SAN DIEGO
Integrated Regional
Water Management

Section B
DESCRIPTION OF REGION

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B. DESCRIPTION OF REGION

***Section B Summary** – The San Diego Region (Region) comprises eleven parallel and similar hydrologic units that discharge to coastal bays, estuaries, or lagoons. The regional boundaries were selected primarily on the basis of water quality regulatory jurisdictional boundaries and political boundaries. Other factors that influenced IRWM Plan boundary selection included similarities in hydrology and watershed characteristics, a common imported water supply, and similarities in wastewater service. Coastal areas of the Region are urbanized, but significant open space exists in upstream areas of the Region's hydrologic units. The Region is home to numerous endangered species, and Multiple Species Conservation Program Plans have been developed to provide for the protection of important habitats. Precipitation and streamflows are highly seasonal. Primary constituents of concern for the Region's surface waters include coliform bacteria, sediment, nutrients, salinity, metals, and toxic organic compounds. Depending on hydrologic conditions, imported water supplied by the Water Authority typically comprises 70 to 90 percent of the Region's water supply. Water conservation, local surface waters, groundwater, and recycled water comprise the remaining supply. The Region's water agencies have targeted increasing local supplies as a key element in meeting future regional water demands.*

B.1 Defining Boundaries for the Region

The San Diego Region (Region) as defined by this IRWM Plan consists of eleven parallel and similar hydrologic units within the County that discharge to coastal waters. Figure B-1 (following page) presents the eleven hydrologic units that comprise the region. The regional boundaries were selected primarily on the basis of water quality regulatory jurisdictional boundaries and political jurisdictional boundaries. Other factors that influenced IRWM Plan boundary selection included similarities in hydrology and watershed characteristics and a common imported water supply.

Appropriateness of Region. The Region is appropriate for regional water management. The selected regional boundaries take into account Regional Board jurisdiction, political jurisdictions, physical and hydrologic characteristics, the imported water supply service area, and wastewater service considerations.

Regional Board Jurisdiction. The Region is entirely within the jurisdiction of the San Diego Regional Board (designated as Region 9 among California's Regional Boards). Water quality and wastewater discharges within the Region are regulated by policies and regulations established in the Regional Board's *Water Quality Control Plan for the San Diego Basin* (Basin Plan). Ocean and marine water quality is regulated by policies and regulations established in the Basin Plan (Regional Board, 1994), Ocean Plan (2005), and Enclosed Bays and Estuaries Plan (1991).

Note on Terminology: Watersheds, Hydrologic Units, Hydrologic Areas, and Watershed Management Areas (WMAs)

A watershed is an area of land that drains downslope to a common point. A hydrologic unit (HU) is a drainage area delineated by DWR that may include one or more individual watersheds. A hydrologic unit is subdivided into hydrologic areas (HA), each of which may represent one or more watersheds.

The San Diego Region is comprised of eleven DWR-designated hydrologic units, four of which (San Juan, Carlsbad, Peñasquitos, and Pueblo) are comprised of several smaller parallel watersheds that drain to common coastal waters. Seven of the Region's hydrologic units constitute watersheds for the Region's primary rivers: Santa Margarita, San Luis Rey, San Dieguito, San Diego, Sweetwater, Otay, and Tijuana.

The Regional Board defines a watershed management area (WMA) as a drainage area that may include one or more hydrologic units or watersheds. As designated by the Regional Board, three hydrologic units (Pueblo, Sweetwater, and Otay) are combined to form the San Diego Bay WMA. The Peñasquitos HU is comprised of the Mission Bay WMA and the Los Peñasquitos WMA. The Region's remaining seven hydrologic units constitute their own individual WMAs.

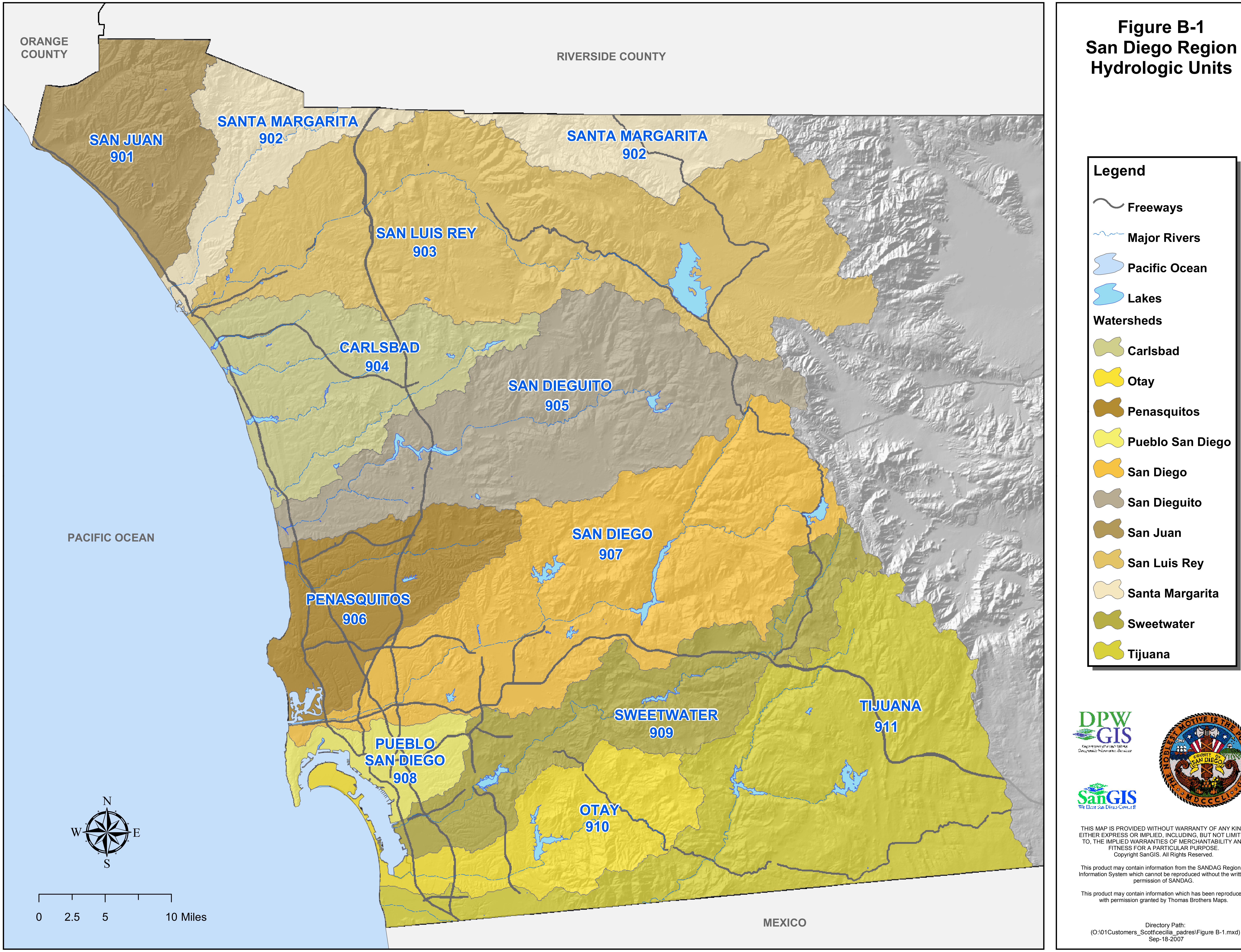
Municipal stormwater runoff within the Region is regulated through a single National Pollutant Elimination Discharge System (NPDES) Municipal Separate Storm Sewer System Permit (MS4 Permit) issued by the Regional Board to 21 copermittees. Two of the three RWMG agencies (the County and City of San Diego) comprise the largest land area among the 21 regulated copermittees.

The Regional Board's jurisdiction includes the southern portions of Orange and Riverside Counties. The IRWM Plan boundaries, however, are limited to the County on the basis of political jurisdictions, development and land use trends, land use regulatory authority, water supply, and stormwater regulation and control. (See insert on next page.)

Political Jurisdictions. The Region is located entirely within the County. The County is comprised of five Board of Supervisor Districts, each represented by one elected official. Districts 1, 3, and 4 are entirely within the Region, and approximately the western two-thirds of Districts 2 and 5 are within the Region.

Through authorities delegated by the California Department of Health Services, the County maintains local regulatory oversight within the Region on drinking water wells, monitoring wells, small water systems, recycled water use, and the beach recreational water quality program. The County also regulates on-site wastewater systems through an agreement with the Regional Board.

Figure B-1
San Diego Region Hydrologic Units



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Eighteen incorporated municipalities exist within the Region, including the Cities of Carlsbad, Chula Vista, Coronado, Del Mar, El Cajon, Encinitas, Escondido, Imperial Beach, La Mesa, Lemon Grove, National City, Oceanside, Poway, San Diego, San Marcos, Santee, Solana Beach, and Vista.

Physical and Hydrologic Characteristics. Each of the Region's east-west trending hydrologic units flows from elevated regions in the east toward coastal lagoons, estuaries, or bays in the west. Each of the hydrologic units features similar habitats at similar elevations, and share habitat restoration and protection needs. A significant majority of the volume of surface flow in each of the hydrologic units is comprised of runoff from seasonal precipitation that predominantly occurs during the winter and spring months. Surface flows during summer and fall months are typically low, and consist of urban runoff, agricultural runoff, and surfacing groundwater. Each of the hydrologic units has similar water quality characteristics and faces similar water quality problems.

Rationale for Exclusion of South Orange County and South Riverside County from the San Diego Region IRWM Plan Boundaries

- Riverside County and Orange County are governed by different land use regulations than San Diego County, and development trends in South Riverside County are different than in San Diego County.
- South Riverside and Orange Counties are in different regional planning spheres than San Diego County.
- South Orange County has developed an IRWM Plan and South Riverside County is developing an IRWM Plan.
- Separate stormwater permits regulate MS4s within Riverside and Orange Counties. Stormwater compliance measures, monitoring programs, and best management practices and controls used in Orange and Riverside Counties vary from those used by San Diego County.
- The imported water supplies served to South Orange County and portions of South Riverside County are from a different combination of sources than the imported supply served by the Water Authority.
- Local supply represents a significant portion of the water supply in portions of South Riverside County, and the quality of this supply differs from the Water Authority's imported supply.
- A bedrock constriction prevents the subsurface movement of groundwater between the upper Santa Margarita River basin (Riverside County) and the lower Santa Margarita River basin (San Diego County).
- Wastewater generated within South Riverside County is either locally recycled or is exported to the Santa Ana River basin; South Riverside County (unlike San Diego County) has no connection to regional ocean outfall disposal systems.
- Ongoing lawsuits between San Diego County and Riverside County agencies over water rights, wastewater disposal practices, and water quality limit the opportunities for inter-County information transfer and project coordination.
- The RWMG and RAC have initiated efforts to coordinate (see Section O) San Diego Region IRWM issues with South Orange County and South Riverside County IRWM efforts.

Imported Water Supply. Imported water supplied by the Water Authority is the predominant source of supply within the Region. The Region's imported water supply infrastructure crosses watershed and jurisdictional boundaries and requires coordination among local agencies and entities to address water supply, water quality, and habitat issues. This broader perspective promotes funding for regional projects and increases the economy of scale for the Region's water supply, water quality, and watershed projects.

Stormwater Regulation. MS4 regulation within the Region is under a single Regional Board NPDES permit (Order No. R9-2007-0001, NPDES CAS0108758).

Future IRWM Plan Boundary Considerations. Input received as part of the stakeholder outreach process included suggestions that the region be expanded to include portions of the County that are tributary to the Colorado River (and under the jurisdiction of the Colorado River Basin Regional Board, Region 7). This area may be considered for inclusion into future versions of this IRWM Plan with concurrence of all applicable parties.

Separate IRWM planning efforts have been initiated in South Orange County, South Riverside County, and a portion of eastern San Diego County that is within the jurisdiction of the Colorado River Regional Board (Region 7). As described in Section O, the RWMG and RAC have established contacts to coordinate this IRWM Plan with these adjacent IRWM planning efforts.

B.2 Regional Overview

Population. The Region addressed by this IRWM Plan includes all but a small fraction of the County's population. Table B-1 (page B-5) presents existing and projected population within the County and Water Authority service area. Table B-1 also presents a population breakdown by ethnicity and age. As shown in Table B-1, population within the region is projected to increase by approximately 28 percent by the year 2030.

Table B-1 also illustrates that all but a fraction of the County's population is within the Water Authority service area. As documented later in this section, the portion of the County's population outside the Water Authority service area is dependent on local groundwater supply.

Social and Cultural Makeup of the Regional Community. The Region is culturally diverse, and features national and ethnic communities from throughout the world. The Region features large and active national and/or ethnic communities from Mexico, Central and South America, the Caribbean, Africa, Europe, former Eastern bloc nations, the Middle East, India, China, Southeast Asia, and the Pacific Islands.

Table B-1
Existing and Projected Population[1]

Category	Demographic Parameter	2005[2]	2010	2020	2030
Population (millions)	Water Authority Service Area[3]	2.95	3.11	3.41	3.70
	San Diego County[3]	3.01	3.21	3.53	3.86
San Diego County Population Breakdown by Age	Percent of Population Age 0-19	28 %	27 %	25 %	24 %
	Percent of Population Age 20-40	31 %	30 %	29 %	27 %
	Percent of Population Age 40-65	30 %	31 %	31 %	29 %
	Percent of Population Age 65+	11 %	11 %	15 %	19 %
	Median Age (years)	34.1	35.1	37.1	38.9
San Diego County Population Breakdown by Ethnicity	Percent White	51 %	48 %	44 %	40 %
	Percent Hispanic	29 %	31 %[4]	34 %[4]	37 %[4]
	Percent Asian	9.2 %	9.6 %[4]	9.7 %[4]	9.5 %[4]
	Percent Pacific Islander	0.9 %	1.3 %[4]	1.7 %[4]	1.7 %[4]
	Percent Black	5.3 %	5.2 %[4]	5.2 %[4]	5.1 %[4]
	Percent Native American	0.5 %	0.5 %[4]	0.5 %[4]	0.5 %[4]
	Percent Other/Mixed	3.6 %	4.1 %[4]	5.1 %[4]	6.2 %[4]

1 From SANDAG (2003). The population forecasts presented in SANDAG (2003) represented the most current forecasts available at the time of preparation of the *Updated 2005 Urban Water Management Plan* and 2005 versions of other local water plans. In 2006, SANDAG developed an update to the above population projections. The most recent available version of SANDAG population projections will be incorporated into future versions of this Plan and future versions of urban water management plans developed by the Water Authority and local water agencies.

2 2005 values interpolated from 2000 census values and SANDAG 2010 projections.

3 The Region addressed in this IRWM Plan includes all of the Water Authority Service Area and almost all of the County's population. Only a small fraction of the San Diego County population that is within the Colorado River watershed is outside the Region addressed in this IRWM Plan.

4 Population increases are projected for all non-white ethnic groups. Population increases within some groups, however, are projected to be less than the population increase of the County as a whole, resulting in slight decreases in percentages.

As documented in Table B-1, the Region's diverse ethnic groups are projected to comprise the majority of the County's population by year 2010. Caucasians represent the only ethnic group for which a population decrease is forecast; population gains are projected within the Hispanic, black, Asian, Pacific Island, and Native American communities.

By numbers, Hispanics represent the fastest growing segment of the population, and currently comprise roughly one-third of the Region's population. The Region also features a diverse Asian population that includes large communities that celebrate heritage from China, Southeast Asia, and India. Pacific Islander populations within the County are projected to show the greatest percentage increase in the next twenty years, with populations projected to increase from approximately 25,000 to more than 65,000 by year 2030. (SANDAG, 2003)

The County features 18 Tribal Nation Reservations, more than any other county in the United States. Native Americans within the Region comprise four tribal groups: the Luiseño, Cupeño, and Cahuilla groups from North San Diego County, and the Kumeyaay/Diegueño tribal group. Only a small percentage of the Region's Native American population of 17,000 lives within the Tribal Reservation lands. (SANDAG, 2003)

Table B-2 summarizes language use within the County. As shown in the table, English and Spanish represent the dominant languages within the Region. English is the sole language of approximately two-thirds of the population, and more than one-fifth of the population speaks Spanish.

Table B-2
Culture/Language Use

Language	Percent Speakers	English Also Spoken	No English Spoken
English Only	67.0%	67.0%	0
Spanish	21.9%	16.2%	5.7%
Asian/Pacific Islander	7.1%	5.9%	1.2%
Other Languages	4.0%	3.6%	0.4%
Totals	100%	92.7%	7.3%

From 2000 Census, as reported by San Diego Association of Governments (SANDAG), *Final 2030 City/County Forecast*. 2003.

Table B-3 summarizes the range of education within the adult population of the County. Approximately 30 percent of the adult population has a 4-year college degree, and more than 10 percent of the population has a graduate degree. Slightly less than 10 percent of the adult population did not graduate from high school.

Table B-3
Education

Highest Level of Education Attained	Percent	Cumulative Percent
Graduate Degree	10.9%	10.9%
Bachelors Degree	18.7%	29.5%
Associates Degree	7.6%	37.1%
Attended College	25.6%	62.7%
High School Graduation	19.9%	82.6%
Attended High School	9.5%	92.1%

1 From 2000 Census for adults over the age of 25, as reported by San Diego Association of Governments (SANDAG), *Final 2030 City/County Forecast*. 2003.

Disadvantaged Communities. The IRWM Program Guidelines published by DWR and State Board (2004, 2007) define disadvantaged communities (DACs) as those with less than 80 percent of the statewide Median Household Income (MHI). (DWR and SRWCB, 2004 and 2007)

The California MHI for year 2000 (the most recent census) was $46,900 (California Department of Finance, 2005) The County MHI for year 2000 was $47,067, which is approximately equal to the statewide MHI.

Within the Region, the MHI was less than 80 percent of the statewide value (80 percent of the statewide value translates to approximately $37,520) in three of the County's 18 cities (El Cajon, Imperial Beach, and National City). In addition, the 2000 census indicates that the MHI was less than 80 percent of the statewide value in 17 of 58 City of San Diego Community Planning Areas (CPAs) and in four of 23 County CPAs. (SANDAG, 2006)

Table B-4 (page B-8) summarizes communities (by planning area) within the Region that meet DWR and State Board criteria for designation as disadvantaged. The disadvantaged communities are geographically spread within the Region.

In addition to the 24 cities and communities listed in Table B-4, 2000 census data indicate that numerous census tract neighborhoods in many of the Region's planning areas (both in incorporated and unincorporated areas) have MHI values less than 80 percent of the statewide value.

Efforts are currently underway (see Table G-6 on page G-19 and Appendix 8) to assess MHI values within the Region on a census tract basis. When this census-tract analysis is complete, the number of disadvantaged communities identified within the Region is projected to significantly expand from those listed in Table B-4.

Table B-4
Economically Disadvantaged Communities

Hydro-logic Unit[1]	Name	Disadvantaged City or Community Planning Area (CPA)[2]	Jurisdiction	Mean Annual Household Income[3]
902	Santa Margarita River	Pendleton-DeLuz County CPA	County	$32,816
903	San Luis Rey River	North Mountain County CPA	County	$33,620
906	Peñasquitos	Mission Bay Park CPA	City of San Diego	$31,917
907	San Diego River	Bostonia County CPA	County	$37,303
		City of El Cajon	City of El Cajon	$35,530
907 908	San Diego River[4] Pueblo	College Area CPA	City of San Diego	$33,534
		Normal Heights CPA	City of San Diego	$30,804
		Ocean Beach CPA	City of San Diego	$36,804
		Midway CPA	City of San Diego	$28,503
		Old San Diego CPA	City of San Diego	$27,384
908	Pueblo	Barrio Logan CPA	City of San Diego	$20,625
		Centre City CPA	City of San Diego	$22,888
		City Heights CPA	City of San Diego	$23,682
		Eastern Area CPA	City of San Diego	$36,294
		Encanto CPA	City of San Diego	$34,349
		Greater Golden Hill CPA	City of San Diego	$30,478
		Greater North Park CPA	City of San Diego	$31,890
		Harbor CPA	City of San Diego	$5,000
		Lindbergh Field CPA	City of San Diego	$31,516
		Southeastern San Diego CPA	City of San Diego	$23,554
908[5] 909	Pueblo[5] Sweetwater River	City of National City	City of National City	$29,980
910[6] 911	Otay River[6] Tijuana River	City of Imperial Beach	City of Imperial Beach	$35,950
911	Tijuana River	San Ysidro CPA	City of San Diego	$26,772
		Mountain Empire County CPA	County	$35,923

1 Numerical hydrologic unit designation per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).
2 City of San Diego Community Planning Areas or County Community Planning areas with a median household income less than 80 percent of the state-wide median. (The state-wide median for 2000 is $46,900, and 80 percent of this value is approximately $37,520.)
3 Mean household income data from 2000 census. (SANDAG, 2006).
4 City of San Diego Community Planning Areas that overlap into both the San Diego River Watershed and Pueblo Hydrologic Unit.
5 National City is located within both the Pueblo and Sweetwater Hydrologic Units.
6 Imperial Beach is located within both the Otay and Tijuana River Watersheds.

Housing. Table B-5 summarizes housing. Approximately 60 percent of the population resides in single-family units, but the percent of households living in multiple-unit structures is projected to increase in the next 20 years.

Table B-5
Existing and Projected Housing[1,3]

Housing within the County[3]	2005[2]	2010	2020	2030
Occupied Units (millions)	1.06	1.12	1.19	1.30
Percent Households in Single Family Units	60%	60%	59%	57%
Percent Households in Multiple Family Units	36%	36%	37%	39%
Percent Households in Mobile Homes	4%	4%	4%	4%

1 From San Diego Association of Governments (SANDAG), *Final 2030 City/County Forecast*. 2003.
2 2005 values interpolated from 2000 census values and SANDAG 2010 projections.
3 The Region addressed in this IRWM Plan includes all of the Water Authority Service Area and almost all of the County's population. Only a small fraction of the County's population is within the Colorado River watershed and is outside the Region addressed in this IRWM Plan.

Land Use. Figure B-2 (following page) presents land use within the Region. Table B-6 (page B-10) summarizes existing and projected land use acreages within the County. Significant residential development within the Region is forecast to occur within the next 25 years. Approximately 19 percent of the County is classified as vacant developable land. By year 2030, vacant developable land is projected to decrease to four percent of the total San Diego County land. Residential lands within the County are projected to more than double by year 2030.

No significant net decrease is projected in the acreage of San Diego County lands zoned for agricultural use. The agricultural lands shown in Table B-6, however, include both irrigated agriculture and non-irrigated (cattle grazing) lands. Most irrigated agriculture occurs within the Region is within the Water Authority service area. Within the Water Authority's service area, the Water Authority's *Updated 2005 Urban Water Management Plan* notes that significant conversion of irrigated agricultural lands to residential use is projected to occur by year 2030. (Water Authority, 2005)

The United States military owns more than six percent of the Region's land. Major bases that include significant open space or undeveloped lands include U.S. Marine Corps Base Camp Pendleton, Fallbrook Naval Weapons Annex, and Miramar Air Station. The military acts as stewards of the open space environment and coordinates with local jurisdictions for watershed planning and environmental protection.

Table B-6
Existing and Projected Land Use within the County[1]

Land Use	Parameter	2005[2]	2010	2020	2030
Residential[3]	Acres	348,567	374,332	445,309	767,826
	% of total	13%	14%	17%	28%
Industrial/commercial[4]	Acres	67,450	69,540	74,090	78,376
	% of total	2%	3%	3%	3%
Institutional[5]	Acres	1,106,698	1,106,966	1,107,598	1,108,139
	% of total	41%	41%	41%	41%
Roads/freeways	Acres	87,853	88,550	88,549	88,638
	% of total	3%	3%	3%	3%
Agriculture[6]	Acres	93,233	91,492	88,951	87,189
	% of total	3%	3%	3%	3%
Vacant Developable Land[7]	Acres	523,595	496,515	423,077	97,225
	% of total	19%	18%	16%	4%
Non-Developable Land[8]	Acres	499,650	499,649	499,649	499,649
	% of total	18%	18%	18%	18%

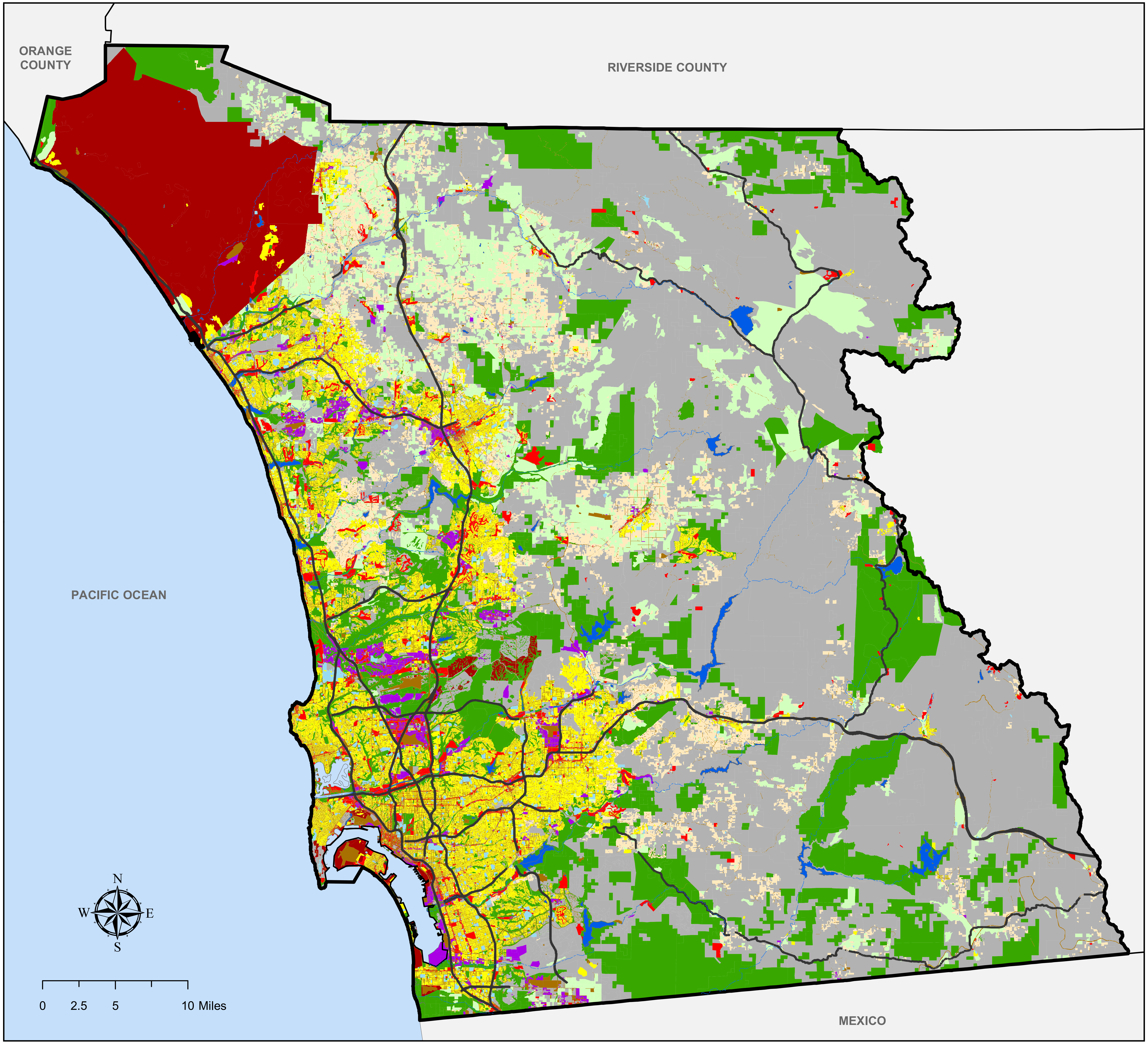
1 From SANDAG (2003). The land use forecasts presented in SANDAG (2003) represented the most current forecasts available at the time of preparation of the *Updated 2005 Urban Water Management Plan* and 2005 versions of other local water plans. In 2006, SANDAG developed an update to the above projections. The most recent available version of SANDAG projections will be incorporated into future versions of this Plan and future versions of urban water management plans developed by the Water Authority and local water agencies.
2 2005 values interpolated from 2000 census values and SANDAG 2010 projections.
3 Includes lands used for low-density single-family housing, single family housing, multiple family housing, and mobile homes.
4 Includes lands used for office, commercial, service, or industrial uses.
5 Includes lands used for schools, universities, developed parks, and military lands.
6 Primarily used for agriculture, but may include low-density single-family residential units within the designated agricultural lands.
7 Undeveloped land zoned for future residential, industrial/commercial, institutional, or road/freeway use.
8 Lands constrained from development include permanent open spaces, conservation lands, parklands, and national forests.

Other large federal land holdings within the Region include lands owned and managed by the United States Bureau of Land Management (BLM) and the United States Forest Service (USFS).

Regional Economy. Table B-7 (page B-11) summarizes the County's Gross Regional Product for the past five years. The County's Gross Regional Product exceeded $150 billion during 2005, and was projected to exceed $161 billion during 2006. (San Diego Regional Chamber of Commerce, 2007)

Historically dependent on military spending, the Region's economy has diversified during the past 20 years. Manufacturing is the largest economic contributor to the local economy,

Figure B-2
San Diego Region
Land Use



Legend

Major Rivers

Freeways and Major Roads

San Diego Region

Land Use

- Agriculture
- Commercial
- Industrial
- Military
- Parks
- Public Services
- Residential
- Residential -Spaced Rural
- Transportation
- Undeveloped
- Water

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accounting for $25 billion of the gross regional product. Leading industries within the region include telecommunications, electronics, computers, industrial machinery, aerospace, shipbuilding, biotechnology, and instruments. Currently, 1,400 companies in the region employ nearly 160,000 high technology workers. The telecommunications industry alone contributes more than $5 billion to the local economy each year. (San Diego Regional Chamber of Commerce and San Diego County, 2007)

Table B-7
Gross Regional Product within the County

Year	San Diego County Gross Regional Product[1] ($ billions)	Percent Increase from Prior Year
2002	124.9	7.4%
2003	133.1	6.5%
2004	141.7	6.5%
2005	151.1	6.6%
2006	161.1[2]	6.6%

1 Gross regional product data from San Diego Regional Chamber of Commerce Economic Research Bureau and County of San Diego (2007).
2 Estimated value.

Tourism is the second largest industry in the Region. In 2005 visitor spending in the County exceeded $5 billion. Defense represents the third largest industry, and more than a dozen Marine Corps and Navy bases and support facilities exist within the County.

Agriculture ranks as the fourth largest industry in the Region. The 2005 annual crop value within the County (almost all of which is irrigated agriculture) exceeded $1.5 billion. (San Diego County Department of Weights and Measures, 2006) The County ranks in the top 20 counties in the nation in its value of agricultural product. (San Diego Regional Chamber of Commerce and San Diego County, 2007) With limited precipitation and local water sources, agricultural within the Region is dependent on imported water.

Climate and Precipitation. The Region experiences a Mediterranean climate, and precipitation follows a strong seasonal pattern. More than 90 percent of the annual precipitation typically occurs during the six-month period of November through April. (Western Regional Climate Center, 2006)

Significant variation occurs in the geographic distribution of precipitation in the County. Figure B-3 (following page) presents the geographic distribution of mean annual precipitation within San Diego County. As shown in Figure B-3, annual precipitation in the region follows a pattern of increased precipitation with increased elevation. Mean annual precipitation in the region varies from approximately ten inches per year along the coast to more than 40 inches per year in the highest elevations of the Peninsular Range mountains that form the eastern boundary of the region.

Significant variation in precipitation also occurs from year to year. Demonstrating this variation, Table B-8 summarizes annual precipitation for a 155-year period at the San Diego Lindbergh Field and City of Escondido precipitation stations. As shown in Table B-8, annual precipitation totals range from more than double the annual mean to less than half the annual mean. The Region is currently experiencing a drought; precipitation during 2006 and 2007 was significantly below the Region's annual mean.

Table B-8
Annual Variation in Precipitation at San Diego Lindbergh Field, 1850-2005

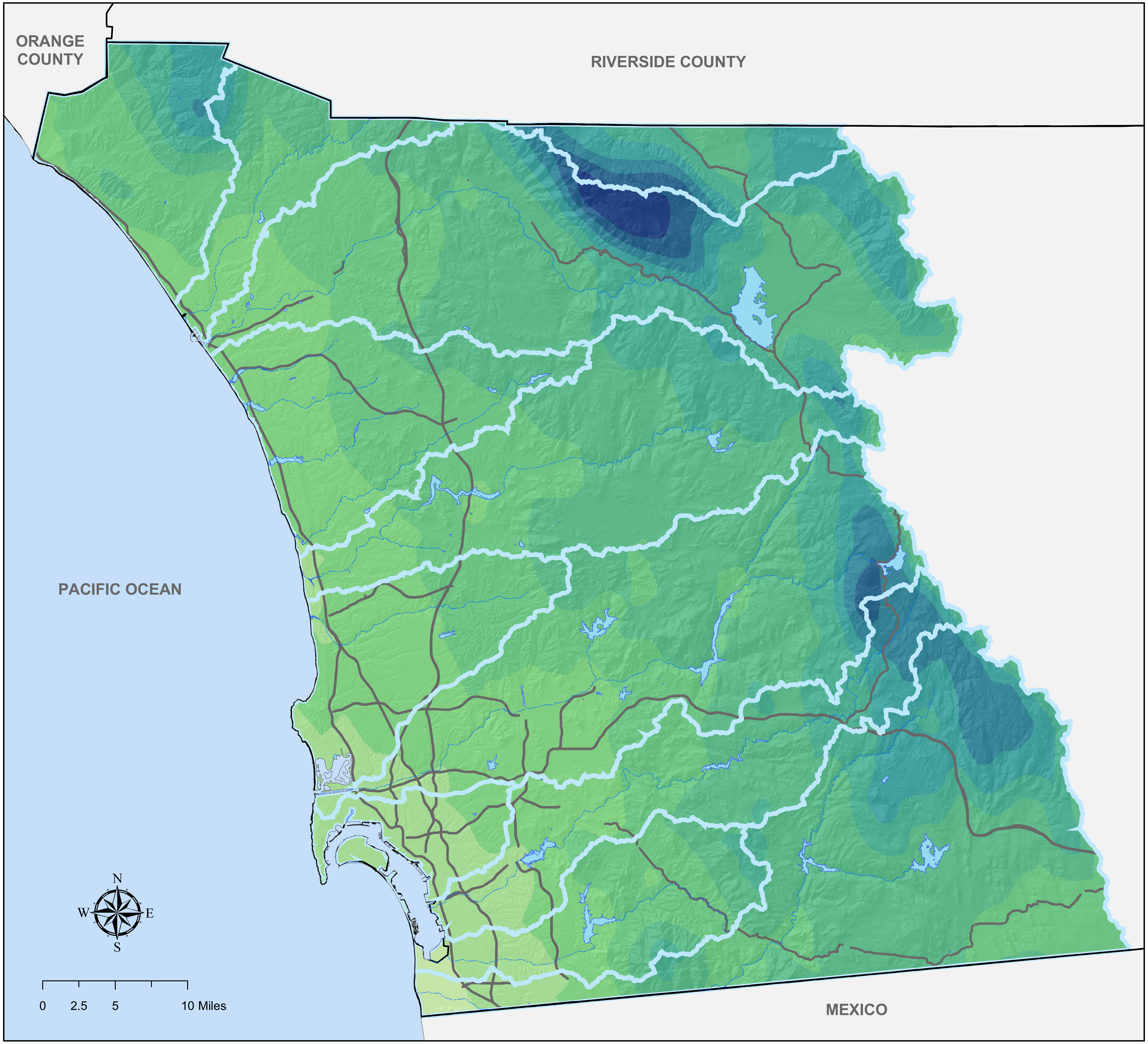
Parameter		San Diego Lindbergh Field, 1850-2005[1]		Escondido, 1875-2005[2]	
		Annual Precipitation (inches)	Percent of Annual Mean	Annual Precipitation (inches)	Percent of Annual Mean
Maximum Observed Value		27.6	277%	32.8	210%
Percentile Values:	5%	17.3	174%	28.3	181%
	10%	16.4	165%	25.4	162%
	25%	11.9	120%	19.1	122%
	50%	9.2	92%	14	90%
	75%	7.2	72%	11.6	74%
	90%	5.6	56%	8.6	55%
	95%	4.4	44%	7.0	45%
Minimum Observed Value		3.0	30%	4.8	31%
Mean Annual Value		10.0	---	15.6	---

1 Annual calendar year precipitation at San Diego Lindbergh Field for the period 1850 through 2005. From Western Regional Climate Center (2006).

2 Annual calendar year precipitation at Escondido Station for the period 1875-2005. From Western Regional Climate Center (2006).

While the mean annual precipitation at the Escondido precipitation station is approximately 50 percent greater than at the San Diego Lindbergh Field station, Table B-8 demonstrates that both stations exhibit a similar statistical distribution about the mean. This is due to the fact that most of the San Diego winter precipitation occurs as a result of eastward-moving frontal storm systems that affect the entire Region.

Figure B-3
Regional Precipitation



Legend

- Major Rivers
- Freeways
- Pacific Ocean
- Lakes
- County Boundary
- Watershed Boundaries

Avg. Annual Precip.

- 3 to 6 inches
- 6 to 9 inches
- 9 to 12 inches
- 12 to 15 inches
- 15 to 18 inches
- 18 to 21 inches
- 21 to 24 inches
- 24 to 27 inches
- 27 to 30 inches
- 30 to 33 inches
- 33 to 35 inches

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Because the mean is skewed by a few years of exceptionally high precipitation, precipitation totals above the annual mean occurred only approximately 45 percent of the time at the two precipitation stations. San Diego Lindbergh Field precipitation was between 7.2 inches (72% of normal) and 11.9 inches (120% of normal) during approximately 50 percent of the years. Escondido precipitation was between 11.6 inches (74% of normal) and 19.1 inches (122% of normal) during 50 percent of the years.

While all but a fraction of Region's precipitation occurs during November through April, a significant majority of the potential evaporation (which is approximately the evapotranspiration rate for grass) occurs during summer and autumn months. More than 80 percent of the potential evaporation occurs during the months of March through October. Potential evaporation within the region ranges from approximately 3.7 feet per year in coastal valleys to more than 4.2 feet per year in inland valleys. (DWR, 1986)

Global Climate Change Issues. Hydrologic conditions in the Region, within California, and in the Colorado River Basin will likely be altered as a result of global climate change (based on conditions observed over the past century). DWR coordinated a literature search on global warming issues and summarized probable global warming impacts within Chapter 4 of the *California Water Plan Update 2005* (DWR, 2005) and within *Progress on Incorporating Climate Change into Management of California's Water Resources* (DWR, 2006). Key probable changes in hydrologic conditions forecast by these DWR reports include:

> *Snowpack Changes.* While snowpack represents a negligible component of the water balance within the Region's local water supplies, snowpack in the Sierra Nevada Mountains represents California's largest water storage component. Decreased snowpack in the Sierras will result in increased runoff during October through March, adversely affecting California's water storage and potentially affecting the amount of imported water available to the Region.
>
> *Hydrologic Patterns.* Global warming may result in a shift in storm tracks. Existing data (DWR, 2006) show a trend of increasing precipitation in Northern California and decreasing precipitation in Southern California during the past century, but El Niño effects (increased Pacific Ocean temperatures) have been shown to result in a shift of the Pacific Coast winter storm tracks toward the south. Other patterns may emerge over time.
>
> *Storm Intensity.* Flood management, erosion, and water quality impacts could occur if climate change results in increased precipitation intensity and reduced health plant cover.

Sea Level Rise. Sea level rises associated with global warming could increase coastal erosion, impacting ecosystems and tidal wetlands. Sea level rises would also increase salinity intrusion into the Sacramento Bay Delta, adversely impacting the quality of State Water Project supplies delivered to the Region.

Water Temperatures. Increased air temperatures and modified storm patterns may result in increased reservoir water temperatures, adversely affecting cold water and other species and increasing the intensity of algae blooms.

Water Demand. Potential global warming effects on vegetation evapotranspiration are currently unknown. While increased temperature results in increased evapotranspiration, this may be partially offset by the fact that increased atmospheric carbon dioxide can result in reduced vegetation water consumption.

Energy Demand. Global warming effects may result in increased energy demands that will require increased conservation and efficiency measures.

DWR (2006) has addressed needs for further research in each of these areas to assess how global climate change may affect California water planning. Regardless of the projected altered conditions, improving local stewardship of the Region's water resources will likely improve the Region's ability to more robustly deal with changed climatic conditions.

B.3 Watersheds within the Region

Hydrologic Units. As shown on Figure B-1 (located after page B-2), the Region addressed in this IRWM Plan is comprised of eleven DWR-designated hydrologic units that are tributary to coastal waters. Table B-9 (page B-15) summarizes characteristics of the eleven hydrologic units. Seven of the hydrologic units comprise watersheds for major water courses, including: Santa Margarita River (designated hydrologic unit 902 by DWR), San Luis Rey River (903), San Dieguito River (905), San Diego River (907), Sweetwater River (909), Otay River (910), and Tijuana River (911). Four of the hydrologic units are comprised of multiple watersheds that drain to coastal waters or coastal wetlands, including:

- San Juan HU (901), which includes the tributary areas of San Mateo Creek, San Onofre Creek, Las Pulgas Creek, and Stuart Mesa,
- Carlsbad HU (904), which includes the tributary areas of Loma Alta, Buena Vista, Agua Hedionda, Encinitas, San Marcos, and Escondido Creeks,
- Peñasquitos HU (906), which includes the Los Peñasquitos Creek WMA and Mission Bay WMA (Tecolote Creek and Rose Creek watersheds), and
- Pueblo HU (908), which includes several watersheds that drain to San Diego Bay.

Table B-9
Summary of the Region's Hydrologic Units[1]

Hydro-logic Unit[2]	Name	Watershed Area (sq. miles)	Primary Watercourses or Hydrologic Areas	Approximate Length[3] (miles)	Elevation Range[4] (feet MSL)	Primary Tributaries
901	San Juan	150[5]	San Mateo Creek San Onofre Canyon Las Pulgas Canyon	21	0 - 3575	Coastal estuaries/marshes Pacific Ocean
902	Santa Margarita River	200[6]	Santa Margarita River	55	0 – 6190	Santa Margarita Estuary Pacific Ocean
903	San Luis Rey River	558	San Luis Rey River	52	0 – 6530	San Luis Rey River Mouth Pacific Ocean
904	Carlsbad[7]	210	Loma Alta Creek	8	0 – 460	Loma Alta Slough Pacific Ocean
			Buena Vista Creek	11	0 – 1670	Buena Vista Lagoon Pacific Ocean
			Encinas HA	4	0 - 350	Pacific Ocean
			Aqua Hedionda Creek	10	0 – 1300	Agua Hedionda Lagoon Pacific Ocean
			San Marcos Creek	14	0 – 1670	Batiquitos Lagoon Pacific Ocean
			Escondido Creek	24	0 – 2330	San Elijo Lagoon Pacific Ocean
905	San Dieguito River	346	San Dieguito River	42	0 – 5720	San Dieguito Lagoon Pacific Ocean
906	Peñasquitos[8]	100	Los Peñasquitos Creek Rose Creek Tecolote Creek	18	0 – 2700	Los Peñasquitos Lagoon Mission Bay
907	San Diego River	440	San Diego River	44	0 – 6510	San Diego River Estuary Pacific Ocean
908	Pueblo[9]	60	Chollas Creek[10]	8	0 – 830	San Diego Bay Pacific Ocean
909	Sweetwater River[9]	230	Sweetwater River	41	0 – 6510	Sweetwater River Estuary San Diego Bay
910	Otay River	160	Otay River	23	0 – 3720	San Diego Bay
911	Tijuana River	470[11]	Tijuana River	47	0 – 6380	Tijuana River Estuary Pacific Ocean

1 Adapted from basin descriptions presented in Comprehensive Water Quality Control Plan Report (Regional Board, 1976).

2 Numerical hydrologic unit designation per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).

3 Approximate distance of eastern end of the watershed to the Pacific Ocean.

4 Approximate range of elevation in feet above mean sea level (MSL) within the watershed.

5 The San Juan Hydrologic Unit (San Juan HU) comprised approximately 476 square miles. The lower 150 square miles of this hydrologic unit is within the County and the Region addressed within this IRWM Plan; this area includes four hydrologic areas: San Mateo, San Onofre, Las Pulgas, and Stuart Mesa. The upper portion of the watershed lies within Orange County and is addressed by that Region's IRWM Plan.

6 The Santa Margarita River Watershed area is approximately 750 square miles. The lower 200 square miles of this watershed is within the County and the Region addressed within this IRWM Plan. The remainder of the Santa Margarita River Watershed lies within Riverside County, and includes the communities of Temecula and Murrieta.

7 The Carlsbad Watershed Management Area (WMA) includes the following six hydrologic areas: Loma Alta (904.1), Buena Vista Creek (904.2), Agua Hedionda (904.3), Encinas (904.4), San Marcos (904.5), and Escondido (904.6). Primary watercourses for each of these six hydrologic areas are listed above. The watershed includes several smaller creeks within these hydrologic areas in addition to the listed primary watercourses.

8 The Peñasquitos HU includes the Los Peñasquitos Creek WMA and the Mission Bay WMA (Rose and Tecolote Creeks).

9 For purposes of stormwater management and reporting, the Regional Water Quality Control Board combines the Pueblo Hydrologic Unit (908), the Sweetwater River Watershed (909) and the Otay River Watershed (910) into a single Watershed Management Area called the San Diego Bay WMA.

10 Chollas Creek is the largest of several drainage courses within the Pueblo Hydrologic Unit. The Pueblo Hydrologic Unit includes the Point Loma, San Diego Mesa and National City hydrologic basins that are tributary to San Diego Bay.

11 The Tijuana River Watershed is approximately 1,750 square miles; approximately 27% of the land area is within the Region.

San Juan Hydrologic Unit (901). The San Juan Hydrologic Unit (San Juan HU) is comprised of five hydrologic areas. Two of the hydrologic areas are within San Diego County and are addressed in this IRWM Plan, including:

- San Mateo Hydrologic Area (the drainage area of San Mateo Creek) and
- San Onofre Hydrologic Area (which includes drainage areas of San Onofre Creek, Las Pulgas Creek, and Stuart Mesa).

The portion of the San Juan HU that is within San Diego County covers approxi-mately 150 square miles and lies within the jurisdiction of the United States Marine Corps Base Camp Pendleton. Appendix 1 presents a map showing boundaries of the hydrologic unit and principal features.

Marine Corps Base Camp Pendleton lands are largely open space and support nearly intact habitats. Water supply within the Camp Pendleton portion of the San Juan HU is from local groundwater and treated waste-water that is percolated back into the ground.

Santa Margarita River Watershed (902). The Santa Margarita River Watershed (Santa Margarita HU) encompasses approximately 750 square miles in northern San Diego and southwestern Riverside Counties. Approximately 27% (200 square miles) of the watershed is within San Diego County (and the region addressed in this IRWM Plan). Appendix 1 presents a map showing primary features and boundaries of the portion of the Santa Margarita River Watershed that is within the Region.

The Santa Margarita River is the primary watercourse in the watershed. The river is formed by the confluence of Temecula and Murrieta Creeks immediately upstream from the San Diego-Riverside County border. Rapidly urbanizing areas of Riverside County exist in the upstream portion of the basin, while the lower portion of the watershed within San Diego County is largely undeveloped and includes portions of the U.S. Marine Corps Base Camp Pendleton. The watershed features chaparral-covered hillsides, riparian woodlands, and coastal marshes. The Santa Margarita River discharges to an estuary in an undeveloped downstream portion of Camp Pendleton.

Groundwater basins within the lower portion of the Santa Margarita River Watershed represent a most important local water supply source within the Region, and represent the primary source of supply to Camp Pendleton. Camp Pendleton is in the process of implementing a series of federally funded master-planned water supply projects that include groundwater treatment for iron and manganese and a future-proposed groundwater demineralization facility.

San Luis Rey River Watershed (903). The 558 square mile San Luis Rey River Watershed (San Luis Rey HU) is the largest watershed completely within the Region. Appendix 1 presents a map showing the watershed boundaries and primary features.

The San Luis Rey River is the primary watercourse within the watershed, and discharges to the Pacific Ocean northern Oceanside. The watershed is bounded by the Moserate Mountains to the north, Cleveland National Forest and Camp Pendleton to the northwest, and the Cities of Oceanside, Vista, San Marcos, and Escondido to the south and has two major drinking water reservoirs (Lake Henshaw and Dixon Lake)

Roughly one-fourth of the land area in the watershed is located west of Interstate 15, and this area has multiple uses including open space/ undeveloped, residential, commercial/ industrial, and agricultural. East of Interstate 15, most of the land is either undeveloped or agricultural. Land use authorities include the County, the State, the Federal government, and several tribal nations.

Groundwater and surface waters in the upstream portion of the San Luis Rey River Watershed are an important local supply source for the Vista Irrigation District, City of Escondido, Pala/Pauma communities, and local Indian Tribes. However, several large water agencies within the watershed (e.g. Valley Center MWD, Rainbow MWD, Fallbrook PUD) are virtually 100 percent reliant on the availability of imported water. The City of Oceanside is the only agency in the downstream portion of the watershed that develops local supply. This supply is developed through demineralization of brackish Mission Basin groundwater.

Carlsbad Hydrologic Unit (904). The Carlsbad Hydrologic Unit (Carlsbad HU) features a significant number of the Region's coastal lagoons. The Carlsbad HU is comprised of six small hydrologic areas, including Loma Alta (904.1), Buena Vista Creek (904.2), Agua Hedionda (904.3), Encinas (904.4), San Marcos (904.5), and Escondido Creek (904.6). Five of these hydrologic areas are tributary to major coastal lagoons, including:

- Loma Alta Slough (located in hydrologic area 904.1),
- Buena Vista Lagoon (in 904.2),
- Agua Hedionda Lagoon (in 904.3),
- Batiquitos Lagoon (in 904.5), and
- San Elijo Lagoon (in 904.6).

Appendix 1 presents a map of the Carlsbad HU showing principal features and boundaries. Approximately half of the 211 square mile Carlsbad HU is urbanized, with a high percentage of the undeveloped land in private ownership. Urban and agricultural runoff is a critical concern within the Carlsbad HU, and can impact both the coastal lagoons and local beaches.

Water supply reliability is also critical issue within the Carlsbad HU, as some water agencies (e.g. City of Carlsbad) are currently 100 percent reliant on imported supply. Additional water supply agencies that provide service within portions of the Carlsbad HU include the Olivenhain Municipal Water District, Vista Irrigation District, and San Dieguito Water District. Surface reservoirs within the Carlsbad HU include Dixon, Maerkel, Olivenhain, San Dieguito, and Wohlford.

Only a limited quantity of groundwater exists within the Carlsbad HU, and groundwater salinity represents a limitation to its use as a potable supply.

San Dieguito River Watershed (905). The San Dieguito River Watershed (San Dieguito HU) covers approximately 346 square miles. Approximately 80 percent of the watershed is within the unincorporated portion of the County. Appendix 1 presents a map that shows the principal watershed features and boundaries.

The watershed includes two major surface water reservoirs (Sutherland Reservoir and Hodges Reservoir). The City of San Diego owns a significant portion of the land in the immediate river valley between these two reservoirs and leases much of the land for agriculture. Land use within the watershed is currently 54 percent vacant or undeveloped and 29 percent parks or open space.

Neither Sutherland Reservoir nor Lake Hodges is currently connected to the Region’s imported water system, although Sutherland Reservoir water can be diverted to San Vicente Reservoir in the San Diego River Watershed. Future facility improvements proposed as part of the Water Authority’s Emergency Storage Program, however, will connect Lake Hodges with the San Diego Aqueduct and Olivenhain Reservoir. As a result, Lake Hodges is projected to become an increasingly important component of the Region’s water supply system.

Groundwater basins in the San Pasqual Valley are owned by the City of San Diego. While public water supply is not currently developed from the San Pasqual basins, the basins represent an important potential additional source of local water supply. High groundwater total dissolved solids (TDS) concentrations in the downstream portion of the San Pasqual Valley and downstream from Lake Hodges limit the usability of groundwaters in those areas.

Despite two surface water reservoirs along the San Dieguito River, flood control issues remain a key concern. Lake Hodges spilled 13 times during the period 1955-2005, representing a once-in-four-years period or recurrence. In addition to flooding in the lower San Dieguito basin associated with the Lake Hodges spills, local flood threats to developed areas exist within the Escondido and Ramona portions of the watershed.

Peñasquitos Hydrologic Unit (906). The Peñasquitos Hydrologic Unit (Peñasquitos HU) is located within the Mission Bay watershed management area. The Peñasquitos HU covers approximately 100 square miles primarily within the northern portion of the City of San Diego and the City of Poway. Appendix 1 presents a map that shows the principal features and boundaries of the hydrologic unit. The hydrologic unit is densely developed with a population of approximately 400,000.

The Peñasquitos HU includes two important watershed areas. The first area is comprised of the Miramar Reservoir (906.1) and Poway (906.2) Hydrologic Areas, which are drained by Los Peñasquitos Creek. Los Peñasquitos Creek discharges to Los Peñasquitos Lagoon and Torrey Pines State Beach. The second area drains to Mission Bay, and is comprised of the Miramar (906.4) and Tecolote (906.5) Hydrologic Area and a portion of the Scripps (906.3) Hydrologic Area.

Los Peñasquitos, Rose, and Tecolote Creeks exist within undeveloped canyons that wind through the highly urbanized watershed. Los Peñasquitos Lagoon and Mission Bay are highly utilized recreational areas that support diverse native fauna and flora.

No significant groundwater resources exist within the Peñasquitos HU. Except for a small amount of local runoff that enters Miramar Reservoir (a small reservoir used to store imported supply), no water supply is developed within the Peñasquitos HU.

San Diego River Watershed (907). The San Diego River Watershed (San Diego HU) covers 440 square miles and supports a larger population than any of the Region’s other hydrologic units. This population, however, is largely confined to the urbanized downstream portion of the watershed in the Cities of San Diego, El Cajon, La Mesa, Poway and Santee. Appendix 1 presents a map showing the watershed boundaries and principal features.

Approximately 60 percent of the San Diego River Watershed is currently undeveloped, with most of this undeveloped land being in the eastern upstream portion of the watershed in the unincorporated county. Cleveland National Forest, Mission Trails Regional Park, and the river flood plain near Lakeside represent important undeveloped areas that support intact habitat and endangered species.

The San Diego River Watershed features two large water supply reservoirs (San Vicente and El Capitan). El Capitan is the largest reservoir in the County, but San Vicente may be the most important reservoir in the region, as San Vicente Reservoir:

- is a key terminus of the San Diego Aqueduct,
- is the second-largest reservoir in the County,
- can receive diverted supplies from both El Capitan Reservoir and Sutherland Reservoir,
- is connected to the Region's largest water filtration plant (the 150 mgd City of San Diego Alvarado plant), and
- can be used to divert stored supplies to South County water agencies.

Flood protection within Mission Valley is provided by the First San Diego River Project, but flooding issues exist within the middle portions of the basin that include the communities of Lakeside and Alpine.

Significant groundwater resources exist within the watershed, but groundwater use is limited in downstream portions of the watershed due to high TDS concentrations. Additionally, an underground fuel plume near Qualcomm Stadium impacts groundwater in Mission Valley.

Pueblo Hydrologic Unit (908). The Pueblo Hydrologic Unit (Pueblo HU) is contained within the San Diego Bay watershed management area, and covers approximately 60 square miles of urbanized land along San Diego Bay within the Cities of San Diego, La Mesa, Lemon Grove and National City. Appendix 1 presents a map showing the boundaries and principal features of the hydrologic unit.

With a population of approximately 500,000, the Pueblo HU is the most densely populated hydrologic unit in the County. Chollas Creek is the largest of several drainage courses within the Pueblo HU. A relatively large percentage of the Pueblo HU land is used for transportation corridors and highways. Due to the high level of existing urbanization in the watershed, only small amounts of additional land are projected for development over the next 15 years.

Five sites in San Diego Bay that are impacted by runoff from the Pueblo HU have been designated as toxic hot spots by California's Bay Protection Toxic Cleanup Program. No water supply is currently developed within the Pueblo HU, but portions of the San Diego Formation (a deep confined groundwater aquifer) are believed to underlie portions of the hydrologic unit.

Sweetwater River Watershed (909). The Sweetwater River Watershed (Sweetwater HU) is contained within the San Diego Bay watershed management area, and covers approximately 230 square miles in an area extending from the Laguna Mountains in the east to San Diego Bay. Appendix 1 presents a map showing the watershed boundaries and principal features. The Sweetwater River is the primary watercourse within the watershed, and two major reservoirs (Loveland and Sweetwater, both operated by Sweetwater Authority) exist along the river.

The downstream portion of the watershed below Sweetwater Reservoir is urbanized, approximately 20 percent of the watershed is dedicated open space or used for agriculture, and an additional 50 percent is undeveloped. Much of the undeveloped land is in the upper one-third of the watershed and is within the unincorporated county, the Cleveland National Forest, and Cuyamaca Rancho State Park. The middle portion of the watershed (between Loveland and Sweetwater Reservoirs) includes the unincorporated communities of Jamul, Dehesa, and Harbison Canyon.

Significant groundwater resources exist in the Middle Sweetwater River Basin (between Loveland and Sweetwater Reservoirs) and the Lower Sweetwater River Basin (downstream from Sweetwater Reservoir). Sweetwater Authority develops potable supply from brackish groundwater from the Lower Sweetwater River Basin.

Otay River Watershed (910). The Otay River Watershed (Otay HU) is contained within the San Diego Bay watershed management area, and covers approximately 160 square miles. Appendix 1 presents a map showing the boundaries and principal features of the Otay River Watershed.

The Otay River (which flows to San Diego Bay) is the primary watercourse in the watershed. Upper and Lower Otay Reservoirs (owned and operated by the City of San Diego) are within the watershed, and represent the southernmost terminus of the San Diego Aqueduct. Lower Otay Reservoir impounds imported water and local runoff diverted from the Otay River Watershed. Upper Otay Reservoir impounds only local runoff. Approximately two-thirds of the watershed is currently preserved as open space. The downstream portion of the watershed within the City of Chula Vista is rapidly developing. Urban and residential land use comprises approximately 20 percent of the watershed.

Approximately 36 square miles of the watershed is within the MSCP Plan area. Other important conservation areas within the watershed include the San Diego National Wildlife Refuge, the Rancho Jamul Ecological Reserve, and vernal pool lands.

Water service within the upstream portion of the watershed is provided by the Otay Water District, which is dependent on the uninterrupted availability of Water Authority treated water supplies.

Tijuana River Watershed (911). The Tijuana River Watershed (Tijuana HU) encompasses approximately 1,750 square miles on either side of the U.S./Mexico border. Twenty-seven percent of the watershed area (470 square miles) is within California; essentially all of this area is in the upper reaches of the watershed. Appendix 1 presents a map showing the boundaries and features of the portion of the Tijuana River Watershed that is within the Region.

The downstream end of the Tijuana River flows from Mexico across the International Border to the Tijuana Estuary in California. Morena and Barrett Reservoirs are located in the upstream portion of the watershed. Water impounded in these reservoirs is transferred to the Otay River Watershed via the Dulzura Conduit. Urban centers within the watershed include the cities of Imperial Beach and San Diego in the United States, and the cities of Tijuana and Tecate in Mexico.

With a population of approximately one million people, urban stormwater runoff pollution from Mexico has created significant impacts within the downstream portion of the Tijuana River Watershed in the U.S. The State Board classifies the Tijuana River Watershed as an impaired watershed.

B.4 Agencies and Jurisdictions

Land Use Jurisdictions. Figure B-4 (following page) identifies agencies responsible for land use and planning within the region. The County, the 18 incorporated cities, and their associated planning districts support community planning, maintain comprehensive plans as required by statute, and administer and enforce land use codes and ordinances.

The U.S. Marine Corps Base Camp Pendleton covers over 125,000 acres in the north portion of the Region. More than a dozen other military facilities exist within the Region. Additional federal land managers within the Region, in part, include the United States Forest Service (USFS), the Bureau of Land Management (BLM), United States Fish and Wildlife Service (USFWS). USFS manages the Cleveland National Forest, which comprises the eastern portions of several of the Region's larger hydrologic units. The BLM manages lands designated as Wilderness Areas, BLM National Monuments, BLM Public Lands, and BLM Wilderness Study Areas. USFWS manages the National Wildlife Refuge in the southwestern part of the County.

State land managers include the California Department of Fish and Game (DFG), which manages land to implement DFG's Natural Community Conservation Plan (California Fish and Game Code Sections 2088-2805), and the California State Parks, which manages parklands such as Cuyamaca State Park. DFG's Natural Community Conservation Plan seeks to conserve natural communities at the ecosystem scale while accommodating compatible land use.

Tribal lands are significant in the Region: there are more Tribal Reservations within the County than in any other county in the United States. (University of San Diego, 2006) These Reservation lands, which are governed by Tribal Nations, total 124,000 acres, or approximately 193 square miles.

While the Tribal Nations have autonomy over their lands, they are subject to Federal environmental laws and regulations. However, they are not subject to State and local environmental laws and regulations, except for those that are required under Compact with the State, and other independent agreements between the Tribal Governments and local agencies. While the State and local governments do not have any authority over Tribal Lands, in a few cases a working relationship exists between the Tribes and local jurisdictions to address water and habitat issues. (As an example, a Tribal representative is currently participating in SANDAG committees.)

Water Supply Agencies. Water supply within the Region is predominantly imported water provided by the Water Authority; the Water Authority is the sole regional imported water wholesale agency within the region. All major retail water agencies within the Region are members of the Water Authority. Figure B-5 (following page) presents boundaries of Water Authority member agencies and the hydrologic areas they serve.

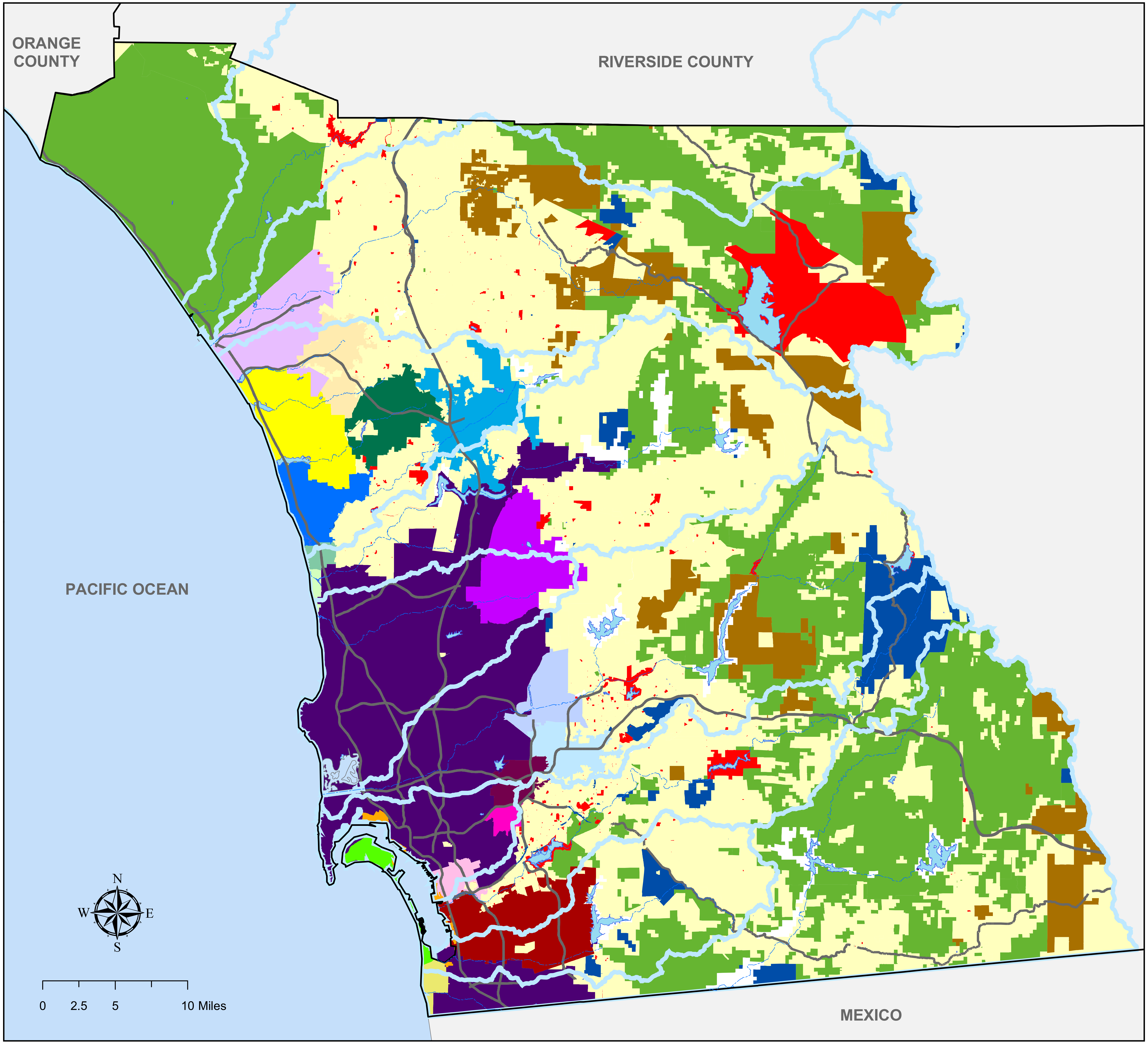
In addition to serving as the Region's provider of imported water, the Water Authority serves as a regional water planning agency to coordinate regional water issues. In this role, the Water Authority assists member agencies (through financial, coordination, or planning support) in local water planning and project development, and serves as a forum for member agencies to discuss and address regional water issues. Most Water Authority member agencies maintain interagency agreements with adjoining member agencies to maximize conveyance flexibility and emergency response.

The rural eastern portion of the Region (see Figure B-5) is outside the Water Authority's service area. Water service within this eastern area is provided by either onsite private wells or by small community water systems or private water companies.

Table B-10 (page B-25) presents a list of water systems within the Region that are operated by special districts or the County. In addition to the community water systems operated by the County or special districts, nearly 200 mutual water companies provide water service (derived from local groundwater supply) to small communities within the Region. As shown in Table B-11 (page B-25), three of these water companies provide service to more than 200 customers.

Tribal Nations within the Region are located on lands east of the Water Authority's service area and are dependent on local sources of water. However, two of the Tribal Nations, the Viejas and Sycuan Bands of the Kumeyaay Indians, are coordinating with the Water Authority to explore the potential for water supply delivery to reservation lands. Also, the Barona Band of Mission Indians has approached the City of San Diego to explore means of delivering City water supplies to the reservation via a proposed agreement that would transfer supplies from a Colorado River Tribal Nation to San Vicente Reservoir.

Figure B-4
Land Use Agencies



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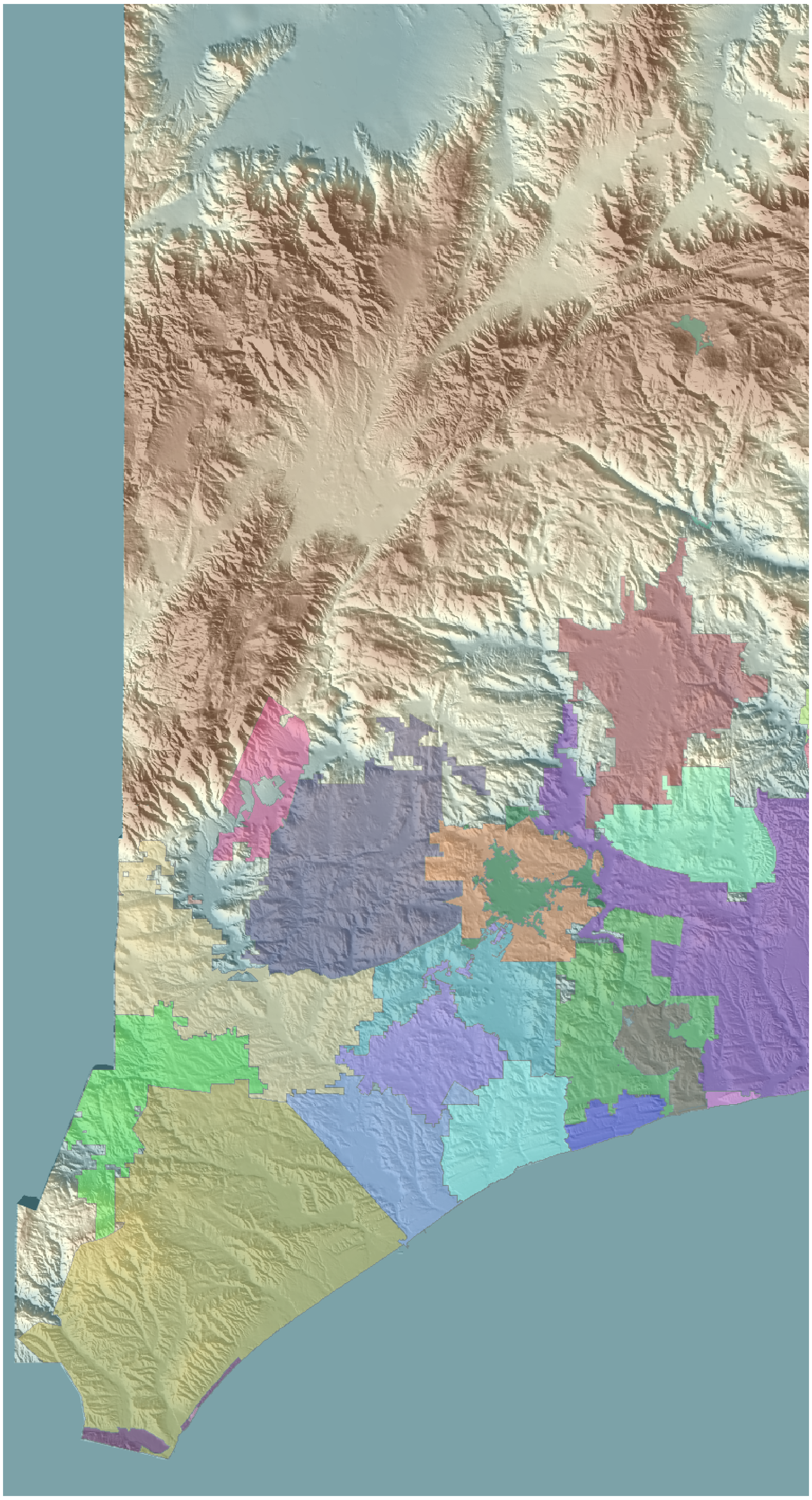

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Table B-10
Special Districts and County-Operated Water Systems Outside the Water Authority Service Area

Hydro-logic Unit[1]	Watershed Name	District	Community	Number of Customers[2]	Water Source
903	San Luis Rey River	Mootamai Municipal Water District	Pala-Pauma	< 110[3]	Local groundwater
		Pauma Municipal Water District	Pala-Pauma	< 150[3]	Local groundwater
		San Luis Rey Municipal Water District	Fallbrook, Valley Center, Pala-Pauma	9	Local groundwater
905	San Dieguito River	Questhaven Municipal Water District	San Dieguito	8	Local groundwater
907	San Diego River	Cuyamaca Water District	Cuyamaca	151	Local groundwater
		Julian Community Service District	Julian	183	Local groundwater
		Majestic Pines Community Service District[4]	Julian	600[4]	Local groundwater
		Wynola Water District	Julian/Wynola	60	Local groundwater
909	Sweetwater	Descanso Community Service District	Descanso	313	Local groundwater
911	Tijuana River	County of San Diego	Campo	45	Local groundwater

1 Numerical hydrologic unit designation per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).

2 Estimated number of customers as of 2003, per San Diego County (2003).

3 No estimate available for the number of water system customers. The listed value represents the number of property owners within the district.

4 A portion of the Majestic Pines Community Service District is within the Colorado River Basin, and is located outside the IRWM Plan region. Approximately 2,300 customers were reported by the County of San Diego (2003). The current (post-wildfire) customer total was reported as 600 in a draft version of the San Diego River Watershed Management Plan. (County of San Diego, 2004) Data are not available on the number of these customers that are inside the Region's boundaries.

Table B-11
Mutual Water Companies with More than 200 Service Connections Outside the Water Authority Service Area

Hydro-logic Unit[1]	Watershed Name	Water Company	Community	Water Source
903	San Luis Rey River	Rancho Pauma Mutual Water Company	Pala-Pauma	Local groundwater
907	San Diego River	Pine Hills Mutual Water Company	Julian/Pine Hills	Local groundwater
		Pine Valley Mutual Water Company	Pine Valley	Local groundwater

1 Numerical hydrologic unit designation per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).

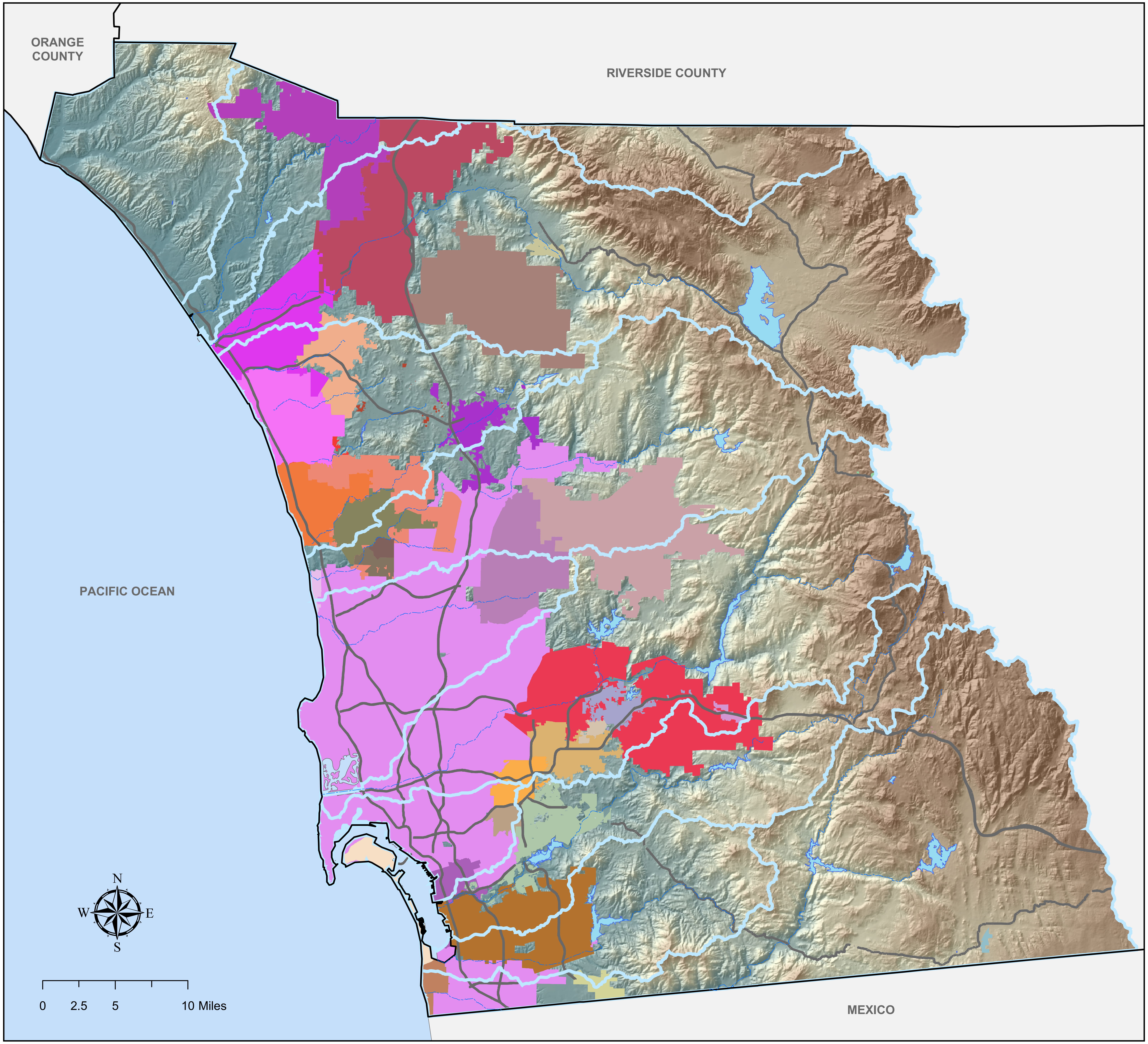
Wastewater Agencies. Municipalities and special districts provide wastewater service within the urbanized portion of the Region. Figure B-6 (following page) presents the wastewater agencies/sanitation districts within the Region. The County Sanitation District boundaries are up to date as of September 2007; the City Utility districts are based on their municipal boundaries (data to show their actual sanitation district boundaries does not currently exist, so there may be some overlap between the City Utility districts). The remaining sanitation district data is current as of July 1, 2007.

Section B.9 (see page B-61) presents a general description of the Region's wastewater infrastructure. The Region's urban wastewater agencies have organized (both through the formation of joint powers authorities and through interagency contracts) into five multi-jurisdictional wastewater systems based around the Region's five deep-water ocean outfalls. Fallbrook Public Utility District and U.S. Marine Corps Base Camp Pendleton (southern portion of the base) have connected to the City of Oceanside system (via contract) to form one regional wastewater system. The northern portion of Camp Pendleton is served by small wastewater treatment systems that percolate treated wastewater into Camp Pendleton's groundwater. The City of San Diego and U.S. Boundary and Water Commission (which treats wastewater originating in Tijuana, Mexico) form another of the regional wastewater systems.

Local wastewater agencies have joined to form joint powers agencies to create three additional multi-jurisdictional wastewater systems within the Region, including:

- Encina Wastewater Authority, comprised of the Buena Sanitation District, City of Carlsbad, City of Encinitas, Leucadia County Water District, Vallecitos Water District, and City of Vista;
- San Elijo Joint Powers Authority, comprised of the City of Solana Beach, Cardiff Sanitation District, and Rancho Santa Fe Community Services District; and,
- Metropolitan Wastewater System Joint Powers Authority, comprised of the City of Coronado, City of Del Mar, City of El Cajon, City of Imperial Beach, City of La Mesa, City of National City, City of Poway, City of San Diego, Lemon Grove Sanitation District, Padre Dam Municipal Water District, Otay Water District, Alpine Sanitation District, Lakeside Sanitation District, Spring Valley Sanitation District, and Winter Gardens Sewer Maintenance District. (*Note*: the City of Chula Vista is not a member of the Joint Powers Authority but receives wastewater service through the Metropolitan Wastewater System.)

Figure B-6
Wastewater Agencies



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In addition to the above five wastewater systems, special service districts exist to provide wastewater service to the communities of Whispering Palms, Valley Center, and Pauma. Sanitation districts operated by the County provide wastewater service to such inland communities as Julian, Pine Valley, and Campo. Local Tribes provide wastewater service within their respective reservation boundaries.

Wastewater service outside of these districts is provided by onsite wastewater (septic) systems.

Stormwater Agencies. As noted in Section A, the Regional Board MS4 Permit (Order No. R9-2007-0001) regulates stormwater/urban runoff within the Region. The County acts as principal Copermittee for the 21 Copermittees named in the MS4 Permit. Each Copermittee is responsible for operating its own stormwater/urban runoff management program within its respective jurisdiction. Copermittees implement stormwater programs on a watershed basis following the boundaries of the WMAs.

As principal Copermittee, the County coordinates with the County's 18 municipalities, the Unified Port District, and the County Regional Airport Authority in the regional development and implementation of stormwater monitoring programs, stormwater management plans, and best management practices. In this role, the County has organized the Stormwater Copermittee Management Committee to facilitate interaction and coordination among the Copermittees.

Additionally, the County formed Project Clean Water (www.projectcleanwater.org) to address region-wide watershed issues through participation of a broad range of governmental agencies, non-governmental agencies, and regulators. As part of Project Clean Water, the Watershed Technical Advisory Committee was formed to discuss and coordinate a range of watershed planning and implementation issues.

Flood Control Agencies. The County Flood Control District (Flood Control District) is the key flood control agency in the County. The Flood Control District (which is governed by the elected Supervisors of the County) establishes flood policies, maintains flood control facilities, operates a regional flood warning system, and is charged with protection of watercourses, watershed management, and protection of water quality. On a project-by-project basis, the Flood Control District coordinates flood control actions among the County's municipalities, federal and state agencies, watershed management groups, and flood control organizations in Orange and Riverside Counties.

Environmental Management Organizations. In addition to the above-noted federal land managers, many private foundations and conservancies have been established within the Region to preserve lands and to provide environmental management of conserved lands. Foundations or conservancies that provide environmental management of lagoons include: Batiquitos Lagoon Foundation, Buena Vista Lagoon Foundation, Agua Hedionda Lagoon Foundation, San Elijo Lagoon Conservancy, Los Peñasquitos Lagoon Foundation, and San Dieguito River Valley Land Conservancy.

Additional conservancy groups involved in conservation and environmental management, in part, include: CoastKeeper, the SCWRP San Diego Task Force, The Nature Conservancy, the Trust for Public Land, the Escondido Creek Conservancy, Cottonwood Creek Conservancy, Fallbrook Land Conservancy, Bonsall Conservancy, Preserve Calaveras, Iron Mountain Conservancy, Back Country Land Trust, San Diego River Park Foundation, San Diego River Conservancy, Lakeside River Park Conservancy, and Groundwater San Diego-Chollas Creek. The San Diego Conservation Resources Network is a network that assists in coordinating efforts among the Region's conservancy groups.

B.5 Surface Water Resources

Designated Beneficial Uses. The Basin Plan designates beneficial uses for surface water, coastal waters, and reservoir and lake resources within each hydrologic area of the Region's eleven hydrologic units. Appendix 2 presents beneficial uses designated in the Basin Plan for each of the hydrologic units.

As shown in Appendix 2, the Basin Plan designates wildlife habitat, water contact recreation, and non-contact recreation of surface waters as a beneficial use within each of the eleven hydrologic units. Additionally, portions of each of the eleven hydrologic units have been designated as warm-water or cold-water aquatic habitats. Municipal, agricultural, and industrial supplies are designated as beneficial uses of surface waters within ten of the eleven hydrologic units.

Streamflow. By volume, most of the surface flow in streams and rivers within the Region is from precipitation runoff (storm events). The amount of storm precipitation that becomes streamflow depends on (1) topography, land uses, and soil permeability, (2) the frequency and timing of storm events, and (3) stormwater management practices.

Streamflows during non-storm periods are the result of urban runoff, agricultural runoff, and surfacing groundwater. Dry weather flows, though small by volume, are significant in that they may carry pollutant loads and can alter the seasonal nature of aquatic and riparian habitats.

Stream gaging stations monitored as part of the U.S. Geological Survey (USGS) network currently exist in all but two of the Region's hydrologic units. Table B-12 (page B-30) summarizes permanent streamflow monitoring stations within the region. As shown in Table B-12, more than 50 years of streamflow data are available from twelve of the Region's streamflow gages.

Table B-12 also presents mean and median annual streamflow at each of the existing USGS stream gaging stations. Significant differences exist between mean and median streamflows.

Mean streamflow values are skewed upward by a few extreme hydrologic events, and surface flows in excess of the annual mean may only occur during a limited portion of the year. Median streamflows are more characteristic of the surface runoff that occurs on most days.

Figures B-7, B-8, and B-9 (page B-31) present mean and median monthly streamflow for three of the largest watercourses within the Region. As shown in the three figures, each of the watercourses follows the same general seasonal pattern of streamflow.

As indicated by the monthly mean values in the figures, nearly 90 percent of the streamflow volume in the Santa Margarita, San Luis Rey, and San Diego Rivers occurs during the months of December through May.

Most of this streamflow occurs as a result of direct stormwater runoff from a few major storm events within each rainy season. Because significant precipitation within the region typically occurs on only 30 to 60 days of the year, streamflow on most days remains low. (This is demonstrated by the median streamflow values shown in Figures B-7 through B-9.)

Streamflow within the Region also varies markedly from year to year. As an example, Figure B-10 (page B-32) shows total annual San Diego River streamflow at El Capitan Reservoir. During this 70-year period, El Capitan runoff was less than 5,000 AF during 29 years, while ten years had greater than 50,000 AF of runoff.

Table B-12
U.S. Geological Survey Surface Flow Gaging Stations

Hydro-logic Unit[1]	Watershed	Number of Historical Gaging Stations in Watershed[2]	Currently Operating Stream Gages[2]	Annual Streamflow[2] (cubic feet per sec.)		Period of Record[2]
				Median Value	Mean Value	
901	San Juan	11[3]	• Las Flores Ck. at Las Pulgas Cyn.	0.3	2.0	1999 - present
			• Las Flores Creek near Oceanside	0.4	2.2	1952 – present[4]
			• San Onofre Creek at San Onofre	0.2	2.0	1947 – present[5]
			• Christianitos Ck. nr. San Clemente	0.5	4.9	1994 - present
			• San Mateo Ck. near San Clemente	3.3	13.4	1953 – present[6]
902	Santa Margarita River	10[7]	• Santa Margarita River at Ysidora	11.0	41.3	1923 – present[8]
			• Santa Margarita R. near Fallbrook	10.0	31.6	1924 – present[9]
			• O'Neill Spillway near Fallbrook	0.0	0.1	1998 - present
			• Lake O'Neill outlet near Fallbrook	0.7	1.4	1998 - present
			• Lake O'Neill trib. near Fallbrook	0.0	0.0	2001 - present
			• Fallbrook Creek near Fallbrook	1.1	1.9	1993 - present
			• DeLuz Creek near DeLuz	3.5	15.1	1992 - present
			• DeLuz Creek near Fallbrook	0.8	4.3	1951 – present[10]
			• Rainbow Creek near Fallbrook	1.9	4.7	1989 - present
			• Sandia Creek near Fallbrook	5.9	10.5	1989 – present
903	San Luis Rey River	11	• San Luis Rey River at Oceanside	10.7	37.7	1912 - present[11]
904	Carlsbad	1	[None currently operating]	NA	NA	NA
905	San Dieguito River	9	• Santa Maria Creek near Ramona	0.9	6.8	1912 - present[12]
			• Guejito Creek near San Pasqual	0.4	3.0	1915 - present[13]
			• Santa Ysabel Creek near Ramona	1.7	10.9	1955 - present
906	Peñasquitos	10	• Los Peñasquitos Creek at Poway	7.1	11.1	1964 - present
907	San Diego River	5	• San Diego River at Fashion Valley	27.6	41.4	1982 - present
			• San Diego River at Mast Blvd.	11.6	25.2	1912 - present
			• Los Coches Creek near Lakeside	1.3	2.1	1983 – present
			• Padre Barona Creek near Lakeside		5.52	2004- present
908	Pueblo	0	[None currently operating]	NA	NA	NA
909	Sweetwater	3	• Sweetwater River near Descanso	2.0	9.1	1957 - present
			• Sweetwater River near Dehesa			
910	Otay	2	• Jamul Creek near Jamul	10.3[14]	14.1[14]	1940 - present
911	Tijuana River	7	• Cottonwood Creek near Dulzura	1.2	15.5	1936 - present
			• Campo Creek near Campo	0.3	3.5	1936 - present

1 Numerical hydrologic unit designation per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).
2 From U.S.G.S. (2006). Many of the historical gaging stations were temporary and were operated for short periods of time as part of special streamflow investigations. Streamflow records summarized above are for gaging stations that remain in operation.
3 All USGS stream gages within the San Juan HU (901) are within the Region.
4 Stream gage not in operation during 1978-1993.
5 Stream gage not in operation during 1968-1998.
6 Stream gage not in operation during 1968-1993.
7 A total of ten historic gaging stations (all currently still operational) are in the San Diego County portion of the Santa Margarita River Watershed. An additional ten historical gaging stations have existed in Riverside County within the Santa Margarita River Watershed. Seven of these stations are currently in operation, including: Santa Margarita River at Temecula (1923-present), Temecula Creek near Aguanga (1957-present), Pechanga Creek near Temecula (1987-present), Murrieta Creek near Murrieta (1997-present), Warm Springs near Murrieta (1987-present), Santa Gertrudis Creek at Temecula (1987-present), and Murrieta Creek near Temecula (1930-present).
8 Stream gage not in operation during 1975-1979 and 2000-2001.
9 A flood destroyed the original stream gage in 1980. The stream gage was relocated in 1989 to its current site near the Fallbrook Public Utility District sump.
10 Stream gage not in operation during 1968-1990 and 1991-2003.
11 Stream gage not in operation during 1942-1946 and 1991-1993.
12 Stream gage not in operation during 1921-1946.
13 The stream gage was relocated in 1957.
14 Includes flow diverted to Jamul Creek by the City of San Diego from Barrett Reservoir (in the Tijuana River Watershed) via the Dulzura conduit.

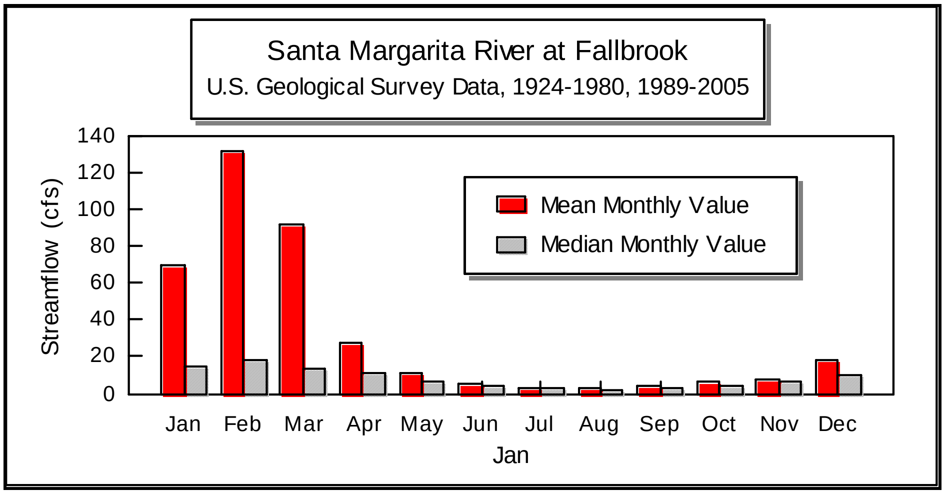


Figure B-7
Mean and Median Monthly Streamflows – Santa Margarita River at Fallbrook

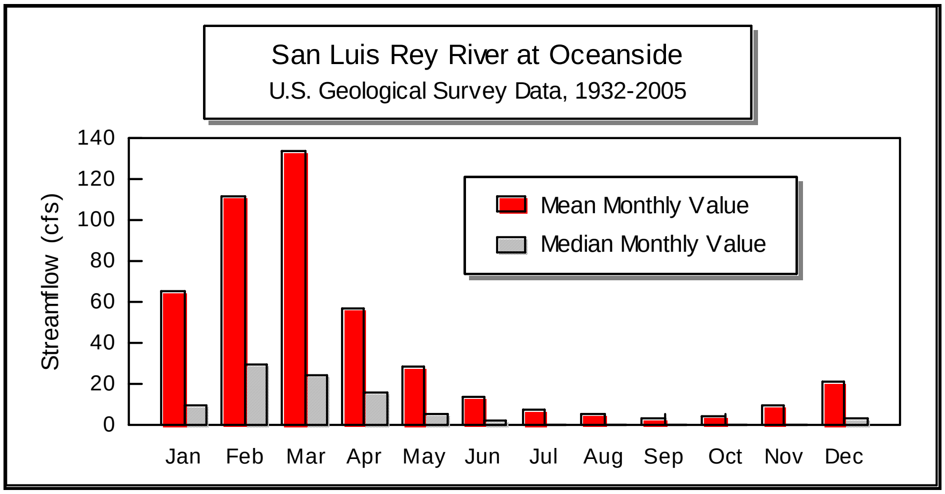


Figure B-8
Mean and Median Monthly Streamflows – San Luis Rey River at Oceanside

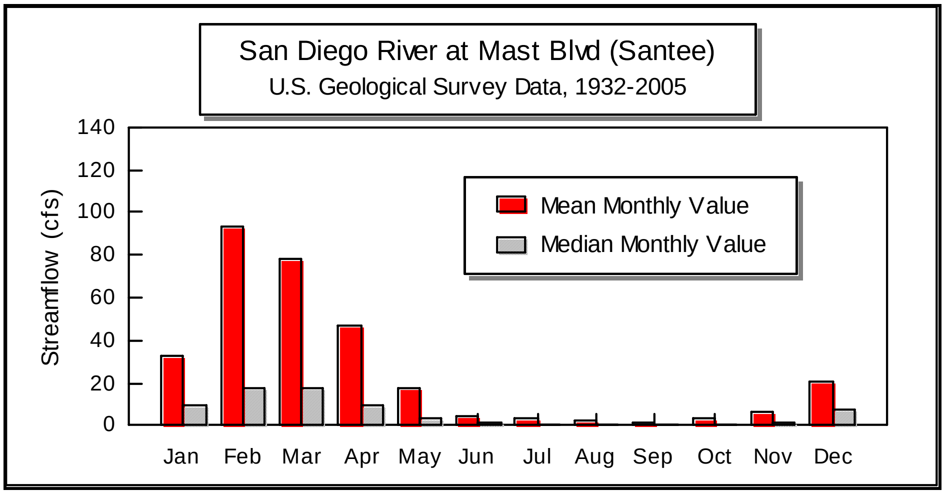


Figure B-9
Mean and Median Monthly Streamflows – San Diego River at Mast Blvd.

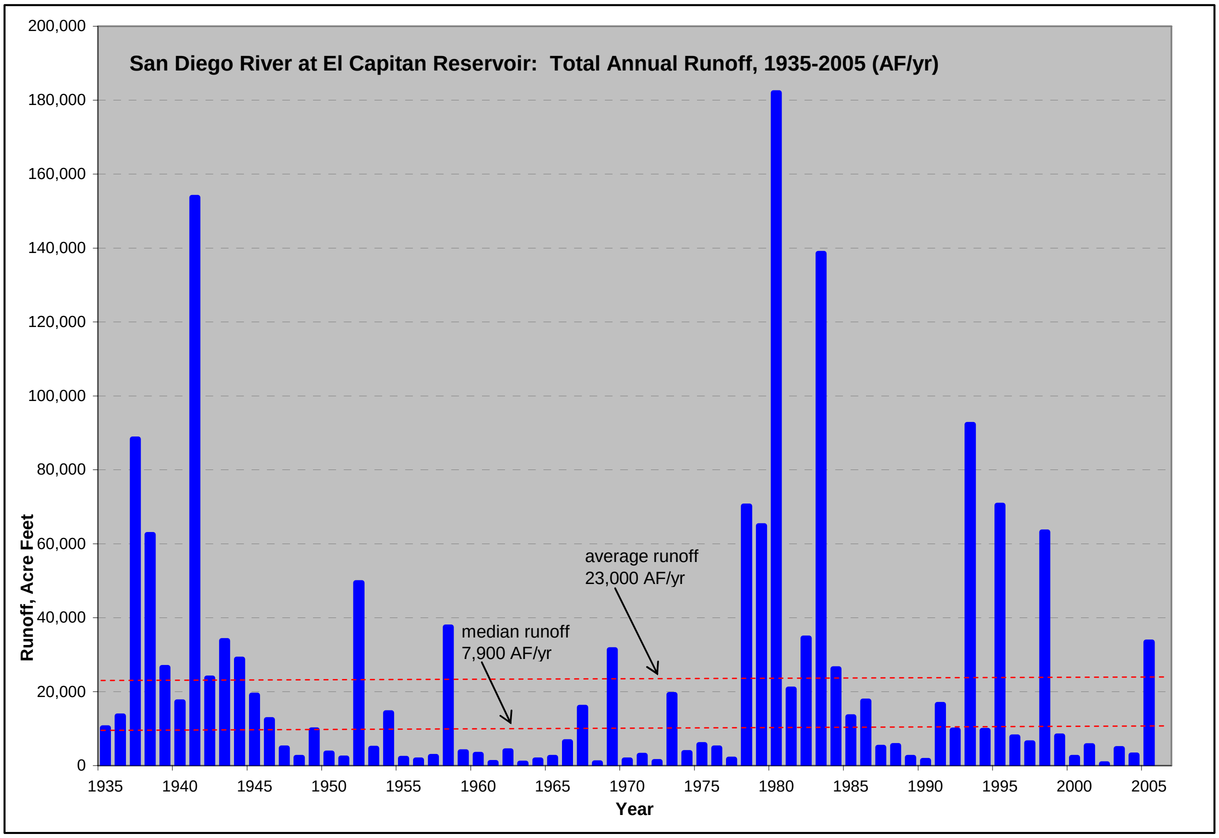


Figure B-10
San Diego River Flow at El Capitan Reservoir, 1935-2005
(Data from City of San Diego Water Department)

Streamflows at other gaging stations within the Region show a similar degree of year-to-year variability. Table B-13 (page B-33) compares pre-1975 and post-1975 summertime streamflow at the Santa Margarita, San Luis Rey, and San Diego River gaging stations. Each of these gaging stations includes significant upstream areas that have been urbanized within the past 30 to 40 years.

While runoff directly associated with precipitation contributes most of the annual volume of streamflow, urban runoff, agricultural runoff, and surfacing groundwater are the prime sources of surface flow during non-storm periods. The Region has experienced a trend of increasing non-storm flows during the past 30 years as the region has developed. Increased development has resulted in increased imported water use and increased urban runoff. Additionally, the availability of good-quality imported water within the Water Authority service area has resulted in reduced groundwater use in the Region's coastal areas during recent decades, increasing the amount of surfacing groundwater that contributes to streamflow in the downstream areas of the region.

Table B-13
Comparison of Pre-1975 and Post-1975 Median Monthly Summer Streamflow
July through October

Gaging Station	Median Monthly Summer Streamflow[1] in Cubic Feet per Second (cfs)	
	Prior to 1975	After 1975
Santa Margarita River at Fallbrook	1.5[2]	4.3[3]
San Luis Rey River at Oceanside	0.0[4]	3.8[3]
San Diego River at Mast Boulevard	0.0[5]	2.8[3]

1 Mean monthly streamflow in cfs for the summer months June through October, as reported by U.S. Geological Survey (2006).
2 Data period covering 1924 through 1974.
3 Data period from 1975 through 2005.
4 Data period from 1929 through 1974.
5 Data period from 1912 through 1974.

As shown in Table B-13, prior to 1975, San Diego and San Luis Rey median streamflows during July through October were zero. Since 1975, summertime streamflows of several cubic feet per second occur on a sustained basis.

Coastal Waters. Each of the Region's eleven hydrologic units feature coastal water resources that support wildlife habitat, endangered species, and recreational uses. (See Appendix 2 for a list of the designated beneficial uses of Region coastal waters.)

The Region's coastal lagoons represent a unique resource, and the Region features more coastal lagoons than any comparably-sized area in California. A total of eight of the eleven hydrologic units discharge to estuaries or brackish coastal lagoons, including:

- San Mateo Lagoon, San Onofre Lagoon, and Las Flores Lagoon (San Juan HU),
- Santa Margarita River Estuary (Santa Margarita River Watershed),
- San Luis Rey River Estuary (San Luis Rey River Watershed),
- Loma Alta Slough, Batiquitos Lagoon, Buena Vista Lagoon, Agua Hedionda Lagoon, and San Elijo Lagoon (Carlsbad HU),
- San Dieguito Lagoon (San Dieguito River Watershed),
- Los Peñasquitos Lagoon (Peñasquitos HU),
- San Diego River Estuary (San Diego River Watershed), and
- Tijuana River Estuary (Tijuana River Watershed).

A portion of the Peñasquitos HU (Rose and Tecolote Creeks) discharges to Mission Bay, a widely used regional recreational asset. Three HUs (Sweetwater, Otay, and a portion of the Pueblo) discharge to San Diego Bay, an important regional commercial and recreational asset.

State Board Resolution No. 74-28 requires Regional Board's to designate coastal waters as Areas of Special Biological Significance (ASBS) if the waters contain "biological communities of such extraordinary, even though unquantifiable, value that no acceptable risk of change in their environment as a result of man's activities can be entertained." The Basin Plan designates two Areas of Special Biological Significance (ASBS) within the Region, both of which are coastal waters of the Peñasquitos HU:

- La Jolla Ecological Reserve Area, and.
- San Diego Marine Life Refuge Area.

Numerous recreational beaches (see Section B.8) exist within the Region's eleven hydrologic units.

Surface Water Quality Standards. The Basin Plan (Regional Board, 1994) establishes numeric and narrative water quality objectives to protect designated beneficial uses of inland surface waters and coastal waters. Appendix 3 presents Basin Plan numerical water quality objectives for the Region. As shown in Appendix 3, the Basin Plan establishes numeric water quality objectives for total dissolved solids (TDS), mineral constituents, and turbidity on a watershed-by-watershed basis within the Region. The Basin Plan establishes TDS objectives for surface waters at 500 milligrams per liter (mg/l) (the state and federal secondary drinking water standard) in most watersheds, but TDS objectives range from as low as 300 mg/l in the upper reaches of the San Diego River Watershed to as high as 2100 mg/l in the downstream reach of the Tijuana River Watershed.

Basin Plan Surface Water Nutrient Standards

The San Diego Regional Board is the only one of the nine California Regional Boards to establish stringent Basin Plan numerical concentration standards for nitrogen and phosphorus in surface waters. The San Diego Basin Plan standard for phosphorus is established at 0.025 mg/l for standing bodies of water and 0.05 mg/l in flowing waters. The original 1976 San Diego Region Basin Plan cited historic nutrient-related biostimulation impacts to San Diego County's coastal lagoons as part of the justification for establishing the numerical phosphorus and nitrogen standards. The 1976 nutrient standards have been maintained in the current (1994) version of the Basin Plan.

As shown in Appendix 3, water quality objectives that apply to the entire region are established for total and fecal coliform bacteria, nutrients (total nitrogen and total phosphorus), pH, dissolved oxygen, and unionized ammonia. The Basin Plan establishes a region-wide phosphorus standard of 0.025 mg/l for standing bodies of water, and a phosphorus standard of 0.05 mg/l for flowing waters. A narrative object for biostimulatory substances defines total nitrogen standards at a 10:1 ratio to the total phosphorus limits.

Water quality objectives for toxic organic and toxic inorganic constituents are established at the corresponding state and federal drinking water standards for waters designated as municipal supply. The Regional Board also implements the Federal California Toxics Rule Water Quality Standards for Toxic Pollutants (CTR) established by the U.S. Environmental Protection Agency in Title 40, Section 141.38 of the Code of Federal Regulations. The California Toxics Rule establishes numeric criteria for cyanide, metals, and toxic organic constituents.

The State Water Resources Control Board establishes water quality concentration objectives for ocean waters in the *Water Quality Control Plan for Ocean Waters of California* (Ocean Plan). The Ocean Plan establishes receiving water standards for total coliform, fecal coliform, toxic inorganic constituents, and toxic organic constituents.

Section 303(d) Listed Waters. Per Section 303(d) of the Clean Water Act, the Regional Board and State Board are required to identify waters that do not meet applicable water quality objectives. Waters not attaining applicable water quality objectives are deemed to be "impaired" water bodies.

Table B-14 (Page B-36) presents 303(d) impaired water body listings for inland surface waters within the Region. As shown in Table B-14, over 40 inland surface water bodies are currently designated as not attaining applicable water quality objectives. (Regional Board, 2006a; State Board, 2006) Currently, 303(d) listed impaired inland surface waters are located within ten of the Region's eleven hydrologic units.

Table B-15 (page B-37) presents 303(d) listed impaired coastal waters. More than 35 coastal water or beach segments are currently listed as impaired within the Region, which includes the coastal waters within ten of the Region's eleven hydrologic units.

Table B-14
Designated Clean Water Act Section 303(d) Impaired Water Bodies – Inland Surface Waters

Hydrologic Unit[1]	Name	Inland Surface Water	Hydrologic Area[1]	Listed Pollutant/Stressor
901	San Juan	None listed	901	None listed
902	Santa Margarita	DeLuz Creek	902.21	Iron, manganese
		Rainbow Creek	902.22	TDS, sulfate, iron
		Sandia Creek	902.22	TDS, sulfate, nitrogen, iron, manganese
		Santa Margarita River	902.22	Phosphorus
903	San Luis Rey River	San Luis Rey River	903.11	TDS, Chloride
		Guajome Lake	903.11	Eutrophication
904	Carlsbad	Loma Alta Creek	904.1	TDS
		Buena Vista Creek	904.21	Bacteria, nutrients, sediment, sediment toxicity
		Agua Hedionda Creek	904.31	TDS, sulfate, manganese, selenium
		Buena Creek	904.32	DDT, nitrate and nitrite, phosphate
		Batiquitos Creek	904.51	Phosphorus
		San Marcos Creek	904.51	Phosphorus, sediment toxicity, DDE
		Encinitas Creek	904.51	Phosphorus
		Lake San Marcos	904.52	Ammonia nitrogen, phosphorus
		Escondido Creek	904.61	TDS, sulfate, manganese, phosphate, selenium, DDT
		Reidy Creek	904.62	Phosphorus
905	San Dieguito River	Green Valley	905.11	Sulfates, chloride, manganese, pentachlorophenol
		Del Dios Creek	905.21	Sulfates
		Lake Hodges	905.21	Nitrogen, phosphorus, color, manganese, turbidity, pH
		Kit Carson Creek	905.21	TDS, pentachlorophenol
		Felicita Creek	905.23	TDS, aluminum
		Cloverdale Creek	905.32	TDS, phosphorus
		Lake Sutherland	905.53	Color, manganese, pH
906	Peñasquitos	Miramar Reservoir	906.1	TDS, sulfates
		Los Peñasquitos Creek	906.1	TDS, phosphorus
		Soledad Canyon	906.1	Sediment toxicity
		Tecolote Creek	906.5	Bacteria, cadmium copper, lead, zinc, toxicity, phosphorus, turbidity
907	San Diego	Lake Murray	907.11	pH
		San Diego River	907.11	Fecal coliform, TDS, phosphorus, dissolved oxygen
		San Vicente Reservoir	907.21	TDS, chloride, sulfate, manganese, pH, color
		El Capitan Lake	907.31	Manganese, pH, color
		Forester Creek	907.12	Fecal coliform, TDS, pH, phosphorus, dissolved oxygen
908	Pueblo	Chollas Creek	908.22	Bacteria, copper, lead, zinc
909	Sweetwater	Sweetwater Reservoir	909.21	Dissolved oxygen
		Loveland Reservoir	909.31	Manganese, dissolved oxygen, aluminum
910	Otay	Pogi Canyon	910.2	DDT
		Lower Otay Reservoir	910.31	Nitrogen, iron, manganese, pH, color
911	Tijuana River	Tijuana River	911.11	Bacteria, trash, solids, dissolved oxygen, eutrophication, lead, synthetic organics, trace elements
		Barrett Lake	911.3	Manganese, pH, color
		Pine Valley Creek	911.41	Enterococci, phosphorus, turbidity
		Lake Morena	911.5	Manganese, pH, color
		Cottonwood Creek	911.6	DDT, phosphorus, sediment toxicity

1 Numerical hydrologic unit and hydrologic area designations are per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).

2 Section 303(d) impaired water bodies (waters not meeting existing water quality standards), as designated by the State Water Resources Control Board (State Board) in Resolution 2006-0079 (State Board, 2006).

Table B-15
Designated Clean Water Act Section 303(d) Impaired Water Bodies – Coastal Waters

Hydro-logic Unit[1]	Name	Coastal Water	Hydro-logic Area[1]	Listed Pollutant/Stressor
901	San Juan	None listed	901	None listed
902	Santa Margarita	Santa Margarita River Lagoon	902.11	Eutrophication
903	San Luis Rey River	San Luis Rey River Beaches	903.11	Bacteria
904	Carlsbad	Loma Alta Slough	904.1	Bacteria, eutrophication
		Loma Alta Creek Beaches	904.1	Bacteria
		Buena Vista Lagoon	904.21	Coliform bacteria, nutrients, sediment
		Buena Vista Creek Beaches	904.21	Bacteria
		Agua Hedionda Lagoon	904.31	Bacteria, sediment
		San Marcos Creek Beaches	904.51	Bacteria
		Escondido Creek Beaches	904.61	Bacteria
		San Elijo Lagoon	904.61	Bacteria, sediment, eutrophication
905	San Dieguito River	San Dieguito River Beaches	905.11	Bacteria
906	Peñasquitos	Los Peñasquitos Lagoon	906.1	Sediment
		Torrey Pines/Del Mar Beaches	906.1	Bacteria[4]
		Pacific and La Jolla Beaches	906.3	Bacteria[4]
		Mission Bay	906.4	Eutrophication, lead
907	San Diego	Famosa Slough	907.11	Eutrophication
		San Diego River Beaches	907.11	Bacteria
908	Pueblo	San Diego Bay	908.1	PCB
		San Diego Bay (Harbor Island)	908.1	Copper
		San Diego Bay (sub base)	908.1	Benthic community, sediment toxicity
		San Diego Bay (Shelter Is.)	908.1	Bacteria
		San Diego Bay (Americas Cup)	908.21	Copper
		San Diego Bay (Mariott Marina)	908.21	Copper
		San Diego Bay (B Street)	908.21	Bacteria, benthic community, sediment toxicity
		San Diego Bay (Switzer Ck.)	908.21	Chlordane, lindane, PAH
		San Diego Bay (downtown)	908.21	Benthic, sediment toxicity
		San Diego Bay (G Street)	908.21	Bacteria
		San Diego Bay (Chollas)	908.22	Benthic community, sediment toxicity
		San Diego Bay (Coronado Br.)	908.22	Benthic community, sediment toxicity
		San Diego Bay (28th Street)	908.22	Copper, mercury, zinc, PAH, PCB
		San Diego Bay (32th Street)	908.22	Benthic, sediment toxicity
		San Diego Bay (7th Street)	908.31	Benthic, sediment toxicity
		San Diego Bay (24th Street)	908.32	Benthic, sediment toxicity
909	Sweetwater	Chula Vista Marina	909.12	Copper
910	Otay	Imperial Beach (pier)	910.1	PCBs
		San Diego Bay	910.1	Bacteria, PCBs
		San Diego Bay (Glorietta Bay)	910.1	Copper
		San Diego Bay (Coronado Cays)	910.1	Copper
911	Tijuana River	Tijuana Riv. Watershed Beaches	911.11	Bacteria
		Tijuana River Estuary	911.11	Bacteria, trash, eutrophication, dissolved oxygen, lead, nickel, pesticides, thallium, turbidity

1 Numerical hydrologic unit and hydrologic area designations are per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).

2 Section 303(d) impaired water bodies (waters not meeting existing water quality standards), as designated by the State Board in Resolution 2006-0079 (State Board, 2006).

As part of the 303(d) impaired water designations, the Regional Board has established priorities for conducting Total Maximum Daily Load (TMDL) evaluations to identify and implement required actions to bring the water bodies into compliance with applicable standards. The Regional Board has assigned high priority TMDL's for the following 303(d) listed waters, and has initiated TMDL studies for the water bodies:

- San Diego Bay (Shelter Island): dissolved copper,
- San Diego Bay (28th Street): copper, mercury, zinc, PAH, and PCB,
- Rainbow Creek: nitrogen and phosphorus, and
- Chollas Creek: copper, lead, zinc, and diazinon.

Adopted TMDLs (see Table J-2 on page J-5) are in the implementation phase for Rainbow Creek (nitrogen and phosphorus), Chollas Creek (metals and diazinon) and Shelter Island (dissolved copper). Final TMDL studies for indicator bacteria for Region-wide beaches and creeks have been prepared and await adoption.

The Regional Board has initiated TMDL studies for the following 303(d) listed water bodies:

- TMDLs addressing indicator bacteria in San Diego Bay (Shelter Island, Shoreline Park, G Street, B Street Pier, and Tidelands Park),
- TMDLs for ten local lagoons addressing bacteria, sediment, nutrients, and TDS, and
- TMDLs addressing benthic community degradation (benthic organisms live in sediments) and sediment toxicity at three San Diego Bay locations (Downtown anchorage, B Street/Broadway Pier, and Switzer Creek) and the mouth of Chollas Creek.

Regional Constituents of Concern. Regional surface water quality monitoring program are summarized in Section J. On the basis of the 303(d) listings and monitoring conducted as part of region-wide monitoring programs, Table B-16 (page B-39) summarizes region-wide water quality issues for inland surface waters and coastal waters of the Region's eleven hydrographic units.

Table B-16
Summary of Key Water Quality Issues
Inland Surface Waters and Coastal Waters

Hydro-logic Unit[1]	Name	Constituents of Concern								
		Trash & Debris	Coliform Bacteria	Nutrients	Dissolved Oxygen	Turbidity	Sediment	Toxic Organics	Metals	TDS
901	San Juan[2]							●[2]	●[2]	●[2]
902	Santa Margarita River		●[3,4]	●[3]		●[3,4]	●[3,5]			●[3,6]
903	San Luis Rey River		●[3,5]	●[3]			●[3,5]	●[3]		●[3,4,7]
904	Carlsbad		●[3,4]	●[3]		●[3,4]	●[3,5]	●[3]	●[3]	●[3,4]
905	San Dieguito River		●[3]	●[3]	●[3]		●[3,5]		●[3]	●[3,4,7]
906	Peñasquitos		●[3,5,8]	●[3]		●[3,8]	●[3,8]	●[3]	●[3,8]	●[3,4,7]
907	San Diego River	●[3]	●[3,4]	●[3]		●[3,4]	●[3,5]	●[3]		●[3,7]
908	Pueblo[9]		●[3,4]				●[3,5]	●[3,4]	●[3,4]	
909	Sweetwater[9]		●[3]				●[3,4]	●[3]	●[3]	●[7]
910	Otay		●[3]					●[3]	●[3]	●[7]
911	Tijuana River	●[3]	●[3,4]	●[3]	●[3]	●[3,4]	●[3]	●[3]	●[3]	●[7]

1 Numerical hydrologic unit designation per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).

2 Coliform, nutrients, toxic organics, chloride, sulfate, and turbidity have been listed by the Regional Board as 303(d) impaired within portions of the San Juan HU (901) outside the Region. None of these listings (see Tables B-14 and B-15) apply to the portion of the San Juan HU within the Region. Camp Pendleton derives groundwater supply from the basin, however, and is concerned about TDS, metals, and toxic organics in ground and surface waters.

3 Designated as a constituent of concern through core monitoring performed the San Diego County Municipal Stormwater Copermittees.

4 Designated as a high frequency constituent of concern through monitoring performed by the San Diego County Municipal Stormwater Copermittees. Reported in *2004-2005 Regional Urban Runoff Monitoring Program Update* (Weston Solutions, 2006).

5 Designated as a priority constituent of concern through Baseline Long-Term Effectiveness Assessments performed as part of San Diego County Municipal Stormwater Permit monitoring program.

6 Designated as a constituent of concern for potable groundwater supplies. Groundwater quality in the lower portion of the Santa Margarita Watershed is highly dependent on the quality of surface flow.

7 TDS is a constituent of concern in areas tributary to potable water reservoirs.

8 Designated a constituent of concern within the portion of the watershed tributary to Mission Bay.

9 The Pueblo HU and the Sweetwater River Watershed are monitored separately but assessed as a single watershed management area as part of the San Diego County Municipal Stormwater Permit.

As documented in the *2004-2005 Regional Urban Runoff Monitoring Program Update*, water quality concerns common to the Region's eleven hydrologic units include:

- *Coliform Bacteria.* Elevated concentrations of coliform bacteria indicate the potential for elevated concentrations of pathogens. High concentrations of coliform bacteria resulted in beach advisories along each of the Region's eleven hydrologic units. Figure B-11 (page B-41) summarizes the results of coastal coliform bacteria sampling during 2000-2004. Beach coliform bacteria sample exceedances ranged from approximately five percent of all samples during 2000 to less than three percent during 2004. (San Diego County Department of Environmental Health, 2005) Figure B-12 (page B-41) summarizes beach advisories during 2000-2004. Observed elevated coliform bacteria concentrations have occurred as a result of stormwater runoff, urban runoff, and sewer spills. Coliform bacteria is designated a constituent of concern by the MS4 Copermittees in each of the Region's hydrologic units as a result of periodic elevated concentrations of coliform bacteria in inland surface waters, coastal waters, and beaches. (Weston Solutions, 2006; Project Clean Water, 2006)
- *Sediment and Turbidity.* Discharges of sediment can adversely impact water clarity, wildlife habitat, and aquatic habitat. Additionally, sediment can adversely affect the hydraulics of lagoons and estuaries, decrease tidal flushing, and contribute to the transport of bacteria. Turbidity can adversely affect aquatic habitats by limiting light penetration and overall aesthetics. Receiving water monitoring conducted by the MS4 Copermittees during 2001-2005 indicated that water quality objectives for total suspended solids were periodically exceeded in the Santa Margarita (902), Carlsbad (904), Peñasquitos (906), Pueblo (908), and Tijuana River (911) hydrologic units. (Weston Solutions, 2006) Sediment is listed as a constituent of concern in each of the watersheds that discharge to coastal lagoons or estuaries. Sediment and turbidity are also constituents of concern for watersheds that discharge to San Diego Bay. (Weston Solutions, 2006; Project Clean Water, 2006)
- *Nutrients.* Elevated concentrations of nitrogen and phosphorus can result in algal blooms and impacts associated with emergent and submergent vegetation. Nutrients are a particular concern in watersheds that discharge to coastal lagoons and estuaries, as summer temperatures and lagoon hydraulics that limit tidal flushing may lead to algal blooms and fish kills related to decreased dissolved oxygen levels. Nutrients can also be a concern in potable water reservoirs, as biostimulation effects can adversely affect reservoir dissolved oxygen, affect the treatability of supplies, and adversely affect taste and odor. Receiving water monitoring conducted by the MS4 Copermittees during 2001-2005 indicated that the Basin Plan's 0.05 mg/l phosphorus

objective was exceeded in a significant majority of samples collected within the Region hydrologic units. (Weston Solutions, 2006)

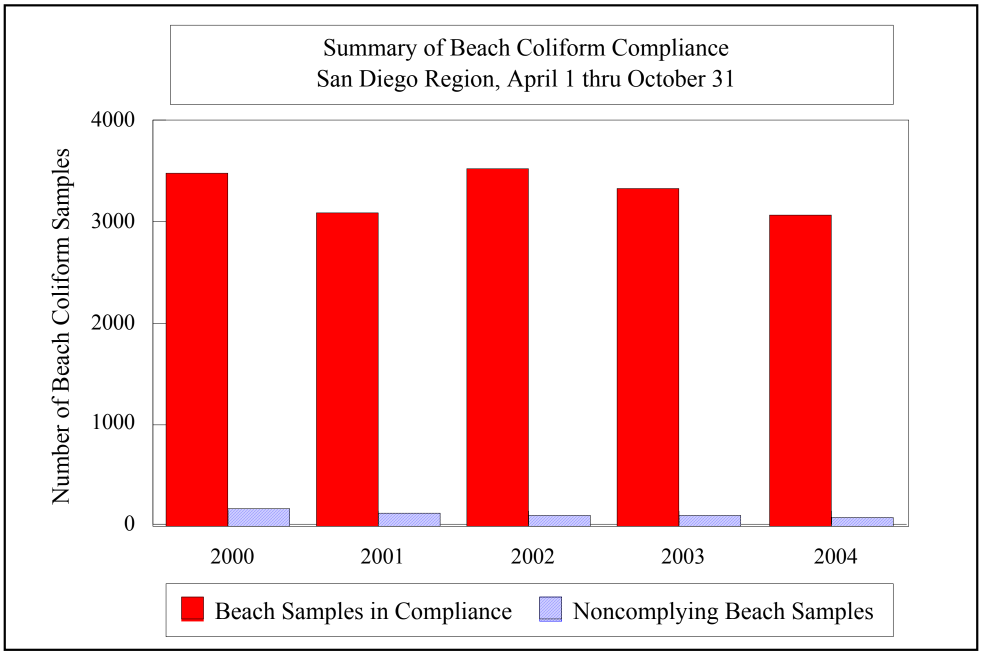


Figure B-11
Summary of Beach Coliform Sample Compliance, 2000-2004

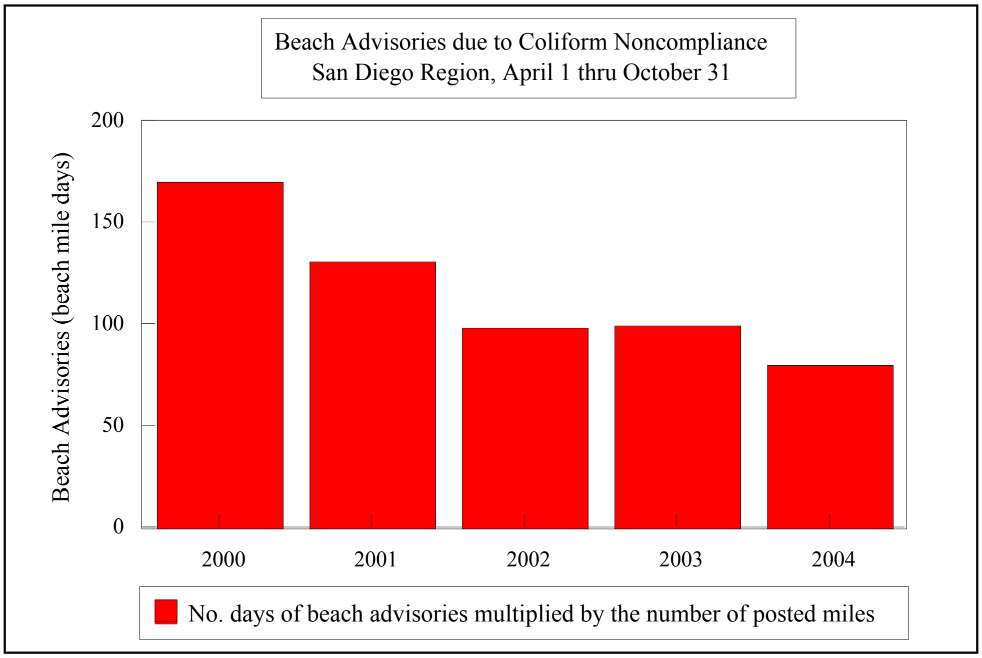
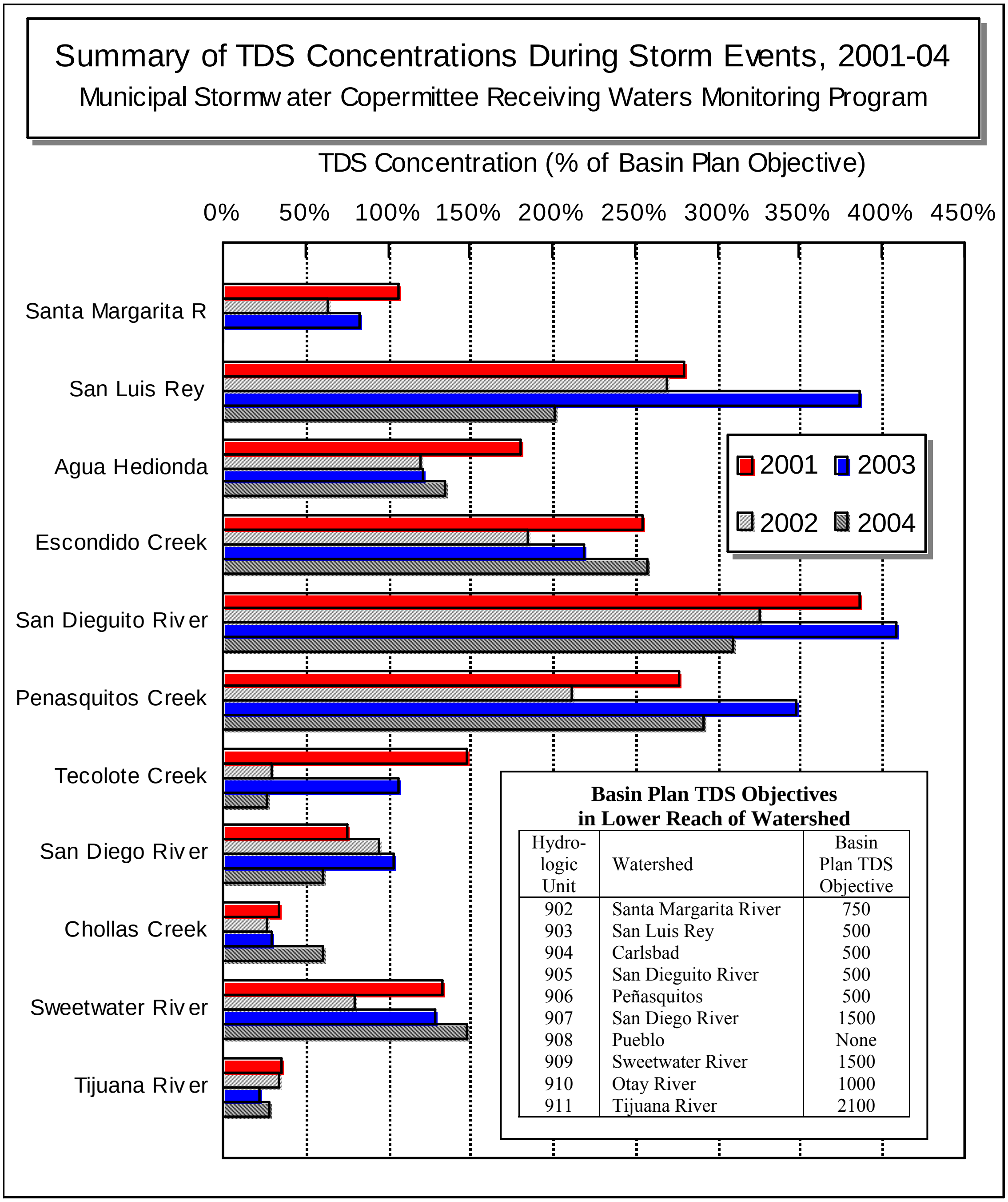


Figure B-12
Summary of Beach Advisories in the Region, 2000-2004

- *Salinity.* Concentrations of TDS and dissolved mineral constituents can adversely impact aquatic and wildlife habitat and the usability of waters for municipal and irrigation supply. TDS concentrations in Region surface waters vary significantly, with TDS concentrations being lower during periods of extreme flow and higher during periods of lower flow. Figure B-13 (page B-43) summarizes TDS concentrations at mass loading stations (stations that monitor both flow and water quality) in the downstream portions of the Region's hydrologic units as part of the MS4 Copermittees Receiving Waters Monitoring program. As shown in Figure B-13, TDS concentrations exceeded Basin Plan water quality objectives in all hydrologic units that had Basin Plan TDS objectives of 500 mg/l. TDS is a constituent of concern within all of the Region's hydrologic units except the Pueblo HU (which has no Basin Plan TDS objective).

- *Toxic Inorganic Compounds.* Toxic inorganic compounds (e.g., metals, nitrates, cyanide, and unionized ammonia) can adversely impact aquatic habitat, wildlife habitat, and water supply uses. As no inland point-source discharges of toxic inorganic pollutants exist within the Region, toxic inorganic compounds in the Region's surface waters can be presumed to originate from non-point sources. Stormwater monitoring conducted by the MS4 Copermittees during 2001-2005 showed the presence of metals in surface waters in all of the monitored hydrologic units. Chollas Creek (within the Pueblo HU), however, was the only watershed that consistently exceeded water quality objectives for copper and zinc. Metals in marine sediments at concentrations that exceed the Effects Range-Low limits (ERL, the concentration adversely affecting ten percent of the studied organisms) were detected at seven of the nine watershed embayments. No sediment metals concentrations were in excess of the Effects Range-Median limits (ERM, the concentration adversely affecting 50 percent of the organisms). In addition to detecting sediment toxicity in San Diego Bay, the MS4 monitoring detected sediment toxicity in Batiquitos and San Dieguito Lagoons. (Weston Solutions, 2006)

- *Toxic Organic Compounds.* Toxic organic compounds (e.g., pesticides and other EPA-designated priority pollutants) can adversely impact aquatic habitat, wildlife habitat, and water supply uses. No inland point-source discharges of toxic organic pollutants exist within the Region, and toxic organic compounds in the Region's waters can be presumed to originate from non-point sources. Stormwater monitoring conducted by the MS4 Copermittees during 2001-2005 detected diazinon (a pesticide) in water samples collected from all of the monitored hydrologic units. Diazinon concentrations exceeded water quality objectives in samples collected from Chollas Creek. No pesticides or organic chemicals were detected in sediment samples in any of the monitored watershed embayments. (Weston Solutions, 2006)



Basin Plan TDS Objectives in Lower Reach of Watershed

Hydro-logic Unit	Watershed	Basin Plan TDS Objective
902	Santa Margarita River	750
903	San Luis Rey	500
904	Carlsbad	500
905	San Dieguito River	500
906	Peñasquitos	500
907	San Diego River	1500
908	Pueblo	None
909	Sweetwater River	1500
910	Otay River	1000
911	Tijuana River	2100

Figure B-13
Summary of TDS Concentrations During Storm Events, 2001-2004
Municipal Copermittee Receiving Waters Monitoring Program

- *Total Organic Carbon (TOC).* Urban runoff and decaying vegetation can result in increased levels of TOC. While TOC is not a measure of toxic organic compounds, elevated TOC concentrations in local reservoir supplies present treatment challenges for surface water filtration plans. Reaction of chlorine compounds and other disinfectants with TOC during the treatment process can result in elevated concentrations of disinfection byproducts in the treated water supply.

B.6 Groundwater Resources

Designated Beneficial Uses. The Basin Plan designates beneficial uses for groundwater within each hydrologic area of the Region's eleven hydrologic units. Appendix 2 presents beneficial uses for groundwater designated in the Basin Plan.

The Basin Plan designates municipal supply, agricultural supply, and industrial process supply as beneficial uses within a significant majority of the Region's hydrologic areas. Industrial service supply, fresh water replenishment (maintaining surface flows), and groundwater recharge are listed as beneficial uses within several of the Region's hydrologic areas. The Basin Plan does not designate wildlife habitat as a beneficial use of groundwater, but significant areas of riparian habitat and groundwater-dependent vegetation exist within each of the eleven hydrologic units.

Overview of Aquifers. Groundwater within the Region occurs in alluvial aquifers, aquifers comprised of semi-consolidated or consolidated sediments, and fractured rock aquifers. Figure B-14 presents the locations of major aquifers in the Region. Table B-17 (page B-45) summarizes characteristics of key groundwater aquifers within the Region.

Except the Warner Basin, none of the Region's alluvial aquifers exceed a storage capacity of 100,000 acre-feet. A total of eight alluvial aquifers, however, are estimated to exceed a 50,000 acre-foot capacity. Aquifers comprised of alluvial deposits (alluvium) provide much of the current groundwater production capacity within the region. Yields from the Region's larger aquifers are typically on the order of several thousand acre-feet per year. (Water Authority, 1997)

Significant groundwater resources have been found to exist in deeper aquifers comprised of semi-consolidated or consolidated sediments. Recent field investigations indicate that one such deep aquifer, the San Diego Formation, has significant unused water storage and groundwater production potential.

Figure B-14
Principal Groundwater Aquifers

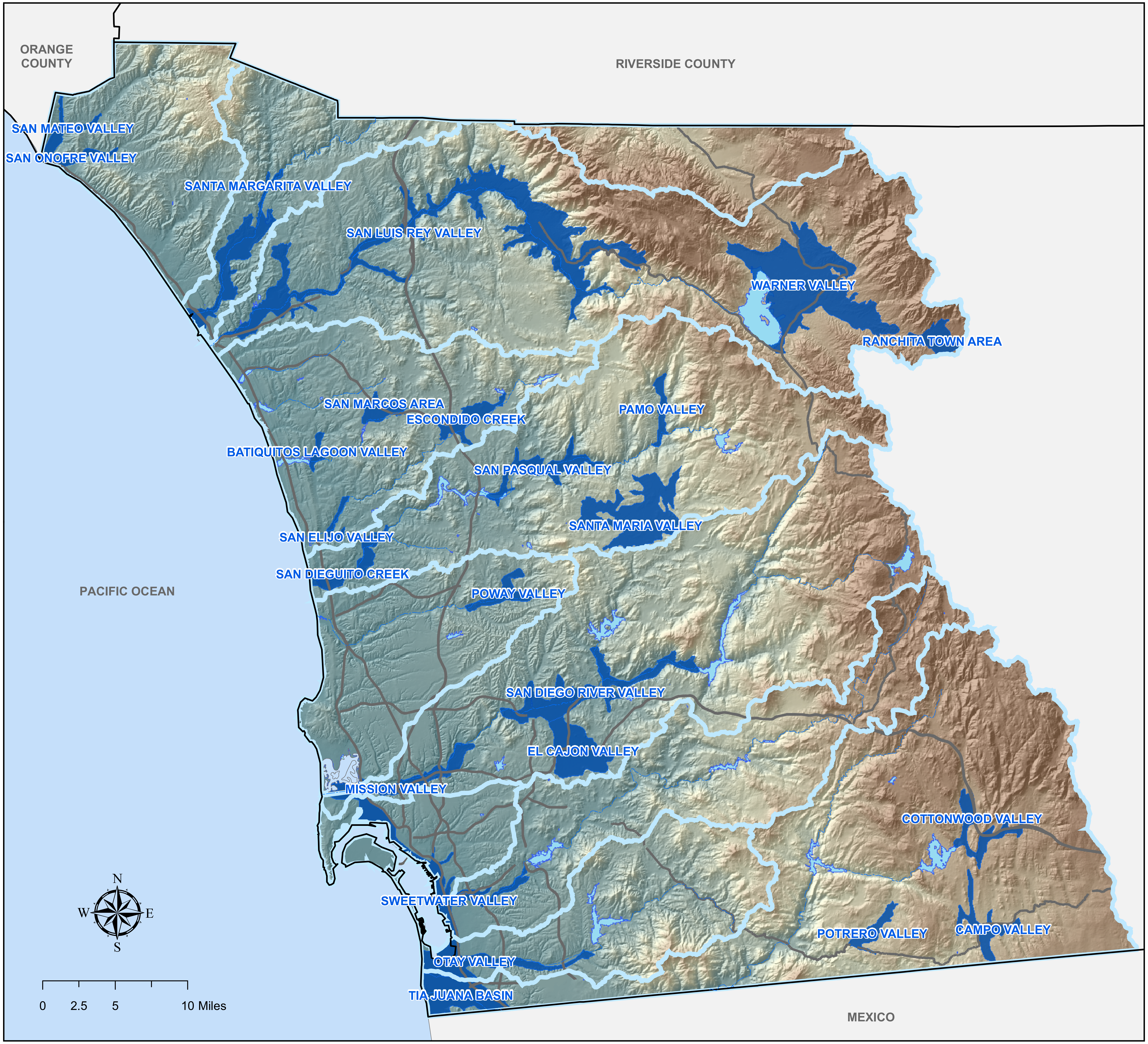


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Table B-17
Summary of the Region's Principal Groundwater Aquifers [1]

Hydrologic Unit	Hydrologic Area[2]	Name of Aquifer	Aquifer Media	Surface Area (sq. miles)	Estimated Storage Capacity (Acre-feet)	Estimated Potential Yield[3] (Acre-feet per year)	Aquifer Depth (Feet)	
							Maximum	Average
San Juan	901.4	San Mateo	Alluvium	5[4]	14,500[4]	2,800[4]	130[4]	80[4]
	901.5	San Onofre	Alluvium	2[4]	6,000[4]	760[4]	100[4]	60[4]
Santa Margarita River	902.00	Lower Santa Margarita[5]	Alluvium	7	69,200	8,500	225	100
San Luis Rey River	903.1	Mission	Alluvium	10	92,000	10,000	220	150
		Bonsall	Alluvium	7	25,000 - 40,000	5,400	130	80
		Moosa Canyon	Alluvium	1	4,000	400	150	100
	903.2	Pala/Pauma	Alluvium	78	50,000 - 75,000	8,000	150	130
	903.3	Warner	Alluvium	37.5	150,000	9,000	350	200
San Dieguito River	905.1	Lower San Dieguito	Alluvium	6	50,000	2,500	150	125
	905.3	San Pasqual	Alluvium	5	58,000	5,800	200	120
	905.4	Santa Maria	Alluvium and Residuum	24	36,000	500	225	40
San Diego River	907.1	Mission Valley	Alluvium	3	40,000	3,500	100	80
		Santee/El Monte	Alluvium	7	70,000	5,600	200	100
Sweetwater	909.1	Lower Sweetwater	Alluvium	3	13,000	1,700	145	80
	909.2	Middle Sweetwater	Alluvium	3	28,900	2,000	80	60
Tijuana River	911.1	Lower Tijuana	Alluvium	6	80,000	1,500	80	60
Pueblo Sweetwater Otay Tijuana River	908.00 909.00 910.00 911.00	San Diego Formation	Consolidated Sediments	200	200,000 - 2,000,000[6]	10,000	1400	800

1 From Water Authority *Groundwater Report* (1997).

2 Numerical hydrologic unit and hydrologic area designations per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).

3 Total existing long-term yield that could be realized on an annual basis without causing long-term overdraft. Does not consider yield restrictions that may be necessary to prevent impacts to groundwater-dependent vegetation or yield restrictions necessary to protect or improve existing groundwater quality. In many coastal basins, the available groundwater yield may not be of a quality that meets potable or irrigation use standards. (See Table B-18 on page B-48.)

4 Additional data from U.S. Marine Corps Base Camp Pendleton (1995).

5 Includes Upper Ysidora, Chappo, and Lower Ysidora Basins.

6 Broad range of estimated San Diego Formation capacity is due to limited data and non-homogeneous nature of the aquifer.

Groundwater also exists within residuum and fractured crystalline rock that occurs throughout much of the eastern portion of the County. Groundwater yields from fractured rock and residuum can be sufficient to provide water supply for individual homes, but these aquifer types are typically not sufficiently productive to warrant supply development by water supply agencies. (Water Authority, 1997)

Groundwater Quality Objectives. The Basin Plan establishes numerical groundwater quality objectives on a watershed-by-watershed basis for color, turbidity, detergent (MBAS), TDS and mineral constituents. Additionally, the Basin Plan imposes state and federal drinking water standards for toxic inorganic and toxic organic constituents on groundwaters designated for domestic use.

Appendix 3 presents Basin Plan numerical groundwater quality objectives within the Region. As documented within Appendix 3, groundwater quality objectives for TDS and mineral constituents are established as lower concentrations in the upstream portions of the hydrologic units and at higher concentrations in downstream portions of the hydrologic units.

Regional Constituents of Concern. While alluvial groundwater aquifers can be quickly recharged by stormwater or urban runoff, the porous nature of the aquifers render them susceptible to contamination by activities on the ground surface, contaminated stormwater infiltration, abandoned well heads, and from underground storage tanks.

Table B-18 (page B-48) summarizes key groundwater quality issues within the Region. As shown in Table B-18, constituents of concern within Region's groundwater aquifers include TDS, nitrate, iron and manganese, and toxic organic pollutants.

- *Total Dissolved Solids (TDS).* TDS can affect both the usability of groundwater as a domestic water source and as an irrigation water source. Groundwater TDS concentrations within coastal groundwater basins vary significantly, but have generally exhibited a trend of deteriorating water quality in recent decades as a result of seawater intrusion and salt load imbalances associated with imported water use. (Water Authority, 1997) Coastal alluvial groundwater aquifers within the region that have experienced significant degradation from elevated TDS concentrations include the Lower Santa Margarita River Basin, Mission Basin (lower San Luis Rey Basin), Lower San Dieguito River Valley, Mission Valley (lower San Diego River Basin), Lower Sweetwater River Valley, and Lower Tijuana River Valley. Groundwater TDS concentrations in these coastal alluvial aquifers currently range from approximately 750 mg/l to more than 2000 mg/l. Among the principal alluvial groundwater aquifers within the Region, only the Pala/Pauma Basin, Warner Basin, and the upstream portions of the San Pasqual, El Monte, and Middle Sweetwater Basins contain groundwater TDS concentrations within the recommended 500 mg/l state and federal secondary (non-enforceable) drinking water limits for TDS. Water quality in the San Diego Formation (a deep consolidated sediments aquifer that underlies a central portion of the City of San Diego) is highly variable. Groundwater TDS concentrations in this aquifer may range from below 500 mg/l to more than 12,000 mg/l. Groundwater TDS concentrations within inland fractured rock aquifers are variable, but most wells produce groundwater that contains TDS concentrations that are allowable for potable water uses. (Water Authority, 1997)

- *Nitrate.* State and federal primary (enforceable) drinking water Maximum Contaminant Levels (MCLs) for nitrate are established at 10 mg/l (as nitrogen), and the Basin Plan establishes more stringent nitrate objectives (as low as 2.2 mg/l as nitrogen) for many of the Region's groundwater basins. Alluvial aquifers are susceptible to nitrate contamination from fertilizer application, animal confinement, wastewater percolation, and septic tank discharges. Exceedance of the Basin Plan nitrate objectives has been documented in portions of the San Luis Rey River and San Dieguito River Watersheds. (Water Authority, 1997)

- *Iron and Manganese.* Iron and manganese occur naturally in Region's alluvial groundwaters. Groundwater from Region's coastal aquifers periodically exceeds recommended state and federal secondary (non-enforceable) drinking water standards (0.3 mg/l for iron and 0.05 mg/l for manganese). Aquifers that have exhibited iron and manganese compliance problems include portions of the Santa Margarita River, San Luis Rey River, San Dieguito River, and San Diego River Watersheds. (Water Authority, 1997)

- *Toxic Organic Compounds.* Several toxic organic compounds have been detected in groundwater within several of the Region's aquifers. Underground fuel tanks are a common source of groundwater contamination that may result in noncompliance with state and federal drinking water limits for benzene, methyl-tertiary-butyl ether (MTBE), and other volatile organic compounds. MTBE, in particular, is a key contaminant due to its low State of California primary MCL of 5 micrograms per liter (µg/l) and its ability to be rapidly dispersed by diffusion and advection throughout an aquifer. The State Board's Geotracker database system lists more than 100 sites of documented leaking underground fuel tanks within the Region's eleven hydrologic units. Although contamination effects from most of these sites are localized, a mile-long plume of petroleum derivatives from the Mission Valley Terminal (a fuel storage facility) contaminates portions of the Mission Valley aquifer in the San Diego River Watershed. The Mission Valley Terminal is under a Regional Board Order to clean up the site by year 2010. (Regional Board, 2005b).

Table B-18
Summary of Water Quality Issues within the Region's Principal Groundwater Aqufiers[1]

Hydrologic Unit	Hydro-logic Area[2]	Name of Aquifer	TDS Concentration Range (mg/l)	Water Quality Constituents of Concern[3]			
				TDS	Nitrate	Iron & Manganese	Toxic Organics
San Juan	901.4	San Mateo	400 – 800	●	●		●
	901.5	San Onofre	600 - 1500	●	●		●
Santa Margarita	902.00	Lower Santa Margarita[4]	600 – 750	●		●	●
San Luis Rey River	903.1	Mission	500 - 2000	●		●	●
		Bonsall	600 - 3400	●	●		
		Moosa Canyon	200 – 900	●	●		
	903.2	Pala/Pauma	350 - 1400	●	●		
	903.3	Warner	250 – 350				
San Dieguito River	905.1	Lower San Dieguito	1000 - 27,000	●		●	
	905.3	San Pasqual	320 - 2500	●	●		
	905.4	Santa Maria	500 - 1500	●	●		
San Diego River	907.1	Mission Valley	1000 - 3000	●		●	●
		Santee/El Monte	500 - 3000	●		●	
Sweetwater	909.1	Lower Sweetwater	1700 - 3100	●			
	909.2	Middle Sweetwater	300 - 1400	●			
Tijuana River	911.1	Lower Tijuana	500 - 3000	●			
Pueblo Sweetwater Otay Tijuana River	908.00 909.00 910.00 911.00	San Diego Formation	340 – 12,000	●			

1 From Water Authority *Groundwater Report* (1997).
2 Numerical hydrologic unit and hydrologic area designations per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).
3 Constituents that have exceeded state or federal drinking water primary or secondary standards in untreated groundwater (prior to treatment).

B.7 Environmental Resources

Habitat Resources. The Region's eleven hydrologic units support many habitat communities, and the Region has more rare, threatened, and endangered plant and animal species than any comparable land area in the continental United States. (Pulliam and Babbitt, 1997). The County MSCP Plan and MHCP Plan are being implemented by the County and local jurisdictions to protect these resources. Figure B-15b (following page) presents the boundaries of the MSCP and MHCP Plan areas.

In addition to the 900-square-mile area covered by the MSCP Plan and 175-square-mile area covered by the MHCP Plan, the County is in the process of developing a North County MSCP Plan encompassing approximately 487 square miles in the northwestern portion of the county, and an East County MSCP Plan that addresses habitat needs within a 2,420-square-mile area. Approximately 41 percent of the MSCP Plan area is developed or urbanized, and about five percent is used for agriculture.

Vegetation Communities. Figure B-15a presents the geographical distribution of vegetation communities within the Region. Table B-19 (page B-50) describes the principal vegetation communities and characteristic species.

In addition to the vegetation communities summarized in Table B-19, vernal pools are also known to occur in San Diego within the Santa Margarita River Watershed, Carlsbad HU, San Dieguito River Watershed, Peñasquitos HU, and Otay River Watershed, and Tijuana River Watershed. Vernal pool sites are characterized by fine textured soils underlain by cemented hardpan. Vernal pool vegetation consists of a low, herbaceous community dominated by annual herbs and grasses.

Wildlife and Endangered Species. The Region's vegetation communities support a wide array of wildlife species. San Diego is home to approximately:

- 1534 total native plant species,
- 75 species of reptiles and amphibians,
- approximately 140 species of mammals, including 23 species of bats,
- 20,000 species of insects, and
- 492 species of birds, of which about 70 breed within the County.

Table B-19
Vegetation Communities[1]

Community	Range	Characteristic Vegetation Species
Coastal Sage Scrub	Extends from the coast to approximately a 1,500-foot elevation. Over 70 percent of the County's coastal sage scrub has been removed by urban development, but the habitat is found in portions of most of the Region's eleven hydrologic units.	• California sagebrush (*Artemisia californica*) • flat-top buckwheat (*Eriogonum fasciculatum*) • laurel sumac (*Malosma laurina*) • white and black sage (*Salvia apiana* and *S. mellifera*)
Chaparral	Exists within an elevation range of 1,000 to 5,000 feet. Vegetation survives the prolonged summer drought season through deep root structure, leaves that minimize evaporation losses, and an ability to recover from wildfire.	• manzanita (*Arctostaphylos* spp.) • redshank (*Adenostoma sparsifolium*) • oaks (*Quercus* spp.) • chamise (*Adenostoma fasciculatum*) • California lilac (*Ceanothus* spp.)
Coastal Sage-Chaparral Scrub	Transition community containing species typical of both chaparral and coastal sage scrub	(See Coastal Sage Scrub and Chaparral)
Grassland	Native and non-native grasslands occur throughout the Region's eleven hydrologic units. The largest mountain grassland in the County is at Lake Henshaw and Warner Ranch (San Luis Rey River watershed).	• purple needlegrass (*Nasella pulchra*) • wild barley (*Hordeum murinum*) • rip-gut (*Bromus diandrus*) • slender wild oat (*Avena barbata*) • foxtail (*Bromus madritensis*).
Riparian/Wetlands	Occurs along watercourses within each of the Region's eleven hydrologic units. Consists of tall, open, broadleafed riparian forests, woodlands, and dense, broadleafed riparian thickets. Herbaceous plants dominate the understory.	• willows (*Salix* spp.) • western cottonwood (*Populus fremontii*) • western sycamore (*Platanus racemosa*) • mule fat (*Baccharis salicifolia*) • Douglas mugwort (*Artemisia douglasiana*) • cattails (*Typha* spp.), bulrush (*Scirpus* spp.) • sedges (*Carex* spp.), primrose (*Oenothera*, spp.)
Oak Woodlands	Consists of open or closed canopy woodlands dominated by oaks, including coast live oaks.	• coast live oaks (*Quercus agrifolia*) • Engelmann oaks (*Quercus engelmannii*)
Coniferous Forest	Found at elevations above 3,500 feet in the northeastern portion of the Region, including Palomar State Park, and the Laguna recreation area in Cleveland National Forest.	• Jeffrey pine (*Pinus jeffreyi*) • Coulter pine (*Pinus coulteri*) • California Black Oak (*Quercus kelloggii*) • incense cedar (*Libocedrus decurrens*) • white fir (*Abies concolor*)
Beach/Foredunes	Found along the coast and bay shores, and characterized by stretches of loose, wind swept, sandy dunes that vary in width from a few to several hundred feet.	• Beach sun cup (*Cammissionia cheirianthifolia)* • Beach bur (*Ambrosia bipinnatifida)* • Sea rockets (*Cakile maritima)*
Eucalyptus Woodland	Consists of open to dense stands of eucalyptus trees, which are an invasive, non-native species. The understory can include grasslands and chaparral habitats.	• Eucalyptus (*Eucalyptus* spp.)
Disturbed Habitat	Disturbed habitat consists of previously disturbed areas that are either devoid of vegetation (dirt roads/trails) or support scattered non-native species	• wild radish (*Raphanus sativus*) • tumbleweed (*Salsola tragus*) • tocalote (*Centaurea* meletinsis)
Shallow Bay	Includes Mission Bay and portions of San Diego Bay. Shallow bay areas may support some scattered emergent wetland vegetation.	None - primarily open water

1 Adapted from USFWS and DFG (1998).

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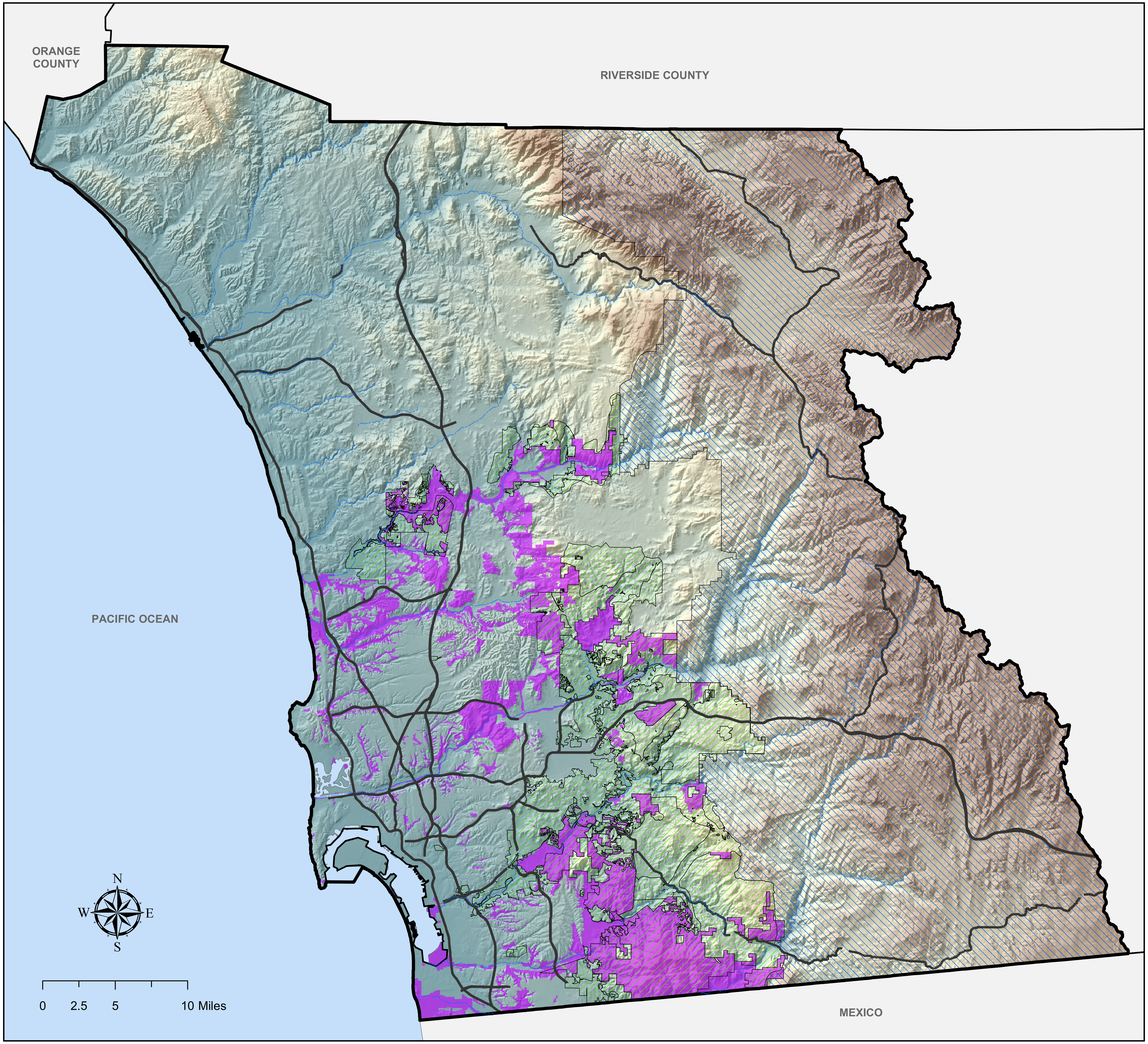

Figure B-15b

San Diego Region

Multiple Species Convervation Planning Areas and Multiple Habitat Planning Areas

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Over 200 plant and animals species in the County are listed as endangered, threatened, rare, or are candidates for listing. (USFWS and DFG, 1998) Over half of these species occur in the southwest portion of Region within the MSCP Plan area. Appendix 4 presents the listed species covered under the MSCP Plan area and describes their associated habitats. Appendix 4 also presents non-listed species that occur within the MSCP Plan area that are considered sensitive.

Wildlife corridors and linkages are a key component of the Region's species protection plans. The plans identify primary wildlife corridors/linkages that (1) connect core biological resource areas within the protection plan boundaries and (2) provide connections to habitat outside the boundaries. As an example, identified linkages in the MSCP Plan include:

- Otay Ranch to Sycuan,
- Sweetwater Reservoir to McGinty Mountain,
- Interstate-8 at Lakeside,
- Dehesa to El Capitan Reservoir, and
- Boden Canyon.

Core biological resource areas and corridors within the City of San Diego portion of the MSCP Plan area that are targeted for conservation include the Otay Lakes Cornerstone Lands, Marron Valley Cornerstone Lands, and San Vicente Cornerstone Lands. Similar linkages and core biological resource conservation lands are addressed within the North and East County habitat protection plans.

The Region's inland surface waters support both warm freshwater aquatic habitat and cold freshwater aquatic habitat. Common channel flow regimes within the Region include alluvial reaches, including pools, bars, and shallow riffles. Upstream sections of the Region's major watercourses may contain cobble and bedrock reaches.

In 1998, the Regional Board implemented a four-year bioassessment program to expand ongoing efforts to assess the integrity of the Region's waters, develop indices of biological integrity, identify reference conditions, and develop baseline data. Assessment work completed to date indicates significant geographic and temporal variation in habitat integrity indices within the Region. The studies recommended designating the lower 25th percentile of reference site data as representing "poor" or "very poor" quality habitat. Monitoring sites with habitat indices in this lower 25th percentile were identified in portions of most of the Region's hydrologic units. (DFG, 1999, 2000, 2001)

Aquatic, Estuarine, and Marine Habitats. Estuarine habitats within the Region include coastal lagoons, seagrass beds, southern coastal salt marsh, and brackish marsh.
A wide range of intertidal marine habitats exist along the Region's coast, including: intertidal sandy beach, cobble beach, intertidal platform, intertidal boulder field, tidal pool, and rocky

headland. Submerged marine habitats along the Region's coastline include: soft/sand bottom, rocky reef, seagrass beds, surfgrass, and kelp beds.

Invasive Species. Non-native invasive vegetation species have become established in portions of all of the Region's eleven hydrologic units. The non-native invasive vegetation can alter fire frequencies, alter soil conditions, change local hydrology, and reduce the reproductive ability of native vegetation. Once established, the non-native vegetation can displace the native vegetation community and dependent wildlife. Invasive species impacting the Region's riparian community include but are not limited to giant reed (*Arundo donax*) and salt cedar (*Tamarix* spp.). Through increased water uptake, these species can lower natural water tables, limit groundwater recharge, and reduce streamflow. In addition to hydrological changes, salt cedar leaf litter can sufficiently increase soil salinity so that areas can become unsuitable for native vegetation and dependent wildlife. *Arundo* and *Tamarix* support few insects, the main food supply for insectivorous birds, while limiting or eliminating native vegetation and their associated habitats. In addition to adversely affecting native vegetation and wildlife, invasive species also negatively affect aesthetics and recreational access, and can increase the potential for flooding. Other key invasive species within the Region include: iceplant (*Carpobrotus edulis*), Pampas grass (*Cortaderia selloana*), and German ivy (*Senecio mikanioides*). Iceplant occupies significant areas of the Region, including coastal dunes, and can deprive native vegetation of moisture and nutrients. German ivy can cover native vegetation and reduce access to light and air. Pampas grass out-competes native vegetation through its aggressive root system. Invasive species eradication efforts are currently underway in many of the Region's hydrologic units.

The marine algae *Caulerpa taxifolia* is an invasive species of concern for the Region's coastal and marine waters. *Caulerpa taxifolia* grows as a dense blanket that covers and kills native aquatic vegetation. Once established, *Caulerpa taxifolia* results in the displacement of fish, invertebrates, marine mammals, and sea birds that are dependent on the displaced native marine vegetation. (Regional Board, 2006b) In 2000, *Caulerpa taxifolia* was found in Agua Hedionda Lagoon (Carlsbad HU). Eradication efforts including chemical treatment, tarping, surveillance, and public outreach efforts were conducted by the Southern California Caulerpa Action Team. As a result of these efforts, full eradication of Caulerpa taxifolia has been achieved.

The Quagga mussel is a recent invasive species of critical concern within the Region. The Quagga mussel is a small mollusk that can adversely impact the Region's water supply operations and facilities by clogging pumps, clogging water lines, creating taste and odor problems in treated water supplies, and adversely altering ecosystems within the Region's surface water reservoirs. In February 2007, Metropolitan launched a comprehensive program to detect and control an invasion of Quagga mussels within Metropolitan's imported water supply network. Quagga mussels were confirmed in several of the Region's imported water supply reservoirs in August 2007. The Water Authority has formed a Task Force to address the issue, and the Region's water agencies are currently working to develop and implement a plan to identify and isolate the potentially damaging mollusk.

Invasive species within San Diego Bay represents an additional concern within the Region. Biological surveys conducted by DFG have confirmed the presence of over 50 non-native species within San Diego Bay. (DFG, 2006)

B.8 Recreational Resources

The Region supports a wide array of recreational resources. The region features 70 miles of recreational beaches, which include:

- eight state beaches, including: Cardiff, Carlsbad, Leucadia, Moonlight (operated by the City of Encinitas), San Elijo, Silver Strand, South Carlsbad, and Torrey Pines, and
- municipal beaches in Oceanside, Encinitas, Solana Beach, Del Mar, San Diego, Coronado, and Imperial Beach.

Important coastal preserves and recreational areas include:

- Buena Vista Lagoon State Marine Park (Carlsbad HU),
- Agua Hedionda State Marine Reserve (Carlsbad HU),
- Batiquitos Lagoon State Marine Park (Carlsbad HU),
- San Elijo State Marine Conservation Area (Carlsbad HU),
- San Elijo County Park and Ecological Preserve (Carlsbad HU),
- Cardiff and San Elijo State Marine Conservation Area (Carlsbad HU),
- San Dieguito Lagoon State Marine Park (San Dieguito River Watershed),
- La Jolla State Marine Conservation Area (Peñasquitos HU),
- Torrey Pines State Reserve (Peñasquitos HU),
- San Diego Scripps State Marine Conservation Area (Peñasquitos HU),
- Mia J. Tegner State Marine Conservation Area (Peñasquitos HU),
- Sweetwater Marsh National Wildlife Refuge (San Diego Bay Watershed),
- South Bay County Biological Study Area (San Diego Bay Watershed),
- Chula Vista Wildlife Preserve (San Diego Bay Watershed),
- Tijuana Slough National Wildlife Refuge (Tijuana River Watershed),
- Tijuana National Estuarine Sanctuary (Tijuana River Watershed),
- Tijuana River Valley Regional Park (Tijuana River Watershed), and
- Border Field State Park (Tijuana River Watershed)

As noted, the La Jolla Ecological Reserve and Marine Live Refuge are designated as ASBS. Together, these areas are part of the San Diego-La Jolla Underwater Park. The 6,000-acre underwater park (established by the City of San Diego) stretches from La Jolla Cove in the south to the north end of Torrey Pines Reserve.

The County Department of Parks and Recreation maintains 90 parks and recreational facilities covering approximately 40,000 acres, including local and regional parks, fishing lakes, community centers, special-use facilities, ecological preserves, and open spaces. The County also operates the County Trails Program that includes (1) a Regional Trails Plan that addresses 650 miles of existing and planned trails, and (2) a Community Trails Master Plan that addresses over 1400 miles of new and existing trails.

The City of San Diego maintains a parks system that includes three regional parks, five open space parks, and numerous community parks. The City also maintains a lakes recreation program that offers fishing and water contact sports to visitors at nine surface water reservoirs. Additionally, the Region’s other 17 municipalities maintain numerous community parks, regional parks, and open space preserves.

Cleveland National Forest covers significant portions of the Region, including upstream areas of the San Luis Rey River, San Dieguito River, San Diego River, Sweetwater, and Tijuana River Watersheds. Mountain area state parks within the Region include Palomar Mountain State Park (San Luis Rey River Watershed) and Cuyamaca Rancho State Park (San Diego and Sweetwater River Watersheds).

B.9 Water Supply Infrastructure

As noted in Section A, the Water Authority serves as the Region’s water wholesale agency. Depending upon local hydrologic conditions, water supplies delivered by the Water Authority to its member agencies comprise approximately 70 to 90 percent of the total water supply within San Diego County. (Water Authority, 2005) Imported water (water originating outside the Region) currently comprises 100 percent of the supply provided to member agencies by the Water Authority.

Imported Water System. The Water Authority purchases imported water from three sources: the Metropolitan Water District of Southern California (Metropolitan), conserved agricultural water from the Imperial Irrigation District (IID), and conserved water from projects that are lining the All-American and Coachella Canals.

Metropolitan is Southern California’s wholesale water agency, and the Water Authority is the largest customer among Metropolitan’s 26 member agencies. Metropolitan derives its water supply from two sources: the Colorado River and the State Water Project. Metropolitan owns and operates the Colorado River Aqueduct to deliver Colorado River water to Southern California. Metropolitan is also the largest of the State Water Contractors that receive supply from the State Water Project. State Water Project water (originating from the Bay Delta) is delivered to Metropolitan via the California Aqueduct.

In 1998, the Water Authority entered into a transfer agreement with IID to purchase conserved agricultural water. Through the agreement, the Water Authority received 30,000 acre-feet in 2005, and 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. Metropolitan conveys the IID transfer water to the Water Authority via an exchange agreement. The Water Authority takes delivery of the Metropolitan and IID transfer supplies at a point located six miles south of the San Diego County-Riverside County border. The Water Authority conveys imported water to its member agencies through two aqueducts that consist of five large-diameter pipelines. Figure B-16 (following page) shows the locations of the Water Authority aqueducts.

The aqueducts follow general north-to-south alignments, and the water is delivered largely by gravity. The First Aqueduct includes Pipelines 1 and 2, which are located in a common right-of-way and are operated as a unit. These pipelines have a combined capacity of 180 cubic feet per second (cfs). Pipelines 3, 4, and 5 form the Second Aqueduct. These pipelines are operated independently and are located in separate rights-of-way from the First Aqueduct. Pipelines 3, 4, and 5 have respective capacities of 280 cfs, 425 cfs, and 480 cfs. Key appurtenant facilities to the aqueduct system include flow control facilities, pump stations, control valves, and air release mechanisms. The Water Authority delivers the imported supply to member agencies via 88 turnouts along the aqueduct system.

The five pipelines of the First and Second Aqueducts allow the Water Authority to take delivery of both treated (filtered and disinfected) and untreated (raw) water from Metropolitan. The Water Authority delivers untreated water to member agency surface reservoirs or water treatment facilities. The Water Authority delivers treated water from Metropolitan’s Skinner Water Treatment Plant (located at Lake Skinner in Riverside County) directly to member agency potable water distribution systems.

Water Supplies. Table B-20 (page B-56) presents a breakdown of member agency water supplies during Water Year 2004-2005. Approximately eleven percent of the overall regional supply was from local sources (groundwater, local surface water, and recycled water). A total of nine member agencies develop potable supplies from local surface waters, and nine member agencies develop local groundwater supplies. Additionally, a total of 14 of the 24 Water Authority member agencies provide recycled water supply to irrigation customers within their respective service areas.

Table B-20
Member Agency Water Supply – Water Authority Service Area

Water Authority Member Agency	2005 Water Supply in Acre-feet per Year[1]			Percent of Supply from Local Sources	Source of Member Agency Local Supply		
	Total Agency Supply	Water Authority Imported Supply	Member Agency Local Supply[2]		Recycled Water	Local Surface Water	Ground-water
Carlsbad MWD	21,497	20,155	1,342	6.2%	●		
City of Del Mar	1,377	1,324	54	3.9%	●[3]		
City of Escondido	29,344	25,103	4,240	14.4%	●	●	
Fallbrook PUD	16,230	15,809	421	2.6%	●		
Helix Water District	38,785	32,060	6,726	17.3%		●	●
Lakeside Water District[4]	5,400[4]	3,940[4]	1,460[4]	27%[4]			●
City of National City	6,741	2,366	4,376	64.9%		●[5]	●
City of Oceanside	33,518	31,181	2,337	7.0%			●
Olivenhain MWD	21,834	21,052	782	3.6%	●		
Otay Water District	38,825	37,787	1,038	2.7%	●		
Padre Dam MWD	19,898	19,246	652	3.3%	●		
Camp Pendleton	9,245	834	8,411	91.0%	●		●
City of Poway	14,879	13,975	904	6.1%	●		
Rainbow MWD	25,252	25,252	0	0.0%			
Ramona MWD	11,299	10,359	939	8.3%	●	●[6]	●
Rincon Del Diablo MWD	7,784	7,732	52	0.7%	●[7]		
City of San Diego	226,906	204,039	22,866	10.1%	●	●	●
San Dieguito Water Dist.	7,904	5,605	2,298	29.1%	●[3]	●	
Santa Fe Irrigation Dist.	13,796	9,737	4,059	29.4%	●[3]	●	
South Bay Irrigation Dist.	16,817	8,965	7,852	46.7%		●[4]	●
Vallecitos Water District	18,150	18,150	0	0.0%			
Valley Center MWD	38,459	38,105	355	0.9%	●		
Vista Irrigation District	22,398	21,299	1,170	5.2%		●	●
Yuima MWD	3,907	2,984	923	23.6%			●
Totals	644,845	573,048	71,797	11.1%			

1 From *Water Authority 2005 Annual Report* (Water Authority, 2005) for Fiscal Year 2004-2005.

2 Includes local recycled water, surface water, and groundwater supplies. Does not reflect conserved water. Also does not include groundwater pumped by private well owners.

3 San Elijo Joint Powers Authority provides recycled water supply to the City of Del Mar, San Dieguito Water District, and Santa Fe Irrigation District.

4 Lakeside Water District joined the Water Authority in 2006. Lakeside Water District water use data for 2005 are from Lakeside Urban Water Management Plan (Lakeside Water District, 2006). Lakeside Water District and Riverview Water District merged in 2007.

5 Local surface water supply is from Sweetwater Authority (a joint powers agency comprised of the South Bay Irrigation District and City of National City).

6 In addition to providing treated (potable supply), the Ramona MWD provides untreated water to irrigation customers.

7 Rincon Del Diablo MWD recycled water supply is provided by the City of Escondido.

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Local hydrologic conditions (precipitation, evaporation, and surface flows) influence both the quantity of water demand and the availability of local supplies within the Region. Table B-21 summarizes the variation in Region's local water supplies from 1999-2005.

As shown in Table B-21, imported water supplies provided through the Water Authority have comprised from 83.5 to 93 percent of the Region's water supply in recent years. (Except during periods of extreme drought, Water Authority supplies typically comprise between 70 and 90 percent of the Region's water supply.)

Table B-21
Imported Water Reliance within the Region, 1999-2005

Fiscal Year	Water Supply in Acre-feet per Year[1]			Percent of Regional Supply from Imported Water[2]
	Total Regional Supply[2]	Water Authority Imported Supply	Member Agency Local Supply[3]	
1999-2000	694,997	580,118	114,877	83.5%
2000-2001	646,387	564,140	82,247	87.3%
2001-2002	686,530	615,572	70,957	89.7%
2002-2003	649,622	586,849	62,773	90.3%
2003-2004	715,763	666,008	49,755	93.0%
2004-2005	644,845	573,048	71,797	88.9%

1 From *Water Authority 2005 Annual Reports* for Fiscal Years 1999-2000 through 2004-2005.
2 Regional supply provided by water agencies within the Water Authority service area. As noted in Table B-1 (page B-5), all but a small fraction of the Region's population is within the Water Authority service area. Local groundwater is the source of water supply in rural areas outside the water distribution networks of the Water Authority member agencies.
3 Includes local recycled water, surface water, and groundwater supplies. Does not reflect conserved water. Also does not include groundwater pumped by private well owners.

Regional Water Supply Infrastructure. Figure B-16 (previous page) presents the location of key local water supply infrastructure within the Region.

Surface water reservoirs located within the Region are summarized in Table B-22 (page B-58). As shown in the table, local water supply reservoirs exist within eight of the Region's eleven hydrologic units. A total of 17 reservoirs are currently connected to the Water Authority's aqueduct system.

Table B-22
Principal Surface Water Reservoirs[1]

Hydro-logic Unit[2]	Watershed	Reservoir	Operating Agency	Capacity (Acre-Feet)	Aqueduct Connection[3]
903	San Luis Rey River	Red Mountain	Fallbrook Public Utility District	1,335	●
		Beck	Rainbow Municipal Water District	625	●
		Morro Hill	Rainbow Municipal Water District	465	●
		Turner[4]	Valley Center Municipal Water Dist.	1,612[4]	
		Henshaw	Vista Irrigation District	51,744	
904	Carlsbad	Maerkle	Carlsbad Municipal Water District	600	●
		San Dieguito[4]	San Dieguito Water District Santa Fe Irrigation District	883[4]	●
		Olivenhain[5]	Water Authority[5] Olivenhain Municipal Water District	24,364	●
		Dixon	City of Escondido	2,606	●
		Wohlford	City of Escondido	6,506	
905	San Dieguito River	Hodges	City of San Diego	33,550	●[6]
		Sutherland	City of San Diego	29,685	
		Ramona	Ramona Municipal Water District	12,000	●
906	Peñasquitos	Miramar	City of San Diego	7,185	●
		Poway	City of Poway	3,330	●
907	San Diego River	Murray	City of San Diego	4,818	●
		San Vicente	City of San Diego	90,230	●
		El Capitan	City of San Diego	112,807	●[7]
		Cuyamaca	Helix Water District	8,195	
		Lake Jennings	Helix Water District	9,790	●
909	Sweetwater	Loveland	Sweetwater Authority	25,387	
		Sweetwater	Sweetwater Authority	28,079	●
910	Otay	Lower Otay	City of San Diego	49,510	●
911	Tijuana River	Barrett	City of San Diego	37,947	
		Morena	City of San Diego	50,207	

1 From *Updated 2005 Urban Water Management Plan* (Water Authority, 2007).
2 Numerical hydrologic unit and hydrologic area designations per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).
3 Bullets indicate which reservoirs are connected to the Water Authority's San Diego Aqueduct to receive untreated aqueduct water.
4 Reservoir is not currently used as a source of raw potable water supply.
5 Reservoir jointly owned and operated by the Water Authority and Olivenhain Municipal Water District. Reservoir is part of the Water Authority's Emergency Storage Program.
6 Hodges Reservoir is not currently connected to the Water Authority's San Diego Aqueduct, but will be connected in the future as part of the Water Authority's Emergency Storage Program.
7 El Capitan Reservoir is indirectly connected, via San Vicente Reservoir, to the Water Authority's aqueduct.

None of the reservoirs are currently operated as hydroelectric power generation facilities, but power recovery opportunities exist downstream from several of the reservoirs. Forty megawatt (40 mW) power generation facilities are currently being constructed as part of a pumped storage project that links Olivenhain Reservoir and Lake Hodges. The pumped storage project would produce peak times of electrical usage within the Region.

Table B-23 summarizes regional water filtration facilities operated by Water Authority member agencies and identifies associated sources of filtration plant raw water supply.

Table B-23
Potable Water Filtration Facilities[1]

Hydro-logic Unit[2]	Watershed	Treatment Facility	Operating Agency	Capacity (million gallons per day)	Aqueduct Connection[3]
903	San Luis Rey River	Weese	City of Oceanside	25	●
		Escondido/Vista[4]	City of Escondido Vista Irrigation District	75	●
904	Carlsbad	Badger[5]	San Dieguito Water District Santa Fe Irrigation District	40	●
		Olivenhain[5]	Olivenhain Municipal Water District	34	●
		Escondido/Vista[4]	City of Escondido Vista Irrigation District	75	●
905	San Dieguito River	Bargar	Ramona Municipal Water District	4	
906	Peñasquitos	Miramar	City of San Diego	140 (200)[6]	●
		Berglund	City of Poway	24	●
907	San Diego River	Alvarado[7]	City of San Diego	150 (225)[8]	●
		Levy	Helix Water District	106	●
909	Sweetwater	Perdue	Sweetwater Authority	30	●
910	Otay	Lower Otay	City of San Diego	36	●

[1] From *Updated 2005 Urban Water Management Plan* (Water Authority, 2007).
[2] Numerical hydrologic unit and hydrologic area designations per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).
[3] Bullets indicate which treatment plants are connected to receive untreated water from the Water Authority's San Diego Aqueduct.
[4] Treatment plant is physically located within the Carlsbad Hydrologic Unit, but receives untreated water from Lake Henshaw (Vista Irrigation District) and Lake Wohlford (City of Escondido) within the San Luis Rey River (903) watershed.
[5] Treatment plant is located within the Carlsbad Hydrologic Unit, but receives surface water supplies from imported water sources and from Lake Hodges within the San Diego River Watershed (905).
[6] The Miramar filtration plant is being upgraded to 225 MGD, to be completed in 2008
[7] Water from Sutherland Reservoir (within the San Dieguito River Watershed) can be directed to San Vicente Reservoir (within the San Diego River Watershed). San Vicente Reservoir is one of the sources of untreated water supply for the Alvarado filtration plant.
[8] The Alvarado filtration plant is being upgraded to 200 MGD, to be completed in 2007

Groundwater resources are currently developed for municipal supply within the following hydrographic units:

- San Juan (901),
- Santa Margarita River (902),
- San Luis Rey River (903),
- San Dieguito River (905),
- San Diego (907), and
- Sweetwater (908).

Demineralization treatment of groundwater is utilized in two of these groundwater basins in order to comply with applicable drinking water standards for TDS. Table B-24 summarizes groundwater demineralization treatment facilities within the Region.

Table B-24
Groundwater Demineralization Facilities[1]

Hydro-logic Unit[2]	Watershed	Groundwater Demineralization Facility	Operating Agency	Treatmemt Capacity (million gallons per day)	Source of Groundwater[3]
903	San Luis Rey River	Mission Basin	City of Oceanside	6.37	Mission Basin
909	Sweetwater River	Reynolds	Sweetwater Authority	4.0	Lower Sweetwater Basin

1 From *Updated 2005 Urban Water Management Plan* (Water Authority, 2007).
2 Numerical hydrologic unit and hydrologic area designations per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).

Emergency Storage Program. Recognizing the Region's dependence on timely delivery of imported water supplies, the Water Authority has initiated an Emergency Storage Program (ESP) designed to provide water to the Region during imported water interruptions of up to six months.

When completed in 2011, the ESP will consist of storage and conveyance facilities that will allow the Water Authority to maintain a 75 percent service level to member agencies during interruption of imported water deliveries. ESP facilities will be located in the north and east portions of the Water Authority service area, and will be constructed in phases. Table B-25 (page B-61) summarizes existing and planned ESP facilities.

Table B-25
Emergency Storage Program Facilities and Schedule

Phase	Facilities	Scheduled Completion
Phase 1	• Olivenhain Dam • Olivenhain Pipelines and Powerline • Olivenhain Pump Station, Surge Control Pipe	Facilities Constructed in 2003
Phase 2	• San Vicente Pipeline • San Vicente/Moreno-Lakeside Interconnect Pipeline • San Vicente Pump Station • San Vicente Surge Control Facility	2002-2008
Phase 3	• Lake Hodges Pipeline • Lake Hodges Pump Station • Pipeline 3 Pump Station and Interconnection • Pipeline 4 Pump Station	2004-2008
Phase 4	• San Vicente Dam Raise • San Vicente Recreational Facilities • Operations Center Upgrade	2008-2011

Wastewater/Recycled Water. Water recycling (developing a usable water supply from wastewater) is an important component of the Region’s local water resources. During 2005, Water Authority member agencies reported the use of approximately 11,480 acre-feet of recycled water, which included approximately 9,240 acre-feet of tertiary treated recycled water and 2,240 acre-feet of secondary treated effluent. The use of tertiary treated recycled water within the region is projected to increase to approximately 45,550 acre-feet per year by 2020. (Water Authority, 2007)

Figure B-17 (following page) presents the location of water recycling facilities within the Region that produce tertiary treated (filtered and disinfected) recycled water. Such tertiary treated recycled water is suitable for all landscape and agricultural irrigation uses. Table B-26 (page B-62) summarizes the Region’s tertiary treatment water recycling facilities.

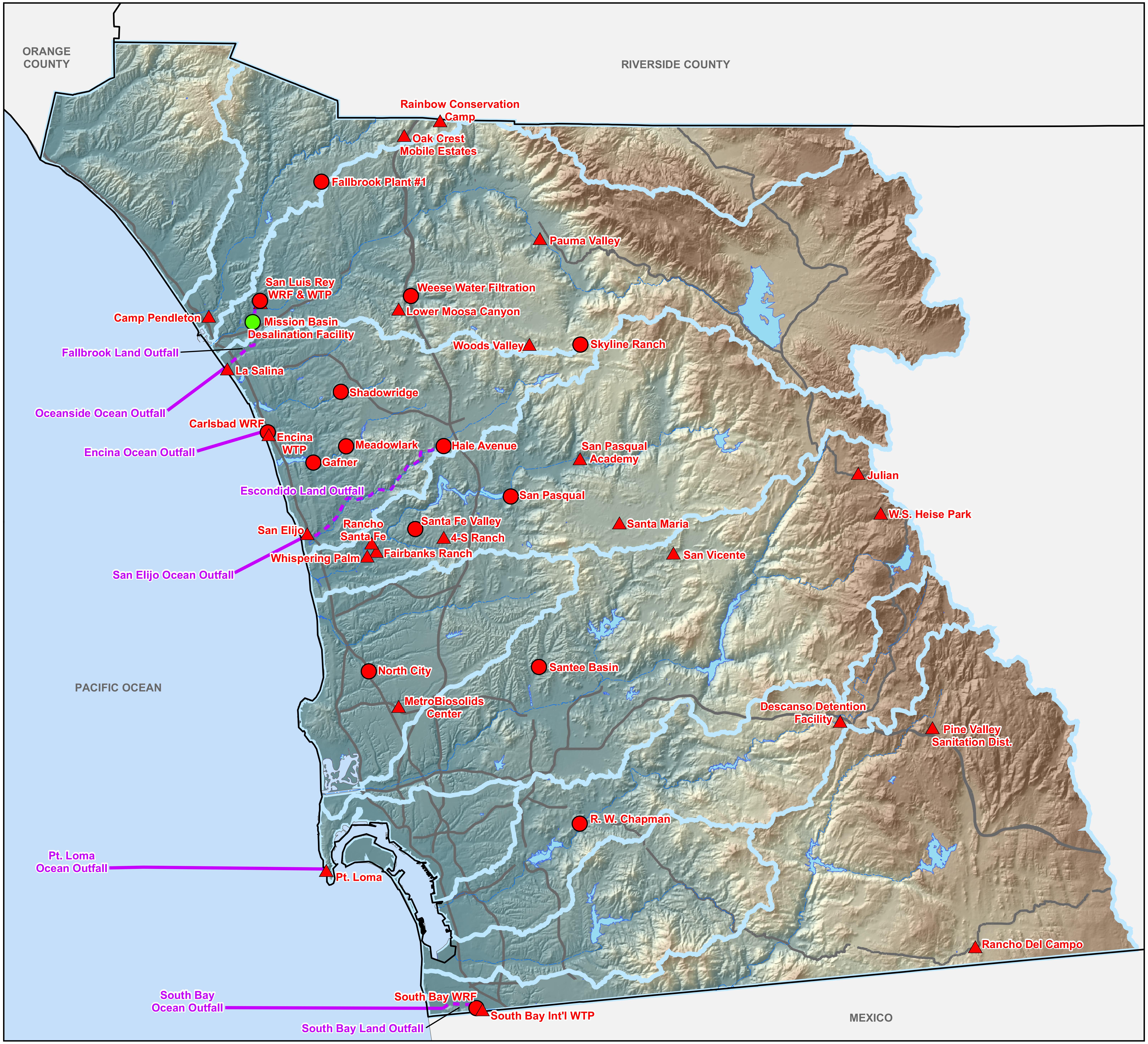
Recycled water is primarily used to irrigate parks, campgrounds, golf courses, freeway medians, community greenbelts, school athletic fields, food crops, and nursery stock. Recycled water is also used to augment supplies in recreational or ornamental lakes or ponds, to control dust at construction sites, to recharge groundwater basins, and for such industrial purposes as power plant cooling water. Currently, most of the recycled water supply is used for agriculture, landscape irrigation, and other municipal and industrial uses. Recycled water is also used to recharge groundwater basins.

Table B-26
Recycled Water Tertiary Treatment Facilities[1]

Hydro-logic Unit[2]	Name	Recycled Water Agency	Recycled Water Facility	Permitted Tertiary Treatment Capacity (mgd)	Reported Year 2005 Recycled Water Use[3] (acre-feet per year)
902	Santa Margarita R.	Camp Pendleton	Southern Regional	5.0[4]	0[4]
903	San Luis Rey River	City of Oceanside	San Luis Rey	0.7[5]	110[5]
		Fallbrook Public Utility District	Plant No. 1	2.7[6]	315[6]
		Valley Center Municipal Water Dist.	Woods Valley Ranch	1.47[7]	0[7]
904	Carlsbad	Buena Sanitation District	Shadowridge[8]	1.16[8]	0[8]
		Carlsbad Municipal Water District	Carlsbad	4.0[9]	0[9]
		Leucadia Wastewater District	Gafner	1.0[10]	250[10]
		Vallecitos Water District	Meadowlark	2.25[11]	1,100[11]
		City of Escondido	Hale Avenue	9.0[12]	110[12]
		San Elijo Joint Powers Authority	San Elijo	2.48[13]	1,050[13]
905	San Dieguito River	Olivenhain Municipal Water District	4-S Ranch	2.0[14]	440[14]
		Ramona Municipal Water District	Santa Maria	0.35[15]	180[15]
906	Peñasquitos	City of San Diego	North City	30.0[16]	3,320[16]
907	San Diego River	Padre Dam Municipal Water District	Padre Dam	2.0[17]	650[17]
		Ramona Municipal Water District	San Vicente	0.6[18]	680[18]
910	Otay River[19]	Otay Water District	R.W. Chapman	1.3[19]	1,040[19]
911	Tijuana River	City of San Diego	South Bay	15.0[20]	0[20]

1 Compiled from adopted recycled water discharge permits adopted by the Regional Board. See footnotes below.
2 Numerical hydrologic unit and hydrologic area designations per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).
3 Recycled water use for year 2005 as reported by member agencies in *Updated 2005 Urban Water Management Plan* (Water Authority, 2007). Values rounded to nearest ten AFY. Reporting criteria for recycled water use may vary on an agency-by-agency basis.
4 The 5.0 mgd tertiary treatment plant regulated by Regional Board Order No. R9-2003-0155 is not yet constructed. The listed recycled water use for 2005 does not include 1880 acre-feet of effluent from Camp Pendleton secondary treatment plants discharged to Horse Lake, used for golf course and landscape irrigation, or percolated to the ground.
5 Permitted tertiary treatment capacity per Regional Board Order No. 93-07. Recycled water used for landscape irrigation.
6 Permitted tertiary treatment capacity per Regional Board Order No. R9-2006-0064. Recycled water used for irrigation.
7 Permitted treatment capacity per Regional Board Order No. 98-09 and Addendum No. 1. Facility is currently under construction. The listed recycled water use for 2005 does not include 330 acre-feet per year of secondary effluent from the Valley Center Moosa Canyon wastewater treatment facility that is discharged to percolation ponds or 30 acre-feet per year of secondary effluent from the Valley Center Skyline Ranch treatment plant that is used for landscape irrigation.
8 Permitted treatment capacity per Regional Board Order No. 93-82 and Addenda Nos. 1 and 2. Facility is currently not in operation.
9 Permitted tertiary treatment capacity per Regional Board Order No. 2001-352. Facility is currently under construction.
10 Permitted tertiary treatment capacity per Regional Board Order No. R9-2004-0223. Recycled water use is for landscape and agricultural irrigation.
11 Permitted tertiary treatment capacity per Regional Board Order No. 93-23. Recycled water used for landscape/agricultural irrigation.
12 Permitted tertiary treatment capacity per Regional Board Order No. 93-70 and Addendum No. 1. Recycled water from the Hale Avenue facility is purveyed by the City of Escondido and Rincon Del Diablo Municipal Water District to landscape irrigation, agricultural irrigation, and industrial customers within their respective service areas.
13 Permitted tertiary treatment capacity per Regional Board Order No. 2000-10. Recycled water from the San Elijo facility is purveyed by the Santa Fe Irrigation District, San Dieguito Water District, and City of Del Mar to landscape irrigation customers within their respective service areas.
14 Permitted tertiary treatment capacity per Regional Board Order No. R9-2003-0007. Recycled water use is for irrigation.
15 Permitted tertiary treatment capacity per Regional Board Order No. 2000-177. Recycled water use is for landscape irrigation, open space irrigation, and replenishing a recreational impoundment.
16 Permitted tertiary treatment capacity per Regional Board Order No. 97-03 and Addendum No. 1. Recycled water uses include residential and landscape irrigation and commercial (nursery) irrigation.
17 Permitted tertiary treatment capacity per Regional Board Order No. 97-49 (recycled water irrigation) and Order No. R9-2003-0179, NPDES CA0107492 (lake replenishment). Recycled water use is for replenishing Santee Lakes and for landscape irrigation.
18 Permitted tertiary treatment capacity per Regional Board Order No. 93-03 and Addenda Nos. 1 and 2. Recycled water use is for agricultural (orchard) and golf course irrigation.
19 Plant is located in the Sweetwater Hydrologic Unit, but recycled water use takes place in the Otay Hydrologic Unit. Permitted tertiary treatment capacity per Regional Board Order No. 92-25 and Addendum No. 1. Recycled water use is for landscape irrigation and irrigation of open space.
20 Permitted tertiary treatment capacity per Regional Board Order No. 2000-203. No recycled water use from the South Bay facility occurred during 2005.

Figure B-17 Regional Wastewater/ Recycled Water Facilities



Facilities

- ▲ Wastewater Treatment Plant
- ● Water Reclamation Facility
- ● Desalination Facility

Sewer Outfalls

- Land Outfall
- Ocean Outfall
- Major Rivers
- Freeways
- Watershed Boundaries
- Pacific Ocean
- Lakes
- County Boundary

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Since most recycled water demands are for irrigation, recycled water demands vary significantly during the year. A key and necessary component of water recycling is providing means of disposal or storage of excess recycled water supplies during periods of limited demand. Local agencies may utilize either storage ponds or regional ocean outfall facilities to handle excess recycled water or wastewater flows during periods of inclement weather or limited demand. (An exception to this is Padre Dam MWD, which has an NPDES permit to discharge recycled water to the Santee Lakes, which can overflow to the San Diego River.) Table B-27 summarizes the deep-water ocean outfalls located within the Region.

Table B-27
Municipal Wastewater Ocean Outfalls[1]

Hydro-logic Unit[2]	Name	Outfall	Operating Agency	Discharge Distance Offshore (feet)	Permitted Discharge Flow (mgd)	Agencies Served
903	San Luis Rey River	Oceanside	City of Oceanside	8,050	22.9[3]	City of Oceanside
					3.6[4]	U.S. Marine Corps Base Camp Pendleton
					2.4[5]	Fallbrook Public Utility District
904	Carlsbad	Encina	Encina Wastewater Authority	7,800	43.3[6]	Encina Wastewater Authority[7]
		San Elijo	San Elijo Joint Powers Authority	8,000	18.0[8]	City of Escondido
					5.3[9]	San Elijo JPA[10]
908	Pueblo	Point Loma	City of San Diego	23,470	240[11]	San Diego Metropolitan Sewerage System[12]
911	Tijuana River	South Bay	City of San Diego	23,600	15[13]	San Diego Metropolitan Sewerage System [12,14]

1 Compiled from adopted recycled water discharge permits adopted by the Regional Board. See footnotes below.

2 Numerical hydrologic unit and hydrologic area designations per Regional Water Quality Control Board (1994) and California Department of Water Resources *Hydrologic Data* (Bulletin 130).

3 Permitted outfall discharge flows for City of Oceanside per Regional Board Order No. R9-2005-0136, NPDES CA0107433.

4 Permitted outfall discharge flows for U.S. Marine Corps Base Camp Pendleton per Regional Board Order No. R9-2003-0155, NPDES CA0109347.

5 Permitted outfall discharge flows for Fallbrook Public Utility District per Regional Board Order No. R9-2006-0002, NPDES CA0108031.

6 Permitted outfall discharge flows for Encina Wastewater Authority per Regional Board Order No. R9-2005-0219, NPDES CA0107395.

7 Encina Wastewater Authority member agencies include Buena Sanitation District, City of Carlsbad, City of Encinitas, Leucadia County Water District, Vallecitos Water District, and City of Vista.

8 Permitted outfall discharge flows for City of Escondido per Regional Board Order No. R9-2005-0101, NPDES CA0107981.

9 Permitted outfall discharge flows for San Elijo Joint Powers Authority per Regional Board Order No. R9-2005-0100, NPDES CA0107999.

10 San Elijo Joint Powers Authority member agencies include the City of Solana Beach and City of Encinitas.

11 Permitted outfall discharge flows for the Point Loma Ocean Outfall per Regional Board Order No. R9-2002-0025, NPDES CA0107409.

12 The City of San Diego serves as operating agency for the San Diego Metropolitan Wastewater System (Metro System). The Metro System serves the following agencies: City of Coronado, City of Chula Vista, City of Del Mar, City of El Cajon, City of Imperial Beach, City of La Mesa, City of National City, City of Poway, City of San Diego, Lemon Grove Sanitation District, Padre Dam Municipal Water District, Otay Water District, Alpine Sanitation District, Lakeside Sanitation District, Spring Valley Sanitation District, and Winter Gardens Sewer Maintenance District.

13 Permitted outfall discharge flows for the South Bay Ocean Outfall per Regional Board Order No. R9-2006-0067, NPDES CA0109045.

14 Metro System member agencies tributary to the South Bay Ocean Outfall include the City of San Diego, City of Imperial Beach, and City of Chula Vista.

In addition to providing means for wastewater and recycled water disposal, the outfalls can also be used as a salinity management asset. Three of the regional municipal wastewater outfalls are currently being used for disposal of saline or brackish water, including:

- Oceanside Ocean Outfall, used for disposal of demineralization brine from the City's groundwater desalter and demineralization brine from a local industry,
- San Elijo Ocean Outfall, used for disposal of brackish cooling tower blowdown from the Palomar Energy Plant in Escondido, and
- Point Loma Ocean Outfall, used for disposal of demineralization brine from the City's North City Water Recycling Plant.

Water Supply Outside Water Authority Service Area. As discussed in Section B.2, all but a small fraction of the Region's 3 million population lives within the Water Authority's service area. (See Table B-1 on page B-5.) Rural residences and small communities that exist outside the Water Authority service area are totally dependent on groundwater resources, and rely exclusively on individual groundwater wells or community water wells operated by small community water systems or private water companies. (See Tables B-10 and B-11 on page B-25.)

While the Region's groundwater-dependent population is proportionately small (compared to the population served by the Water Authority), the population is spread over a significant geographic portion of the Region. (See Figure B-5.) The availability of groundwater in the portion of the Region that lies east of the Water Authority's service area is limited by (1) available precipitation recharge, (2) recharge infiltration limitations, (3) low aquifer yields, and (4) limited groundwater storage. The majority of this area is underlain by fractured rock aquifers. Such aquifers typically have well yields no more than several gallons per minute. Shallow alluvial valleys exist along several of the river and stream valleys in portions of the eastern section of the Region. Groundwater production from these shallow aquifers, however, is constrained by the limited aquifer storage. Overall, the above groundwater-limiting factors severely limit the potential of additional growth and development in this area of the County.

While some community well systems outside the Water Service's area keep records of overall water production, very few wells are required to be metered for production. As a result, it is difficult to estimate the overall quantity of water supplies used. The low-density residential population in this area uses a small fraction of water when compared to of the overall Water Authority supply. However, non-residential water use within this area (e.g. agriculture, golf courses, campgrounds, resorts, retreat centers, public parks, casinos, hotels, and industrial uses) can represent a sizable demand on available groundwater resources.

B.10 Water Demand and Supply Diversification

Demand Forecasts. Demand for water in the Water Authority's service area includes municipal and industrial (M&I) demand and agricultural demand. M&I demand currently comprises approximately 80 to 85 percent of regional water consumption and can be subdivided into residential demand and commercial/industrial demand. (Water Authority, 2005)

Approximately two-thirds of the M&I demand is currently for residential use. Residential water consumption includes both indoor and outdoor uses. Indoor water use includes sanitation, bathing, laundry, cooking, and drinking, while most outdoor use is for landscape irrigation. Outdoor residential M&I demands for single family homes may be 60 percent of total residential use. (Water Authority, 2005)

Industrial water consumption consists of a wide range of uses, including product processing, aggregate washing, concrete batching, dust control, cooling, air conditioning, sanitation, and landscape irrigation. Commercial water demand is typically for sanitation, landscape irrigation, and drinking.

In recent years, agriculture has accounted for 10 to 20 percent of the Water Authority’s total water demand. All but a small fraction of the agricultural demand is for irrigation. Primary crops within the Region include avocados, citrus, flowers, and nursery products. Agricultural water use within the Water Authority's service area is concentrated mainly in the northern portion of the Region within the Fallbrook Public Utility District, the City of Escondido, Rainbow, Valley Center, Ramona, and Yuima Municipal Water Districts. (Water Authority, 2005) The Water Authority is the largest consumer of agricultural water within the Metropolitan service area, accounting for over 65 percent of Metropolitan’s agricultural water demands during fiscal year 2004. (Water Authority, 2005)

Because a significant portion of the overall regional water demand is for irrigation, weather and hydrologic conditions (precipitation, temperature, evaporation) have a significant effect on water demands within the Water Authority service area. Population, housing, and employment are also key factors in influencing the regional water demand.

To forecast future M&I water use, the Water Authority selected the IWR-MAIN (Institute for Water Resources – Municipal and Industrial Needs) computer model. Versions of this econometric model have evolved over a 20-year period and are being used by many U.S. cities and water agencies. The IWR-MAIN system is designed to utilize projections of local population, housing, and employment and other demographic data to forecast M&I water demand. The Water Authority's version of the IWR-MAIN model was modified to reflect the Region's unique parameters and is known as CWA-MAIN.

Per a 1992 Memorandum of agreement between SANDAG and the Water Authority, the Water Authority agreed to use SANDAG's most recent regional growth forecasts for planning purposes. Water demands presented in the Water Authority's *Updated 2005 Urban Water Management Plan* were developed using the CWA-MAIN model and the most current SANDAG 2030 population forecast that was available at the time. The CWA-MAIN model was adjusted to incorporate:

- estimated demands for Camp Pendleton that are based on historic trends (and added into the CWA-MAIN model),
- updated conservation forecasts that include implementation of water conservation best management practices developed by the California Urban Water Management Council, and
- a separate agricultural demand model that estimates demand on the basis of projected agricultural acreage, and updated crop distribution and irrigation management data.

Using this modeling approach, Table B-28 (page B-67) presents projected water demands through 2030 under "normal year" hydrologic conditions. Figure B-18 (page B-67) superimposes these projected demands on historic water demands. Information presented in Table B-28 and Figure B-18 reflects current demand projections presented within the *Updated 2005 Urban Water Management Plan*. It should be noted that an updated version of the SANDAG 2030 population forecast was released in 2006 (subsequent to completion of the *Updated 2005 Urban Water Management Plan*). Future updates of the Water Authority's water management plans will incorporate SANDAG's most recent growth forecast to ensure that the Region's water supplies met future growth.

Table B-28
Normal Year Water Demand Forecast – Water Authority Service Area[1]

Demand Parameter	Projected Water Demand (acre-feet per year)				
	2010	2015	2020	2025	2030
M&I Baseline Forecast	699,250	739,020	780,350	830,550	877,740
Estimated Conservation Savings	79,960	87,310	94,170	101,950	108,400
M&I Forecast Reduced by Conservation[2]	619,290	651,710	686,180	728,600	769,340
Agricultural Forecast	89,700	83,130	77,270	58,908	51,630
Total Projected Demand	708,990	734,840	763,450	787,508	820,970
Total Projected Demand with Pending Annexations[3]	715,450	742,900	771,510	795,640	829,030

1 From *Updated 2005 Urban Water Management Plan* (Water Authority, 2007). Based on anticipated water conservation savings. (See Table B-29 on page B-70) Water demand estimates for the portion of the Region outside the Water Authority service area are not available.
2 Includes M&I demands for Camp Pendleton area customers.
3 Includes anticipated annexation demands of 6,455 acre-feet in 2010, 8,060 acre-feet in years 2015 and beyond.

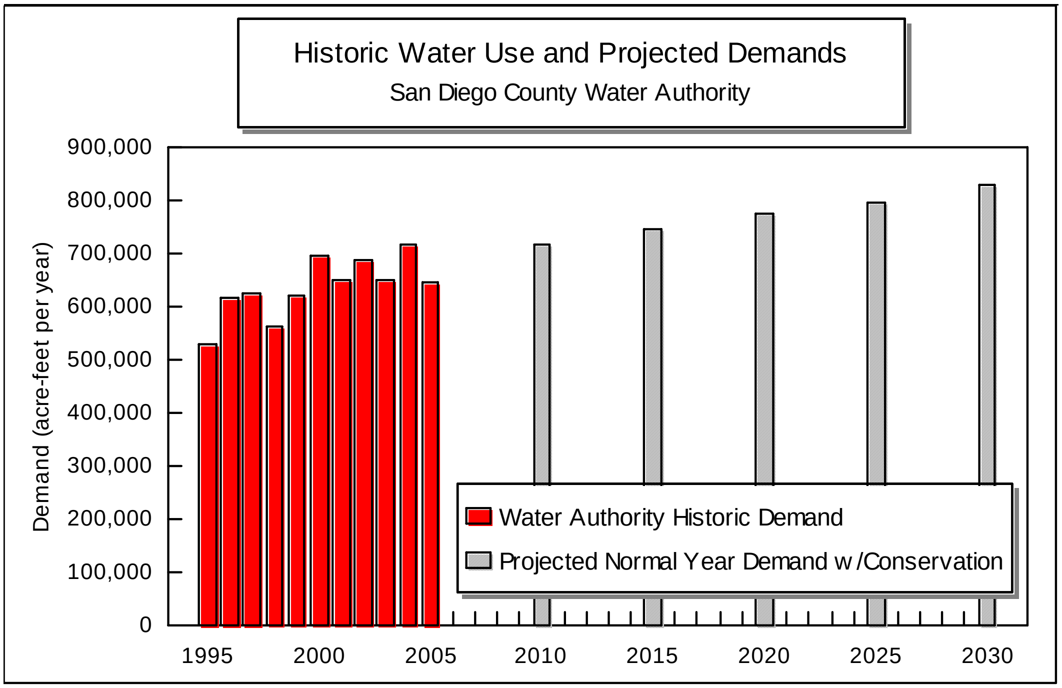

Figure B-18 Historic Water Use and Projected Water Demands

Water Supply Diversification. The *California Water Plan Update 2005* (DWR, 2005) identifies short-term and long-term issues that may impact water supply availability and include (in part): drought, flood, earthquake, facility malfunction, sabotage, global climate change, and environmental restrictions. The *California Water Plan Update 2005* identifies the following two initiatives to ensure reliable water supplies within the state:

1. Promote and practice integrated regional water management.
2. Maintain and improve statewide water management systems.

Initiative 1 incorporates the following three elements:

- foster regional partnerships,
- develop and implement integrated regional water management plans, and
- diversify regional water portfolios.

Recognizing that imported State Water Project and Colorado River supplies are subject to legal, environmental, drought, and other uncertainties, the Water Authority's *Updated 2005 Urban Water Management Plan* develops a comprehensive plan to diversify the Region's water portfolio. This diversification plan is based on:

- implementation of additional water conservation measures and implementation of California Urban Water Conservation Council best management practices,
- implementation of planned Emergency Storage Program facilities,
- implementation of water transfer agreements with Imperial Irrigation District for the conservation and transfer of conserved agricultural water from Imperial County,
- implementation of projects for the transfer of water conserved through lining the All-American and Coachella Canals in Imperial County,
- development of seawater desalination capability within the region,
- increasing the amount of recycled water use implemented by member agencies, and
- increasing development of local groundwater and increasing the quantity of poor-quality groundwater recovered through demineralization treatment.

In implementing the water supply diversification element of the *California Water Plan Update 2005*, the Water Authority's *Updated 2005 Urban Water Management Plan* continues the water supply diversification approach initiated by the Water Authority in the early 1990s.

Water conservation is a fundamental component of the Water Authority's water diversification plan. The Water Authority has been aggressively implementing water conservation since 1990. Significant Water Authority and member agency funding has been directed toward implementing comprehensive water conservation programs (see inset below) to reduce water use for residential, commercial, and agricultural irrigation, and to reduce water use in homes, businesses, industries, and institutions.

California Urban Water Conservation Council
Water Conservation Best Management Practices (BMPs)

The Water Authority and its member agencies comply with all 14 water conservation BMPs developed by the California Urban Water Conservation Council, including:

1. implementing a Residential Water Survey Program,
2. implementing residential plumbing retrofits (distributing water-efficient shower heads),
3. performing water distribution system audits to detect and repair system leaks,
4. metering water use and establishing use-based water rates,
5. implementing large landscape programs and incentives, including landscape incentive programs for commercial use, businesses, and homes,
6. implementing a high-efficiency washing machine voucher program,
7. implementing public information programs including a speakers bureau, newsletters, literature, websites, promoting media coverage, and issuing xeriscape awards,
8. implementing a comprehensive school education program,
9. implementing a commercial, industrial, and institutional voucher program for water-efficient appliances/fixtures and a program for water efficiency of industrial processes,
10. implementing wholesale agency assistance programs,
11. offering water pricing structures to encourage conservation,
12. staffing water conservation coordinator positions,
13. implementing prohibitions against water waste, and
14. implementing a residential ultra-low flush toilet voucher program.

The comprehensive water conservation program implemented by the Water Authority and its member agencies resulted in more than 50,000 acre-feet of water savings during 2005. (Water Authority, 2005) Additional water conservation savings are projected as the Water Authority and its member agencies expand regional water conservation efforts. Table B-29 (page B-70) presents a breakdown of projected future water conservation savings with expanded implementation of residential, landscape, agricultural, commercial, industrial, and institutional water conservation programs. As shown in the table, water conservation savings within the region are projected to annually exceed 100,000 acre-feet by year 2025.

During 2006 and 2007, the Water Authority and member agencies began a transition in the approach to water conservation. Future conservation programs will phase out ultra low flush toilets (ULFTs) and increase the emphasis on landscape and commercial/industrial conservation. The Water Authority and member agencies sponsored a conservation symposium in September 2006 that brought in business and industry, land use planning agencies, environmental groups and other stakeholders to participate in a regional approach to landscape conservation. A post event white paper is being used as a basis for a strategic plan for conservation. Ongoing stakeholder participation is being implemented through a

Conservation Action Committee. The Water Authority is also implementing conservation partnerships with its member agencies, the Water Conservation Garden, Metropolitan Water District, and San Diego Gas and Electric.

Table B-29
Projected Water Conservations Savings[1]

Demand Parameter	Water Conservation Savings (acre-feet per year)					
	Existing (2005)	2010	2015	2020	2025	2030
Existing Best Management Practices (BMPs)						
• Residential surveys[2]	1,620	1,620	1,620	1,620	1,620	1,620
• Residential retrofits[3]	8,100	8,100	8,100	8,100	8,100	8,100
• Landscape[4]	3,520	18,850	21,790	24,780	27,740	30,720
• Clothes washer incentives[5]	500	1,280	1,670	1,670	1,670	1,670
• Commercial/industrial/institutional[6]	2,260	3,330	5,060	6,800	8,530	10,270
• Toilet Incentives[7]	17,550	23,620	23,620	23,620	23,620	23,620
Future BMPs and Efficiency Standards						
• Efficiency Standards[8]	19,840	23,140	25,410	27,530	30,600	32,320
• Graywater	0	25	30	40	50	50
• On-demand heaters[9]	0	5	10	15	20	25
Total Supplies[10]	53,390	79,960	87,310	94,170	101,950	108,400

1 From *Updated 2005 Urban Water Management Plan* (Water Authority, 2007). Values rounded to nearest 10 acre-feet except for graywater and on-demand heaters, which are rounded to the nearest 5 acre-feet per year.
2 The Residential Survey Program (California Urban Water Conservation Council BMP No. 1) has been completed by Water Authority member agencies.
3 Water savings resulting from Residential Plumbing Retrofit showerhead distribution program.
4 Includes savings resulting from the following Water Authority conservation programs: Distribution Water System Audits, Landscape Assistance Program for Business and Home, Protector Del Agua, Artificial Turf, Water Budget, and Commercial Landscape Incentive Program. Includes implementation of incentive programs for improved irrigation devices, weather-based irrigation controllers, artificial turf, and operator education/training.
5 Based on continued implementation of Residential High-Efficiency Washing Machine Rebate Program (BMP No. 4 of the California Urban Water Conservation Council).
6 Based on continued implementation of BMP No. 9 of the California Urban Water Conservation Council, which includes the Commercial, Industrial and Institutional Voucher Program for water-efficiency appliances and equipment, and the Industrial Process Improvement Program. Water savings include expanded use of high-efficiency commercial washing machines, food steamers, commercial dishwashers, water pressurized brooms, and waterless urinals.
7 Based on continued implementation of the Residential Ultra-Low Flush Toilet Voucher Program (BMP No. 14 of the California Urban Water Conservation Council).
8 Includes water savings for new construction, additional code compliance/enforcement, natural replacement of residential and commercial water-efficient appliances and fixtures.
9 Studies for on-demand water heaters are proceeding. Appropriate programs will be developed for encouraging use of on-demand heaters upon completion of the studies.
10 Values may not add to exact total due to rounding.

Water transfers represent another key element of the Water Authority's water source diversity program. In 1998, the Water Authority executed an agreement with the IID for the conservation and transfer of agricultural water. Under the agreement, water conserved by Imperial County farmers who participate in a voluntary program would be transferred to the Water Authority. Water transferred to the Water Authority totaled 50,000 AFY during 2006, and is projected to increase at 10,000 AFY increments to a maximum annual total of 200,000 AFY in 2021.

Additionally, the Water Authority in 2003 was assigned rights to 77,000 acre-feet per year of water that will be conserved through projects that would line 24 miles of the All-American Canal and 37 miles of the Coachella Canal in Imperial County. Work on the Coachella Canal lining project was initiated in 2004 and was completed in November 2006, with deliveries of conserved water anticipated in early 2007. Work on the All-American Canal is scheduled for completion in 2009.

Conserved IID agricultural water and water conserved through the canal lining projects would be credited to the Water Authority through a 2003 agreement between the Water Authority and Metropolitan. Under the agreement, Metropolitan would take delivery of conserved IID agricultural water and water conserved by the canal lining projects. Metropolitan, in turn, would provide the Water Authority with a like quality and quantity of water.

Groundwater represents an additional key component of local supply within the Region. Water Authority member agencies develop groundwater supply through management and recovery of good-quality alluvial groundwater. Member agencies also recover poor quality groundwater through demineralization treatment.

Groundwater represents the exclusive source of supply outside the Water Authority service area in the rural portion of the Region. Groundwater use and demand data for private wells and small community water systems in this rural area are unavailable; the lack of such data represents a significant water management challenge within these rural portions of the Region.

Seawater desalination is another element of the Water Authority's supply diversity program. Planning is underway for a seawater desalination facility at the Encina Power Station in Carlsbad that would be constructed as part of a public-private partnership between the City of

Carlsbad and Poseidon Resources, Inc. At full production, the proposed facility would produce 50 millions gallons per day of potable water from seawater.

Taking into account projected water conservation savings, Table B-30 presents a breakdown of projected water supplies and compares projected supplies with the demand forecast for a normal hydrologic year. As shown in Table B-30, imported supplies from Metropolitan are projected to comprise less than 45 percent of the total regional water demand by year 2030.

Table B-30
Water Authority Water Supply Portfolio – Normal Water Year

Demand Parameter	Projected Water Supply (acre-feet per year)				
	2010	2015	2020	2025	2030
Water Authority Supplies					
• IID Water transfer[1,2]	70,000	100,000	190,000	200,000	200,000
• Canal Lining projects[1,3]	77,700	77,700	77,700	77,700	77,700
Water Authority Member Agency Supplies					
• Local surface water[1,4]	59,650	59,650	59,650	59,650	59,650
• Water recycling[5]	33,670	40,660	45,550	46,490	47,580
• Seawater desalination[6]	0	34,700	36,060	37,750	40,000
• Groundwater[1,7]	17,180	18,950	19,780	19,780	19,780
• Groundwater recovery[1,7]	11,400	11,400	11,400	11,400	11,400
Metropolitan Supplies[1,8]	445,860	399,860	331,370	342,870	372,920
Total Supplies[1,8]	715,450	742,900	771,510	795,640	829,030
Total Projected Demand with Conservation[1,8]	715,450	742,900	771,510	795,640	829,030

1 Verifiable expected water supplies for the Water Authority service area, as presented in *Updated 2005 Urban Water Management Plan* (Water Authority, 2007). Water budget data for the rural portion of the Region outside the Water Authority service area not available. Values rounded to nearest 10 acre-feet per year.
2 Expected Water Authority supply, per 1997 Water Conservation and Transfer Agreement between the Water Authority and the Imperial Irrigation District for the transfer of conserved agricultural water.
3 Expected Water Authority supply, per agreements with Metropolitan, the Water Authority has been assigned Metropolitan's rights to 21,500 acre-feet per year conserved by lining the Coachella Canal and 56,200 acre-feet per year by lining the All-American Canal.
4 Expected average yield of member agency surface reservoirs during normal year hydrologic conditions.
5 Projected recycled water development based on member agency project schedules.
6 Proposed seawater desalination facility at Encina Power Station. Member agencies may contract directly with the desalination plant operator to obtain seawater desalination supplies.
7 Projected groundwater extraction yields by Water Authority member agencies during normal year hydrologic conditions. Includes groundwater recovery through demineralization treatment of brackish groundwaters.
8 Values may not add to exact total due to rounding.

In addition to assessing a normal hydrologic year, the *Updated 2005 Urban Water Management Plan* also developed supply estimates under single dry and multiple dry water years. Table B-31 presents the Water Authority's water supply and demand assessment for a single dry water year. The *Updated 2005 Urban Water Management Plan* concludes that no shortages are anticipated within the Water Authority's service area under single dry-year or multiple dry water years through 2030 provided that:

- projected Water Authority and member agency supplies are developed as planned, and
- Metropolitan's Integrated Regional Plan is implemented as planned.

Table B-31
Water Authority Water Supply Portfolio – Single Dry Water Year[1]

Demand Parameter	Projected Water Supply (acre-feet per year)				
	2010	2015	2020	2025	2030
Water Authority Supplies					
• IID Water transfer[1,2]	70,000	100,000	190,000	200,000	200,000
• Canal Lining projects[1,3]	77,700	77,700	77,700	77,700	77,700
Water Authority Member Agency Supplies					
• Local surface water[1,4]	22,280	22,280	22,280	22,280	22,280
• Water recycling[1,5]	33,670	40,660	45,550	46,490	47,580
• Seawater desalination[1,6]	0	34,700	36,060	37,750	40,000
• Groundwater[1,7]	10,840	10,840	10,840	10,840	10,840
• Groundwater recovery[7]	11,400	11,400	11,400	11,400	11,400
Metropolitan Supplies[8]	541,760	498,390	431,720	442,140	473,220
Total Supplies[1,8]	767,650	795,970	825,560	848,610	883,030
Total Projected Demand with Conservation[1,8]	767,650	795,970	825,560	848,610	883,030

1 Verifiable expected water supplies for the Water Authority service area, as presented in *Updated 2005 Urban Water Management Plan* (Water Authority, 2007). Water budget data for the rural portion of the Region outside the Water Authority service area not available. Values rounded to nearest 10 acre-feet per year.

2 Expected Water Authority supply, per 1997 Water Conservation and Transfer Agreement between the Water Authority and the Imperial Irrigation District for the transfer of conserved agricultural water.

3 Expected Water Authority supply, per agreements with Metropolitan, the Water Authority has been assigned Metropolitan's rights to 21,500 acre-feet per year conserved by lining the Coachella Canal and 56,200 acre-feet per year by lining the All-American Canal.

4 Projected average yield of member agency surface reservoirs during single dry year hydrologic conditions.

5 Projected recycled water development based on member agency project schedules.

6 Proposed seawater desalination facility at Encina Power Station. Member agencies may contract directly with the desalination plant operator to obtain seawater desalination supplies.

7 Projected groundwater extraction yields by Water Authority member agencies during single dry year hydrologic conditions. Projected groundwater recovery is through demineralization treatment of brackish groundwaters.

8 Values may not add to exact total due to rounding.

The *Updated 2005 Urban Water Management Plan* notes, however, that the Water Authority is at risk for shortages should supplies identified in Metropolitan's Integrated Resources Plan not be developed. The plan also notes that the most reliable method for alleviating shortages during a dry period is to enhance regional storage and local water supply development. (Water Authority, 2005) The Water Authority has developed a *Drought Management Plan* (Water Authority, 2006) to minimize the impacts of drought-related imported water shortages and to equitably allocate supplies to member agencies.

Water demand projections and water supply diversification strategies developed by the Water Authority are acknowledged by the State of California Department of Water Resources in the *California Water Plan Update 2005* (Bulletin No. 160). The *California Water Plan Update 2005* notes the importance of regional water supply planning, and describes water supply diversification strategies of the Water Authority and other Southern California agencies.

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