Chapter 1 MAC Region

Integrated Regional Water Management (IRWM) Plans must include a description of:

- **The watersheds and the water systems, natural and anthropogenic (i.e. "man-made"), including major water related infrastructure, flood management infrastructure, and major land-use divisions;**
- **The quality and quantity of water resources within the region (i.e. surface waters, groundwater, reclaimed water, imported water, and desalinated water);**
- **Areas and species of special biological significance and other sensitive habitats, such as marine protected areas and impaired water bodies within the region;**
- **Internal boundaries within the region;**
- **Water supplies and demands for a minimum 20-year planning horizon;**
- **Important ecological processes and environmental resources within the regional boundaries and the associated water demands to support environmental needs;**
- **Potential effects of climate change on the region;**
- **Comparison of current and future (or proposed) water quality conditions in the region, including water quality protection and improvement needs or requirements within the area of the Plan;**
- **Social and cultural makeup of the regional community, important cultural or social values, DACs in the management area, economic conditions and important economic trends within the region.**
- **Efforts to effective involve and collaborate with Tribal government representatives to better sustain Tribal and regional water and natural resources (if applicable);**
- **Major water related objectives and conflicts in the defined management region, including clear identification of problems within the region that focus on the objectives, implementation strategies, and implementation projects that ultimately provide resolution;**
- **How the IRWM regional boundary was determined and why the region is an appropriate area for IRWM planning.**

1.1 Regional Geography

The MAC IRWMP region incorporates all of Amador County and sizeable portions of Alpine and Calaveras Counties. Included within the region's boundary are cities, water and irrigation districts, watershed management areas, portions of groundwater basins, disadvantaged communities, and large tracts of federally-owned lands. Figure 1-1 shows the MAC IRWMP region.

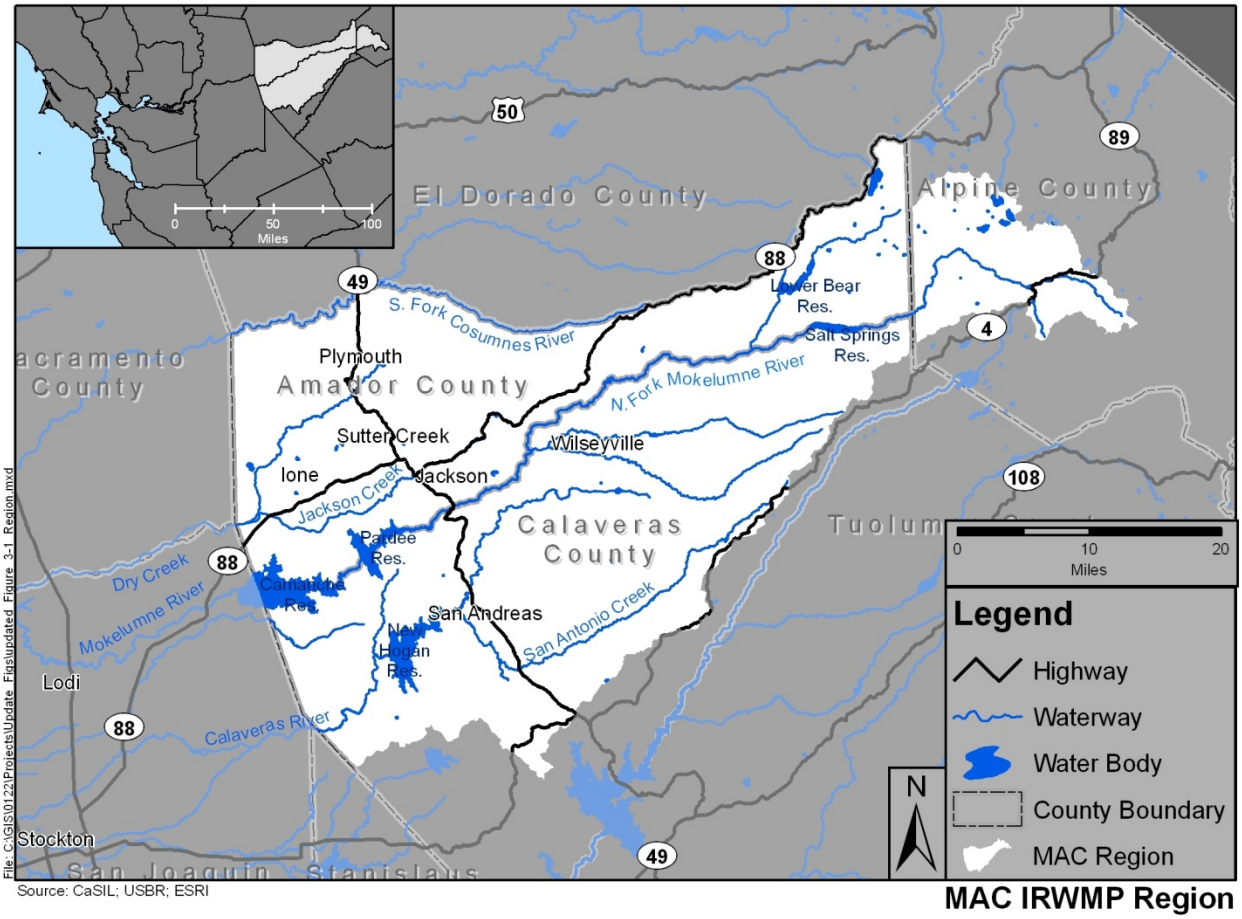

Figure 1-1: MAC IRWMP Region

The approximately 950,000 acre region (about 1,460 square miles) is located in the Sierra Nevada foothills, approximately 45 miles southeast of Sacramento. Situated in a transitional zone between the San Joaquin Valley and the Sierra Nevada, the region stretches across varied topography and microclimates. Warm, dry summers and mild winters are predominant in the western foothills with temperature ranging from the middle 30s to the high 90s (in degrees Fahrenheit, ^{o}F). Mild summers and cold winters characterize the mountainous eastern region with temperatures ranging from the low 20s to the middle 80s. Hot, dry summers and mild winters prevail in the Central Valley portion of the region with temperatures ranging from middle 30s to highs in excess of 100^{o}F.

The primary sources of water in the region are the Mokelumne and Calaveras River watersheds (and to a lesser extent, the Cosumnes River watershed), with snowmelt and rainfall from the Sierra Mountain Range transported via the rivers and their tributaries. Although the region is famous for its historic mining and existing active mines (asbestos, gold, industrial minerals, limestone, sand and gravel), current land uses also include cattle ranching, orchards, timber, vineyards and row crops.

The MAC IRWMP region was formed using physical, political and social boundaries. The Mokelumne River watershed forms the eastern border, while the Calaveras River watershed forms the southern boundary. The Amador County boundary generally follows the Mokelumne watershed boundary and roughly defines the northern border. The southwestern boundary of the region extends to intersection of the San Joaquin County and the Calaveras County boundaries. This region was defined based on similar water supply and demand characteristics and the opportunities to facilitate water resources protection, development and security.

1.1.1 Regional Boundary

The boundaries of the MAC IRWMP region were determined using a variety of physical, political and water management considerations as discussed below. The primary physical determinant in establishing the region was the Mokelumne River watershed. The secondary determinant was the Calaveras River watershed. These two rivers and their watersheds are the predominant water features in the region, and during the past 150 years, have supported a myriad of activities including hydropower generation, agriculture, mining, domestic water supply, recreation, fisheries and more.

The Mokelumne River is the boundary between Amador and Calaveras Counties and has long served the needs of cities and communities within these counties. Since the 1920s, the Mokelumne River has been the primary source of water used by EBMUD to serve East Bay communities. Thus, for nearly one hundred years, the local governments and water agencies of Amador and Calaveras Counties have competed with EBMUD and the environment for Mokelumne River water supply. During this period, there have been many water rights decisions, court decrees, agreements, and contracts pertaining to the Mokelumne River, some of which have settled, to some degree, the many disputes that have arisen between Amador and Calaveras agencies, downstream Mokelumne River users in San Joaquin County, and EBMUD. However, as the Foothill and East Bay communities continue to grow, so does the need for additional water supply. Consequently, one of the primary purposes in establishing the MAC IRWM region has been to promote and facilitate a collaborative planning process to develop program and project solutions which address future Amador, Calaveras, and East Bay water resource needs.

While the Mokelumne River represents a key central feature in the MAC region, the geographic boundaries of the region define its relationship to neighboring regions. Presented below are the four primary regional boundaries and the reasons these boundaries were used in defining the MAC region.

Northern boundary: The northern boundary defining the MAC region is the political boundary of the Amador County line. The county line was selected as the MAC region's northern border because (1) the City of Plymouth, the one incorporated community outside the Mokelumne River watershed in Amador County, receives water from the Mokelumne River by Amador Water Agency; and (2) the entire area south of the county line lies within Amador County and within AWA's service area. Both of these two Amador agencies (the County and AWA) are members of UMRWA, the regional water management group responsible for the MAC Plan Update and implementation.

It should be noted that the southern boundary of the CABY IRWM region encroaches into the northern area of the MAC region. The CABY IRWM region uses the South Fork Cosumnes River watershed boundary as its regional delineator. In the Plymouth area, the Amador County border and Cosumnes River watershed boundaries overlap, resulting in an overlapping boundary between the two regions. This overlap is not considered to be a significant planning obstacle.

Southern boundary: The Calaveras River watershed forms the southern boundary of the MAC region. This watershed lies almost entirely within Calaveras County, with only the upper reaches of the watershed located in Alpine County. The Calaveras River watershed was selected to represent the southern border of the MAC region because (1) the proximity of the Calaveras River watershed and New Hogan reservoir to the Mokelumne River and Camanche reservoir may present feasible water management opportunities during the regional planning process; (2) western Calaveras County overlies the upper reach of the Eastern San Joaquin Groundwater Basin that provides conjunctive use opportunities; (3) the Stanislaus River watershed, south of the Calaveras River watershed, is a major water source for communities in southern Calaveras and Tuolumne Counties; and (4) the Stanislaus River watershed is included in the Tuolumne-Stanislaus IRWM region.

Eastern boundary: The eastern MAC boundary is defined by the eastern-most portions of the Mokelumne and Calaveras River watersheds, all of which lie in Alpine County. There is also a small portion of the South Fork American River watershed (a portion of Amador County near Kirkwood Meadows) included

in the region along the eastern boundary. The hydrologic boundaries of the Mokelumne and Calaveras River watersheds were selected to represent the eastern MAC region boundary because (1) these areas are the headwaters of the two river systems which are critical water supply sources for MAC region communities, and (2) lands adjacent to and east of this boundary are generally contained in watersheds which drain eastward to the Carson River watershed, away from the MAC IRWM region.

Western boundary: The political boundaries that separate Amador and Calaveras Counties from their western neighbor, San Joaquin County, form the western boundary of the MAC region. This border was determined to be the best western extent of the MAC region because (1) the water supply issues facing the western portions of Amador and Calaveras counties must be addressed by water agencies with the authority and jurisdiction to do so (AWA and CCWD); and (2) other than the western portion of Calaveras County that overlies the Eastern San Joaquin Groundwater Basin, the groundwater resource issues that predominately characterize the Eastern San Joaquin IRWM region are very different from the predominately surface water issues that must be addressed by the MAC region.

1.1.2 Neighboring and Overlapping Regions

The MAC region has three neighboring IRWM regions. To the north is the CABY region which generally encompasses the Cosumnes, American, Bear and Yuba River watersheds. The Eastern San Joaquin region is near the western boundary of the MAC region, and the Tuolumne-Stanislaus integrated water management region is immediately south. For each of these neighboring regions, the nature of its interface with the MAC region – overlapping or adjacent – and the primary differences between the neighboring regions and the MAC region are described below. Figure 1-2 shows the geographic relationship of these neighboring regions to the MAC region.

CABY region – The CABY region, which lies directly north of and adjacent to the MAC region, overlaps the MAC region in two locations. These overlaps between the two regions are in part due to CABY's preference to establish all of its boundaries coincident with hydrologic boundaries. The MAC region instead has factored physical, political and water management considerations in determining region boundaries.

These different approaches to establishing regional boundaries result in two overlap areas: the northwest corner of Amador County, which lies within the South Fork Cosumnes River watershed (hereafter referred to as the *Cosumnes Overlap*), and the northeast corner of Amador County, which lies within the South Fork American River basin (referred to as the *American Overlap*).

The vast majority of the *Cosumnes Overlap* area is sparsely developed and contained within unincorporated Amador County. The balance of the area is contained within the City of Plymouth, also located in Amador County. The City of Plymouth obtains water from the Mokelumne River and provides domestic water to its city customers. Both Amador County and the City of Plymouth are represented on the MAC Plan RPC, and the current MAC Integrated Regional Water Management (IRWM) Plan includes projects located in this area.

The *American Overlap* area is also entirely within Amador County. This area, and contiguous adjacent lands that lie within El Dorado and Alpine Counties, comprise the uppermost 'headwaters' of the South Fork American River. Aside from the Kirkwood Ski Area, this area is very sparsely developed with seasonal homes and cabins. There are no representatives from this overlap area serving on the MAC Plan RPC.

CABY and MAC region officials have discussed the two overlap areas and acknowledge the different approaches used by the two regions in formulating their boundaries. A communication and coordination process will be developed which will be used by the CABY and MAC regions in the event competing interests in programs or projects within these overlap areas develop in the future.

Eastern San Joaquin region – The eastern border of the East San Joaquin region is near the western border of the MAC region. The county line between Amador County and San Joaquin County, and the county line between Calaveras County, Stanislaus County, and portions of San Joaquin County constitute the interface between the two regions. The two regions have remained separate IRWM regions because the water supply issues are significantly different (predominately groundwater in the East San Joaquin region versus surface water in the MAC region), the number of agencies and non-governmental organizations interested in water resource issues is significant in both the valley and the foothills, and the travel distances between the outlying areas of the two regions are great and therefore would be an impediment to participation.

The MAC region and the Eastern San Joaquin region have been engaged in regular coordination and communication for more than five years. The Mokelumne River Forum, a facilitated discussion between agencies involved in both regions, has been very effective in developing improved understanding among the valley interests and the foothill interests. This improved understanding is evidenced by a four-party agreement established between San Joaquin, Amador and Calaveras Counties and EBMUD to jointly investigate water supply and conjunctive use opportunities. In addition, the IRWM Plans for both regions currently include a joint project that would jointly benefit both regions.

Tuolumne-Stanislaus region – The Tuolumne-Stanislaus (T-S) region is immediately south of the MAC region with its northern boundary reflecting the watershed boundary of the North Fork Stanislaus River. The southern boundary of the MAC region, as stated previously, is the southern boundary of the South Fork of the Calaveras River. Calaveras County Water District, a MAC region member, is also participating in the emerging T-S IRWM program and will serve as a liaison between the IRWM regions. By participating in both IRWM efforts, CCWD will keep members of both regions informed of progress and activity and will identify potential conflicts in the event they arise.

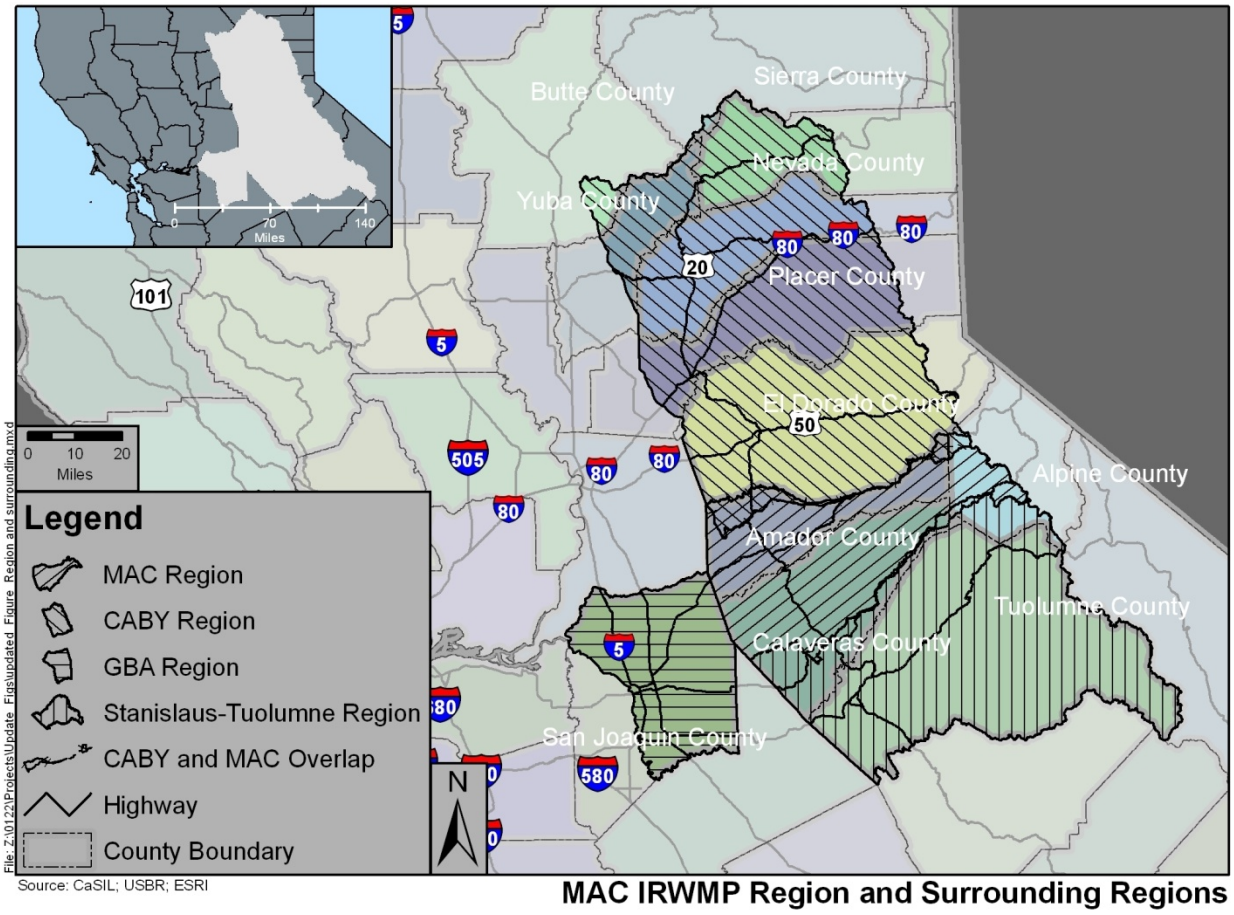

Figure 1-2: MAC IRWMP Region and Surrounding Regions

1.1.3 Internal Water-Related Boundaries

The following sections present the water-related components of the MAC region. These components include the physical elements - both natural and man-made - and institutional elements (i.e. the groups that manage these components, or influence their management) as described in Section 1.1.4.

The topography of the MAC IRWMP region varies greatly. The western boundary of the region is in the Central Valley, west of Ione, which is very close to sea level. The eastern boundary of the region is in the Sierra Nevada mountain range at the headwaters of the Mokelumne River at an elevation well over 10,000 feet. The terrain from east to west becomes gentler as the mountains and foothills give way to the Central Valley. Figure 1-3 depicts the topography of the region.

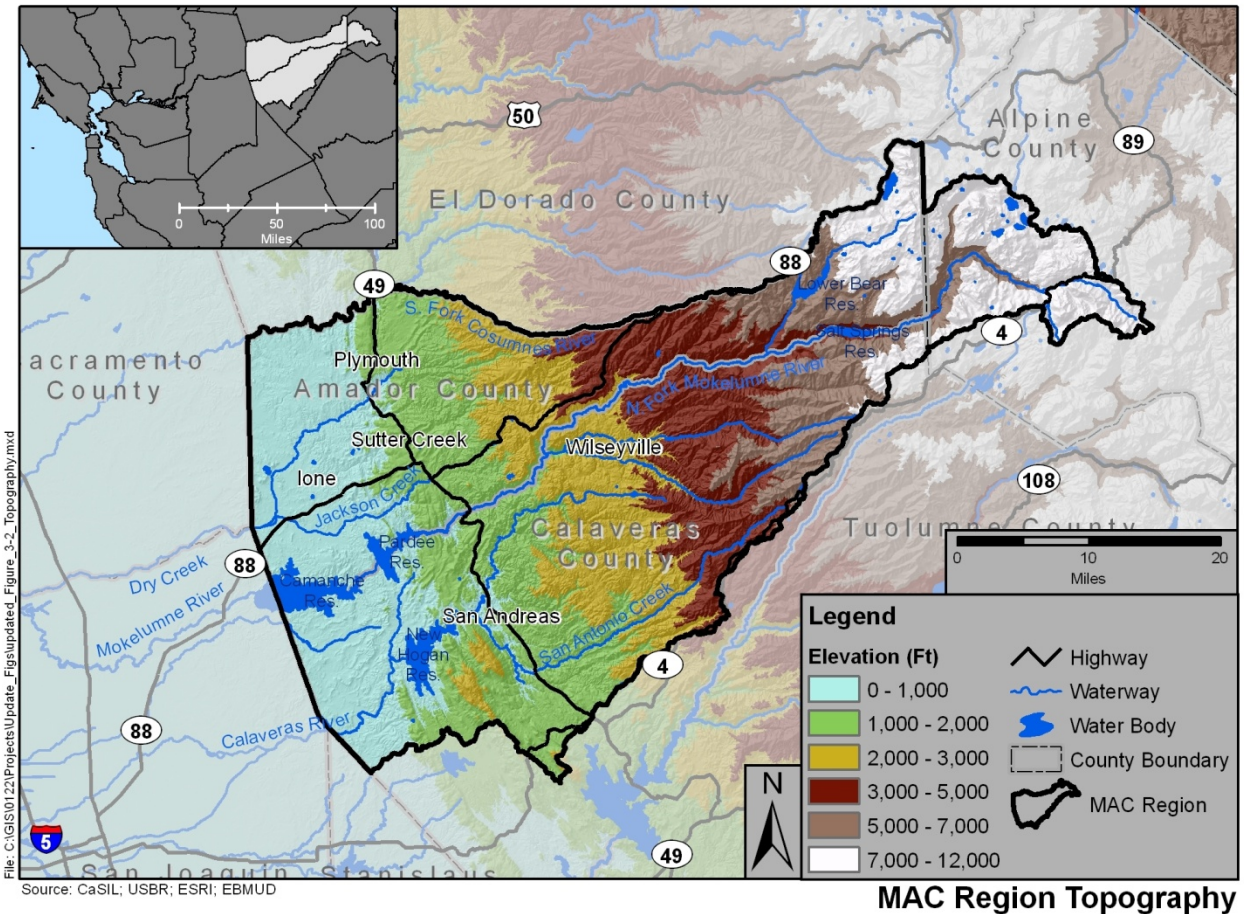

Figure 1-3: MAC Region Topography

The topography of the region has defined multiple watersheds within the region. The two watersheds (Mokelumne and Calaveras) that comprise the bulk of the region are described below. The watersheds of the region, as defined by the California Interagency Watershed Mapping Committee, are shown in Figure 1-4.

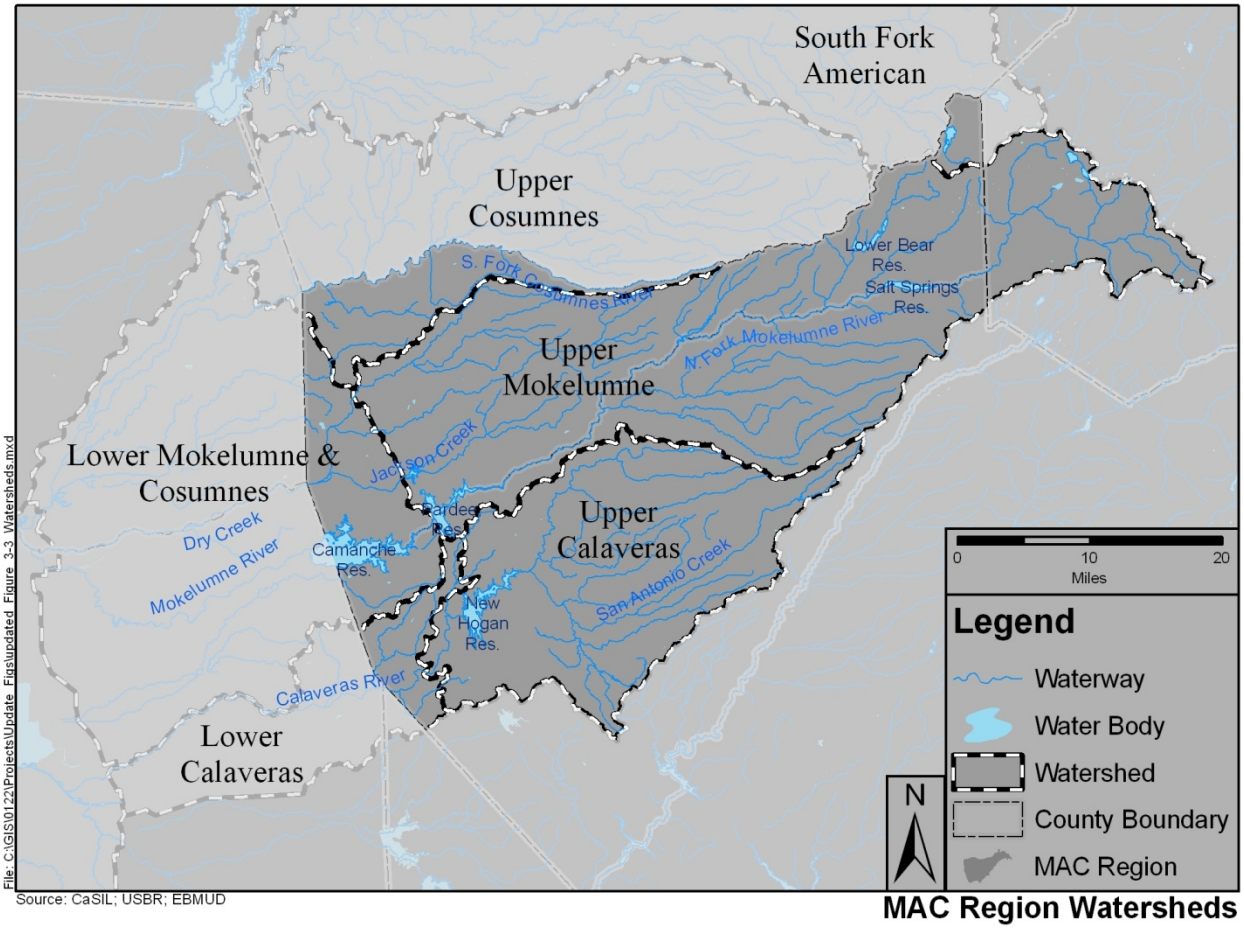

Figure 1-4: MAC Region Watersheds

Mokelumne River Watershed

The Mokelumne River originates in the Sierra Nevada and flows west to its confluence with the Cosumnes River in the Central Valley (San Joaquin County). With a watershed encompassing approximately 630 square miles, the annual average runoff of the Mokelumne River at Pardee Reservoir is 753,000 acre-feet (AF), with the majority of flow derived from snowmelt. Annual precipitation and streamflow in the Mokelumne River are extremely variable both month to month and year to year. Streamflow is influenced by upstream diversions and regulated by reservoir storage operations for hydroelectric power generation and water supply. The Mokelumne River watershed is typically subdivided into the Upper Mokelumne River watershed and Lower Mokelumne River watershed. The Upper Mokelumne River watershed extends from its headwaters in eastern Alpine County, past Pardee Reservoir downstream. The Lower Lower Mokelumne River watershed begins just downstream of Pardee Reservoir through northeastern San Joaquin County to the river's confluence with the Cosumnes River.

Upper Mokelumne River Watershed

The Upper Mokelumne River watershed is approximately 550 square miles in area, and includes portions of the 105,165 acre Mokelumne Wilderness. The Mokelumne Wilderness, a federal wilderness area protected under the Wilderness Act of 1964, straddles the crest of the central Sierra Nevada within the Stanislaus, El Dorado, and Toiyabe National Forests as well as portions of Calaveras, Alpine, and Amador Counties. Watersheds within the Mokelumne Wilderness area drain to the Mokelumne River on the west slope and the Carson River on the east slope. The Upper Mokelumne River watershed is defined as all lands that drain into the North Fork, Middle Fork, South Fork, and Main Stem of the Mokelumne

River and to Pardee Reservoir, the downstream boundary. The North Fork watershed is the largest tributary at 370 square miles, and contributes 85% of the river flow. The Upper Mokelumne River watershed topography is rugged, with elevations ranging from 600 to 10,400 feet. The watershed contains important habitat for sensitive species, is used by outdoor recreation enthusiasts throughout the year, and is the source of drinking water for one and a half million people living both within and outside of the watershed.

As the Mokelumne River flows westward from the watershed's eastern Sierra Nevada origins, the main river and its tributaries pass through several lakes and reservoirs, including Amador Lake, Henderson Reservoir, Lower Bear River Reservoir, Mosquito Lake, Tiger Creek Reservoir, Salt Springs Reservoir, and Pardee Reservoir. Early settlers used the Mokelumne River during the second half of the 19th century for mining, hydropower development, and transportation. The most notable effects on the river, however, resulted from mining activity following the discovery of gold in 1848 and copper in 1861. Gold mining in the Mokelumne River watershed peaked in 1854, and declined steadily thereafter. Copper was discovered in 1861 and the area was mined heavily between 1899 and 1919. Mine effluent discharged into the river through these decades has had a significant adverse impact on the area's natural resources.

Today, the Mokelumne River is used as a water supply for Amador Water Agency (AWA), Calaveras Public Utilities District (CPUD), Calaveras County Water District (CCWD), Jackson Valley Irrigation District (JVID) and East Bay Municipal Utility District (EBMUD). Pacific Gas & Electric Company (PG&E) and EBMUD also use the river for hydroelectric generation. Restoration activities began on the river in 1992 to improve the impacted aquatic community, resulting in increased salmon runs over those observed following the water project developments in decades past.

Lower Mokelumne River Watershed

The Lower Mokelumne River terminates at the confluence with the Cosumnes River in San Joaquin County. The combined area of the Lower Mokelumne River and Cosumnes River watersheds within the MAC region (i.e. the portions lying within Amador and Calaveras counties) is about 122 square miles in size. It contains the stretch of the Lower Mokelumne River that flows from Pardee Reservoir to Camanche Reservoir. The Camanche Dam is located within two miles of the county line that separates San Joaquin County from Amador and Calaveras Counties.

Land uses within the portion of the Lower Mokelumne River watershed contained in the MAC region are predominately grazing, recreation, water storage within Camanche Reservoir, and very sparse residential/ranchette development. Water stored in Camanche Reservoir, a flood control and recreation reservoir, is used for downstream fisheries, recreation, hydroelectric generation and water supply.

Calaveras River Watershed

The 470-square mile Calaveras River watershed contains lands located in Calaveras and San Joaquin counties. The majority of the watershed lies in Calaveras County with the smaller western-most portion of the watershed located in San Joaquin County. The Calaveras River is tributary to the San Joaquin River.

Like the Mokelumne River, the Calaveras River watershed may be divided into the Upper Calaveras River watershed and the Lower Calaveras River watershed, with the dividing line occurring just west of New Hogan Reservoir. Flow in the Calaveras River is primarily derived from rainfall with small contributions by snowmelt. New Hogan Dam was constructed on the Calaveras River in 1963 for flood control as well as municipal, industrial and irrigation purposes. Releases from New Hogan Dam currently control flows on the Lower Calaveras River. The upper watershed above New Hogan reservoir covers 363 square miles with an average annual runoff of about 166,000 AF.

The Lower Calaveras River – Mormon Slough area is below New Hogan Dam. The watershed for this portion of the river encompasses approximately 115,000 acres and receives up to 90,000 AF of surface water supply from the Calaveras River. The four main tributaries below New Hogan are Cosgrove Creek,

South Gulch, Indian Creek, and Duck Creek. Cosgrove Creek contributes the most flow to the Calaveras River, which has been as much as 8,500 AF in some years.

As with the Mokelumne River, land and water resource management decisions for the Calaveras River are made by a variety of entities, including many of the same organizations as for the Lower Mokelumne River. The agencies that manage water resources within the MAC region are listed in Table 1-1. One additional organization involved in the preservation and management of the Calaveras River is the Calaveras River Watershed Stewardship Group. They focus on the lower Calaveras River below the New Hogan Dam. Members of this group include the U.S. Fish and Wildlife Service, the California Department of Fish and Game, Stockton East Water District, Calaveras County Water District, NOAA Fisheries, California Department of Water Resources (DWR), City of Stockton, and California Department of Conservation.

Table 1-1: Agencies with Water Resources Management Responsibilities in the Region

Agency Name	Location and Services Provided
Amador Water Agency (AWA)	AWA provides water and wastewater services to residents of Amador County. AWA uses water from the North Fork of the Mokelumne River for 6,600 service connections in western Amador County.
Amador County	Amador County is authorized to carry out flood control and stormwater management through its Public Works Department and the implementation of environmental health programs.
Alpine County	For portions of Alpine County within the MAC region, Alpine County, and its affiliated Alpine County Water Agency, has water management responsibilities related to water quality, water-dependent recreation and several small community service areas located on the western slope of the Sierra Nevada mountains.
Amador Regional Sanitation Authority (ARSA)	A JPA consisting of Amador County, Sutter Creek and Amador City for the primary purpose of transporting effluent from the secondary treatment facility at Sutter Creek to the treatment facility at Ione.
Calaveras County Water District (CCWD)	CCWD provides water and wastewater services to its customers in its service area which coincides with Calaveras County boundaries.
Calaveras Public Utility District (CPUD)	CPUD provides water to San Andreas, Mokelumne Hill and outlying areas.
Calaveras County	The county is authorized to carry out flood control and stormwater management through its Public Works Department and the implementation of environmental health programs.
East Bay Municipal Utility District (EBMUD)	EBMUD provides water and wastewater services to its service area within Alameda and Contra Costa counties near San Francisco and also to its recreation areas at Pardee and Camanche North Shore in Amador County and Camanche South Shore in Calaveras County.
City of Ione	The City has secondary and tertiary wastewater treatment facilities and relies on AWA for potable water service.
City of Jackson	The City relies on AWA for water service but maintains its own wastewater treatment facilities.
City of Plymouth	The City supplies domestic sanitary sewer facilities, storm sewer, water treatment and wastewater treatment facilities to city residents. Water service is provided via an open channel from Cosumnes River and groundwater wells.
City of Sutter Creek	The City provides local wastewater treatment services to city residents of Sutter Creek and Martell. AWA provides the City's water services.
Jackson Valley Irrigation District (JVID)	Organized in 1956 and contains 12,800 acres along Jackson Creek in Amador County. Owned by farmers and ranchers to control, distribute, salvage any water, including sewage for beneficial use, and irrigation.

Groundwater

Groundwater is used in the Amador County portion of the MAC region. Groundwater quantity and quality in this area varies considerably between well sites due to the small and unpredictable yields of the fractured rock system that typifies the underlying geology. Groundwater accounts for approximately two

percent of AWA's total water supply, and it is currently only used in the communities of La Mel Heights and Lake Camanche Village at a total rate of approximately 200 acre-feet per year (AFY). Wells serving the Lake Camanche Village area of Amador County are located within the Cosumnes Subbasin portion of the San Joaquin Valley Groundwater Basin. The Cosumnes Subbasin is approximately 439 square miles in size, and is bounded on the north and west by the Cosumnes River, on the east by the bedrock of the Sierra Nevada Mountains, and on the south by the Mokelumne River.

A portion of western Calaveras County overlies the Eastern San Joaquin Subbasin. This subbasin is a part of the larger San Joaquin Valley Groundwater Basin. This groundwater subbasin extends from the western corner of the County west of the cities of Stockton and Lodi. Use of groundwater for irrigation and municipal purposes has resulted in a continuous decline of available groundwater over the past 40 years. As of 1990, annual groundwater extractions in San Joaquin County had exceeded the estimated safe yield. Overdraft of the groundwater in this subbasin has created groundwater depressions in areas near Stockton and east of Lodi. The Cosumnes groundwater subbasin of the San Joaquin Valley Basin is located north of and adjacent to the Eastern San Joaquin Groundwater Subbasin.

Groundwater resources are known to exist in other areas of the MAC region, although there are no officially delineated groundwater basins defining these areas. In fact, most of the groundwater used within the region is obtained from areas outside of the Eastern San Joaquin Groundwater Subbasin. This groundwater may be found in hard rock formations and extracted in relatively small amounts from fractured rock, faults, or changes in rock strata.

Groundwater does not account for any of CCWD's total water supply. In 2007, CCWD updated its adopted 2001 AB 3030 Groundwater Management Plan per SB 1938 requirements for the Camanche/Valley Springs area (which overlies the Eastern San Joaquin Groundwater Subbasin in western Calaveras County). CCWD has also completed a hydro-geologic assessment of groundwater conditions in the area. In 2008, CCWD was awarded a Proposition 50 Local Groundwater Assistance grant of $250,000 as part of a $425,000 total project budget to install nested monitoring wells and upgrade its groundwater monitoring activities. Because groundwater levels have declined in the basin, CCWD is moving toward integration of its surface water supplies with management of its share of the Eastern San Joaquin Valley Groundwater Basin.

1.1.4 Internal Institutional Boundaries

The following sections describe the institutions or groups that have varying degrees of responsibility or involvement related to the management of the water resources and infrastructure within the MAC region. These groups are organized and presented in the following order; county governments, city governments, special districts, joint powers agencies, stakeholder and special interest groups, PG&E, and federal and state agencies.

County Governments

The MAC region is wholly contained within the boundaries of Amador, Calaveras and Alpine Counties. The region is sparsely inhabited and contains just five incorporated areas. The total combined population of the three counties was 84,844 (U.S. Census, 2011). Individual county populations are shown in Table 1-2.

Table 1-2: MAC Region County Populations

	Alpine County	Amador County	Calaveras County
Number of inhabitants	1,175	38,091	45,578

Source: U.S. Census, 2011

The Boards of Supervisors for these three counties are responsible for overseeing a variety of services for county residents, primarily in unincorporated areas, but in some cities as well. Such countywide services

include voter registration, health and welfare programs, court and law enforcement operations, jail facilities, the recording of official documents, tax assessment and collection, and social services. The supervisors are also responsible for providing some municipal-type services for residents of incorporated areas. These include planning, zoning and land-use regulation, street maintenance, and in some cases sewage disposal, water, parks and recreational facilities and other municipal services, although these needs are frequently met by special districts as discussed below.

City Governments

There are five municipalities within the MAC region, all of which are located in Amador County: Amador City (2010 population - 185); Ione (2010 population - 7,918), Jackson (2010 population - 4,651), Plymouth (2010 population - 1,005) and Sutter Creek (2010 population - 2,501) (U.S. Census Bureau, 2011). Although there is one incorporated city within Calaveras County (Angels Camp), this city is outside the MAC region. Alpine County has no incorporated areas.

These city governments are responsible for providing services which directly affect the lives of their residents. To varying degrees, they provide fire and police protection, construct and maintain streets, provide facilities for sewage and storm drainage, and other community services. Additionally, each of the cities prepares land use plans and administers planning and zoning codes. There are Census Designated Places (CDPs) in Calaveras County which include Arnold, Dorrington, Forest Meadows, Mokelumne Hill, Mountain Ranch, Railroad Flat, Rancho Calaveras, San Andreas, Valley Springs, Wallace and West Point. CDPs are geographic entities that serve as census data collection points in areas with concentrated population, housing, and commercial structures that are not within an incorporated area or city (the statistical counterpart of an incorporated area). The cities and CDPs within the MAC Region are shown in Figure 1-5.

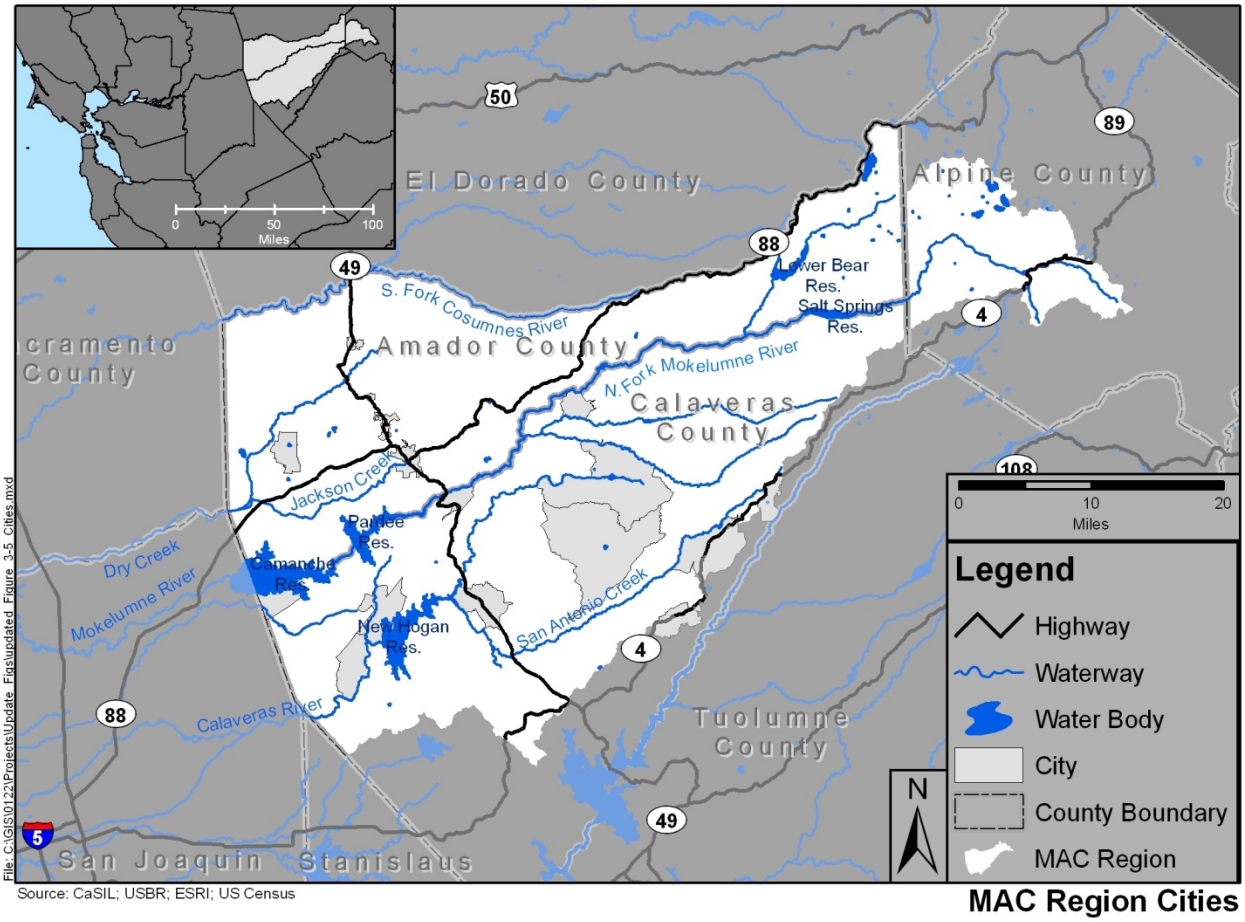

Figure 1-5: MAC IRWMP City and CDP Boundaries

Special Districts

Special districts are units of local government established by the residents within MAC region to provide one or more special services not otherwise available. The special districts within the MAC region that provide water-related services are shown in Table 1-3.

Table 1-3: Water-Related Special Districts within the MAC Region

County	Special Districts
Alpine	Alpine County Water Agency
Amador	Amador Water Agency
	Jackson Valley Irrigation District
	East Bay Municipal Utility District
Calaveras	Calaveras County Water District
	Calaveras Public Utility District
	East Bay Municipal Utility District
	Mokelumne Hill Sanitary District
	Wallace Community Services District
	Valley Springs Public Utility District

Joint Powers Agencies

Under provisions of the California Government Code, two or more public agencies may come together under a joint powers authority (JPA) to provide more efficient government services or solve a service delivery problem. Three JPAs have been formed within the MAC region to address water resource management and related matters.

Upper Mokelumne River Watershed Authority (UMRWA) – UMRWA is a joint powers authority comprised of the three MAC region counties (Alpine, Amador and Calaveras) and six special districts which provide water and related services to areas within the MAC region. UMRWA is fully described in Chapter 2 of this application.

Amador Regional Sanitation Authority (ARSA) – ARSA is a joint powers authority consisting of Amador County, Sutter Creek and Amador City. The JPA's primary purpose is to transport effluent from the secondary treatment facility at Sutter Creek to the tertiary treatment facility at Ione. Mule Creek State Prison and the Preston School of Industry, a California Youth Authority facility, also discharge to ARSA facilities.

Calaveras-Amador-Mokelumne River Authority (CAMRA) – CAMRA is a joint powers agency established in 1997 between Amador County, Calaveras County, CCWD, CPUD, AWA and JVID. The Authority provides an institutional vehicle for the counties and local water-related special districts to discuss water related issues and concerns.

Stakeholder and Special Interest Groups

Regional Participants Committee (RPC) – The RPC is a diverse committee organized with the primary objective of bringing stakeholder interests to the forefront during the development and administration of the MAC Plan. Members of the RPC represent the views of their respective organizations or interest groups within the community, commit time to take part in the plan development and updating processes, and work collaboratively with other RPC members, project staff, and UMRWA representatives. The RPC is more fully described in Section 2.2.1.

Mokelumne River Forum (MRF) – The MRF is an open stakeholder process intended to address Mokelumne River water resource conflicts between San Joaquin interests and MAC region stakeholders. In April 2005, members of the MRF and others signed a Memorandum of Understanding (MOU) and agreed to work cooperatively to develop mutually beneficial solutions to meet widely accepted water supply and related needs of the region. MOU signatories include DWR, Alpine County, Amador County, AWA, CCWD, CPUD, the City of Lodi, the City of Stockton, EBMUD, JVID, North San Joaquin Water Conservation District, San Joaquin County Flood Control and Water Conservation District and Mokelumne River Water and Power Authority, Stockton East Water District, Central San Joaquin Water

Conservation District, WID and the San Joaquin Farm Bureau Federation. The MRF is also open to other organizations and groups that are not MOU signatories but have direct interest in the Forum's goals.

Because MRF participants include agencies responsible for preparing both the Eastern San Joaquin and MAC integrated regional water management plans, the MRF creates opportunities to propose and consider inter-regional projects which meet a broader range of needs and provide greater inter-regional benefits. A collaborative planning process is underway in which the MRF participants are coordinating several water resource planning efforts across regional boundaries with respect to river hydrology, facilities, infrastructure and institutional arrangements required for the inter-regional projects.

Foothill Conservancy – The Foothill Conservancy's stated mission is to protect, restore, and sustain the natural and human environment in Amador and Calaveras counties for the benefit of current and future generations. The Conservancy has been actively involved in water resource issues for many years, and its members serve on the Regional Participants Committee, the Mokelumne Forum, and other stakeholder organizations involved with water resource issues in the MAC region.

Upper Mokelumne River Watershed Council (Council) - The Council was originally formed with a State Proposition 204 grant in the spring of 2000. The group has focused its efforts on water quality, watershed planning, watershed assessment/restoration, and public outreach and education in the Upper Mokelumne River, Dry Creek, and Upper Calaveras River watersheds. The mission of the Council is to work collaboratively with local stakeholders to restore and maintain the Upper Mokelumne River and other watersheds in a manner that ensures sustainable environmental, economic, educational, cultural, recreational, and water quality benefits for present and future generations.

Alpine Watershed Group – This organization operates similar to a watershed council. The Alpine Watershed Group works to preserve and enhance the natural system functions of Alpine County's watersheds for future generations. The Alpine Watershed Group is represented on the MAC region's RPC.

Pacific Gas and Electric Company

PG&E is the owner and operator of the Mokelumne River Hydroelectric Project (FERC license No. 137). The project consists of a series of storage and regulating reservoirs and associated tunnels and pipelines which supply water to four hydropower generating units located primarily on the North Fork of the Mokelumne River. PG&E operates the project in accordance with FERC license requirements and other operating obligations. A new FERC license, issued to PG&E in October 2001, requires the company to work with a stakeholder committee to adaptively manage project operations in a manner that balances the needs of recreation and the environment with power generation needs.

Federal and State Agencies

A number of federal and state agencies influence water resource decisions within the MAC region to some degree. Which agency or agencies have influence, and the extent of their influence, depends on the nature of the water resource matter being considered. Those agencies which would typically be expected to have input on water-related projects and programs in the MAC region are listed in Table 1-4.

Table 1-4: Federal and State Agencies with MAC Region Jurisdictions

Federal Agencies	State Agencies
U.S. Forest Service	Department of Water Resources
Bureau of Land Management	State Water Resources Control Board
Environmental Protection Agency	Department of Fish and Game
U.S. Army Corps of Engineers	Department of Public Health
U.S. Fish and Wildlife Service	Regional Water Quality Control Board
Federal Energy Regulatory Commission	Department of Parks and Recreation
	Department of Transportation

1.1.5 Major Water-Related Infrastructure

Surface water provides the majority of water supply in the MAC region. Associated with the surface water bodies within the region are several major water-related projects. Figure 1-6 shows the major water infrastructure within the study region and highlights the regions dependence on the Mokelumne and Calaveras Rivers. The water infrastructure includes major conveyances, water treatment plants, pump stations and water storage facilities.

Amador Water System – The Amador Water System conveys Mokelumne River water transported via PG&E's Electra Tunnel to Lake Tabeaud. Lake Tabeaud then feeds the Amador Canal, transporting water to treatment plants in Sutter Hill and Ione. The 23-mile Amador Canal was replaced in 2008 with an 8-mile pipeline project. Buckhorn, Ione, and Tanner Water Treatment Plants, located in Pioneer, Ione and Sutter Hill, respectively, are owned and operated by AWA and provide treated surface water to AWA's service area.

Camanche Dam and Reservoir – Owned and operated by EBMUD, Camanche Reservoir has a capacity of 417,120 AF. Camanche Reservoir is primarily operated for flood control and to meet downstream flow requirements and riparian needs. Hydroelectric power generation also occurs at the Camanche Reservoir. The reservoir regulates Mokelumne River water flows pursuant to agreements and entitlements held by Woodbridge Irrigation District (WID) and the North San Joaquin Water Conservation District, both located within San Joaquin County.

Central Amador Water Project (CAWP) System – The Central Amador Water Project System provides wholesale treated water to upcountry communities in Amador County such as Pine Grove, Pioneer, and the Mace Meadows areas. Water is diverted from the Tiger Creek Afterbay (a component of PG&E's Mokelumne River hydroelectric project) and pumped to the Buckhorn Treatment Plant in Pioneer to be treated and distributed to the local communities.

Groundwater Wells – A single groundwater well, located in the La Mel Heights subdivision, is used by AWA to supply La Mel Heights customers. Three groundwater wells located in the Lake Camanche area are used to supply Lake Camanche residents.

Ione Pipeline – The Ione Pipeline transports raw water from the Tanner Reservoir to the Ione Water Treatment Plant where it is treated for use by customers of Ione.

Jenny Lind System – The source of water for the Jenny Lind Improvement District is an infiltration gallery one mile below the New Hogan Dam on the Calaveras River. Water allocation is highly dependent on the water year. CCWD's water allocation for this system is 30,928 AFY plus riparian water rights of 350 AFY. Water for the system is treated at the Jenny Lind Water Treatment Plant. The Dr. Joe Waidhofer WTP capacity is rated at 45 million gallons per day (MGD), and delivers water to the City of Stockton. Eight MGD is also delivered to Jenny Lind WTP, which will be augmented with a new regional facility within the next five years, or as development pressures rebound from the slow economy.

Lake Tabeaud – Used by AWA to divert water from the Mokelumne River, Lake Tabeaud has a storage capacity of 1,170 AF. Water from Lake Tabeaud is conveyed by pipeline to the Tanner Water Treatment Plant where it is treated for use by the customers of Jackson, Sutter Creek, Amador City, and Drytown.

Mokelumne Aqueducts – Raw water from Pardee Reservoir is moved through the Pardee Tunnel to the three Mokelumne Aqueducts near Valley Springs in Calaveras County. All three steel pipelines extend 82.2 miles from the Pardee Tunnel to the east end of the Lafayette Aqueduct in Walnut Creek, east of San Francisco Bay.

New Hogan Dam and Reservoir – New Hogan Dam and Reservoir stores approximately 317,000 AF of water for municipal, industrial, irrigation, and flood control purposes. Flood control releases are controlled by the U.S. Army Corp of Engineers with Stockton East Water District operating the reservoir at all other times.

New York Ranch Reservoir - The New York Ranch reservoir, located just southwest of the intersection of Ridge and Climax Roads, currently serves as a holding basin for water flowing via the Amador Canal pipeline from Lake Tabeaud to the Tanner Reservoir near Sutter Hill.

Pardee Dam and Reservoir – Owned and operated by EBMUD, Pardee Reservoir has a capacity of 197,950 AF and is operated as a water supply reservoir. Water from Pardee is conveyed by the Mokelumne Aqueducts to the EBMUD service area approximately 91 miles away. Hydroelectric power generation (30 megawatts) is produced at the Pardee Powerhouse.

Tanner Reservoir – Tanner Reservoir stores raw water transferred from Lake Tabeaud via the Amador Canal pipeline. The raw water is then transferred to the Ione Water Treatment Plant via the Ione Pipeline for treatment and subsequent distribution to customers in Ione.

Tiger Creek Reservoir (Forebay and Afterbay) – The combined capacity of the Tiger Creek Forebay and Afterbay is approximately 4,000 AF. The Tiger Creek reservoirs are used by PG&E for power generation. AWA currently uses water stored in the Tiger Creek Afterbay for water supply. Water is pumped from the afterbay to Buckhorn Water Treatment Plant where it is treated and ready for use by the customers of Pine Grove, Pine Acres, Sunset Heights, Fairway Pines, Jackson Pines, Pioneer, Gayla Manor, Ranch House Estates, Pine Park East, Toma Lane, Sierra Highlands, Silver Lake Pines, Ridgeway Pines, Rabb Park, and Mace Meadows. Water from the afterbay is also gravity fed to the PG&E Tiger Creek Powerhouse treatment plant, which serves the PG&E Conference Center.

Electra Run - This small, scenic canyon on the Upper Mokelumne River, upstream of Pardee Reservoir and Highway 49, is a popular whitewater run. Located below PG&E's Electra powerhouse, this narrow, 1,000-foot-deep, wooded canyon is also a favorite place for other recreational activities such as fishing and picnicking.

Mokelumne River Fish Hatchery- The Mokelumne River Fish Hatchery is owned by EBMUD and operated by the California Department of Fish and Game. The fish hatchery raises and releases anadromous fish on the Mokelumne River, in addition to obtaining and maintaining data regarding the condition of fish stock in the river.

West Point/Wilseyville System – Sources of water for the West Point and Wilseyville water systems are Bear Creek and the Middle Fork of the Mokelumne River. CCWD has water rights for a year-round diversion of 4 cubic feet per second (cfs) and 150 AF of storage rights on Bear Creek for a total potential supply of 1,980 AF.

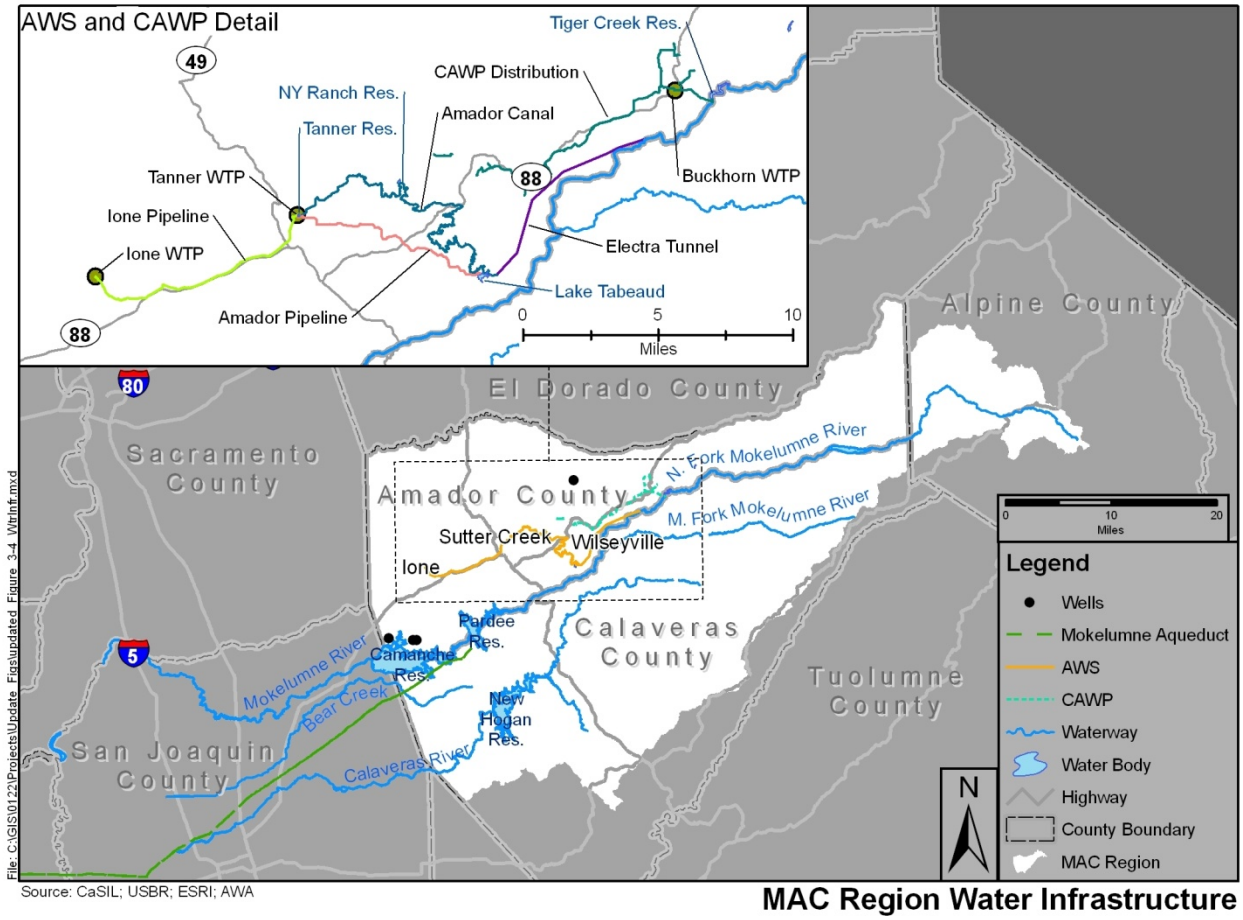

Figure 1-6: **MAC Region Water Infrastructure**

1.1.6 Social and Cultural Makeup

This section describes the social and cultural makeup of the MAC Region, discusses important cultural values, identifies the DACs in the Region, and describes the economic conditions and important economic trends within the region.

Land Use

Land use data are critical for identifying and evaluating a multitude of water resources management characteristics including water use, wastewater production, stormwater runoff, environmental habitats, and other natural resources. Land use data are available from DWR, the United States Geological Survey (USGS) and local governmental agencies. Figure 1-7 summarizes the major land uses in the MAC IRWM planning region. Development within the region, both urban and rural, is clustered around the major cities and highways. Agriculture, grazing, and open space dominate, representing a relatively large portion of the total regional land use. Other industries outside the urban setting include mining and timber harvesting, where the majority of the land cover is forest, shrub and grassland.

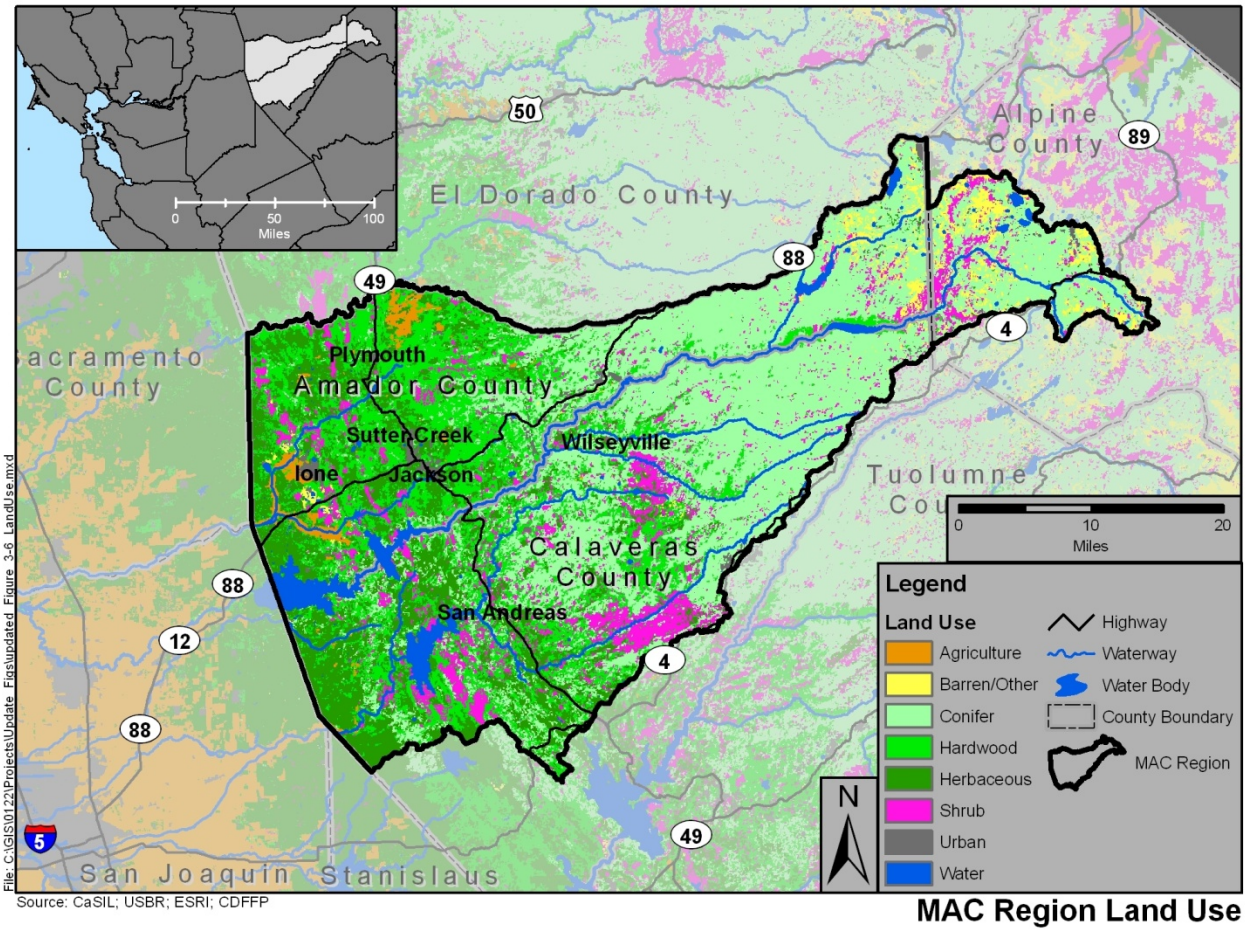

Figure 1-7: MAC Region Land Use

General land use trends in the region include development of rural and agricultural areas and a shift from grazing to viticulture and from viticulture to residential development.

Amador County

In recent years, Amador County has experienced increased urbanization and decreased farming and agriculture, though continued agriculture and preservation of agriculture lands is encouraged by the County. Primary farming commodities in the County include wine grapes and cattle. Grazing on public lands is still a custom and part of the County's culture. Large land holdings for timber harvesting of softwood forests exist in areas designated as Timberland Preservation Zones (TLZ), but significant urbanization pressures continue. Amador County is currently updating its General Plan; a draft was released in March 2011. This IRWMP is not intended to drive the General Plan process or influence growth patterns in the County. The Draft General Plan identified the greatest challenge facing successful implementation as insufficient available water and wastewater services. As of 2010, infill development was limited by a lack of water and sewer capacity (Amador County, 2011).

Calaveras County

The General Plan divides Calaveras County into two categories based on land use: Natural Resource Lands and Community Development Lands. Natural Resource Lands are used for agriculture, timber and mining, or contain sensitive habitat. The Community Development Lands are already developed or slated for future development. The General Plan establishes target development densities within each of these categories such that Community Development Lands will be developed at higher densities and Natural

Resource Lands density will be restricted to ensure future use, conservation, and the use of resources. Currently, Natural Resource Lands comprise approximately 55% of the land area (22% of that designated for Timber or Dam Areas), whereas 43% of the total area is designated as Community Development Lands. The remaining 2% is designated for the City of Angels and its sphere of influence. The Calaveras County General Plan is completing a comprehensive update to its General Plan with implementation expected in the fall of 2011. As with the Amador General Plan, this IRWMP is not intended to drive the General Plan Update process or to influence growth in the County.

Alpine County

Due to Alpine County's topography, minimal development pressure, and citizen appreciation for the conservation of the forest and mountain meadow environment, development will be concentrated in Kirkwood and Bear Valley, two ski-resort communities, consistent with the Land Use Element of Alpine County's General Plan. This will allow much of the County to remain designated as Open Space or Wilderness. Two types of residential subdivisions are recognized – standard and conservation. Lots in a standard subdivision will be a minimum of 20 acres whereas in a conservation subdivision, residential lot sizes will be reduced, provided that the overall density of development does not exceed one residential lot per 20 acres of land. Lands not included in residential lots shall be retained as open space. County population is expected to continue to grow at a slow and steady rate with increases over the next 10 years due primarily to demographic changes in age and household size. Population increases will directly increase demands for public services and facilities, including fire protection, sewage disposal, water systems, and other utilities (Alpine County, 2009).

Culture

Also known as the "Heart of the Mother Lode", the MAC IRWM region was first developed when the California gold rush began. Cities were developed around and nearby local mines to support the prospectors and hard rock miners. Evidence of the area's past is visible, with many historic buildings still standing as part of the current local culture. The area is now known for its vineyards and wines, small town charm and hospitality, scenic open space, and rich history.

The MAC IRWMP region is home to approximately 130,000 people, representing a number of different races. Table 1-5 summarizes the results of the 2000 Census racial data for the region. According to this dataset, while about 80% of the population lives in urban areas, 98% of the region is considered rural. This translates to an approximate population density of 2000 people per square mile on average. The population density in rural areas is about 40 people per square mile. This low population density minimizes urban impacts to the region's water features, making the region valuable as a watershed and ideal for habitat and natural resources. NOTE: Census tract/block group data will not be released until December 2011. This analysis as well as the DACs analysis will be completed after the release of the necessary data.

Table 1-5: Racial Percentages in the MAC IRWMP Region

White	Hispanic	Asian	African American	American Indian	Islander	Multi-racial
84.3%	8.9%	1.3%	2.6%	1.7%	0.1%	2.0%

Note: Table does not reflect San Joaquin County population statistics.
Source: California Department of Forestry and Fire Protection 2000 Census Block Group Data

Disadvantaged Communities

A "disadvantaged community" (DAC) is defined by the State of California as a community with an annual median household income (MHI) that is less than 80% of the statewide MHI [CA Water Code, Section 79505.5(a)]. The 2000 State MHI was $47,493; therefore, communities with an average MHI of $37,994 are considered disadvantaged communities.

Based on the 2000 Census for median household income, the cities of Jackson (Amador County), Plymouth (Amador County), Mokelumne Hill (Calaveras County), Rail Road Flat (Calaveras County), San Andreas (Calaveras County), and West Point (Calaveras County) are DACs. In 2005, AWA performed a survey of the Camanche region and identified the North Shore Lake Camanche Unit 6 & Recreation Areas area as a DAC as well. Finally, the MAC IRWMP region contains Amador City (Amador County) and Mountain Ranch (Calaveras County), which do not qualify as DACs based on MHI, but do have Median Family Incomes (MFIs) that are well below 80% of the state MFI. Table 1-6 summarizes the 2000 Census data and the MHI statistics.

Table 1-6: Median Household Income Statistics

City (County)	Median Household Income	Percent of State MHI
California	$47,493 (80% = $37,994)	
Jackson (Amador)	$35,944	76%
Plymouth (Amador)	$37,262	78%
North Shore Lake Camanche Unit 6 & Recreation Areas[a] (Amador)	$36,000-$36,999	77%
Mokelumne Hill (Calaveras)	$35,526	75%
Rail Road Flat (Calaveras)	$35,938	76%
San Andreas (Calaveras)	$32,500	68%
West Point (Calaveras)	$25,417	54%

a. Mercy Housing performed survey and provided MHI.

Table 1-7 summarizes the 2000 Census data and the MFI statistics.

Table 1-7: Median Family Income Statistics

City (County)	Median Family Income	Percent of State MFI
California	**$53,025 (80% = $42,420)**	
Amador City (Amador)	$39,861	75%
Mokelumne Hill (Calaveras)	$37,237	70%
Mountain Ranch (Calaveras)	$39,324	74%
Rail Road Flat (Calaveras)	$35,278	67%
San Andreas (Calaveras)	$37,969	72%
West Point (Calaveras)	$27,794	52%

There are no DACs in the portion of Alpine County within the MAC IRWM planning region.

A brief description of each DAC is provided in Table 1-8. These data are summarized from the 2000 Census conducted by the U.S. Census Bureau. For comparison purposes, the State average "per capita" income is $22,711 with an average family size of 3.43 persons, an average household size of 2.72, and a median age of 33.3 years.

Overall, the DACs in the MAC IRWMP region were smaller than those throughout California, with a higher median age. This indicates that many of the households in the MAC IRWMP region are maintained by older persons, most likely retired and living on fixed incomes.

Table 1-8: 2000 Census Demographic Statistics for Disadvantaged Communities

City (County)	Population	No. of Households	No. of Families	Ave. Family Size	Ave. Household Size	Median Age	Per Capita Income
California	**33,871,653**	**--**	**--**	**3.43**	**2.72**	**33.3**	**$22,711**
Amador City (Amador)	196	85	54	2.76	2.31	42	$17,963
Jackson (Amador)	3,989	1,746	1,023	2.74	2.13	47	$21,399
North Shore Lake Camanche Unit 6 and Recreation Areas (Amador)[a]	--	398	--	--	--	--	$36,000-$36,999
Plymouth (Amador)	980	392	272	2.99	2.50	39	$16,197
Mokelumne Hill (Calaveras)	774	340	227	2.71	2.28	46	$17,281
Mountain Ranch (Calaveras)	1,557	656	474	2.76	2.37	50	$19,594
Rail Road Flat (Calaveras)	549	240	150	2.72	2.29	47	$18,454
San Andreas (Calaveras)	2,615	1,097	652	2.85	2.24	43	$16,813
West Point (Calaveras)	746	305	203	2.86	2.43	45	$11,439

a. Data developed outside of Census 2000 by Mercy Housing (Jan. 2006)

Figure 1-8 presents the locations of these communities and the source of the DAC classification (80% of the statewide MHI, MFI, or both).

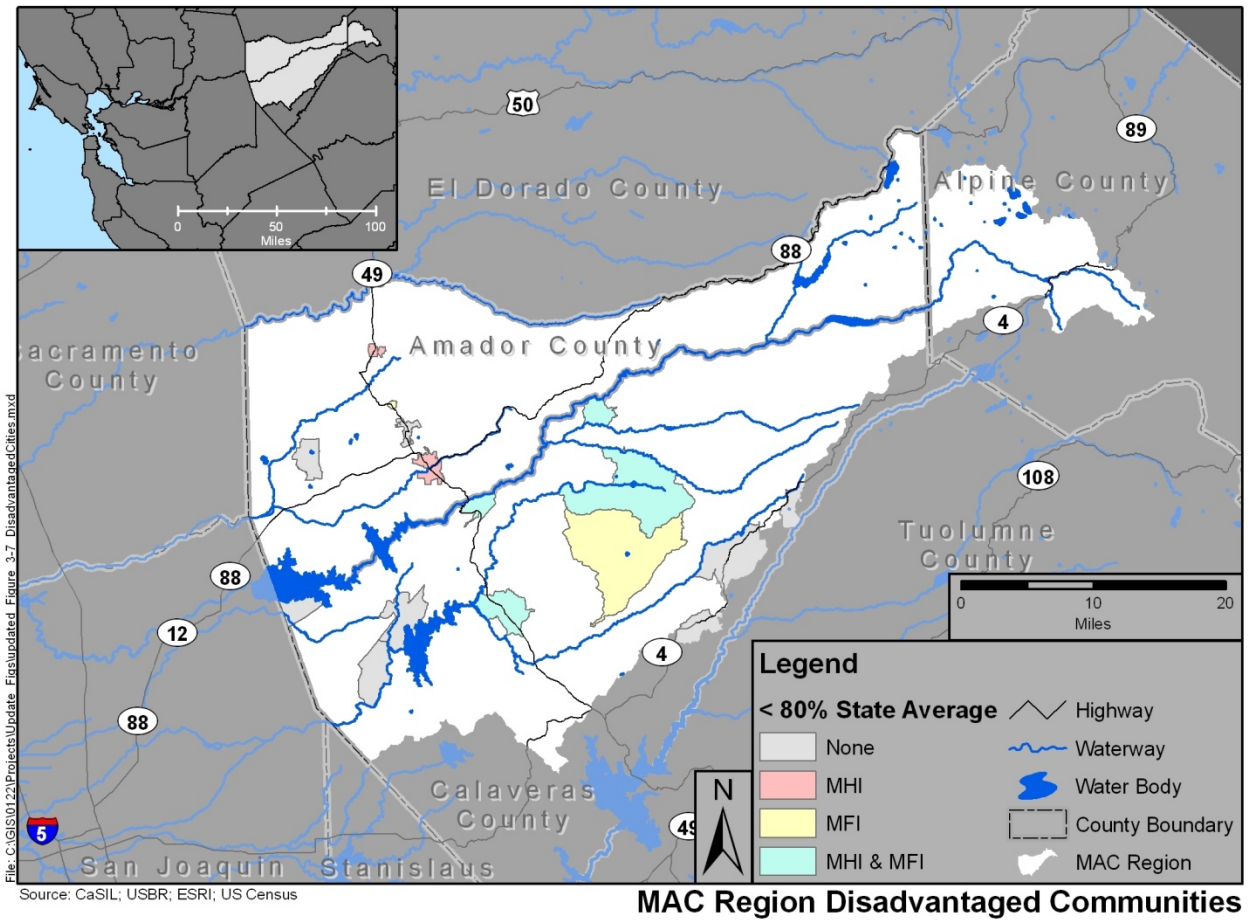

Figure 1-8: MAC Region Disadvantaged Communities

Environmental justice is addressed by providing all stakeholders with ample opportunities for involvement in decision-making processes and ensuring that minority and/or low-income populations do not bear disproportionate quality of life, human health, and / or environmental impacts. DACs existing with the MAC Region and increases in water or wastewater service rates that could accompany the implementation of several projects discussed herein could affect these communities. A priority of the IRWMP RPC is to seek external grant funding or subventions to offset the cost of implementing new, and often expensive, projects. External funding assistance will help offset costs to existing ratepayers in the region - especially those ratepayers with a limited ability to pay - and will help to ensure that those ratepayers are affected as little as possible. Additionally, the MAC IRWMP projects will be reviewed for compliance with CEQA, NEPA, and any other local, state, and federal requirements. Through any necessary environmental documentation review (to be completed by project proponents prior to implementing projects and not as part of the IRWM Plan), compliance with Executive Order 12898 will be addressed on a project-by-project basis.

Construction of project facilities will create short-term environmental impacts (noise, dust, traffic disruption) potentially affecting neighboring land uses. A preliminary analysis of the areas affected by construction of project facilities will assist in minimizing adverse impacts to minority and / or low-income populations.

1.1.7 Ecological and Environmental Resources

The MAC IRWMP region is a largely natural area with significant portions designated as rural or open space. The region is host to an abundance of water features in the form of rivers, creeks, ponds, lakes, and reservoirs. As such, the region provides a great deal of varied habitat for numerous species. The Upper Mokelumne River has been designated as a scenic waterway.

There are a number of special-status biological species in the MAC IRWMP region. Table 1-9 summarizes the species that are listed in the 10/08 California Natural Diversity Database designated as "Threatened," "Endangered," or "Candidate," with the latter indicating that the species is under consideration for official listing in the future. Additionally, there are several "Special" animal and plant species in the MAC region that have been designated as such by either the California Department of Fish and Game or the California Native Plant Society due to declining population levels, limited ranges and/or continuing threats that make them vulnerable to extinction.

Table 1-9: Special-Status Species Potentially within the MAC IRWMP Region

Common Name	CA State Status	Federal Status
Bald eagle	Endangered	Delisted
California red-legged frog	None	Threatened
California tiger salamander	Threatened	Threatened
California wolverine	Threatened	Candidate
Great gray owl	Endangered	None
Ione buckwheat	Endangered	Endangered
Ione manzanita	None	Threatened
Irish Hill buckwheat	Endangered	Endangered
Lahontan cutthroat trout	None	Threatened
Pacific fisher	None	Candidate
Sierra Nevada red fox	Threatened	None
Sierra Nevada yellow-legged frog	Candidate Endangered	Candidate
Valley elderberry longhorn beetle	None	Threatened
Yosemite toad	None	Candidate

Source: California Natural Diversity Database, September 2011

In addition to these special-status species, the MAC region is home to a wide variety of plant and animal life in many different environments, including riparian, wetland, forest, and alpine. Wildlife in the area includes noteworthy rainbow and brown trout fisheries, black bear and deer populations, furbearers, 119 different bird species - including peregrine falcons, cliff swallows, spotted owls, and many more - and a vast array of amphibians and reptiles, including foothill yellow-legged frogs, western fence lizards, Gilbert skink, western rattlesnake, and pacific treefrog.

1.2 Water Resource Conditions

1.2.1 Water Supplies and Demands

The regional water supplies and demands included in this section are based on the best available information and projections. Demands are very sensitive to population and land use, and the increasing

demands reflect regional trends. To help offset increasing demands, agencies are implementing demand management measures as described in their respective Urban Water Management Plans.

Amador County

AWA provides potable water and raw water to more than 25,000 people in its four service areas, Amador Water System, Central Amador Water Project System, La Mel Heights, and Lake Camanche Village, for municipal, industrial, and irrigation uses. Demands have flattened during the recent economic recession, but AWA continues to manage its water supplies and demands over a range of normal and emergency conditions.

As part of the 2010 UWMP, AWA calculated its baseline daily per capita water use and interim and urban water use targets as required by Senate Bill x7-7 (SBx7-7). As a result, future water demands were calculated assuming the required reduction in daily per capita water use would be achieved in future years. Demands were estimated based on the projected growth described in the local general plans and housing elements, the Amador County Housing Element average of 2.25 persons per household, and the daily per capita water use target for 2020 of 166 gallons per capita per day (GPCD) calculated as required by SBx7-7.

The domestic sector of AWA's water service customers includes permanent and seasonal, single and multi-family residences. Since JVID is the primary supplier of agricultural water, AWA does not supply agricultural water except for incidental purposes. AWA also serves water or recycled water to several commercial/industrial consumers and golf courses. Past and projected water demands are shown in Table 1-10.

Table 1-10: Past and Projected Water Demands (AFY)

Water Use	2005	2010	2015	2020	2025	2030
Total Water Deliveries [a]	3,312	3,129	3,590	4,574	5,218	5,879
Sales to Other Water Agencies [b]	1,683	1,377	1,482	1,787	1,941	2,116
Additional Water Uses and Losses [c]	4,738	3,901	3,980	4,137	4,248	4,362
TOTAL	**9,733**	**8,407**	**9,052**	**10,498**	**11,407**	**12,356**

Source: AWA, 2011.
Footnotes:

a) Water deliveries include deliveries to the following: single family residential, multi-family residential, commercial/institutional, industrial.
b) Sales to other water agencies includes sales to Drytown County Water District, City of Jackson, Mace Meadows Water Association, Pine Grove Community Services District, City of Plymouth, Rabb Park Community Services District.
c) Additional water uses and losses includes Backwash Water, Raw Water Billed, Raw Water Losses, Recycled Water and System Losses.

Surface water accounts for approximately 97% of AWA's total water supply and it's the sole source of water for the Amador Water System and the Central Amador Water Project. Groundwater accounts for the remaining 3% of AWA's total water supply and is only used in the La Mel Heights community and Lake Camanche Village. Due to growth in the area and concerns over groundwater quality and basin overdraft, the Lake Camanche Village area is planning to phase out the use of groundwater. There are currently plans for a joint surface water treatment plant project between EBMUD, AWA, and CCWD to supply surface water to this area; this project is still in the planning stages and surface water rights have not been identified.

The La Mel Heights area has restricted growth potential and build-out will be achieved in the next ten years. Therefore, the amount of groundwater projected to be pumped is held constant after the year 2020. To help meet the water demand of La Mel Heights, AWA completed the construction of a second well which has a yield of 50 AFY. The old well has been retained as a back-up source. Table 1-11 summarizes the amount of groundwater expected to be pumped through 2030.

Table 1-11: Amount of Groundwater Projected to be Pumped, AFY

Basin Name	2010	2015	2020	2025	2030
San Joaquin Valley Cosumnes Basin 5-22.16 (Lake Camanche Village wells)	280	349	419	488	558
Unclassified Groundwater Aquifer (La Mel Heights well) [a]	16.3	19.7	22.7	22.7	22.7
% of AWA's Total Supply	3.2%	3.7%	3.8%	4.1%	4.4%

Source: AWA, 2011.
Footnotes:
a) La Mel Heights area assumed to be built out by 2020.

Table 1-12 summarizes AWA's current and future water supplies. Future water supplies were developed as part of AWA's 2010 Urban Water Management Plan and are based on the following assumptions:

- La Mel Heights will reach build out in 2020 and not require additional water supply.
- Lake Camanche Village will switch to surface in 2015.

AWA previously used the Amador Canal to transfer the Amador Water System surface water from Lake Tabeaud to Tanner Reservoir, but almost half of the diverted water was lost due to open ditch conveyance leakage. As a result, the Amador Transmission Pipeline was constructed. The reduction in losses associated with pipeline conveyance allows surface water in excess of the Amador Water System demand to remain in the Mokelumne River and be incidentally captured in EBMUD's reservoirs. EBMUD participated in funding the pipeline but was not guaranteed a specific amount of water; as Amador Water System water demand increases, incidental transfer to EBMUD reservoirs will be reduced. in the AmAWA is not pursuing any other water transfers or exchanges at this time. AWA does not currently produce any recycled water, but in the future it anticipates development of a regional reclaimed water supply to offset raw and potable water demands.

Table 1-12 describes current and projected maximum water supplies available to AWA.

Table 1-12: Current and Planned Water Supplies, AFY

Water Type	2010	2015	2020	2025	2030
Surface Water [a]	16,150	17,200	17,200	17,200	17,200
Supplier Produced Groundwater	296	369	442	511	581
Recycled Water [b]	0	0	0	0	0
Incidental Transfer to EBMUD [c]	N/A	N/A	N/A	N/A	N/A
TOTAL [d]	16,446	17,569	17,642	17,711	17,781

Source: AWA, 2011.
Footnotes:
a) It is anticipated AWA will obtain additional water rights in CAWP, increasing the right from 1,150 to 2,200 AFY.
b) Recycled water is not supplied by AWA but it is used in a small portion of its service area. Future supply does not include several potential uses that are currently being investigated.
c) Quantities transferred to EBMUD are incidental and not guaranteed for any specific amount; therefore, they are not projected.
d) Total does not reflect amount of water incidentally transferred out of supply to EBMUD.
Source: AWA, 2011

Comparing supply and demand as presented in Table 1-13 highlights the decreased future margin of safety that AWA is currently able to provide its future customers. Projects within the IRWMP will help to increase that margin to better accommodate current and future water demands (AWA, 2011).

Table 1-13: Supply and Demand Comparison

	2010	2015	2020	2025	2030
Water Supply [a]	16,446	17,569	17,642	17,711	17,781
Water Demand [b]	8,407	9,052	10,498	11,407	12,356
Difference	8,039	8,517	7,144	6,304	5,425

Footnotes:
a) Water supplies as shown in Table 1-12.
b) Water demands as shown in Table 1-10.

Calaveras County

Since the 1990s and until the recent economic downturn, Calaveras County has exhibited one of the fastest growing populations in the State. From 1990 to 2000 the County's population increased by 12.4%. Adjacent areas in San Joaquin Valley are preparing plans to deal with a population of over one million people, and spillover population effects are likely to occur in Calaveras County. In addition to the population growth, Calaveras County boundaries overlap three separate watersheds. Only the Calaveras River watershed is currently included in the MAC region. In the future, the region definition may be modified to include specific rapidly expanding water systems outside of the current southern boundary of the region. This section will be updated with quantity and demand for these systems as the regional definition is expanded.

CCWD

CCWD is the primary water service provider to Calaveras County. CCWD is participating in the IRWMP with the goal of enhancing its ability to efficiently use supplies among all of its service areas and conjunctively use its surface and groundwater supplies. CCWD faces challenges associated with rapid development, growth in agricultural development, failing groundwater supplies, and annexation of small water supply systems. The projects anticipated under the IRWMP would protect and promote the health and welfare of Calaveras County residents by improving CCWD's ability to protect against localized drought, regulatory uncertainty, infrastructure limitations and other localized system issues.

CCWD provides water service to nearly 13,000 municipal and residential/commercial customers through five independent water systems located throughout the County. CCWD's boundaries align with Calaveras County's boundary, but CCWD does not provide water and/or wastewater services to all communities in the County, as some of them are served by private wells or other public or private agencies. CCWD services municipal, residential, and commercial customers in the following five independent water systems within Calaveras County:

- Jenny Lind
- Copper Cove / Copperopolis
- Ebbetts Pass
- West Point
- Sheep Ranch

These service areas are geographically distinct and do not currently interact or connect with one another. In the past, decisions were made to keep the water systems local. Due to recent trends of rapid growth, regional systems have become more attractive due to the potential for economies of scale and system redundancy. However, since the water systems currently remain local, no redundancy is in place to protect individual water systems, should their water supplies be unavailable. Regional projects proposed in this IRWMP may improve interconnectivity of the existing water systems, improving reliability of all systems. Of the five service areas, the Jenny Lind and West Point/Wilseyville systems are within the MAC Region.

CCWD service areas include primarily domestic and light commercial uses, with no major industry or large agricultural demands. Most of Calaveras County is rural, with many small communities. Some of these communities, particularly those on the western border, are rapidly urbanizing. According to the Housing Element of the Calaveras County General Plan, the annual growth rate between 2001 ans 2009 was 2.7%, though this number is very sensitive to construction and is constantly being updated. Demand is expected to increase at approximately the same rate as population growth.

Surface water is the sole source of supply for CCWD's five systems. CCWD obtains its water supplies from three main watersheds that drain the western slope of the Sierra Nevada mountains and foothills. The Stanislaus River Watershed serves communities along the Highway 4 corridor (communities not within the MAC region). The Calaveras River Watershed serves the Jenny Lind service area while the Mokelumne River Watershed serves West Point. Three of CCWD's systems incorporate recycled water to irrigate golf courses, and CCWD is seeking to expand its recycled water use to additional agricultural users and public activities where water is unavailable.

Groundwater is not a reliable source of supply in much of the County due to the small and unpredictable yields of the local fractured rock system. CCWD has adopted a Groundwater Management Plan to address a 30,000-acre alluvial area within the San Joaquin Valley Groundwater Basin, located in the Camanche / Valley Springs region in the northwest corner of Calaveras County (DWR Bulletin 118). The GWMP includes efforts to protect water supply reliability such as conjunctive use, groundwater recharge projects, as well as other measures. CCWD's water supplies and demands for the two water systems in the MAC region are included in

Table 1-14.

Table 1-14: CCWD Projected Supply and Demand, AFY

System	2015	2020	2025	2030	2035
New Hogan / Camanche / Valley Springs[a]					
Supply					
Surface Water	31,278	31,278	31,278	31,278	31,278
Recycled Water	509	756	1,003	1,250	1,497
Total Supply	31,787	32,034	32,281	32,528	32,775
Demand					
Potable	2,754	2,944	3,231	3,517	3,827
Recycled	245	245	245	245	245
Raw	12,846	16,010	20,175	24,339	28,503
Total Demand	15,845	19,199	23,651	28,101	32,575
West Point / Wilseyville					
Supply					
Surface Water	2,080	2,080	2,080	2,080	2,080
Total Supply	2,080	2,080	2,080	2,080	2,080
Demand					
Potable	376	418	465	513	540
Raw	0	2,000	2,000	2,000	2,000
Total Demand	376	2,418	2,465	2,513	2,540

Footnotes:
a) Regionalization demand and serving aeras with failing groundwater could increase potable and raw surface water demand above projected volumes.
b) Values based on upper limits of permit or contract right for Mokelumne River.
Source: CCWD, 2011. Tables 7-1 and 7-4

Combined with projected growth and potential environmental demands, CCWD is examining cost-effective alternatives to maximize supply through increased storage to provide improved supply reliability. CCWD's water supplies are currently projected to be sufficient to meet demands for the two water systems within the region for a 20-year horizon. However, variability in supply availability and dependence on local, aging infrastructure have caused CCWD to plan for additional water supply, system redundancy, and upgraded infrastructure to avoid water shortages.

Calaveras Public Utility District (CPUD) obtains its water at a diversion dam and pump station near the confluence of the Licking Fork and South Fork of the Mokelumne River. Water is pumped to Jeff Davis Reservoir and gravity-fed to a treatment plant, where it is then conveyed to storage tanks in Rail Road Flat, Mokelumne Hill, Paloma, and San Andreas. CPUD also derives a small amount of agricultural water from the Calaveras River. CPUD's boundaries cover 21,543 acres, including areas within and around the communities of Mokelumne Hill and San Andreas. CPUD's Sphere of Influence (SOI) is L-shaped, covering an area of approximately 64,553 acres. In 2001, CPUD's water sales were 962 AF, approximately 9% of its water rights. CPUD has 1,720 customers within the following customer classes: single-family residential (82%), multi-family residential (6%), commercial (12%), and agricultural (less than 1%).

CPUD's SOI may expand to encompass a total of 179,464 acres in future years. The areas proposed for inclusion in the SOI currently rely on groundwater sources, which vary dramatically in availability and quality. The need for water in the proposed CPUD SOI depends on multiple factors including: continued

growth in the area, density of new development, desire to have high quality water, need for fire protection, and availability of grants and loans to fund expansion of the distribution system.

According to the Calaveras County Water Master Plan, by 2040, water demand is projected to be between 4,335 AF and 5,898 AF annually. CPUD's water rights from the Mokelumne River amount to 10,950 AFY, so available supplies should be sufficient to meet demands through 2040, provided that demands follow the slower growth curve. If demands progress according to the high demand curve, supplies are projected to be sufficient to meet demands through approximately 2025.

Alpine County

Alpine County has experienced relatively slow, steady population growth. Population is expected to grow more quickly in Bear Valley, Kirkwood, Markleeville, and Woodfords than in other parts of the county, in part due to the increased availability of public water and sewer services. In contrast, much of the county is served by on-site wells and septic systems.

Extra-Regional Demands

EBMUD is the primary extra-regional user of Mokelumne River water. On an average annual basis, approximately 90 percent of the water used by EBMUD comes from the Mokelumne River watershed. EBMUD has water rights that allow for delivery of up to 325 MGD from the Mokelumne River, subject to annual runoff and senior water rights of other users. EBMUD's position in the hierarchy of Mokelumne water users is established by a variety of agreements between Mokelumne water rights holders, the appropriative water rights permits and licenses which have been issued by the State, pre-1914 rights, and riparian rights.

EBMUD's Mokelumne River supply facilities include Pardee Dam and Reservoir, located near Valley Springs, and Camanche Dam and Reservoir, located approximately 10 miles downstream. EBMUD diverts supplies at Pardee Reservoir, conveying stored Mokelumne River supplies to its primary users in the East Bay portion of the San Francisco Bay area via the Pardee Tunnel, Mokelumne Aqueducts, and Lafayette Aqueducts.

1.2.2 Water Quality Conditions

The MAC IRWMP region obtains the majority of its supplies from the Mokelumne and Calaveras River watersheds. In Amador County, only 3% of the domestic or treated water supply is from groundwater sources, and 97% of supply is from the Mokelumne River. Calaveras County derives nearly all its water supply from surface water, as does the portion of Alpine County located with the MAC IRWMP region.

Surface Water

Surface Water Supplies

The winter snow pack in the Sierra Nevada Mountains serves as the primary source of water for the Mokelumne River. There are four water systems in Amador County that draw water from the Mokelumne River watershed. The Amador Water System and the Central Amador Water Project have yearly Mokelumne River surface water allotments of 15,000 AFY) and 1,150 AF (with a possibility of expanding to 2,200 AF), respectively. The Lake Camanche Area and La Mel Heights service areas pump groundwater within the watershed. In addition, JVID has water rights to 3,800 AF per year from Pardee Reservoir for agricultural irrigation, and CPUD pumps 920 AF per year from the South Fork of the Mokelumne River. EBMUD has water rights and facilities to divert 325 MGD (approximately 364,072 AFY) from the Mokelumne River. CCWD uses Bear Creek water (a tributary of the Mokelumne River) as a primary source of water. The Mokelumne River serves as a backup source for the West Point, Wilseyville, and Bummerville water systems.

Communities in Calaveras County within the IRWM planning region also rely heavily on the Calaveras River as a source of water. Unlike the Mokelumne River, the Calaveras River depends almost totally on

rainfall. River flows are controlled by New Hogan Dam and Reservoir, which is operated by Stockton East Water District (SEWD) and the U.S. Army Corps of Engineers. Both SEWD and CCWD have rights to the yield from New Hogan, with SEWD's supplies subject to reduction based on CCWD's future demands.

Surface Water Quality

The Mokelumne River provides high quality source water for most of the year. According to the 2010 Amador Urban Water Management Plan Update, the water may become somewhat turbid during storm events. Additionally, there are some potential water quality issues at specific locations in the IRWMP region. Table 1-15 summarizes the impaired water bodies within the IRWMP region listed on the State Water Resources Control Board 303(d) list.

Table 1-15: Impaired Water Bodies within the MAC IRWMP region

Water Body	Pollutant	TMDL Priority	Estimated Size Affected
Bear Creek	Mercury	Medium	15 miles
Lower Bear Reservoir	Diazinon	Medium	21 miles
Upper Bear Reservoir	Mercury	Medium	10 miles
Lower Calaveras River	Diazinon	Low	5.8 miles
	Organic Enrichment	Low	
	Pathogens	Low	
Camanche Reservoir	Copper	Low	7,389 acres
	Zinc	Low	
Five Mile Slough (Alexandria Place to Fourteen Mile Slough)	Chloropyrifos	Medium	1.6 miles
	Diazinon	Medium	
	Organic Enrichment	Low	
	Pathogens	Low	
Lower Mokelumne River	Copper	Low	29 miles [a]
	Zinc	Low	
Mosher Slough (upstream of I-5)	Pathogens	Low	3.5 miles

Footnotes:
a) Not all 29 miles are necessarily within the study area
Source: 2002 CWA Section 303(d) List of Water Quality Limited Segment, Region 5.

Flooding

Flooding is a concern for many areas within the MAC IRWM planning region. Many cities are included in 100-year floodplains (of both the Mokelumne River and its tributaries), including Sutter Creek, Jackson, Ione, and Mokelumne Hill. In some cases, like in the City of Plymouth, flooding is due to an inadequate storm drainage system, unable to handle heavy storms during winter and spring seasons. The Calaveras County General Plan discusses three basic types of potential flood hazards: stream-side overbank flows, areas of flat terrain with slow surface drainage, and inundation due to structural dam failure. Flooding can occur from heavy rainfall, rapid snow melt, saturated soils, or a combination of these conditions. Also, increasing development leads to an increase in impervious surface areas and a decrease in natural vegetative cover, which reduces the detention and attenuation characteristics of the overland areas. Documented flooding in the past has caused the following general damages and impacts to areas within the region:

- Property Damage: Extensive water damage to building contents.
- Structural Damage: Structural damage to residential and commercial buildings, as well as sewer system pipes/infrastructure.
- Business/Economic Impact: Some businesses must close for a period of time after flooding.
- Road/School/Other Closures: Bridges routinely close during high-water periods and floods.
- FEMA funds have been available after floods in the past to assist with recovery.

Groundwater

Groundwater quantity and quality in the MAC IRWMP region varies considerably between well sites due to the small and unpredictable yields of the fractured rock system that typifies the foothill geology. Groundwater accounts for approximately 3% of AWA's total water supplies. It is only used in the communities of La Mel Heights and Lake Camanche Village. There is one well in La Mel Heights which has a safe yield of 50 AFY. In the Lake Camanche Village area, AWA operates 4 wells that pump approximately 1,300 AFY of water from the Cosumnes Subbasin portion of the San Joaquin Valley Groundwater Basin. The well locations overlying the Cosumnes Subbasin are shown in Figure 1-9.

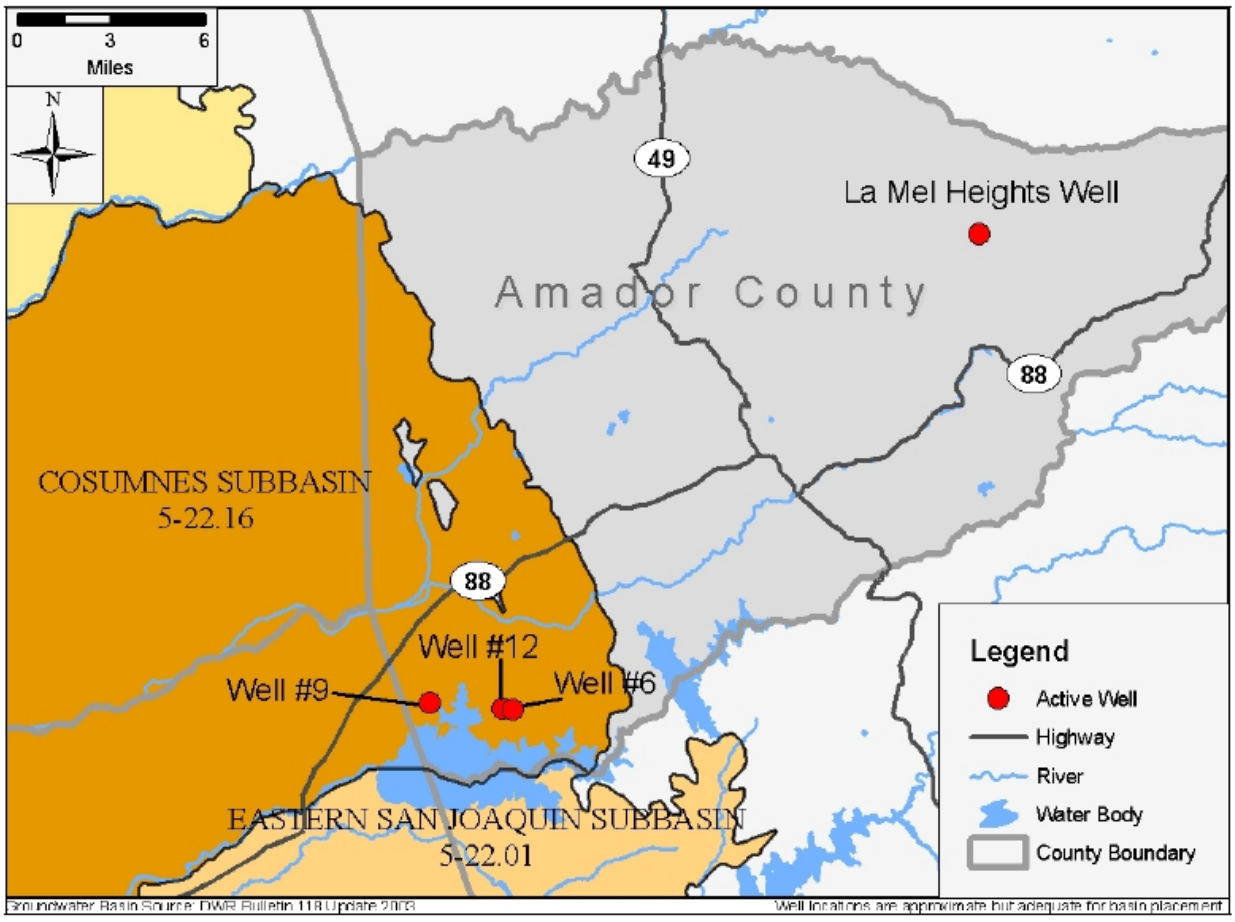

Figure 1-9: Cosumnes Subbasin and AWA Wells in Lake Camanche Village

The Cosumnes Subbasin is approximately 439 square miles in size, and is bounded on the north and west by the Cosumnes River, on the east by the bedrock of the Sierra Nevada Mountains, and on the south by the Mokelumne River. The groundwater level has paralleled the available surface water supply over the past 25 years. Table 1-16 summarizes the rise and fall of groundwater levels.

Table 1-16: Historic Groundwater Levels in Cosumnes Subbasin

Time Period	Change in Level	Change from Reference Level[a]
Mid-1960s	0	0
Mid-1960s - 1980	-20 to -30 feet	-20 to -30 feet
1980-1986	5 to 10 feet	-10 to -25 feet
1987-1992	-10 to -15 feet	-20 to -40 feet
1993-2000	15 to 20 feet	-5 to -20

Footnotes:
a) Reference level is taken to be the groundwater level during the mid-1960s.
Source: California's Groundwater Bulletin 118 Updated 2/06

As shown in Table 1-16, the groundwater levels in 2000 were approximately the same or slightly higher than those in the mid-1980s. The groundwater storage capacity is estimated to be about 6,000,000 AF with an average specific yield of 7.4%. Basin inflows are estimated to be about 269,500 AFY. Water leaves the Subbasin through subsurface flow (144,600 AFY), urban extraction (35,000 AFY), and agricultural extraction (94,200 AFY). Based on this water balance, the Subbasin is in overdraft by about 4,300 AFY (DWR, 2006b).

Groundwater does not account for any of CCWD's total water supply. CCWD adopted a GWMP in 2001 and updated it in 2005, according to Senate Bill 1938. CCWD owns one well west of the Jenny Lind system in the Camanche/Valley Springs Area, but it is not operated. Located in the northwestern portion of Calaveras County, the Camanche/Valley Springs area is part of the Eastern San Joaquin Subbasin (DWR, 2006a), which is identified by DWR Bulletin 118 as being in the San Joaquin Valley Groundwater Basin. The Eastern San Joaquin Subbasin is approximately 1,105 square miles in size and is bounded on the south, southwest, and west by the Modesto, Delta-Mendota and Tracy Subbasins, respectively, and on the northwest and north by the Solano, South American, and Cosumnes Subbasins. The Solano and South American Subbasins are located in the Sacramento Valley Groundwater Basin. The Eastern San Joaquin Subbasin is drained by the San Joaquin, Stanislaus, Calaveras and Mokelumne Rivers. Based on a 1990 study by the U.S. Bureau of Reclamation, annual groundwater extractions total about 731,000 AFY, which exceeds the estimated safe yield of 618,000 AFY; hence the Subbasin was determined to be in a state of overdraft. The Eastern San Joaquin Subbasin is currently being managed under an AB3030 Groundwater Management Plan (GMP), prepared by the Northeastern San Joaquin County Groundwater Banking Authority. The Camanche/Valley Springs area is managed under a separate GWMP, adopted by CCWD in 2001, for investigation of opportunities to improve management of groundwater resources in western Calaveras County.

Imported Water

CCWD does not import water from outside the basin, but it has purchased water from CPUD in the past. During summer and fall months, water from the Middle Fork of the Mokelumne River stored in Schaad's Reservoir is supplied to the West Point area if the Bear Creek supply is inadequate. An agreement between CCWD and CPUD allows exchange of up to 150 AFY.

Recycled Water

Several of the RPC members currently use recycled water to meet part of their water demands. The City of Ione operates a tertiary treatment facility, Castle Oaks Wastewater Reclamation Plant, which treats Amador Regional Sanitation Authority (ARSA) effluent from the City of Sutter Creek plant and produces a disinfected tertiary Title 22 effluent suitable for unrestricted reuse. The disinfected tertiary effluent is currently used to irrigate the Castle Oaks Golf Course. Additionally, a portion of the secondary effluent from the Sutter Creek Wastewater Treatment Plant conveyed to the ARSA outfall is delivered to the Bowers and Hoskins Ranches to irrigate land used for cattle grazing. The amount of water delivered to each plot is unknown, but has been approximated using an irrigated pasture application rate of 2.5 AFY

per acre of pasture. Table 1-17 summarizes the current recycled water uses in the ARSA service area. The recycled water use at these sites in not projected to increase due to the limited acreage of these sites.

Table 1-17: Recycled Water Uses in the ARSA Service Area, AFY

User Type	Treatment Level	2005	2010	2015	2020	2025	2030
Landscape (Castle Oaks Golf Course)[a]	Tertiary	557	557	557	557	557	557
Bowers Ranch Irrigation[b]	Secondary	100	100	100	100	100	100
Hoskins Ranch Irrigation[c]	Secondary	150	150	150	150	150	150
Landscape (Mace Meadows Golf Course)	WTP Backwash[d]	56	56	56	56	56	56
	TOTAL	**863**	**863**	**863**	**863**	**863**	**863**

Footnotes:
a) Based on Year 2004 Castle Oaks Reclamation Plant effluent of 557 AFY.
b) Approximate delivery. Based on 40 acres of cow pasture and an Irrigated Pasture application rate of 2.5 AFY/acre.
c) Approximate delivery. Based on 60 acres of cow pasture and an Irrigated Pasture application rate of 2.5 AFY/acre.
d) Backwash water from Buckhorn Water Treatment Plant based on Year 2005 and 2006 average annual flows.

1.3 Climate Change

While the impacts of climate change will be experienced differently by different regions and watersheds, water supply systems that exhibit the following characteristics are most likely to be impacted by climate change:

- Depend on surface storage for water supply and flood control;
- Depend on late spring snowmelt;
- Are sensitive to climatic variability;
- Contain biological habitats that are sensitive to water temperatures, quality and runoff timing;
- Are located in arid parts of western North America.

Because the primary sources of water in the MAC Region are the Mokelumne and Calaveras River watersheds, which rely on snowmelt and rainfall from the Sierra Mountain Range, the water supply systems within the Region display many of these characteristics. Climate change and its potential impacts to the MAC Region are further described in Chapter 17. A climate change analysis was performed for EBMUD's Water Supply Management Program (WSMP) 2040 Plan in 2009. Because the Upper Mokelumne River Watershed is the primary water supply source for EBMUD, the approach, methodology and results focused on the Upper Mokelumne River Watershed. The approach can also be applied to the Calaveras River watershed and ultimately to the MAC IRWM region. In general, climate change is expected to cause an increase in regional air temperatures, likely leading to an increase in water temperature in the Mokelumne River and watershed reservoirs. There will also be changes in precipitation, but these changes have a higher degree of variability than predicted changes in temperature. Precipitation could increase by as much as 77% or decrease by as much as 25% by the year 2100, depending on future emissions scenarios (Dettinger, 2005).

In general, the results of the climate change sensitivity analyses identified that the Region's surface water supplies are most vulnerable to:

- A more extreme shift in spring-time runoff from the April-to-July period to winter months relative to what has been observed in historic years, further lowering spring runoff volumes.
- Decreases in annual runoff volumes (especially reductions of 20% or more in runoff).

Storage (measured at Pardee Reservoir) is expected to be moderately vulnerable to shifts in timing of early springtime runoff and increased customer demands, and very vulnerable to decreases in annual runoff volumes. Shifts in springtime runoff on the Mokelumne River could result in an approximate 5% decrease in storage. Decreasing Mokelumne River runoff by 10% and 20% could result in average decreases in storage of 12% and 24%.

Finally, the modeling results indicate that increases in water temperature can be expected with increases in air temperature; however, the severity of the impacts will depend on both the magnitude of air temperature increases and the hydrologic year type.

Overall, based on the modeling results, additional storage combined with source diversity will provide water purveyors dependent upon the Mokelumne River and Calaveras River with the maximum amount of flexibility and the ability to adapt to unknown future conditions.

1.4 Water Resource Issues and Major Conflicts

The following list of water resource conflicts in the MAC region was compiled from two sources. The MAC region RPC met in January 2009 and identified a number of regional water resource conflicts and issues through a facilitated discussion. Additional issues and conflicts were obtained from the Upper Mokelumne River Watershed Assessment and Planning Project (UMRWAPP). The potential conflicts and issues have been organized under the following seven topic headings:

1. Land Use and Water Use Conflicts
2. Environmental Protection
3. Water Quality Conflicts
4. Supply Management
5. Forest Management
6. Fire Management
7. Economic Impacts

Specific conflicts in each area are summarized in the following sections. Conflicts identified through the UMRWAPP are denoted as such.

1.4.1 Land Use and Water Use Conflicts

- Amador County General Plan housing element resulting in more development in areas with no water/wastewater infrastructure
- Inadequate supply and infrastructure to meet growth projected by the general plans of Amador County and its cities
- Problems with providing infrastructure in dispersed, low density areas
- Watershed protection versus community economic needs
- Groundwater overdraft versus development approvals
- Insufficient groundwater quantity and quality to accommodate growth
- Projected population increases expediting the transport of contaminants to water bodies (UMRWAPP)

1.4.2 Environmental Protection

- Obtaining Wild and Scenic River status versus preserving opportunity to develop additional surface water storage
- PG&E pumped storage project on North Fork versus preserving or restoring river natural systems

- Third party impacts from reuse and conservation (reduced return flows)
- Protecting and improving fish passage on lower Mokelumne and Calaveras Rivers versus river-sourced water supply development needs and opportunities
- Management of federal lands resulting in environmental impacts

1.4.3 Water Quality Conflicts

- Promoting and improving water-related recreation opportunities versus recreational water quality impacts
- Groundwater overdraft in the Eastern San Joaquin Groundwater Basin contributing to deteriorating groundwater quality levels in the portion of the basin underlying Calaveras County
- Wastewater discharge water quality impacts
- Failing septic system contaminant leakage to surface water and groundwater versus body contact recreation and drinking water (UMRWAPP)
- Wastewater treatment levels and technology versus environment and benefits
- Improper disposal of household wastes (UMRWAPP)
- Wastewater treatment plant overflows during high precipitation events (UMRWAPP)
- Inactive mines without restoration causing leaching of soils with high mineral content and surface runoff of contaminants to water bodies (UMRWAPP)
- Increased impervious surfaces exacerbating flooding and contributing contaminants to surface waters versus designing streets and compact development with techniques to reduce peak flows, minimize runoff, and remove contaminants during flow (UMRWAPP)

1.4.4 Supply Management

- New water supply versus recycled water versus conservation of supplies
- Stormwater management and rights to use this water
- Climate change impacts
- Water rights concerns
- Supplies not matched to use (e.g., industrial users receiving potable supplies)
- White water recreation versus flat water recreation

1.4.5 Forest Management

- Timber harvesting disturbance of vegetation and soils which contributes loadings to surface waters (UMRWAPP)
- Roads and road maintenance practices that contribute to erosion, peak runoff, and transport of contaminants in runoff to surface waters (UMRWAPP)

1.4.6 Fire Management

- Vegetation and soil disturbances caused by wildfires, which contributing loadings to surface waters (UMRWAPP)
- Fire response to protect landowner and water quality objectives versus managing naturally-occurring fires (UMRWAPP)

1.4.7 Economic Impacts

- Costs of projects and financing
- Aging existing water and wastewater infrastructure
- Drinking water regulations failing to realistically reflect human health protection needs (treatment levels too onerous)
- Local economic opportunities versus out of region resources