfers (such as the water conserved through lining of the All-American and Coachella canals to SDCWA) in California.</td>
</tr>
</tbody>
</table>

Source: Adapted from USBR 2008c

Flood Management

Flooding is a significant problem in the South Coast region because winter rainfall is generally intense and flood conditions are often exacerbated by wildfire damage. In addition, many of the major flood control infrastructure projects were built 75+ years ago and thus are in deteriorating condition. Precipitation over short periods can produce large amounts of water, often leading to flash floods and localized flooding. Seasonal fires denude the watersheds of their vegetation, which decreases interception rates, accelerates erosion, and leaves steep terrain vulnerable to winter storms. Debris flows are a common occurrence during the winter months. Appendix 5 provides an overview of the flood parameters for principal streams in the region. Figure 5-8 illustrates the 100- and 500-year floodplains identified by the Federal Emergency Management Agency (FEMA).

The South Coast region has one of the highest densities of flood control and water conservation structures in the State. Channel modification and realignment have taken place on many of the waterways to provide improved A tremendous infrastructure has been built to protect the South Coast region from major flooding events. However, this infrastructure must continue to be maintained and also improved to help restore water quality and ecosystems.
conveyance for floodflows. Multiple channels, dams, and reservoirs contribute to an extensive network of flood storage facilities throughout the region. Debris basins along many of the waterways provide protection against sedimentation, a major cause of flood damage. Many miles of levees provide flood protection to areas historically inundated by floodwaters.

The urban development that supports the South Coast’s vast population produces many challenges for local flood control agencies. Urbanization has led to the depletion of natural flood plains, increased surface runoff, and ultimately changes in the region’s hydrology. Flood control projects accommodate this ever-changing hydrology by protecting life, property, public infrastructure, and watercourses from potential damage associated with storm flows and floods. County flood control districts in each of the six counties accomplish these goals through floodplain management, construction of flood control infrastructure, mapping, and development of flood control ordinances. Replenishment of local groundwater aquifers is also a major activity of the flood management agencies.

In the **Santa Clara/Ventura Planning Area**, the Ventura County Watershed Protection District provides flood management to 1,670 square miles. The agency divides the county into four zones; each zone is managed separately to protect aquatic ecosystems, human life and health, and other natural resources.

In the **Los Angeles Planning Area**, the Los Angeles County Flood Control District (LACFCD) was created in 1915 to provide for the control and conservation of flood, storm, and other waste waters. LACDPW’s Watershed Management Division was created in 2000 to evaluate and address flood control needs from an integrated watershed management approach taking into account flood protection, water quality and conservation, and enhancement of habitat, open space, and recreational opportunities.

In the **Santa Ana Planning Area**, the Orange County Flood Control District manages 790 square miles and more than 350 miles of flood channels, dams, pump stations, flood control basins and other infrastructure. The San Bernardino County Flood Control District is responsible for providing flood protection, water conservation, and storm drain construction. The district is divided into six planning zones that cover an area of 21,105 square miles; each zone functions independently. The Riverside County Flood Control and Water Conservation District provides flood management to 2,700 square miles in the western region of the county. The district divides its jurisdiction into seven management zones; each zone is managed separately.

In the **San Diego Planning Area**, the San Diego County Flood Control District is responsible for flood management in 4,200 square miles of unincorporated San Diego County. Individual municipalities are responsible for flood management within their jurisdictions. Although flood management is a top priority, the agency’s other responsibilities include water supply, watershed-based recreation, water quality enforcement, and watershed rehabilitation.

### Historic Floods

The South Coast region has seen many floods over the past 200 years. One of the earliest recorded floods occurred along the Santa Ana River in 1810 and washed away adobes. One of the more prominent floods in California history was the “Great Flood” of 1861-62. Heavy flooding during this event inundated a vast majority of the west coast and transformed much of Orange County into an inland sea. This flood event was notable because it occurred during the severe drought of 1856-64 and floodwaters did not recede for 20 days. In 1884, the region experienced an unusually long wet season, receiving rains well into June and more than doubling the seasonal average. The second of two floods that occurred that year inundated the towns of Santa Ana and Orange, and caused the Santa Ana River to cut a new channel to the ocean.
Two floods occurring in 1914 and 1916 shined a significant light on the relationship between urban development in the Los Angeles basin and the flood damage potential of surrounding rivers. In 1914, floodwaters caused over $10 million in damages and took the lives of many people. In 1916, a similar flood event caused significant damage to the Los Angeles area when inadequately sized bridges acted as debris plugs. Following these floods, in 1920, LACFCD built Devil's Gate Dam, the first flood control dam in Los Angeles County. Another significant flood in 1925 was so severe that it altered the course of both the Santa Ana and Los Angeles Rivers. In 1928, the St. Francis Dam, located 40 miles northwest of Los Angeles, catastrophically failed and the resulting flood killed more than 600 people. The collapse of the St. Francis Dam remains the second-greatest loss of life in California's history, after the 1906 San Francisco earthquake and fire. The concrete dam was part of the LAA system.

In 1938, a flood inundating over 250,000 acres caused an estimated $78.5 million in damages and killed 87 people. Flooding in 1969 took the lives of 103 people and caused over $160.1 million in damages to the South Coast region. Due to increased development, the 1969 flood was the worst on record for Ventura, Orange, San Bernardino, and Riverside counties. In 1978, intense storms combined with inadequate drainage systems caused widespread street flooding and forced the evacuation of homes and businesses residing in lower elevations. Damages caused by this event were estimated to be $86 million. In 1980, a powerful series of storms left the region with destroyed homes, washed out bridges and roads, and disrupted utilities. Thousands of people were evacuated from the area and 29 people lost their lives. Los Angeles, Orange, Riverside, San Bernardino, San Diego and Ventura counties were all declared disaster areas by President Carter.
Flood Hazards

Urbanization and encroachment of development onto floodplains predisposes much of the South Coast region to chronic flooding. Major hazards currently facing the region are listed below. Appendix 5 provides a more detailed listing of flood hazards in the region.

- Potential for more destructive floods and debris flows due to wildfire damage
- Many engineered flood control channels lack the capacity to convey a 100-year flood flow
- Flooding is exacerbated by clogged conveyance structures, uncontrolled hillside sheet flow, and foundation pads constructed lower than drainage facilities
- Vegetation growth within unmaintained channels further decreases conveyance volumes
- Excessive sedimentation from hillsides denuded of vegetation by wildfires reduces flood control reservoir capacity
- Several debris basins do not have adequate capacity to capture the anticipated mudflows
- Several dams do not meet current State seismic and spillway requirements

Institutions

Construction of several major flood control projects in the South Coast region has been the responsibility of USACE, with the Natural Resources Conservation Service and other public agencies participating on a much smaller scale. The LACFCD, in cooperation with USACE, constructed and maintains one of the more extensive projects built for a metropolitan area. Maintenance of these flood control facilities is primarily left to local agencies, with the exception of a few structures under the purview of the USACE.

Emergency response is provided under the National Incident Management System and the Standardized Emergency Management System in order of available resources by local agencies, operational area emergency management organizations, Office of Emergency Services (OES) regions, OES headquarters, with the DWR Flood Operations Center and USACE supporting throughout. USACE facilitates recovery of federal facilities; local and private facilities, housing, businesses, and infrastructure depend on local resources and the allocation of event-specific federal or state funds.

Existing Flood Damage Reduction Measures

Flood protection in the South Coast region is sustained through an extensive network of flood control reservoirs, debris basins, flood channels, and levees; land use regulations, flood forecasting, and SEMS; and flood insurance. Major flood damage reductions measures are described below.

The Santa Clara River Project in the Santa Clara/Ventura Planning Area included extension of levees on the Santa Clara River to protect the City of Oxnard and the Port Hueneme Naval Base, and removal of 1,800 feet of concrete-lined channel on Santa Paula Creek and replacement with grouted side-slopes and a natural bottom.

The Arroyo Conejo Creek Flood Control Project, constructed in 1992 in the City of Camarillo, prevented ongoing erosion by Conejo Creek flows of about 200 feet of the stream bank that were threatening major local thoroughfares and utilities.

In the Los Angeles Planning Area, the LACFCD, in cooperation with USACE, constructed one of the largest flood control projects ever built for a metropolitan area. The Los Angeles County Drainage Area Project includes 20 dams, 90 debris basins, 458 miles of modified and concrete-lined flood channels, and 1,424 separate storm drains. Included in this project are the Sepulveda Dam on the Los Angeles River, Hansen Dam on the Tujunga Wash, Santa Fe Dam on the San Gabriel River, and the Whittier Narrows Dam on the San Gabriel and Rio Hondo rivers. LACFCD now operates and maintains 14 major dams (see Appendix 5), 115 debris basins, 525 miles of modified and concrete-lined flood channels, 29 pumping plants, and 2,800 miles of storm drains.

Several projects were developed in the Santa Ana Planning Area to increase flood protection to Orange, San Bernardino, and Riverside counties. The first major project, the Santa Ana River Project, was developed by USACE in two phases: the first phase consisted of the construction of five dams and two channel modifications;
and the second phase involved construction of four channel modifications, three flood control channels, and levees on five waterways. As of 1980, the completed project had prevented an estimated $510 million in flood damages. The Santa Ana Main Stem Project, implemented to further improve flood protection along the Santa Ana River, consisted of seven major components: construction of an earth and rock fill dam; raising the embankment of Prado Dam; widening and deepening the river channel between Prado Dam and the Pacific Ocean; creating a reservoir on Santiago Creek; and widening and deepening three major flood control channels. The Walnut Canyon Creek project, constructed in 1995 by the City of Anaheim, prevented severe bank erosion which threatened to damage a major municipal sewer line by placing riprap on the 700-foot reach.

Increased growth in the San Diego Planning Area has lead to substantial investment in flood control projects. The San Diego River and Mission Bay Project, Escondido Creek Watershed Project, and significant undertakings along the Tijuana River, Sweetwater River, Buena Vista Creek, Los Coches Creek, Telegraph Canyon Creek, and Rose Creek all brought an increased level of flood protection to the City of San Diego and surrounding urban areas.

5-3 Relationship with Other Regions

The South Coast region is a major importer of water supplies from other regions both within and outside of the State. Because these supplies are vital to sustaining the South Coast region, local representatives work closely with other regions to ensure that their local resource needs are met while ensuring the reliability of supply to the South Coast region.

Within the South Coast region, water supply agencies have undertaken strategic regional planning to increase the reliability of local water supplies during normal and dry hydrologic conditions. This effort has resulted in the preparation and execution of water transfer and banking agreements both within and outside of the region. Outside of the South Coast region, environmental and water resource management in the Delta, Colorado River, and Owens River systems affect imported water supply reliability and quality. However, these inter-regional and inter-state linkages go well beyond direct water use. The overall planning direction (i.e., land use development patterns, economic drivers, agricultural production) established in other regions effect water resources available to the South Coast. As a region dependant on others, the South Coast agencies recognize the need to invest in water management strategies in these other regions in order to provide coordinated benefits.

Sacramento-San Joaquin Delta

SWP contractors in the South Coast region – including Metropolitan, CLWA, San Bernardino Valley MWD, VCWPD, SGPWA, and San Gabriel Valley MWD – work with DWR to coordinate delivery of SWP supplies. Due to a series of short-term ecosystem collapses in 2007, including declines in native species and significant loss of habitat, Metropolitan also participates with DWR and other state, federal, and local agencies and environmental organizations in the development of the Bay-Delta Conservation Plan (BDCP). Metropolitan further maintains individual relationships with each of its 26 member agencies for sale and conveyance of SWP supplies, as well as adjacent agencies with which it has storage and transfer agreements (see discussion below).

Significant restrictions were placed on SWP pumping in accordance with the December 2007 federal court imposed interim rules to protect the Delta smelt (Hypomesus transpacificus). Additionally, the inherent annual variability in location, timing, and amount of precipitation in California introduces uncertainty to the availability of future SWP deliveries. In June 2008, the Governor issued Executive Order S-06-08 declaring a statewide drought, which directed State agencies and departments to take immediate action to address serious drought conditions and water delivery reductions. Solutions developed to address environmental and drought-related concerns, including conservation and restoration efforts associated with the BDCP, will continue to impact future SWP exports. Other important factors that impact supply reliability include the vulnerability of Delta levees’ to failure due to floods and earthquakes, as well as long-term management and maintenance of SWP conveyance infrastructure. As the regional SWP wholesaler, Metropolitan is continuing to develop closer
relationships with DWR and other State agencies to deal with fundamental Delta issues including environmental protection and levee rehabilitation.

**Colorado River System**

Metropolitan and USBR have been working together for many decades to manage Colorado River deliveries, including drought allocation planning and salinity management. Allocations and diversions of Colorado River water function within the legal and administrative rules known as the “Law of the River” (see Chapter 2, Regional Water Setting). With full implementation of the programs identified in the QSA, Metropolitan expects to be able to annually divert 852,000 AFY of Colorado River water plus any unused agricultural water that may be available. With continuation of the current drought, however, the South Coast’s reliance on diversions of excess Colorado River water (such as wet-year flows and allocated but unused supplies) will place substantial pressure on regional water availability.

Metropolitan will continue to collaborate with USBR to ensure the reliability and quality of Colorado River supplies. Although agricultural water conservation and transfer agreements (described below) will increase the volume of water available to the South Coast region via the CRA, further development of local supplies will be necessary to defend against future shortages.

**Owens Valley/Mono Basin**

The City of Los Angeles and Inyo County have historically had a poor relationship. The overall Owens Valley ecosystem was dysfunctional for many decades because of LAA water diversions in excess of ecosystem function (i.e., lake and river surfaces were lowered to extreme levels). Following more than 24 years of litigation over groundwater pumping and water exports, the Inyo/Los Angeles Long Term Water Agreement and MOU has resulted in improved conditions.

The Lower Owens River Project, considered one of the most ambitious river restoration projects in the West, is currently underway. The Owens Valley is gradually being restored to a functional ecosystem as river reaches in the Owens Gorge and the Lower Owens River are re-watered. LADWP is working with Inyo County and other stakeholders on numerous restoration projects, including in-stream flow management in Rush and Lee Vining Creeks, restoration of Mono Lake water surface level, riparian restoration on Convict and McGee Creeks, and stabilization of the Owens Lake bed. Meanwhile, LADWP is looking into other ways to offset environmental water supplies, including water banking.

**Other Water Storage and Transfers**

South Coast agencies continue to build relationships with other areas of the State via various storage and transfer programs. Under many of the storage and exchange agreements, imported water supplies are banked in groundwater aquifers in neighboring regions. These agreements are an essential component of the region’s overall strategic planning to meet peak demand during the dry season.

Metropolitan has agreements with the Semitropic and Arvin-Edison Water Storage Districts which can result in the delivery of 197,000 AF to Metropolitan over a 10-month period. Metropolitan can store portions of its SWP entitlements in the groundwater basins managed by these agencies during wet hydrologic conditions and retrieve the supplies when conditions are dry. Metropolitan’s program with the San Bernardino Valley MWD yields between 20,000-80,000 AF during dry years and permits Metropolitan to store up to 50,000 AF of transfer water supplies in its groundwater basin. Metropolitan’s programs with the Kern-Delta Water District and Mojave Water District operate in a similar manner. Dry year yields for Metropolitan are 50,000 AF and 35,000 AF respectively.

In addition to exchange agreements, Metropolitan is partnering with the Coachella Valley Water District (CVWD) and Desert Water Agency on an advance delivery agreement. The agreement allows Metropolitan to deliver exchange water in advance of receiving CVWD’s and Desert Water Agency’s SWP water. Metropolitan releases Colorado River water into the Whitewater River in Riverside which flows into the Coachella Valley and deep percolates in the groundwater basin. During dry hydrologic conditions, Metropolitan can take the CRA and
SWP supplies for its partners until the banked water supplies are used. Through 2004, 177,400 AF was banked in the groundwater basin.

CLWA has executed a long-term transfer agreement for 11,000 AFY with the Buena Vista and Rosedale-Rio Bravo WSDs. These two districts, both located in Kern County, joined together to develop a program that provides both a firm water supply and a water banking component. The supply is based on existing long-standing Kern River water rights, which would be delivered by exchange of SWP supplies.

Additionally, the Governor’s Water Bank was developed in 1991 to facilitate the exchange of water throughout the State. DWR purchases water from willing sellers upstream of the Sacramento-San Joaquin Delta and conveys it via the SWP or Central Valley Project to water suppliers that need to augment supplies and lessen the severity of drought impacts. The sellers make water available to the Water Bank through reservoir releases above normal conditions, groundwater substitution, cropland idling, and crop substitution (DWR 2008a).

In 1998, SDCWA entered into a transfer agreement with IID to purchase conserved agricultural water. Through the agreement, SDCWA will receive an annually-increasing volume up to 200,000 acre-feet by 2021. The volume then remains fixed for the duration of the 75-year agreement.

In 2003, the QSA resulted in the movement of supplies between the Colorado River and South Coast regions. SDCWA was assigned rights to 77,000 AFY of water that will be conserved through lining of the All-American and Coachella Canals in Imperial County. Another 16,000 AFY of water conserved with the lining of the All-American Canal will go to the San Luis Rey Indian Water Rights Settlement Parties.

### 5-4 Regional Water and Flood Planning and Management

Over the past decade, the South Coast region has improved water supply reliability in the face of uncertainty regarding import volumes available from the SWP, CRA, and LAA. Coordinated planning efforts within the region have enabled local agencies to develop partnerships, joint projects, and conservation programs to address these concerns. New issues such as the impact of climate change on water resources, replacement of aging water infrastructure, and the recent court ruling on pumping from the Delta will require the region to continue with these planning activities.

#### Integrated Regional Water Management

For the past several years, the number of IRWM planning efforts has grown. Water supply, wastewater, and flood control agencies, local jurisdictions, and environmental organizations now collaborate in the development of strategic regional plans to give them the necessary water management tools and planning practices to improve and optimize local water resources.

The region is currently engaged in 11 IRWM planning efforts that empower stakeholders to collaboratively develop integrated water management solutions: Watersheds Coalition of Ventura County IRWMP (2006), Upper Santa Clara River IRWMP (2008), Greater Los Angeles County IRWMP (2006), SAWPA (One Water One Watershed) IRWMP (2005), Central Orange County IRWMP (2007), South Orange County IRWMP (2006), Upper Santa Ana River IRWMP (2007), San Jacinto River Watershed IRWMP (2007), Western MWD IRWMP (2006), Upper Santa Margarita IRWMP (2007), and San Diego IRWMP (2007) (Figure 5-9). Two additional groups are currently involved in developing IRWM Plans: Northern Orange County IRWM and Gateway Cities IRWM. The main water issues identified by the South Coast’s IRWM plans include:

- Continued population growth and associated water demand
- Significant reliance on imported water supply
- Salinity management in groundwater, imported water, and recycled water sources
- Expansion of water recycling and brackish desalination
- Acceleration of erosion and sedimentation by agriculture and urbanization
- Water quality degradation due to urban runoff, including impacts on sensitive coastal habitats
- Flood control within lowlying areas, particularly in existing disadvantaged communities
- Loss of critical habitats for endangered and threatened species

Figure 5-9 IRWM Planning Efforts within the South Coast Region

To address the region’s water resources challenges, each IRWM Plan identifies plan objectives and water management strategies to be implemented through regional partnerships (Table 5-6). Selected water management strategies are generally in keeping with those listed in the California Water Plan Update 2005 and Proposition 50 IRWM Program Guidelines. Many of the water management strategies are complementary and may be integrated to avoid duplication of effort, address common issues, provide for cost savings, and optimize attainment of IRWM Plan goals and objectives.

Through its IRWM efforts, the South Coast has developed numerous projects that provide for both geographic and water management strategy integration. Additionally, most projects are the result of multi-agency collaboration. The makeup of each IRWM planning region in this hydrologic region is unique and reflects the water management priorities and stakeholder relationships specific to that region. Regardless of their stage of development, each IRWM region represents an extensive endeavor to meet regional water needs and the new paradigm of water resource planning.
Table 5-6 Integrated Regional Water Management Plan Objectives in the South Coast Region

<table>
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<tr>
<th>Plan Objectives</th>
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<tr>
<td>• Water supply reliability</td>
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<tr>
<td>• Diversify water supply sources</td>
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<tr>
<td>• Protect and improve water quality</td>
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<tr>
<td>• Flood management and protection</td>
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<tr>
<td>• Protect and restore wildlife habitats/ ecosystems</td>
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<td>• Provide recreational, public access, and</td>
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<td>educational opportunities</td>
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<td>• Balance groundwater management</td>
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<td>• Maximize water storage</td>
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<td>• Promote water use efficiency</td>
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Accomplishments

The South Coast has a long history of regional water management and planning that has helped form the backbone of its current system. As the State’s water resources continue to become more precious, the South Coast has continued to make significant regional accomplishments. These include the following.

**Integrating Water Management Efforts.** Recent developments in IRWM planning and collaboration have expanded the development of strategic, multi-benefit projects that meet regional water demands, improve water quality, and enhance environmental functions. Coordination of numerous stakeholders in development of the IRWM plans has been one of the biggest successes in the region. As a result, South Coast agencies acquired $135 million in Proposition 50 grant funding for local water resources projects.

**Diversifying Supplies.** As demonstrated in Box 5-4, the South Coast has clearly succeeded in diversifying its water supply sources over the last decade. Environmental and drought concerns have reduced imported water supplies, while local agencies have expanded local groundwater production, water recycling, and surface storage. Water transfers, banking, and conservation programs have further contributed to supply reliability.

**Box 5-4 Comparison of 1998 and 2005 Water Supply Portfolio for South Coast**

Reducing Water Demands. DWR, SWRCB, and 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. Metropolitan and its member agencies have developed a robust inter-regional...
water conservation and efficiency program, and the CCP further assists member agencies in pursuing urban BMPs and other demand management opportunities. The 2007 Blueprint for Water Conservation was a San Diego regional partnership to for increasing conservation. In tandem with these urban conservation efforts, Metropolitan and IID entered into an agricultural water savings program.

**Increasing Local Surface Storage.** South Coast agencies are developing partnerships for reservoir construction, reoperation, and maintenance in order to meet water demands. The Carryover Storage and San Vicente Dam Raise project is a joint project by SDCWA and the City of San Diego to raise the existing dam at San Vicente Reservoir to provide additional capacity.

**Replenishing Groundwater.** As a result of Metropolitan’s Groundwater Replenishment program, there are currently 14 conjunctive use programs being implemented by local water agencies. Eleven dams were constructed as part of the San Gabriel River and Montebello Forebay water conservation system to impound storm water runoff for groundwater recharge. The Vern Freeman Diversion and Pumping Trough Pipeline in Ventura County provides a means to capture high flows in the Santa Clara River and provide recharge to groundwater basins on the Oxnard Plain.

**Desalting Brackish Supplies.** There are 19 brackish groundwater recovery programs currently being implemented in the region. Some of these programs have multiple facilities in operations. The Calleguas MWD Salinity Management Project is a 35-mile pipeline that provides disposal of tertiary treated effluent for five WWTPs and brine disposal for seven groundwater desalters. SAWPA’s 30 MGD capacity SARI pipeline conveys desalter brine to OCSD for treatment and then discharge to the ocean. Further, several agencies within the South Coast are pursuing design, engineering, and environmental review for seawater desalination facilities.

**Recycling Water.** Progress continues on the start-up or augmentation of water recycling programs in the region. The IEUA is finalizing a strategic business plan that will expand the use of recycled water supplies within its service area. West Basin MWD’s Edward Little Water Recycling Facility in El Segundo recently completed its Phase IV Expansion, which increased production of recycled water. IRWD is planning for expansion of its recycled water treatment and delivery system to meet expected recycled water demand at buildout. Further, IPR is being pioneered through various groundwater recharge and reservoir augmentation projects – the San Diego City Council recently authorized a demonstration IPR/reservoir augmentation project.

**Controlling NPS Pollution.** Local agencies are continuing to collaborate with RWQCBs on NPS pollution prevention, including development of public outreach campaigns to reduce pollutant loading as well as LID for more sustainable storm water management.

**Managing Flood and Emergency Hazards.** Major flood control accomplishments in the region include the adoption of Hazard Mitigation Plans in 2004 and 2005 by all six counties. The LACFCD, in cooperation with USACE, constructed the Los Angeles County Drainage Area Project including 20 dams, 90 debris basins, 458 miles of flood channels, and 1,424 separate storm drains. The Santa Ana River Project, developed by USACE, consisted of five dams, three flood control channels, and levees on five waterways. Local agencies have also established partnerships to construct emergency connections in order to ensure water supply deliveries during major emergencies.

**Challenges**

With the South Coast metropolitan region and population projected to continue growing, water resources challenges will continue to grow. These include the following.

**Resource Development.** Water districts throughout the South Coast are engaged in integrated urban water management and groundwater planning. Decisions regarding development and expansion of other water supplies, such as recycled water and ocean desalination, will require more rigorous analysis of costs and tradeoffs between options.

**Drought.** Drought is a constant concern for water districts in the South Coast region. A drought simulation developed by Harding et al. (1995) indicated that, under current management practices, a severe sustained drought would heavily impact the Colorado River. In some months, stretches of river would be completely dry.
in order to maintain reservoir storage elsewhere in the system. Potential repercussions of drought on imported water reliability have led to an emphasis on the development of local supplies and demand management strategies. Further, given the uncertainty of water imports in the future, local agencies are aggressively developing local alternatives and transfer agreements.

**Climate Change.** Global climate change is expected to impact the South Coast region through changes in Statewide precipitation and surface runoff volume. More extreme storm events may exceed reservoir storage capacity and therefore result in allocated water supplies discharged to the ocean. Sea level rise may impact local aquifers and Delta water quality via seawater intrusion, as well as impact local coastal water and wastewater infrastructure. All of these uncertainties related to climate change could potentially reduce delivery of imported supplies and the ability of local agencies to meet South Coast water demand.

**Sustainability.** With a new paradigm that water resources management is a major component to sustainable development for the State, an overarching emphasis must be placed on the concept of integration in all water resource planning efforts. As water supply development is considered, the energy and greenhouse gas emission impacts must be addressed to assure that proposed water development projects are sustainable for the future.

**Environmental Concerns in Delta.** Uncertainty about the availability of imported water supplies from the Delta through the SWP is of primary concern to the South Coast region. A federal court found that a 2004 biological opinion by the USFWS does not adequately protect sensitive fish populations when authorizing long-term operations of the State and federal water projects. Further, significant restrictions were placed on SWP and CVP pumping in accordance with the December 2007 federal court imposed interim rules to protect the Delta smelt (*Hypomesus transpacificus*). Metropolitan and other stakeholders are reviewing the impact of the ruling and possible future solutions.

**Groundwater Overdraft.** Groundwater overdraft and lower groundwater levels are further water supply challenges to the region. Historically, agricultural, industrial, and urban development has led to increased groundwater pumping from many of the region’s basins. Natural recharge is typically insufficient to maintain basin water levels and current pumping levels due to the extent of impervious surfaces and the presence of clay soils. 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.

**Runoff Management.** Surface water quality issues in the region are dominated by storm water and urban runoff, which contribute contaminants to local creeks and rivers, lagoons, beaches, and bays. Shipping can also influence water quality, especially in San Diego Bay and the Long Beach and Los Angeles harbors, where there are toxic sediment hot spots. The Chino Basin faces substantial nutrient loading impacts from dairy farming, thereby impacting groundwater quality and downstream Santa Ana River quality.

**Salinity.** Salinity in both local and imported supplies will continue to be a challenge for local water agencies. Salinity sources in local groundwater supplies include concentration from agricultural tailwater, imported water, seawater intrusion, discharge of treated wastewater, and recycled water. Higher levels of treatment are also needed following long-range import of water supplies, as TDS levels are increased during conveyance. High salinity levels and perchlorate contamination contribute to degraded Colorado River supplies. Seawater intrusion and agricultural drainage threatens to increase the salinity of SWP supplies. The long-term salt balance of the region’s groundwater basins is an increasingly critical management issue. Abandoned groundwater basins, due to high salinity levels, have only recently been restored through brackish water desalting projects.

**Water Recycling.** Public health and environmental concerns have grown with the expansion of water recycling programs in the South Coast region. Concerns are generally related to TDS levels and the presence of pharmaceuticals, household products, and other emerging contaminants in treated wastewater. The high salinity of imported Colorado River water limits the number of times water can be reused and wastewater can only be discharged to the ocean. Additionally, some inland water districts that use recycled water also have salt accumulation problems in their groundwater basins because they lack an ocean outfall or stream discharge. Increased use of recycled water and marginal quality groundwater supplies during droughts can result in water quality problems that endanger future water management projects.
Flood Control Infrastructure. Major challenges include maintenance of 100-year flood protection where it has been provided throughout the South Coast in light of continued urbanization and climate change. Major flood control projects in the Los Angeles, San Gabriel, and Santa Ana areas are threatened as urbanization in the upper watersheds adds to storm volumes. Flood control agencies are also faced with aging infrastructure and the costs to repair, rehabilitate, or replace such facilities. Regulatory hurdles further extend the processing time and mitigation costs for routine maintenance of earthen flood control facilities. Finally, adequate evaluation is needed of the long-term secondary impacts of environmental enhancements proposed for integration into flood control projects.

Higher Costs. SWP contractors pay for the cost of constructing and operating facilities which store and convey SWP water supply, plus a transportation charge which covers the cost of delivery facilities. Thus, contractors located in the South Coast pay higher transportation charges than those near the Delta. Metropolitan’s 2009 Tier 1 rates for treated water total $579/AF and recovers the costs of purchasing, pumping, and delivering SWP and CRA supplies, as well as a surcharge for purchase of additional water transfers.

Drought and Flood Planning

The South Coast region is subject to severe repercussions from extreme weather events. Drought conditions both within and outside of the region can substantially limit water availability to urban and agricultural users. In contrast, extreme precipitation events can result in sudden and severe flooding and mud flows. This unusual paradox of concurrent drought and flooding is being addressed by the South Coast region’s integrated regional planning efforts.

Drought Planning

Drought planning in the South Coast region is being conducted in coordination with State agencies, per the Governor’s Executive Order S-06-08 declaring a statewide drought. Metropolitan’s Water Supply Allocation Plan (2007) provides a formula and implementation plan for equitable regional allocation of water supplies during times of shortage. The objectives, mechanics, and policy aspects of the Allocation Plan were developed in coordination with member agencies.

In 2007, SDCWA adopted a Drought Management Plan that outlined a series of potential actions to take when faced with a shortage of imported water supplies from Metropolitan due to drought conditions. Further, SDCWA adopted a model Drought Response Ordinance in March 2008. SDCWA member agencies will be asked to use the model ordinance in updating their own codes to help provide consistency in drought response levels and water conservation requirements throughout the region. A Drought Management Committee has been formed in the Upper Santa Clara watershed to address the need to comprehensively respond to the current drought. Water agencies and cities within Ventura County are working together to coordinate their disaster and drought preparedness efforts.

Flood Planning

Most flood control districts in the South Coast region incorporate flood planning as a component in their flood management strategy. As described above, regional flood protection is sustained through an extensive network of flood control reservoirs, debris basins, flood channels, and levees; land use regulations, flood forecasting, and SEMS; and flood insurance. All counties in the region use the ALERT system to notify the public of impending flood hazards. The Disaster Mitigation Act of 2000 required development of Hazard Mitigation Plans, which emphasize community partnerships in planning for and responding to disasters; assessing strategies for reducing risks; and identifying capabilities and resources for addressing various hazards. Each county in the South Coast region has an adopted Hazard Mitigation Plan.

FloodSAFE California is a strategic initiative, recently developed by DWR, to guide the development of regional flood management plans. Regional flood management plans will include flood hazard identification, risk analyses, review of existing measures, and identification of potential projects and funding strategies. The plans will emphasize multiple objectives, system resiliency, and compatibility with State goals and IRWM plans. Several other groups in the South Coast are addressing flood management programs and issues at the
local level. VCWPD staff is currently looking into an integrated surface water and groundwater model of the entire County as an element of the IRWM Plan. The model would facilitate implementation of a real-time flood forecasting, alert emergency personnel on impending flood flows, and calculate the water budget for all of the County’s rivers/creeks and aquifers.

5-5 Looking to the Future

With a growing population, drought conditions in many parts of the West, and an aging infrastructure system, water resource managers will be focusing on three important areas: protection of imported water supplies; increased development of local water resources; and creation of integrated flood control projects.

Protection of Imported Supplies. Protection of imported water supplies is essential for South Coast agencies. Continued partnerships with DWR, USBR, and other State and regional agencies are necessary to ensure that the Delta, Colorado River basin, and Owens Valley ecosystems are managed in such a way that allows for successful allocation of water supplies. Effective salinity and water quality management will also be necessary to ensure that imported supplies are usable. Further, South Coast agencies are moving forward with plans to operate conjunctive use programs in local groundwater basins. South Coast water agencies are storing discount-priced imported water during winter months into groundwater basins and increasing their groundwater use during summer and drought periods. Metropolitan will continue its Groundwater Replenishment program to encourage local agencies to store imported water in groundwater basins for use during the summer and during drought years.

Development of Local Supplies. Due to uncertainties related to imported supplies, South Coast agencies are also aggressively pursuing development of local supplies. In 2002 and again in 2006, California’s voters approved water bond packages to help address the State’s water crisis and ensure clean, safe water for generations to come. Funding from these bonds will support a variety of local water management efforts including implementation of water conservation programs, expansion of water reclamation plants and conveyance systems, construction of desalination facilities, and restoration of streams, wetlands, and lagoons. Brackish groundwater and ocean desalination will likely serve an important role in the solution to southern California’s water supply shortfall. Metropolitan and five member agencies are planning for the potential development of up to 300 MGD of desalinated seawater. Further, the Southern California Water Recycling Initiative – a joint effort by DWR, USBR, and 10 local agencies – will continue a multi-year planning study that evaluates the feasibility of a regional water-recycling plan and identifies short-term projects to increase recycled water supplies. The Initiative projects recycled water demand to increase between 615,700 AF in moderate reuse conditions and 1.0 MAF under maximum reuse conditions by 2040.

Creation of Integrated Flood Control Projects. Finally, the South Coast will continue pursuing development of integrated projects that achieve flood management, improve runoff water quality, and protect environmental resources. Flood control reservoirs are becoming valuable for their potential to provide all three benefits, as well as water supply benefits through reoperation to enhance groundwater recharge. LACDPW is completing a study, in cooperation with the USACE, to reauthorize four USACE flood control facilities in Los Angeles County for the purpose of capturing 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 to explore the challenge of capturing storm water for infiltration, in terms of groundwater quality and quantity.

Most of the South Coast’s future supply projects will be designed to improve water quality as the means to develop new water supplies. These include watershed protection activities, groundwater desalination, use of highly treated recycled water, 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. Ground and surface water treatment and reuse is the future of water management in the South Coast.
Future Scenarios

*DWR to complete (based on Vol 1).*

**Climate Change**

Global climate change is expected to impact the South Coast region through changes in Statewide precipitation and surface runoff volumes, and therefore availability of local surface and imported water supplies. Additionally, sea level rise is expected to degrade Delta water quality and impact coastal water and wastewater infrastructure, requiring substantial capital investments by local agencies. All of these uncertainties related to climate change could potentially reduce the ability of local agencies to meet South Coast water demand.

Model simulations run using the Intergovernmental Panel on Climate Change’s twenty-first century climate scenarios suggest increasing temperatures in California, with greater increases in the summer (Cayan 2008). Changes in annual precipitation across California may result in changes to surface runoff timing, volume, and form. By the end of the century, the Sierra Nevada snowpack is expected to decline as warmer temperatures raise the elevation of snow levels, reduce spring snowmelt, and increase winter runoff. Locally, climate change is expected to result in hotter summer months and more extreme winter storms. Winter runoff may result in flashier flood hazards, with flows potentially exceeding reservoir storage capacity and resulting in discharges to the ocean. Higher flow volumes may scour stream and flood control channels, degrading aquatic and riparian habitats already impacted by shifts in climate. Further, hotter summer temperatures would increase wildfire hazards in the arid South Coast region. Additionally, changes in climate and runoff patterns may create competition between sectors. The agricultural industry’s demand could increase due to higher evapotranspiration rates caused by increased temperatures. Environmental water supplies would need to be retained in reservoirs for management of in-stream flows necessary to maintain habitat for aquatic species throughout the dry season. For the South Coast, this would likely result in reduced supplies available for import through the SWP during the non-winter months (California Climate Change Portal 2008; Cayan 2008; Hayhoe 2004).

Impacts resulting from extreme sea levels associated with tides, winter storms, and other episodic events would be superimposed on the higher sea level. This rise could heavily impact the South Coast through inundation of low lying areas, causing severe coastal flooding and erosion, increased salinity in the Delta, damage to coastal structures, and damage to coastal marshes and wildlife reserves (Cayan 2008; California Climate Change Portal 2008). Additionally, higher sea levels would exacerbate current seawater intrusion issues in South Coast groundwater aquifers. A USGS study on the vulnerability of the West coast to sea level rise shows the South Coast area as being in the moderate to very high vulnerability range (Thieler 2001).

The State has mandated through Assembly Bill 32 that GHG emissions be reduced to 427 million metric tons of CO2 by 2020. One way the State is looking to meet this mandate is by examining California’s water supply system, tasked to the Water-Energy Subgroup of the Climate Action Team (WET-CAT). Further development of alternative local supplies throughout the South Coast region will reduce GHG generation associated with long-distance conveyance. The South Coast region already implements numerous conservation, groundwater management, and water recycling programs which further reduce import volumes.

**Response Strategies**

*DWR to complete (based on Vol 2).*

A key objective of the *California Water Plan* is to present a diverse set of resource management strategies to meet the water related resource management needs of each region. Management strategies can be integrated in various ways to fit the objectives and values of different regions and to achieve multiple resource benefits. The South Coast region implements virtually all 31 of the State’s resource management strategies to some extent.
The South Coast region has identified the following “emerging strategies” (i.e., growth sectors) for meeting water demands in the coming decade:

1. **Water Conservation.** Water conservation is a fundamental component of the region’s water diversification plans. Local agencies have engaged in aggressive urban and agricultural conservation programs.

2. **Water Transfers.** The development water transfer and exchange agreements with neighboring water agencies are a key tool for future water management.

3. **Conjunctive Management and Groundwater Storage.** Numerous conjunctive management programs are underway to better manage the reliability of water supplies within the South Coast’s dry summer months. Protection of recharge and spreading grounds is key for meeting future demands.

4. **Recycled Municipal Water.** Water recycling has the potential to increase the reliability and availability of water supply at the local/regional scale at a reduced cost.

5. **Desalination – Brackish and Seawater.** Desalination is an emerging technology that can increase potable water supplies by reclaiming brackish groundwater or seawater for municipal use.

6. **Urban Runoff Management.** The most urbanized region in the State, the South Coast clearly grapples with managing urban runoff quantity and quality.

**Implementation Next Steps**

*DWR to complete.*

**5-6 Water Portfolios from 1998–2005**

*DWR to complete.*

**5-7 References**


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