Merced Integrated Regional Water Management Plan

Prepared by:

RMC
Water and Environment

In Association with:

AMEC Geomatrix

CLGardiner Associates

Davids Engineering

Fremming, Parson & Pecchenino

Peterson, Brustad Inc.

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List of Acronyms and Abbreviations

CEQA	California Environmental Quality Act
CSD	Community Services District
CVRWQCB	Central Valley Regional Water Quality Control Board
CWD	Chowchilla Water District
DAC	Disadvantaged Community
DMM	Demand Management Measure
DMS	Data Management System
DWR	Department of Water Resources
EJ	Environmental Justice
EMRCD	East Merced Resource Conservation District
ESA	Endangered Species Act
EWMP	Efficient Water Management Practice
GHG	Greenhouse Gas
gpd	Gallons Per Day
Guidelines	IRWM Program Guidelines
IRWM	Integrated Regional Water Management
JPA	Joint Powers Authority
LGCSD	Le Grand Community Services District
M&I	municipal and industrial
MAGPI	Merced Area Groundwater Pool Interests
Merced HydroDMS	Merced Hydrologic Database Management System
Merced OPTI	Merced Online Project Tracking and Integration Program
mgd	million gallons per day
MID	Merced Irrigation District
MIRWMP	Merced Integrated Regional Water Management Plan
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
PCE	Perchloroethyene
ppb	Parts Per Billion
RAC	Regional Advisory Committee
RAP	Region Acceptance Process
Region	Merced Region

RMS	resource management strategy
RWMG	Regional Water Management Group
SED	Substitute Environmental Document
SWRCB	State Water Resources Control Board
TCE	Trichloroethylene
TCP	Trichloropropane
UWMP	Urban Water Management Plan
VOC	Volatile Organic Compound
WPMC	Work Plan Management Committee
WWSD	Winton Water and Sanitary District

Merced Integrated Regional Water Management Plan

Chapter 1 Introduction

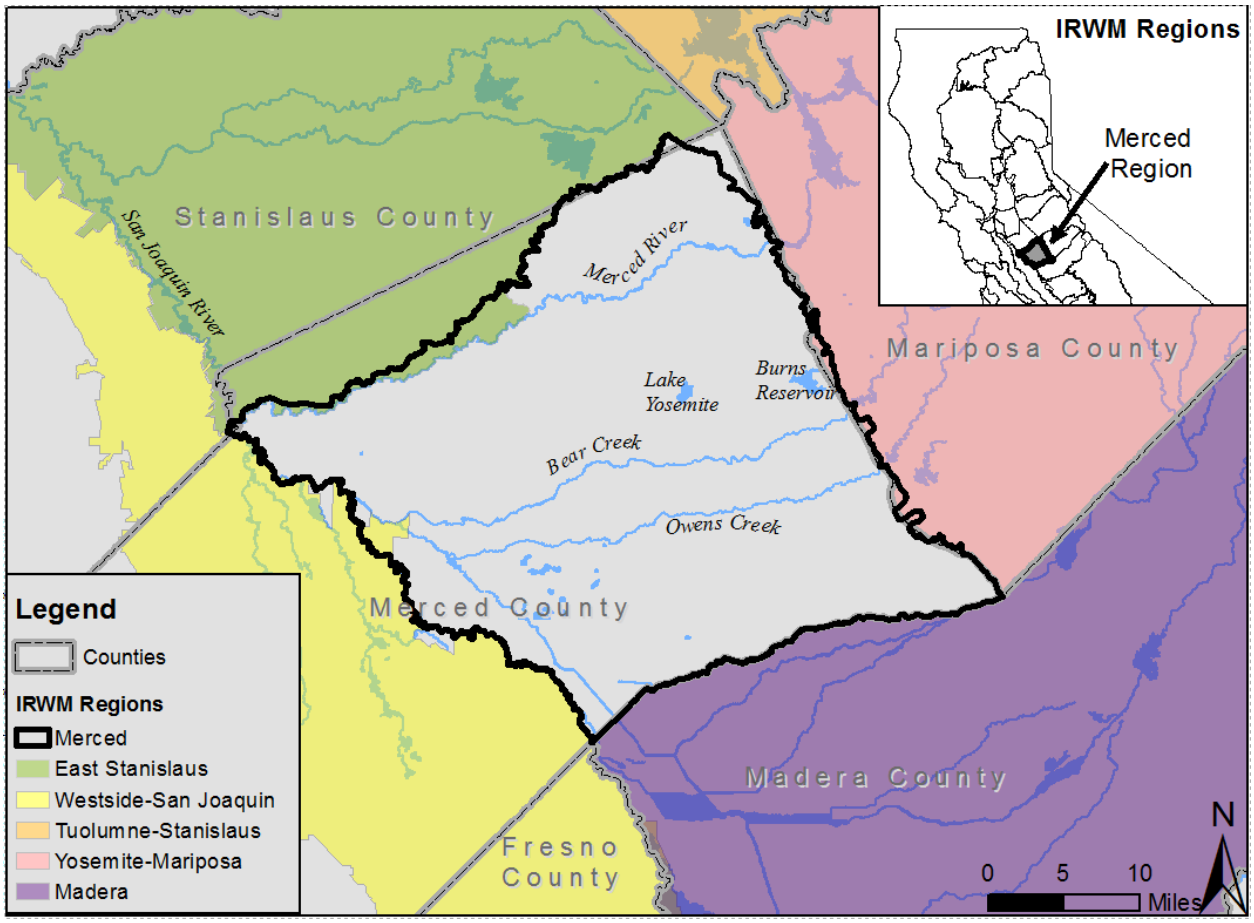
The Merced Integrated Regional Water Management Plan (MIRWMP) is the first Integrated Regional Water Management (IRWM) Plan for the Merced Region (Region). The MIRWMP was developed through a stakeholder-driven process, building upon the Region's successful history of collaboration on water resource management issues. The MIRWMP represents the culmination of years of cooperative and collaborative planning among regional stakeholders.

1.1 Overview

The Merced Region encompasses the northeast portion of Merced County, as shown in Figure 1-1. Its boundaries are generally defined by the eastern boundary of the Merced and Turlock Groundwater Subbasins to the east, the San Joaquin River to the west, the northern boundary of the Dry Creek watershed to the north, and the Chowchilla River to the south. Low-lying areas north of the Merced River between the river's confluences with Dry Creek and the San Joaquin River are also included in the Region.

The eastern and western boundaries of the Merced Region are critical hydrogeologic features that distinguish the Region from neighboring regions, and these distinctive boundaries were recognized by the Department of Water Resources (DWR) through the Region Acceptance Process (RAP). The crystalline basement rock that defines the Region's eastern boundary divides the groundwater/alluvial basin of the Merced Region from the fluvial and fractured rock systems of the mountainous watersheds of Tuolumne and Mariposa. On the west, the San Joaquin River marks the boundary between Merced Subbasin and the Delta-Mendota Subbasin and is also the dividing line between the Merced Region and Westside San Joaquin Region. Beyond having distinctly different groundwater basins, the Merced Region has different water management and land use patterns than the Westside San Joaquin Region, including the Merced Region's lack of reliance on imported sources of water. Additionally, while areas both east and west of the San Joaquin River are dominated by the agricultural industry of the Central Valley, the agricultural economy of the Merced Region is typified by small-scale multi-generational family farming operations, especially in areas that hold pre-1914 water rights. This is in contrast to the large-scale commercial agricultural operations common in areas west of the San Joaquin River.

Figure 1-1: Merced Region



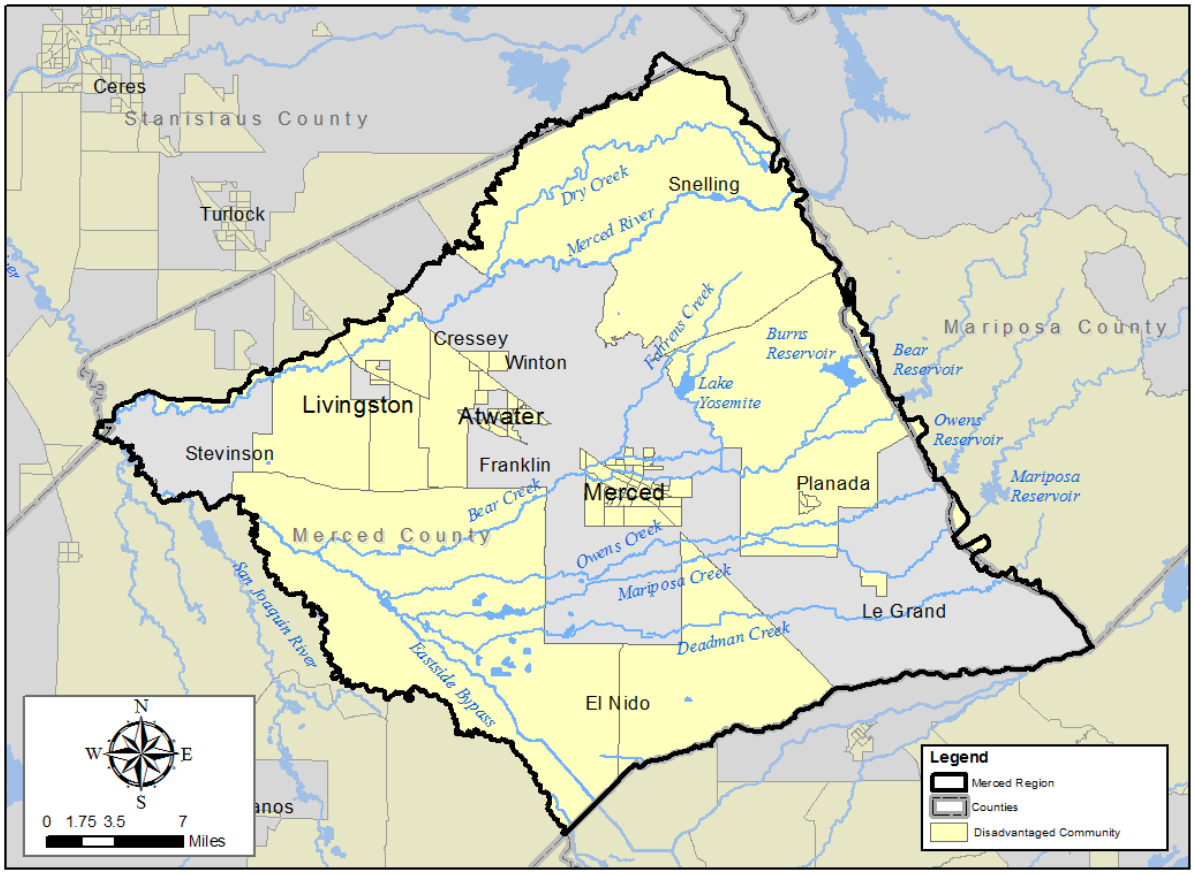
The Merced Region plays a vital part in the future of California and the nation. As illustrated in Figure 1-2, the Merced River is one of three eastside tributaries that contribute the majority of flow to the Lower San Joaquin River upstream of Vernalis. Protecting the Merced River protects water supply and quality in the Delta, a critical water supply source for two-thirds of Californians. Due to its role as a major upstream tributary to the Delta, water management activities implemented in the Merced Region have the potential to provide significant benefits to the Delta.

Figure 1-2: Merced Region: A Critical Component of the Delta System

Unlike its neighboring regions, the Merced Region is marked by an extensive network of creeks. Managing the numerous creeks and channels that traverse the basin poses a significant challenge for the Region, and flooding – along with associated water quality impacts – is a major issue facing the Region. Because each of these creeks ultimately drains to the Lower San Joaquin River upstream of the Delta, flooding in the Merced Region impacts Delta water quality. Further, Merced is part of the agricultural economic engine of the Central Valley, which not only supports California but accounts for the majority of agricultural production in the United States. The value of agricultural production in Merced County is approximately $1.5 billion annually, much of which is sustained by irrigation. As noted in the California Water Plan Update 2009, California agriculture is resource-dependent; it depends on land, water, and labor. Protecting the land, water resources, and communities of Merced supports the continued agricultural productivity of the Region, which in turn supports the economy of the State.

Despite its vital role in supporting California's economy, the Merced Region encompasses one of the most economically depressed areas of the California. With a 2011 median household income (MHI) of $40,055 and unemployment rate of 17.6%, Merced County has the fourth lowest MHI and fourth highest unemployment rate among California counties. Moreover, with 27.4% of the Merced County population below the poverty level, the county had the highest poverty rate of any county in California in 2011. The Merced Region includes the incorporated cities of Atwater, Livingston, and Merced and the unincorporated communities of Cressey, El Nido, Franklin/Beachwood, Le Grand, Planada, Snelling, Stevinson and Winton. As shown in Figure 1-3, all of these communities (with the exception of Cressey and Stevinson) have an MHI of less than 80% of the statewide MHI, thus meeting the State's definition of a disadvantaged community (DAC). As such, nearly the entire Merced Region is considered a DAC.

Figure 1-3: Disadvantaged Communities in the Merced Region (based on Census Block Group)



With challenging economic conditions and a strongly water-dependent agricultural economy, water issues in the Merced Region are well-understood and are treated as a high priority for the Region. Water resources stakeholders in the Merced Region are committed to identifying for opportunities to collaborate to improve water management in the Region.

This commitment to collaborative water resources planning is evidenced by the Region's history of successful cooperative water management planning. Since 1997, the Merced Area Groundwater Pool Interests (MAGPI), which lies wholly within the Merced Region, has been meeting to develop technical data and management strategies to improve the health of the groundwater basin, which is generally in overdraft. MAGPI members and non-member interest groups include most of the agencies with water

supply, water quality and water management authority in the Region. However, the focus of MAGPI is limited to management of the groundwater basin. In 2008, MAGPI established a subcommittee to encourage cooperative planning among additional aspects of water resources management beyond groundwater management and to lay the groundwork for development of the Region's first IRWM Plan. MAGPI completed the Merced RAP application in April 2009 and subsequently secured a DWR IRWM Planning Grant in February 2012 to develop the first Merced IRWM Plan (MIRWMP).

In 2012, MAGPI transferred responsibility for development of the MIRWMP to the interim RWMG, which is comprised of the City of Merced, County of Merced, and Merced Irrigation District (MID). The interim RWMG assembled a Work Plan Management Committee (WPMC), which consists of staff members from each of the interim RWMG agencies. The interim RWMG is responsible for overseeing this first Merced IRWM planning process, and each of its members has committed to continue support the MIRWMP as a member of the RWMG following adoption of the plan and implementation of the long-term governance structure.

The Merced IRWM process has been a strongly stakeholder-driven process. The RWMG is advised by a Regional Advisory Committee (RAC) that represents the broad interests of the Merced Region and shapes the direction of the IRWM program. The RAC was formed in May 2012 following an application process. All parties that applied for inclusion on the RAC were accepted as either full or alternate members and were officially appointed by the MID Board of Directors, in consultation with member agencies represented by the RWMG. The RAC currently consists of 23 members and 16 alternates representing broad interests and perspectives in the Region, including:

- Water Supply Interests
- Wastewater Interests
- Stormwater Interests
- Flood Control Interests
- Local Government
- Agricultural Interests
- Other Business Interests (non-agriculture)
- Environmental Interests
- Other Institutional Interests (e.g. UC Merced)
- Disadvantaged Community and Environmental Justice Interests
- Recreational Interests
- Community / Neighborhood Interests

The RAC met monthly between May 2012 and June 2013 to discuss regional water management issues and identify regional water management needs, goals and objectives, plans and projects, and future funding opportunities, and program governance. RAC meetings are all publicly noticed and are frequently attended by members of the general public as well as the DWR regional service representative. This broad-based involvement by regional stakeholders has led to balanced input that reflects the wide array of water resources management perspectives throughout the Region.

The RAC met monthly during the development of the MIRWMP.

In addition to inviting the public to attend RAC meetings, the RWMG and RAC have conducted targeted outreach and involvement activities to inform community members and solicit input. During IRWM Plan development, the RWMG held five technical workshops focused on specific water resources management issues as well as six public workshops, which were hosted by different agencies throughout the Region. The RWMG also retained a consultant to assist with outreach to some of the most disadvantaged DACs in the Region.

The RWMG and RAC coordinated with different agencies throughout the Merced Region to host public workshops. The workshop pictured here was held in the DAC of Planada.

Completion of this MIRWMP represents attainment of a critical water resources planning milestone for the Region. This document, and the stakeholder process by which it was established, will serve as a blueprint for water resources management for years to come.

1.2 Document Organization

The MIRWMP was developed based on the Proposition 84 IRWM Program Guidelines (Guidelines) finalized in November 2012. Table 1-1 summarizes the sections of the MIRWMP that address each IRWM Plan Standard.

Table 1-1: MIRWMP Sections Addressing IRWM Plan Standards

IRWM Plan Standard	MIRWMP Chapter
Governance	Chapter 3 Governance
Region Description	Chapter 2 Region Description
Objectives	Chapter 4 Objectives
Resource Management Strategies	Chapter 5 Resource Management Strategies
Integration	Chapter 6 Project Review Process, Section 6.2.2 Integration of Resource Management Strategies Chapter 14 Stakeholder Involvement, Section 14.3Stakeholder Integration
Project Review Process	Chapter 6 Project Review Process
Impacts and Benefits	Chapter 7 Impacts and Benefits
Plan Performance and Monitoring	Chapter 8 Plan Performance and Monitoring
Data Management	Chapter 9 Data Management
Finance	Chapter 10 Finance
Technical Analysis	Chapter 11 Technical Analysis
Relation to Local Water Planning	Chapter 12 Relation to Local Water Planning
Relation to Local Land Use Planning	Chapter 13 Relation to Local Land Use Planning
Stakeholder Involvement	Chapter 3 Governance Chapter 14 Stakeholder Involvement
Coordination	Chapter 15 Coordination

Climate Change	Chapter 2 Region Description, Section 2.10 Potential Effects of Climate Change on the Region Chapter 4 Objectives, Section 4.3Water Management Objectives Chapter 5 Resource Management Strategies, Section 5.5Adapting Resource Management Strategies to Climate Change Chapter 6 Project Review Process, Section 6.2.7Strategic Considerations and Other Regional Priorities Chapter 8 Plan Performance and Monitoring, Section 8.3 Adaptive Management Chapter 16 Climate Change

Merced Integrated Regional Water Management Plan

Chapter 2 Region Description

This chapter addresses the Integrated Regional Water Management (IRWM) Region Description Plan Standard that requires IRWM Plans to describe the IRWM region, including:

- ✓ Watersheds and water systems, including major water related infrastructure, flood management infrastructure, and major land-use divisions
- ✓ Quality and quantity of water resources within the region
- ✓ Areas and species of special biological significance and other sensitive habitats within the region
- ✓ Internal boundaries within the region including the boundaries of municipalities, service areas of individual water, wastewater, flood control districts, and land use agencies
- ✓ Water supplies and demands for a minimum 20-year planning horizon, including water demands from important ecological processes and environmental resources within the region
- ✓ Potential effects of climate change on the region
- ✓ Comparison of current and future (or proposed) water quality conditions in the region and water quality protection and improvement needs or requirements
- ✓ Social and cultural makeup of the regional community, including important cultural or social values, DACs , economic conditions and economic trends, and efforts to collaborate with Tribal government representatives (if applicable)
- ✓ Major water-related objectives and conflicts in the region, including problems within the region that focus on the objectives, implementation strategies, and implementation projects
- ✓ Explanation of how the IRWM regional boundary was determined and why the region is an appropriate area for IRWM planning
- ✓ Identification of neighboring and/or overlapping IRWM efforts (if any) and an explanation of the planned/working relationship between regions

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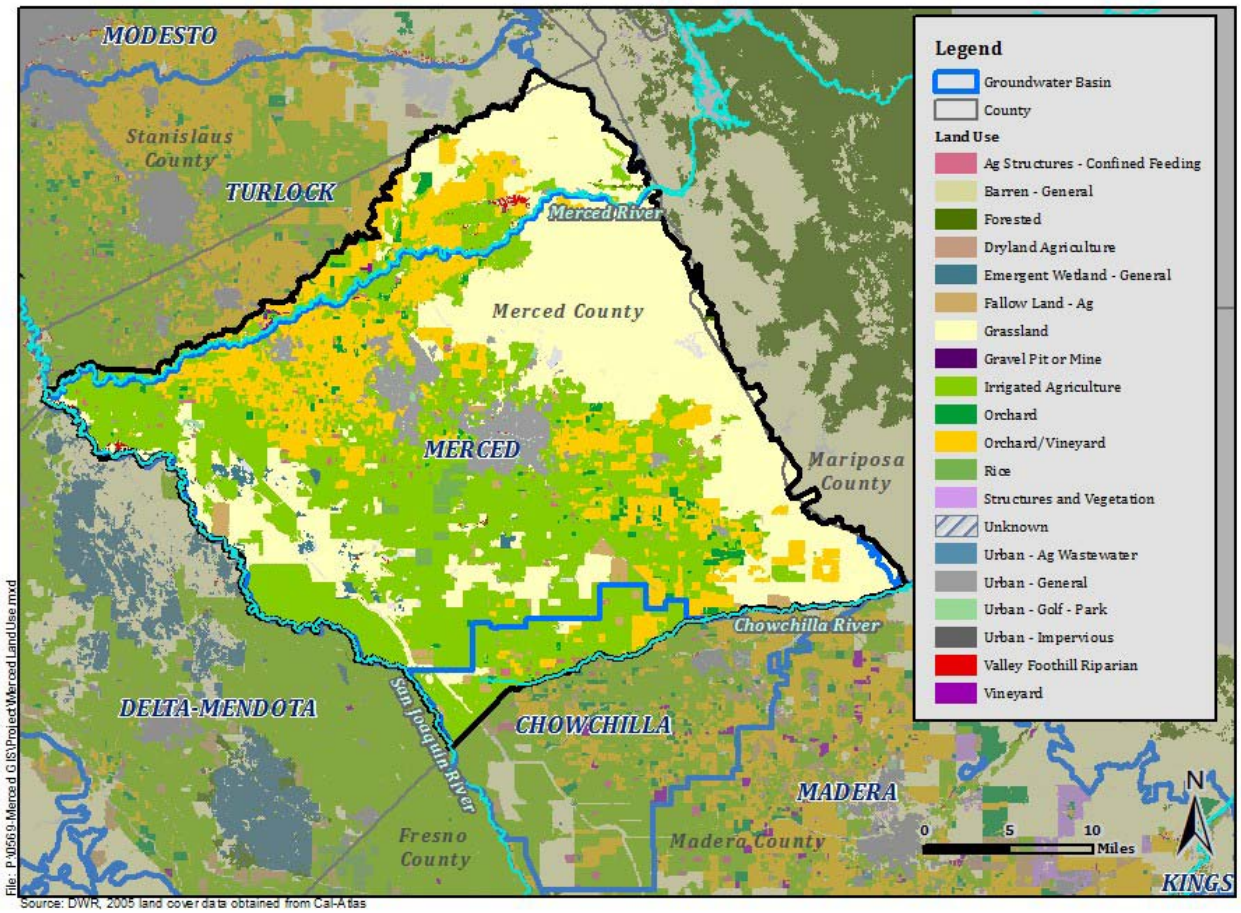
The Merced Region is emerging in its implementation of integrated water resources management. Within the Region, stakeholders with an interest in water resources have a long history of cooperation. The Region has all of the components necessary to produce an effective IRWM Plan that reflects broad collaboration by stakeholders within the region. Consistent challenges, terrain, and natural features present throughout the Region establish a sound basis for a logical and cohesive IRWM planning. The Region's stakeholders are enthusiastic about this effort, which represents a major step toward integrating the various water management challenges and opportunities facing the Region. The following sections provide an overview of the Merced Region and its water management conditions, needs, and challenges.

2.1 Selection of Regional Boundary

The Merced Region encompasses approximately 607,000 acres in the northeast portion of Merced County. Its boundaries are defined by the Merced Groundwater Subbasin to the east, the San Joaquin River to the west, the Dry Creek watershed to the north (a tributary to the Merced River), and the Chowchilla River to the south. The Region was approved by DWR through the 2011 Region Acceptance Process, or RAP. As shown in Figure 2-1, the Region includes primarily agricultural and some urban lands located on the San Joaquin Valley floor in Eastern Merced County. Groundwater resources in the Region have been extensively developed since the 1870s and managed conjunctively with the Region's surface water resources to satisfy regional agricultural, urban and environmental water demands.

Figure 2-1: Merced Region Overview



The Region is primarily defined by the 491,000-acre Merced Groundwater Subbasin (Merced Subbasin), but it also includes portions of the Chowchilla Groundwater Subbasin to the south and the Turlock Groundwater Subbasin to the north, totaling approximately 607,000 acres. The portion of the Chowchilla Subbasin that is included in the Region coincides with the area encompassed by MAGPI's boundary, which is the portion of the subbasin within Merced County. MAGPI includes this portion of the Chowchilla Subbasin because this boundary is more consistent with natural hydraulic boundaries than the jurisdictional boundary (which is the basis for the DWR Bulletin 118 division between the Merced Subbasin and Chowchilla Subbasin). The portion of the Turlock Subbasin that underlies the Dry Creek watershed and the low-lying areas north of the Merced River between its confluence with Dry Creek and its confluence with the San Joaquin River is included in the Region. Dry Creek is included in the Region as the only major tributary to the Merced River within Merced County, and consequently, the portion of the Turlock Groundwater Subbasin that underlies this area is also part of the Merced Region.

Land use patterns in the Merced Subbasin and the Merced IRWM boundary area are dominated by agricultural uses, including animal confinement (dairy and poultry), grazing, forage, row crops, and nut and fruit trees. These uses rely heavily on purveyors/districts, private groundwater wells and surface water sources in some areas. Urban land use relies on groundwater except for limited landscape applications. Land use is primarily controlled by local agencies.

The Merced Region boundary is not based solely on geographic, hydrologic, and watershed delineations, considerations or characteristics. The boundary has been carefully evaluated and defined to align with water management boundaries and areas represented by regional stakeholders. The Merced Region boundary was also designed to diversify and strengthen the regional water management portfolio. Specific considerations that contributed to the regional boundary definition included:

Differing Hydrogeology. The crystalline basement rock at the eastern edge of the Merced Subbasin is a critical hydrogeologic feature that was considered in developing the MIRWMP regional boundary. With the exception of the Yosemite Valley Subbasin (Bulletin 118 Basin Number 5-69) in Yosemite National Park, no DWR-designated groundwater basins are located east of Merced County to the crest of the Sierra Nevada range throughout the entire mountainous zones (Sierra Nevada range) of the San Joaquin River Hydrologic Region. Therefore, the bulk of supplies in counties such as Tuolumne, Mariposa, and Madera derive from fluvial (creek and river) and fractured rock systems, and water systems in these mountainous areas must be managed in a dramatically different manner from the Merced Region. In addition, the type of modeling needed to assess a water system in a mountainous watershed is entirely different from that required for watersheds dominated by a groundwater/alluvial basin setting.

Distinct Land Use Patterns. Land use patterns in the mountainous areas to the east of the Merced Region are dominated by national forest and timber, recreation, tourism, and rangeland grazing of forested areas in the lower foothills. Significant portions of the land areas to the east of the MIRWMP boundary are controlled at the federal level as National Parks, National Forests, and Bureau of Land Management areas. The balance of land area in the mountainous areas to the east of the Merced Region is controlled by private entities and local agencies.

Unique Water Management Needs and Challenges. West of the San Joaquin River and adjacent to the Merced Subbasin lies the Delta-Mendota Subbasin (Bulletin 118 Basin Number 5-22.07). The Delta-Mendota Subbasin is unique due to the composition of the contributing parent/alluvial materials and reliance on imported water sources such as the Delta-Mendota Canal and State Water Project (SWP). The Subbasins on the west side of the San Joaquin River from the San Joaquin Delta to Mendota Pool have significantly different characteristics than the Merced Subbasin, including differences in hydrogeology, flooding from Cantua and Panoche drainages into the California Aqueduct, land use, water use patterns, and water quality issues. There are also localized water quality concerns, including areas with high levels

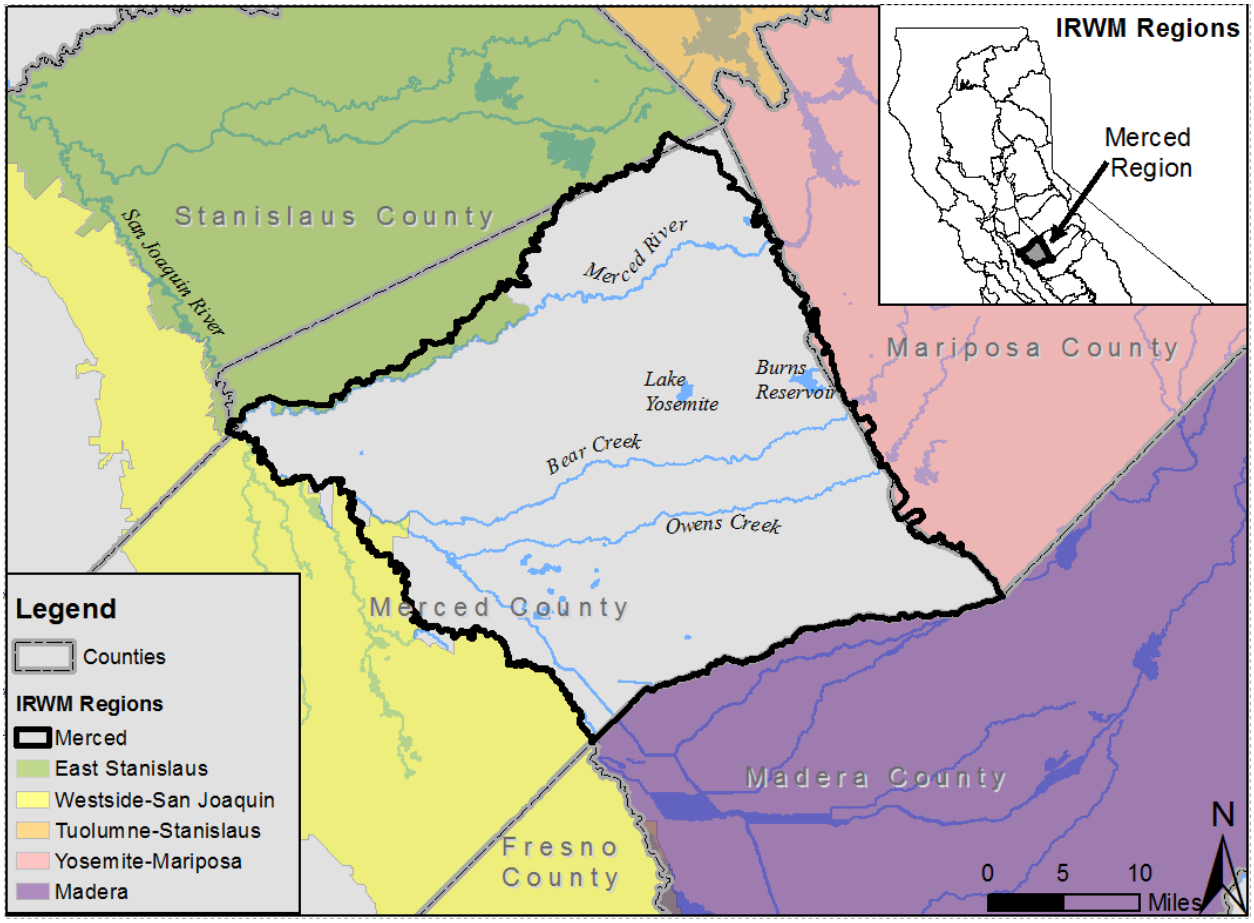
of iron, fluoride, nitrate, boron, selenium, and salts in the Delta-Mendota Subbasin. As such, this area has different water management challenges and needs than the Merced Region, and is appropriately covered by a different IRWM region.

2.2 Neighboring Regions

The Merced Region is located within the San Joaquin River Funding Area, which contains twelve IRWM Regions completely or in part. Of these twelve regions, five IRWM planning regions are adjacent to the Merced Region: the Madera Region, the Yosemite-Mariposa Region, the East Stanislaus Region, the Tuolumne-Stanislaus Region, and the Westside-San Joaquin Region (refer to Figure 2-2).

During the RAP process, the Merced Region sent letters to neighboring RWMG representatives expressing the Merced Region's interest in entering into a Memorandum of Understanding or other letter agreement outlining areas of cooperation with its neighboring regions. While MOUs between the IRWM regions have not been established, participants from the Merced Region have been coordinating with members of neighboring regions. Coordination with all neighboring regions is anticipated to increase as each region formalizes its governance structure and associated interregional coordination activities (see Chapter 15 Coordination).

Figure 2-2: Merced Region and Neighboring IRWM Regions



2.3 Watersheds and Water Systems

The Merced Region falls within the San Joaquin River Hydrologic Region, which is generally the northern portion of the San Joaquin Valley. The San Joaquin Valley is a structural trough up to 200 miles long and 70 miles wide. It is filled with up to 32,000 feet of marine and continental sediments deposited during periodic inundation by the Pacific Ocean and by erosion of the surrounding mountains, respectively.

The San Joaquin River Hydrologic Region includes all of the San Joaquin River drainage area extending south from the southern boundaries of the Delta. It includes the northern drainage of the San Joaquin River main stem in Madera County and its southern drainage in Fresno County. The San Joaquin River is the principal river of the region, and all other streams of the hydrologic unit are tributary to it, including the streams of the Merced Region.

2.3.1 Groundwater Basins

Basin and Subbasin designations by DWR were first published in 1952 in Bulletin 118, and subsequently updated in 1975, 1980, and 2003. Updated Bulletin 118 data provides the primary source of hydrogeologic information for the Region. The San Joaquin River Hydrologic Region contains eleven (11) distinct subbasins including three that underlie the Merced Region: Merced Subbasin (Bulletin 118 Basin Number 5-22.04), Turlock Subbasin (Bulletin 118 Basin Number 5-22.03) and Chowchilla Subbasin (Bulletin 118 Basin Number 5-22.04).

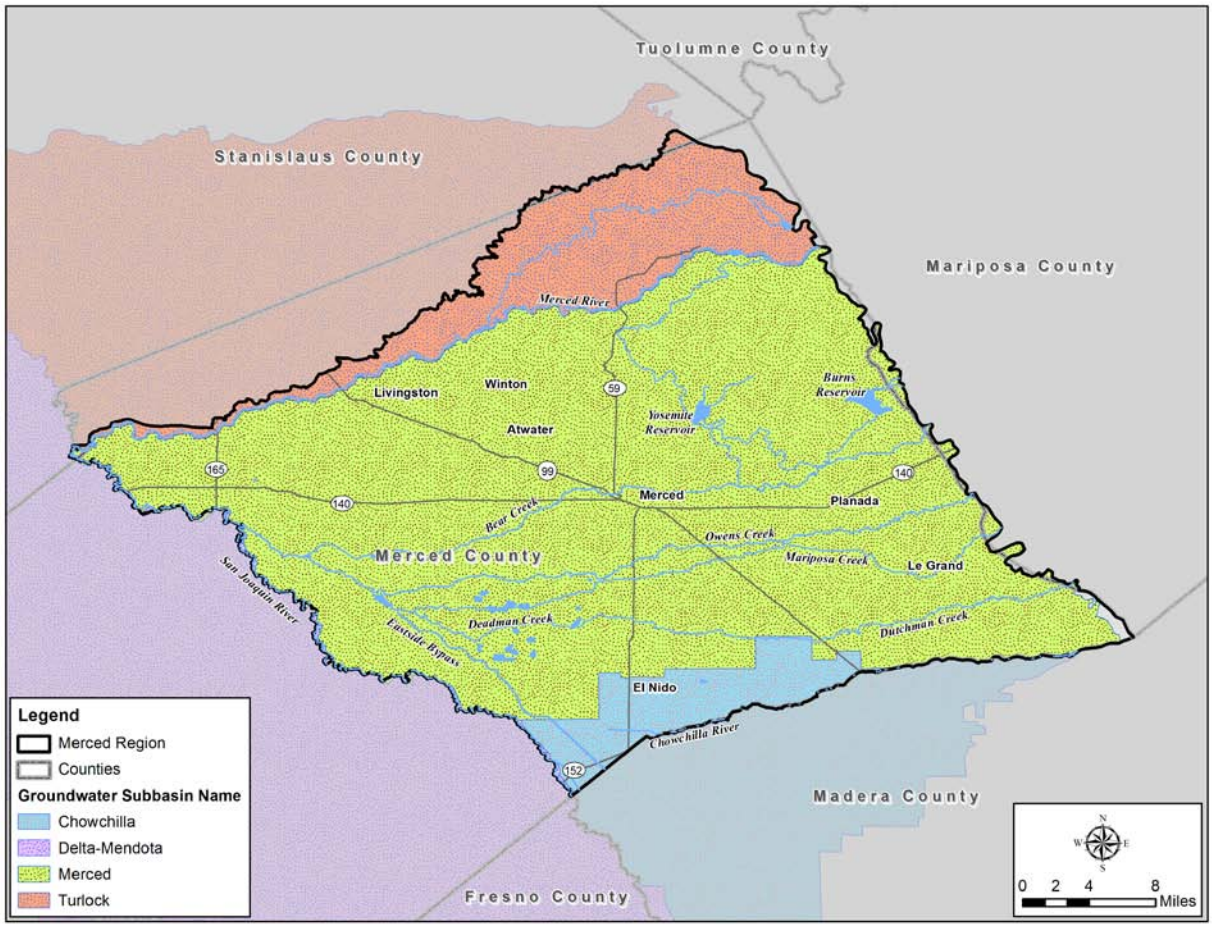
The Merced Subbasin includes lands south of the Merced River between the San Joaquin River on the west and the crystalline basement rock of the Sierra Nevada foothills on the east. The Subbasin boundary on the south stretches westerly along the Madera-Merced County line (Chowchilla River) and then between the boundary of the Le Grand-Athlone Water District and the Chowchilla Water District. The boundary continues west along the northern boundaries of Chowchilla Water District and the southern portion of the MID. The southern boundary then follows the western boundary of MID south to the northern boundary of the Sierra Water District, which is followed westerly to the San Joaquin River. Geologic units in the Merced Subbasin consist of consolidated rocks and unconsolidated deposits. The whole of the Merced Subbasin is encompassed by the Merced Region.

There are three groundwater aquifers in the Merced Subbasin: an unconfined aquifer, a confined aquifer, and an aquifer in consolidated rocks. The unconfined water body occurs in the unconsolidated deposits above and east of the Corcoran Clay, which underlies the western half of the subbasin at depths ranging from about 50 to 200 feet, except in the western and southern parts of the area where clay lenses occur and semi-confined conditions exist. The confined aquifer occurs in the unconsolidated deposits below the Corcoran Clay and extends downward to the base of fresh water. The aquifer system in consolidated rocks occurs under both unconfined and confined conditions.

The Chowchilla Subbasin lies to the south of the Merced Subbasin. Its western boundary is the San Joaquin River and the eastern boundary is defined by the Columbia Canal Service Company. The Merced Region encompasses the portion of the Chowchilla Subbasin that falls north of the Chowchilla River.

The Turlock Subbasin lies to the north of the Merced Subbasin. It includes land between the Tuolumne and Merced Rivers. Like the Merced Subbasin, which borders the Turlock Subbasin to the south, the Turlock Subbasin is bounded on the west by the San Joaquin River and on the east by crystalline basement rock of the Sierra Nevada foothills. Groundwater flow is primarily to the southwest. The primary hydrogeologic units in the Turlock Subbasin include both consolidated and unconsolidated sedimentary deposits. The Merced Region encompasses portions of the Turlock Subbasin; mainly the portion that underlies the Dry Creek watershed.

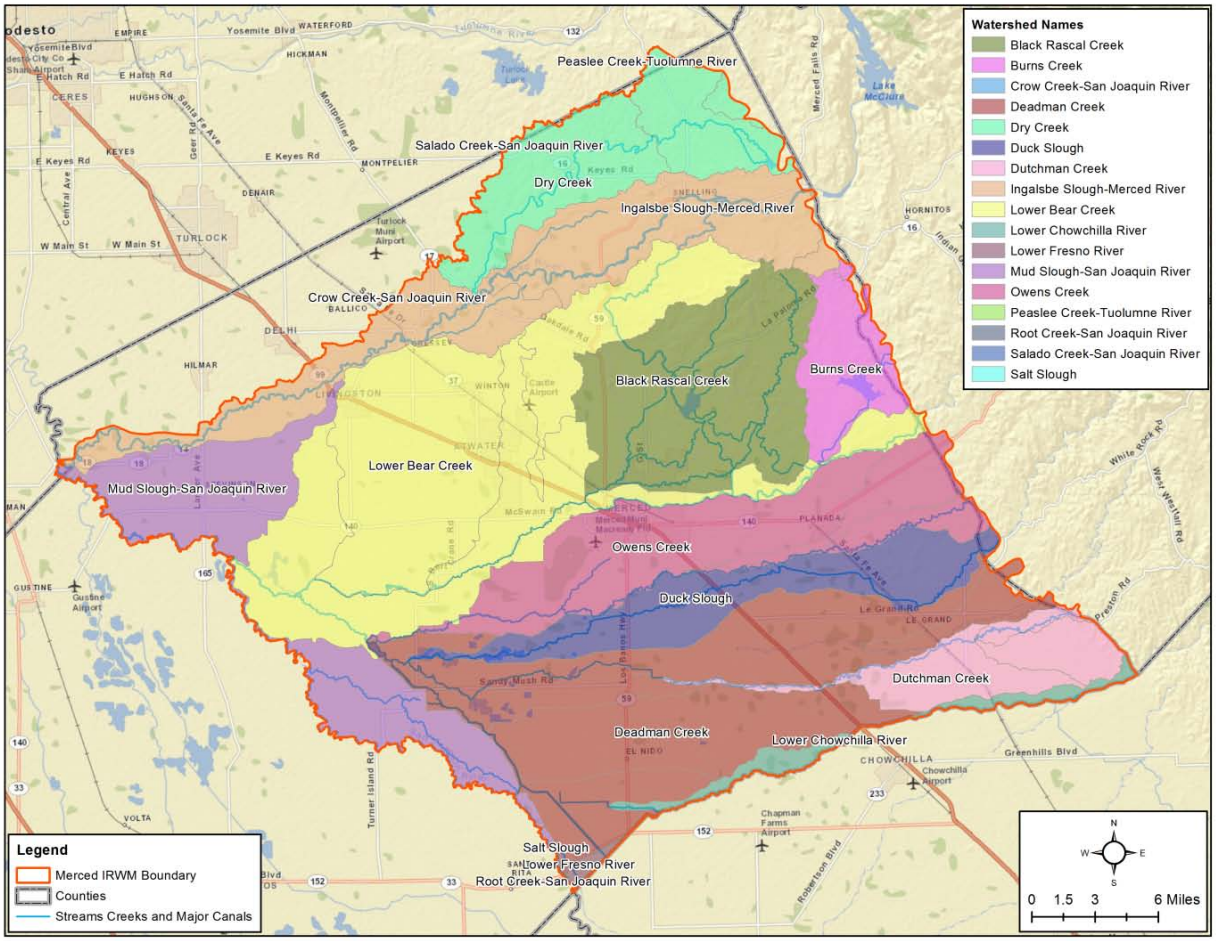
Figure 2-3: Groundwater Basins



2.3.2 Watersheds

Watersheds defined by both the California Department of Conservation through the California Watershed Portal and the U.S. Geological Survey (USGS) Watershed Boundary Dataset were reviewed in defining the watersheds of the Merced Region. The USGS Watershed Boundary Dataset classifications (refer to Figure 2-4 below) were selected as more representative of the Merced Region because watershed boundaries are determined solely upon hydrologic principles and do not favor any administrative boundaries. Based upon USGS cataloging, the Region lies mainly within the Middle San Joaquin-Lower Chowchilla Watershed with a small portion of the Region in the Middle San Joaquin-Lower Merced-Lower Stanislaus Watershed. Each of these watersheds is subdivided into smaller hydrologic areas. The Merced Region overlies the following hydrologic areas: Lower Chowchilla River, Dutchman Creek, Duck Slough, Deadman Creek, Owens Creek, Burns Creek, Black Rascal Creek, Lower Bear Creek, Ingalsbe Slough-Merced River, Mud-Slough-San Joaquin River and Dry Creek. These hydrologic areas are named after the numerous rivers and creeks within the Region, which include the Chowchilla River, Merced River, San Joaquin River, Dutchman Creek, Deadman Creek, Canal Creek, Fahrens Creek, Miles Creek, Owens Creek, Burns Creek, Black Rascal Creek, Bear Creek and Dry Creek.

Figure 2-4: Watersheds within the Merced Region



2.3.3 Water Supply Systems and Distribution

Numerous agencies and organizations supply water throughout the Merced Region, as shown in Figure 2-5. Domestic water systems within the unincorporated portions of Merced County are generally small, independent systems providing water to individual communities. Most of the unincorporated areas outside of major communities are designated for agricultural use and receive their water supply from individual groundwater wells; however, agricultural water supply systems also exist to serve irrigation users. Agencies providing domestic and irrigation water services to the unincorporated areas of Merced County and within the Region (eastern Merced County) are shown in the Table 2-1.

Figure 2-5: Water Supply Entities within the Region

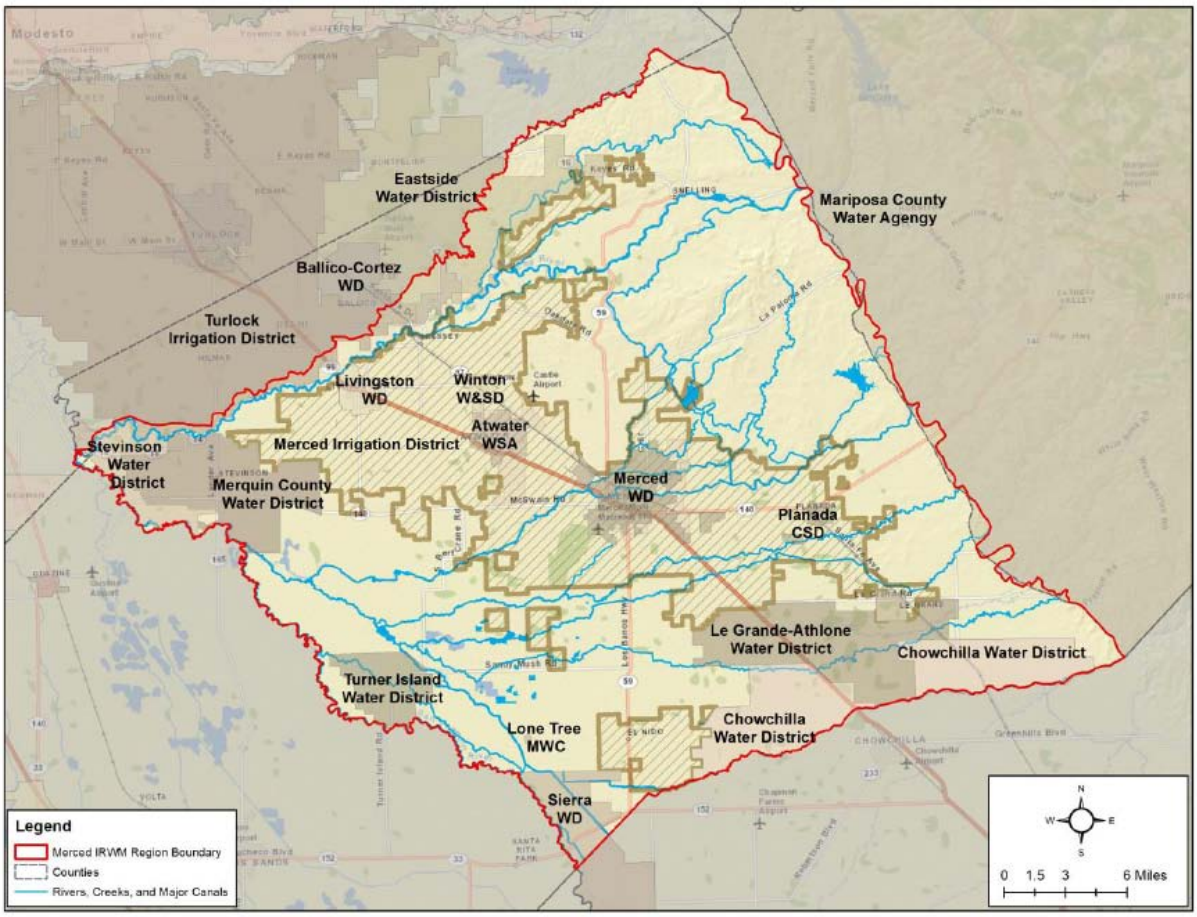


Table 2-1: Agencies Providing Water Service to Unincorporated Areas of the Merced Region

Agencies Providing Water Service to Unincorporated Areas in the Merced Region	
Public Water Supply Agencies	
Municipal	Agricultural
Le Grand Community Services District	Chowchilla Water District
Planada Community Service District	East Side Water District
Winton Water and Sanitary District	Le Grand - Athlone Water District
	Merced Irrigation District
	Merquin County Water District
	Stevinson Water District
	Turlock Irrigation District
	Turner Island Water District
Private Water Companies	
Municipal	Agricultural
Black Rascal Water Company	Lone Tree Mutual Water Company
Meadowbrook Water Company	

In addition to water systems within unincorporated areas of the Region, separate domestic systems are provided to the residents of the incorporated cities of Merced, Livingston, and Atwater. Services provided by the Region's incorporated cities, in addition to other major water suppliers in the Region, are described in the following sections.

Municipal Water Suppliers

The following municipal water suppliers provide services to the Region.

- Black Rascal Water Company
- City of Atwater
- City of Livingston
- City of Merced
- Le Grand Community Services District
- Meadowbrook Water Company
- Planada Community Services District
- Winton Water and Sanitary District

Information on each supplier is provided below.

Black Rascal Water Company

Black Rascal Water Company is a private water company that provides domestic water service to an area northeast of the City of Merced. Municipal water is supplied by two groundwater wells. Well 1 is capable of meeting demand and Well 2 is a standby facility. In 2012, Black Rascal Water Company supplied 113 AF (or an average of 0.10 mgd).

City of Atwater

The City of Atwater provides domestic water service to a growing population. According to the 2010 United States Census, the population of Atwater grew by almost 22% from 2000 to 2010, reaching 28,168 in 2010. The City of Atwater operates a municipal water system that utilizes local groundwater wells to provide water to the city's residents. The City of Atwater does not treat groundwater prior to delivering it to customers, with the exception of chlorine injection as required by the State of California. The City's municipal water system consists of 11 wells, nine of which are active, and two of which are on standby due to elevated concentrations of dibromochloropropane (DBCP). In 2005, the City of Atwater pumped approximately 9,606 acre-feet (AF) (or an average of 8.58 mgd) of water from the Merced subbasin, which constituted the entire water supply for the city.

City of Livingston

The City of Livingston provides water supplies to its residents, which numbered approximately 13,058 in 2010. The sole source of water supply for the City of Livingston is groundwater, which is pumped from eight groundwater wells (seven active and one emergency standby well) that have a combined capacity of 1.0 million gallons (City of Livingston 2007). Some of the City's groundwater is impacted by high levels of DBCP and nitrates have been detected in an isolated location. The City is considering a combination of centralized well head treatment and surface water treatment from MID.

City of Merced

The City of Merced provides water supplies primarily to residential users, which included approximately 83,400 people in 2010. The City's population is projected to continue to increase, reaching nearly 160,000 in 2030. In addition to residential users, the City of Merced also supplies water to commercial/institutional, industrial, and landscape irrigation users.

The City of Merced's sole water supply source is groundwater, which is pumped from 22 active groundwater wells that are scattered throughout the City's service area. Approximately four of the City's groundwater wells are impacted by water quality issues associated with either arsenic, methyl-tertiary-butyl-ether (a gasoline additive), or nitrates. Although the City of Merced's existing water supplies are provided solely from groundwater sources, the City anticipates using a small amount of surface water from MID to supplement its water supply by 2015. MID's deliveries to the City are initially expected to be around 1,200 AFY. The surface water would be used for irrigation of parks, city landscaping and row crops.

Le Grand Community Services District

The Le Grand Community Services District (LGCSD) provides domestic water service to residents in the unincorporated community of Le Grand located in the eastern portion of the Region. The community of Le Grand had a population of 1,659 in 2010, and is located in eastern Merced County approximately 12 miles southeast of the City of Merced. Municipal water is supplied to the community of Le Grand by three groundwater wells which are capable of producing 2 million gallons per day (mgd). According to the 1990 Merced County General Plan, average annual water use in Le Grand is 1,075 AFY (0.96 mgd).

Meadowbrook Water Company

Meadowbrook Water Company was founded in 1955 to serve a small subdivision in what is now known as the Franklin-Beachwood area. Most of the land in the Meadowbrook service area was originally agricultural land and dairy farms. As the years went by, many farmers subdivided their land and some of the dairies closed down so that more and more subdivisions could be put in. As of 2005, Meadowbrook was serving groundwater to more than 1,600 homes and businesses.

Winton Water and Sanitary District

The Winton Water and Sanitary District (WWSD) serves water to the unincorporated community of Winton and its surrounding area, located north of the City of Atwater. According to the 2010 United States Census, the population of the community of Winton was approximately 10,613 in 2010. WWSD provides water services to approximately 2,982 connections, supplying an annual average of approximately 1,748 AFY (1.56 mgd).

Planada Community Services District

The Planada Community Services District (CSD) provides domestic water service to residents in the unincorporated community of Planada. The community of Planada had a year 2010 population of 4,584 and is located in eastern Merced County along State Route 140. Municipal water is supplied by five groundwater wells. Groundwater is chlorinated prior to conveyance through a pressurized system. In 2012, Planada CSD produced 1,205 AF (or an average of 1.08 mgd).

Agricultural Water Suppliers

The following agricultural water suppliers provide services to the Region.

- Chowchilla Water District
- East Side Water District
- Le Grand – Athlone Water District
- Lone Tree Mutual Water Company
- Merced Irrigation District
- Merquin County Water District
- Stevinson Water District
- Turlock Irrigation District
- Turner Island Water District

Information on each supplier is provided below.

Chowchilla Water District

The Chowchilla Water District (CWD), formed in 1949, serves portions of both Merced County and Madera County, and therefore is only partially located within the Merced Region. In total, CWD serves approximately 85,000 total acres of agricultural land, including over 400 water users.

CWD receives water from the Madera Canal and the Buchanan Dam. This water is conveyed to irrigation users through CWD's water distribution system which consists of 150 miles of unlined canals and 49 miles of pipeline.

East Side Water District

The East Side Water District occupies most of the Dry Creek Watershed on the valley floor. The District relies predominantly on groundwater.

Le Grand – Athlone Water District

The Le Grand – Athlone Water District provides water service south of the community of Le Grand, up to the border of the Chowchilla Water District. The Le Grand – Athlone Water District distributes water purchased from the Merced Irrigation District when available. In 2012 the Le Grand – Athlone Water District served approximately 322 acre-feet of water from groundwater sources.

Lone Tree Mutual Water Company

Lone Tree Mutual Water Company is a private water company that provides water for agricultural irrigation uses in the El Nido area.

Merced Irrigation District

MID, formed in 1919, is a regional water supplier that supplies water to users within its service area. In addition, MID also delivers water to satisfy other entitlements, and provides water to irrigators located outside of the MID service area. MID sells water, as supplies are available, to the following areas within the Merced Region:

- Merced Union High School (landscape application only)
- Le Grand-Athlone Water District
- Chowchilla Water District
- Unincorporated areas within MID's Sphere of Influence

In addition, MID fulfills water commitments to:

- Cowell Agreement Diverters, encompassing an area in excess of 20,000 acres in the Merced River valley between Snelling and Oakdale Road
- Stevinson Water District
- Various riparian and appropriated water users in Merced River and thorough MID system.
- Merced National Wildlife Refuge.

MID has made deliveries under various water transfers mainly for agricultural and environmental purposes, such as transfers to:

- Department of Water Resources for instream flows under Davis Gransky contract since 1967.
- Lands within MID Sphere of Influence.
- United States Bureau of Reclamation (USBR) and DWR for river instream flows under Vernalis Adaptive Management Plan between 1999 and 2011.
- The Environmental Water Account
- Westlands Water District
- Delta Mendota Water Authority
- Kern County Water Agency and Duddley Ridge
- San Luis Wildlife Refuge – East Bear Creek unit

MID also provides irrigation water to Eastern Merced County's agricultural land. MID's service area covers 164,000 acres, which includes approximately 140,000 acres of farmland. Approximately 320,000 acre-feet of water per year is distributed through 790 miles of canals and pipelines. MID possesses pre-1914 diversion and storage rights from the Merced River and local streams. In addition, MID possesses a number of State Water Resources Control Board water licenses from Merced River, Mariposa Creek and Deadman Creek.

The Merced Water Supply Plan, completed in 1993 and updated in 2001, provides a general plan for overall water system expansion and recommendations for managing the water supply for the study area. The Plan Update was prepared by the City of Merced and MID in conjunction with the University of California, Merced due to the occurrence of significant activities in the study area and a better understanding of water resources issues. The five goals identified in the Plan include:

- Manage groundwater resources;
- Provide a high-quality, reliable supply of water for cities;
- Protect and enhance the economic base;
- Protect MID's Merced River water rights; and
- Maintain consensus on a water supply plan.

The Plan Update identified water needs and planning scenarios through the year 2040 for the study area, which includes 582,000 acres located in Eastern Merced County and closely follows the Merced Subbasin. Historical water data showed that the use of surface water supplied by MID decreased in the Region, while groundwater pumping for irrigation rose. The change was attributed to five years of extended drought in the late 1980s and a lack in technological advancement for filtering surface water to levels adequate for sprinkler and drip systems, making groundwater more desirable. The Plan Update outlined potential consequences that could occur if aquifer levels continue to decline, including land subsidence, reduction of drought protection, imposition of regulatory control, higher energy usage and costs, and reduction in agricultural production.

The Plan Update also identified numerous planning scenarios to address future conditions and reach program goals. Common solutions were identified among the planning scenarios and developed into a base level of solutions for immediate response, including the following.

- Intentional recharge site investigations
- Incentives and related system improvements
- Surface water conservation and automation
- Agricultural capacity improvements
- Urban water conservation
- Urban groundwater to surface water conversion
- Participation in water rights issues
- Institutional program establishment

Other potentially more costly solutions may be required if specific "triggers" occur. For example, future regulatory actions on the Merced River may trigger the need for drought relief wells. As a next step, the Plan Update recommended formation of a committee to identify beneficiaries of program implementation and to allocate costs accordingly.

Merquin County Water District

The Merquin County Water District serves the unincorporated area around Stevinson, including the lands in the community of Stevinson and to the east of Stevinson. Stevinson is a small community, containing approximately 82 parcels as of 2006. Merquin County Water District receives water deliveries from Stevinson Water District and East Side Canal and Irrigation District totaling 14,281 acre-feet per year and also pumps groundwater.

Stevinson Water District

Stevinson Water District serves a small area of approximately 3,600 acres in the northwest corner of the Region that abuts Merced River and the San Joaquin River along the southeasterly banks of their confluence. Stevinson Water District holds appropriative and adjudicated water rights off the rivers and local streams. The District owns, operates and maintains the East Side Canal, a feature that can intercept flows from all Merced Streams (Bear Creek, Owens Creek, Mariposa Creek, and Deadman Creek) and their tributaries. The District receives approximately 26,400 AF annually from MID per an adjudicated agreement between the Districts. The District provides surface water to agricultural users that lie south and west of the unincorporated community of Stevinson. Stevinson Water District also delivers water to Merquin County Water District.

Turlock Irrigation District

A small portion of Turlock Irrigation District is located within the Region north of the Merced River and west of the confluence of Dry Creek and the Merced River. Turlock Irrigation District receives its surface water flows from the Tuolumne River.

Turner Island Water District

The Turner Island Water District serves a small area in the southern portion of the Region, and is a member of the San Luis & Delta-Mendota Water Authority. The District is generally served from groundwater.

Inactive Water Agencies

Plainsburg Irrigation District is an inactive district located to the southwest of the community of Planada. Land owners in the area depend on groundwater for supply and some purchase surface water from MID when available.

Sierra Pacific Water District is another inactive district located at the southwesterly corner of the Region, and land owners rely on groundwater for supply. Subsidence has occurred within the area, which is of special interest to the Region.

2.3.4 Wastewater

Most of the sanitary sewer systems within the unincorporated areas of the Region serve individual small communities. Sanitary sewer service within the unincorporated County portions of the Region is generally provided by special districts including community service districts, public utility districts, sanitary districts, and sewer maintenance districts. Some agencies provide sewer collection service only, and contract with surrounding agencies for wastewater treatment and disposal. Some of the unincorporated communities of Merced County lack sanitary sewer infrastructure, and are serviced by individual or community septic systems. Areas within the Region currently lacking sanitary sewer infrastructure are listed below.

- Cressey
- El Nido
- Stevinson
- Tuttle
- Celeste (portions of the community are served by the City of Merced)

Most of the unincorporated areas outside of major communities are designated for agricultural use and discharge wastewater through onsite wastewater treatment systems. In areas serviced by individual or community systems, property owners are generally responsible for maintenance and improvement.

The County's 1990 General Plan does not discuss sanitary sewer service and defers wastewater transmission, treatment, and disposal planning to local service providers. Thus, there is little coordination between the service capacities and capabilities of local wastewater service providers and increasing demands for service as a result of land use decisions of private project proponents and Merced County.

The paragraphs to follow describe the current state of sewer infrastructure in the Region:

- City of Atwater
- City of Livingston
- City of Merced
- Franklin County Water District
- Le Grand Community Services District
- Planada Community Services District
- Snelling Community Services District
- Winton Water and Sanitary District

City of Atwater

The City of Atwater also provides wastewater collection and treatment services within its service area. In 2005, all of the city's wastewater flows were beneficially reused and recycled through land disposal. Land disposal includes application at a local farm for irrigation purposes and use by the United States Fish and Wildlife Service (USFWS) for wetland habitat.

The City of Atwater collects and treats approximately 4.2 million gallons of wastewater per day, or approximately 4,705 AFY. Wastewater is collected through a network of sanitary sewer collection pipelines and fed by gravity to the City's wastewater treatment plant via 18 sewer pump stations. After treatment at the City's wastewater treatment plant, treated effluent is conveyed from the Atwater Drain to land disposal methods explained above. In addition, solids generated at the wastewater treatment plant are dried and applied to the City's sludge reuse facility or one of several permitted sites in Merced County that are used to grow hay.

The City is in the process of upgrading its existing wastewater treatment plant while plans to build a new plant are under development. The upgrade will increase average flow capacity to 6 mgd (expandable to an ultimate capacity of 12 mgd) and will allow the City to comply with new regulatory requirements for advanced treatment. The upgrade includes the following major treatment processes:

- Headworks, including screening, grit removal, and odor control provisions.
- Two biological nutrient removal oxidation ditches with secondary clarifiers providing for effluent ammonia below 2 milligrams per liter (mg/L) and nitrate below 10 mg/L. Effluent biological oxygen demand (BOD) and suspended solids (SS) will be consistently below 10 mg/L. Provisions for supplementary alkalinity addition, which may be required to fuel the nitrification process, are also provided.
- Effluent filtration/UV disinfection facilities.
- Sludge digestion/dewatering facilities including cake storage with off-haul provisions.

City of Livingston

The City of Livingston provides sanitary sewer service within its service area, including a collection system of mains, manholes, service laterals, pump stations, and trunk sewer mains that are used to convey wastewater to the City's domestic wastewater treatment plant, which has the capacity to treat an average daily maximum month flow of 2.0 mgd. Treated effluent from the City's domestic wastewater treatment plant is sent to percolation ponds and lined sludge drying beds. Currently, effluent is not reclaimed.

Historically, the City of Livingston also operated an industrial wastewater treatment plant that was used to treat flows from a private poultry processing plant. The poultry plant now treats its own wastewater onsite, and the City is in the process of decommissioning its old industrial wastewater treatment plant.

City of Merced

In addition to providing water supply within its service area, the City of Merced is also responsible for collecting, treating, and disposing of wastewater. Currently, all treated effluent from the City of Merced wastewater treatment facility is discharged through a gravity channel to Hartley Slough, to a Food Processing and Land Application Area (FPLAA) owned by the City, and to a wildlife management area wetland. Treated effluent that is conveyed to the Hartley Slough and the FPLAA is used for agricultural irrigation purposes, while the water that is conveyed to the wildlife management area wetland is used to create a series of percolation and evaporation ponds. According to estimates from the City's 2010 Urban Water Management Plan, approximately half of the City's wastewater was treated to secondary levels and conveyed to the wildlife management area wetland in 2010.

The City of Merced recently completed a significant upgrade and expansion design for the City's wastewater treatment plant (WWTP) to produce disinfected tertiary effluent in accordance with Title 22 of the California Code of Regulations. With the new upgrade, wastewater generated within the City is conveyed to the City's WWTP. The wastewater is screened and rocks and sand are removed. It is then pumped to primary clarifiers that allow any particles in the water to settle. Wastewater then flows to aeration basins where bacteria consume organic material and secondary clarifiers are used to settle out the bacteria. Secondary effluent is chemically conditioned, filtered, and disinfected with ultraviolet (UV) light. The treated water is then aerated prior to discharge into Hartley Slough. After final treatment, the water is suitable for unrestricted reuse for agriculture purposes. The waste solids, or sludge, is digested and dried so the material can be applied as a soil amendment.

The City will continue to provide treated effluent to the Hartley Slough, FPLAA, and wildlife management area wetland, and does not currently plan to distribute recycled water. The quantity of treated effluent conveyed to these three areas is anticipated to increase substantially compared to current levels. Currently, the City disposes of approximately 2,284 AFY of treated effluent, and anticipates disposing of over 17,000 AFY by 2030.

Franklin County Water District

Franklin County Water District (FCWD) provides sanitary sewer collection and treatment services to residents in the unincorporated community of Franklin-Beachwood. FCWD owns and operates a wastewater treatment facility (WWTF) located on the eastern side of the community. The community WWTF consists of headworks with a bar screen, an aerated pond with two aerators, and eight evaporation/percolation ponds totaling 30 acres. The WWTF is operated in accordance with Waste Discharge Requirements Order (WDR Order) No. 89-171 (Regional Water Quality Control Board). Upon adoption, the Order limited the 30-day average daily flow to 0.4 mgd until collection system improvements could be implemented, due to the influent sewer line and pump station capacity limitations. Upon completion of the improvements, the Order limits the 30-day average daily flow to 0.6 mgd. A Notice of Violation from the Regional Water Quality Control Board (RWQCB) dated February 2002 (related to disposal of wastes and failure to complete self-monitoring reports) indicated wastewater flows had increased to an average of 0.43 mgd at the time of the inspection. The Order states that the evaporation/percolation ponds have a capacity to treat 0.6 mgd while the aeration ponds are designed to treat flows up to 0.8 mgd.

Le Grand Community Services District

In addition to domestic water service, the Le Grand Community Services District (LGCSD) also provides sanitary sewer collection and treatment services to the community of Le Grand. The LGCSD owns and operates a WWTF located southwest of the community of Le Grand.

The expanded WWTF is operated in accordance with WDR Order No. 97-053 (RWQCB). The WWTF consists of a headworks with a mechanically-cleaned bar screen and screenings press, two partially-mixed aerated lagoons with surface aerators, and one stabilization pond. Disposal is to two evaporation/percolation ponds and a 37-acre reuse area of fiber, fodder, and seed crops. Sludge removed from the ponds is also applied to the reuse area. According to the Order adopted by the RWQCB, the capacity of the WWTF is 0.35 mgd. The stabilization pond was designed in a manner that will allow a future increase in capacity to 0.50 mgd. A Notice of Violation dated December 2001 from the RWQCB (related to self-monitoring report requirements) indicated wastewater flows to be 0.15 mgd at the time of the inspection.

Planada Community Services District

In addition to domestic water service, the Planada CSD provides sanitary sewer collection and treatment services to the community of Planada. The Planada CSD owns and operates a WWTF located to the southwest of the community.

The WWTF is operated in accordance with WDR Order No. R5-5005-0009 (RWQCB). The treatment system consists of: a metering manhole, an influent pump station, a grinder to shred solids in raw sewage, an influent distribution box, three aerated lagoons, three stabilization ponds, six intermittent sand filters, six pressure filter pods, a chlorination manhole, a chlorine contact pipe, and an effluent pump station. Treated effluent is discharged to Miles Creek, a tributary to the San Joaquin River.

According to the WDR Order, the average daily flow rate is 0.36 mgd and the maximum daily flow rate is 1.07 mgd (based on 2000/2001 data). The design monthly daily average flow rate for the WWTF is 0.53 mgd.

Snelling Community Services District

Snelling Community Services District was formed in 1974 and provides wastewater service only. It has a service area of approximately 480 acres centered on the community of Snelling and serving 115 sewer connections. It has a wastewater treatment plant with a maximum capacity of 60,000 gallons per day (gpd), and the district has a policy that it will not exceed 75 percent of the maximum capacity to provide capacity for emergency situations. Average flows to the plant are approximately 31,000 gpd

Winton Water and Sanitary District

A treatment facility feasibility study was completed for the Castle Airport/Winton Area by Merced County in 2007. The feasibility study was prompted by an implementation plan proposed by the Merced County Department of Commerce Aviation and Economic Development. The implementation plan is designed to fully utilize the resources of the former Castle Air Force Base (now designated as Castle Airport). The recommended alternative in the feasibility study was a 3.0 mgd tertiary treatment plant to serve the 1600 acre Castle Airport and approximately 800 acres within the unincorporated area of the Winton Water and Sanitary District. The treatment facility would discharge treated effluent into the Casad Lateral Canal in the summer with effluent applied to on-site percolation ponds in the winter. Currently Winton Water and Sanitary District discharges raw wastewater to the City of Atwater for treatment and disposal.

2.3.5 Recycled Water

As discussed previously, wastewater collection and treatment in the Region is generally provided by special districts within the unincorporated areas of Merced County and by the cities of Merced, Atwater, and Livingston.

There is currently no recycled water being used for domestic purposes within the Region. However, the Cities of Merced and Atwater both currently reuse treated wastewater effluent for other beneficial uses (agriculture). The City of Merced recently upgraded its wastewater treatment plant to treat wastewater to disinfected tertiary levels in accordance with Title 22 of the California Code of Regulations. As such, wastewater from the City of Merced could potentially be used for industrial and irrigation uses in accordance with Title 22. According to the City of Merced 2010 Urban Water Management Plan, there are no plans to increase recycled water use within the city at this time. The City of Merced and MID are investigating trading MID surface water for recycled water from the City of Merced. Recycled water would be applied over areas serviced by MID, and in exchange, MID would provide surface water to various parks and landscape areas in the City that can be served by MID facilities that still traverse the City. This effort would avoid the need to install more than 12 miles of pipeline and multiple pumps and is in compliance with Merced Groundwater Management Plan update recommendation to defer recycled water use in areas upstream from the WWTP. Wastewater treated by the City of Atwater does not adhere to standards established by Title 22 of the California Code of Regulations, and therefore cannot be used for expanded recycled water uses. The City of Livingston has evaluated the use of recycled water and determined that water recycling is not cost effective for the City at this time.

2.3.6 Agricultural Water

Agriculture is the dominant land use in Merced County, estimated to account for more than 90 percent of all land use. Based on the Merced Groundwater Basin Management Plan, the majority of water used within the Merced Subbasin has historically been and continues to be used for agricultural purposes.

Agricultural water supply within the Merced IRWMP area can be grouped into three broad classes (Table 2-2).

1. Merced Irrigation District/Stevinson Water District: The largest irrigated area is served by MID with a generally reliable surface water supply available from the Merced River that is adequate to meet customer demands in most years. The MID service area covers about 164,000 acres, of which approximately 140,000 acres are irrigated agricultural land. Some groundwater is pumped within the MID service area by both private landowners and by MID. This category also includes Stevinson Water District, which has a more reliable surface water source than MID.
2. Other Organized Agricultural Water Suppliers: Approximately 72,600 irrigated acres are served by other agricultural water suppliers that rarely, if ever, have adequate surface water supplies to meet agricultural demands. These areas rely on a blend of surface water and groundwater with groundwater being the primary source. The ratio of surface to groundwater supply availability varies widely between these agencies.
3. No Organized Agricultural Water Suppliers: Irrigated areas outside of the service areas of MID and the other agricultural water suppliers rely solely on groundwater supplies for irrigation, with the exception of limited surface water purchases made in some years, subject to availability.

These three classes of agricultural use can be more broadly considered as areas with adequate surface water supplies in most years and areas with inadequate surface water supplies.

Table 2-2: Classes of Agricultural Water Suppliers in the Merced IRWMP

Agricultural Water Suppliers within Merced IRWMP Boundaries	Total 2009 Irrigated Ag area (acres)	Total 2009 Non-Ag area (acres)	Total Area (acres)
Organized Agricultural Water Suppliers Relying Mainly on Surface Water[1]			
• Merced Irrigation District	133,000	31,000	164,000
• Stevinson Water District	3,600	2,600	6,200
Other Organized Agricultural Water Suppliers	68,000	29,400	97,400
No Organized Agricultural Water Suppliers	94,000	220,600	314,600
Total	298,600	283,600	582,200

[1]Turlock Irrigation District also supplies surface water to a small portion of the Merced Region. However, because the irrigated area supplied is minimal, TID supplies have not been included in this analysis.

2.3.7 Water Conservation

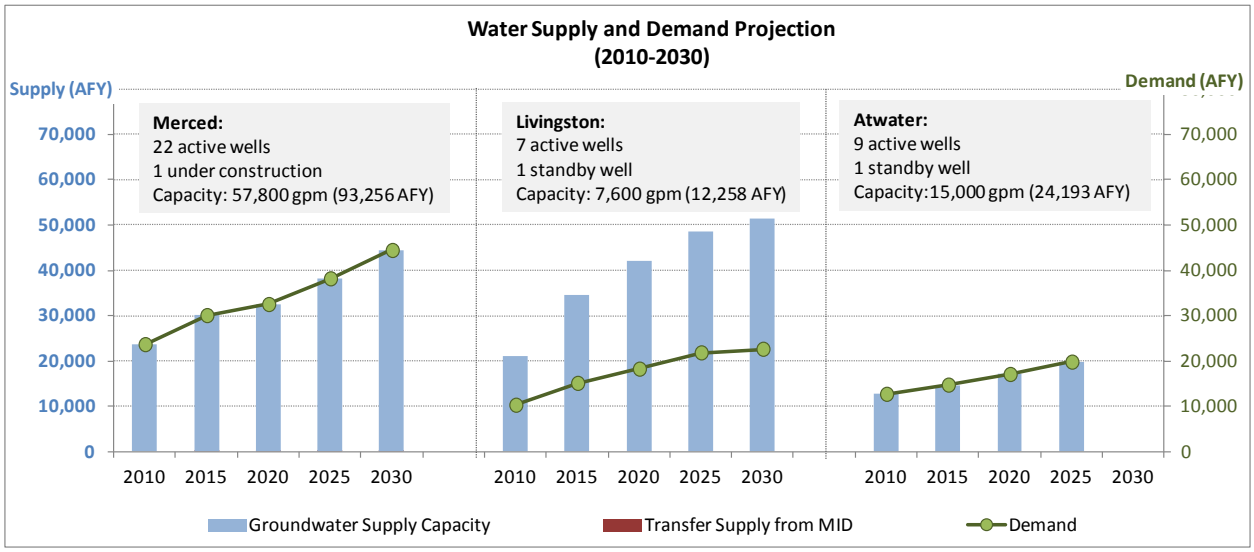
In response to declining groundwater levels in the Merced Subbasin, water supply entities in the Region are working to implement programs to maintain groundwater levels, including conservation programs.

Conservation efforts are often influenced by factors such as supply availability and regulatory guidelines. Supply availability and regulatory constraints faced by the Region when shaping water conservation programs and conservation measures that the Region is currently implementing are described in detail in Appendix A and summarized below.

Supply Availability

Groundwater is the primary source of water supply and the sole supply of potable water for the Region. The City of Merced and MID are currently planning to introduce the use of surface water from MID for landscape irrigation. The Cities of Livingston and Atwater plan to continue to use groundwater as their sole source of water supply. Each city operates groundwater wells that pump from the Merced Subbasin. Figure 2-6 summarizes the number, total rated capacity, and projected available supply from each city's wells with respect to projected demand. As shown in this figure, all cities are currently projected to be able to fully meet their urban water demands in 2030 based on projections provided in the most recent UWMP updates. However, water conservation is vital to prevent overdraft or other adverse impacts to the groundwater basin. For example, the City of Merced began implementing a number of conservation measures in response to Merced Subbasin overdraft conditions between 1990 and 1995.

Figure 2-6: Supply and Demand Projections (2010-2030)[1]



Effective conjunctive use of surface water and groundwater requires different conservation approaches in areas with adequate surface water supplies compared to areas with inadequate or no surface water supplies that rely mostly (or solely) on groundwater. Sustainable use of groundwater relies on surface water for recharge of the groundwater storage reservoir. Thus, continued use of surface water must be encouraged to the greatest extent possible. Use of surface water in place of groundwater, known as in lieu recharge, helps maintain groundwater storage by reducing groundwater demand. The City of Livingston is currently investigating the use of surface water for potable use while maintaining the existing groundwater well network for years of surface water shortage.

Regulatory Frameworks

State and federal laws mandate conservation practices help to shape existing conservation programs. Regulations affecting the Region are summarized below:

- **Assembly Bill 1420** (AB 1420) amended the Urban Water Management Planning Act to require, effective January 1, 2009, that the terms of and eligibility for any water management grant or loan made to an urban water supplier and awarded or administered by the Department of Water Resources (DWR), State Water Resources Control Board (SWRCB), or California Bay-Delta Authority (CBDA) or its successor agency be conditioned on the implementation of the Water Demand Management Measures (DMMs) described in Water Code Section 10631 (f). As shown in Table 2-3, all cities in the Region are currently implementing a subset of the DMMs.
- **Assembly Bill 1881** (AB 1881), the Water Conservation in Landscaping Act of 2006, mandated increased water efficiency for both new and existing development statewide. The law required DWR to update the Model Water Efficient Landscape Ordinance (MWELO), which established water management practices and water waste prevention for landscape irrigation needs. Cities can elect to either adopt the DWR's MWELO or introduce their own local landscape ordinances.

[1]Demand projections for the City of Livingston are based on projections from the City of Livingston 2025 General Plan, which have been challenged. The City of Livingston is in the process of updating its UWMP, and the projections presented in the MIRWMP will need to be updated after the newer projections are available.

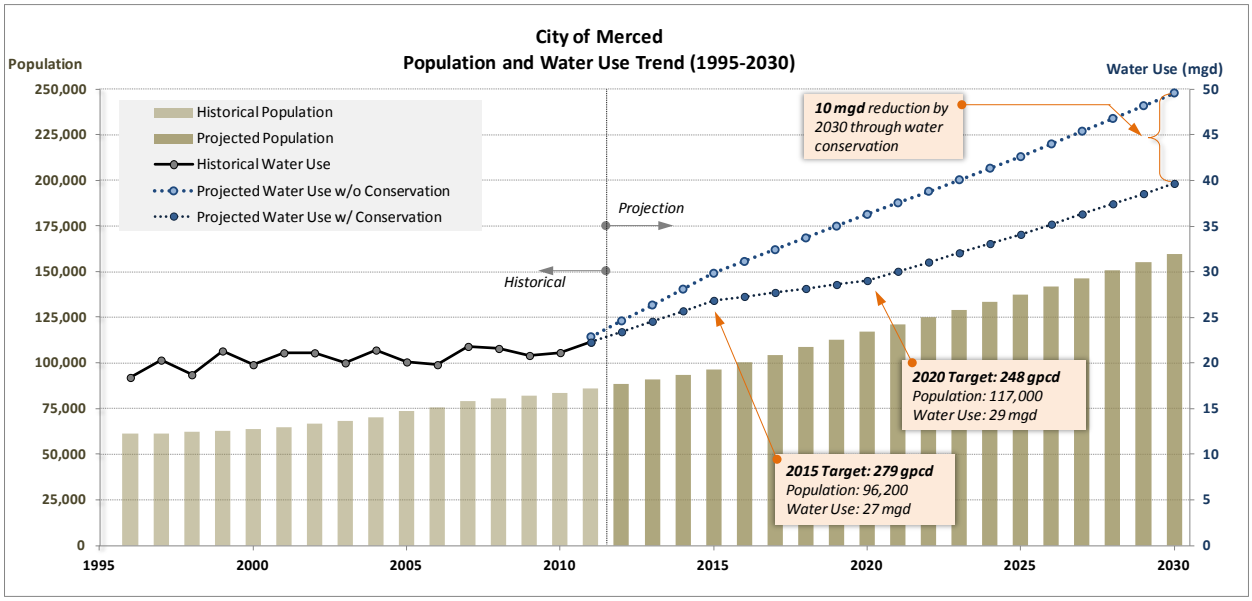
In addition to adopting the MWELO, each city in the Region has its own efforts in place to further reduce irrigation needs. For example, all of Atwater's city-maintained median strips and traffic islands that require plantings are landscaped with drought-tolerant plants. Atwater's five-year Capital Improvement Plan also calls for $0.2M in parks water conservation improvements (City of Atwater Municipal Service Review, April 2010). The City of Merced is also currently enforcing a local Water Conservation Ordinance that restricts outdoor irrigation to three days a week and only between 7 p.m. and 11 a.m.

- **California Water Code Sections 525-529.5** require that urban water suppliers install water meters on all municipal and industrial service connections on or before January 1, 2025 and charge customers based on the actual volume of deliveries as measured by the water meters. As discussed in the previous section, all three cities have a large number of unmetered accounts, primarily in the single family residence sector.
- **Water Conservation Bill of 2009 (SB x7-7)** was enacted in November 2009, requiring all water suppliers – urban and agricultural – to increase water use efficiency.

  SBx7-7 sets an overall goal of reducing per capita urban water use by 20 percent by 2020, with an interim goal of reducing per capita water use by at least 10 percent by December 31, 2015. Each urban water supplier must develop its water use target and interim target using one of the four methods established by DWR. According to City of Merced's 2010 UWMP, the City's baseline daily per capita water use is 310 gallons per capita day (gpcd). Figure 2-7 illustrates City of Merced's historical and projected population and water use, its interim target and 2020 target. The interim and 2020 targets for the City of Livingston and City of Atwater were not yet available at the time this document was prepared.

  SBx7-7 also requires agricultural districts serving over 25,000 acres to implement Efficient Water Management Practices (EWMPs) and to prepare and adopt an agricultural water management plan per new standards. Districts under 25,000 acres are required to produce a plan if they receive State funds. MID is currently completing its Agricultural Water Management Plan consistent with these new standards. Other agricultural agencies may follow with their own plans.

Figure 2-7: City of Merced Urban Water Conservation Trend



Urban Demand Management Measures

All three of the Region's urban water suppliers implement a number of water conservation measures. Table 2-3 summarizes the implementation status of the 14 demand management measures (DMMs) listed in each of the cities' most recent Urban Water Management Plans (UWMPs).

Table 2-3: Water Conservation Measures Employed in the Region

	Demand Management Measure	City of Merced	City of Livingston	City of Atwater
1	Water Survey Program	⦸	○	●
2	Residential Plumbing Retrofit	●	○	●
3	System Water Audits, Leak Detection and Repair	●	●	●
4	Metering with Commodity Rates	●	●	●
5	Large Landscape Conservation Programs	○	●	●
6	High-Efficiency Washing Machine Rebate Program	⦸	○	⦸
7	Public Information Programs	●	○	●
8	School Education Program	●	○	●
9	Conservation Programs for CII Accounts	⦸	○	●
10	Wholesale Agency Programs	n/a	n/a	n/a
11	Conservation Pricing	○	●	●
12	Water Conservation Coordinator	●	○	●
13	Water Waste Prohibition	●	●	●
14	Residential Ultra Low Flow Toilet Replacement Programs	⦸	○	⦸

● *- Fully or Partially Implemented;* ○ *- Planned or in Evaluation;* ⦸ *- Not Implemented;*
n/a -Not applicable to agency

Agricultural Efficient Water Management Practices

Agricultural water conservation can be defined as reducing the amount of water applied to crops while maintaining or improving crop yield. In 2003, MID completed a Water Management Plan in accordance with Assembly Bill 3616 (AB 3616), also known as the Agricultural Water Suppliers Efficient Water Management Practices Act. The plan focuses on establishment of applicable Efficient Water Management Practices, which include water conservation efforts. EWMPs within MID's existing Water Management Plan that pertain to conservation include:

- Measurement of the volume of water delivered to customers
- Designate a Water Conservation Coordinator (complete since 1998)
- Program to support the availability of water management services to users, including:
    - Support a full-time staff Water Conservation Specialist
    - Provide monthly billing report of water usage to customers
- Evaluate and improve efficiencies of water suppliers' pumps
- Line or pipe ditches and canals
- Optimize conjunctive use
- Pricing and incentives

According to the Merced Groundwater Basin Management Plan, in total MID has implemented various recharge and conservation efforts that have resulted in the cumulative in-lieu recharge of approximately 300,000 acre-feet of water since 2001.

As noted in Section 2.3.6 and described in detail in Appendix A, agricultural water use can be grouped into three settings: areas served by organized water suppliers relying on surface water supplies (MID and Stevinson Water District), areas served by other organized agricultural water suppliers, and areas without service from an organized agricultural water supplier. In areas served by organized water suppliers relying on surface water supplies, maximizing water use efficiency is important for drought preparedness so that available surface water supplies can provide the most benefit. However, the inevitable tradeoffs of this increased efficiency (primarily reduced recharge in wet years) must be recognized and actions taken to offset the reduced recharge. In other words, projects that reduce recharge in wet years should include a managed recharge component to replace the reduced recharge. A managed recharge component could include direct recharge of groundwater within the surface water supplier's service area or other designated areas within the Region, in-lieu recharge through surplus water sales to areas within the Region with inadequate surface water supplies, or a combination of strategies. Areas with inadequate surface water supplies should maximize conservation within cost-effective limits. However, since most water pumped from groundwater above crop requirements returns to the groundwater through deep percolation, the main benefit of maximizing water conservation is energy conservation.

2.3.8 Stormwater and Flood Management

Stormwater and flood management efforts in the Region are described in the following sections.

Stormwater Management

The County of Merced is the lead agency providing stormwater management within the unincorporated areas of the Region. In addition to the County, various subdivisions within the MID service area use MID canals to discharge stormwater. In general, developers are required to provide storm drainage systems on-site at developments within the unincorporated County. In the cities of Atwater, Livingston, and Merced, stormwater management is the responsibility of the individual jurisdiction.

In 1994, MID created the Merced Irrigation District Drainage Improvement District No. 1 (MIDDID No. 1). This assessment district regulates and processes agreements, mandates detention and discharge system requirements, and maintains MID facilities for the purpose of receiving urban stormwater from lands within the cities of Merced, Atwater, and Livingston, and unincorporated areas of Merced County. The District only assesses parcels that drain to MID manmade facilities.

In 2007, the cities of Atwater and Merced, the County of Merced, and MID, collectively referred to as the Merced Storm Water Group (MSWG), completed a comprehensive Storm Water Management Program (SWMP). The purpose of the SWMP was to limit, to the Maximum Extent Practicable (MEP), the discharge of pollutants from the MSWG agencies. The SWMP identifies structural and non-structural best management practices (BMPs) that can be implemented to treat and reduce stormwater pollution).

Flood Management

Flooding in the Region is typically caused by infrequent, severe winter storms, combined with snowmelt runoff from the foothills east of Merced County. Runoff from these storm events traverses the Region via numerous creeks and rivers, ultimately draining to the San Joaquin River. The relatively flat topography of the Planning Area causes floodwaters to exceed the banks of these rivers and streams to spread out over large areas. Figure 2-4 in Section 2.3.2 illustrates the many streams which traverse the Region.

The Merced Region has a long history of active stormwater and flood management, dating back to development of the original Merced County Streams Group project under authorization of the Flood Control Act of 1944 as part of the comprehensive plan for flood control for the Sacramento and San Joaquin River Basins. The Merced Streams Group project focuses on the Merced County Streams Group, which is a collection of streams within the County, including: Black Rascal Creek, Canal Creek, Bear Creek, Burns Creek, Edendale Creek, Fahrens Creek, Miles Creek, Owens Creek, and Mariposa Creek. The creeks comprising the Merced County Streams Group meander through the City of Merced as well as the unincorporated areas of Le Grand, Planada, and the Franklin/Beachwood area, in which flooding is a recurring problem. Numerous projects have been undertaken to address the problem of flooding from the Merced County Streams Group, and to date, the Merced County Streams Group project is mostly complete. However, a key feature intended to protect downtown Merced was put on hold following a decision by the United States Army Corps of Engineers (USACE) to place the project under general re-evaluation. Local entities do not have sufficient funds to construct the project without federal support or another source of funding. For these reasons, unfortunately, a significant portion of the Planning Area is still subject to flooding.

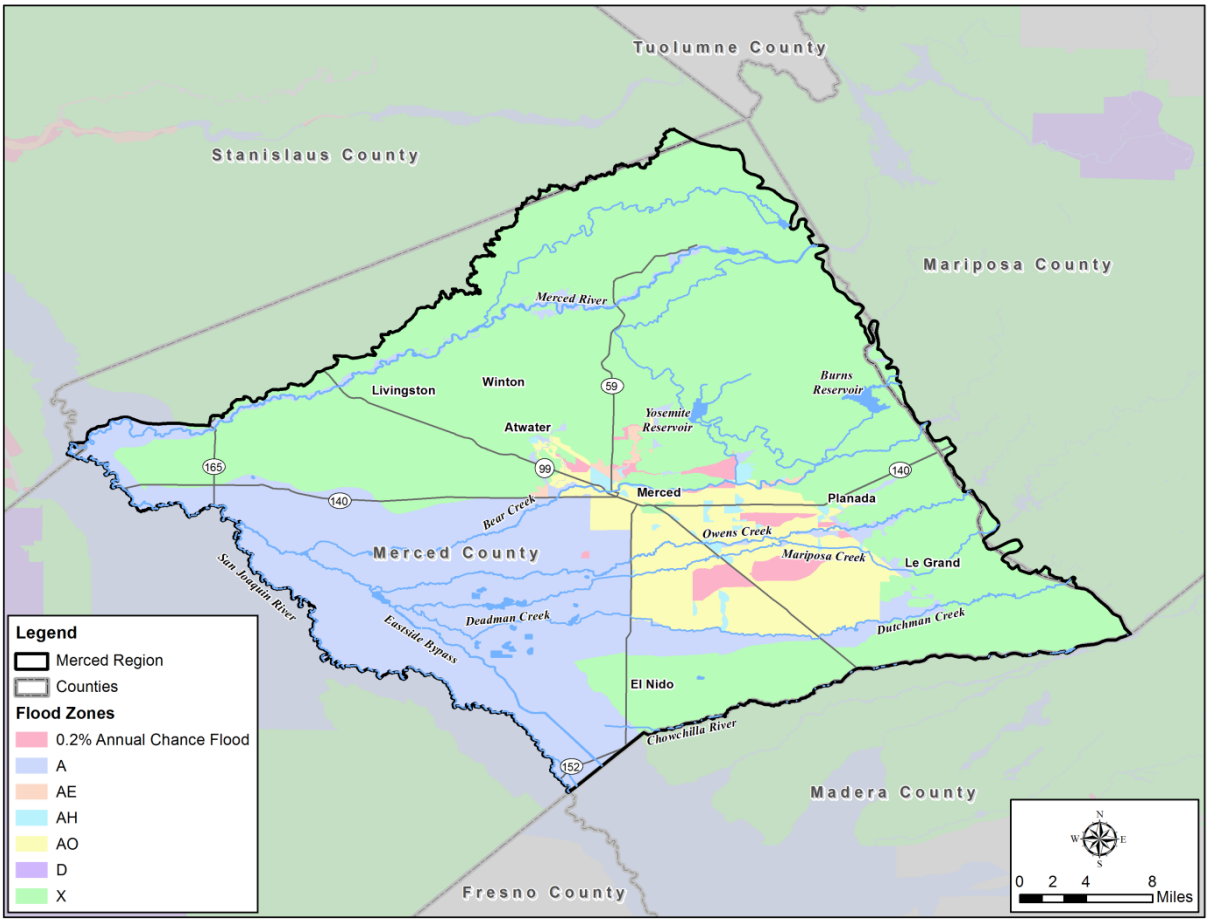
Flooding from the creeks in the Merced County Stream Groups is a recurring problem.

While regional flood management efforts have focused primarily on the Merced County Streams Group, generalized flooding occurs throughout the Region. Figure 2-8 presents an overview of areas with potential flood concerns according to mapping from the Federal Emergency Management Agency (FEMA), which is described below. In general, flood hazard zones are those subject to inundation by a one percent annual chance flood event (100 year flood) or a 0.2 percent annual chance flood event (500 year flood). As shown on Figure 2-8, several areas within the Region are classified within the FEMA-designated 100-year or 500-year flood zones, and these areas are directly related to creeks within the Merced County Stream Group such as Owens Creek and Bear Creek.

- Flood Zone A: Areas subject to inundation by the 1-percent-annual-chance flood event (100 year flood zone) but not determined by detailed methods. Mandatory flood insurance purchase requirements and floodplain management standards apply.
- Flood Zone AE: Areas subject to inundation by the 1-percent-annual-chance flood event (100 year flood zone) determined by detailed methods. Mandatory flood insurance purchase requirements and floodplain management standards apply.
- Flood Zone AH: Areas subject to inundation by 1-percent-annual-chance (100 year flood zone) from shallow flooding (usually areas of ponding) where average depths are between one and three feet (not determined by detailed methods). Mandatory flood insurance purchase requirements and floodplain management standards apply.
- Flood Zone AO: Areas subject to inundation by 1-percent-annual-chance (100 year flood) from shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet (determined by detailed methods). Mandatory flood insurance purchase requirements and floodplain management standards apply.

- Flood Zone D: Areas with possible but undetermined flood hazards.
- Flood Zone X: Areas of minimal flood hazard.
- 0.2 Percent Annual Chance Flood Hazard: Areas subject to inundation by 0.2-percent annual chance (500 year flood).

Figure 2-8: FEMA Designated Flood Zones within the Region

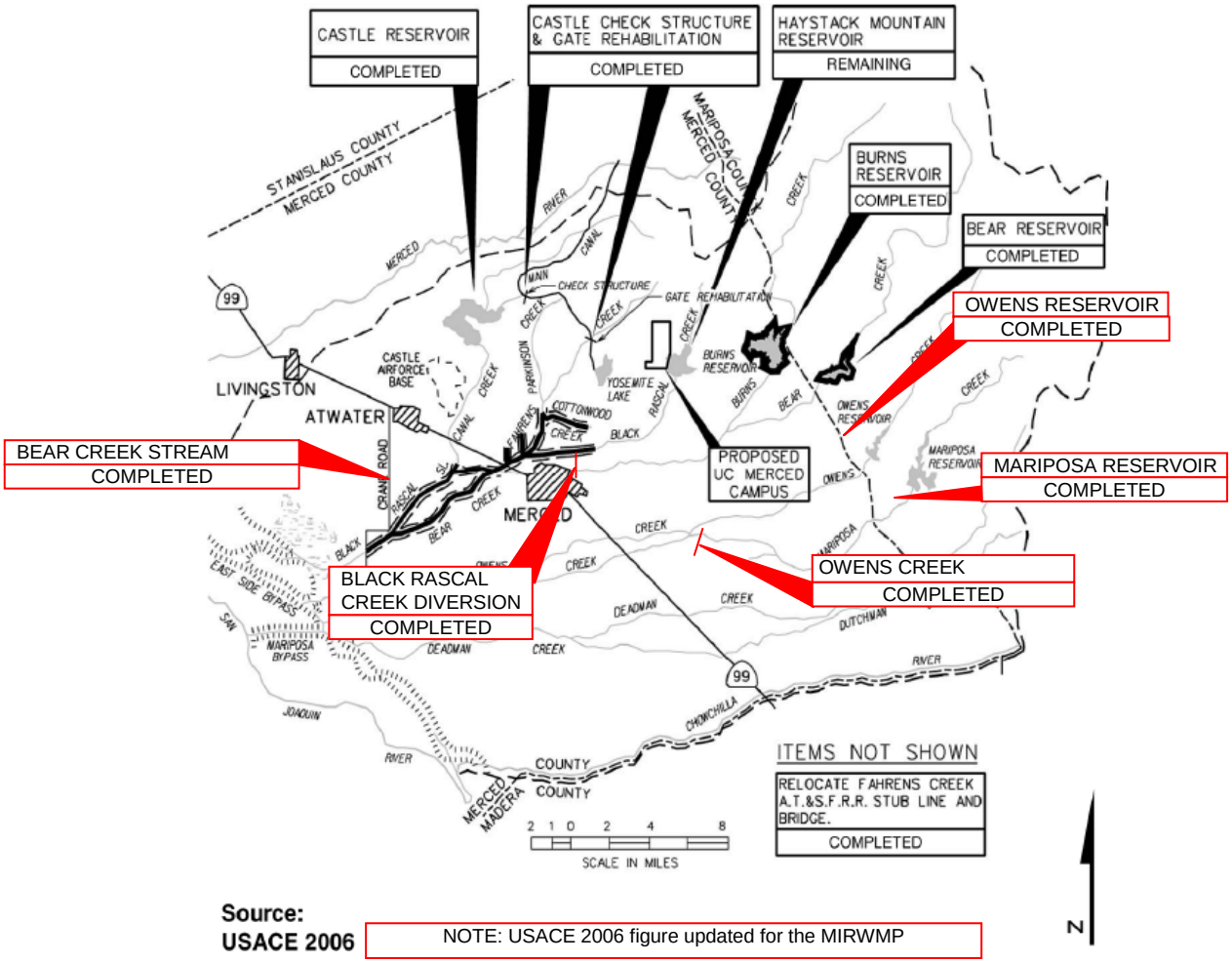


According to FEMA, approximately 380,000 acres in Merced County are located within a 100-year (1% Annual Chance Exceedance, ACE) floodplain. A significant component of the flooding in Merced appears to be caused by breakout flow over the south bank of Bear Creek upstream of Merced. This floodplain then becomes comingled with overbank flooding from Miles Creek.

Flood legislation passed in 2007 established a 200-year (0.5% ACE) level of flood protection as the standard for urban development. This means that development in a moderate-flood or high-flood hazard zone would only be allowed if the permitting agency found, based on substantial evidence in the record, that urban or urbanizing areas would be protected to a 200-year-flood level. This applies to all developed areas with population of at least 10,000 (or with plans to reach 10,000 within 10 years). Moderate-flood-hazard zones correspond to FEMA Zone B and the 0.2 Percent Annual Chance Flood Hazard. High-flood-hazard zones correspond to FEMA Zones A, AE, A1-30, AH, AO, AR and A99.

As previously noted, flood control projects in the Planning Area date back to 1944 with the Merced County Streams Group project. Figure 2-9 summarizes the USACE progress implementing the Merced County Stream Group projects. Note that Marguerite Reservoir/Dam was removed from the project prior to being implemented. The one remaining component that has not been completed is a detention basin on Black Rascal Creek, known as Haystack Dam. In addition to the reservoir projects shown in Figure 2-9, improvements along Black Rascal Creek, Bear Creek, Burns Creek, Miles Creek, Owens Creek, and Mariposa Creek were completed. Although channels were improved, very few levees were constructed, and the incised channels are subject to periodic overflows, causing widespread but relatively shallow flooding. Merced County is responsible for maintenance of channels and levees on Black Rascal Creek, Black Rascal Creek Diversion, Burns Creek, Mariposa Creek, Miles Creek, sections of Owens Creek, Owens Creek Diversion, sections of Bear Creek, and Canal Creek. MID performs maintenance of Castle Dam.

Figure 2-9: Merced County Streams Group Project Status



Source:
USACE 2006

NOTE: USACE 2006 figure updated for the MIRWMP

The Merced County Streams Group is only one of several flood control projects in the Planning Area. Figure 2-10 illustrates USACE project levees in the Planning Area, and Figure 2-11 outlines State Plan of Flood Control (SPFC) levees in the Planning Area.

Figure 2-10: USACE Project Levees

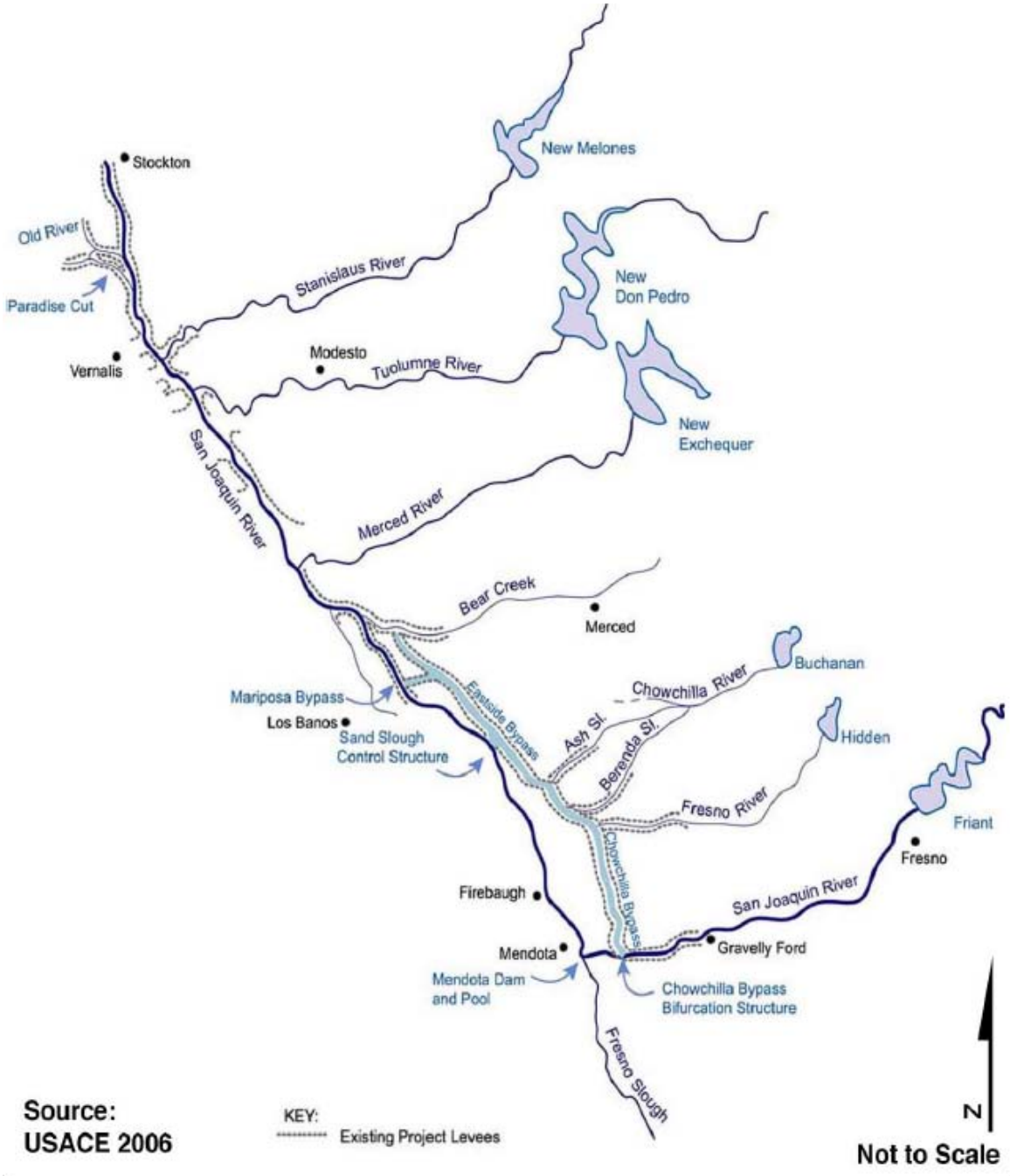
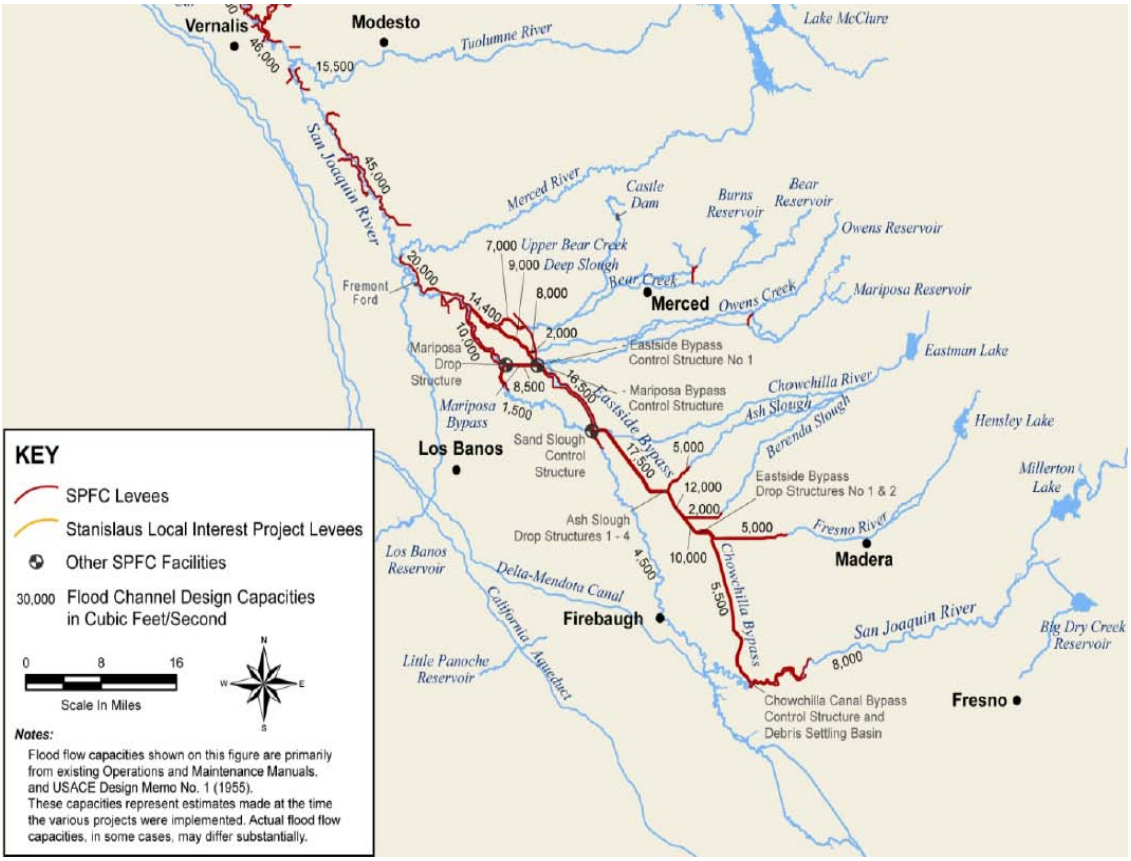


Figure 2-11: State Plan of Flood Control Levees



Appendix B contains a detailed flood management summary for the Region.

2.3.9 Water Conveyance and Storage Infrastructure

In addition to the flood control reservoirs identified in Figure 2-9, the Region is served by a number of surface water storage reservoirs both within and upstream of the Region.

Surface water storage reservoirs outside the Region include two facilities along the Merced River just northeast of the Region – New Exchequer Dam, which forms Lake McClure (1,024,000 AF) and McSwain Dam, which forms McSwain Reservoir (9,000 AF). About 83 percent of the Merced River watershed lies upstream of the Region. To capture and regulate flows from the Merced River, which is the main source of surface water supply in the Region, MID utilizes Lake McClure as its principal storage and regulating facility. McSwain Reservoir also serves as a regulating facility and as an afterbay, optimizing hydroelectric power generation at New Exchequer.

New Exchequer Dam

Within the Region, MID operates several dams. These include the PG&E Merced Falls Dam (including the associated hydroelectric facility) and the Crocker-Huffman Dam, which MID uses to divert water from the Merced River into MID's primary water conveyance canals and off-stream storage at Lake Yosemite and Castle Dam. MID also operates a number of diversion dams on Bear Creek, Miles Creek, Owens Creek, Mariposa Creek, and Deadman Creek to divert water for various beneficial uses including recharge, depending on the respective rights. In addition MID operates and maintains a number of regulating basins within its distribution area. Buchanan Dam, which impounds Eastman Lake (150,000 AF), provides surface water to areas of Chowchilla Water District within the Region.

Crocker-Huffman Dam

2.4 Natural Communities and Habitats

The Region contains a vast amount of open space and agricultural lands, which provide unique natural communities and habitats such as pristine vernal pool grasslands, highly specialized unique plant and animal species, large managed wetland preserves, and wildlife-based recreational opportunities (Merced County 2007).

The East Merced Resource Conservation District (EMRCD) works to develop and further ongoing programs to conserve natural resources in eastern Merced County (east of the San Joaquin River). EMRCD has identified three primary geographic land use regions within their jurisdiction, which nearly covers the Region in its entirety. These geographic land uses, which are important to the overall health and functioning of the watersheds within the Region, include crop and dairy lands, rangelands and vernal pools, and the Lower Merced River Corridor. Figure 2-12 provides an overview of land uses within the Region, including habitat areas.

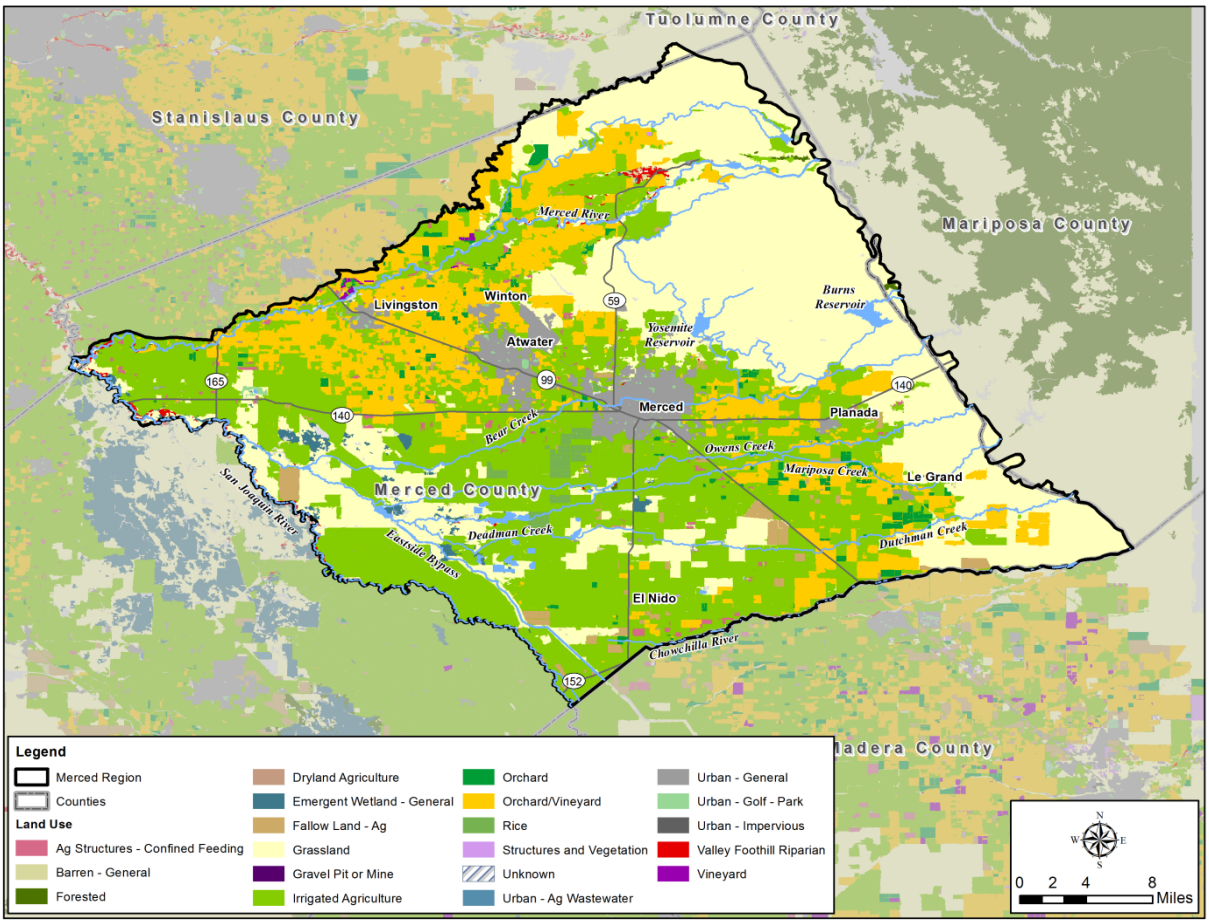
The Cities of Merced and Atwater both have conjunctive reuse programs that provide water treated from local wastewater facilities for use on crop and dairy lands and designated wetland areas. Environmental water demands are growing within the Region, as the Region enjoys vast tracks of wildlife refuges, conservation easements and duck clubs, especially along the San Joaquin River corridor.

MID provides 15,000 AFY to the Merced National Wildlife Refuge to sustain local habitats. The District also provides water transfers to local refuges such as the East Bear Creek Unit of the San Luis Wildlife Refuge when surface water is available. MID has been actively involved with various fisheries agencies in providing pulse flows with designed time, peak and duration for the purpose of attracting adult Chinook salmon since 1999. The District has entered into different agreements and transfers for providing spring pulse flows with the most recent in 2013.

MID coordinates with various fisheries agencies including the Department of Fish and Wildlife and its Merced River Fish Hatchery.

In December 2012, the SWRCB issued a Draft Substitute Environmental Document (SED) in Support of Potential Changes to the Water Quality Control Plan for the Bay-Delta: San Joaquin River Flows and Southern Delta Water Quality. The preferred alternative identified in the SED called for 35 percent unimpaired flows from February through June within the Merced, Tuolumne and Stanislaus Rivers to support spring fish populations. This proposed action has the potential to significantly change water management on the Merced River, restricting MID's ability to divert surface water and conjunctively manage the Merced Subbasin. Additionally, the proposed action has the potential to negatively impact fall-run Chinook as the changes may lead to increased temperatures of releases from reservoirs.

Figure 2-12: Regional Habitat Map

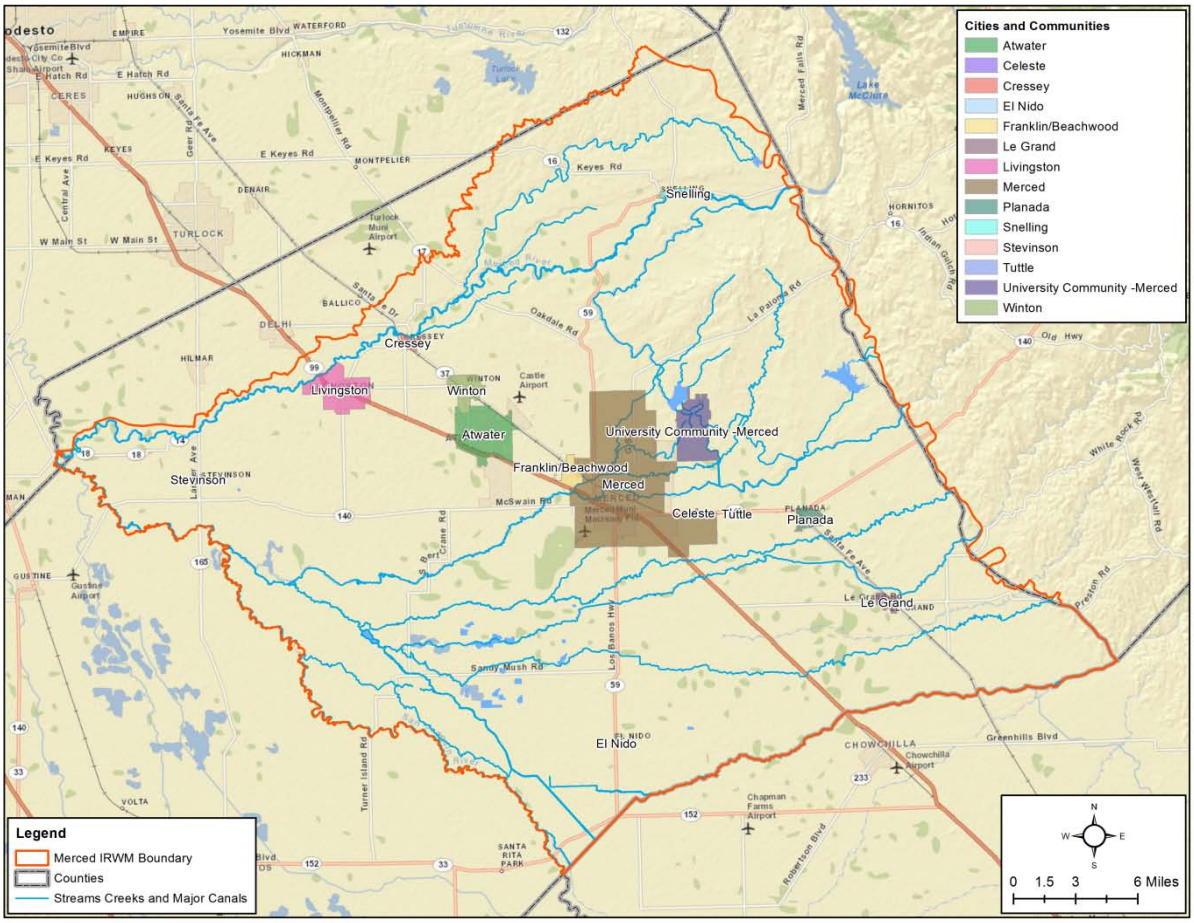


2.5 Internal Boundaries

There are five entities within the Region with land use jurisdiction: the County of Merced, the City of Merced, the City of Livingston, the City of Atwater, and the University of California, Merced (UC Merced). The cities of Merced, Atwater, and Livingston and UC Merced are contained entirely within the Region, while only a portion of the eastern portion of Merced County lies within the Region.

The Region encompasses the following unincorporated communities within eastern Merced County: Celeste, Cressey, El Nido, Franklin/Beachwood, Le Grand, Planada, Snelling, Stevinson, Tuttle, and Winton. Figure 2-13 demonstrates the location of the incorporated cities and unincorporated communities within the Region.

Figure 2-13: Merced Region Cities and Communities



2.6 Water Supplies and Demand

Water supply and demand within the Region are described in the following sections.

2.6.1 Water Supply

Water supply within the Region is primarily groundwater pumped from the Merced Subbasin. Groundwater is also withdrawn from the Turlock and Chowchilla Subbasins. In addition to groundwater sources, the Region also has local surface water sources. Local surface water sources come from the Merced, Chowchilla, Tuolumne and San Joaquin Rivers and smaller creeks and streams.

Merced Subbasin

The Merced Region overlies the Merced Subbasin. Groundwater management, historic trends and conditions, and existing and projected groundwater supplies are described in the following sections.

Groundwater Management

Management of water supplies within the Merced Subbasin is complex, involving a multitude of agencies and interested parties. MID and the City of Merced prepared a final draft Groundwater Management Plan (GWMP) in 1997 to comply with requirements of the Groundwater Management Act (also known as Assembly Bill 3030 or AB3030). Due to broad interest in groundwater management within the Region, in December 1997, water purveyors within the Merced Subbasin signed a Memorandum of Understanding (MOU) to create MAGPI, formally agreeing to work cooperatively to promote conjunctive use projects within the Merced Subbasin. MAGPI has a Board of Directors of fifteen agencies and one non-purveyor member at large (EMRCD) that hold open public meetings associated with groundwater management in accordance with provisions of AB3030. The MAGPI Board of Directors is comprised of the following agencies:

- Merced County
- City of Merced
- City of Atwater
- City of Livingston
- Winton Water and Sanitary District
- Meadowbrook Water Company
- Planada Community Service District
- Le Grand Community Service District
- Black Rascal Water Company
- Merced Irrigation District
- Stevinson Water District
- Le Grand-Athlone Water District
- Turner Island Water District
- Merquin County Water District
- Lone Tree Mutual Water Company
- East Merced Resource Conservation District

In 2008, MAGPI adopted a Groundwater Management Plan Update (2008 GWMP Update), which supersedes the 1997 GWMP produced by MID and the City of Merced.

Groundwater Levels and Historical Trends

According to the 2008 GWMP Update, Merced Subbasin groundwater elevations have been monitored by DWR, MID, and other entities since the 1950's. This monitoring data demonstrates that since 1980, average groundwater levels beneath the Merced Subbasin have declined approximately 14 feet, with most of this decline occurring between 1980 and 1996. As such, the Merced Subbasin is considered to be in a state of mild long-term groundwater level decline. However, a notable exception to this trend is the El Nido area, where the rate of groundwater level decline has shown a substantial decrease since 1980 due to increased delivery of surface water to the area by MID. Decline in groundwater is normalized over the entire base; however, local decreases ranged from 5 feet in the southwesterly area to more than 50 feet south of Le Grand, along the Chowchilla River.

Water supply within the Region is primarily groundwater pumped from the Merced Subbasin. This photo shows a typical MID groundwater well.

Existing and Projected Groundwater Supplies

According to the 2008 GWMP Update, groundwater levels within the Merced Subbasin declined by an average of approximately 3.7 feet per year between 1995 to 2007. Using an assumption of a 9.0 percent average specific yield, this decline in groundwater levels represents a decrease in storage capacity of approximately 117,200 AF. Historical data suggests that the Merced Subbasin experiences periods of long-term groundwater level decline and subsequent recovery, with a general trend toward mild groundwater level decline and a cumulative decrease in storage of approximately 720,000 AF from 1980 to 2007. Although there have been attempts to estimate safe yield in the basin, a defensible and robust safe yield estimate will require a comprehensive hydrologic and groundwater study. MAGPI is in the process of developing an Integrated Water Resources Model, which, once developed, will be used to estimate the safe yield of the Merced Subbasin. This estimate will guide the long-term management of the groundwater Basin and the water supplies in the Region.

Available groundwater supply is difficult to estimate for the Region, as groundwater supplies depend upon numerous varying factors. Groundwater is frequently used by private pumpers to meet demands not met by surface water supplies. As such, groundwater pumping generally increases in drought years when there is not enough surface water available to meet water demands.

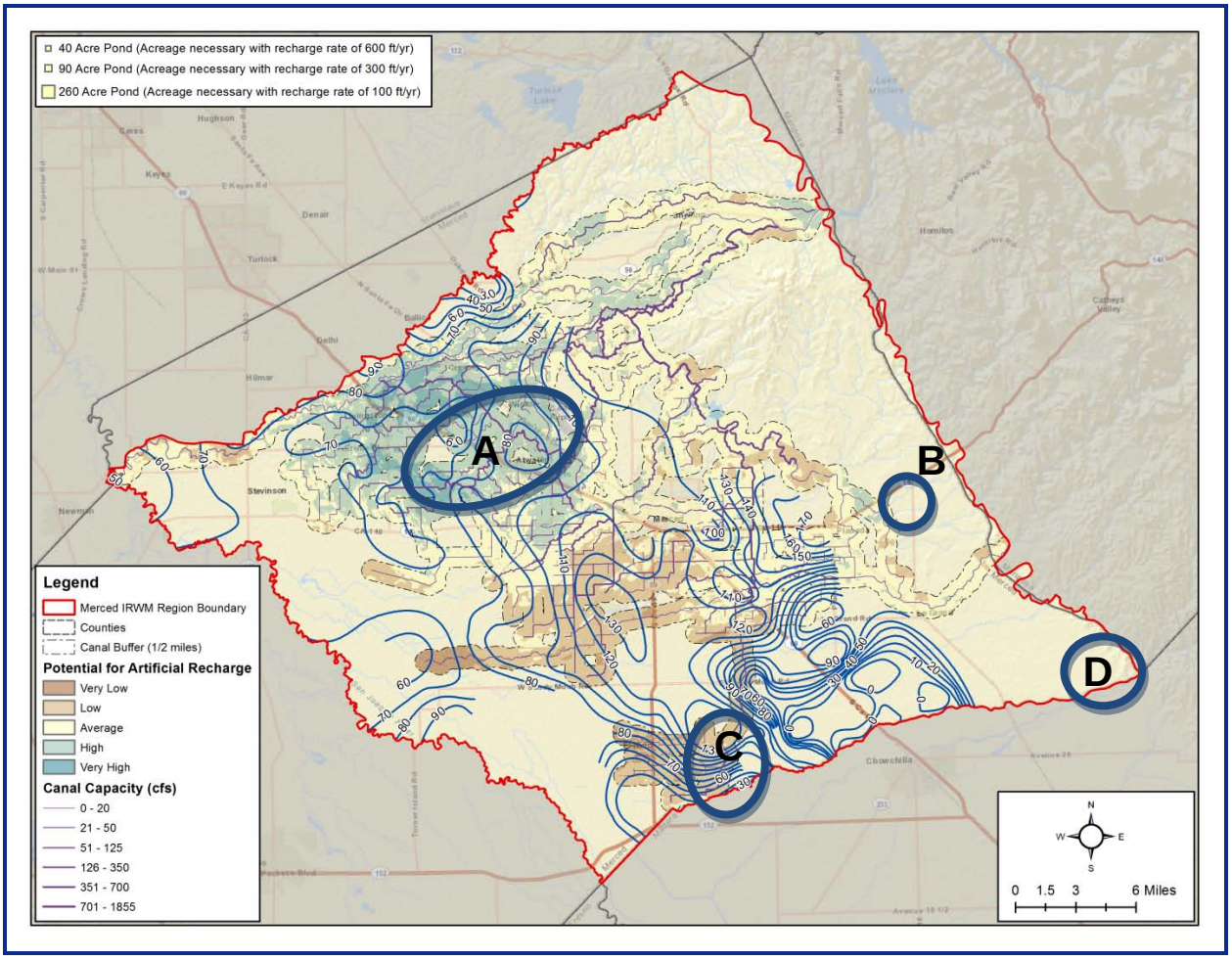
In order to address groundwater overdraft, the *Merced Water Supply Plan Update – Final Status Report* recommends taking actions to stabilize groundwater elevations in the Merced Subbasin to 1999 levels, which were approximately 160 feet above mean sea level. The City of Merced and MID created a Merced Water Supply Task Force, which is comprised of City Council and MID Board members, that is working to implement recommended actions included in the *Merced Water Supply Plan Update – Final Status Report*, which will move the Region forward in stabilizing groundwater elevations in the Merced Subbasin to 1999 levels.

Groundwater Recharge

As part of the IRWM planning effort, the Region completed a Groundwater Recharge Feasibility Study (see Appendix C). The purpose of this study was to define areas with high potential for recharge. An understanding of areas with high potential for recharge and factors that influence recharge assists in identifying where recharge projects should be considered, where recharge is occurring currently and where existing land use has impacted recharge. Identification of recharge areas and mechanisms can also assist in preserving and managing important natural features such as riparian areas or stream channels. Anthropogenic recharge, particularly deep percolation from agricultural irrigation and earthen-lined canals, is a key source of recharge in the Merced Region. Identifying where this and other human-influenced recharge is occurring provides an assessment of current recharge and assist in the recognition of the effects of land use change.

Four opportunity areas were identified through the Recharge Feasibility Study, as shown in Figure 2-14.

Figure 2-14: Groundwater Recharge Opportunity Areas



Surface Water

Surface water is primarily supplied to the Region from the Merced River. Merced River supplies originate from diversions into the MID distribution system through the Northside Canal from the Merced Falls Dam, and through the Main Canal from the Crocker-Huffman Diversion Dam. From 1994 to 2007, MID diversions from the Merced River ranged from 430,600 AFY to 571,400 AFY, with an average of approximately 499,400 AFY. The amount of surface water available for use within the Region varies depending upon the amount of water present.

Surface water is primarily supplied to the Region from diversions along the Merced Region. This photo shows MID's Main Canal Diversion.

Other surface water sources include the Chowchilla and San Joaquin Rivers and permanent and ephemeral streams such as Bear Creek, Black Rascal Creek, Burns Creek, Canal Creek, Cottonwood Creek, Deadman Creek, Fahrens Creek, Little Dutchman Creek, Mariposa Creek, and Owens Creek. Gauging stations located on Burns Creek, Bear Creek, Mariposa Creek, and Owens Creek indicate that since 1993, annual outflow from the Region's creeks has ranged from 15,000 AFY to 238,700 AFY, with an average of approximately 94,000 AF. DWR estimates that approximately half of the inflow from surface water bodies (approximately 47,000 AFY) infiltrates and recharges the Merced Subbasin.

Water Supply Projections

Water supply projections for the Region are presented in Table 2-4. These projections are based on supply projections from each urban water supplier's most recent UWMP and best available data for other municipal and agricultural water suppliers.

Table 2-4: Anticipated Water Supply through 2035

	2010 (AFY)	2015 (AFY)	2020 (AFY)	2025 (AFY)	2030 (AFY)	2035 (AFY)
Municipal						
City of Atwater[1]	12,712	14,737	17,084	19,805	19,805	19,805
City of Livingston[2]	21,059	34,500	41,968	48,502	51,302	51,302
City of Merced[3]	25,945	43,208	46,879	53,708	62,111	62,111
Le Grand CSD[4]	2,016	2,016	2,016	2,016	2,016	2,016
Planada CSD[4]	4,817	4,817	4,817	4,817	4,817	4,817
Winton Water and Sanitary District[4]	6,777	6,777	6,777	6,777	6,777	6,777
Black Rascal Water Company[5]	139	139	139	139	139	139
Meadowbrook Water Company[5]	1,220	1,220	1,220	1,220	1,220	1,220
Agricultural						
MID – Groundwater[6]	9,500	6,500	2,000	1,000	0	0
MID – Surface Water[7]	516,110	516,110	516,110	516,110	516,110	516,110
Le Grand/Athlone Water District[5]	372	372	372	372	372	372
Merquin County Water District[5]	14,281	14,281	14,281	14,281	14,281	14,281
Stevinson Water District[8]	28,000	28,000	28,000	28,000	28,000	28,000
Turner Island Water District[5]	21,000	21,000	21,000	21,000	21,000	21,000
Chowchilla Water District[9]	43,000	43,000	43,000	43,000	43,000	43,000

Notes:

1. Water supply projections from City of Atwater 2005 UWMP are available through 2025. Water supplies after 2025 are assumed to be equivalent to 2025 conditions.
2. Water supply projections from City of Livingston 2005 UWMP are available through 2030. Water supplies after 2030 are assumed to be equivalent to 2025 conditions.
3. Water supply projections from City of Merced 2010 UWMP are available through 2030. Water supplies after 2030 are assumed to be equivalent to 2030 conditions.
4. Water supply projections assume the current capacity of groundwater supply infrastructure remains constant through 2035.
5. Water supply projections assume the supply is equal to recent estimates of demand.
6. MID groundwater supply projections were provided by MID staff. MID groundwater pumping increases during drought years as part of its conjunctive management.
7. MID surface water supply projects assume MID's water rights remain constant. According to the MID Water Management Plan, MID has water rights that allow withdrawal and storage of up to 516,110 AF of surface water from the Merced River per year. As discussed in Section 2.4 Natural Communities and Habitats, the SWRCB is proposing to reduce diversions from Merced River, which would curtail the use of the Merced River as a supply source for the Region; however at this time the outcome of the SWRCB is unknown.
8. Water supply projections based on communication with Stevinson Water District.
9. Chowchilla Water District water supply projections assume the District maintains delivery of 43,000 AFY from Buchanan Dam. Chowchilla Water District also receives water from the Madera Canal; supply from Madera Canal is not included in these projections.

2.6.2 Water Demand

Water demand within the Region is variable, depending upon land use, population, and agricultural specifics such as the types of crops grown. Water demand projections for the Region are presented in Table 2-5. The projections for urban demands are based on projections from each urban water supplier's most recent UWMP and demands for the unincorporated areas are based on estimates developed for the Merced County General Plan Update.

Table 2-5: Anticipated Water Demand through 2035

	2010 (AFY)	2015 (AFY)	2020 (AFY)	2025 (AFY)	2030 (AFY)	2035 (AFY)
Municipal						
City of Atwater[1]	12,712	14,737	17,084	19,805	22,975	26,650
City of Livingston[2]	10,305	15,122	18,258	21,843	22,642	23,548
City of Merced[3]	23,660	30,066	32,502	38,168	44,419	51,526
Unincorporated Urban Areas[4]	ND	ND	ND	8,050	8,050	8,050
Agricultural						
MID[5]	305,000	305,000	305,000	305,000	305,000	305,000
Le Grand/Athlone Water District[6]	372	372	372	372	372	372
Merquin County Water District[5]	14,281	14,281	14,281	14,281	14,281	14,281
Stevinson Water District[7]	25,000	25,000	25,000	25,000	25,000	25,000
Turner Island Water District[5]	21,000	21,000	21,000	21,000	21,000	21,000
Chowchilla Water District	ND	ND	ND	ND	ND	ND

Notes:
ND = No Data

1. Water demand projections from City of Atwater 2005 UWMP are available through 2025. Water demands after 2025 are calculated assuming the growth rate between 2020 and 2025 remains constant in the future.
2. Water demand projections from City of Livingston 2005 UWMP are available through 2025. Water demand for 2035 assumes the growth rate between 2030 and 2035 is equivalent to that of 2025 and 2030. The City of Livingston 2005 UWMP is based on projections from the City of Livingston 2025 General Plan, which have been challenged. The City of Livingston is in the process of updating its UWMP, and the projections presented in the MIRWMP should be revised to reflect the updated projections when available.
3. Water demand projections from City of Merced 2010 UWMP are available through 2030. Water demand for 2035 assumes the growth rate between 2030 and 2035 is equivalent to that of 2025 and 2030.
4. Unincorporated urban demands are based on the Qualitative Comparison of Water Supply and Demands In Merced County Technical Memorandum prepared for the Merced County General Plan Update, which provides estimates of urban demands at buildout. Buildout conditions are assumed to occur in 2025.
5. Water demand projections assume the existing demands remains constant through 2035. Existing demands are based on the Qualitative Comparison of Water Supply and Demands In Merced County Technical Memorandum prepared for the Merced County General Plan Update.
6. Water demand projection assumes the existing demands remains constant through 2035. Existing demands are based on MID Water Management Plan.
7. Water demand projection assumes the existing demands remain constant through 2035. Existing demands based on communication with Stevinson Water District.

The Merced Subbasin is not regulated through a joint powers authority or adjudication. Therefore, there are no defined legal pumping rights or constraints on groundwater pumping for groundwater users in the Region. In addition, groundwater demands (groundwater use) are difficult to record within the Region, because there are numerous un-metered private groundwater wells. Modeling efforts indicate that groundwater demands are highest during dry years, likely due to the fact that groundwater is primarily used for agricultural irrigation. Conversely, modeling data indicates that during wet years when surface water is abundant, groundwater pumping is significantly decreased. This modeling data reinforces the trend noted previously, in which groundwater levels stabilize or recover to a higher elevation during multiple wet years. An integrated groundwater and surface water model is being pursued by the Region to better characterize water demands.

2.7 Water Quality

Water quality objectives for the Region are established within the Water Quality Control Plan for the San Joaquin River Basin (Basin Plan). The Basin Plan is intended to protect surface and groundwater quality throughout the San Joaquin River Basin, which includes the Merced Region. Maximum contaminant levels (MCLs), established by the U.S. Environmental Protection Agency (USEPA) under the Safe Drinking Water Act, are the standard by which water quality is described throughout this section. MCLs are the maximum allowable concentration of contaminants in surface or groundwater delivered as drinking water following any required treatment.

2.7.1 Groundwater Quality

Groundwater within the Merced Subbasin contains both man-made and naturally occurring constituents. Some of these constituents either currently impact or have the potential to impact groundwater use within the Region in the future. A salinity and nutrient study was completed as part of the IRWM planning effort to establish the baseline water quality conditions within the Merced Region. Information from the study (see Appendix D) is summarized in this section.

Salinity

Groundwater salinity results from the presence of various salts, metals, and inorganic compounds dissolved in groundwater. Salts are composed of positively charged cations and negatively charged anions that dissociate when dissolved in water. Common dissolved salts in groundwater include calcium (Ca^{+}), sodium (Na^{+}), potassium (K^{+}), chloride (Cl^{-}), carbonate (CO_3^{-}), sulfate (SO_4^{-}) and perchlorate (ClO_4^{-}). Common dissolved metals and nutrients in groundwater include arsenic (As), iron (Fe^{+}), hexavalent chromium (Cr^{6}), manganese (Mn^{+}), nitrate (NO_3^{-}), potassium (K^{+}), and phosphate (PO_4^{3-}).

Historically, groundwater beneath the Merced Region has been categorized as primarily calcium-bicarbonate to sodium-bicarbonate type water due to variability in soil conditions, soil type, geologic structure, irrigation practices, and irrigation water quality, especially in the upper water-bearing zone. Sodium-rich groundwater may require the addition of soil amendments (such as gypsum) in order to percolate through soil, increasing salt loading in the Merced Region. In general, groundwater salinity is lowest in the easterly portion of the Merced Region, and increases westward toward the San Joaquin River and southward toward the Chowchilla River. A small area of predominantly sodium-chloride type water has been identified near the confluence of the Merced and San Joaquin rivers.

Salinity, which is generally measured by total dissolved solids (TDS), has an MCL of 1,000 (upper limit) to 1,500 (short-term limit) mg/L. TDS in the eastern two-thirds of the Merced Subbasin generally measures less than 500 mg/L. In these areas, high TDS water is found in wells deeper than 350 feet, although shallow wells generally contain TDS levels below 1,000 mg/L.

In general, groundwater with high concentrations of TDS is present throughout the Merced Subbasin, generally located at depths between 400 to 800 feet. Saline waters originating from ancient marine sediments are migrating upward and mixing with freshwater in the basin. This process results from natural conditions; however, pumping of deep wells within the western and southern parts of the Merced Subbasin may cause these saline waters to upwell and mix with fresh water more rapidly than under natural conditions.

Nitrate

Nitrate originates from both natural and man-made sources, and can be found in groundwater in many parts of the San Joaquin Valley. Elevated nitrate concentrations are generally of concern for potable water supplies, and are not a concern for many crops because they act as a fertilizer. However, crops such as grape vineyards may be adversely impacted by high nitrate concentrations.

The MCL for nitrate is 45 mg/L as NO_3 (equivalent to 10 mg/L for nitrate as N) for public drinking water supplies, and several municipal water districts have reported wells that have reached or are approaching the MCL. High nitrate concentrations in groundwater are often associated with the use of fertilizers (commercial/animal waste) and onsite wastewater treatment systems (OWTS or septic systems). Within the Merced Region, nitrate concentrations range from non-detect (less than 2 mg/L) to as high as 330 mg/L. The 5-year average (2007 through 2012) nitrate concentration in groundwater in the Merced Region is generally less than 20 mg/L. In the northwest quadrant, there is a small area where nitrate concentrations exceed 200 mg/L and several larger areas where nitrate concentrations range from 20 to 40 mg/L. The elevated NO_3 concentration in these areas may be associated with animal confinement facilities and other agricultural non-point sources. Elevated nitrate in groundwater exists in small areas northeast of Merced and southwest of Atwater among areas where high densities of OWTSs occur.

Chloride

Chloride (Cl) is a dissolved salt commonly associated with saline groundwater. Within the Merced Region, Cl concentrations range from non-detect (less than 2 mg/L) to as much as 1,850 mg/L. The recommended secondary MCL for chloride is 250 mg/L and the upper secondary MCL is 500 mg/L (CDPH, 2011). The 5-year average (2007 through 2012) chloride concentration in groundwater in the northern two quadrants of the Merced IRWM area is generally less than 50 mg/L. Like TDS, chloride in groundwater increases in the southern quadrants towards the San Joaquin River to as much as 500 mg/L.

Iron and Manganese

Iron and manganese are both regulated through secondary MCLs, which are non-enforceable guidelines that regulate contaminants that affect drinking water aesthetics. The secondary MCLs for iron and manganese are 0.3 mg/L and 0.05 mg/L, respectively.

Groundwater in some portions of the Merced Subbasin contains elevated iron and manganese concentrations that exceed the secondary MCLs. Such areas are generally at shallow depths where oxygen levels are low or associated with shallow groundwater areas near streams.

Arsenic

Arsenic, which can have human health impacts, is naturally found within many bedrock formations. The current California MCL for arsenic is 0.010 mg/L. The 5-year average (2007 through 2012) arsenic concentration in groundwater in the northern two quadrants of the Merced Region is generally less than 0.010 mg/L. There are localized areas where the average arsenic concentrations in shallow groundwater range between 0.020 and 0.050 mg/L northeast of Atwater, near Stevenson, and in the southwest Merced IRWM area near the intersection of Sandy Mush Road and Highway 59.

Hexavalent Chromium

Hexavalent Chromium (Cr6) is a dissolved metal that rarely occurs naturally and can be associated with industrial contamination in groundwater. While there is currently no primary MCL for Cr6, Cr6 is a component of total chromium and is therefore regulated under the total chromium MCL. The primary MCL for total chromium is 50 micrograms per liter (µg/L) (CDPH, 2011). Within the Merced Region, Cr6 concentrations range from non-detect (less than 0.01 microgram per liter, or µg/L) to as high as 370 µg/L. The 5-year average (2007 through 2012) Cr6 concentration in groundwater in the Merced Region is generally less than 1 µg/L, except for a small area in the northwest quadrant where concentrations exceed 100 µg/L. This area of elevated Cr6 concentrations is likely associated with point sources.

Radionuclides

Radionuclides, including alpha particles and uranium, have MCLs of 15 picocuries per liter and 30 µg/L, respectively. Data for radionuclides in the Region is not available at this time, and testing for these constituents is generally limited to public water systems.

Bacteria

Levels of bacteria within the Merced Subbasin are generally acceptable for deep groundwater aquifers. Bacteria is of primary concern for drinking water systems, and bacteria is regulated based on the number of service connections within a given drinking water system. The California Department of Public Health (CDPH) requires testing for pathogens (disease-causing organisms) and indicator organisms within drinking water systems. Elevated bacteria in groundwater can occur due to inadequate construction, improperly located, destroyed, and abandoned groundwater wells, and improper use of groundwater wells for waste disposal.

Perchlorate

Perchlorate occurs from both natural and man-made sources and is widespread in groundwater in many parts of the San Joaquin Valley. High perchlorate concentrations in groundwater are often associated with the use of nitrate fertilizer or munitions manufacturing. Within the Merced Region, perchlorate concentrations range from non-detect (less than 2 mg/L) to as high as 4 µg/L. The primary MCL for perchlorate is 6 µg/L (CDPH, 2011). The 5-year average (2007 through 2012) perchlorate concentration in groundwater in the Merced Region is generally less than 1 mg/L. Slightly elevated perchlorate concentrations observed in groundwater beneath the Atwater area may be associated with point sources.

Petroleum Hydrocarbons

Petroleum hydrocarbons, including oxygenates such as methyl-tertiary-butyl-ether (MTBE), have been released from underground storage tanks (USTs). Most of these cases are localized in nature, and spills associated with USTs are regulated by the SWRCB and the Merced County Division of Environmental Health (MCDEH). MCDEH has a contract with the SWRCB to provide mitigation services to define and clean up releases resulting from leaking USTs.

The 5-year average (2007 through 2012) MTBE concentration in groundwater in the Merced Region is generally less than 5 µg/L, with elevated concentrations found in localized urban areas along Highway 99 and beneath the Atwater area

Pesticides

DBCP, a pesticide banned in 1977, continues to be found in groundwater within the Region. The MCL for DBCP is 0.0002 mg/L (0.2 µg/L), as DBCP can potentially be a carcinogen even at very low concentrations. DBCP has been found in public and domestic water supply wells.

In addition, the cleaning and degreasing solvent, 1,2,3-trichloropropane (1,2,3-TCP), also used as a soil fumigant, has been detected in the Merced Region, with elevated concentrations found in localized areas in the northwest quadrant and beneath the City of Merced. Until the MCL is developed, CDPH is utilizing a Notification Level of 0.005 µg/L (CDPH, 2012). The California Office of Environmental Health Hazard Assessment (OEHHA) has set a Public Health Goal (PHG) for 123-TCP of 0.0007 µg/L.

Ethylene dibromide (EDB), a related nemacide banned in the 1980's, has also been detected in at least one public water supply well and several domestic wells in the Atwater/Livingston area.

Trichloroethylene

Trichloroethylene (TCE) is a volatile organic compound (VOC) used as a solvent for dyes, rug cleaners, and as a degreaser for metal parts. The MCL for TCE is 0.005 mg/L due to carcinogenicity.

TCE has been detected at levels exceeding the MCL in two locations in the Merced Subbasin. These areas, the Castle Airport Aviation and Development Center and the City of Merced's Eastern Industrial Park, are both undergoing remediation activities.

Perchloroethylene

Perchloroethyene (PCE), which is also a VOC, has been detected in isolated public water supply wells within the Merced Subbasin. This contaminant is typically associated with industrial wastewater and dry-cleaning operations.

2.7.2 Surface Water Quality

Surface water quality varies throughout the Region, and is dependent upon climate, geology, and land use. In general, surface water quality within the Region is moderately impacted by salinity, as agriculture and the Delta-Mendota Canal may contribute to salinity intrusion in close proximity to the San Joaquin River. However, moving from east to west (toward the valley floor), water quality tends to be poorer due to diversions and regulations that decrease flows and due to agricultural return flows that may contain pollutants.

Samples of Merced River water collected near the Crocker-Huffman Diversion Dam between September 2011 and December 2012 indicate that the Merced River water is mostly calcium-bicarbonate type water, which is typical of most surface water derived from Sierra Nevada sources.

The Central Valley RWQCB is responsible for compiling a list of water bodies within the Sacramento River and San Joaquin River Basins that are classified as impaired according to standards set forth in the Clean Water Act. This list, also known as the 303(d) list, names specific water bodies that have water quality conditions that do not meet or are not expected to meet applicable water quality standards. Those water bodies listed on the 303(d) list must be addressed through the development of Total Maximum Daily Loads (TMDLs) that demonstrate the total mass loading of water quality constituents that may enter each water body without violating applicable water quality standards. Table 2-6 provides an overview of water bodies on the 303(d) list, as well as the corresponding pollutants, any known potential sources of pollutants, and the date of anticipated completion for applicable TMDLs.

Table 2-6: 303(d) Listed Impaired Water Bodies within the Region

Water Body[1]	Pollutant/ Stressor	Potential Sources	Expected TMDL Completion Date
Deadman Creek	Chlorpyrifos[2]	Agriculture	2021
	Escherichia coli (E. Coli)[3]	Unknown	2021
Duck Slough	Chlorpyrifos	Agriculture	2021
	Copper[4]	Unknown	2021
	E. Coli	Unknown	2021
	Lead[4]	Unknown	2021
	Sediment Toxicity	Unknown	2021
	Unknown Toxicity	Unknown	2021
Miles Creek	Diuron[5]	Agriculture	2021
Merced River, Lower (McSwain Reservoir to San Joaquin River)	Chlorpyrifos[2]	Agriculture	2008
	Diazinon	Agriculture	2008
	Group A Pesticides	Agriculture	2011
	Mercury	Agriculture	2019
	Temperature, water	--	2021
	Unknown Toxicity[6]	--	2021
San Joaquin River (Mud Slough to Merced River)	Boron	Agriculture	2006
	DDT	Agriculture	2011
	Electrical Conductivity	Agriculture	2006
	Group A Pesticides	Agriculture	2011
	Mercury	Resource Extraction	2020
	Selenium	Agriculture	1996

Notes:
1. Water body designations are based on designations from the Central Valley RWQCB 303(d) list. The San Joaquin River, which forms the western boundary of the Merced Region, is influenced by areas within the Merced Region as well as areas outside the Region.
2. Chlorpyrifos is a pesticide.
3. *E. Coli* is a bacteria commonly found in the digestive system of animals.
4. Copper, lead, and selenium are all metals.
5. Diuron is a pesticide specifically targeted at plants (an herbicide).
6. The Unknown Toxicity designation is based on observed affects on aquatic life for which the source is unknown.

In 2003, the Central Valley RWQCB instituted the Irrigated Land Regulatory Program aimed at monitoring and setting rules for discharges from irrigated lands to waters of the State, which include natural streams and all public conveyance systems. Growers within the Region can seek coverage under the East San Joaquin River Water Quality Coalition which monitors and prepare Water Monitoring Plans to the Board. Raised canals within the Region tend to have better water quality than manmade drains and local creeks. In fact, MID facilities were designated as a low threat area by the Board after multiple years of sampling and reporting.

2.7.3 Recycled Water Quality

Wastewater reclamation plants are operated by municipalities to treat and discharge effluent back into the Merced Region. The cities of Atwater and Merced and the community of Planada discharge treated wastewater to land under NPDES permits. Treated water from all three treatment plants meet the discharge requirements specified by their respective NPDES permits. A review of available effluent water quality data on the California Integrated Water Quality System Project database indicates that Merced is discharging sodium-bicarbonate type water and Planada is discharging calcium-bicarbonate type water. These waters are reused for agricultural purposes.

2.7.4 Stormwater Quality

The City of Atwater, the City of Merced, the County of Merced, and MID are co-permittees (the Merced Storm Water Group) that jointly implement a regional Storm Water Management Program covering the majority of the Region as well as a small portion north of the Region surrounding the unincorporated community of Delhi. While the Storm Water Group's Stormwater Management Program does not cover the entirety of the Region, it does address stormwater pollution within the major urban and developed areas in the Region where stormwater quality is of greatest concern (Merced Storm Water Group 2007).

The Merced Storm Water Group's Storm Water Management Program addresses priority pollutants that are common in stormwater runoff from municipal areas, and therefore addresses the following pollutants: sediment, nutrients, organic materials, pathogens, hydrocarbons, metals, synthetic chemicals, chlorides, and trash and debris.

2.7.5 Drinking Water Quality

As discussed previously, drinking water is provided within the Region via a multitude of water supply agencies. Drinking water quality is regulated through several agencies, including CDPH and the United States Environmental Protection Agency (USEPA), entities responsible for setting MCLs for various water quality constituents to protect human health. Drinking water supplied by the Region's water purveyors to incorporated cities and unincorporated communities is therefore required to comply with state and federal drinking water quality standards.

2.8 Social and Cultural Composition

The Region is home to a diverse and growing population. The following sections describe Regional demographics.

2.8.1 Population and Housing Information

In general, population in the Region is growing at a rapid rate, with average growth rates for the incorporated cities and Merced County exceeding 20% from 2000 to 2010 - approximately twice the rate for California as a whole (US Census Bureau 2010). Continued population growth within the Region has the potential to impact water management as domestic water demands and wastewater generation increase. Historically, agricultural water demands have dominated in the Region, so as population increases within the Region, water supply management will need to adapt to accommodate increasing municipal and domestic needs associated with urban development (Merced County 2007).

Table 2-7 provides an overview of population and household statistics for the incorporated cities of Merced, Atwater, and Livingston, as well as the larger unincorporated communities within the Region. As shown in this table, the average household sizes in Winton, Planada, and Livingston exceed the statewide average. This is likely due to the fact that average cost of living is relatively high in those communities, which is compounded by the fact that each community also has lower than average median household income. As such, people living within these communities generally have larger than average household sizes to reduce individual expenses related to housing.

Table 2-7: 2010 Population and Housing Data for the Region

City or Community	Population	Average Household Size	Housing Units	% Owner Occupied	% Rental Units
El Nido	330	3.51	105	51%	49%
Winton	10,613	3.90	3,056	53%	47%
Le Grand	1,659	3.62	503	69%	31%
Planada	4,584	4.11	1,207	58%	42%
Merced	78,958	3.13	27,446	43%	57%
Atwater	28,168	3.18	9,771	56%	45%
Livingston	13,058	4.14	3,320	61%	39%
California	**37,253,956**	**3.88**	**13,680,081**	**57.4%**	**42.6%**

2.8.2 Economic Profile

A DAC is defined by the State of California as a community with an annual MHI that is less than 80% of the statewide MHI. The 2010 State MHI was $60,883; therefore, communities with an average MHI of $48,706 or less are DACs by the State's definition. Communities in the Merced Region which meet the State's definition of a DAC are Planada, Winton, Le Grand, El Nido, Livingston, Merced, Atwater and Snelling (Figure 2-15). Based on location knowledge of economic conditions, the Merced Region considers the following communities to be DACs:

- Planada
- Winton
- Le Grand
- El Nido
- Livingston
- Merced
- Atwater
- Franklin/Beachwood
- Snelling
- Stevinson

Figure 2-15: Disadvantaged Communities Recognized by the State

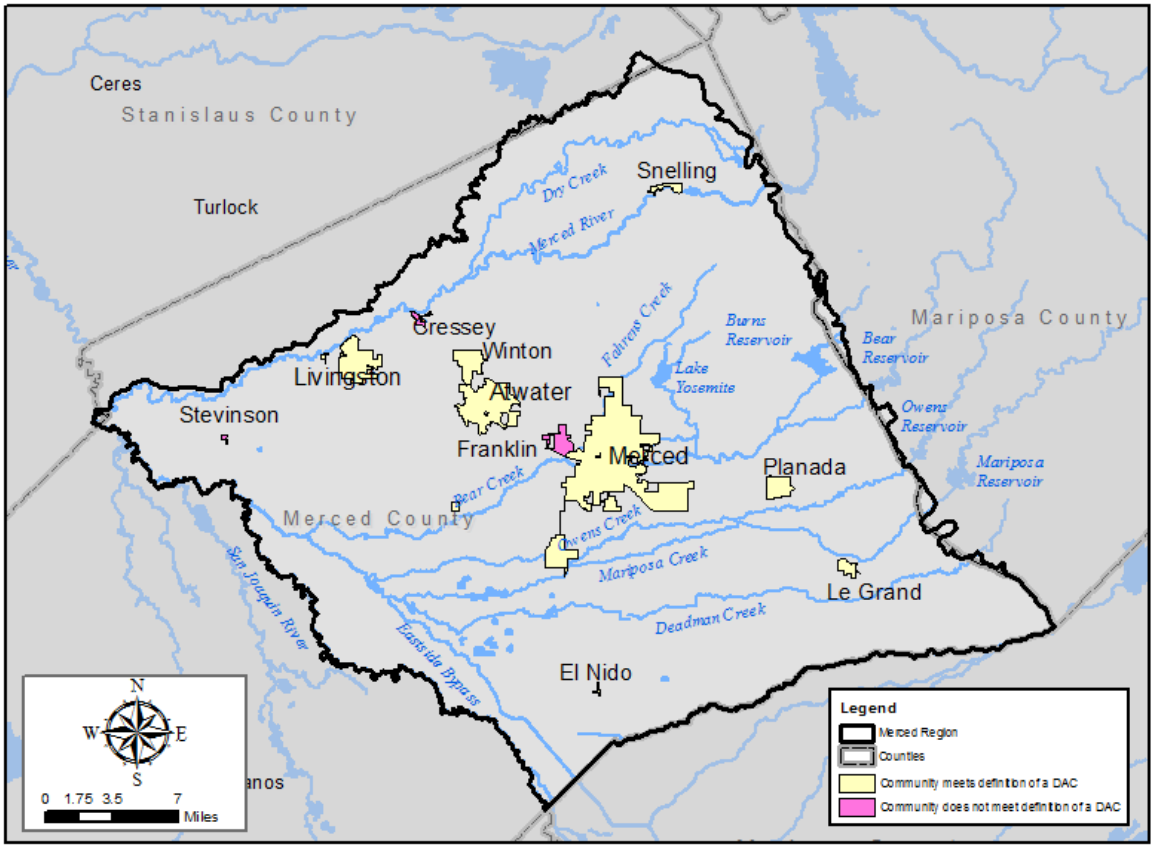


Table 2-8 presents economic data for the communities the Region considers to be DACs.

Table 2-8: Economic Data for Merced DACs

City or Community	MHI by Census Place (ACS, 2006-2010)	Analysis of Average MHI by Block Group (ACS, 2006-2010)	Unemployment Rate (ACS, 2006-2010)	Unemployment Rate (CA Employment Development Department, 2011)
Planada	$35,880	$31,137	19.4%	39.3%
Winton	$29,586	$35,370	18.2%	26.2%
Le Grand	$35,694	$35,417	14.6%	29.3%
El Nido	$29,115	$46,420	19.4%	Not Reported
Livingston	$46,198	$46,791	17.5%	21.0%
Merced	$39,834	$40,110	13.1%	18.1%
Atwater	$42,226	$46,263	14.7%	18.6%
Franklin/Beachwood	$52,748	$42,370	12.0%	Not Reported
Snelling	$13,899	$45,081	10.3%	Not Reported
Stevinson	$110,284	$49,018	4.9%	Not Reported

2.8.3 Culture and Diversity

The Region has a well-established and growing Hispanic/Latino population, which constitutes the largest single ethnic group in Merced County as well as each of the Region's three incorporated cities. In addition, the Region has a substantial and growing Asian population that constituted approximately 17% of the City of Livingston in 2010.

Table 2-9: 2010 Ethnic Composition of the Region

City or Community	White	Hispanic/Latino	Asian	Other
City of Merced	30.0%	49.6%	11.8%	8.6%
City of Atwater	35.8%	52.6%	5.0%	6.6%
City of Livingston	8.0%	73.1%	17.0%	1.9%
County of Merced	31.9%	54.9%	7.4%	5.8%
California	40.1%	37.6%	13.0%	9.3%

2.9 Major Water Related Objectives and Conflicts

The MIRWMP is intended to be a useful future guide to the Region. As part of this process, the Region has identified major water-related conflicts and objectives, which will guide the IRWM Program as it moves forward. The objectives of the MIRWMP is presented in Chapter 4 Objectives along with a discussion of the major water related needs that have been identified by stakeholders and which led to these objectives.

2.10 Potential Effects of Climate Change on the Region

There is mounting scientific evidence that global climate conditions are changing and will continue to change as a result of the continued build-up of greenhouse gases (GHGs) in the Earth's atmosphere. Changes in climate can affect municipal water supplies through modifications in the timing, amount, and form of precipitation, as well as water demands and the quality of surface runoff. These changes can affect all elements of water supply systems, from watersheds to reservoirs, conveyance systems, and treatment plants.

Planning for and adapting to anticipated changes in climate will be essential to ensuring water supply reliability for all users and to protecting sensitive infrastructure against more frequent and extreme precipitation and wildfire events. Chapter 16 summarizes anticipated climate change impacts on the State of California and the Merced Region, evaluates the impacts of those changes with regard to water resource management, assesses the vulnerability of the Region to anticipated climate change impacts, and provides recommended adaptation and mitigation strategies to address uncertainty and reduce GHG emissions. In addition, a plan for ongoing data collection to fill data gaps and monitor the frequency and magnitude of local hydrologic and atmospheric changes is provided.

As described in Chapter 16, primary water users in the Merced IRWM region include urban users, agriculture, and the environment. Water supplies include both groundwater and surface water, with groundwater coming from the Merced (predominantly), Turlock and Chowchilla Subbasins of the San Joaquin Valley Groundwater Basin and surface water being diverted primarily from the Merced, Chowchilla, Tuolumne and San Joaquin Rivers. Declining Sierra Nevada snowpack, earlier runoff, and reduced spring and summer streamflows will likely affect surface water supplies and shift reliance to groundwater resources, which are already overdrafted in many places. This will, in turn, affect critical natural resource issues in the Region, such as agricultural land conversion, population growth, air, water and soil quality concerns, and loss of habitat land.

Other anticipated regional impacts resulting from climate change (increased air temperatures and variable precipitation) include changes to water quality; increased flooding, wildfires and heat waves; and impacts to ecosystem health. Earlier springtime runoff will increase the risk of winter flooding as capturing earlier runoff to compensate for future reductions in snowpack would take up a large fraction of the available flood protection space, forcing a choice between winter flood prevention and maintaining water storage for summer and fall dry-period use. Under the 'business-as-usual' climate change scenario (A2), wildfires could increase by 100% or more by the end of the century (CNRA 2009). Some of these impacts on water resources management are already being observed within the Region.

The identified vulnerabilities within the Merced Region are summarized in Table 2-10 and further described in the following sections.

Table 2-10: Merced Region Vulnerabilities

Vulnerability	Description
Water Demand	Vulnerable to increased agricultural demands due to longer growing season, increased temperatures and evapotranspiration rates, and more frequent/severe droughts. Vulnerable to increased urban and commercial, industrial, and institutional (CII) demand due to increased outside temperatures.
Water Supply and Quality	Vulnerable to decreased snowpack in the Sierra Nevada, shifts in timing of seasonal runoff, increased demands exacerbating groundwater overdraft, degraded surface and groundwater quality resulting from lower flows, exaggerated overdraft conditions, a reduction of meadows which can provide contaminant reduction, and more frequent/severe droughts and storm events increasing turbidity in surface supplies.
Flood Management	More severe/flashier storm events and earlier springtime runoff leading to increased flooding, and a reduction of meadows which help reduce floods in the winter.
Hydropower	Vulnerable to increased customer demand combined with changes in timing of seasonal runoff and flashier storm systems affecting reservoir storage.
Ecosystem and Habitat	Vulnerable to decreased snowpack, more frequent/severe droughts and wildfires, shift in seasonal runoff, increased low flow periods and increased water temperatures (degraded water quality).

Merced Integrated Regional Water Management Plan

Chapter 3 Governance

This chapter addresses the Integrated Regional Water Management (IRWM) Governance Plan Standard, which requires IRWM Plans to:

- ✓ Document a governance structure that ensures the IRWM Plan will be updated and implemented beyond existing Sate grant programs
- ✓ Describe the RWMG responsible for development and implementation of the Plan and explain how the RWMG meets the California Water Code definition
- ✓ Identify the RWMG and individual project proponents who adopted the Plan
- ✓ Describe how the chosen governance addresses public involvement, effective decision making, balanced access and opportunity for participation, effective communication, long-term implementation, coordination with neighboring IRWM regions and State and federal agencies, collaboration and process for updating the Plan.

The California Water Code (CWC) defines a Regional Water Management Group as: "a group in which three or more local agencies, at least two of which have statutory authority over water supply or water management, as well as other persons who may be necessary for the development and implementation of a plan that meets the requirements of CWC §10540 and §10541, participate by means of a joint powers agreement, Memorandum of Understanding (MOU), or other written agreement, as appropriate, that is approved by the governing bodies of those local agencies."

The Merced IRWM planning process was initiated in 2008 by a RWMG consisting of MAGPI - a consortium of municipal and agricultural water purveyors and other interest groups that includes most of the agencies with water supply, water quality and water management authority in the Region. MAGPI has been meeting since 1997 to develop technical data and management strategies to improve the health of the Region's groundwater basin. In 2008, MAGPI established a subcommittee to encourage cooperative planning among additional aspects of water resources management beyond groundwater management and to lay the groundwork for development of the MIRWMP. This subcommittee completed the IRWM program RAP application in April 2009, which resulted in the approval of the MIRWMP regional boundary. In February 2012, MAGPI secured a DWR IRWM Planning Grant to develop the first Merced IRWM Plan.

In 2012, MAGPI transferred responsibility for the Region's IRWM planning to an interim RWMG, comprised of MID, Merced County, and the City of Merced, responsible for overseeing the development of the MIRWMP. In coordination with a 39-member interim RAC, the interim RWMG developed this MIRWMP, which includes a long-term governance structure for continued planning and implementation of the plan.

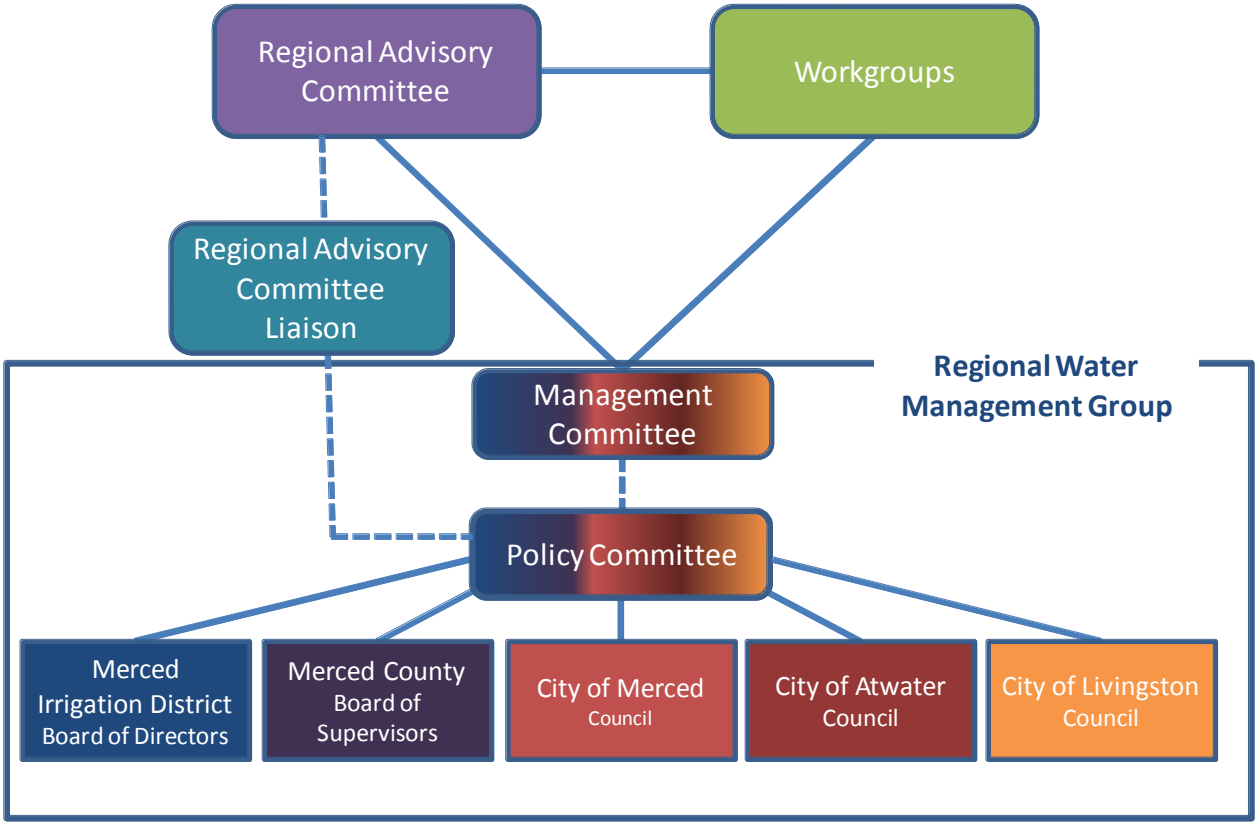
3.1 Long-Term Governance Structure

The interim RAC identified a preferred long-term governance structure for the Merced IRWM planning process, to be implemented following adoption of the MIRWMP. This recommended long-term governance structure, illustrated in Figure 3-1, consists of the following entities.

- A long-term RAC that represents the broad water-related interests of the Region and reviews regional water management issues and needs, plans, projects and work products developed through the ongoing planning process
- Workgroups formed on an as-needed basis to address specific IRWM planning needs at the request of the RAC
- A long-term RWMG, including MID, Merced County, the City of Merced, the City of Livingston, and the City of Atwater, that is responsible for overall direction, funding and approval for the IRWM planning process; the governing bodies of the RWMG member agencies collectively form the governing body of the RWMG, and elected officials and staff members from each of the RWMG member agencies coordinate through the committees of the RWMG
- A Management Committee, comprised of staff from each RWMG member agency, responsible for managing the day-to-day business of the IRWM planning program
- A Policy Committee, comprised of one official from each RWMG member agency, tasked with advising the RWMG governing bodies on IRWM-related business and policy based on recommendations of the RAC and Management Committee

Each of these entities is described further in the following sections.

Figure 3-1: Merced IRWM Recommended Governance Structure



3.1.1 Regional Water Management Group

The RWMG administers and manages the IRWM planning process with the RAC in an advisory role. The RWMG is described in this section along with an explanation of its relationship with the RAC. The RAC is described in greater detail in Section 3.2.

The recommended long-term governance structure includes a RWMG that includes MID, the City of Merced, the County of Merced, the City of Atwater, and the City of Livingston. Collectively, these agencies have jurisdiction over all of the incorporated and unincorporated areas of the Region and associated interests of both urban and agricultural communities in the Region. All five of these entities have statutory authority over water supply and management.

Water management responsibilities of each of the proposed RMWG member agencies are described below:

- Merced Irrigation District – MID manages various water facilities in eastern Merced County. The district was formed in 1919 pursuant to the Irrigation District Law contained in California Water Code §20500 et. seq and is governed by a five-member, elected Board of Directors. Each director is elected from the district in which he or she resides. MID's water management responsibilities include water supply, storm drainage, flood management on the Merced River, environmental uses of water and recreational uses of water. MID is also negotiating a recycled water exchange proposal with the City of Merced.
- Merced County – As described in Chapter 2 Region Description, the Merced Region is comprised of the northeastern portion of Merced County. Merced County is a general-law county that operates under the provisions of California State law and is governed by a five-member, elected Board of Supervisors. Each supervisor is elected from the district in which he or she resides. The County's water management responsibilities include storm drainage, flood management, and recreational uses of water.
- City of Merced – The City of Merced is the largest of the three incorporated cities in the Region, serving a population of approximately 79,000 people. Incorporated in 1889, Merced is a charter city that operates under the Council-Manager form of government in which the elected City Council is responsible for legislation. The Merced City Council consists of a mayor and six City Council members who are elected at large. The City of Merced's water management responsibilities include water supply, wastewater collection and treatment, storm drainage, flood management, environmental uses of water and recycled water.
- City of Atwater – The City of Atwater is the second largest of the three incorporated cities in the Region, serving a population of approximately 28,000 people. Incorporated August 16, 1922, Atwater is a general-law city that operates under California State law and is governed by an elected City Council, which consists of a mayor and four council members. The mayor is directly elected by the voters and the council members are elected at large. The City of Atwater's water management responsibilities include water supply, wastewater collection and treatment, storm drainage, flood management and recycled water.
- City of Livingston – The City of Livingston is the third largest of the incorporated cities in the Region, serving a population of approximately 13,000 people. Incorporated September 11, 1922, Livingston is a general-law city that is governed by an elected City Council, consisting of a mayor and four council members. The City of Livingston's water management responsibilities include water supply, wastewater collection and treatment and storm drainage.

The organization of the RWMG may evolve based on advisement by the long-term RAC and discussion among the proposed RWMG member agencies. However, the RWMG member agencies are envisioned to be equal partners in management of the MIRWMP and will be responsible for managing the Merced IRWM program indefinitely or until a revised governance structure is developed and adopted. The RWMG's commitment to the implementation of this MIRWMP will be formalized through the adoption of the MIRWMP by each of the RWMG member agencies. The RWMG will organize itself either through execution of an MOU to manage the ongoing IRWM planning process, or through development of a Joint Powers Authority (JPA). The preferred organization will be identified by the RWMG member agencies on implementation of the long-term governance structure (following Plan adoption).

The East Merced Resource Conservation District (EMRCD) has also expressed interest in becoming a member of the RWMG in order to more fully represent landowner interests and natural resources management. The interim RAC recommended that the RWMG should be initially limited to the five-member group of MID, the City of Merced, the County of Merced, the City of Atwater, and the City of Livingston, with the 30-member RAC serving as the working arm of the MIRWMP and providing the balance between the diverse interests of the Region. However, recognizing the need to have a process to allow for modifications to RWMG membership in the future, the long-term RAC will be responsible for developing a process by which additional agencies can apply and be considered for membership and a process to follow should existing members choose to leave the RWMG. It was also recommended that the long-term RAC consider recommending the addition of the EMRCD to the RWMG.

3.1.2 Management Committee

During development of the MIRWMP, one staff member from each of the interim RWMG member agencies participated on a Work Plan Management Committee. As its name suggests, the WPMC was responsible for establishing and implementing a work plan for completing the MIRWMP and managing day-to-day IRWM program business. Throughout MIRWMP development, the WPMC coordinated via biweekly conference calls and occasional in-person meetings. The standing biweekly conference calls provided a forum for WPMC members to discuss IRWM business (e.g. invoicing, progress of technical studies being completed by consultants, on-going public outreach efforts, etc.) and to coordinate preparation of monthly RAC meetings and periodic public workshops, which were integral to the IRWM planning process.

Following adoption of the MIRWMP, the WPMC will be replaced by a Management Committee. Similar to the WPMC, the Management Committee will be comprised of staff from each of the RWMG member agencies, which is proposed to include MID, Merced County and the Cities of Merced, Atwater and Livingston.

The Management Committee will serve as a bridge between the management and planning sides of the IRWM program. The Management Committee will meet approximately monthly, or as needed, to discuss the status of the IRWM program, coordinate day-to-day business needs, organize meetings of the Policy Committee and address coordination needs for the quarterly RAC meetings.

Management Committee members, while responsible for attending and supporting Policy Committee and RAC meetings, will not be members of either of these committees. The role of the Management Committee members is to facilitate meetings and to provide their respective governing bodies with the information and recommendations needed to make informed program decisions. Management Committee members will support RAC meetings by providing information to support RAC decision-making and share RWMG member agency perspectives. As nonvoting participants at RAC meetings, the Management Committee members will be in a position to provide suggestions and offer feedback related to the feasibility of RAC recommendations; however, recommendations of the Management Committee remain independent from recommendations of the RAC.

3.1.3 Policy Committee

During MIRWMP development, the interim RAC noted that improved coordination among the elected representatives of the RWMG was needed. Furthermore, the interim RAC indicated a need for direct connection to elected officials as opposed to relying on the Management Committee to communicate the perspective of the RAC to the RWMG governing bodies. The outcome of the interim RAC's recommendation was the formation of a Policy Committee.

The recommended structure for the Policy Committee includes one elected official from each RWMG member agency. Each RWMG member agency will have sole discretion to appoint its own representative to the Policy Committee; however, the intent is for each Policy Committee member to be an elected member of the RWMG agency's governing board or council. The Merced County Board of Supervisors representative on the Policy Committee should be a Supervisor that represents a community within the Region (Districts 1 through 4). While the ultimate composition of the Policy Committee will be determined by the RWMG member agencies and may differ from the structure initially proposed, the RWMG shall ensure that the Policy Committee structure meets the original intents of improving coordination among elected representatives and providing a forum for coordination with the RAC.

The Policy Committee will be responsible for maintaining coordination among the RAC and RWMG agency governing bodies regarding the IRWM program, providing feedback to the Management Committee and RAC, making critical IRWM-related policy decisions based on recommendations from the RAC, and reporting to their respective Boards or Councils on the status of the IRWM program. Additionally, in the future, should changes to the governance structure be desired, the Policy Committee will be responsible for evaluating potential changes. To fulfill these duties, the Policy Committee will meet approximately twice per year or as necessary.

Meetings of the Policy Committee will be open to the public and will include participation from each Policy Committee member, Management Committee members, and a RAC member appointed by the RAC to serve as a liaison to the Policy Committee. In addition to facilitating the Policy Committee meetings, Management Committee members will participate in Policy Committee meetings to provide staff recommendations as appropriate. The RAC liaison will also participate, communicating RAC recommendations directly to the Policy Committee.

3.2 Regional Advisory Committee

The interim RAC was formed in May 2012 to assist in completing the MIRWMP. Members of the RAC were recruited through an open invitation process that was publicly advertised by MID, Merced County and the City of Merced. All parties that applied for inclusion on the RAC were formally appointed by the MID Board of Directors as either full or alternate members of the RAC. The interim RAC includes 23 full members and 16 alternates representing broad interests and perspectives in the Region related to water management, land use, natural resources and community stewardship. The interests represented by the interim RAC include:

- Water Supply Interests
- Wastewater Interests
- Stormwater Interests
- Flood Control Interests
- Local Government
- Agricultural Interests
- Other Business Interests (non-agriculture)
- Environmental Interests
- Other Institutional Interests (e.g. UC Merced)
- Disadvantaged Community and Environmental Justice Interests
- Recreational Interests
- Community / Neighborhood Interests

During development of the MIRWMP, the interim RAC met on a monthly basis to review progress and provide comments and guidance on key plan elements, including recommendations for the MIRWMP long-term governance structure. The recommended long-term governance structure includes a reformulated RAC that will meet on an approximately quarterly basis, or as needed, to provide guidance on upcoming IRWM planning and funding activities and educate participants on water resources-related topics.

The RAC met regularly throughout MIRWMP development to provide guidance on IRWM planning and funding activities and to educate participants on water resources-related topics.

The purpose of reformulating the RAC following adoption of the MIRWMP is to provide for continued representation of the broad interests of the Region in long-term water resources planning. Participants from the interim RAC are encouraged to participate in the long-term RAC; however, current participants are not obligated to continue participation.

A succession policy was developed by the interim RAC and endorsed by the interim RWMG to dictate how RAC replacements will be appointed, should a RAC member need to step down for any reason. This policy is described in the draft RAC charter, provided as Appendix F.

When the new RAC is formed, one of its first tasks will be developing an application and acceptance process for expanding the RWMG to include other interested members, as discussed in Section 3.1.1 3.1.1 Regional Water Management Group,

3.3 Workgroups

Two types of workgroups may be established: standing workgroups and ad-hoc workgroups.

Standing workgroups may be convened to deal with ongoing RAC business. In contrast, ad-hoc workgroups will be formed, as needed, to carry out discrete tasks such as project selection for funding opportunities, review of proposed legislation, and other actions. The purpose of ad-hoc workgroups is to enable participants in the IRWM program to work through topics requiring intensive discussions an evaluation to develop recommendations for the larger group. The process for convening and managing workgroups is described in the draft RAC charter, provided as Appendix F.

3.4 Entities Adopting the MIRWMP

Adoption of the MIRWMP is the formal acceptance of the plan and indicates support of the Merced IRWM program. At a minimum, the governing body of each RWMG agency must adopt the MIRWMP. Other agencies that desire to formally indicate their support for the MIRWMP are also encouraged to adopt the plan.

The entities that have indicated their intent to adopt this first MIRWMP include:

- City of Merced
- East Merced Resource Conservation District
- Merced County
- Merced Irrigation District
- Planada Community Services District
- Stevinson Water District
- University of California, Merced

Adoption of the MIRWMP by additional agencies may occur at later dates. Prior to becoming members of the long-term RWMG, the Cities of Atwater and Livingston will be required to adopt the plan just as any other RWMG Member.

3.5 Public Involvement

Engagement of stakeholders and members of the general public, in addition to RAC members, is integral to the IRWM planning and implementation process. Stakeholder outreach began early in the development of the MIRWMP. The MIRWMP has benefitted from the legacy of MAGPI's established relationships with various stakeholders such as water purveyors; wastewater agencies; flood management agencies; municipal, county government and special districts; land use authorities; self-supplied water users; environmental stewardship organizations; community and landowner organizations; industry organizations; state, federal and regional agencies; colleges and universities; DACs; and other interests in the area. The MAGPI stakeholder list was used as a starting point for MIRWMP public outreach, and that list was expanded during the Merced IRWM RAP by circulating an invitation letter to organizations throughout the Region. During development of the MIRWMP, the RWMG continued to reach out to interested parties by personally contacting potential project proponents and hosting six public workshops. The workshops were advertised through multiple outlets including public service announcements, newspaper advertisements, web postings and e-mail distribution lists, and personal communication with potential project proponents.

Public workshops are held during critical junctures in the IRWM program.

Stakeholder involvement in key program decisions will remain a priority for ongoing IRWM planning and implementation. The RWMG will continue to host public workshops at critical junctures in the program (e.g. plan updates, calls for projects), and news and events related to the program will continue to be posted on the Merced IRWMP website (www.mercedirwmp.org) and the websites of RWMG member agencies.

3.6 Decision-Making Process

The RWMG maintains overall decision-making authority for the MIRWMP and planning process. IRWM activities requiring legislation or policy decisions will be brought before each RWMG member agency's governing body for approval. Before bringing the action before the RWMG Boards or Councils, Policy Committee representatives will be responsible for discussing relevant issues with the Management Committee members and the RAC liaison at the Policy Committee level (Policy Committee meetings discussed in Section 3.1.3 provide a forum for these discussions).

Day-to-day management will be accomplished by the Management Committee, and the RAC will be the primary forum for discussion and information exchange on regional water management topics among community representatives.

The RAC decision-making process is described in the draft RAC charter, provided as Appendix F.

3.7 Communication

Key IRWM program decisions will be made following thorough discussion and vetting by all interested parties. At RAC meetings, members and alternates assume responsibility for raising issues, concerns, and ideas from their communities and constituents who are not able to attend the meetings. RAC members are also expected to inform and educate constituents of the information and discussions from each meeting.

Information will continue to be conveyed to the general public through the Merced IRWMP website (www.mercedirwmp.org), RWMG partner agency websites and media releases, as appropriate.

3.8 Coordination

The Merced Region is bordered by five other IRWM regions: Madera, Yosemite-Mariposa Region, East Stanislaus Region, Tuolumne-Stanislaus and Westside-San Joaquin Region. While cooperation with the adjacent regions has not been formalized, representatives of the Merced Region routinely attend meetings of the Yosemite-Mariposa Region to maintain ongoing communication and coordination. Additionally, staff members from Merced County and MID routinely meet with members of the Turlock Groundwater Basin Association which manages groundwater activities in the East Stanislaus Region.

3.9 Plan Updates

The MIRWMP is intended to be a living document, requiring periodic updates. The current MIRWMP provides guidance for developing and refining water resources projects at the local level for a 20-year planning horizon based on current regional objectives, priorities, and water management strategies. Recognizing that regional conditions will change within the Plan's 20-year timeframe, the RWMG and RAC appreciate the need to continue to hold regular meetings. Through these meetings, MIRWMP stakeholders will continue to discuss and coordinate on critical water- related needs to determine whether shifts in regional objectives or priorities are needed to maintain currency with local conditions and needs. When changes are dictated, the RWMG in consultation with the RAC will prepare amendments or full updates to the MIRWMP, as appropriate. Changes to the State's IRWM planning framework may also necessitate updates to the MIRWMP, and continuation of the RWMG and RAC collaboration will ensure the Region is prepared to respond to future changes. The project list is a living document, and the current project list can be accessed through the project website. The project list can be updated in real-time without requiring a full Plan update or re-adoption.

Merced Integrated Regional Water Management Plan

Chapter 4 Objectives

This chapter addresses the Integrated Regional Water Management (IRWM) Objectives Plan Standard which requires IRWM Plans to:

- ✓ Present plan objectives, which must address major water-related issues and conflicts of the region and must be measurable by some practical means so achievement of objectives can be monitored
- ✓ Describe the process used to develop the objectives
- ✓ Contain an explanation of the prioritization or reason why the objectives are not prioritized
- ✓ Consider climate change

Through a series of facilitated public workshops and meetings, the interim RAC developed 12 specific IRWM Plan objectives to address regional water management needs and issues. Detailed descriptions and the rationale for development and inclusion of each objective are presented in the following sections.

IRWM Plan Objectives

A. Manage flood flows for public safety, water supply, recharge, and natural resource management.
B. Meet demands for all uses, including agriculture, urban, and environmental resource needs.
C. Correct groundwater overdraft conditions.
D. Improve coordination of land use and water resources planning.
E. Maximize water use efficiency.
F. Protect and improve water quality for all beneficial uses, consistent with the Basin Plan.
G. Protect, restore, and improve natural resources.
H. Address water-related needs of disadvantaged communities (DACs).
I. Protect and enhance water-associated recreation opportunities.
J. Establish and maintain effective communication among water resource stakeholders in the Region.
K. Effectively address climate change adaptation and/or mitigation in water resource management.
L. Enhance public understanding of water management issues and needs.

Of the 12 IRWM objectives listed above, the RAC identified Objectives A, B and C as the highest priority objectives for the Region. The following sections summarize water management needs in the Region and the process for developing and prioritizing objectives to address these needs. In addition, measurable performance measures are presented, which will be used to assess the Region's progress in achieving each objective.

4.1 Regional Water Management Issues

Water management issues in the Merced Region were identified by reviewing existing water management plans in the Region and brainstorming with the RAC, which represents a broad cross-section of water management interests throughout the Region. In addition, a series of technical workshops were held focused on water conservation, groundwater recharge, salt and nutrient management, climate change, and integrated flood management. These workshops, which were publicly noticed and announced through media vehicles including newspaper advertisements and local radio announcements, were open to all interested stakeholders. A key focus of these meetings was to identify specific water management issues in the Region and develop objectives to address those issues. Based on input from the RAC and stakeholders, the following regional water management issues were identified.

- **Inadequate flood control.** Some creeks such as Black Rascal Creek have little or no flood control infrastructure in place. Improved flood management should be coordinated with surface storage and / or recharge facilities to maximize use of local supplies. For example, MID is currently evaluating the potential to connect creeks on the east side of the Merced Region and convey the flows west to better manage flood flows while providing enhanced recharge through corridors in the southeastern portion of the Region with sandy soils. Flood control, combined with surface storage, is also being evaluated for the Dry Creek watershed, which could include the Montgomery Reservoir Project.
- **Lack of holistic water management.** Not all water resources are currently being managed in a sustainable way. For example, there are opportunities to improve current water use patterns to enhance the health of the groundwater basin. Converting existing groundwater irrigators to surface water within irrigation or water districts that enjoy surface water rights could result in groundwater basin recharge as opposed to contributing to overdraft conditions. The Region could also benefit from an overall policy aimed at planning, financing and operating recharge basins in coordination with surface water purchases made specifically for recharge purposes; the basis of this policy should be agreed upon scientific recommendations. A long-term view must be taken in planning efforts to prevent water management policies from being heavily impacted by political will and other short-term influences.
- **Failure to protect supply.** The current State Water Resources Control Board does not have rules aimed at the management of the groundwater basin sustainably for all uses. There is minimal control over private use of groundwater supplies despite overdraft conditions. Additionally, the State Water Resources Control Board has recently proposed reductions in the allowable surface diversions from the Merced River, which impacts the Region's ability to conjunctively manage supplies.
- **Need for better groundwater information and management.** There is a need for better information related to current groundwater conditions and management actions necessary to maintain the health of the basin for all water users. Water users need to understand how their water use impacts the basin as a whole.
- **Need for groundwater recharge.** There is currently a limited number of managed groundwater recharge operations in the Region. Opportunities to increase groundwater recharge in areas that are determined to be most conducive for recharge should be explored, including opportunities to recharge flood waters.

- **Disconnect between land use planning and water management planning.** The Merced Subbasin, which serves the majority of demands in the Merced Region, is in overdraft; however, significant population growth is projected. In addition, throughout the Merced Region, rangelands and lands being used for purposes with relatively low water demands are being converted to more water-intensive land uses such as irrigated agriculture. Improved coordination between water and land use management is needed to ensure that future development is sustainable.
- **Inefficient water use practices.** Improved water use efficiency could reduce the mismatch between water demands and available supplies. Onsite water reuse, effective use of stormwater and flood flows, increased water conservation, and improved water use efficiency should be explored.
- **Water quality impacts.** Water quality in the Region is being impacted by saline intrusion from groundwater near the San Joaquin River, the use of pesticides and herbicides in the Region, mining impacts, fracking occurring in the grasslands area, urban runoff, and legacy nitrate issues. Emerging contaminants such as pharmaceuticals and personal care products must also be considered. Practices such as deep-well injection of wastewater (currently being practiced in the Hilmar area) must be managed to prevent potential water quality impacts.
- **Inadequate wastewater management.** Wastewater collection and treatment capacity is limited in many parts of the Region. Adequate wastewater collection and treatment is necessary to protect water quality.
- **Impacts to sensitive ecosystems.** Lower groundwater levels impact environmental resources. For example, protecting vernal pools in eastern Merced County requires adequate water supply. Groundwater levels are also important for sustaining streamflows. Rerouting flows from areas prone to flooding to areas where water levels have been decreasing can improve habitat.
- **Funding challenges.** Water management projects cannot be implemented without funding, and it can be difficult to raise water rates for needed projects. As such, long-term financing alternatives should be explored.
- **Lack of public understanding of water management.** There is a need to educate the general public on issues related to local hydrology, water management, and the potential and need for enhanced water use efficiency. Cultural differences play a role in how water is valued and managed. Public education efforts must consider these cultural differences.

4.2 Process to Develop Objectives

A set of objectives was developed to address the water management issues identified above. For each objective, performance measures were identified. Performance measures are benchmarks that can be used to measure the Region's progress toward achieving each objective. The MIRWMP objectives were developed through a series of facilitated workshops and meetings that were advertised and open to the public, including:

- Three RAC meetings
- Five technical workshops, focused on water conservation, groundwater recharge, salt and nutrient management, climate change and flood management
- One general public meeting

In addition, local water and land use management plans were reviewed to identify local planning objectives that may be appropriate to include in the IRWM Plan. Objectives identified in local planning documents are summarized in Appendix F to this document.

4.3 Water Management Objectives

Using the process outlined above, the RAC established the MIRWMP objectives and performance measures in Table 4-1. The objectives represent the RAC's long-term aspirations for the Region. The RAC recognizes that attainment of these objectives necessitates incremental improvements implemented over multiple years. Furthermore, the RAC has acknowledged that, in some cases, the ideal set by the MIRWMP objectives may prove to be technically or economically infeasible, but the objectives provide a long-term direction towards which the Region desires to move and will attempt to meet to the greatest extent possible. As regional stakeholders strive towards these long-term goals, the performance measures provide a practical means for the Region to monitor the incremental improvement from year to year.

Table 4-1: MIRWMP Objectives

Long-Term Objectives for the Merced Region	Performance Measures
A. Manage flood flows for public safety, water supply, recharge, and natural resource management	1. Occurrence of flooding at the Bear Creek, Black Rascal Creek diversion, Deadman Creek, Dry Creek, Fahrens Creek, Lake Yosemite, Mariposa Creek, Merced River, and San Joaquin River 2. Volume of flood water stored and / or recharged 3. Flood-related damages (extent and frequency)
B. Meet demands for all uses, including agriculture, urban, and environmental resource needs.	1. Curtailment of voluntary and/or mandatory water use restrictions 2. Stability of groundwater levels 3. Ability to meet instream flow requirements
C. Correct groundwater overdraft conditions.	1. Groundwater surface elevation 2. Volume of water recharged 3. Reduction in groundwater subsidence 4. Improvement in groundwater quality
D. Improve coordination of land use and water resources planning.	1. Number of cooperative planning meetings held between land use and water resource planning entities 2. Number of General Plans with water resource elements

Long-Term Objectives for the Merced Region	Performance Measures
E. Maximize water use efficiency.	1. Estimated annual savings from demand management programs 2. Volume of water per year put to beneficial reuse 3. Percent of water users with meters and commodity pricing 4. Urban per capita water use (in accordance with provisions of SBx7-7)
F. Protect and improve water quality for all beneficial uses, consistent with the Basin Plan.	1. New 303(d) listings and / or delistings 2. Surface water and groundwater quality
G. Protect, restore, and improve natural resources.	1. Acres of habitat protection / restoration / enhancement completed 2. Development trends in the largest and most ecologically sensitive areas of Merced County (including the Merced and San Joaquin River corridors and Eastside Grasslands)
H. Address water-related needs of disadvantaged communities (DACs).	1. Programs implemented that focus on meeting critical water-related needs of DACs 2. Percent of population with drinking water that complies with all applicable standards
I. Protect and enhance water-associated recreation opportunities.	1. Number of programs that include water-associated recreation opportunities
J. Establish and maintain effective communication among water resource stakeholders in the Region.	1. Number of stakeholders or their representatives and members of the public attending IRWM-related meetings 2. Number of collaborative projects jointly implemented by multiple entities
K. Effectively address climate change adaptation and/or mitigation in water resource management.	1. Number of projects implemented that address climate change
L. Enhance public understanding of water management issues and needs.	1. Number of educational programs / number of people participating in water-focused educational events in the Region

Table 4-2 identifies the basis for each of the MIRWMP objectives. In most cases these objectives were developed to address one or more of the regional water management issues identified in Section 4.1, Regional Water Management Issues. Some of the objectives were added primarily in consideration of the IRWM Guidelines.

Table 4-2: Basis of the MIRWMP Objectives

MIRWMP Objective	Basis
A. Manage flood flows for public safety, water supply, recharge, and natural resource management	This objective addresses the Region's challenge of inadequate flood control and promotes an integrated approach to flood management.
B. Meet demands for all uses, including agriculture, urban, and environmental resource needs.	This objective addresses the Region's need to provide a long-term, holistic approach to the management of the Region's water resources. The objective requires a sustainable and coordinated approach among water management agencies to meet the Region's various demands. The RAC identified this objective as one of the most challenging to meet giving the economic and technical challenges of meeting all demands with limited supplies, but it is an ideal towards which the Region will strive.
C. Correct groundwater overdraft conditions.	This recognizes the need to improve current water use patterns to enhance the health of the groundwater basin and the need to increase recharge opportunities. This was identified by the RAC as one of the Region's highest priorities.
D. Improve coordination of land use and water resources planning.	This objective addresses the Region's disconnect between land use management and water management. The objective is intended to ensure that future development is sustainable.
E. Maximize water use efficiency.	This objective addresses opportunities to improve the efficiency of the Region's water use practices. The objective was developed recognizing there are both opportunities to reduce demand as well as opportunities to use water more efficiently and minimize water waste.
F. Protect and improve water quality for all beneficial uses, consistent with the Basin Plan.	This objective addresses potential water quality impacts to both the Region's groundwater and surface waters, including potential water quality impacts from areas with inadequate wastewater collection and treatment systems.
G. Protect, restore, and improve natural resources.	This objective addresses the importance of water management in preventing impacts to sensitive ecosystems. The objective encompasses the need to protect sensitive environmental resources from water-related impacts such as the effect of decreasing groundwater levels on stream flows.
H. Address water-related needs of disadvantaged communities (DACs).	The Merced Region is unique in that it is almost entirely classified as a DAC. As such, addressing water-related needs of DACs is of critical importance to the Region. This objective also addresses the IRWM Guidelines requirement to consider water-related needs of DACs in the area within the boundaries of the Plan.

MIRWMP Objective	Basis
I. Protect and enhance water-associated recreation opportunities.	This objective addresses the need to provide low-cost, water-related recreation opportunities that are an important resource for DACs throughout the Region. In addition, the objective recognizes the importance of providing water-related recreation opportunities despite potential trade-offs that can exist between recreation and other areas of water management such as water supply, water quality, and ecosystem restoration.
J. Establish and maintain effective communication among water resource stakeholders in the Region.	This objective addresses the importance of engaging key stakeholders and interested parties in water management decision-making to enhance coordination and collaboration in the Region. This is particularly critical to encourage the development of integrated, multi-benefit water management projects and programs.
K. Effectively address climate change adaptation and/or mitigation in water resource management.	The Region has identified several water management areas that are vulnerable to the potential impacts of climate change. This objective supports climate change mitigation and / or adaptation actions that would reduce the Region's vulnerability to potential climate change impacts. In addition, this objective the IRWM Guidelines requirement to address both adaptation to the effects of climate change and mitigation of GHG emissions.
L. Enhance public understanding of water management issues and needs.	This objective addresses the importance of public understanding of water management. The objective also assists in addressing the Region's funding challenges by increasing public understanding of the need to fund water projects.

4.4 Prioritizing Objectives

The RAC discussed the benefits and drawbacks of prioritizing objectives. Prioritizing objectives could aid in identifying core issues that all interest groups in the Region could agree upon. Prioritized objectives could then be used in the project prioritization process to help the Region identify those projects that would provide the greatest benefit to the Region as a whole. While establishing highest priority objectives indicates that some objectives are more important than others, it does not mean that the remaining high priority objectives are unimportant. All of the Merced Region IRWM objectives are important to meeting needs of the Region and are considered to be high priority objectives.

Recognizing the value of prioritizing objectives, the RAC went through an exercise at the August 2012 meeting to prioritize objectives through a simple polling approach. Each participant was asked to identify the top three objectives that were most important to him or her and rank the importance of those objectives, with one being most important and three being least important of the top three. The results of the prioritization clearly indicated that the top three priorities are the objectives associated with flood management, meeting water demands, and correcting groundwater overdraft. The participants all agreed that those three objectives reasonably represent the highest priority concerns of the Region.

Based on the results of the prioritization, the RAC developed the following objective priority groupings:

Highest Priority Objectives

A. Manage flood flows for public safety, water supply, recharge, and natural resource management

B. Meet demands for all uses, including agriculture, urban, and environmental resource needs.

C. Correct groundwater overdraft conditions.

High Priority Objectives

D. Improve coordination of land use and water resources planning.

E. Maximize water use efficiency.

F. Protect and improve water quality for all beneficial uses, consistent with the Basin Plan.

G. Protect, restore, and improve natural resources.

H. Address water-related needs of disadvantaged communities (DACs).

I. Protect and enhance water-associated recreation opportunities.

J. Establish and maintain effective communication among water resource stakeholders in the Region.

K. Effectively address climate change adaptation and/or mitigation in water resource management.

L. Enhance public understanding of water management issues and needs.

As projects are implemented, regulations change, and regional conditions change over time, the Region's priorities may change. The Merced IRWM Plan is a living document that will be periodically updated to reflect changing conditions.

Merced Integrated Regional Water Management Plan

Chapter 5 Resource Management Strategies

This chapter addresses the Integrated Regional Water Management (IRWM) Resource Management Strategies Plan Standard which requires IRWM Plans to:

- ✓ Document the range of RMS considered to meet the IRWM objectives and identify which RMS were incorporated into the IRWM Plan
- ✓ Consider the effects of climate change on the IRWM region when considering RMS
- ✓ Consider, at a minimum, the RMS found in Volume 2 of the California Water Plan (CWP) Update 2009

A comprehensive range of resource management strategies (RMS) was considered to achieve the Merced Region's IRWM Plan objectives. This chapter identifies the RMS considered within this MIRWMP, documents the selection process used to determine appropriate RMS for the Region, and describes any existing efforts that are being taken within the Region for each RMS. This section considers all RMS covered in the California Water Plan 2009 Update, assesses the Region's IRWM Plan objectives outlined in Chapter 4 Objectives, and determines how the RMS identified in the California Water Plan 2009 Update can work together to achieve the Region's specific IRWM Plan objectives.

5.1 Resource Management Strategies Considered

The MIRWMP considered each RMS listed in the California Water Plan Update 2009 as required by the Proposition 84 and Proposition 1E IRWM Guidelines. The California Water Plan Update 2009 identified seven categories of RMS applicable to water management in California. Table 5-1 presents the seven categories of RMS considered for the MIRWMP. Though all the RMS identified by the California Water Plan Update 2009 were considered for inclusion in the MIRWMP, not all are appropriate for meeting the Region's IRWM plan objectives. The RMS determined to be inappropriate for the Region included: conveyance-Delta, desalination, precipitation enhancement, fog collection, dewvaporation or atmospheric pressure desalination, and waterbag transport/storage technology.

Table 5-1: Resource Management Strategies Considered for the MIRWMP

Reduce Water Demand	Improve Flood Management
Agricultural Water Use Efficiency	Flood Risk Management
Urban Water Use Efficiency	**Practice Resources Stewardship**
Improve Operational Efficiency and Transfers	Agricultural Lands Stewardship
Conveyance- Delta*	Economic Incentives (Loans, Grants and Water Pricing)
Conveyance- Regional/Local	Ecosystem Restoration
System Reoperation	Forest Management
Water Transfers	Land Use Planning and Management
Increase Water Supply	Recharge Area Protection
Conjunctive Management and Groundwater Storage	Water-Dependent Recreation
Desalination*	Watershed Management
Precipitation Enhancement*	**Other Strategies**
Recycled Municipal Water	Crop Idling for Water Transfers
Surface Storage- CALFED	Dewvaporation or Atmospheric Pressure Desalination*
Surface Storage- Regional/Local	Fog Collection*
Improve Water Quality	Irrigated Land Retirement
Drinking Water Treatment and Distribution	Rainfed Agriculture
Groundwater Remediation/Aquifer Remediation	Waterbag Transport/Storage Technology*
Matching Quality to Use	
Pollution Prevention	
Salt and Salinity Management	
Urban Runoff Management	

*RMS deemed inappropriate for the Merced Region

5.2 Objectives Assessment

Table 5-2 presents the RMS that were determined to be appropriate for the MIRWMP and illustrates which strategies can be implemented to achieve each objective. In many cases, multiple RMS may be implemented together – or integrated - to fulfill one or more regional objectives. Descriptions of each RMS, including those not appropriate for the Region, can be found in Section 5.4.

Table 5-2: Resource Management Strategies that Achieve MIRWMP Objectives

	Agricultural Lands Stewardship	Agricultural Water Use Efficiency	Conjunctive Mgmt and Groundwater Storage	Conveyance—Regional/Local	Crop Idling for Water Transfers	Drinking Water Treatment & Distribution	Economic Incentives	Ecosystem Restoration	Flood Risk Management	Forest Management	Groundwater /Aquifer Remediation	Irrigated Land Retirement	Land Use Planning and Management	Matching Water Quality to Use	Pollution Prevention	Rainfed Agriculture	Recharge Area Protection	Recycled Municipal Water	Salt and Salinity Management	Surface Storage—CALFED	Surface Storage—Regional/Local	System Reoperation	Urban Runoff Management	Urban Water Use Efficiency	Water Transfers	Water-Dependent Recreation	Watershed Management
A. Manage flood flows for public safety, water supply, recharge, and natural resource management	○	-	●	●	-	○	-	●	●	○	○	-	●	○	○	-	○	-	-	●	●	●	●	-	○	○	●
B. Meet demands for all uses, including agriculture, urban, and environmental resource needs.	-	●	●	●	●	●	●	-	-	-	●	●	●	●	-	●	●	●	-	●	●	●	○	●	●	-	○
C. Correct groundwater overdraft conditions.	-	○	●	●	○	-	●	○	○	○	●	○	○	-	-	●	●	●	-	●	●	●	○	○	●	-	●
D. Improve coordination of land use and water resources planning.	●	●	-	●	●	○	●	●	●	●	○	●	●	○	●	-	○	●	●	●	●	●	●	●	●	●	●
E. Maximize water use efficiency.	-	●	●	●	●	●	●	○	○	○	-	●	-	○	-	●	-	●	-	-	-	●	○	●	●	-	○
F. Protect and improve water quality for all beneficial uses, consistent with the Basin Plan.	●	-	●	●	-	●	●	●	○	●	●	-	○	●	●	-	●	●	●	●	●	-	●	-	-	●	●
G. Protect, restore, and improve natural resources.	●	-	-	●	-	-	●	●	○	●	●	-	●	-	○	-	●	-	●	-	-	-	○	-	-	○	●
H. Address water-related needs of disadvantaged communities (DACs).	○	○	○	●	○	●	●	○	●	○	●	○	○	●	●	○	●	●	○	○	○	●	●	○	○	●	○
I. Protect and enhance water-associated recreation opportunities.	○	-	-	-	-	-	○	○	-	○	-	-	●	-	-	-	-	-	-	○	○	-	○	-	-	●	●
J. Establish and maintain effective communication among water resource stakeholders in the Region.	○	○	○	○	○	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
K. Effectively address climate change adaptation and/or mitigation in water resource management.	○	○	○	○	○	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
L. Enhance public understanding of water management issues and needs.	○	○	○	○	○	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

●RMS can directly contribute to meeting MIRWMP objective ○ RMS can indirectly contribute to meeting MIRWMP objective -RMS does not contribute to meeting MIRWMP objective

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5.3 Process Used to Consider RMS

The inclusion of RMS in this IRWM Plan is based on a review of all 33 RMS identified by the California Water Plan Update 2009 and the Proposition 84 and Proposition 1E IRWM Guidelines. The RWMG and RAC together determined that 26 RMS are appropriate for inclusion in the Merced IRWM Plan as they are either currently being utilized or may reasonably be utilized in the management of water resources in the Region.

The process of identifying RMS that address the regional goals and objectives identified for the Merced IRWM Plan involved evaluating all strategies in consultation with the RAC. The full list of RMS was reviewed and discussed by the RAC to determine potential of each strategy to meet the Merced Region's IRWM Plan objectives.

5.4 RMS Evaluation for the Merced Region

The following sections describe the relevant RMS in further detail and provide examples of efforts currently underway in the Region that apply each strategy.

5.4.1 Reduce Water Demand

RMS identified in the Reduce Water Demand category include:

- Agricultural Water Use Efficiency
- Urban Water Use Efficiency

These RMS are discussed in further detail below.

Agricultural Water Use Efficiency

Agricultural water use efficiency can reduce the quantity of water used for agricultural irrigation. This strategy could increase the Region's net water savings, improve water quality, provide environmental benefits, improve flow and timing, and increase energy efficiency.

Strategies recommended by the California Water Plan Update 2009 to achieve agricultural water savings and benefits include:

- Improving irrigation system technology and management of water, both on-farm and at the irrigation district level to minimize water losses
- Adjusting irrigation schedules to decrease the amount of water applied
- Installing remote monitoring to allow districts to measure flow, water depth and improve water management and controls
- Developing community educational conservation activities to foster water use efficiency

Merced Region Efforts

An example of current agriculture water use efficiency efforts employed by the Region's primary agricultural water supplier (MID) is listed below.

- **Merced Irrigation District Water Management Plan**. MID has prepared and periodically updates a Water Management Plan focused on establishing applicable Efficient Water Management Practices, including agricultural water use efficiency and conservation efforts. According to information from MID's Water Management Plan, agricultural water use efficiency

efforts include improvements to that reduce operational discharges from the distribution system (such as remote monitoring installation), as well as on-farm incentive programs.

- **MID Surface Water/Groundwater Optimization Program (SUGWOP)**. The program among other objectives aims at increasing system efficiency. MID has invested several million dollars since the 1990s to complete projects aimed at increasing system efficiency, such as regulating reservoirs, canal automation, remote control monitoring and control through a net work of sites under Supervisory Control and Data Acquisition (SCADA), and water order upgrades.

Urban Water Use Efficiency

Due to the Region's growing population and expanding urban development (refer to *Chapter 1, Region Description*), it is vital that urban water use efficiency strategies are adopted to reduce pressure on the Region's groundwater and surface water supplies. Further, in accordance with provisions stipulated by Senate Bill x7-7 (the Water Conservation Act of 2009), all urban water suppliers within the Region must reduce urban water consumption by 20% by 2020.

Approaches recommended by the California Water Plan Update 2009 to increase urban water use efficiency include:

- Implementing programs such as Best Management Practices
- Reviewing the Urban Water Management Plan to ensure 20 percent water use reductions are achieved by 2020
- Installing water efficient landscapes
- Encouraging gray water and rain water capture to increase water conservation and improve water quality
- Increasing public outreach and encouraging community involvement
- Funding incentive programs for small districts and economically disadvantaged communities

Merced Region Efforts

Various aggressive measures are currently being implemented to increase urban water use efficiency in the Region. Example water demand management measures currently being implemented or planned to be implemented by the City of Merced to increase urban water use efficiency include:

- **Residential Plumbing Retrofit:** The City is in the process of installing physical devices to reduce the amount of water used or to limit the amount of water that can be served to a customer.
- **Water System Audits:** The City performs water system audits to quantify unaccounted-for water.
- **Metering with Commodity Rates:** The City installs meters for all new connections to allow billing by volume of use.
- **Public Information Program:** The City has an active public information program that distributes information to the public through a variety of methods including brochures, press releases, school curricula, educational flyers, commercials, etc.
- **School Education Program:** The City is implementing a school education program that includes providing educational materials and instructional assistance.

- **Water Conservation Coordinator:** The City employs a Water Conservation Specialist who serves as the City's Conservation Coordinator.
- **Water Waste Prohibition:** The City has ordinances in place to prohibit the waste of water.
- **Planada Community Services District Water Conservation Project:** Planada Community Services District is in the process of metering all services within its service area in order to implement volumetric pricing, which is a proven technique to reduce water consumption. Additional the District is rehabilitating an aging and brittle portion of the distribution system that is prone to leaks and conveyance system losses.

5.4.2 Improve Operational Efficiency and Transfers

RMS identified in the Improve Operational Efficiency and Transfers category include:

- Conveyance - Delta
- Conveyance – Regional / Local
- System Reoperation
- Water Transfers

These RMS are discussed in further detail below.

Conveyance - Delta

The Delta conveyance system supplies water to the San Francisco Bay Area, Central Valley, and Southern California. The Merced Region does not currently receive imported water from the Delta.

Delta conveyance strategies identified by the California Water Plan Update 2009 include:

- Establishing performance metrics that record quantity of water deliveries for agricultural and urban users
- Utilizing Delta Vision Task Force and Bay-Delta Conservation Plan recommendations to increase operational flexibility and conveyance reliability to benefit water supply and aquatic ecosystems
- Developing strategies that maintain channel capacity in the Delta

Merced Region Efforts

As the Region does not receive water supplies from the Delta and would not undertake a project involving conveyance within the Delta, the Conveyance-Delta RMS was not included in the MIRWMP.

While Delta conveyance does not have a direct impact on the Region, there is an indirect connection between the Delta conveyance and the Region. Improved conveyance in the Delta can benefit the Region through improved water quality and reduced flooding impacts. The Region currently experiences saline intrusion from the San Joaquin River, and improving fresh water conveyance in the Delta to improve Delta water quality might reduce salinity intrusion into the Region. Additionally, improving flows through the Delta could reduce backwater flooding experienced in the Region.

Although the Region determined that the Conveyance-Delta RMS is not applicable to the MIRWMP, decisions made by the State may require the MIRWMP to consider this RMS in the future. For example, in December 2012, the SWRCB issued a Draft SED in Support of Potential Changes to the Water Quality Control Plan for the Bay-Delta: San Joaquin River Flows and Southern Delta Water Quality. Implementation of the proposed changes would require the Merced Region to release 35% of unimpaired Merced River runoff, reducing the amount of water available for diversion within the Region in order to support conveyance reliability through the Delta. At the SWRCB's public hearing for the Draft SED, stakeholders from the Region expressed concerns over the proposed action and noted its impact to the Conjunctive Management and Groundwater Storage RMS, which is important to water supply reliability in the Region.

Conveyance- Regional/Local

As described in detail in Chapter 2 Region Description, the Region relies on both groundwater and surface water supplies. Surface water supplies can be used to offset groundwater demands and to recharge local groundwater basins in certain areas in the Region, and therefore can be used to correct groundwater overdraft conditions within the Region. As such, the Region would benefit from improvements in water supply reliability and conveyance infrastructure that increase operational efficiency and transfers of surface water and groundwater supplies. Benefits of improving regional/local conveyance infrastructure include: maintaining/increasing water supply reliability, protecting water quality, augmenting current water supplies, and providing water system operational flexibility.

Strategies identified by the California Water Plan Update 2009 for improving regional/local conveyance of water supplies include:

- Improving aging infrastructure, increasing existing capacities, and/or construction of new conveyance facilities
- Replacing or improving canal structures to improve an irrigation district's ability to manage and control water in the district and reducing spillage
- Constructing alternative water conveyance pipelines to improve water supply reliability

Merced Region Efforts

Examples of current regional/local conveyance strategies employed within the Region are listed below.

- **MID Regulating Reservoirs**. MID operates six regulating reservoirs that are used to regulate flows and balance MID's water supply system. As of 2003, these reservoirs had a total active regulating volume of 3,235 acre-feet.
- **MID Water Management Activities**. MID conducts a variety of water management activities designed to reduce diversions and operational discharges and to improve delivery response. These projects included conveyance-related activities such as improving conveyance structures to remove capacity constraints.
- **Canal Improvements.** MID canals are used to deliver water supplies, but are also used to discharge and convey stormwater flows. Improvements to MID canals will be required to address increasing stormwater discharges that are related to population increase and other factors.

Canal improvement projects include lining canals.

System Reoperation

System reoperation strategies alter operation and management procedures for existing reservoirs and conveyance facilities to increase water-related benefits from these facilities. Changes in water demands and changing climate may require reoperation of existing facilities to increase project yield or address climate change impacts. System reoperation strategies will require making changes to how projects operate to best meet the changing needs of the Region. Some of the potential benefits of system reoperation strategies include: increasing water supply reliability, additional flexibility to respond to extreme hydrologic events, and improving the efficiency of existing water uses.

System reoperation strategies identified by the California Water Plan Update 2009 include:

- Establishing a baseline hydrology and enhanced description of present water management system components
- Considering possible climate change effects in reoperation projects
- Collaborating between federal, state, and local agencies on system reoperation studies

Merced Region Efforts

Examples of Region-wide system reoperation strategy are listed below.

- **Merced Groundwater Basin Groundwater Management Plan**. The 2008 MAGPI Groundwater Management Plan, which covers the majority of the Merced Region, establishes a baseline hydrology and a description of water management system components within the Region.
- **Lake Yosemite Reoperation.** MID reoperated Lake Yosemite during flood seasons from 2011 to 2013. During the flood seasons, MID released small volumes of water which provided

beneficial flows in Bear Creek while also increasing flood control capacity in Lake Yosemite. The volume of water released to Bear Creek was recovered by subsequent storm flows.

- **Groundwater Well Reoperation:** MID changed its groundwater operational strategy such that only groundwater wells that supply areas of higher elevation are operated during years of ample water supply. The change has resulted in 15,000 AF of additional in-lieu recharge since 1993.

Water Transfers

Water transfers are temporary or long-term changes in the point of diversion, place of use, or purpose of use due to transfer or exchange of water or water rights in response to water scarcity. Benefits to establishing water transfers include improving economic stability and environmental conditions for receiving areas. Compensation for water transfers can fund beneficial projects/activities for the Region, reduce water rates, and/or improve facilities.

Water transfer strategies identified by the California Water Plan Update 2009 include:

- Developing and implementing groundwater management plans and monitoring programs
- Allowing community participants to identify and respond to conflicts caused by transfers
- Refining current methods for identifying and quantifying water savings for transfers using crop idling, crop shifting, and water use efficiency measures
- Improving coordination and cooperation among local, state, and federal agencies to facilitate sustainable transfers

Merced Region Efforts

The Region has employed various water transfer strategies including the following:

- **Buchanan Dam Water Transfer**. The Chowchilla Water District currently coordinates with a federal agency, the United States Bureau of Reclamation, to implement a contract that allows CWD to pay to use approximately 24,000 acre-feet of water transferred from Buchanan Dam each year.
- **Merced Irrigation District Transfers.** Since 1993, MID has implemented numerous water transfers a water management tool. These include sales to the United Sates Bureau of Reclamation, DWR, the Environmental Water Account, San Luis Delta Mendota Water Authority, Westlands Water District and other agencies. Revenue from the sales was used to undertake system improvements and stabilize water rates. Maintaining MID's water rates at a rate lower than the average groundwater pumping cost is important to discourage growers from reverting to groundwater pumping, which impacts the groundwater aquifer and thereby further impacts District revenues.

5.4.3 Increase Water Supply

RMS identified in the Increase Water Supply category include:

- Conjunctive Management and Groundwater Storage
- Desalination
- Precipitation Enhancement
- Recycled Municipal Water

- Surface Storage – CALFED
- Surface Storage – Regional / Local

These RMS are discussed in further detail below.

Conjunctive Management and Groundwater Storage

The reliability of the Region's water supplies can be improved through conjunctive use of both surface and groundwater supplies. Conjunctive management and groundwater storage refers to the coordinated and planned use and management of both surface water and groundwater resources to maximize the availability and reliability of water supplies to meet water management objectives. The conjunctive management and groundwater storage strategy seeks to increase water supply reliability and groundwater sustainability. Several benefits of utilizing conjunctive management and groundwater storage strategies include: improving water supply reliability and sustainability, reducing groundwater overdraft and land subsidence, protecting water quality, and improving environmental conditions.

Conjunctive management and groundwater storage strategies identified by the California Water Plan Update 2009 include:

- Implementing monitoring, assessment, and maintenance of baseline groundwater levels
- Encouraging local water management agencies to coordinate with tribes and other agencies involved in activities that might affect long term sustainability of water supply and water quality
- Local groundwater monitoring and management activities and feasibility studies to increase the coordinated use of groundwater and surface water

Merced Region Efforts

Conjunctive management and groundwater storage strategies being considered within the Region are listed below.

- **Merced Irrigation District Conjunctive Use Program**. MID has been implementing an extensive conjunctive use program since the 1950s. This program reached its maximum capacity in the late 1960s. MID owns and operates a total of 180 groundwater wells; these wells typically remain on standby and are used only when and where there is a shortage of surface water. MID groundwater pumping has been as low as 5,800 AF during wet years when groundwater is used solely to supply areas of high elevation that are not connected to a surface water system. In dry years, MID groundwater pumping has been as much as 80,000 AF. Through its conjunctive management program, MID has expanded its groundwater recharge during years of ample surface water to a total of 45,000 AF as follows:

    1. Reoperation of Groundwater Wells: See 5.4.2 Improve Operational Efficiency and Transfers, System Reoperation.
    2. Low Head Boosters: These boosters were constructed to serve high elevation areas with surface water rather than groundwater wells in years of ample surface water supply. Groundwater wells that serve these areas remain on standby to be used in dry years.
    3. Highlands Pilot Project: MID constructed a pond and installed a pumping system to provide filtered, pressurized water service to 450 acres, replacing the use of private groundwater wells in normal years. During dry years, the District supplies groundwater to the area.

4. MID Groundwater Conservation Incentive Program: MID assists growers using private groundwater wells to return to surface water by providing a monetary incentive which is paid back through a commitment to purchase surface water during years of ample water supply.

- **Merced Groundwater Basin Groundwater Management Plan**. Since its formation, the primary focus of MAGPI has been implementation of the Merced Groundwater Basin Groundwater Management Plan, which promotes conjunctive surface water and groundwater management. As such, the fifteen municipal and agricultural water purveyors that comprise MAGPI work together on activities aimed at improving long term sustainability of the Merced Groundwater Basin (Merced Subbasin).
- **MAGPI and DWR Memorandum of Understanding**. In 2001 MAGPI entered into an MOU with DWR to work cooperatively to promote conjunctive use projects within the Merced Subbasin.
- **Groundwater Recharge Feasibility Study**. As part of the IRWM program, the Region completed a Groundwater Recharge Feasibility Study (Appendix C). The purpose of this study was to define areas with high potential for recharge.
- **El Nido Area Recharge Project**. One of the areas identified through the Groundwater Recharge Feasibility Study as having high potential for recharge is the El Nido area. MID is undertaking a project to maximize the use of an existing water license from the State Water Resources Control Board to divert water from Mariposa Creek for recharge in the El Nido area. The project will automate the existing diversion structure on Mariposa Creek, allowing MID to increase use of the existing surface water right. A combination of direct and in-lieu recharge will be implemented, using an existing recharge basin in El Nido as well as adjacent agricultural lands for recharge.
- **Pilot Study of Off-Season Flooding of Agricultural Lands**. California Water Foundation is working with Merced Irrigation District to develop a pilot feasibility study to determine the effectiveness of using winter-time excess flows to flood agricultural lands for groundwater recharge.

Desalination

Desalination, the process of removing salts and other minerals from saline water, requires complicated technologies and is an energy intensive technology. Desalination offers many potential benefits including: increasing water supply reliability during drought periods, reducing dependence on groundwater supplies, protecting public health, and facilitating water recycling and reuse.

Recommendations identified by the California Water Plan Update 2009 to facilitate desalination strategies include:

- Desalination projects should be given the same funding opportunities as other water supply and reliability projects
- Ensure most economical and environmentally appropriate desalination technology is utilized
- Project sponsors need to ensure planning of desalination projects is a collaborative process that engages key stakeholders, the general public, and permitting agencies

Merced Region Efforts

Desalination is not currently used within the Region. Due to the distance between the Merced Region and potential saline water sources, desalination is not likely to serve as a future water source for the Region and was not considered in the IRWM Plan. There is a saline water sink along the San Joaquin River, but this area is not considered a viable water source because extensive groundwater pumping in this area could cause subsidence.

Precipitation Enhancement

Precipitation enhancement strategies seek to artificially stimulate clouds to produce more rainfall or snowfall than would naturally occur. The benefit of this strategy is primarily to increase water supply.

Recommendations identified by the California Water Plan Update 2009 for implementing precipitation enhancement projects include:

- Seeking State support for development and funding of new precipitation enhancement projects
- Collecting data and evaluations of existing California precipitation enhancement projects to perform research on the effectiveness of the technology
- Investigating the potential of augmenting Colorado River Water supply through cloud seeding

Merced Region Efforts

Precipitation enhancement is not currently implemented within the Region. Although the Region relies on surface water from the Merced River, which varies depending upon rainfall patterns, precipitation enhancement is not a likely RMS for the Region due to its expense and uncertain effectiveness. Furthermore, current regulations in Yosemite National Park prevent precipitation enhancement from being utilized in the Region.

Recycled Municipal Water

One way to offset current and future water demands for the Region is to reuse highly treated wastewater for non-potable uses (recycled municipal water). Recycled water use can be a potentially significant local resource that can be used to help reduce groundwater and surface water demands. Further, because recycled water supplies are minimally impacted by changes in hydrology; they are not expected to be significantly impacted by climate change.

Recycled municipal water strategies identified by the California Water Plan Update 2009 and Water Recycling 2030: Recommendations of California's Recycled Water Task Force include:

- Increasing funding availability for water reuse/recycling facilities and infrastructure
- Creating education curriculum for public schools and institutions of higher learning to educate the public about recycled water
- Engaging the public in an active dialogue and encouraging participation in the planning process of water recycling projects including nonpotable and potable applications
- Providing resources (i.e. funding) to agencies that will perform comprehensive analysis of existing water recycling projects to estimate costs, benefits, and water deliveries
- Assessing water recycling technology to determine least costly and environmentally appropriate technology based on location and need

Merced Region Efforts

Examples of water recycling strategies employed within the Region are described below.

- **Water Reclamation Plants.** The cities of Merced and Atwater both have water reclamation plants that treat and reuse wastewater. The City of Merced's water reclamation plant is capable of producing recycled water in accordance with Title 22 of the California Code of Regulations for irrigation and industrial uses.

Surface Storage- CALFED

Potential benefits from CALFED surface storage include releases of new storage and system flexibility such that the operation of other facilities can be modified without reducing current benefits. The additional water storage can be used to improve ecosystem functions, conditions for target species, improve water quality, and supply reliability for water users.

CALFED surface storage strategies identified by the California Water Plan Update 2009 include:

- Decreasing demand of imported water through water conservation programs
- Engaging stakeholders, potential projects participants, tribes, the public, and agencies in identifying, evaluating, and quantifying potential projects that address the CALFED surface storage goals and their effects (positive and negative)
- Developing alternatives and potential future scenarios that incorporate alternative delta conveyance, operations, and possible climate change effects to allow potential participants to assess their interest in specific projects
- Developing mechanisms that provide assurance projects are being operated in a manner consistent with the objectives of CALFED surface storage

Merced Region Efforts

The Merced Region does not currently benefit from surface storage projects related to the Delta, and does not use imported water. However, CALFED did identify potential surface storage projects within the Merced Region that are of interest to the Region.

On March 31, 1997, CALFED produced a preliminary study in support of a 101-foot high offstream dam on Dry Creek with a 240,000 AF capacity. The proposed project known as the Montgomery Dam could be reevaluated in future updates to the MIRWMP for use as a flood control reservoir receiving flows from the Merced River. Such a project would result in higher storage behind New Exchequer Dam with a revised higher Top of Conservation pool. Benefits of the increased storage could include a more reliable water supply, preservation of the cool water pool benefitting fisheries, support of wetlands at the minimum pool level and potential venues for recreation. The more reliable water supply and preservation of the cool water pool provide an important benefit in the face of climate change.

Surface Storage- Regional/Local

Though groundwater is the predominant supply used in the Merced Region, the Region also uses surface water from MID as well as a system of canals, reservoirs, and dams for conveyance and storage of surface water supplies. Projects that incorporate regional / local surface water storage focus on alternatives to expand local surface storage capacity. Climate change threatens to change the timing of precipitation, with fewer, more intense rainfall events. Increased surface storage can provide flood management benefits, as well as improving the Region's ability to capture and store watershed runoff under changing climate conditions. Benefits of expanding regional/local surface storage include: improved flood management, ecosystem management, emergency water supply, river and lake recreation, capture of surface water runoff, and water supply reliability against catastrophic events and droughts.

Regional/local surface storage strategies identified by the California Water Plan Update 2009 include:

- Development of a comprehensive methodology for analyzing project benefits and costs by local agencies
- Continued studies, research, and dialogue to identify a common set of tools for determining costs and benefits of surface storage projects
- Adaptively manage operations of existing surface storage facilities
- Rehabilitation and/or enlargement of existing surface storage infrastructure
- Developing water purchasing agreements to buy water from other agencies that own storage reservoirs with substantial water supplies

Merced Region Efforts

Examples of regional/local surface storage strategy considered within the Region are listed below.

- **MID Existing Regulating Reservoirs**. MID operates six regulating reservoirs that are used to regulate flows and balance MID's water supply system by providing storage in times when water flows are high. As of 2003, these reservoirs had a total active regulating volume of 3,235 AF.
- **MID Proposed Regulating Reservoirs.** MID has proposed the construction of a 100-AF offstream reservoir near the termination of the McCoy Lateral, southwest of Livingston. MID is required to provide Stevinson Water District with 24,600 AFY. The McCoy Lateral is currently one of the waterways in which water is delivered to Stevinson Water District. The proposed regulating reservoir basin will improve water supply management by increasing the efficiency, consistency and reliability of deliveries to both Stevinson Water District and MID growers.
- **Casebeer Regulating Reservoir**. MID has proposed the construction of a 100-acre foot offstream reservoir to be located at the confluence of the Casebeer Lateral Extension and Deadman Creek, southwest of Livingston.
- **Black Rascal Creek Regulating Reservoir**. This reservoir would be a part of the Black Rascal Creek Flood Control Project (see Section 5.4.5 Improve Flood Management). The capacity of the regulating reservoir would be in excess of 500 AF.
- **MID Tunnel 1 Reservoir.** This project would be located upstream from MID Tunnel 1 southwest of Snelling. The reservoir would include a small dam approximately 40 feet high to impound 10,000 AF. The project would also include a canal and pipeline with a possible mini hydro plant to bypass Tunnel 1. The project would benefit water supply, increased efficiency in

MID's distribution system, and optimize power generation from all hydro plants upstream from the reservoir.

5.4.4 Improve Water Quality

RMS identified in the Improve Water Quality category include:

- Drinking Water Treatment and Distribution
- Groundwater Remediation/Aquifer Remediation
- Matching Quality to Use
- Pollution Prevention
- Salt and Salinity Management
- Urban Runoff Management

These RMS are discussed in further detail below.

Drinking Water Treatment and Distribution

Providing a reliable supply of safe drinking water is critical for protecting public health. Though the Region's water purveyors provide high-quality drinking water that meets regulatory standards, public water systems must continue developing and maintaining adequate water treatment and distribution facilities to ensure that public health is protected. Climate change could reduce flows in the Merced River and increase saline intrusion in groundwater supplies, impacting the quality of existing supplies and increasing the level of treatment needed to provide drinking water that meets all regulatory requirements. Several benefits of drinking water treatment and distribution strategies include: improving public health, reducing water distribution delivery problems, and ensuring delivery of high-quality drinking water.

Drinking water treatment and distribution strategies identified by the California Water Plan Update 2009 include:

- Working closely with CDPH to quantify the total needs for water system infrastructure improvement and replacement
- Regionalizing and consolidating public water systems
- Developing incentives to allow water systems to reduce waste of limited water resources
- Researching and developing new treatment technologies
- Providing additional funding for water supply, water treatment, and infrastructure projects to ensure safe and reliable supply of drinking water for individuals and communities
- Joining the California Water/Wastewater Agency Response Network (WARN) program, which provides mutual aid and assistance more quickly than through the Standardized Emergency Management System (SEMS)
- Creating source control and reduction programs to address pharmaceuticals and personal care products

Merced Region Efforts

Drinking water treatment and distribution strategies employed within the Region are listed below.

- **Drinking Water Systems**. All of the water purveyors that provide drinking water have water systems that provide water to the Region's residents. Domestic water suppliers in the Region are discussed in Chapter 2 Region Description, Section 2.3.3.
- **Monitoring**. Water purveyors in the Merced Region monitor drinking water regularly according to state (CDPH) and federal (USEPA) regulations.

Groundwater Remediation/Aquifer Remediation

Groundwater is a valuable local resource that is comprehensively managed through MAGPI's adopted Groundwater Management Plan. Groundwater Remediation/Aquifer Remediation strategies seek to improve the quality of degraded groundwater for beneficial uses. Groundwater contamination can come from a multitude of sources such as: heavy metals, salts, organic and inorganic pollutants, nitrates, arsenic, pesticides, septic systems, and urban and agricultural activities. Several benefits of adopting groundwater remediation/aquifer remediation strategies include: availability of additional water supplies, avoiding purchasing alternate water supplies, and storage of excess surface water supplies in remediated aquifers.

Groundwater remediation/aquifer remediation strategies identified by the California Water Plan Update 2009 include:

- Limiting potentially contaminating activities in recharge areas
- Identifying historic commercial and industrial sites with contaminated discharges and responsible parties to remediate sites
- Implementing source water protection measures
- Establishing and supporting funding for detecting emerging contaminants by commercial laboratories and installation of wellhead treatment systems

Merced Region Efforts

Groundwater remediation strategies employed within the Region are listed below.

- **Castle Airport Aviation Groundwater Remediation**. Castle Airport, a former military base located outside of the City of Merced, has known plumes of trichloroethylene (TCE). This site is undergoing remediation, including implementation of groundwater extraction systems that are being used to remove TCE from the groundwater. As of 2007, 13.6 billion gallons of contaminated groundwater was extracted and treated near or within the Castle Airport remediation site (MAGPI 2008).
- **Detection of Emerging Contaminants**. In 2007, research was completed by the University of California, Davis, and the United States Geological Survey, which involved surveying for pharmaceuticals in dairies located within the Merced Subbasin. This research resulted in a few detections of pharmaceuticals in shallow groundwater areas within the Merced Subbasin.

Matching Quality to Use

Matching water quality to use is directly linked to four other resource management strategies: pollution prevention, recycled municipal water, salt and salinity management, and groundwater/aquifer remediation. Matching quality to use strategies recognize that water quality should suitably match its intended use such that water quality constituents do not adversely affect the intended use of water. Several benefits of maintaining and matching water quality to use include: reduction of disinfection byproducts in delivered drinking water sources, opportunities for blending water sources through improvements in treated water quality, potential to reduce energy use due to reduced quality needs, and avoiding costly treatment procedures.

Strategies for matching water quality to use identified by the California Water Plan Update 2009 include:

- Managing water supplies to optimize and match water quality to the highest possible use and to the appropriate technology
- Encouraging upstream users to minimize the impacts of non-point urban and agricultural runoff and treated wastewater discharges
- Supporting the development of salt management plans
- Reviewing projects to determine the potential impacts from wastewater elimination into local streams
- Supporting research into solutions to the potential conflicts between ecosystem restoration projects and the quality of water for drinking water purposes

Merced Region Efforts

Projects and programs that match quality to use in the Merced Region are listed below.

- **Merced Salinity and Nutrients in Groundwater & Surface Waters Study**. Through the IRWM program, stakeholders in the Merced Region have developed a salinity and nutrient management study (Appendix D), which identifies water quality issues in the Region and provide a basis for managing salinity and nutrients in the Merced Region.
- **Uses of Non-Potable Water.** Two municipalities within the Region, the City of Merced and the City of Atwater, currently supply treated wastewater to agricultural users and to wildlife management wetlands. This allows water reuse to occur without the additional treatment that may be required if this water were to be reused for other purposes.

Pollution Prevention

Pollution prevention strategies are vital for protecting and improving water quality at its source, and for preventing costly water treatment options. Preventing pollution throughout watersheds ensures that water supplies can be used and reused for a broad number of uses.

Pollution prevention strategies identified by the California Water Plan Update 2009 include:

- Developing proper land management practices that prevent sediment and pollutants from entering source waters
- Establishing drinking water source and wellhead protection programs to protect drinking water sources and groundwater recharge areas from contamination

- Identifying communities relying on groundwater contaminated by anthropogenic sources for drinking water and take appropriate regulatory action
- Addressing improperly destroyed, sealed and abandoned wells that can serve as potential pathways for groundwater contaminants

Merced Region Efforts

Examples of current pollution prevention strategies employed within the Region are listed below.

- **Merced Storm Water Management Program.** The City of Atwater, the City of Merced, the County of Merced, and the Merced Irrigation District are co-permittees (the Merced Storm Water Group) jointly implementing a regional Storm Water Management Program that covers the majority of the Region. The Merced Storm Water Group's Storm Water Management Program addresses priority pollutants that are common in stormwater runoff from municipal areas, and therefore works to prevent pollution within the Region.

Salt and Salinity Management

Accumulation of salts in soil can impair crop productivity, making salinity management a critical concern for the Region's highly productive agricultural industry. Salinity management strategies establish or improve salinity management in the Region based on an understanding of salt loading and transport mechanisms. Several potential benefits of establishing or improving salt and salinity management include: protecting water resources and improving water supplies, securing, maintaining, expanding, and recovering usable water supplies, and avoiding future significant costs of treating water supplies and remediating soils.

Salt and salinity management strategies identified by the California Water Plan Update 2009 include:

- Developing a regional salinity management plan, and interim and long-term salt storage, salt collection, and salt disposal management projects
- Monitoring to identify salinity sources, quantifying the level of threat, prioritizing necessary mitigation action, and working collaboratively with entities and authorities to take appropriate action
- Reviewing existing policies to address salt management needs and ensure consistency with long-term sustainability
- Collaborating with other interest groups to optimize resources and effectiveness
- Identifying environmentally acceptable and economically feasible methods for closing the loop on salt

Merced Region Efforts

An example of a current salt and salinity management strategy employed by the Region is listed below.

- **Merced Salinity and Nutrients in Groundwater & Surface Waters Study**. Through the IRWM program, stakeholders in the Merced Region developed a salinity and nutrient management study, which identifies water quality issues in the Region and provide a basis for managing salinity and nutrients in the Merced Region (included as Appendix D).
- **Reducing Encroachment of Saline Water Wedge**. MID provides water supply within its sphere of influence including areas south of Livingston during years of ample surface supply.

The surface water replaces groundwater pumping in areas near the periphery and up-gradient of a high salinity wedge.

Urban Runoff Management

Urban runoff management strategies involve managing both stormwater and dry weather runoff. To successfully manage urban runoff, agencies need to incorporate other resource management strategies such as pollution prevention, land use planning and management, watershed management, urban water use efficiency, recycled municipal water, recharge area protection, and conjunctive management. Several potential benefits of urban runoff management strategies include: minimizing soil erosion and sedimentation problems, reducing surface water pollution, protecting natural resources, protecting and augmenting groundwater supplies, and improving flood protection.

Urban runoff management strategies identified by the California Water Plan Update 2009 include:

- Coordinating efforts with agencies, stakeholders, and the public to decide how urban runoff management should be integrated into work plans
- Encouraging public outreach and education concerning funding and implementation of urban runoff measures
- Designing recharge basins to minimize physical, chemical, or biological clogging
- Working with community to identify opportunities to address urban runoff management
- Providing incentives for the installation of low impact development features on new and existing developments
- Emphasizing source control measures and strong public education/outreach efforts as being the most effective way to manage urban runoff in this highly arid region

Merced Region Efforts

An example of a current urban runoff management strategy employed by the Region is listed below.

- **Merced Storm Water Management Program.** The City of Atwater, the City of Merced, the County of Merced, and the Merced Irrigation District are co-permittees (the Merced Storm Water Group) that jointly implement a regional Storm Water Management Program covering the majority of the Region. The Merced Storm Water Group's Storm Water Management Program addresses priority pollutants that are common in stormwater runoff from municipal areas, and emphasizes implementing urban runoff management strategies.

5.4.5 Improve Flood Management

The RMS identified in the Improve Flood Management category is:

- Flood Risk Management

This RMS is discussed in further detail below.

Flood Risk Management

The Merced Region is subject to flooding, and many portions of the Region are located within the 100-year flood zone as defined by the Federal Emergency Management Agency (refer to *Chapter 2, Region Description* for more information). Reducing flood risks will require management strategies that enhance flood protection through projects and programs that assist in managing flood flows and to prepare for, respond to, and recover from floods.

Flood risk management strategies identified by the California Water Plan Update 2009 include:

- Structural approaches that can consist of:
    - Setting back levees
    - Modifying channels to include lining (i.e. concrete, rip rap) to improve conveyance of flood flows
    - High flow diversions into adjacent lands to temporarily store flows
    - Improved coordination of flood operations
    - Maintaining facilities to secure the long-term preservation of flood management facilities
- Land use management approaches that consist of:
    - Floodplain function restoration to preserve and/or restore the natural ability of undeveloped floodplains to absorb, hold, and release floodwaters
    - Floodplain regulation
    - Development and redevelopment policies
    - Housing and building codes
- Disaster Preparedness, Response, and Recovery for flood risk management approaches such as:
    - Information and education
    - Disaster preparedness
    - Post-flood recovery

Merced Region Efforts

Examples of flood risk management strategies considered by the Region are listed below.

- **Merced Region Integrated Flood Management Summary**. In conjunction with preparation of the IRWM Plan, the Region completed an Integrated Flood Management Summary that will improve integrated flood management in the Region. This effort summarizes opportunities to coordinate and integrate Merced IRWM flood management planning with progress made by the Central Valley Flood Management planning process.
- **Black Rascal Flood Control Project**. The Black Rascal Flood Control Project would protect DACs in the Merced Region from chronic flooding issues that have plagued the Region for decades. The project will evaluate various detention basin alternatives along Black Rascal Creek

to protect downstream communities from a 200-year flood event, which is the standard level of flood protection for urban development.

- **Flood Water Conveyance Projects.** A number of projects have been proposed to divert flows from watersheds that experience high flood flows to watersheds that could benefit from additional water for environmental enhancements, water supply or groundwater recharge.

5.4.6 Practice Resources Stewardship

RMS identified in the Practice Resources Stewardship category include:

- Agricultural Lands Stewardship
- Economic Incentives (Loans, Grants and Water Pricing)
- Ecosystem Restoration
- Forest Management
- Land Use Planning and Management
- Recharge Area Protection
- Water-Dependent Recreation
- Watershed Management

These RMS are discussed in further detail below.

Agricultural Lands Stewardship

Agricultural lands stewardship is the practice of conserving and improving land for various conservation purposes as well as protecting open spaces and rural communities. Several potential benefits of agricultural lands stewardship management strategies include: protecting environmentally sensitive lands, recharging groundwater, improving water quality, providing water for wetland protection and restoration, increasing carbon sequestration within soil, and reducing costs of flood management.

Agricultural land stewardship strategies identified by the California Water Plan Update 2009 include:

- Stabilizing stream banks to slow bank erosion and filter drainage water from the fields
- Installing windbreaks (i.e. trees and/or shrubs) along field boundaries to help control soil erosion, conserve soil moisture, improve crop protection among many other benefits
- Performing conservation tillage to increase water infiltration and soil water conservation and reduce erosion and water runoff
- Encouraging irrigation tailwater recovery to help capture and reuse irrigation runoff water to benefit water conservation and off-site water quality

Merced Region Efforts

An example of a current agricultural lands stewardship management strategy employed by the Region is listed below.

- **UC Merced Agricultural Conservation Courses**. The University of California, Merced (UC Merced) currently offers courses regarding conservation and other sustainable agricultural

techniques. These courses vary, but may include things such as education regarding soil erosion and conservation tillage.

- **El Nido Area Recharge Project.** MID is undertaking a project to maximize the use of an existing water license from the State Water Resources Control Board to divert water from Mariposa Creek for recharge in the El Nido area. MID has obtained letters of interest from individuals that own or lease agricultural lands in the El Nido indicating their intent to spread flood flows from Mariposa Creek on their lands, thereby allowing the agricultural lands to act as intermittent recharge basins. Economic Incentives (Loans, Grants and Water Pricing)

Economic incentives can influence water management, amount and timing of water use, wastewater volume, and source of supply. Types of incentives include low interest loans, grants, and water rates and rate structures. Free services, rebates, and use of tax revenues to partially fund water services have a direct effect on the prices paid by water users. Several potential benefits of establishing or improving economic incentive-based strategies include: promoting efficient water management practices and encouraging the adoption/improvement of water efficient/ on-site water recycling technologies.

Economic incentive management strategies identified by the California Water Plan Update 2009 include:

- Instituting loans and grant programs that support better regional water management
- Adopting policies that promote long-term water use efficiency
- Developing modeling tools for economic analyses of economic incentives as well as guidelines and ranking criteria for grant and loan awards
- Exploring innovative financial incentives

Merced Region Efforts

Example economic incentive strategies employed by the Region are listed below.

- **MID Incentives**. MID implements several efficient water management practices that include economic incentives to promote water use efficiency.
- **City of Merced Water Use Efficiency.** The City of Merced implements several demand management measures that aim to promote long-term water use efficiency, including: water waste prohibition ordinances and metering with commodity rates that allow for billing to occur by volume of use.

Ecosystem Restoration

Ecosystem restoration strategies are vital for improving modified natural landscapes and biological communities. Restoration of aquatic, riparian, and floodplain ecosystems are of primary concern, as they are most directly affected by water and flood management actions and likeliest to be affected by climate change. Potential benefits of establishing ecosystem restoration strategies include: improved water quality and quantity for wildlife, aquatic species, and human consumption; and increased diversity of native species and biological communities.

Ecosystem restoration strategies identified by the California Water Plan Update 2009 include:

- Increasing the use of setback levees and floodwater bypasses
- Creating programs that support and fund the identification of stream flow needs

- Establishing biological reserve areas that connect or reconnect habitat patches
- Expanding riparian habitat
- Devising climate change adaptation plans that benefit ecosystems, water, and flood management
- Reproducing natural flows in streams and rivers
- Controlling non-native invasive plant and animal species
- Filtering of pollutants and recharging aquifers

Merced Region Efforts

Examples of current ecosystem restoration strategies employed by the Region are listed below.

- **Environmental Water Provisions.** The Region has a growing environmental water demand, and MID and other water purveyors regularly release water to augment natural flows in streams and rivers. For example, since 1993 MID has benefitted fisheries and ecosystems in the Merced River and the San Joaquin River through water transfers.
- **October Pulse Flow:** Since 1999 MID has coordinated with California Fish and Wildlife for the release of a water pulse flow designed to attract adult Chinook Salmon. This flow equates to 12,500 AF during the month of October.
- **Lower Merced River Stewardship Project.** Ecosystem restoration is one of the various strategies employed by the East Merced Resource Conservation District's Lower Merced River Stewardship Project. A key component of the project is updating maps of invasive species along the lower Merced River and subsequent removal of species such as water hyacinth, Arundo and star thistle.

MID's October pulse flows help to attract fall Chinook Salmon to the Merced River Salmon Hatchery, which is located along the Merced River downstream of the Crocker-Huffman Diversion Dam.

Forest Management

Forest management strategies focus on activities that are designed to improve the availability and quality of water for downstream users on both publicly- and privately-owned forest lands. Water produced by forest has an economic value that equals or exceeds that of any other forest resource (CWP 2009). Several potential benefits of establishing forest management strategies include: interception of rainfall, reduction of urban runoff, energy-efficient shade during hot weather, reduce flooding and increase dry-season base flows, and protection from surface erosion and filtering pollutants.

Several forest management strategies identified by the California Water Plan Update 2009 include:

- Establishing long-term monitoring to understand hydrologic changes resulting from possible climate change effects through the installation of stream gages, precipitation stations, water-quality and sediment monitoring stations, and long-term monitoring wells
- Increasing research efforts into identifying effective BMPs for forest management and the effects of wildfires
- Assessing sediment sources and erosion processes in managed and unmanaged forested watersheds
- Increasing multi-party coordination of forest management
- Improving communication between downstream and upstream water users
- Developing public education campaigns for water users.

Merced Region Efforts

Although the local water agencies that constitute the RWMG currently have no responsibility to manage the upland forested areas that drain to the Region, protection of those headlands is important for ensuring high quality surface runoff supplies. Additionally, forest management is an important component of increasing water supply.

An example of a forest management strategy employed by the Region is listed below.

- **Sierra Nevada Adaptive Management Project (SNAMP).** SNAMP is a joint effort by the University of California, state and federal agencies, and the public to study the predicated and actual effects of management of forest lands in the Sierra Nevada across four response variables: public participation, wildlife, water and fire/forest health. In the upper Merced River watershed, SNAMP is researching water quality and quantity across treatment and control catchments prior to and after vegetation treatments.

Land Use Planning and Management

Land use planning and management is aimed at developing more efficient and effective land use patterns, recognizing that land use type and intensity influence water supply, water quality, flood management and natural habitat. Integrating land use and water management involves planning for housing and economic development needs while providing for resource protection.

Land use planning and management strategies identified by the California Water Plan Update 2009 include:

- Regulating land use through zoning and subdivision regulations

- Providing incentives for developers to plan and build infill developments and more compact, mixed-use urban developments
- Controlling stormwater through low impact development
- Adopting green building codes with low impact development principles

Merced Region Efforts

An example of a land use planning and management strategy employed by the Region is listed below.

- **Merced County Zoning Code.** The County's zoning code discourages development in flood zones and requires construction of individual stormwater detention basins for new development to limit peak flows to pre-project conditions.

Recharge Area Protection

Recharge areas provide the primary means of replenishing groundwater. Strategies to protect recharge areas ensure the continual capability for the area to recharge groundwater. Protecting recharge areas requires the implementation of urban runoff management strategies, groundwater remediation strategies, and conjunctive management strategies. Several potential benefits of establishing recharge area protection strategies include: protecting and maintaining high-quality groundwater, increased amount of groundwater storage, reduction of urban runoff, and some removal of microbes and chemicals through percolation.

Recharge area protection strategies identified by the California Water Plan Update 2009 include:

- Expanding research into surface spreading and the fate of chemicals and microbes in recharge water
- Increasing funding for the identification and protection of recharge areas
- Creating education and media campaigns to increase public awareness and knowledge on the importance of recharge areas and relevancy to groundwater
- Requiring source water protection plans
- Developing methods for analyzing the economic benefits and costs of recharge areas.

Merced Region Efforts

Examples of current recharge area protection strategies employed by the Region are listed below.

- **Cressey Basin Direct Recharge Project.** MID has implemented a pilot direct recharge project at the Cressey Basin, which has the potential to recharge up to 10,000 acre-feet per year when surface water is available.
- **El Nido Recharge Basin.** MID has an 18-acre recharge basin in El Nido area. MID has proposed a project to establish effective recharge rates and other complete improvements to optimize diversions from Mariposa Creek to the basin.

The photos below show the Cressey Basin Direct Recharge Project at start-up and in operation.

The El Nido Recharge Basin project includes automation of the existing manually operated El Nido Dam to optimize diversions from Mariposa Creek for recharge in the El Nido Area.

Water-Dependent Recreation

Water-dependent recreation strategies are vital to ensuring enjoyment of water recreation activities currently and in the future. Maintaining and protecting water-dependent activities such as fishing, swimming, birding, boating, and others can provide economic, environmental, and social benefits.

Water-dependent recreation strategies identified by the California Water Plan Update 2009 include:

- Using existing data and new surveys to determine recreational needs

- Partnering with schools to provide drowning prevention programs primarily aiming at youth from urban and low income families
- Developing partnerships with universities to coordinate monitoring of public recreation use, equipment, and emerging water recreation trends
- Developing a procedure to incorporate climate change assessments within all infrastructure planning, budgeting, and project development
- Researching, identifying, and mitigating impacts of stream flows that prevent Native Americans from participating in their traditional cultural activities
- Developing invasive species prevention measures.

Merced Region Efforts

An example of a water-dependent recreation strategy employed by the Region is listed below.

- **Lake Yosemite**. Various recreational opportunities are available to residents and visitors in and/or around Lake Yosemite, these include: picnicking, fishing, boating, waterskiing, wind surfing, and swimming.
- **Life Jacket Loan Program**. The East Merced Resource Conservation District is coordinating with the California Department of Boating and Waterways and McConnell State Recreation Area to implement a life jacket loan program for recreationists using the Merced River.
- **Lower Merced River Recreational Boating Public Access**. This project will construct a public access point for safe boat launching on the Merced River, which is frequented by boating enthusiasts and rafters. The project will include a non-motorized launch ramp, vehicle access and parking near the river's edge, a restroom facility, trash containers and interpretive/educational panels.

Boating is a popular activity at Lake Yosemite.

Watershed Management

Watershed management strategies increase and sustain a watershed's ability to provide for the diverse needs of the communities that depend on it. Managing at the watershed scale has proven effective in coordinating and integrating the management of numerous physical, chemical, and biological processes. Watershed management provides a basis for greater integration and collaboration among those policies and actions.

Watershed management strategies identified by the California Water Plan Update 2009 include:

- Creating a scientifically valid tracking and reporting method to document changes in the watershed
- Assessing the performance of projects and programs
- Providing watershed information to better inform local land use decision makers on how to maintain and improve watershed functions
- Using watershed approaches in which all RMS strategies are coordinated

Merced Region Efforts

An example of a watershed management strategy employed by the Region is listed below.

- **Merced River Alliance Project**. The Merced River Alliance was formed to establish and promote a river-wide, watershed-scale view of the Merced River to engage stakeholders in a collaborative effort to work together to protect this valuable resource. The Merced River Alliance Project Final Report focuses on assessing and evaluating the Merced River at the watershed-scale.
- **Merced River Education and Enhancement Program.** This program integrates a series of small, related initiatives to provide holistic, watershed-based benefits to the Merced River watershed. It includes strong community awareness and education component. It also includes monitoring to document changing conditions in the upper Merced River watershed related to climate change and research into improved methods of communicating climate change risks to the general public.

5.4.7 Other Strategies

The California Water Plan Update 2009 and the Proposition 84 and Proposition 1E IRWM Guidelines (DWR 2010) identified other potential RMS that may aid in meeting water management goals and objectives; however, these strategies are currently limited in their ability to address long-term regional water planning needs. These strategies include crop idling for water transfers, dewvaporation or atmospheric pressure desalination, fog collection, irrigated land retirement, rainfed agriculture, and waterbag transport/storage technology.

Crop Idling for Water Transfers

Crop idling is a strategy that removes lands from irrigation to make water available for transfers. Several of the potential benefits from implementing this strategy include: enhancing water supplier reliability by making water available for redistribution, enhancing water quality, protecting and restoring fish and wildlife, and helping farm communities (as well as urban areas) infuse money into the local economy while increasing the reliability of water supply for urban consumers.

Crop idling strategies identified by the California Water Plan Update 2009 include:

- Developing necessary coordination structures to satisfy agency policy requirements
- Consulting with agencies and entities that will be leading crop idling programs
- Understanding the local community impact and third party impacts to develop and implement necessary actions for maintaining economic stability of local communities and mitigating socioeconomic impacts

Merced Region Efforts

With an agricultural production value of approximately $1.5 billion annually (within Merced County), agriculture is a significant economic driver in the Region. Due to the high value of agricultural crops within the Region and the benefits that agriculture imparts to the Region's economy, crop idling is not widely implemented in the Merced Region. However, crop idling could be implemented to address groundwater overdraft and reduce agricultural water demands, especially in areas that are solely dependent on groundwater. Agricultural water demands vary by crop and agricultural use, and it is plausible that in the future the Region could implement actions to idle water-intensive crops to make water (particularly groundwater) available for water transfers and other uses.

Dewvaporation or Atmospheric Pressure Desalination

The dewvaporation or atmospheric pressure desalination strategy would heat brackish water until deposits of fresh water are collected as dew from the opposite side of a heat transfer wall. The heat sources for this strategy can be derived from multiple sources (i.e. fuel, solar, waste heat) and the energy required for evaporation can be supplied by the energy released from the dew formation.

Though dewvaporation technology is still being developed in California, Arizona State University (ASU) currently has a dewvaporation pilot project underway. The potential benefits of this technology include the ability to provide small amounts of water in remote locations (basic tests have produced up to 150 gallons per day) and the ability to reclaim salt water at relatively low costs.

Merced Region Efforts

Dewvaporation or atmospheric pressure desalination is not currently being planned or explored in the Merced Region because it is not a feasible RMS. Due to low water yields expected from this strategy, it is unlikely to serve as a future water source for the Region.

Fog Collection

Fog collection is a form of precipitation enhancement that has yet to be used in California, although it does occur naturally along coastal zones. Though there is interest in using this strategy for increasing domestic water supplies in dry areas, such as California desert regions, this strategy is more appropriate for regions near the ocean.

The potential benefits of fog collection primarily include increasing water supplies. For example, a fog collection project in Chile yielded about 2,800 gallons per day from about 37,700 square feet of collection net. However, this strategy produces limited volumes of water supply.

Merced Region Efforts

Due to climatic conditions in the Region leading to negligible amounts of fog, fog collection is not currently being implemented or explored in the Merced Region.

Irrigated Land Retirement

Irrigated land retirement is the removal of farmland from irrigated agriculture to make water available for redistribution for other uses. The potential benefits of retiring irrigated land include: enhancing water supply reliability, enhancing water quality, protecting and restoring fish and wildlife resources, reducing drainage volume and associated costs due to drainage disposal.

Strategies for facilitating irrigated land retirement programs identified by the California Water Plan Update 2009 include:

- Evaluating and ensuring urban areas receiving water made available from land retirement have exhausted all means of water conservation
- Making all land retirement programs voluntary
- Studying local community and third party impacts from land retirement such as from reduced agricultural production inputs, reduced farm income, and habitat restoration
- Developing and implementing necessary actions for maintaining the economic stability of local communities and mitigating socioeconomic impacts

Merced Region Efforts

Irrigated land retirement is a potential RMS that is not currently being implemented in a formal way in the Merced Region. As explained above with crop idling, high agricultural productivity and resulting economic outputs from the agricultural industry in the Region make this highly unlikely in the near-term future. Irrigated land retirement - including replacing water intensive crops with agricultural uses such as grazing that do not require much, if any, irrigation - could be implemented within the Region to reduce agricultural water demands. Although this RMS may be employed in the future to make water available for transfer, it will likely only be employed on a temporary basis. Due to the importance of agriculture to the Region's economy, the majority of stakeholders do not support permanent agricultural land retirement.

Rainfed Agriculture

The rainfed agriculture strategy involves irrigating crops with natural rainfall. Potential benefits associated with rainfed agriculture include: increased water supply (though limited), improved post-harvest/pre-planting soil management for winter crops, and decreased soil erosion. However, due to the unpredictability of rainfall frequency, duration, and amount, this strategy is highly uncertain and risky. Additionally, the quantification of potential water savings from rainfed agriculture, though small, will not be possible due to lack of available information.

Strategies for implementing rainfed agriculture programs identified by the California Water Plan Update 2009 include:

- Developing new technologies, management, and efficient water management practices for rainfed agriculture
- Providing technical and financial assistance for implementing rainfed agriculture technologies and management practices
- Developing cooperative efforts to link rainfed agriculture runoff and water banking and conjunctive use activities and groundwater recharge

Merced Region Efforts

Due to the abundance of agriculture in the Region and the importance of precipitation in irrigation, rainfed agriculture is an important strategy for the Region and is currently employed in the Region's rangelands.

Waterbag Transport/Storage Technology

The waterbag transport/storage technology involves diverting water in areas that have unallocated freshwater supplies, storing the water in large inflatable bladders, and towing them to an alternate coastal region. Currently, this strategy is not used in California though there have been various proposals for this technology worldwide. Potential benefits of waterbag transport/storage technology include: improvements in drought preparedness and water quality; reductions in groundwater overdraft; and environmental, energy and water supply benefits.

Merced Region Efforts

The Merced Region is located inland, and is surrounded by mountains. Because the Region lacks access to an ocean port, waterbag transport/storage technology is not currently being planned or explored in the Region, and this RMS is not applicable to the MIRWMP.

5.5 Adapting Resource Management Strategies to Climate Change

The variability of location, timing, amount, and form of precipitation in California expected to result from future climate changes, could present some uncertainty to the availability of surface water supplies for the Region. DWR has determined that the Sierra snowmelt is shrinking and that melting is occurring earlier, shifting runoff from spring / summer further into the winter / spring and causing early flooding. Concerns about climate uncertainty have resulted in the need to adapt existing flood management and water supply systems in response to changing conditions.

As vulnerability tools and assessments are developed related to impacts that climate change may have on water resources, additional adaptation strategies will be identified to address the potential region-specific impacts of climate change.

Achievable "no regret" management practices for addressing climate change concerns that the Merced Region can employ include:

- Continued investment in local water conservation
- Diversification of local water supply portfolio
- Practicing integrated flood management
- Increasing conjunctive use of available water supplies
- Protecting and restoring water-related ecosystems
- Increasing water reuse and recycling
- Monitoring local and regional activities
- Tracking related legislation
- Investigating water supply/energy relationships and coordinating with larger water utilities

- Following the State's required adaptation strategies and legislation

RMS that are implemented to manage water resources can also address climate change adaptation and/or mitigation. Table 5-3 summarizes how the RMS selected for inclusion in the MIRWMP aid in climate change adaptation; additional details are provided in Chapter 16 Climate Change.

Table 5-3: Applicability of RMS to Climate Change Adaptation

Management Strategies	Habitat Protection	Flood Control	Water Supply Reliability	Additional Water Supply	Water Demand Reduction	Sea Level Rise	Water Quality Protection	Hydropower
Reduce Water Demand								
Agricultural Water Use Efficiency			✓		✓		✓	
Urban Water Use Efficiency			✓		✓		✓	
Improve Operational Efficiency and Transfers								
Conveyance-Regional/Local	✓	✓	✓	✓			✓	
System Reoperation		✓	✓	✓				✓
Water Transfers			✓	✓				
Increase Water Supply								
Conjunctive Management and Groundwater Storage		✓	✓	✓			✓	
Recycled Municipal Water			✓	✓				
Surface Storage-Regional/Local	✓	✓	✓	✓			✓	✓
Improve Water Quality								
Drinking Water Treatment and Distribution			✓	✓			✓	
Groundwater Remediation/Aquifer Remediation			✓	✓			✓	
Matching Quality to Use			✓	✓			✓	
Pollution Prevention	✓		✓				✓	
Salt and Salinity Management	✓		✓	✓			✓	
Urban Runoff Management	✓	✓					✓	

Management Strategies	Habitat Protection	Flood Control	Water Supply Reliability	Additional Water Supply	Water Demand Reduction	Sea Level Rise	Water Quality Protection	Hydropower
Practice Resource Stewardship								
Agricultural Lands Stewardship	✓	✓			✓		✓	
Economic Incentives	✓	✓	✓	✓	✓	✓	✓	✓
Ecosystem Restoration	✓	✓	✓			✓	✓	
Forest Management	✓	✓	✓				✓	
Land Use Planning and Management	✓	✓				✓	✓	
Recharge Area Protection		✓	✓	✓			✓	
Water-dependent Recreation	✓	✓	✓				✓	
Watershed Management	✓	✓	✓	✓		✓	✓	✓
Improve Flood Management								
Flood Risk Management	✓	✓				✓	✓	✓
Other Strategies								
Crop Idling for Water Transfers			✓	✓	✓			
Irrigated Land Retirement			✓		✓			
Rainfed Agriculture					✓			

Table 5-4 was adapted from the California Water Plan Update 2009; it identifies greenhouse gas (GHG) reduction opportunities associated with each RMS.

Table 5-4: Resource Management Strategies and Greenhouse Gas (GHG) Reduction Opportunities

Management Objectives	Resource Management Strategy	GHG Reduction Opportunities
Reduce Water Demand	Agricultural Water Use Efficiency Urban Water Use Efficiency	Reducing water demands will reduce groundwater pumping demands, which result in GHG emissions.
Improve Operational Efficiency and Transfers	Conveyance – Regional/local System Reoperation Water Transfers	Improving operational efficiencies can improve the overall efficiency of the Region's water system, thereby reducing cumulative energy demands and GHG emissions.
Increase Water Supply	Conjunctive Management & Groundwater Recycled Municipal Water Surface Storage – Regional/local	Localize water use, and efficiently reuse water to reduce groundwater pumping requirements and associated GHG emissions.
Improve Water Quality	Drinking Water Treatment and Distribution Groundwater Remediation/Aquifer Remediation Matching Quality to Use Pollution Prevention Salt and Salinity Management Urban Runoff Management	Stabilize water cycles by conserving water systems to their natural state.
Improve Flood Management	Flood Risk Management	Controlling flooding in a holistic watershed-based nature will potentially reduce the need for construction of intensive flood control systems. This will reduce energy and associated GHG emissions that would be required for construction.
Practice Resources Stewardship	Agricultural Lands Stewardship Economic Incentives (Loans, Grants and Water Pricing) Ecosystem Restoration Forest Management Land Use Planning and Management Recharge Area Protection Water-Dependent Recreation Watershed Management	Provide opportunities for carbon sequestration, reforestation, and reduce climate change impacts by restoring/maintaining land surfaces.
Other	Crop Idling for Water Transfers Irrigated Land Retirement Rainfed Agriculture	Reduce energy requirements and GHG emissions from decreased groundwater pumping demands.

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Merced Integrated Regional Water Management Plan

Chapter 6 Project Review Process

This chapter addresses the Integrated Regional Water Management (IRWM) Project Review Process Plan Standard, which requires IRWM Plans to:

- ✓ Contain a process to select projects for inclusion in the IRWM Plan including procedures for submitting a project, reviewing projects and communicating the list of selected projects
- ✓ Consider how the project contributes to IRWM Plan objectives, how the project is related to resource management strategies selected for use in the IRWM Plan, technical feasibility of the project, specific benefits to disadvantaged community water issues, environmental justice considerations, project costs and financing, economic feasibility, project status, strategic considerations for IRWM Plan implementation, contribution of the project in adapting to the effects of climate change in the region, contribution of the project in reducing greenhouse gas emission as compared to project alternatives, whether the project proponent has adopted or will adopt the IRWM Plan and for IRWM regions that receive water supplied from the Sacramento-San Joaquin Delta, how the project or program will help reduce dependence on the Sacramento-San Joaquin Delta for water supply
- ✓ Promote and prioritize projects in the selection process, while keeping in consideration the unique goals and objectives of the IRWM Region

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In order to identify water resources management projects for implementation, the WPMC implemented a public "Call for Projects" to solicit projects for consideration for inclusion in the MIRWMP. Organizations from across the Region submitted a total of 77 projects addressing a wide variety of water supply, water quality, flood management, and habitat protection needs. While all of the projects included in the MIRWMP are considered to be important to effectively manage water resources in the Region, a prioritization process was developed to help manage the project list and determine which projects best meet regional needs and objectives. The prioritization process allows projects to be ranked for implementation using a transparent method. In addition, the process encourages development and identification of projects well-suited to meet the identified needs of the Merced Region.

Throughout the IRWM planning process, the WMPC has engaged stakeholders across multiple areas of water resource management to identify priorities for the Region and to prioritize projects for implementation. As described below, the RAC played an integral role in reviewing and selecting projects that best achieve the regional goals and objectives. This section presents the process for prioritization and selection of IRWM projects, including:

- Procedures for soliciting and submitting projects to the IRWM Plan
- Procedures for reviewing and prioritizing projects submitted to the IRWM Plan
- Procedures for selecting and communicating the final project list

6.1 Project Submittal Process

The WPMC, working with the RAC, developed a preliminary project submittal process in August 2012, and refined the process in September 2012. This process involved three major steps: solicitation, prioritization, and selection.

Solicitation can be described as a "Call for Projects" that help meet the Region's established objectives. The objective of this step is to compile a comprehensive list of water-related projects for the Region. Any individual(s), public agency representatives, or non-profit organization with common water interests and needs can submit a project to the IRWM program. An online project database was developed to aid in the submittal, collection, and management of project information (http://www.mercedirwmp.org/projects.html). The online database, known as the Merced Online Project Tracking and Integration Program (Merced OPTI), provides stakeholders with access to project information. Stakeholders can access the online project database from the project website, enter and edit project information, and submit projects for inclusion in the IRWM Plan. A hard-copy project information form was also developed to allow individuals without internet access an equal opportunity to participate. Copies of the project information form were made available at MID, City of Merced, and County of Merced offices.

In order to submit a project, the project submitter was required to provide basic project information, including a project description and discussion of how the project contributes to IRWM objectives, water-related benefits, estimated costs, project status, and project sponsor information. The IRWM project website allows this project information to be reviewed, organized, and easily updated by the project submitter. Access to project summaries is available to all interested parties with the goal of improving transparency and encouraging integration. Figure 6-1 presents a screenshot of the Merced IRWM website page that contains the online project database.

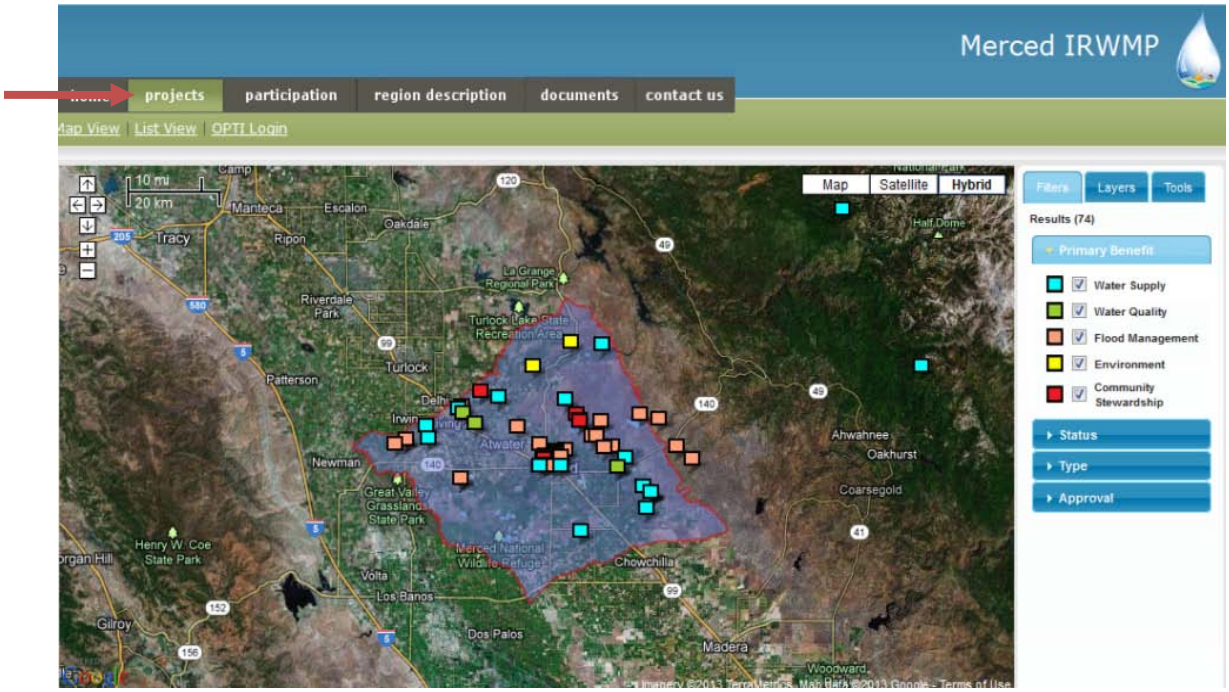
Project solicitation was announced to the public through various channels beginning in early October 2012. Notices regarding the Call for Projects were sent to Merced IRWM stakeholders via email, and advertisements were placed on the Merced IRWM website, as well as the MID, City of Merced, and County of Merced websites. In addition, a radio advertisement was placed to broaden awareness of the Call for Projects to individuals without ready computer access, and targeted mailings and phone calls were made to potential project proponents identified by the RAC. A Public Workshop was held on October 17, 2012 to discuss the project submittal process and answer stakeholders' questions.

Project submittals were requested beginning October 9, 2012, with a submittal deadline of November 6, 2012. While projects can continue to be modified and new projects can be submitted for consideration for inclusion in the MIRWMP, only projects submitted on or before November 6, 2012 are listed in the snapshot of projects presented in this MIRWMP. It should be noted, however, that the list of projects presented in this MIRWMP is not the official project list; the official project list, which is continually updated and revised, resides in the project database. This MIRWMP does not require revision, update, or re-adoption following changes to the project list.

In order to facilitate review and organization of the project submittals, the IRWM project website provides the option of printing or exporting a detailed list of all projects submitted. The WPMC used this project list in discussions of submitted projects with the RAC and other stakeholders.

The online project database is open at all times for submittal of new IRWM projects as well as editing and revising existing projects. As IRWM Plan updates and new funding opportunities arise, the Merced Region will issue new "Calls for Projects" with deadlines appropriate to those opportunities. Projects at all stages of development were and will continue to be accepted into the project database and IRWM Plan, ranging from conceptual planning projects to implementation-ready construction projects.

Figure 6-1: Merced IRWM Program - Project Submittal Website



6.2 Project Review Process

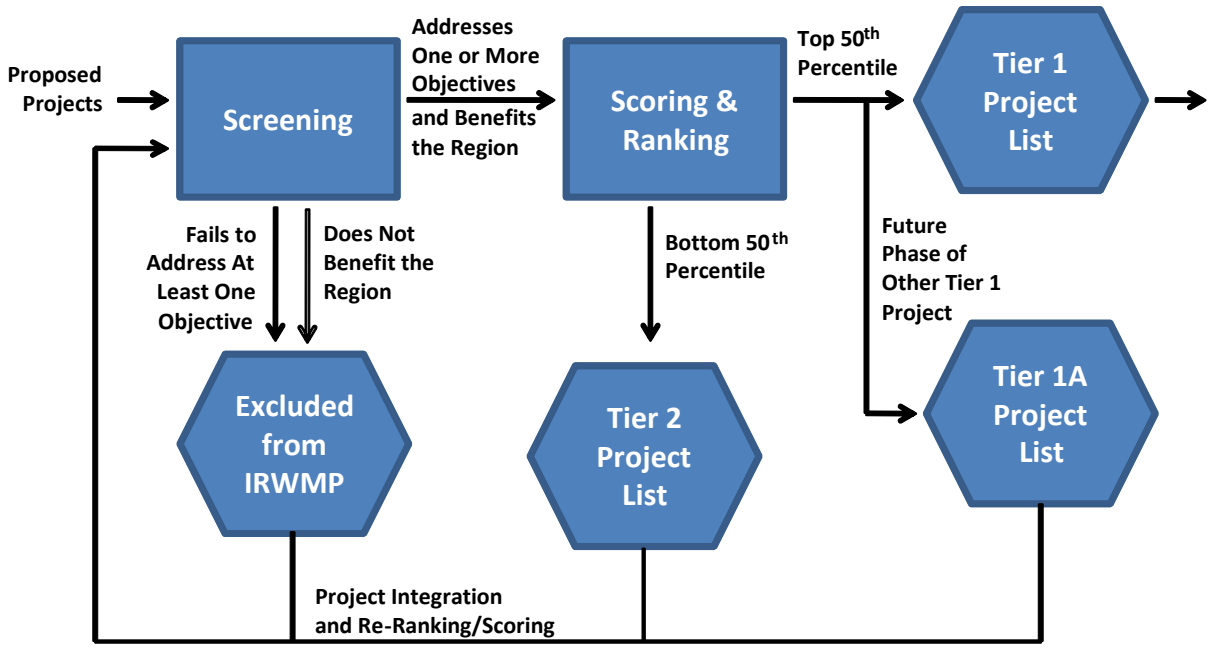
After the November 6, 2012 deadline, projects submitted through the open "Call for Projects" were reviewed, ranked, and prioritized using a two-step screening and scoring approach. Figure 6-2 below illustrates the overall process for screening of projects for the IRWM Program. As shown in this figure, projects submitted for consideration were first evaluated for consistency with the Merced IRWM objectives that were developed by the RAC as explained in Chapter 4 Objectives. Projects that did not meet any regional objectives were excluded from the MIRWMP. Projects were also screened based on their ability to provide benefits to the Merced Region. Projects included in the MIRWMP do not need to be physically located within the Region, but the benefits of the project must accrue at least in part to the Region. Projects that were found to meet at least one objective with benefits to the Region passed the screening process and moved on to the next step of the project review process: scoring and ranking.

To evaluate and prioritize projects as part of the IRWM planning process, the scoring and ranking process takes into account three fundamental components:

- Principles of IRWM planning,
- Feasibility of projects to proceed,
- Other regional priorities.

As described in Chapter 4 Objectives (Section 4.4 Prioritizing Objectives), at the RAC meeting held on August 28, 2012, stakeholders decided that they did wish to prioritize the IRWM objectives. As such, the components established above were used to prioritize projects along with the prioritized program objectives. Scoring criteria were developed for each component as illustrated in Table 6-1.

Figure 6-2: Prioritization Process Overview



Through facilitated meetings, the RAC established the relative importance of each of these criteria. The approach to scoring projects and the relative importance of each criterion is presented in Table 6-1**.** Project scoring was developed to identify projects that:

- Address IRWM Plan objectives
- Integrate multiple resource management strategies
- Link to / integrate with other projects
- Are identified in existing plans
- Demonstrate technical feasibility
- Provide a positive benefit cost
- Benefit disadvantaged communities (DAC)
- Directly address a critical water supply or water quality need of a DAC or address an environment justice issue
- Assist the region in adapting to effects of climate change or mitigating effects
- Are locally supported.

Each project was evaluated with respect to the criteria presented in Table 6-1**.** For each criterion, a project could receive a raw score of up to 100 points. The raw scores were then weighted by a percentage to reflect the relative importance of the different prioritization criteria. Based on the outcome of this evaluation, each project received a final, weighted score of up to 100 points. Projects were then ranked with the highest-scoring project ranked as number one. Projects within the top 50th percentile (i.e., all projects with scores greater than the median score) were designated as Tier 1 projects that strongly contribute to the attainment of regional goals and objectives. Future phases of Tier 1 projects were considered Tier 1A projects, as they would not be considered to be high priorities for implementation until after the related Tier 1 projects had been completed. The bottom 50th percentile (i.e., all projects below the median) were considered Tier 2 projects. While these projects are considered to be important for achieving the Region's water resources management objectives, they are not currently considered the Region's highest priorities for implementation.

Scoring for each submitted project was based on the responses provided in the online project database. For projects which were submitted using the hard copy submittal form, the WPMC entered responses into the online project database. In addition, the project team reviewed each project individually for accuracy before ranking projects within the online project database.

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Table 6-1: Project Scoring Guide

Component	Criterion	Scoring Procedure	Raw Score Assigned	% of Score	Subtotal
1. Principles of IRWM Planning	Addresses Multiple IRWM Plan Objectives	Score based on # of objectives addressed with priority objectives counting as two objectives	6+ objectives = 100 pts 5 objectives = 80 pts 4 objectives = 60 pts 3 objectives = 40 pts 2 objectives = 20 pts	11.49	22.23
	Integrates Multiple Resource Management Strategies	Score based on # of strategies employed	8+ strategies = 100 pts 6-7 strategies = 75 pts 4-5 strategies = 50 pts 2-3 strategies = 25 pts	10.74	
2. Project Status and Feasibility	Is Ready to be Implemented	Score based on degree of work needed prior to implementation	Ready to construct / implement = 100 pts Preliminary Design Completed = 75 pts Planning Completed = 50 pts Planning in Progress = 25 pts No Work Completed = 0 pts	9.08	32.13
	Is Technically Feasible	Score based on availability of documentation supporting technical feasibility	Feasibility documentation is available = 100 pts Feasibility documentation is not available = 0 pts	11.71	
	Is Economically Feasible	Score based on estimated benefit-cost ratio	B:C Ratio = 4 = 100 pts B:C Ratio ≥ 3 and < 4 = 75 pts B:C Ratio ≥ 2 and < 3 = 50 pts B:C Ratio ≥ 1 and < 2 = 25 pts B:C Ratio < 1 = 0 pts	11.34	

Component	Criterion	Scoring Procedure	Raw Score Assigned	% of Score	Subtotal
3. Other Regional Priorities	Benefits Disadvantaged Communities	Score based on providing targeted benefits to more significantly disadvantaged communities within the Region, considering household income and unemployment rate	Project directly benefits Planada, Winton, Le Grand or El Nido = 100 pts Project directly benefits Livingston, Merced or Atwater = 75 pts Project directly benefits Franklin/Beachwood, Snelling or Stevinson[1] = 50 pts Does not provide a benefit to a disadvantaged community = 0 pts	9.61	45.64
	Directly Addresses a Critical Water Supply or Water Quality Need of a Disadvantaged Community and / or Address an Existing Environmental Justice Issue	Score is based on whether the project addresses one of the critical needs identified by the DAC Outreach effort	Yes = 100 pts No = 0 pts	12.01	
	Contributes to Climate Change Adaptation or Mitigation	Score is based on Yes/No response	Yes = 100 pts No = 0 pts	8.63	
	Supported by Multiple Local Project Sponsors or Contiguous IRWM Regions	Score is based on # of local project sponsors working together to implement the project	4+ local project sponsors = 100 pts 3 local project sponsors = 75 pts 2 local project sponsors = 50 pts 1 local project sponsor = 25 pts	8.86	
	Creates Local Jobs and/or Uses Local Materials	Score is based on Yes/No response	Yes = 100 pts No = 0 pts	6.53	
Total					

[1]The communities of Franklin/Beachwood and Stevinson are not considered DACs by the State definition; however they are considered DACs by the Merced Region due to local knowledge of economic conditions.

The following subsections outline the project selection factors identified by DWR IRWM Plan standards as well as additional factors developed by the RAC for use in the project selection process.

6.2.1 Contribution to IRWM Plan Objectives

As described in detail in Chapter 4 Objectives, the RAC developed twelve specific objectives for the Merced Region through a series of facilitated public workshops and meetings. These objectives address major water-related issues and conflicts in the Region, and provide a summary of the Region's water-related priorities.

The Region's twelve regional objectives are:

A. Manage flood flows for public safety, water supply, recharge, and natural resource management
B. Meet demands for all uses, including agriculture, urban, and environmental resource needs.
C. Correct groundwater overdraft conditions.
D. Improve coordination of land use and water resources planning.
E. Maximize water use efficiency.
F. Protect and improve water quality for all beneficial uses, consistent with the Basin Plan.
G. Protect, restore, and improve natural resources.
H. Address water-related needs of disadvantaged communities (DACs).
I. Protect and enhance water-associated recreation opportunities.
J. Establish and maintain effective communication among water resource stakeholders in the Region.
K. Effectively address climate change adaptation and/or mitigation in water resource management.
L. Enhance public understanding of water management issues and needs.

At the RAC meeting held on August 28, 2012, stakeholders prioritized objectives, determining that the top priorities for the Region are Objectives A, B and C.

Contribution to the achievement of the IRWM Plan objectives provides a measure of the degree to which the project will address the Region's water resource management challenges. Projects submitted for inclusion in the MIRWMP are scored based on how well each project contributes to the objectives, up to a maximum of 100 points. The scoring for this criterion was developed such that contribution to the priority objectives for the Region (i.e. Objectives A, B and C) was given twice the weight of contribution to the other objectives.

Appendix H provides a snapshot of projects included in the MIRWMP (as of November 6, 2012) and includes a summary of the primary and secondary objectives of each project that correspond to IRWM Plan objectives.

6.2.2 Integration of Resource Management Strategies

Chapter 5 Resource Management Strategies identifies the RMS deemed appropriate for the Region. Table 5-2 (see Chapter 5 Resource Management Strategies) presents the MIRWMP objectives and their correlation to each RMS included in the MIRWMP. Project proponents submitting projects for consideration in the MIRWMP are required to identify both the IRWM Plan objectives and the specific RMS employed by the project.

IRWM planning is intended to encourage integrated regional strategies for management of water resources that yield multiple benefits, and the number of RMS employed by a project is included in the MIRWMP project scoring process to give priority to projects that demonstrate greater resource integration.

Appendix H provides a snapshot of projects included in the MIRWMP (as of November 6, 2012) and includes analysis of the RMS incorporated by each project.

6.2.3 Project Status

Project status, also known as "readiness to proceed," is considered during project prioritization as required by the Project Review Process Plan Standard in that projects are scored based upon the degree of work required before they can be implemented. However, the RAC and RWMG recognize that readiness to proceed is not necessarily a reason to exclude projects from the MIRWMP. As the MIRWMP planning horizon is 20 years, even a conceptual project may be considered, as it could generate benefits within the planning horizon.

Appendix H provides a snapshot of projects included in the MIRWMP (as of November 6, 2012) and includes information regarding project status. Project status was assessed based on project proponents' responses to questions related to the status of planning, design, environmental documentation and permitting efforts.

6.2.4 Technical Feasibility

The technical feasibility of submitted projects is considered during the project review process. Technical feasibility is related to the knowledge of the project location; knowledge of the water system at the project location; or the material, methods, or processes proposed to be employed in the project. Technical feasibility of each project submittal is assessed based on the availability of feasibility documentation as demonstrated by project proponent's responses to the following questions in the project information collection process: feasibility studies that have been completed for the project, planning documents that identify the project, regulatory permits that have obtained for the project and completion of environmental documentation.

Appendix H provides a snapshot of projects included in the MIRWMP (as of November 6, 2012) and identifies which projects have feasibility documentation.

6.2.5 Economic Feasibility

As part of the project selection process, the economic feasibility of each project was considered. Project proponents were asked to submit estimated capital and operating costs, project lifecycle, and expected benefits.

As required by the Project Review Process Plan Standard, the project selection process included a preliminary assessment of economic feasibility of each submitted project. A simulated benefit-cost ratio was developed for each project as described below.

Calculating Simulated Benefit-Cost Ratio

The Proposition 84 and Proposition 1E Guidelines require an economic assessment such as development of a benefit-cost ratio to be used in reviewing projects for inclusion in the Plan. Projects submitted to the Plan are at a variety of different planning stages; some may be ready to construct and have benefit-cost ratios already developed or easily calculated, while others may be preliminary concepts, and the costs and benefits of the projects are unclear. As such, for the purposes of the Plan evaluation, a simulated benefit-cost ratio was developed.

Calculating Benefit

In developing the benefit score to be used in the benefit-cost ratio, the benefit was calculated based on the number of objectives achieved. Prior to completing a grant application, a full qualitative and quantitative benefits analysis would need to be completed. However, given the disparate level of detail of projects submitted, objectives were used as a surrogate for benefits to provide a consistent way of comparing projects. Benefit scores were assigned as follows.

- 4 or more objectives = 4 pts
- 3 objectives = 3 pts
- 2 objectives = 2 pts
- 1 objective = 1 pts

Calculating Cost

The project solicitation form requests information on capital and operations and maintenance (O&M) costs associated with each project, as well as base year for costs provided and project life. If neither capital nor O&M costs were provided in the project application, the project automatically received the lowest score possible (0 pt). If capital costs were provided but O&M costs were not provided, annual O&M costs were estimated to be 10% of capital cost (if the project submittal indicated that the O&M costs were $0/year, $0/year was used). If the project life was not provided, the project life was assumed to be 20 years. If a base year for cost information was provided, costs were escalated to 2012 costs; however, if a base year was not provided, costs were assumed to be in 2012 dollars.

Present value cost was then calculated in 2012 dollars as follows:

$$\text{Present Value Cost} = \text{Capital Cost} + \text{O\&M cost} * \sum_{0}^{n} PV Factor$$

where *n* is the project life, and PV factor is defined as:

$$PV\ Factor = 1/[(1 + i) \wedge n)]$$

where *i* is the discount factor. For consistency with DWR guidelines, a discount factor of 6% was applied for all projects.

Cost scores were then assigned as follows.

Present Value Cost $\geq$ $5 M = 4 pts

$2 M < Present Value Cost < $5M = 3 pts

$1 M < Present Value Cost < $2M = 2 pts

Present Value Cost $\leq$ $1M = 1 pt

Calculating Simulated Benefit-Cost Ratio

Simulated benefit-cost ratios were then calculated for each project by dividing the benefit score (up to 4) by the cost score (up to 4). The resulting simulated benefit-cost ratio ranges from 0.25 to 4. Projects with benefit-cost ratios less than one (1) received a score of 0 points. Projects with a simulated benefit-cost ratio of one (1) or greater received up to 100 points, with projects with greater simulated benefit-cost ratios receiving higher scores.

6.2.6 Benefits to DACs and Environmental Justice Considerations

The state defines a disadvantaged community (DAC) as a community with an annual MHI that is less than 80% of the statewide annual MHI (as of the 2010 Census, 80% of the statewide MHI equals $48,706).

Environmental justice (EJ) is defined in California law (Government Code section 65040.12) as "the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations and policies." Environmental justice in water management includes:

- Supporting community health, as well as a clean and safe environment
- Diversifying the decision-making process by calling for involvement of all people and communities
- Encouraging a more equitable distribution of economic benefits
- Empowering communities themselves to take action towards improving their environment
- Increasing awareness, understanding and effective cooperation within and among communities
- Ensuring the right of all people to equal and fair treatment under the laws and regulations of the United States

The project selection process considered whether or not projects benefit DACs or address existing environmental justice issues using two criteria.

The first criterion considers the degree of economic distress experienced by communities served by the project with projects targeted to communities in greater distress receiving additional points. If a project was found to benefit multiple DACs, points were awarded based on the least disadvantaged community benefitted. Based on the recommendations of an ad-hoc DAC workgroup convened during development of the project review process, the RAC grouped the Region's DACs into scoring tiers based on a combination of the communities' MHI as viewed by census place, the average MHI of census blocks encompassed by the community and unemployment statistics. The work of the workgroup as presented to the RAC at the January 22, 2013 meeting is included as Appendix I.

The second DAC/EJ criterion takes into account specific needs of the communities, with projects that aid in addressing critical water supply and water quality needs of DACs within the Merced Region or addressing an existing EJ issue given priority over those which do not. Critical water supply and water quality needs were those identified through the targeted disadvantaged community outreach program implemented as part of the IRWM Plan.

The "Call for Projects" was open to any public agency or non-profit organization, including DACs, who wanted to submit water projects within the Region.

Appendix H provides a snapshot of projects included in the MIRWMP (as of November 6, 2012) and identifies which projects have feasibility documentation, describes whether or not the projects directly benefit a DAC and identifies critical water supply or water quality needs of DACs or environmental justice issues which the projects address.

6.2.7 Strategic Considerations and Other Regional Priorities

The following Strategic Considerations and other regional priorities were included in the prioritization process.

Integration

Resource and project implementation integration are strategic considerations when scoring and prioritizing projects. Projects were given points for integration by awarding increased scores to projects that integrate more resources management strategies as well as additional points to projects that involve multiple project sponsors. This is a strategic consideration in that integrating multiple resources management strategies implies that a project has been structured to incorporate multiple water management approaches, rather than only serving a single purpose. Having multiple project sponsors is also an indication of project integration, as it requires collaboration among the sponsors to develop a project that meets the needs of their respective agencies and organizations.

Climate Change Adaptation and GHG Emissions

As required by the Guidelines, the project review process included consideration of climate change adaptation and mitigation. Projects that assist the Region in adapting to climate change and projects that mitigate climate change through GHG reduction or offset were awarded additional points in the prioritization process.

Appendix H provides an overview of all projects submitted for inclusion in the MIRWMP (as of November 6, 2012) and identifies which projects either assist the Region in adapting to climate change or mitigate the Region's contribution to climate change.

Supported by Multiple Local Project Sponsors

In developing the project review process, the RAC considered whether projects in the MIRWMP should be limited to those sponsored by local project proponents. After discussion on this topic, the RAC determined that any project that meets the objectives of the MIRWMP and provides a benefit to the Region should be included in the plan, regardless of who proposed the project or the physical location of the project. Projects do not need to be sponsored by a local entity; however, preference is given to projects that are led by local agencies and organizations or neighboring IRWM Regions. A greater number of points were awarded to projects that involve collaboration among a greater number of local entities or neighboring IRWM Regions.

Creates Local Jobs and/or Uses Local Materials

While recognizing that local economic development is not the main focus of the IRWM planning process, the RAC elected to include a project scoring criterion that would encourage project proponents to consider use of local labor and local materials.

6.2.8 Supported by an Adopting Entity

The Proposition 84 and Proposition 1E Guidelines require the project review process to consider whether the project proponent will adopt the IRWM Plan as part of the project review process. In compliance with this requirement, applicants were asked when submitting their project whether their entity would be willing to adopt the completed IRWM Plan. The responses were recorded but were not used to score the projects.

6.2.9 Specific Benefits to Critical Water Issues for Native American Tribal Communities

There are no California Native American tribal communities within the Merced Region. As such, specific benefits to critical water issues of Native American tribal communities do not apply to the Merced Region, and were not considered in project prioritization.

6.3 Communicating the List of Selected Projects

The MIRWMP project list, as of November 6, 2012, is included in Appendix H of this MIRWMP. The up-to-date project list can be accessed through the Merced OPTI, which is accessible through the projects module of the Merced IRWMP (http://www.mercedirwmp.org/projects.html). Merced OPTI allows project proponents to add projects at any time, update project information, review other projects, and identify integration opportunities to enhance the benefits provided by the projects. The online database allows the project list to remain a "living document", always available for review and update. The MIRWMP does not require update, revision, or re-adoption following changes to this project list.

The MIRWMP project list should be periodically updated and reviewed through formal requests for projects to ensure that new projects are continually considered for upcoming funding opportunities and that new projects are added to respond to evolving regional conditions. Further, formal updates provide a reminder for project proponents to update and revise their project submittals as necessary to maintain currency. As new funding opportunities arise, the RWMG and RAC will communicate new project submittal deadlines and other relevant information to the stakeholder list and the public.

Merced Integrated Regional Water Management Plan

Chapter 7 Impacts and Benefits

This chapter addresses the Integrated Regional Water Management (IRWM) Impact and Benefit Plan Standard which requires IRWM Plans to:

- ✓ Discuss potential impacts and benefits of plan implementation
- ✓ Contain a screening level discussion of impacts and benefits within the IRWM Region, between regions, and those directly affecting disadvantaged communities, environmental justice related concerns and Native American Tribal communities
- ✓ State when more detailed project-specific impact and benefit analyses will occur

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This section describes the potential impacts and benefits that could occur through implementation of the MIRWMP and / or through implementation of projects included in the MIRWMP. More detailed analyses of project benefits and impacts will occur as projects near implementation. For example, project-specific environmental impacts are evaluated in California Environmental Quality Act (CEQA) and / or National Environmental Policy Act (NEPA) documents prior to project construction / implementation.

The MIRWMP consists of a planning study and basic data compilation that would not result in the disturbance of any environmental resource. These activities are exempt from CEQA pursuant to CEQA Guidelines §15262 and §15306. As such, programmatic environmental analysis under CEQA is not required. Furthermore, implementation of each project included in the MIRWMP will be the responsibility of the project proponent and any applicable project partners. If implementing a project, project proponents bear full responsibility for ensuring all regulatory requirements for the project are met.

7.1 Plan Implementation Benefits and Impacts

The MIRWMP objectives discussed in Chapter 4 Objectives were developed to address various water management issues faced by the Merced Region. While the purpose of these objectives is to promote actions which benefit the Merced Region, the RWMG and RAC recognize that the various resource management strategies employed in the implementation of the MIRWMP have the potential to result in regional, interregional and / or localized benefits as well as impacts. Potential benefits and impacts are identified in Table 7-1 and discussed in the following sections.

7.1.1 Regional Benefits and Impacts

Implementation of the MIRWMP will generate a variety of benefits to the Merced Region, including the following:

- **Improved flood management.** Flooding is a significant challenge for the Merced Region, and addressing this challenge is one of the Region's highest priority objectives. Improved conveyance and storage, system reoperation, and flood risk management strategies can reduce flooding and flood impacts in the Region.
- **A more reliable and high quality water supply.** Additional water supplies, conjunctive use, and water use efficiency improvements will lead to enhanced water supply reliability and assist in improving water quality. Water quality projects will ensure that existing water quality is

sustained and protected. Reliable and high-quality water is directly linked to economic and environmental health and well-being.

- **Reduced groundwater overdraft/subsidence**. Strategies which reduce dependence on groundwater either through the creation of new supplies or through water use reduction can reduce reliance on the groundwater basin and avoid further subsidence. Water use efficiency strategies which reduce overall water demand can also assist in reducing overdraft of the basin.
- **Improved habitat.** Strategies that improve habitat include those which improve water quality, such as pollution prevention and runoff management strategies, and resource stewardship strategies, such as agricultural lands stewardship, preservation of open spaces, protection or improved management of forest communities, protection or restoration of riparian areas and removal of invasive species.
- **Increased public health and safety.** Flood management strategies and recreational strategies can increase public health and safety. Flood management strategies achieve this by reducing the impacts of floods on homes, water supply sources and water supply infrastructure and also by reducing the loss of life. Recreational strategies do so by providing safe access to waterways and encouraging communities to be more active.
- **Cost-effective and multi-benefit projects.** Opportunities for multi-benefit projects, which achieve a multitude of goals and objectives for several stakeholders rather than a single entity, provide increased value to stakeholders and the communities they serve. Integrated planning and collaboration can lead to multi-benefit projects that achieve cost savings through cost-sharing opportunities, economies of scale, resource-sharing, and other mechanisms. Existing resources can be optimized, duplication of efforts avoided, and larger-scale efforts developed to provide cost savings to all involved.
- **No-regrets adaptation**. By promoting and implementing projects that address current conditions and can be easily justified under plausible future conditions, the RWMG, RAC and stakeholders can invest in actions which will reduce the Region's vulnerability to future climate change risks while meeting today's needs. As such, these projects provide significant benefit to the Region, regardless of whether and to what degree projected climate change impacts are experienced in the future.
- **Shared experience and resources.** The completion and implementation of the MIRWMP facilitates knowledge-sharing and equips agencies and stakeholders to overcome future challenges by coordinating resources, more effectively meeting the needs of the Region as a whole. In addition to direct quantitative benefits of Plan implementation, such as new or more reliable water supplies, indirect benefits associated with avoided negative impacts of non-action are expected to be realized.
- **Increased regional understanding.** Agencies and stakeholders are working together as a cohesive group to address regional water resources challenges through a consensus-based process, resulting in a deeper understanding of the effects of each individual project on other agencies and stakeholders. This deeper understanding, in turn, reduces interagency conflicts that could otherwise prevent projects from gaining the necessary support for successful implementation.
- **Improved local understanding of water resources issues.** Through consistent and coordinated public outreach and education, local understanding of regional water resources issues, conflicts,

and solutions will improve. Maintaining a consistent message will improve public understanding of water resource management issues and encourage the acceptance and understanding of integrated projects.

Potential impacts of implementation of the MIRWMP could include the following. Additional impacts may be identified on a project-by-project basis during CEQA and / or NEPA analyses. It is assumed that every effort will be made by project proponents to mitigate any impacts in accordance with CEQA and NEPA requirements:

- **Reduced groundwater recharge**. While water use efficiency strategies can reduce the Region's water demands and thereby reduce demands on the groundwater basin, projects which improve irrigation efficiency can lead to reductions in groundwater recharge in areas supplied with surface water.
- **Reduced in-stream flows**. In-stream flows can be impacted by loss of agricultural drainage flow as a result of water use efficiency measures as well as projects which increase reliance on surface water supplies. Additionally, flood management strategies which restore natural floodplain functions and allow flows to leave the stream channel can reduce in-stream flows.
- **Degraded water quality.** While the MIRWMP promotes strategies to protect and improve water quality for all beneficial uses, various strategies have the potential to negatively affect water quality. For example, by matching quality to use, some users may see a reduction in their water quality, though the quality remains suitable for their uses. For example, recycled water is expected to have a higher concentration of salts than the Region's surface water supplies, so replacement of surface water with recycled water could degrade the end user's water quality. Recycled water can also increase salt nutrient loading to the groundwater basin; the Merced Groundwater Basin Groundwater Management Plan suggests that care be taken to not adversely impact recharge areas when using recycled water for agricultural and landscape irrigation. Increased salt loading can also occur from saline groundwater intrusion as a result of increased groundwater pumping. Additionally, surface water may be impacted by increased erosion and sedimentation as a result of increased recreation.
- **Construction-relation impacts.** A variety of temporary construction-related impacts could occur from project implementation, including dust, noise, and traffic generation. Construction of new infrastructure could also lead to long-term disturbance or even loss of habitat and wildlife. For example, a new treatment plant could have long-term noise and traffic impacts that affect wildlife, or a new reservoir could permanently displace wildlife by inundating habitat.
- **Restricted river access**. Strategies that could lead to restricted access or navigation of the Region's rivers, such as the creation of new levees or dams, could impact river recreation which is an important no-cost recreational resource for the Region. Such strategies are considered to be unlikely in the Merced River corridor.
- **Growth inducement**. Flood management and improved water supply and quality management can enable land development and economic development which in turn can have other adverse impacts.
- **Land use restrictions**. Land use restrictions may be implemented for a variety of reasons including removal of structures from flood zones, protection of recharge areas, and protection of critical habitat and wildlife.

- **Economic impacts**. Improved water management is likely to increase costs to water users and property owners. Additional economic impacts could result from land use restrictions to improve water management or natural resources. The economic incentives RMS can also lead to short-term economic impacts for agencies sponsoring incentives such as water use efficiency rebates.
- **Increased energy use**. Increased energy use in the Region increases the Region's contribution to greenhouse gas emissions. New water treatment facilities, new conveyance strategies that involve pumping water and system reoperation strategies all have the potential to increase energy use.

7.1.2 Interregional Benefits and impacts

Meeting the objectives of the MIRWMP not only benefits the local agencies and residents of the Merced Region, but also neighboring IRWM regions (Mariposa-Yosemite, Madera, East Stanislaus Region, and Westside-San Joaquin Region). Meeting the objectives of the MIRWMP also benefits members of the public throughout California by helping to meet statewide priorities. Specific ways in which attainment of the MIRWMP objectives could provide benefits beyond the Merced Region include the following:

- **Reduced flooding.** Flood management projects for the Region may involve reservoirs and channels upstream of the Region; increasing the capacity of these facilities could reduce flooding for communities upstream, within, and downstream of the Merced Region. Additionally, projects that put flood flows to beneficial use within the Merced Region will reduce flooding for downstream communities.
- **Improved water quality**. The water quality of the Merced and San Joaquin Rivers may be enhanced through improved flood/stormwater management techniques, restoration of riparian areas, and rehabilitation of aging water and wastewater infrastructure. Improved quality of runoff and effluent discharges into the Merced and San Joaquin Rivers may also benefit water quality further downstream in the Delta.
- **Improved water supply reliability**. Improving water use efficiency in the Region and thereby reducing water demands will reduce future competition over interregional surface water supply sources and improve interregional water supply reliability. Correcting groundwater overdraft conditions in the Region will also increase water supply reliability outside the Region.
- **Protection or improvement of fish and wildlife passage.** The Merced Region contains a vast amount of open space and agricultural lands. Protecting these land uses maintains wildlife corridors used by species that move in and outside of the Region.
- **Climate change response actions.** Climate change affects all of California. Projects that lead to reductions in energy use by water and wastewater systems, or that use or generate green energy, benefit all of California by reducing greenhouse gas emissions.

Potential interregional impacts of MIRWMP implementation may include:

- **Changes in streamflow**. Increases in flood flows or decreases in in-stream flows downstream of the Region resulting from upstream channel modifications, operational changes or land use changes can result in changes to streamflow within and outside the Region.
- **Degraded water quality**. Flood management strategies that increase channel capacity within the Merced Region can lead to increased flows in downstream channels outside the Region that may have less capacity. This can cause increased erosion and sedimentation in downstream reaches.

Recreational activities can cause erosion and increase downstream sedimentation. Over-pumping can impact groundwater quality. Recycled water use or other projects designed to match quality to use can increase salt and nutrient loading to the groundwater basin.

- **Reduced water availability and reliability**. Increased dependence by the Merced Region on interregional surface water supplies will reduce the availability and reliability of these supplies for other regions.
- **Restricted wildlife passage**. Infrastructure projects could cause fragmentation of habitat types and separate wildlife corridors used by species that migrate through the Region.
- **Construction-related impacts**. MIRWMP infrastructure projects physically located outside the Merced Region could have temporary construction-related impacts as well as permanent loss of habitat (which would be assumed to be fully mitigated in accordance with CEQA and / or NEPA requirements).

7.1.3 Benefits and Impacts to DACs, Environmental Justice-Related Concerns, and Native American Tribal Communities

Given that the majority of the Merced Region currently qualifies as a DAC, protection of the people and economy of DACs is a priority for the RWMG and RAC. The commitment of the RWMG and RAC to providing benefits to DACs now and in the future is evidenced by the MIRWMP objective of addressing water-related needs of DACs and the inclusion of two DAC scoring criteria in the project prioritization process. The objective of managing flood flows for public safety, water supply, recharge, and natural resource management, which is one of the Region's highest priority objectives, also benefits DACs. Much of the Merced Region is located within the 100-year floodplain, and recurring floods in the past several decades demonstrate that many areas in the region are prone to flooding from storm events less severe than a 100-year event. Management of these floods, which endanger the health and safety of communities and threaten the habitability of dwellings, is a critical water quality need for DACs in the Region.

Since the majority of the Region is a DAC, potential impacts to DACs are the same as the potential impacts identified in Section 7.1.1 Impacts will be kept to a minimum and ongoing coordination and public involvement will aid in preventing a disproportionate share of impacts from being borne by the most economically-distressed communities.

Environmental justice is addressed by ensuring that all stakeholders have access to the MIRWMP planning decision-making process and that minority and/or low-income populations do not bear disproportionate adverse human health or environmental impacts from Plan and project implementation. Construction of project facilities, which can have short-term or long-term impacts such as noise and traffic disruption for neighboring communities, is often an environmental justice concern. Prior to implementing projects as part of the MIRWMP, the RWMG and RAC will do a preliminary analysis of the areas that could be affected by construction of project facilities to ensure that construction nuisance impacts and long-term impacts will not be borne predominantly by any minority population or low-income group.

Additional environmental justice issues that the RWMG and RAC will consider include water quality of small community water systems, groundwater quality in private domestic wells, flooding that impacts low income areas and areas with inadequate wastewater collection and treatment capacity. Water quality of small community water systems can be a potential environmental justice issue either as a result of an identified, unaddressed water quality issues or due to the cost of treatment to address an identified issue. A related environmental justice concern is groundwater contamination in areas with private wells that are used for domestic supply and where households cannot afford to purchase bottled water as an alternative drinking water supply, Flooding that disproportionately affects low-income areas could be an environmental justice concern because the benefit-cost ratio for flood projects in affluent areas are typically higher (due to the increased value of at-risk property) than in low-income areas; as such, it may be easier to justify and move forward flood protection projects that benefit more affluent areas. Inadequate wastewater collection and treatment capacity also has the potential to be an environmental justice issue due to the cost of increasing wastewater conveyance, treatment, and disposal capacity. In pursuing future regional grant opportunities, the RWMG and RAC will ensure that agencies and stakeholders representing potential environmental justice areas have equal access to participate in the Region's project selection processes. However, local funding match requirements that are often required by grant programs may prohibit these agencies from being able to compete for funding. In situations in which local funding match requirements can be waived or the agencies are able to provide match, the RWMG and RAC will work to ensure small community project are given due consideration and are not consistently deferred in favor of agencies serving greater populations or agencies with greater resources.

There are no California Native American tribal communities within the Merced Region. As such, implementation of the MIRWMP will not directly benefit or impact California Native American tribal communities. Plan and project implementation does, however, have the potential to benefit or impact lands that were historically occupied by California Native American tribal communities. As part of the environmental documentation process, proponents of projects funded through the MIRWMP under Proposition 84 will be required to provide notification of the proposed project to California Native American tribes that had traditional lands within the area of the proposed project. California Native American Tribes that had traditional lands in the Merced Region include the Dumna Wo-Wah Tribal Government, the North Valley Yokuts Tribe and the Chowchilla Tribe of Yokuts.

7.2 Project or Program Benefits and Impacts

A summary of projects included in the MIRWMP and the objectives which they address is included in Appendix H. For each project, potential benefits and impacts are assumed to be similar to those identified for the resource management strategies they employ.

Table 7-1:Potential Benefits and Impacts of MIRWMP Implementation

Resource Management Strategy	Within Merced Region		Interregional	
	Potential Benefits	**Potential Impacts**	**Potential Benefits**	**Potential Impacts**
Reduce Water Demand				
Agricultural Water Use Efficiency	Increased water savings Reduced groundwater overdraft/subsidence Improved water supply reliability Decreased operational costs Avoided cost of purchasing new supplies or developing new supply infrastructure Runoff reduction/pollution prevention	Reduced groundwater recharge in areas supplied with surface water Reduced in-stream flows, including loss of agricultural drainage flow to downstream water users	Improved water supply reliability Improved groundwater quality resulting from reduced saline intrusion	Reduced in-stream flows, including loss of agricultural drainage flow to downstream water users
Urban Water Use Efficiency	Increased water savings Reduced groundwater overdraft/subsidence Improved water supply reliability Decreased operational costs Avoided cost of purchasing new supplies or developing new supply infrastructure Runoff reduction/pollution prevention	Reduced groundwater recharge in areas supplied with surface water Reduced in-stream flows, including reduction of municipal wastewater discharges	Improved water supply reliability Improved groundwater quality resulting from reduced saline intrusion	Reduced in-stream flows, including reduction of municipal wastewater discharges
Improve Operational Efficiency and Transfers				
Conveyance- Regional/Local	Reduced flooding Improved water supply reliability Improved water quality, including protection of groundwater quality	Reduced in-stream flows Restricted wildlife passage Increased energy use Construction related impacts, including temporary impacts and long-term disturbance of habitat and wildlife	Reduced flooding	Reduced in-stream flows Restricted wildlife passage Construction related impacts, including disturbance of habitat and wildlife
System Reoperation	Reduced flooding Improved water supply reliability Improved water quality Reduced energy use	Changes in streamflow Increased energy use Construction related impacts, including temporary impacts and long-term disturbance of habitat and wildlife	Reduced flooding Reduced energy use	Changes in streamflow Increased energy use
Water Transfers	Improved water supply reliability Reduced groundwater overdraft/subsidence Improved groundwater quality resulting from reduced saline intrusion	Reduced in-stream flows	Improved water supply reliability Improved groundwater quality resulting from reduced saline intrusion	Reduced water availability and reliability (through transfer of water to Merced)

Resource Management Strategy	Within Merced Region		Interregional	
	Potential Benefits	**Potential Impacts**	**Potential Benefits**	**Potential Impacts**
Increase Water Supply				
Conjunctive Management and Groundwater Storage	Improved water supply reliability Reduced groundwater overdraft/subsidence, including reduced threat of flooding from levee subsidence	Reduced in-stream flows Degraded water quality Loss of farmland Construction-related impacts, including temporary impacts and long-term disturbance of habitat and wildlife	Increased water supply reliability Reduced subsidence, including reduced threat of flooding from levee subsidence	Reduced water availability and reliability (competition over interregional supplies) Reduced in-stream flows Degraded water quality
Recycled Municipal Water	Improved water supply reliability (including offset of potable water use) Decreased operational costs (through reduced fertilizer requirements) Improved groundwater quality resulting from reduced saline intrusion	Increased salt/nutrient loading Construction related impacts, including temporary impacts and long-term disturbance of habitat and wildlife Growth inducement	Improved water supply reliability Improved groundwater quality resulting from reduced saline intrusion	Increased salt/nutrient loading
Surface Storage- Regional/Local	Reduced flooding Improved water supply reliability	Reduced in-stream flows Construction related impacts, including temporary impacts, long-term disturbance of habitat and wildlife, and loss of habitat Growth inducement	Reduced flooding	Reduced in-stream flows Construction related impacts, including temporary impacts, long-term disturbance of habitat and wildlife, and loss of habitat
Improve Water Quality				
Drinking Water Treatment and Distribution	Improved water supply reliability Improved water quality Public health benefits	Reduced in-stream flows Increased energy use Growth inducement Construction related impacts, including temporary impacts, long-term disturbance of habitat and wildlife, and loss of habitat	Improved water supply reliability (reduced demand on interregional supplies)	Reduced water supply reliability (increased use of interregional supplies) Increased energy use Construction related impacts, including disturbance of habitat and wildlife
Groundwater Remediation/Aquifer Remediation	Improved water supply reliability Improved water quality	Increased groundwater pumping/subsidence Construction related impacts, including temporary impacts and long-term disturbance of habitat and wildlife	Improved water supply reliability (reduced demand on interregional supplies)	Increased groundwater pumping/subsidence
Matching Quality to Use	Improved water supply reliability	Reduction in delivered water quality	Improved water supply reliability (reduced demand on interregional supplies)	None
Pollution Prevention	Improved water quality Improved habitat Decreased treatment costs Improved experience for water dependent recreation	None	Improved water quality Improved habitat Improved experience for water dependent recreation	None

Resource Management Strategy	Within Merced Region		Interregional	
	Potential Benefits	**Potential Impacts**	**Potential Benefits**	**Potential Impacts**
Salt and Salinity Management	Improved water quality Improved water supply reliability Improved groundwater quality resulting from reduced saline intrusion	None	Improved water supply reliability (reduced demand on interregional supplies) Improved groundwater quality resulting from reduced saline intrusion	None
Urban Runoff Management	Improved water supply reliability Improved water quality Improved habitat Decreased treatment costs	Land use restrictions	Improved water supply reliability Improved groundwater quality resulting from reduced saline intrusion	None
Improve Flood Management				
Flood Risk Management	Reduced flooding Increased aquifer recharge Improved water quality Reduced risk to life and property Decreased flood insurance costs Improved water supply reliability Reduced saline intrusion	Loss of revenue from restricted land use Loss of flows to downstream water users Increased sedimentation and erosion Construction related impacts, including temporary impacts, long-term disturbance of habitat and wildlife and loss of riparian and/or wetland acreage	Reduced flooding Improved surface water quality Reduced risk to life and property Decreased flood insurance costs Improved water supply reliability Reduced saline intrusion	Loss of flows to downstream water users Increased sedimentation and erosion Increased flood flows to downstream communities Construction related impacts, including temporary impacts, long-term disturbance of habitat and wildlife and loss of riparian and/or wetland acreage
Practice Resources Stewardship				
Agricultural Lands Stewardship	Local prosperity (decreased operational costs and improved agricultural productivity) Improved water quality Improved habitat Open space preservation Flood control enhancement Improved water supply reliability	Land use restrictions (prevention of future urbanization)	Open space preservation Improved water supply reliability Improved water quality	None
Economic Incentives (Loans, Grants and Water Pricing)	Improved water supply reliability Local prosperity (decreased operational costs) Improved groundwater quality resulting from reduced saline intrusion	Economic impacts (either for the agency sponsoring loans and grants or customers affected by water pricing)	Improved water supply reliability (reduced demand on interregional supplies) Improved groundwater quality resulting from reduced saline intrusion	Economic impacts (loss of revenue)
Ecosystem Restoration	Improved habitat and wildlife passage Improved water quality Increased numbers of native species Increased recreational opportunities including recreational viewing Open space preservation	Land use restrictions Economic impacts (loss of revenue from restricted land use) Construction related impacts	Improved habitat and wildlife passage Improved water quality Open space preservation (protection of some of the most ecologically sensitive areas in Merced County)	None

Resource Management Strategy	Within Merced Region		Interregional	
	Potential Benefits	**Potential Impacts**	**Potential Benefits**	**Potential Impacts**
Forest Management	Improved water supply reliability (through protection of snowpack) Improved water quality Improved habitat and wildlife passage	Land use restrictions	Improved supply reliability Improved water quality	Land use restrictions
Land Use Planning and Management	Minimize unintended impacts resulting from land use planning that is not coordinated with water resources planning Improved water supply reliability (including increased groundwater recharge) Improved water quality	Land use restrictions Growth inducement	Improved supply reliability	None
Recharge Area Protection	Improved water quality Increased groundwater recharged/reduced subsidence Improved supply reliability	Land use restrictions	Improved water supply reliability (reduced demand on interregional supplies) Improved supply reliability	None
Water-Dependent Recreation	Increased recreational opportunities for the region Enhanced public safety Local prosperity	Degraded water quality (through increased erosion and sedimentation) Construction related impacts, including temporary impacts and long-term disturbance of habitat and wildlife	Degraded water quality	Degraded water quality (through increased erosion and sedimentation)
Watershed Management	Reduced flooding Improved water supply reliability Improved water quality Improved habitat and wildlife passage Improved local understanding of water resources issues Improved coordination among water resource stakeholders	Land use restrictions Construction related impacts, including temporary impacts and long-term disturbance of habitat and wildlife	Reduced flooding Improved water supply reliability Improved water quality Improved habitat and wildlife passage Improved coordination among water resource stakeholders	Land use restrictions
Other Strategies				
Crop Idling for Water Transfers	Improved water supply reliability	Economic impacts (loss of revenue)	Improved water supply reliability (reduced demand on interregional supplies)	None
Irrigated Land Retirement	Improved water supply reliability	Economic impacts (loss of revenue) Loss of habitat and open space (through conversion to urban uses)	Improved water supply reliability (reduced demand on interregional supplies)	None
Rainfed Agriculture	Improved water supply reliability Decreased operational costs	Economic impacts (loss of revenue through reduced productivity)	Improved water supply reliability (reduced demand on interregional supplies)	None

Merced Integrated Regional Water Management Plan

Chapter 8 Plan Performance and Monitoring

This chapter addresses the Integrated Regional Water Management (IRWM) Plan Performance and Monitoring Plan Standard which requires IRWM Plans to:

- ✓ Contain performance measures and monitoring methods to ensure the objectives of the Plan are met
- ✓ Describe a method for evaluating and monitoring the ability of the Regional Water Management Group (RWMG) to meet the objectives and implement the projects in the Plan

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This chapter describes the process by which the RWMG will periodically verify that the Region is efficiently making progress towards meeting the MIRWMP objectives, is implementing projects listed in the plan, and is ensuring that each project in the MIRWMP is monitored to comply with all applicable rules, laws, and permit requirements. This chapter describes the general process that will be employed to track plan performance and to monitor progress being made to implement the projects contained in this plan.

8.1 Plan Performance Review

A Plan Performance Review will be conducted three years after the initial adoption of the plan and in five-year intervals following the first review. The Plan Performance Review will evaluate progress made toward achieving Plan objectives and will be administered by the RWMG and supported by the RAC or a workgroup thereof.

Two tables will be generated with each Plan Performance Review: one that addresses the extent to which the MIRWMP objectives have been met, and one that describes progress made in implementing the projects listed in the MIRWMP. The first table, which will be entitled "Progress Toward Achieving Plan Objectives", will report the aggregate of the performance measure data collected and submitted by the reporting agencies for each of the MIRWMP objectives listed in Chapter 4 Objectives. The second table, which will be entitled "Status of Project Implementation" will list all of the projects within the Merced OPTI project database that have been IRWMP approved, the project proponent for each, the implementation status, and funding sources. Projects that have been fully implemented will be highlighted separately.

Templates of these tables are provided on the following pages.

Table 8-1: Example Reporting Template: Progress toward Achieving Plan Objectives

Objective	Performance Measures	Monitoring/Reporting Result	Cumulative Progress To-Date
A. Manage flood flows for public safety, water supply, recharge, and natural resource management	1. Occurrence of flooding at the Bear Creek, Black Rascal Creek diversion, Deadman Creek, Dry Creek, Fahrens Creek, Lake Yosemite, Mariposa Creek, Merced River, and San Joaquin River 2. Volume of flood water stored and / or recharged 3. Flood-related damages (extent and frequency)		
B. Meet demands for all uses, including agriculture, urban, and environmental resource needs.	1. Curtailment of voluntary and/or mandatory water use restrictions 2. Stability of groundwater levels 3. Ability to meet instream flow requirements		
C. Correct groundwater overdraft conditions.	1. Groundwater surface elevation 2. Volume of water recharged 3. Reduction in groundwater subsidence 4. Improvement in groundwater quality		
D. Improve coordination of land use and water resources planning.	1. Number of cooperative planning meetings held between land use and water resource planning entities 2. Number of General Plans with water resource elements		

Objective	Performance Measures	Monitoring/Reporting Result	Cumulative Progress To-Date
E. Maximize water use efficiency.	1. Estimated annual savings from demand management programs 2. Volume of water per year put to beneficial reuse 3. Percent of water users with meters and commodity pricing 4. Urban per capita water use (in accordance with provisions of SBx7-7)		
F. Protect and improve water quality for all beneficial uses, consistent with the Basin Plan.	1. New 303(d) listings and / or delistings 2. Surface water and groundwater quality		
G. Protect, restore, and improve natural resources.	1. Acres of habitat protection / restoration / enhancement completed 2. Development trends in the largest and most ecologically sensitive areas of Merced County (including the Merced and San Joaquin River corridors and Eastside Grasslands)		
H. Address water-related needs of disadvantaged communities (DACs).	1. Programs implemented that focus on meeting critical water-related needs of DACs 2. Percent of population with drinking water that complies with all applicable standards		
I. Protect and enhance water-associated recreation opportunities.	1. Number of programs that include water-associated recreation opportunities		

Objective	Performance Measures	Monitoring/Reporting Result	Cumulative Progress To-Date
J. Establish and maintain effective communication among water resource stakeholders in the Region.	1. Number of stakeholders or their representatives and members of the public attending IRWM-related meetings 2. Number of collaborative projects jointly implemented by multiple entities		
K. Effectively address climate change adaptation and/or mitigation in water resource management.	1. Number of projects implemented that address climate change		
L. Enhance public understanding of water management issues and needs.	1. Number of educational programs / number of people participating in water-focused educational events in the Region		

Table 8-2: Example Reporting Template: Status of Project Implementation

Project	Proponent	Status of Project Implementation	Secured Funding Sources
Black Rascal Flood Control Project	Merced County		
Planada Community Services District Water Conservation Project	Planada Community Services District		
El Nido Area Recharge Project	MID		
Merced River Education and Enhancement Program	MID		

8.2 Project-Specific Data Collection and Monitoring Plans

Proponents of projects implemented as part of the MIRWMP will be required to develop project-specific monitoring plans prior to, or in conjunction with, project implementation. Project proponents will be responsible for performing monitoring activities, collecting and validating the data consistent with MIRWMP requirements, and submitting data to the Merced Hydrologic Database Management System (Merced HydroDMS) and relevant statewide databases (refer to Chapter 9 Data Management). For projects that receive funding for project implementation through the IRWM Program, the RWMG will require each project proponent to provide evidence that it has prepared its project-specific monitoring plan(s) consistent with the requirements outlined in this Plan and the funding contract, and that the Plan is being implemented accordingly. Each monitoring plan will include a schedule with an estimated timeline of monitoring activities, which the RWMG will use as a guideline for overall program implementation. Consistent with DWR grant requirements which require quarterly reporting as part of the performance monitoring plan, data collected and analyses performed for DWR grant funded projects will be reported to the Merced HydroDMS and appropriate statewide databases on a quarterly basis, along with required documentation and an evaluation of project performance. This will help to ensure that implemented projects fulfill MIRWMP objectives as originally intended.

Project-specific monitoring plan requirements will vary based on the type of project being implemented. All projects must adhere to appropriate State guidelines for monitoring, depending upon the type of data being collected, in order to be implemented through the MIRWMP. These include:

- Projects that involve surface water quality must meet the criteria for and be compatible with the State Water Resources Control Board (SWRCB) Surface Water Ambient Monitoring Program (SWAMP), http://www.waterboards.ca.gov/water_issues/programs/swamp/tools.shtml.
- All projects that involve groundwater quality must meet the criteria for and be compatible with the SWRCB Groundwater Ambient Monitoring and Assessment (GAMA) program, http://www.waterboards.ca.gov/gama/.
- Projects collecting groundwater elevation should be compatible with the needs of the California Statewide Groundwater Elevation Monitoring (CASGEM) program, http://www.water.ca.gov/groundwater/casgem/.
- All projects that involve wetland restoration must meet the criteria for and be compatible with the State Wetland and Riparian Area Monitoring Plan (WRAMP), http://www.waterboards.ca.gov/mywaterquality/monitoring_council/wetland_workgroup/docs/2010/tenetsprogram.pdf

All project-specific monitoring plans must include the following:

- A table describing what is being monitored for the project (e.g. water quality, water depth, flood frequency), and effects the project may have on habitat or particular species (before and after construction).
- Measures to remedy or react to problems encountered during monitoring.
- Location of monitoring.
- Monitoring frequency.
- Monitoring protocols/methodologies and quality assurance and quality control (QA/QC) procedures, including who will perform the monitoring.

- A description of how those monitoring protocols / methodologies and QA / QC procedures are consistent with requirements for applicable statewide databases including SWAMP, GAMA, and WRAMP.
- Procedures and a schedule for incorporating collected data into the Merced HydroDMS, or if data being monitored cannot be entered within the Merced HydroDMS, a description of procedures to keep track of what is monitored.
- Procedures and a schedule for incorporating collected data into statewide database(s).
- Procedures and a schedule for reporting to the RWMG confirmation of data submittal to appropriate statewide database(s).
- Procedures to ensure the monitoring schedule is maintained and that adequate funding is available to maintain monitoring of the project throughout the scheduled monitoring timeframe

In developing monitoring plans, project proponents should keep in mind the MIRWMP objectives that the project is intended to address. The MIRWMP provides measurable targets for each Plan objective (see Chapter 4 Objectives). These measurable targets provide a way to assess each submitted project's contribution to the MIRWMP objectives established by the Region's stakeholders. Monitoring each project's contribution to the MIRWMP objectives can assist with the assessing the MIRWMP's overall progress towards achieving the regional objectives.

Project sponsors will be solely responsible for completing data collection in accordance with the approved project-specific monitoring plan, which will clearly identify monitoring and analytical techniques and quality assurance / quality control (QA/QC) procedures to be implemented, and will describe how those techniques are compatible with the requirements of appropriate statewide database(s). Individual project sponsors will be responsible for reviewing the data collection and QA/QC protocols to validate that data was collected in accordance with QA/QC procedures required as part of the project monitoring program. In addition, project proponents will be responsible for "spot-checking" all data for accuracy at the time of entry to the database to identify any apparent errors. Once data collection and QA/QC has been completed in accordance with provisions of the approved project-specific monitoring plan, project sponsors will submit the compatible data to the Merced HydroDMS and the appropriate statewide database(s). Project sponsors will also provide the RWMG with confirmation that the data has been submitted to the appropriate statewide database(s) consistent with the project-specific monitoring plan.

The RWMG will maintain the Merced HydroDMS, which will house data provided by project sponsors. The data will be maintained by the RWMG and copies of data will be available to stakeholders and members of the public as discussed in Chapter 9 Data Management.

8.3 Adaptive Management

The Plan Performance Review process will include an adaptive management component which will allow the RWMG to respond to lessons learned from analyzing collected performance measure and project monitoring data. Adaptive management also allows the Region to incorporate new information about the effects of climate change as new tools and information becomes available. With this information, the RWMG, in coordination with the RAC, may consider modifying Plan objectives, performance measures, the applicability of selected resource management strategies, and the project review and prioritization process. These actions may, in turn, determine the types of projects that will be selected and implemented in the future.

Local agencies implementing projects as part of MIRWMP implementation will monitor for the parameters specified in order to determine how well each project is fulfilling its objectives. This information will be fed back into the project's decision-making structure to adapt the project to better meet its overall objectives. Only by consistent monitoring and analysis can projects successfully achieve their objectives. Monitoring will also provide a clear reporting mechanism for the public, decision-makers, and regional planners to determine the planned versus actual value of the project. When the MIRWMP is updated in the future and regional objectives are revisited, the RAC will discuss and evaluate the status of MIRWMP implementation. The results of project-specific monitoring efforts will be utilized to identify areas where Plan implementation may need to be modified to best achieve Plan objectives moving forward.

When projects included in the MIRWMP that are implemented independently from the MIRWMP program, project sponsors will be encouraged to prepare and administer project-specific monitoring plans that are generally consistent with the monitoring plans described above. During the Plan Performance Review, the RWMG will assess the extent to which the MIRWMP objectives have been met, based on the projects and programs completed throughout the Region. In this way, progress made toward achieving Plan objectives by projects implemented outside of the IRWM Program will be assimilated into the Plan Performance Review, though specific monitoring data may or may not be made available by project sponsors within the Merced HydroDMS.

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Merced Integrated Regional Water Management Plan

Chapter 9 Data Management

This chapter addresses the Integrated Regional Water Management (IRWM) Plan Data Management Plan Standard which requires IRWM Plans to:

- ✓ Describe the process of data collection, storage and dissemination to IRWM participants, stakeholders, the public and the State

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This chapter describes the process that will be implemented to provide for the efficient use of available data, ensure stakeholder access to data, and integrate the data generated by IRWM implementation activities into existing State databases.

The RWMG and RAC have developed standard data management documentation practices that are required to be followed for projects and programs implemented as part of the MIRWMP. Projects and programs implemented outside of the IRWM Program are encouraged to follow similar protocols to maximize usefulness and compatibility of data collected throughout the Region, and to improve potential integration into statewide databases. The data that may be collected and anticipated reporting procedures are presented in the sections below. For the purposes of this plan, the term data includes technical documentation (such as designs, feasibility studies, and reports), as well as technical information collected as part of project or program planning, design, implementation, and operation.

9.1 Overview of Data Needs

Throughout the Merced Region, a variety of local, state and federal agencies and non-governmental organizations collect valuable water-related data, but that data is not currently assembled in a uniform or collaborative manner. At times, the data that is collected is program-specific with limited region-wide applicability. The Merced IRWM planning process can facilitate better information-sharing and identify data needed by the Region's agencies and organizations, project proponents, and stakeholders to more efficiently analyze and understand water quality and environmental conditions within the Region.

Procedural data needs in the Merced Region include the following:

- Uniform data management protocols for MIRWMP projects to allow broader sharing and comparability
- Centralized data management to provide a means for addressing regional questions about the condition of water resources in the Region
- Dissemination of data to the general public in a format that improves public understanding of water management issues

In addition, the following specific data needs that are broadly applicable to the Merced Region were identified through review of existing water management plans, RAC discussions and public input:

- Up-to-date, spatially-referenced land use data that includes recent agriculture-to-agriculture conversions that impact water demands in the Region
- Groundwater data to assess current groundwater conditions and to determine necessary management activities

- Local groundwater water quality data to determine the suitability of recharge areas
- Current and projected water demands

Implementation of the MRIWMP will assist in meeting these data needs. The procedural data needs will be addressed through the implementation of the centralized data management system created as part of the development of this MIRWMP (see Section 9.3 Data Management System), and the identified data gaps will be addressed through project implementation. In some cases, these gaps may be filled by projects specifically designed to collect needed data, and in other cases, data gaps may be addressed indirectly through data reported in project performance monitoring plans.

9.2 Data Collection Techniques

Data collected in conjunction with MIRWMP implementation projects will vary based on the type and scope of each individual project, but may include:

- streamflow
- surface water deliveries
- groundwater elevations
- groundwater pumping
- precipitation
- volume of water impounded or recharged
- water demand
- locations and sizes of water-related facilities
- political and agency boundaries
- land use
- contaminant plume location and extent
- water quality data
- locations of sensitive habitats and species
- hydrogeologic and hydrologic data
- visitor days at recreational areas
- community members served by educational events

Data may also be developed by project sponsors using numerical models such hydrologic models. Working with the project sponsors, the agencies shown in Table 9-1, regional stakeholders, the RWMG, and the RAC will continue to seek out data needed to address regional data gaps on an ongoing basis. Identified data gaps will be filled as new data sources and / or new or expanded monitoring activities are identified.

Table 9-1: Potential Sources of Water Resources Data

Federal	State	Local
National Climate Data Center	California Irrigation Management Information System (CIMIS)	City Planning Departments
National Resource Conservation District	Department of Fish & Game	East Merced Resource Conservation District
Army Corps of Engineers	Department of Public Health	Merced County Association of Governments
Bureau of Reclamation	Department of water Resources	Merced Area Groundwater Pool Interests
U.S. Fish & Wildlife Service	State Water Resources Control Board & the Regional Water Quality Control Board	Merced County
U.S. Geologic Survey	California Natural Diversity Database	Merced Irrigation District
National Marine Fisheries Service	California Department of Pesticide Regulation	Merced Streams Group
U.S. Environmental Protection Agency		University of California, Merced
The Nature Conservancy		Stakeholders
U.S. Forest Service		Water and Wastewater Districts

MIRWMP project proponents implementing projects through the IRWM Program will be required to prepare project-specific monitoring plans. The monitoring plans will clearly identify monitoring and analytical techniques and QA/QC procedures to be implemented, and will describe how those techniques are compatible with the requirements of statewide database(s) relevant to the project. Selected potentially-applicable statewide databases are summarized below.

SWAMP: Projects collecting surface water data will be required to adhere to SWAMP data collection protocols. Typical data collection techniques for surface waters include both field measurements and laboratory analysis. Field measurements are either collected using meters or field kits for a common list of constituents including but not limited to: water temperature, pH, conductivity, dissolved oxygen and turbidity. For an example of a field data sheet and complete list of fields required SWAMP go to: http://swamp.mpsl.mlml.calstate.edu/wp-content/uploads/2009/04/swamp_sop_field_measures_water_sediment_collection_v1_0.pdf.

There is a large list of possible constituents that are measured in surface waters that require laboratory analysis. Typical laboratory analysis includes fecal indicator bacteria, metals, nutrients, persistent organic pollutants, and turbidity. SWAMP provides guidance on methods and quality assurance. This guidance can be found at: http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/qapp/qaprp082209.pdf.

Biological monitoring is helpful for determining the health of a system and whether it is able to sustain a diverse community of benthic macro invertebrates. Standard operating procedures for determining a stream's physical/habitat condition and benthic invertebrate assemblages can be found at: http://swamp.mpsl.mlml.calstate.edu/wp-content/uploads/2009/04/swamp_sop_bioassessment_collection_020107.pdf.

GAMA: Projects collecting groundwater data will be required to adhere to GAMA data collection protocols. The GAMA Priority Basin Project is grouped into 35 groundwater basin groups called "study units." Each study unit is sampled for common contaminants regulated by CDPH, and also for unregulated chemicals. Testing for these chemicals—usually at detection levels well below those achieved by most laboratories—will help public and private groundwater users to manage this resource. Results from the Central Eastside San Joaquin study unit, which includes the Merced Region, can be found at http://pubs.usgs.gov/fs/2010/3001/. Some of the chemical constituents that are sampled by the GAMA Priority Basin Project include:

- Low-level volatile organic compounds (VOCs)
- Low-level pesticides
- Stable isotopes of oxygen, hydrogen, and carbon
- Emerging contaminants (pharmaceuticals, perchlorate, chromium VI, and other chemicals)
- Trace metals (arsenic, selenium, lead, and other metals)
- Radon, radium, and gross alpha/beta radioactivity
- General ions (calcium, magnesium, fluoride)
- Nutrients, including nitrate, and phosphates
- Bacteria: total and fecal coliform bacteria

CASGEM: Projects collecting groundwater elevation should be compatible with the needs of the California Statewide Groundwater Elevation Monitoring (CASGEM) program. As the designated Monitoring Entity for the Merced Groundwater Subbasin, MAGPI is the entity responsible for providing regular and systematic monitoring of groundwater elevations to DWR. To support MAGPI's efforts, project collecting groundwater elevation data must provide well identification number, measurement date, reference point and land surface elevation, depth to water, method of measuring water depth and measurement quality codes. Additional information on the CASGEM program is available at: http://www.water.ca.gov/groundwater/casgem/.

WRAMP: Projects involving wetland restoration must meet the criteria for and be compatible with WRAMP. WRAMP is intended to track trends in wetland extent and condition to determine the performance of wetland, stream, and riparian protection programs in California. The program defines standardized assessment methods and data management with the goal of minimizing new costs and maximizing public access to assessment information. Additional information on the WRAMP program can be found at the following location: http://www.waterboards.ca.gov/mywaterquality/monitoring_council/wetland_workgroup/docs/2010/tenetsprogram.pdf.

9.3 Data Management System

The Merced Hydrologic Data Management System (Merced HydroDMS) will serve as the centralized data management system for the Merced Region, housing data provided by project sponsors. The system includes data entry forms for users to submit data and tools to automate report and chart preparation based on available data. It can be used to fill data gaps, identify additional data gaps, document the status of current water resources problems, detect new problems, and provide information to the RWMG to track progress in MIRWMP implementation efforts. The Merced HydroDMS will be maintained by the RWMG through a workgroup of the RAC and will be accessible to stakeholders via a link on the Merced IRWMP website.

9.4 Quality Assurance/Quality Control Measures

As described in Chapter 8 Plan Performance and Monitoring, Section 8.2, individual project sponsors will be responsible for reviewing data collection and QA/QC protocols to validate that data was collected in accordance with QA/QC procedures required as part of the project monitoring program. In addition, project proponents will be responsible for "spot-checking" all data for accuracy at the time of entry to the database to identify any apparent errors. Once data collection and QA/QC has been complete in accordance with provisions of the approved project-specific monitoring plan, the project sponsor will submit the compatible data to the appropriate statewide database, as well as to the Merced HydroDMS.

9.5 Data Sharing

The RWMG, RAC, project proponents, and other IRWM planning participants are all jointly responsible for data dissemination. During development of the MIRWMP, data was disseminated via public workshops, special technical workshops, RAC meetings and the Merced IRWMP website postings. During implementation, two online databases created during the Merced IRWM planning process – Merced OPTI and Merced HydroDMS – will be used to share project information and data collected as part of MIRWMP.

Merced OPTI is a tool for locating, connecting, sharing and integrating projects within the Region. Basic information must be provided for a project to be included within the project database, and any interested member of the public can register for Merced OPTI to view this information. Merced OPTI is designed to promote collaboration and members who register as community members can collaborate on projects. The site includes space for collaborators to share notes and documents related to their projects, and the project proponent has the option to make these items visible for public users interested in following the project progress.

Merced HydroDMS is designed to be a central location for agencies and stakeholders throughout the Merced Region to store and share water-related data. Data collected as part of the MIRWMP will be made available to stakeholders and other interested parties through the Merced HydroDMS. Individuals without Internet access may contact one of the RWMG member agencies to request hard copies of specific datasets.

In addition to these two existing databases, one of the projects proposed for the Merced Region is the Merced IRWM Digital Library Project. This project proposes to develop and maintain an online content management system which would serve as a community clearing house for information from relevant local, statewide, regional, and international watershed planning and projects. The Merced IRWM Digital Library would be similar to Merced OPTI in that it would provide summaries and supporting documents for planning and implementation projects and allow for collaboration among members of the community using the site.

Sponsors of projects implemented through the MIRWMP will also be required submit data to the statewide database(s) specified in the approved project-specific monitoring plan. Each project sponsor will provide the RWMG with confirmation that the data has been submitted to the appropriate statewide database(s).

Environmental documentation processes (i.e. CEQA and NEPA) are another method of disseminating data for review by interested stakeholders and the public; completion of environmental documentation will be the sole responsibility of project proponents and will be completed on a project-by-project basis.

Merced Integrated Regional Water Management Plan

Chapter 10 Finance

This chapter addresses the Integrated Regional Water Management (IRWM) Finance Plan Standard which requires IRWM Plans to:

- ✓ List known, as well as, possible funding sources, programs and grant opportunities for the development and ongoing funding of the IRWM Plan
- ✓ List the funding mechanisms, including water enterprise funds, rate structures, and private financing options, for projects that implement the IRWM Plan
- ✓ Explain the certainty and longevity of known or potential funding for the IRWM Plan and projects the implement the Plan
- ✓ Explain how operation and maintenance (O&M) costs for projects that implement the IRWM Plan would be covered and the certainty of operation and maintenance funding

10.1 Funding Sources and Mechanisms for Planning and Implementation

As with many regions in California, project funding is a major obstacle for the implementation of projects in the Merced Region. Demands on limited local funds continue to increase, construction costs continue to rise, and existing infrastructure requires maintenance or upgrades to meet growing demands. In this economic climate, agencies are challenged to balance costs associated with ensuring the highest standards of water quality and supply reliability for existing customers while protecting and enhancing the sensitive ecosystems within the region. Further, projects that benefit the environment but do not provide new water or a measurable improvement to water supply reliability and/or water quality are typically dependent upon public assistance for implementation.

Funding is particularly difficult for the Merced Region due to the economic distress of its communities. The poverty rate in Merced County rose from 23 percent in 2010 to 27.4 percent in 2011, and the California Employment Development Department reported multiple communities within the Merced Region having unemployment rates greater than 20 percent in 2011. Given the Merced Region's economic conditions, the RWMG and regional stakeholders are mindful of the need to implement the MIRWMP, including any projects or programs considered for implementation, in a cost-effective manner.

This first MIRWMP was developed with funding from the DWR IRWM Grant Program in conjunction with significant time and resources from MID, the City of Merced and the County of Merced. Moving forward, the RWMG recognizes that the bulk of the cost to maintain the MIRWMP must come from its member agencies. The RWMG is committed to continuing to fund a useful and implementable IRWM Plan. Using in-kind services performed by staff from their respective agencies, supplemented by grant funding when available, the RWMG's member agencies intend to implement periodic plan performance reviews, continue coordinating and participation in meetings of the RAC, organize stakeholder outreach efforts, and update the MIRWMP as needed in the future to help ensure it responds appropriately to current day conditions and issues. The time commitment from the RWMG is estimated to be approximately 100-120 hours per year for organization and attendance of quarterly RAC meetings (distributed among the staff of the RWMG member agencies) and 40-60 hours per year to organize and attend biannual meetings of the Policy Committee (distributed among elected officials and staff members), as discussed in Chapter 3 Governance.

The estimated costs of projects included in the MIRWMP range from tens of thousands of dollars to multi-million dollar projects. Estimated costs for the snapshot of projects that was included in the MIRWMP as of November 2012 is presented in Appendix J[2]. The list of projects in the appendix also identifies local funding sources and existing grants that have been secured by the project proponent; in most cases these amounts are not applicable. The majority of the project proponents have not yet successfully identified local funding sources to support implementation of their proposed projects. The combined estimated cost of the projects within the plan is approximately $350 million. Of this amount, only $7 million, or 2% of the total estimated costs, has been secured. As illustrated by this snapshot of projects, funding is a real challenge for the Region. Many of the projects included within the MRIWMP were submitted with the hope of securing outside funding for implementation.

The RWMG, RAC, and regional stakeholders understand that in the long run, project and program costs must be borne primarily by local entities. However, outside funding provides assistance critical to moving projects from planning to construction. While grants and loans represent unsecured sources of funding, in a region where some water and sewer enterprise funds have been running at a significant deficit and the rate base is composed of DACs, there is significant uncertainty in local sources of funding. Due to lack of funding, some projects which are "shovel-ready" have not been completed. In other cases, projects to meet critical regional water management needs are unable to move beyond planning phases due to inadequate funding.

The RWMG will fund oversight of the MIRWMP through in-kind time and limited material commitments, but outside sources of funding will be needed to supplement locally available funds and advance some critical projects.

It should be recognized that each implementing organization has a unique set of revenue and financing methods and sources. The MIRMWP does not provide an exhaustive list of funding sources available. Many of the same funding sources and/or mechanisms would be used for continued development of the IRWM Plan and for project / program implementation. Potential funding sources for furthering the MIRWMP and implementing projects are listed in Table 10-1, and the funding mechanisms are further described below.

[2] The project list provided in this Plan reflects the project list as of November 2012. The project list contained in the Merced OPTI database is the current MIRWMP project list, and the project list provided in this Plan reflects the project list as of November 2012.

Table 10-1: Funding Sources for Development of the IRWM Plan and Implementation of Projects

Funding Mechanisms	Continued IRWM Plan	Project / Program Implementation	Certainty & Longevity of Funding
User Rates / Recovery		✓	Dependent upon rate structure adopted by project proponents
Capacity Fees		✓	Dependent upon rate structure adopted by project proponents
User Fees		✓	Dependent upon rate structure adopted by project proponents
Special Assessments		✓	Dependent upon the ability to demonstrate direct and unique benefits to parcels. Once in place this represents high certainty of funding.
General or Capital Improvement Funds	✓	✓	Dependent upon budgets adopted by project proponents and participating agencies
Revenue Bonds		✓	Dependent upon debt carried by project proponents & bond market
Local, State, or Federal Grant Programs	✓	✓	Dependent upon future local, state, and federal budgets, and success in application process
Low-interest Loan Programs		✓	Dependent upon future local, state, and federal budgets, and success in application process

- **User Rates/Rate Recovery**. User rates or rate recovery pays for the operations and maintenance of a water agency or public utility's system. Within a water agency user rate, there is a fixed cost component that covers costs that do not vary with the amount of supplied water, such as labor and overhead expenses, and a variable cost component that covers costs that are based on the amount of pumping and treatment needed to meet the water demands of the customers. These costs, such as electrical and chemical costs, vary with the amount of supplied water. A water

agency customer pays a monthly fixed rate and a variable rate based on the metered usage. In some cases, the variable rate includes an allowance for water use and the variable rate is charged only if the customer's usage exceeds the fixed allowance. In tiered water rates, the variable fee increases with water consumption. For services without meters, a single monthly rate is assessed based on assumed consumption. Unmetered customers may also be assessed miscellaneous fees, including charges for swimming pools.

Regional stakeholders understand the need to fully vet projects before passing the costs of projects onto ratepayers in the form of increased water and wastewater rates. Additionally, regional stakeholders have expressed the need for projects designed to address existing water management needs to be economically sustainable given the current population/ratepayers. As such, the certainty of funding for projects which propose rate increases will be largely dependent on the support garnered for the project and ratepayers understanding of the project need.

- **Capacity Fees**. Capacity fees are charged to users who create new or additional demand on water or wastewater systems. Capacity fees are used to achieve and maintain equity among its past, present and future customers. They are typically charged per connection, measured in equivalent dwelling units (EDUs). A single connection may encompass more than one EDU.

  California law requires that these charges comply with the Mitigation Act (AB1600, Government Code 66000 et seq.), which states that there needs to be nexus between the connection and costs, and that fees should be proportionate to the cost of providing service.

- **User Fees**. Monthly user fees are assessed by water agencies when facilities are implemented that directly benefit existing customers. This is particularly true for water agencies that are developing conjunctive use water systems in which existing customers may have paid for the groundwater component when they paid the development fee (through the purchase of the home). The surface water and/or recycled water component is a new water supply for a water agency that is needed for conjunctive use with groundwater supplies. Income from this monthly revenue source may be used to pay debt service on debt financed assets.

- **Special Assessments**. Upon compliance with Proposition 218, a government agency can impose a special assessment on properties that receive a special benefit from the public project that is being constructed.

  As the Region works to address critical flood management needs, it may be necessary to form a Flood Control District or a JPA comprised of agencies with authority over flood management. The Flood Control District or JPA could focus on the creation of drainage areas, flood control zones and other special assessment areas to support design, construction and maintenance of flood and stormwater management facilities. The Flood Control District would absorb all functions currently performed by the Merced Streams Group.

  An assessment district for maintaining the groundwater basin, such as the districts authorized under AB3030 could be created and properties could be assessed to support groundwater recharge projects and monetary cost of purchased recharge water.

- **General or Capital Improvement Funds**. General or capital improvement funds are monies that an agency sets aside to fund general operations and/or facility improvements, upgrades, and at times development. These funds are usually part of the overall revenue stream and may or may not be project-specific.

- **Revenue Bonds**. In cases in which large facilities are needed to support current services and future growth, revenue bonds may be issued to pay for new capital. In this way, large facilities can be paid for by bonded debt service at the time of construction with repayment of the debt service over a 20- to 30-year timeframe. This is a preferred approach to paying for high-cost facilities because it avoids the perceived over-collection of fees from past customers that go toward facilities that serve present and future customers. The drawback to bonded debt is that it cannot be accomplished with capacity fees alone due to the variability and uncertainty of new development over time. A user rate is needed as a bond document covenant in the event that development fees are not adequate to make the required annual payment for the debt service.
- **Local, State, and Federal Grant Programs.** Grant programs typically require that local matching funds be available. The matching fund requirement demonstrates a local commitment to promoting and completing the study or project. Grants typically carry relatively high administration costs because extensive grant reporting may be required, and typically only a relatively small portion of the grant may be used to cover grant administration. The development of this MIRWMP was partially funded through a Proposition 84 Integrated Regional Water Management Planning Grant. Grant programs that project proponents within the Region have used in the past and/or may consider for the future include the following.
    - Proposition 50
        - DWR Water Use Efficiency Grant Programs
    - Proposition 84
        - DWR IRWM Grant Program
        - DWR Flood Emergency Response Grant Program
        - State Water Resources Control Board (SWRCB) Storm Water Grant Program
        - SWRCB Agricultural Water Quality Grant Program
        - California Department of Public Health (CDPH) Emergency Grants
    - Proposition 1E
        - DWR Stormwater Flood Management Grant Program
    - California State Parks Office of Grants and Local Service Annual Grant Programs
        - Habitat Conservation Fund
        - Land and Water Conservation Fund
        - Recreational Trails Program
    - U.S. Environmental Protection Agency Environmental Justice Grants and Cooperative Agreements
    - U.S. Department of Agriculture Rural Development Grant Assistance
    - U.S. Department of Agriculture Natural Resources Conservation Service Financial Assistance Program
        - Agricultural Management Assistance
        - Agricultural Water Enhancement Program

        - Conservation Innovation Grants
        - Environmental Quality Incentives Program
        - Wildlife Habitat Incentive Program
        - Farm and Ranch Lands Protection Program
    - U.S. Fish & Wildlife Grant Programs
        - North Americans Wetlands Conservation Act
        - North American Wetlands Conservation Act
        - Cooperative Conservation Initiative
    - U.S. Economic Development Administration Investment Programs
    - U.S. Bureau of Reclamation Title XVI Water Reclamation and Reuse Program
    - U.S. Bureau of Reclamation WaterSMART Program (funded under SECURE Water Act)
    - The Nature Conservancy
    - Community Alliance with Family Farms

- **Low-interest Loan Programs.** Several funding agencies provide low-interest loans for implementation of water resources projects. Low-interest loans can save the implementing agency significant amounts of money by reducing interest payments as compared to traditional bonds. The SWRCB offers low-interest loans for wastewater and recycled water projects through its Clean Water State Revolving Fund (SRF) loan program. CDPH administers a similar Safe Drinking Water SRF loan program for drinking water-related projects. The California Infrastructure and Economic Development Bank (I-Bank) administers the Infrastructure SRF loan program for financing implementation projects such as sewage collection and treatment, water treatment and distribution, and water supply projects.

  The Clean Water SRF program generally has approximately $200 to $300 million available in loans each year to help cities, towns, districts, Native American tribal governments, and any designated and approved management agency under Section 208 of the Clean Water Act to construct publicly-owned facilities including wastewater treatment, local sewers, water reclamation facilities, nonpoint source projects, and development and implementation of estuary comprehensive conservation and management plans. The interest rate is half of the most recent General Obligation (GO) Bond Rate at the time of the funding commitment. Over the last five years, the Clean Water SRF loan interest rate has ranged from 1.8% to 3.0%. Amounts available through the CDPH Safe Drinking Water SRF loan program vary, but $100 million to $200 million is typically available each year. Available loan funding is dependent upon federal appropriations to each program.

10.2 Operation and Maintenance Funding for Implemented Projects

Ongoing support and funding for operations and maintenance costs of projects included in the MIRWMP are expected to derive from many of the same sources that were identified to fund project implementation. Support and funding will likely come primarily from local sources, including user rates, user fees and special assessments. Since regional projects and programs often involve multiple partner agencies, the range of local sources available is broadened. The details of funding and financing larger, multi-partner projects are typically worked out on a project-by-project basis. Large multi-purpose projects typically adhere to standard cost accounting and cost of service principles which are typically described and codified in the agreements for ownership, and operation and maintenance of facilities is typically developed as part of a project financing package.

O&M costs of proposed implementation projects must be evaluated as the overall viability of a particular project is determined. Prior to advancing a project forward to implementation, an analysis must be completed to establish the ability to operate and maintain the project and project benefits following completion. The annual fiscal impact on user rates, and the willingness of ratepayers to accept any increased cost of service as may be required for project implementation, must be included in this analysis.

To improve the Region's ability to provide ongoing support to priority projects, agencies and stakeholders in the region should work together to minimize associated O&M costs and gain savings from economies of scale.

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Merced Integrated Regional Water Management Plan

Chapter 11 Technical Analysis

This chapter addresses the Integrated Regional Water Management (IRWM) Technical Analysis Plan Standard which requires IRWM Plans to:

- ✓ Document the data and technical analyses that were used in the development of the IRWM Plan

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The MIRWMP was developed using sound technical information, analyses, and methods. Information and documents were collected from various sources including MAGPI, MID, the City of Merced, the County of Merced, DWR, USGS, USBR, USEPA, and other relevant agencies.

Multiple local planning documents were reviewed and used to prepare the MIRWMP. These include Urban Water Management Plans (UWMPs), Water Management Plans, the Merced Groundwater Basin Groundwater Management Plan Update, Municipal Service Reviews, documents associated with the Merced County General Plan Update and project feasibility studies and assessments. While some of these are project-specific documents, others address water management issues on a local or regional basis. This allows for an understanding of regional issues shared by multiple entities in the Merced Subbasin as well as more specific, localized issues.

Table 11-1 summarizes some of the key planning reports used in the MIRWMP planning process. Additionally, the documents cited in the References section were reviewed and used in development of the MIRWMP.

Table 11-1: Foundational Documents Used to Create the MIRWMP

Document Title/Description	Publication Date	Source	Relation to MIRWMP
City of Atwater 2005 Urban Water Management Plan	July 2007	City of Atwater	Information related to City of Atwater urban water needs, management and planning objectives.
City of Livingston 2005 Urban Water Management Plan	March 2007	City of Livingston	Information related to City of Livingston urban water needs, management and planning objectives[1]
City of Merced, 2010 Urban Water Management Plan	June 2011	City of Merced	Information related to City of Merced urban water needs, management and planning objectives
Merced Water Supply Plan Update – Final Status Report	September 2001	City of Merced, MID, and UC Merced	Information related to water demands throughout the Merced Subbasin area
MID Agricultural Water Management Plan	2001	MID	Information related to the irrigation distribution system
2030 Merced County General Plan Update	February 2011	Merced County	Information related to land uses and its coordination with water management

Document Title/Description	Publication Date	Source	Relation to MIRWMP
Merced Groundwater Basin Groundwater Management Plan Update	July 2008	MAGPI	Information related to groundwater conditions.
Final Report for the Merced River Alliance Project	September 2008	East Merced Resource Conservation District	Information related to existing watershed studies and planning along the Merced River.

Note: 1. Demand projections for the City of Livingston are based on projections from the City of Livingston 2025 General Plan, which have been challenged. The City of Livingston is in the process of updating its UWMP, and the projections presented in the MIRWMP will need to be updated after the newer projections are available.

To supplement existing documents, five special technical studies were commissioned by the RWMG during the development of this MIRWMP. These studies were:

- Conservation Study (see Appendix A)
- Flood Management Summary (see Appendix B)
- Groundwater Recharge Feasibility Study (see Appendix C)
- Salt and Nutrient Management Study (see Appendix D)
- Climate Change Technical Study (see Appendix E)

The MIRWMP includes a list[3] of projects, programs, studies, and planning activities that local and regional planners have found to be technically feasible based on similar projects, pilot studies, technical analyses, benefit analyses, cost estimating, modeling and simulation efforts and data assessments. As each project moves closer to design and implementation, technical and economic analyses will be conducted to confirm project feasibility and to provide any necessary feedback to modify the project's plan to improve its likelihood of success. Appendix K summarizes project-specific documentation that supports the technical feasibility of the projects included in the MIRWMP, and therefore, the technical feasibility of Plan implementation.

In development of the MIRWMP, the following data gaps were identified:

- Up-to-date, spatially-referenced land use data that includes recent agriculture-to-agriculture conversions that impact water demands in the Region
- Groundwater data to assess current groundwater conditions and to determine necessary management activities
- Local groundwater water quality data to determine the suitability of recharge areas
- Current and projected water demands

[3] For a current list of the MIRWMP projects, programs, studies and planning activities, got to www.mercedirwmp.org/projects

Land use and water demand information should be developed at the local level, which is beyond the scope of the MIRWMP as an umbrella document. However, implementation of the MIRWMP can assist with the collection of groundwater data, which can be readily collected through project-specific monitoring plans as projects are implemented as part of the MIRWMP. This data will then be organized, managed, and disseminated through the Region's central data management system and process.

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Merced Integrated Regional Water Management Plan

Chapter 12 Relation to Local Water Planning

This chapter addresses the Integrated Regional Water Management (IRWM) Relation to Local Water Planning Standard which requires IRWM Plans to:

- ✓ List local water plans used in the IRWM Plan
- ✓ Discuss how the IRWM Plan relates to planning documents and programs established by local agencies
- ✓ Describe the dynamics between the IRWM Plan and local planning documents

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The MIRWMP builds upon a wide variety of existing local water plans and studies, as well as on-going studies being developed in parallel with Plan development. The MIRWMP uses these existing documents, plans and programs to establish a planning baseline for water resources management throughout the Region.

Local water planning documents set forth water resources management policies and projections at the local level. Through their role in determining land use and development types, patterns, and densities, these local plans dictate the location and extent of impervious surfaces, quantity and density of population, areas of open space, and other characteristics fundamental to water resources planning. As such, local plans ultimately serve as the basis for water resources management planning, and consequently for MIRWMP development as well. The relationship and linkages between these local planning documents and the MIRWMP are described in the following subsections.

Table 12-1 summarizes the local water plans used to develop the MIRWMP.

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Table 12-1: Local Water Plans Used to Develop the MIRWMP

	Region Description Standards																																													
	Watersheds/Water System														Internal Boundaries								Water Supply and Demand						Water Quality										Major Water-Related Objectives and Conflicts		Explanation of Regional IRWM Boundary			Identification of Neighboring/Overlapping IRWM Regions		
Document Name	Hydrology	Groundwater	Vegetation	Fisheries	Species/Habitat of Special Concern	Management Issues	Effects of Climate Change	Imported Water	Water Supply System	Wastewater	Reclaimed Water	Desalination	Flood-water	Natural Water Systems	Municipal Boundaries	Water Service Areas	WW Service Areas	Flood Control Service Areas	LU Agency Service Areas	GW Basin Areas	Watershed Areas	Political Boundaries	Water Supply Projections	Supply Related to Climate Change	Water Demand Projections	Effects on Demand by Growth	Effects on Demand by LU Changes	Effects on Demand by Environmental Need	Current WQ Conditions (GW)	Current WQ Conditions (Imported)	Current WQ Conditions (Storage)	Future WQ Conditions	Protect/Improve WQ (Efforts)	Basin Plan(s)	Watershed Management Initiative	WQ Goals	WQ Obj.	Any Projects or Examples (WQ-WU)	Major Water Management Objectives	Major Water Management Conflicts	Describe	How/Why Chosen	Why an IRWM?	Describe other IRWMs	Coop/Coordination with other IRWMs	Governance as it relates to other IRWMs
Region Acceptance Process	●	●	--	--	--	○	--	--	○	--	--	--	--	○	●	●	●	●	●	●	●	●	--	--	--	--	--	--	●	--	--	--	--	--	--	--	--	--	○	○	●	●	●	●	●	○
Merced County - GPU Background Report	●	●	●	○	●	○	--	○	●	●	○	--	●	○	●	●	●	●	●	●	●	●	--	--	--	--	--	--	●	--	--	--	●	●	--	●	●	●	○	○	--	--	--	--	--	--
MAGPI - GWMP, 2008	●	●	--	○	○	●	--	--	●	--	●	--	--	●	●	●	--	--	●	●	●	--	●	--	●	--	--	●	●	--	--	--	●	●	--	--	--	--	○	○	--	--	--	--	--	--
Merced County GPU - Water Supply/Demand TM	●	●	--	--	--	--	--	--	--	--	--	--	--	--	●	●	--	--	●	●	●	--	●	--	●	●	●	○	--	--	--	--	--	--	--	--	--	--	○	○	--	--	--	--	--	--
MAGPI - Data Assessment	●	●	○	--	--	●	--	--	--	--	--	--	--	○	●	●	●	--	●	●	●	--	●	--	●	●	●	--	●	--	--	--	--	--	--	--	--	--	○	○	--	--	--	--	--	--
Merced County - GPU Alternatives Report	○	○	○	--	○	○	○	○	○	○	○	--	○	○	●	●	●	●	●	●	●	--	--	--	--	--	--	--	○	--	--	--	--	--	--	--	--	--	○	○	--	--	--	--	--	--

Document Name	Region Description Standards																																												
	Watersheds/Water System														Internal Boundaries								Water Supply and Demand						Water Quality										Major Water-Related Objectives and Conflicts		Explanation of Regional IRWM Boundary			Identification of Neighboring/Overlapping IRWM Regions		
	Hydrology	Groundwater	Vegetation	Fisheries	Species/Habitat of Special Concern	Management Issues	Effects of Climate Change	Imported Water	Water Supply System	Wastewater	Reclaimed Water	Desalination	Flood-water	Natural Water Systems	Municipal Boundaries	Water Service Areas	WW Service Areas	Flood Control Service Areas	LU Agency Service Areas	GW Basin Areas	Watershed Areas	Political Boundaries	Water Supply Projections	Supply Related to Climate Change	Water Demand Projections	Effects on Demand by Growth	Effects on Demand by LU Changes	Effects on Demand by Environmental Need	Current WQ Conditions (GW)	Current WQ Conditions (Imported)	Current WQ Conditions (Storage)	Future WQ Conditions	Protect/Improve WQ (Efforts)	Basin Plan(s)	Watershed Management Initiative	WQ Goals	WQ Obj.	Any Projects or Examples (WQ-WU)	Major Water Management Objectives	Major Water Management Conflicts	Describe	How/Why Chosen	Why an IRWM?	Describe other IRWMs	Coop/Coordination with other IRWMs	Governance as it relates to other IRWMs
Merced County - Flood Control Project FS	--	--	--	--	○	○	--	--	--	--	--	--	●	○	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	○	○	--	--	--	--	--	--
Merced County SW Management Program	○	○	--	--	--	○	--	--	○	○	--	--	--	--	○	●	●	--	●	--	●	--	--	--	--	--	--	--	●	--	--	○	●	●	--	●	●	●	○	○	--	--	--	--	--	--
MID - Merced GW Basin GWMP	●	●	●	○	○	●	--	--	●	●	●	--	--	●	--	--	--	--	--	●	●	--	●	--	●	○	○	--	●	--	--	●	●	--	--	--	--	●	○	○	--	--	--	--	--	--
MID - GWMP	●	●	--	--	--	●	--	--	○	--	--	●	--	○	--	--	--	--	--	--	--	--	--	--	--	--	--	--	●	--	--	○	●	○	--	--	--	●	○	○	--	--	--	--	--	--
MID - Water Management Plan	●	●	○	●	●	●	--	--	●	●	●	--	●	●	●	●	●	--	●	●	●	--	●	--	●	●	●	●	●	--	--	○	○	○	--	--	--	--	○	○	--	--	--	--	--	--
MID- Water Supply Plan	●	●	--	●	○	●	--	--	●	●	●	--	--	●	●	●	--	--	●	●	●	--	●	--	●	●	●	--	○	--	--	--	○	--	--	○	○	○	○	○	--	--	--	--	--	--
MID-Hydrogeologic Investigation	●	●	--	--	--	○	--	--	--	--	--	--	--	--	●	--	--	--	--	●	--	--	--	--	--	--	--	--	●	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Document Name	Region Description Standards																																													
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MID - Public Water Supply Well Survey/Bear Creek Study	•	•	--	--	--	○	--	--	--	--	--	--	--	--	•	--	--	--	--	•	--	--	--	--	--	--	--	--	•	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MID - Basin Management Objective	•	•	○	--	--	•	--	--	○	--	--	--	--	○	•	•	--	--	--	•	--	--	--	--	--	--	--	--	○	--	--	--	○	•	--	--	--	--	○	○	--	--	--	--	--	--
City of Merced - 2010 UWMP	•	•	--	--	--	•	--	--	•	•	•	--	--	•	•	•	--	--	•	•	•	--	•	--	•	•	○	--	•	--	--	--	--	--	--	--	--	○	○	--	--	--	--	--	--	--
City of Merced - 2030 GP EIR	•	•	•	•	•	•	•	○	•	•	•	--	•	•	•	•	•	--	•	•	•	--	•	○	•	•	•	--	•	--	--	○	--	•	--	--	--	--	•	•	--	--	--	--	--	--
City of Atwater - 2005 UWMP	•	•	--	--	--	○	--	--	•	•	•	--	--	--	•	•	--	--	--	--	--	--	•	--	•	•	--	--	•	--	--	--	•	--	--	--	--	--	--	--	--	--	--	--	--	--
City of Livingston – 2005 UWMP[1]	•	•	--	--	--	○	--	--	•	•	--	--	--	--	•	•	--	--	--	--	--	--	•	--	•	•	--	--	•	--	--	--	•	--	--	--	--	--	--	--	--	--	--	--	--	--
City of Livingston- Storm Drain Master Plan	•	--	--	--	--	•	--	--	•	--	--	--	•	○	•	•	•	•	•	--	--	--	--	--	--	--	--	--	○	--	--	--	--	--	--	--	--	--	○	○	--	--	--	--	--	--

Document Name	Region Description Standards																																												
	Watersheds/Water System														Internal Boundaries								Water Supply and Demand						Water Quality										Major Water-Related Objectives and Conflicts		Explanation of Regional IRWM Boundary			Identification of Neighboring/Overlapping IRWM Regions		
	Hydrology	Groundwater	Vegetation	Fisheries	Species/Habitat of Special Concern	Management Issues	Effects of Climate Change	Imported Water	Water Supply System	Wastewater	Reclaimed Water	Desalination	Flood-water	Natural Water Systems	Municipal Boundaries	Water Service Areas	WW Service Areas	Flood Control Service Areas	LU Agency Service Areas	GW Basin Areas	Watershed Areas	Political Boundaries	Water Supply Projections	Supply Related to Climate Change	Water Demand Projections	Effects on Demand by Growth	Effects on Demand by LU Changes	Effects on Demand by Environmental Need	Current WQ Conditions (GW)	Current WQ Conditions (Imported)	Current WQ Conditions (Storage)	Future WQ Conditions	Protect/Improve WQ (Efforts)	Basin Plan(s)	Watershed Management Initiative	WQ Goals	WQ Obj.	Any Projects or Examples (WQ-WU)	Major Water Management Objectives	Major Water Management Conflicts	Describe	How/Why Chosen	Why an IRWM?	Describe other IRWMs	Coop/Coordination with other IRWMs	Governance as it relates to other IRWMs
City of Livingston - Water Dist. System Master Plan[1]	○	●	--	--	--	○	--	--	●	○	--	--	--	○	●	●	●	--	●	--	--	--	●	--	●	●	●	--	○	--	--	--	--	--	--	--	--	--	○	○	--	--	--	--	--	--
City of Livingston – Wastewater Collection System Master Plan[1]	○	○	--	--	--	○	--	--	○	●	○	--	--	○	●	●	●	--	●	--	--	--	●	--	●	●	●	--	--	--	--	--	--	--	--	--	--	--	○	○	--	--	--	--	--	--
City of Livingston - Parks Master Plan	○	--	○	○	○	○	--	--	--	--	--	--	○	○	●	--	--	--	●	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
City of Livingston- Traffic Circulation Master Plan	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Plana CSD - Monthly Water Flow Data	--	○	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	○	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Winton WSD - CCR, 2009	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	●	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Note: 1. Demand projections for the City of Livingston are based on projections from the City of Livingston 2025 General Plan, which have been challenged. The City of Livingston is in the process of updating its UWMP, and the projections presented in the MIRWMP will need to be updated after the newer projections are available.

12.1 Relationship Between MIRWMP and Local Planning Documents and Programs

12.1.1 Water Supply and Water Quality Planning

Planning departments throughout the Region are continually developing documents that establish population projections and water use projections at the local level. These local planning efforts serve as the basis for development of UWMPs and Agricultural Water Management Plans (AWMPs). These documents are developed and adopted by local water agencies and municipalities, and are submitted to the state for acceptance. The information in these UWMPs and AWMPs is local to the preparing water agency or municipality, and builds upon the local planning information presented in local plans such as general plans and municipal service reviews (MSRs). Rather than superseding the local planning documents, the IRWM Plan uses these documents as a basis for developing a wider, regional view of water supply, demand, and quality throughout the Region.

In addition to building on these local agency plans, the MIRWMP compiles information from water resources management plans developed by local agencies, where local planning entities have identified preferred projects for implementation at the local level.

12.1.2 Wastewater and Recycled Water Planning

Local wastewater and recycled water agencies and municipalities create various plans and documents which are used to develop projects for future implementation. These plans and documents include wastewater and recycled water master plans, facilities plans, and feasibility studies. These master plans, facilities plans and feasibility studies build upon the water supply and demand information developed in UWMPs and based on local planning documents such as General Plans to project future wastewater flow quantity and quality. Based on these projections, local wastewater and recycled water agencies and municipalities develop plans to manage these flows. Further, based on the land use types outlined through the general planning process, these agencies are able to evaluate potential markets for recycled water use at the local level. The MIRWMP compiles and builds upon these local documents to develop a regional picture of wastewater and recycled water planning.

12.1.3 Flood Protection and Stormwater Management Planning

Flood protection and stormwater management intrinsically build upon local planning efforts, such as General Plans and Specific Plans. Dependent on the location and extent of impervious surfaces dictated through the local planning process, flooding issues can be either managed or exacerbated. In addition, stormwater runoff quality and quantity are directly influenced by the type, location, and density of adjacent development. Further, municipalities are increasingly tasked with development and implementation of stormwater management BMPs at the local level.

The MIRWMP assembles local information to establish a baseline understanding of flood and stormwater conditions across the Merced Region. Further, the MIRWMP builds upon work being conducted at the local level to enhance flood protection and stormwater management by considering the proposed local projects in the context of the greater regional challenges, goals and objectives.

12.1.4 Natural Resources Planning

Ecosystem protection and restoration projects are often closely tied to local land use planning efforts. Restoration of riparian and wetland habitats frequently occurs within urbanized areas, or areas experiencing development pressure. As a result, local municipal approvals are required for implementation and maintenance to be effective. Local planning documents used in preparation of project design, construction, and environmental documents include general plans, specific plans, watershed management plans, habitat conservation plans, and stewardship plans. In addition to local municipalities, water and flood control districts, resource and regulatory agencies, and non-governmental organizations (NGOs) all play key roles in development of local planning documents. These agencies and organizations establish watershed and habitat management policies, programs, and projects which delineate ecosystem restoration activities throughout the Merced Region.

12.2 Dynamics Between MIRWMP and Local Planning Documents and Programs

As described above, the MIRWMP serves as an umbrella document, building upon the work developed at the local level into a comprehensive planning document that encompasses all areas of water management. Water management conditions throughout the Region are not static; conditions are continually changing, and local planning documents are revised and updated periodically to reflect these changing conditions. The MIRWMP must, similarly, respond to changing conditions. As described in Chapter 3 Governance, the MIRWMP will be reviewed and updated periodically. During the revision process, changes in local planning documents will be incorporated into the MIRWMP. In this way, the MIRWMP will respond to changing local water management conditions, and will continue to reflect the planning completed at the local level.

Merced Integrated Regional Water Management Plan

Chapter 13 Relation to Local Land Use Planning

This chapter addresses the Integrated Regional Water Management (IRWM) Relation to Local Land Use Planning Standard which requires IRWM Plans to:

- ✓ Contain processes that foster communication between land use managers and RWMGs with the intent of effectively integrating water management and land use planning
- ✓ Document the current relationship between local land use planning, regional water issues, and water management objectives
- ✓ Identify future plans to further a collaborative, proactive relationship between land use planners and water managers.

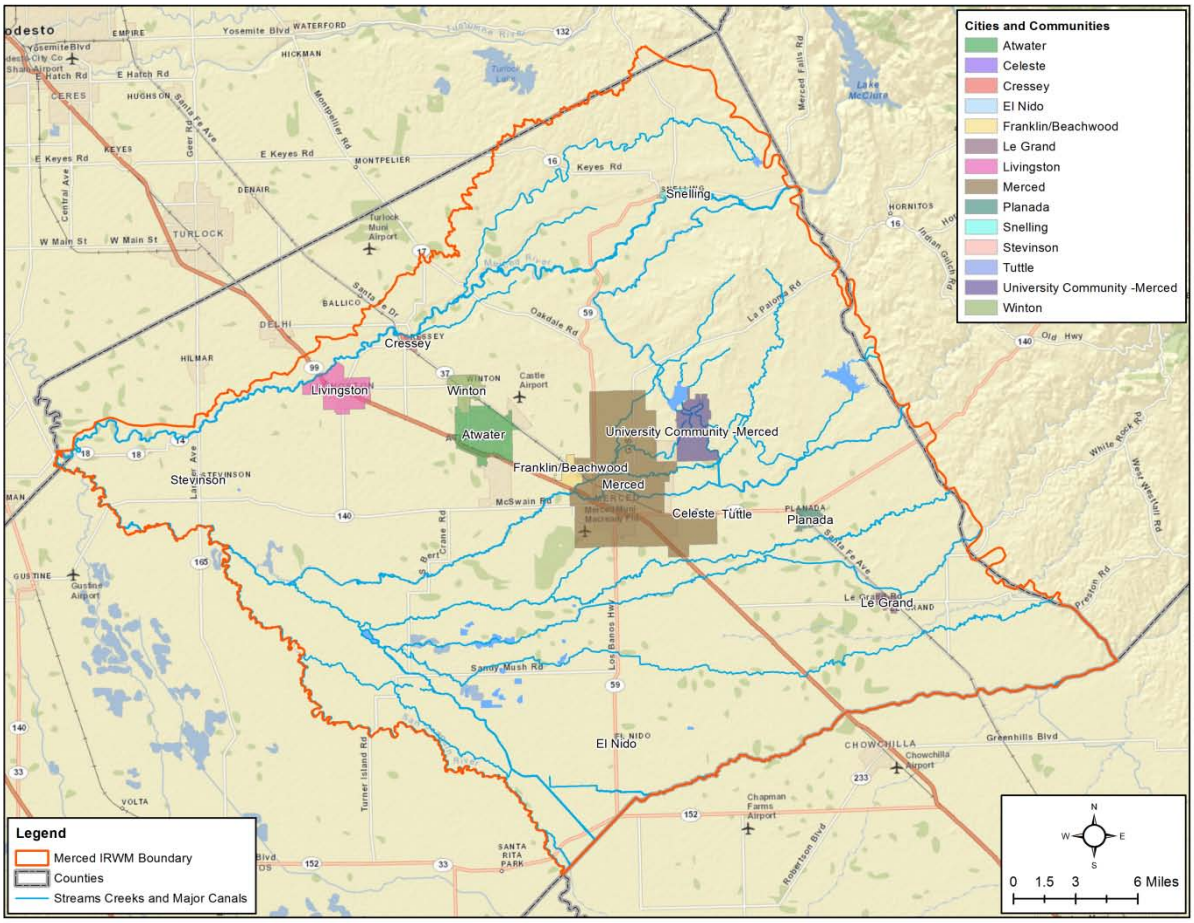
The Merced Region appreciates the importance of fostering communication between land use managers and water resource managers to effectively integrate water management and land use planning. This section documents the current relationship between local land use planning, regional water issues, and water management objectives in the Merced Region. Additionally, future plans to foster a collaborative, proactive relationship between land use planners and water managers are identified.

California State Law requires every city and county in the state to prepare and maintain a General Plan. General Plans provide a blueprint for future decisions regarding land use and resource conservation. Land use agencies that prepare these plans are responsible for managing growth and development while ensuring a healthy and sustainable economy. In the Merced Region, entities with land use authority include:

- County of Merced
- City of Merced
- City of Livingston
- City of Atwater
- UC Merced

Figure 13-1 includes the boundaries of these local land use agencies. These agencies implement public outreach efforts to help define the local community's vision for future growth and development. Stakeholders within the Merced Region are enthusiastic about the IRWM planning effort and the opportunity for more comprehensive land use considerations in developing future conceptual models for water management issues.

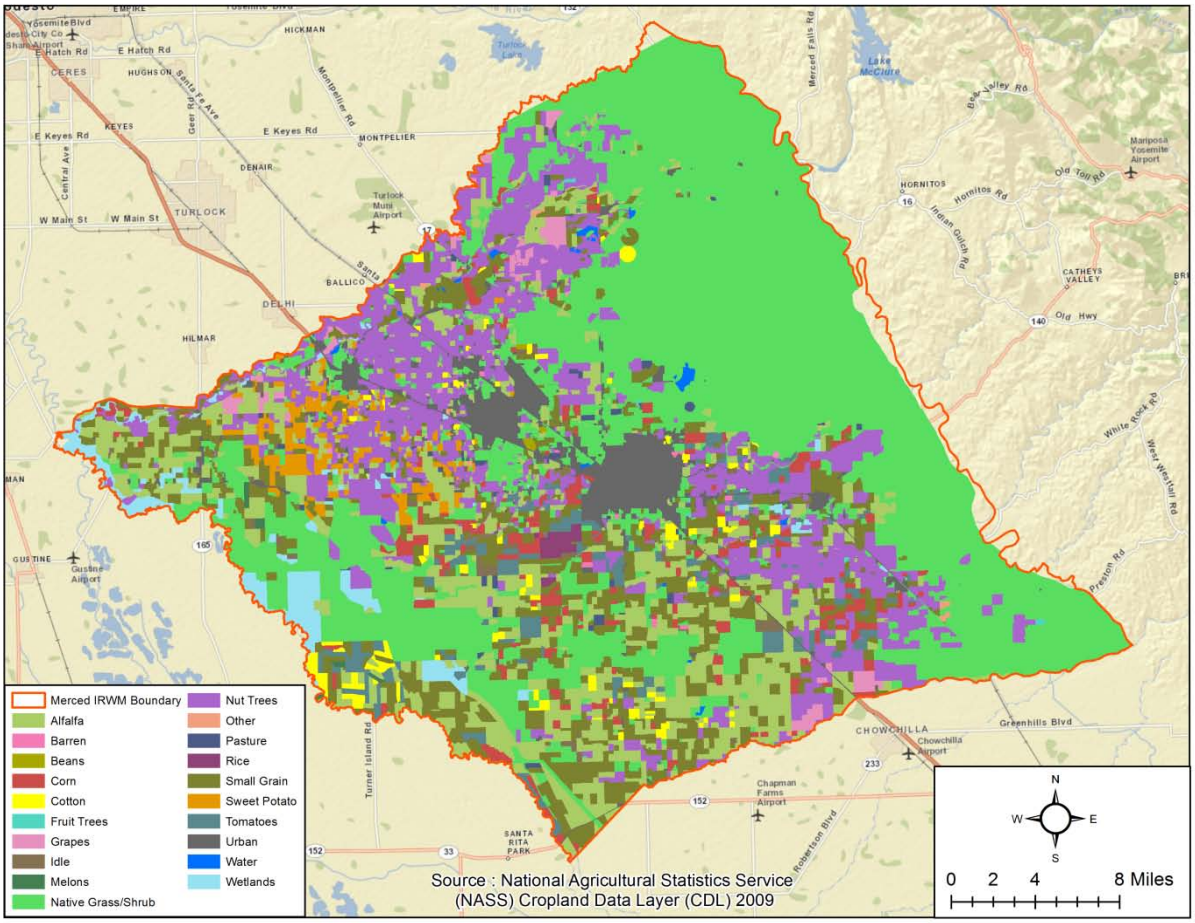
Figure 13-1: Merced Region Cities and Communities



13.1 Linkages Between Water Management and Land Use Planning

Land use patterns in the Merced Region are dominated by agricultural uses including animal confinement (dairy and poultry), grazing, forage, row crop, and nut and fruit trees, all of which rely heavily on water purveyors/districts, private groundwater wells, and surface water supply sources. Figure 13-2 shows the current land uses within the Region.

Figure 13-2: Current Land Uses in the Merced Region (2009)



The interconnected surface water and groundwater system in the Merced Region is complex, and water quality is both directly and indirectly affected by land use practices throughout the Region. Stormwater drainage, precipitation-based sheet flow, agricultural drainage, wastewater effluent, and other contributing sources can dramatically affect surface water quality and quantity. Precipitation, irrigation, and recharge-based infiltration through variable surfaces and soil types in different land use settings also affect groundwater quality and quantity. In addition, groundwater additions to surface waters have interrelated impacts to both surface and groundwater resources. Manmade and natural conveyances, including irrigation and flood management projects, have the potential to transfer water sources with significantly different characteristics throughout the Merced Region. Public, domestic, irrigation and industrial production wells can create highly variable ground water flow patterns and cones of depression affecting groundwater elevations and regional flow directions temporally and spatially, ultimately affecting the quality and quantity of groundwater in the proposed boundary. Led by the RWMG and RAC, the Merced IRWM program presents a structured opportunity to integrate water management activities related to natural and manmade water systems, including water supply reliability, water quality, environmental stewardship, recreation, and flood management in the Merced Region.

13.2 Current Relationships Between Water Managers and Land Use Planners

The Merced Region encompasses a variety of agencies with water management responsibilities. Four of these water management agencies also have local land use jurisdiction: the City of Atwater, City of Livingston, City of Merced, and Merced County. This allows for water planning activities to be an integral part of land use planning processes within these agencies' jurisdictions. However, water infrastructure within Merced County is highly decentralized, with over 25 irrigation and local special districts, as well as private companies serving relatively small areas. For the most part, the districts are independent entities created under California State law, each governed by separate elected boards and managed by individual staff. The Merced County government does not have any jurisdiction over the districts and is not directly involved in water policy or management; therefore, linking water and land use planning can be challenging. Land use planning is addressed for each of the water and sanitary districts within the Merced County General Plan.

13.3 Future Efforts to Establish Proactive Relationships

The IRWM program presents a unique opportunity to help water planners, land use planners, and the public work together, identify efficiencies, foster communication, and integrate water management and land use planning. Four of the five agencies recommended to serve on the RWMG under the long-term governance structure for the Region (see Chapter 3 Governance) – Merced County, the City of Merced, the City of Atwater and the City of Livingston – have local land use planning authority in the Region. UC Merced, which has considerable land use influence, is represented on the RAC.

As IRWM planning continues in the Region, the following actions will be taken to enhance coordination and communication between water resources managers and land use planners.

- Targeted forums for land use planners and water resource managers will be held to improve understanding of the nexus between land use planning and water management. For example, meetings between water managers and land use planners will be arranged to discuss regional water issues and concerns and identify areas for enhanced collaboration. Ultimately these discussions are expected to generate multi-purpose IRWM projects that will assist the Region in meeting its objectives while maintaining consistency with local land use designations.
- Early consultation regarding land use decisions as suggested by the Ahwahnee Water Principles for Resource-Efficient Land Use will be encouraged (Local Government Commission 1991). Nine community principles and five implementation measures were developed by leading water experts from the national, state, and local levels. These principles and measures address concerns about stormwater runoff, flood damage, and local water supply reliability for current residents and new development by identifying cost-saving stewardship actions that cities and counties can implement. The Merced Region believes that all five Ahwahnee Implementation Principles for Resource-Efficient Land Use should be applied, as appropriate:

    1. Water supply agencies should be consulted early in the land use decision-making process regarding technology, demographics and growth projections.
    2. City and county officials, the watershed council, LAFCO, special districts, non-governmental organizations, and other stakeholders sharing watersheds should collaborate to take advantage of the benefits and synergies of water resource planning at a watershed level.

3. The best, multi-benefit and integrated strategies and projects should be identified and implemented before less integrated proposals, unless urgency demands otherwise.
4. From start to finish, projects and programs should involve the public, build relationships, and increase the sharing of and access to information.
5. Plans, programs, projects and policies should be monitored and evaluated to determine if the expected results are achieved and to improve future practices (Local Government Commission, 2012).

Implementing these actions will ultimately benefit the Region by:

- Fostering enhanced understanding of water supply and water quality impacts associated with land use planning decisions
- Improving representation of water-related needs and regional objectives related to land use planning
- Identifying IRWM projects and programs that address regional objectives as well as local land use planning goals

As previously described, the IRWM planning process will provide the Region's water managers and land use planners with an established forum to engage in discussion regarding water management issues and land use plans. RAC meetings will continue to provide an interface for the water and land use managers to express concerns and propose solutions. In the future, should a more robust and detailed approach be needed to further establish relationships between land use and water planners, some or all of the options previously described may be implemented.

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Merced Integrated Regional Water Management Plan

Chapter 14 Stakeholder Involvement

This chapter addresses the Integrated Regional Water Management (IRWM) Stakeholder Involvement Plan Standard which requires IRWM Plans to:

- ✓ Contain a public process that provides outreach and an opportunity to participate in IRWM Plan development and implementation to the appropriate local agencies and stakeholders, as applicable to the region, including wholesale and retail water purveyors, wastewater agencies, flood control agencies, municipal and county governments and special districts, electrical corporations, Native American tribes, self-supplied water users, environmental stewardship organization, community organizations, industry organizations, State, federal and regional agencies or universities and DAC members
- ✓ The process used to identify, inform, invite and involve stakeholder groups in the IRWM process including mechanisms and processes that have been or will be used to facilitate stakeholder involvement and communication during development and implementation of the IRWM Plan
- ✓ Discuss how the RWMG will endeavor to involve DACs and Native American tribal communities in the IRWM planning effort
- ✓ Describe the decision making process including IRWM committees, roles or positions that stakeholders can occupy and how a stakeholder goes about participating in those committees, roles or positions regardless of their ability to contribute to the Plan
- ✓ Discuss how stakeholders are necessary to address objectives and resource management strategies of the IRWM Plan and are involved or are being invited to be involved in Plan activities
- ✓ Discuss how collaborative processes will engage a balance of interest groups listed above in the IRWM process regardless of their ability to contribute financially to the IRWM Plan's development or implementation

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The Merced IRWM process is a strongly stakeholder-driven process. While the RWMG retains overall responsibility for ongoing IRWM planning and implementation of the MIRWMP, the planning and implementation work is primarily generated by the RAC, a multi-disciplinary stakeholder group designed to represent the broad interests of the Region. Opportunities also exist for individuals not participating on the RAC to participate in the IRWM program as discussed in this chapter.

14.1 Opportunities for Stakeholder Participation

14.1.1 Regional Advisory Committee

Chapter 3 Governance describes the roles and responsibilities of RAC in detail. This section discusses the public process used to form the interim RAC that advised the RWMG through development of this first MIRWMP and the process that will be used to continue stakeholder involvement throughout MIRWMP implementation.

In March 2012, the MID Board of Directors, on behalf of the RWMG, invited applications for community and business representatives to serve on a Regional Advisory Committee for development of the Merced IRWM Plan. Through a media release, announcements at MID Board of Directors meetings, and announcements posted to the websites of MID, the County of Merced, and the City of Merced, individuals with "a demonstrated commitment to community service and civic leadership, prior experience participating on similar task forces and advisory committees, and an understanding of water issues" or who "represent the diversity of the region, including community, business, agriculture, environmental, and recreational perspectives on water, wastewater, groundwater, flood management, and water quality" were encouraged to apply to serve on the RAC.

This interim RAC was initially intended to include 15 to 20 members representing the following interests:

- Water Supply Interests (including water purveyors and self-supplied water users, as described in Plan Standards)
- Wastewater Interests (including wastewater agencies, as described in Plan Standards)
- Stormwater Interests
- Flood Control Interests (including flood control agencies, as described in Plan Standards)
- Local Government (municipal and county governments and special districts, as described in Plan Standards)
- Agricultural Interests
- Other Non-Agricultural Business Interests (including industry organizations and electrical corporations , as described in Plan Standards)
- Environmental Interests (including environmental stewardship organizations, as described in Plan Standards)
- Other Institutional Interests (e.g. UC Merced)
- Disadvantaged Community and Environmental Justice Interests
- Recreational Interests
- Community / Neighborhood Interests

Given the diversity and strength of the applicants that responded to the application process, the RWMG elected to accept all of the applicants as either full members or alternates. The interim RAC that advised the RWMG through development of the MIRWMP included 23 full members and 16 alternates.

Since the interim RAC members were only asked to commit to an 18-month term (coinciding with the duration of the MIRWMP development process), a long-term process for continuing stakeholder participation through the RAC was developed as part of the long-term governance structure. A Governance Workgroup of the interim RAC was convened in April 2013 to develop the process for assembling a long-term RAC (discussed in Chapter 3 Governance). The RAC allows for stakeholder participation regardless of ability to contribute financially to the MIRWMP.

14.1.2 Public Participation

The composition of the RAC is intended to ensure the varied interests and perspectives of the Region are represented; however, individuals who are not members of the RAC but are interested in maintaining active involvement in the IRWM program are encouraged to do so. All meetings of the RAC are open to the public to allow any interested parties to participate in the IRWM program, and the RWMG and RAC have and will continue to host public workshops at critical junctures in the IRWM planning process (e.g. plan updates, calls for projects, etc).

The RWMG and RAC have coordinated with different agencies throughout the Merced Region to host public workshops. The workshops shown here were held in Merced and Livingston.

Stakeholder outreach began early in the development of the MIRWMP. Because the MIRWMP was initially spearheaded by a subcommittee of MAGPI, the IRWM program has benefitted from the legacy of MAGPI's established stakeholder relationships. The MAGPI stakeholder list was used as a starting point for MIRWMP public outreach, and the list was expanded during the Merced IRWM RAP by circulating an invitation letter to organizations throughout the Region. During development of the MIRWMP, the RWMG and RAC continued to reach out to interested parties by personally contacting potentially-interested individuals and hosting public workshops. The workshops were advertised through multiple outlets including public service announcements, newspaper advertisements, web postings and e-mail distribution lists. The IRWM stakeholder list was updated with contact information provided by individuals attending the public workshops.

During development of the MIRWMP, the RWMG created an updated Merced IRWMP website (www.mercedirwmp.org) which includes basic information about the IRWM program. The homepage features a News and Events section, which is intended to keep visitors informed of upcoming meetings. The website also contains a Documents section where meeting agendas, meeting notes, working documents, and final reports and memoranda are posted.

News and events related to the IRWM program will also continue to be posted on the RWMG partner agencies' websites.

14.1.3 Project Proponents

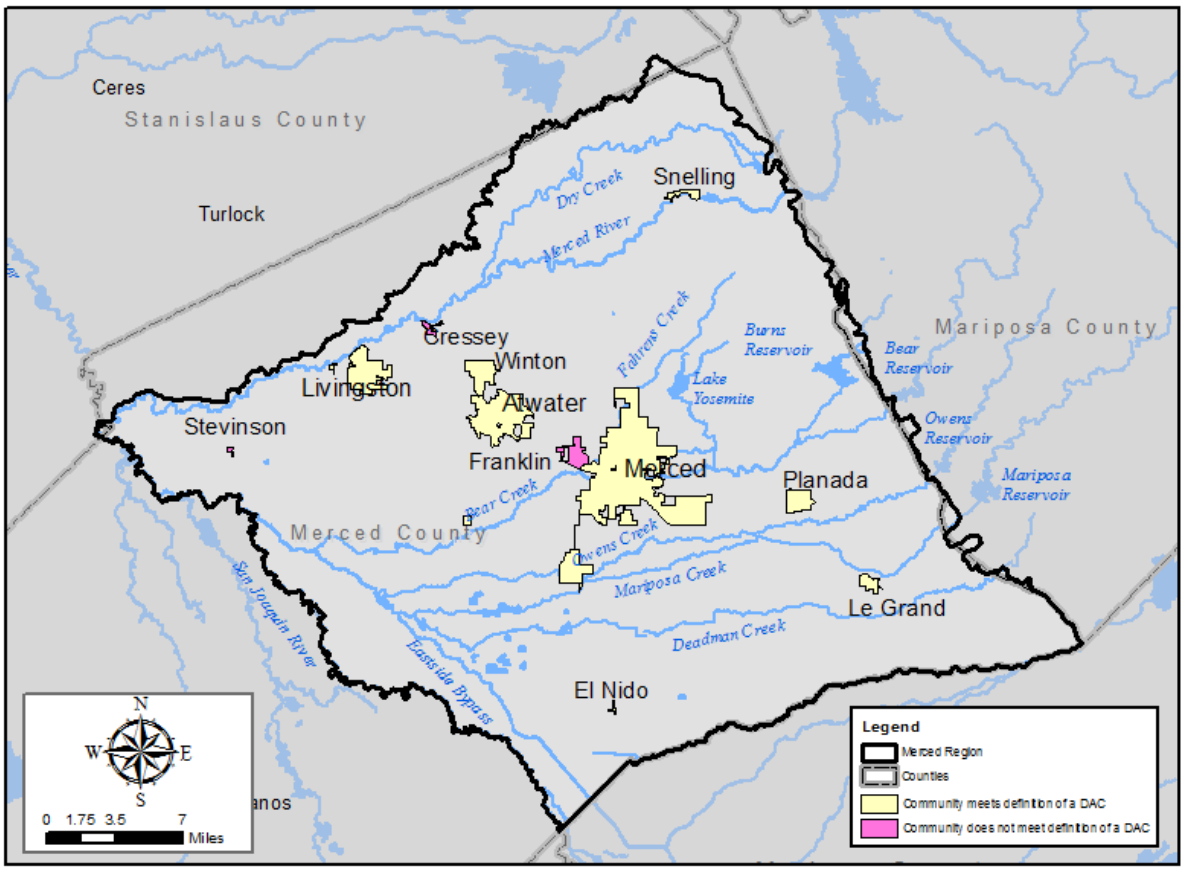
Project proponents are the stakeholders with primary responsibility for implementing projects listed in the MIRWMP. As with other stakeholders, project proponents are encouraged to maintain active involvement in the IRWM program. Project proponents can volunteer to serve on the RAC by following the application process outlined in Chapter 3 Governance, or they may participate as general public participants.

Since project proponents are the entities implementing IRWM projects, their involvement is necessary to address objectives and resource management strategies of the MIRWMP.

14.1.4 DAC Representation

The Merced Region is unique among IRWM regions in that the majority of the Region is currently considered a DAC. As discussed in Chapter 2 Region Description, the Region includes the incorporated cities of Atwater, Livingston, and Merced, and the unincorporated communities of Cressey, El Nido, Franklin/Beachwood, Le Grand, Planada, Snelling, Stevinson and Winton. All of these communities, with the exception of Cressey, Franklin/Beachwood, and Stevinson, have MHIs of less than 80% of the statewide MHI, thus meeting the State's definition of a DAC. Although Franklin/Beachwood and Stevinson are not recognized as DACs by the State's definition, due to local knowledge of economic conditions for the purposes of the MIRWMP they are considered to be DACs.

Figure 14-1: DACs Recognized by the State based on American Community Survey (2006-2010):



From the beginning stages of MIRWMP development, the RWMG worked to include DAC representation in the planning process. Disadvantaged Community and Environmental Justice Interests was identified as a specific interest group recruited for participation on the interim RAC, and DAC interests were represented on RAC by one member and one alternate throughout MIRWMP development. In the recommended long-term governance structure, DACs will continue to be represented on the RAC.

As part of the IRWM planning process, the RWMG also secured the services of a local consultant to provide targeted outreach to DACs and ensure that information about the IRWM program was presented during regular sessions of the City of Merced City Council, the City of Atwater City Council, and the City of Livingston City Council. Additionally, during the Call for Projects, flyers were provided to the water and sanitary districts that represent the communities of Stevinson, Winton, Franklin-Beachwood, Planada and Le Grand for distribution in their service area; this flyer provided an overview of the MIRWMP, invited the public to a scheduled public workshop at which project submittal would be discussed, and provided directions for accessing the online project submittal form through Merced OPTI. Prior to the public workshop at which project submittals were discussed, the communities of Stevinson, McSwain, Winton, Planada and Le Grand held informative meetings for their respective areas to explain the process of entering a project on the Merced OPTI. These informative meetings were coordinated through the County of Merced Supervisor representing the communities. County staff publically noticed the meeting dates and times, which were typically coordinated with meetings of the Municipal Advisory Committees (MACs). In some cases, interpreters were secured. At each presentation, public attendees and members of each MAC were provided with the opportunity to ask questions and receive assistance in defining potential projects for their respective communities. The RWMG also directly contacted local individuals knowledgeable in the needs of the basin and encouraged those individuals to submit projects during the Call for Projects.

14.2 Decision Making Process

The RAC decision-making process is described in Chapter 3 Governance, Section 3.6 Decision-Making Process.

14.3 Stakeholder Integration

The MIRWMP's recommended long-term governance structure enables a diverse group of stakeholders to participate in all levels of the IRWM planning effort regardless of their ability to contribute financially to the MIRWMP as required by the California Water Code §10541(h)(2). The RAC, which is described in Chapter 3 Governance, is designed to encompass diverse interests and does not require financial contributions from its members. The RAC is also structured to enable participation at all levels of the IRWM program. The foundation of the IRWM program is the planning work that has been and will continue to be completed by the RAC and Workgroups of the RAC. At the policy level, the RAC is able to provide direct input to the RWMG through its liaison to the Policy Committee. Other interested parties are able to participate in all levels of the IRWM program as all meetings of the RAC, the Policy Committee and meetings of the RWMG governing bodies are open to the public.

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Merced Integrated Regional Water Management Plan

Chapter 15 Coordination

This chapter addresses the Integrated Regional Water Management (IRWM) Coordination Plan Standard which requires IRWM Plans to:

- ✓ Identify a process to coordinate water management projects and activities of participating local agencies and local stakeholders to avoid conflicts and take advantage of efficiencies
- ✓ Identify other neighboring IRWM efforts and the way cooperation or coordination with these other efforts will be accomplished and a discussion of any ongoing water management conflicts with adjacent IRWM efforts
- ✓ Identify areas where a State agency or other agencies may be able to assist in communication, cooperation, or implementation of IRWM Plan components, processes, and project or where State or federal regulatory decisions are required before implement the projects.

The Region is coordinating water management activities on multiple levels – within the region, with neighboring IRWM regions and with other agencies.

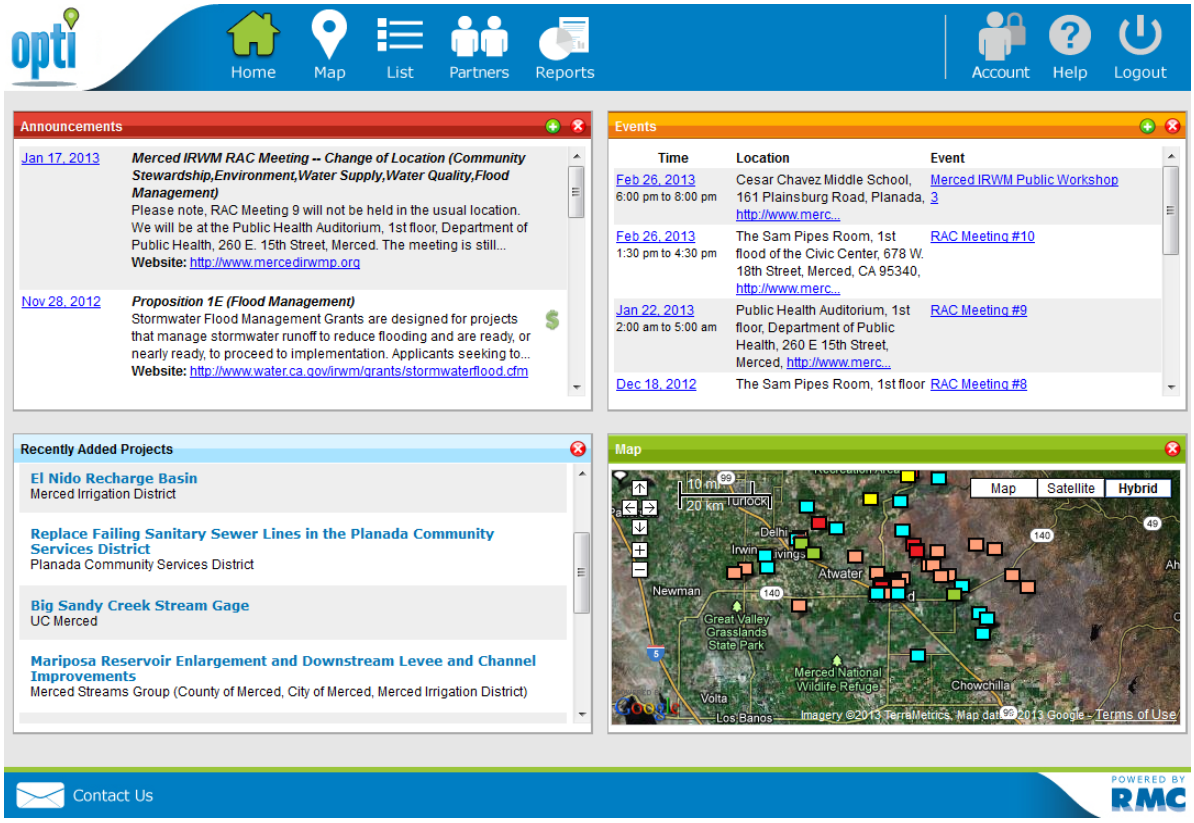
15.1 Coordination within the Merced Region

In addition to the regular coordination meetings of the RAC and Policy Committee (refer to Chapter 3 Governance), the IRWM program provides two web-based venues for local agencies and stakeholders to coordinate and identify opportunities for cooperative project: the Merced IRWMP website and Merced OPTI.

The Merced IRWMP website, www.mercedirwmp.org, was developed early in the IRWM planning process to serve as a source of information for individuals interested in learning basic information about the IRWM program. During the development of the MIRWMP, the RWMG enhanced the website to include meeting notifications, meeting materials and documents developed through the IRWM planning process. All program materials are posted to the website to keep stakeholders informed of activities being pursued at the regional level.

Merced OPTI, which is the Region's online project database, was launched during the Region's first Call for Projects. Beyond serving the fundamental role of maintaining the Region's project list, Merced OPTI provides a venue for increased collaboration between and among project proponents. Merced OPTI allows any member of the public that registers for access to view and follow projects of interest. Users that register as community members also have the ability to enter new projects and share projects with other community members, enabling multiple entities to collaborate on a single project.

Figure 15-1: Merced OPTI



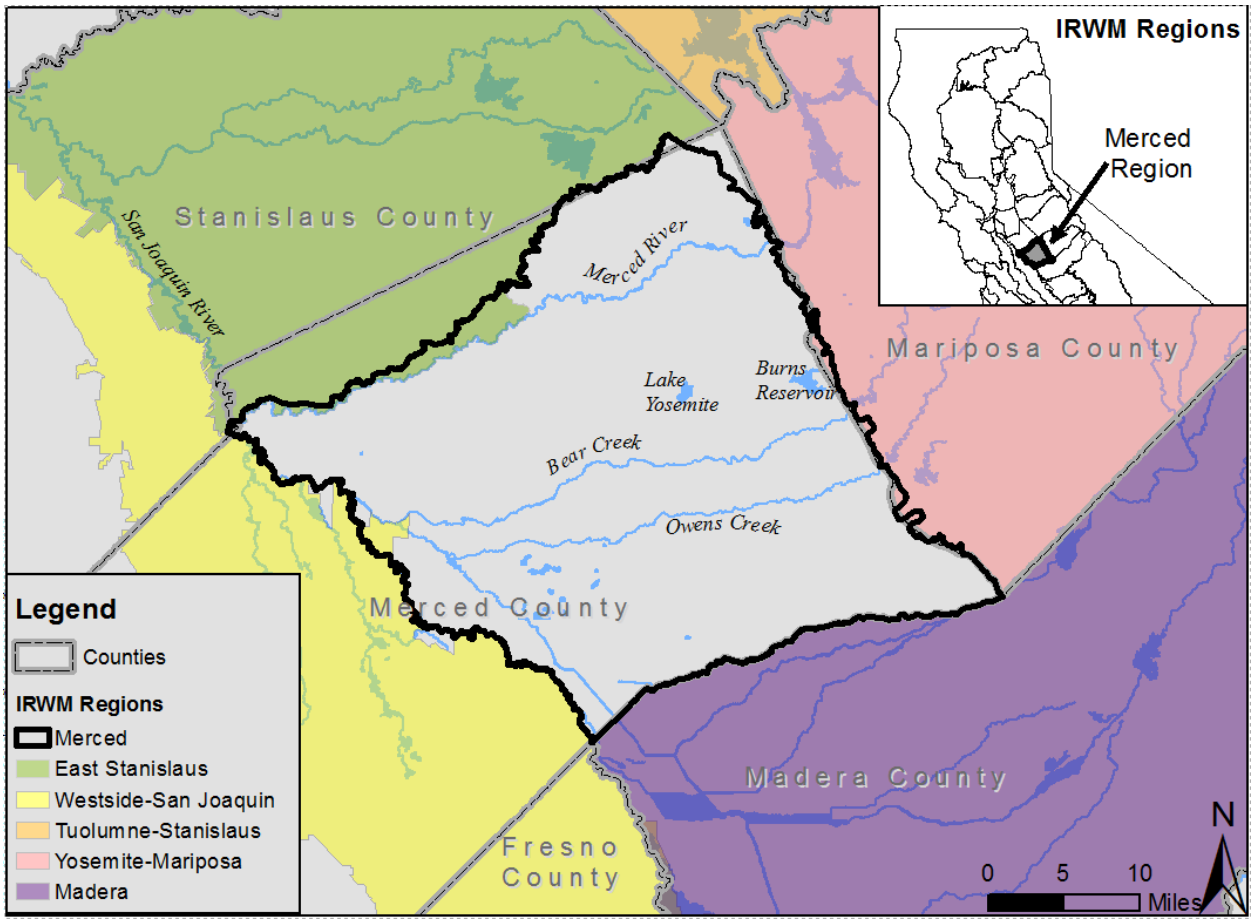
15.2 Coordination with Neighboring IRWM Regions

Through the RAP and DWR's acceptance of the Merced Region as an IRWM Region, the Region has clearly demonstrated how water management within its boundaries is distinctly different than its neighboring regions. The Region's boundaries are defined by the eastern boundary of the Merced Groundwater Subbasin to the east, the San Joaquin River to the west, the northern boundary of the Dry Creek watershed to the north, and the Chowchilla River to the south. The eastern and western boundaries of the Merced Region are critical hydrogeologic features that distinguish the Region from neighboring regions. The crystalline basement rock that defines the Region's eastern boundary divides the groundwater/alluvial basin of the Merced Region from the fluvial and fractured rock systems of the mountainous watersheds of Tuolumne, Mariposa and Madera. On the west, the San Joaquin River marks the boundary between Merced Subbasin and the Delta-Mendota Subbasin and is also the dividing line between the Merced Region and Westside San Joaquin Region.

Beyond having distinctly different groundwater basins, the Merced Region has different water management and land use patterns than the Westside San Joaquin Region, including the Merced Region's lack of reliance on imported water supplies. Additionally, while areas both east and west of the San Joaquin River are dominated by the agricultural industry of the Central Valley, the agricultural economy of the Merced Region is typified by small-scale multi-generational family farming operations, in contrast to the dominantly large-scale commercial agricultural operations common in areas west of the San Joaquin River.

Although the Merced Region functions independently of its neighboring IRWM regions, the RWMG and RAC appreciate the importance of coordinating with neighboring regions, particularly given their shared groundwater and surface water resources. Coordination with adjacent RWMGs can result in better utilization of these resources and avoid potential conflicts. The value placed upon coordination with neighboring regions is reflected in the Region's project review process, which awards additional points to projects that are supported by multiple local project sponsors or contiguous IRWM regions (see Chapter 6 Project Review Process).

Figure 15-2: Neighboring IRWM Regions



The following IRWM Regions are located adjacent to the Merced Region.

- Yosemite-Mariposa
- Madera
- Westside-San Joaquin
- East Stanislaus
- Tuolumne-Stanislaus

During the RAP process, the Merced Region, which was represented by MAGPI at the time, sent letters to neighboring RWMG representatives expressing the Merced Region's interest in entering into a Memorandum of Understanding or other letter agreement that outlines areas of cooperation with its neighboring regions.

Of the neighboring regions, the RWMG and RAC are most interested in the Yosemite-Mariposa and Madera Regions, as activities that occur within these watersheds have the greatest potential to affect the Merced Region. MID is a member agency of Yosemite-Mariposa IRWM; MID's involvement in both the Yosemite-Mariposa and Merced Region provides for regular communication between the two regions and allows for improved coordination between the regions. MID is also participating in the Madera IRWM planning processes and will continue to stay involved in that process. Similarly, representatives from the Yosemite-Mariposa and Madera Regions have indicated an interest in Merced IRWM planning efforts and have participated in Merced RAC meetings. Staff members from Merced County and MID, both of which are members of the Merced RWMG, routinely meet with members of the Turlock Groundwater Basin Association (TGBA); several TGBA members are founding members of the East Stanislaus Region.

MAGPI, which includes members of the RWMG and other RAC members, is interested in coordinating with the Westside-San Joaquin Region on issues relating to subsidence near the boundary between the regions.

15.3 Coordination with Other Agencies

Continued coordination with local agencies with permitting authority will be critical to the implementation of projects in the MIRWMP. In the Merced Region, the primary agency with permitting authority for water projects is the Merced County Environmental Health Division. Merced County is engaged in the IRWM program as a member of the RWMG and the Environmental Health Division specifically is represented by the Merced County's Management Committee staff members.

The Region has identified the need for a streamlined permitting process for environmental enhancement projects which requires improved coordination with state and federal agencies at the regional level. Historically, coordination with state and federal agencies has mainly occurred on a local, project-specific basis as needed to complete necessary permits and CEQA or NEPA documentation. In order to remain current on climate change activities occurring at the State and national levels, the RWMG should stay involved in California Natural Resources Agency's California Adaptation Strategy process to help shape the document through their participation.

Merced Integrated Regional Water Management Plan

Chapter 16 Climate Change

Chapter 16: Climate Change addresses both adaptation to the effects of climate change and mitigation of GHG emissions and includes the following items, as required by the IRWM Plan Climate Change Standard:

- ✓ A discussion of the potential effect of climate change on the IRWM region, including an evaluation of the IRWM region's vulnerabilities to the effects of climate change and potential adaptation responses to those vulnerabilities. The evaluation of vulnerabilities must, at a minimum, be equivalent to the vulnerability assessment contained in the Climate Change Handbook for Regional Water Planning (December, 2011).
- ✓ A process that considers GHG emissions when choosing between project alternatives (provided in Chapter 6 Project Review Process).
- ✓ A list of prioritized vulnerabilities based on the vulnerability assessment and the IRWM's decision making process.
- ✓ A plan, program, or methodology for further data gathering and analysis of the prioritized vulnerabilities.

Additional information on the Region's vulnerability to climate change impacts and potential adaptation strategies are discussed in the Climate Change Study, provided as Appendix E.

As discussed previously, there is mounting scientific evidence that global climate conditions are changing and will continue to change as a result of the continued build-up of greenhouse gases in the Earth's atmosphere. Changes in climate can affect municipal water supplies through modifications in the timing, amount, and form of precipitation, as well as water demands and the quality of surface runoff. These changes can affect all elements of water supply systems, from watersheds to reservoirs, conveyance systems, and treatment plants.

Planning for and adapting to anticipated changes in climate will be essential to ensuring water supply reliability for all users and to protecting sensitive infrastructure against more frequent and extreme precipitation and wildfire events. This chapter summarizes anticipated climate change impacts on the State of California and the Merced Region, evaluates the impacts of those changes with regard to water resource management, assesses the vulnerability of the Region to anticipated climate change impacts, and provides recommended adaptation and mitigation strategies to address uncertainty and reduce GHG emissions. In addition, a plan for ongoing data collection to fill data gaps and monitor the frequency and magnitude of local hydrologic and atmospheric changes is provided.

16.1 Regional Climate Change Projections and Impacts

The Merced Region lies within the San Joaquin River Hydrologic Region and contains the San Joaquin River, Merced River, Bear Creek and Owens Creek. The Merced River watershed of 660,000 acres is the smallest of all watersheds contributing to the San Joaquin River upstream of the Delta. Approximately 122 miles of the Merced River are designated as Wild and Scenic; however, none of this designation applies to reach of the Merced River within the Region. MID owns two hydroelectric and three mini-hydro facilities in the Region with an online capacity of 115 MW. MID also owns two dams (New Exchequer Dam and McSwain Dam) with a total water storage capacity of over 1 million AF.

16.1.1 Recent Regional Studies and Research

At present, the Upper Merced River watershed is the focus of several research projects linked to the impacts of climate change on hydrology in the California Sierra Nevada. Studies currently underway or recently completed include:

- Impacts of climate change on the Lyell and Maclure Glaciers in Yosemite National Park (Yosemite National Park)
- Changes in snow cover patterns in the Sierra Nevada (University of Washington)
- The role of atmospheric rivers in extreme events in the Sierra Nevada (USGS)
- Impacts of climate changes on soil properties and habitats in the Sierra Nevada (UC-Merced and USGS)
- Study of the effects of climate change on hydrology and stream temperatures in the Merced and Tuolumne River watersheds (Santa Clara University)
- A study conducted by Null et al. of the University of California, Davis Center for Watershed Sciences, published in 2010.

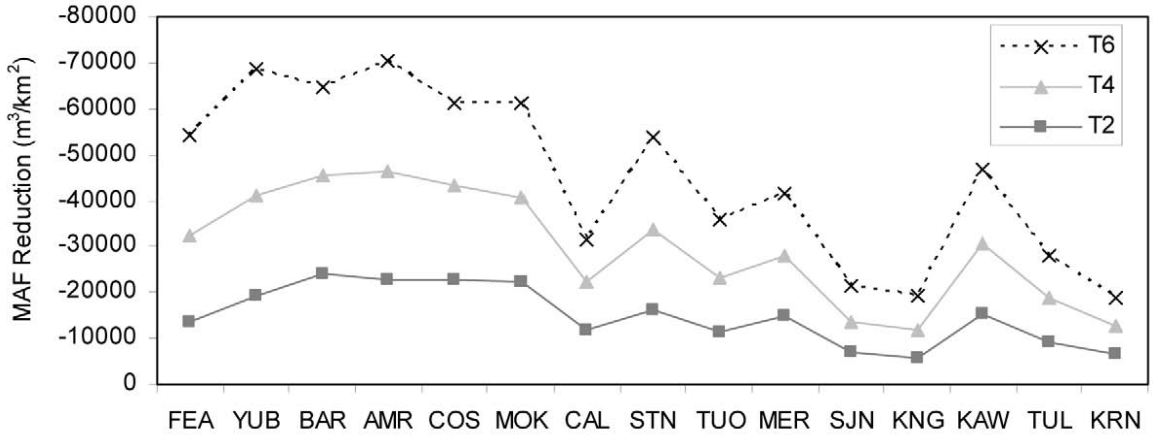
In general, these studies are multi-year endeavors and are either in progress or have yielded data that are currently being evaluated. While preliminary study reports appear to support other climate change impact observations and modeling simulations, the final published conclusions of these studies are, for the most part, not yet available.

16.1.2 Regional Climate Change Projections

In general, regional climate change modeling simulations project temperature increases throughout California, with consistent spatial patterns. Anticipated temperature increases are expected to be less extreme along the southwest coast, with increasing warming to the north and northeast. There is significant uncertainty associated with future precipitation patterns and water supply projections statewide. In general, changes in precipitation correlate with changes in water supply, with decreased precipitation correlating to decreased stream flows and decreased groundwater percolation. A study conducted by Null et al. of the University of California, Davis Center for Watershed Sciences, published in 2010, evaluated the hydrologic response and watershed sensitivity to climate change for the Sierra Nevada watersheds, including that of the Merced River. This study used a climate-forced rainfall-runoff model to explicitly simulate intra-basin hydrologic dynamics and understand localized sensitivity to climate warming. Using the Stockholm Environmental Institute's Water Evaluation and Planning System (WEAP21), the researches simulated anticipated 2^{o}C, 4^{o}C and 6^{o}C temperature increases and evaluated changes from baseline for three key parameters – mean annual flow, centroid timing, and low flow duration – to highlight relative differential responses across the Sierra Nevada watersheds and in relation to water resource development (water supply, hydropower and mountain meadow habitat, respectively).

Modeled changes to climate warming in the Merced River watershed resulted in reductions in mean annual flow (MAF). Specifically, there were approximately 3%, 6% and 8% decreases in mean annual flow on the Merced River resulting from 2oC, 4oC and 6oC increases in air temperature, respectively. These reductions in mean annual flow impact instream conditions and habitat for aquatic and riparian ecosystems. Relative to other Sierra watersheds, the Merced River experienced a moderate change in MAF due to climate change and was therefore considered to be less vulnerable to climate warming based on total water stored and changes in MAF than more northern watersheds (such as the American, Yuba, Bear, Mokelumne and Cosumnes Rivers).

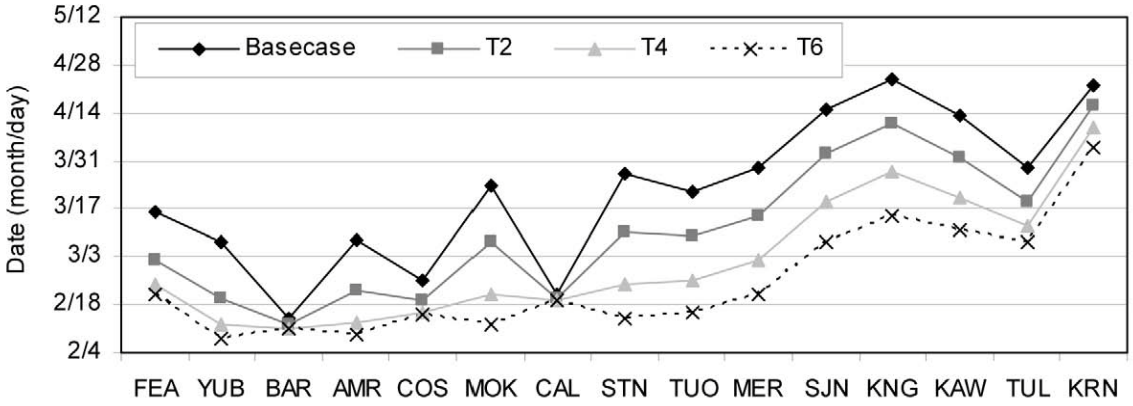
Figure 16-1: Reduction in Mean Annual Flow from Base Case by Watershed



Notes:
MER – Merced River watershed
Source: Null et al. 2010

The modeling also showed that runoff centroid timing (CT) was 2 weeks, 4 weeks, and 6 weeks earlier given the respective 2oC, 4oC and 6oC increases in air temperature. Change in seasonal runoff timing may affect electrical generation capabilities, flood protection, water storage and deliveries. Using online hydropower capacity as a measure of impact, the study identified watersheds vulnerable to CT shifts as they rely on hydropower generation and may face substantial changes in runoff timing with climate warming. Hydropower is often generated during high demand periods, which may be compromised if facilities are forced to spill due to higher magnitude flows or to accommodate early arrival of flows. While the Merced River demonstrated changes in CT due to climate warming, the limited generating capacity of the river (relative to that on other Sierra Nevada rivers) makes it one of the less vulnerable watersheds state-wide.

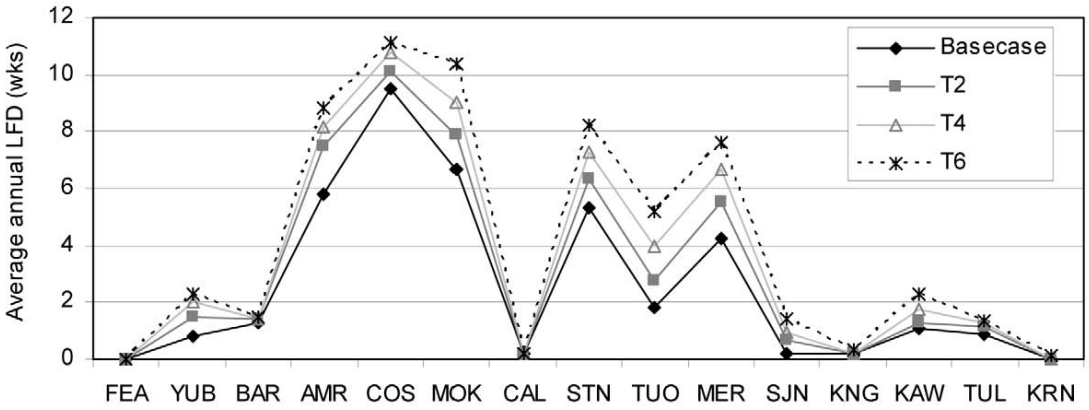
Figure 16-2: Average Annual Centroid Timing by Watershed



Notes:
MER – Merced River watershed
Source: Null et al. 2010

Finally, the study evaluated the average low flow duration (LFD) for the Sierra Nevada watersheds relative to climate change. For the Merced River, average low flow duration lasted 2, 3 and 4 weeks longer for the 2oC, 4oC and 6oC increases in air temperature, respectively. Changes in LFD were considered a surrogate for montane ecosystems in the study as persistent low flow conditions deplete meadow groundwater reserves and soil moisture, reducing the downstream benefits of meadows. Meadows provide ecosystem services such as maintaining summertime flow during dry periods and reducing floods in winter; providing aquatic and riparian habitat for birds, fish, amphibians, and insects; promoting riparian vegetation rather than conifer or dry shrub vegetation that increases wildfire risks; and improving downstream water quality. Merced River was considered vulnerable to LFD. Along with Yosemite and its meadows upstream, the Merced River could experience habitat loss as a result of climate change.

Figure 16-3: Average Annual Low Flow Duration by Watershed



Notes:

MER – Merced River watershed

Source: Null et al. 2010

16.2 Regional Water Resource Vulnerability

Primary water users in the Merced Region include urban users, agriculture, and the environment. Water supplies include both groundwater and surface water, with groundwater coming from the Merced (predominantly), Turlock and Chowchilla Subbasins of the San Joaquin Valley Groundwater Basin and surface water being diverted primarily from the Merced, Chowchilla, and San Joaquin Rivers. Declining Sierra Nevada snowpack, earlier runoff, and reduced spring and summer streamflows will likely affect surface water supplies and shift reliance to groundwater resources, which are already overdrafted in many places. This will, in turn, affect critical natural resource issues in the Region, such as agricultural land conversion, population growth, air, water and soil quality concerns, and loss of habitat land.

Other anticipated regional impacts resulting from climate change (increased air temperatures and variable precipitation) include changes to water quality; increased flooding, wildfires and heat waves; and impacts to ecosystem health. Earlier springtime runoff will increase the risk of winter flooding as capturing earlier runoff to compensate for future reductions in snowpack would take up a large fraction of the available flood protection space, forcing a choice between winter flood prevention and maintaining water storage for summer and fall dry-period use. Under the 'business-as-usual' climate change scenario (A2), wildfires could increase by 100% or more by the end of the century (CNRA 2009). Some of these impacts on water resources management are already being observed within the Region.

The identified vulnerabilities within the Merced Region are summarized in Table 2-10 and further described in the following sections.

Table 16-1: Merced Region Vulnerabilities

Vulnerability	Description
Water Demand	Vulnerable to increased agricultural demands due to longer growing season, increased temperatures and evapotranspiration rates, and more frequent/severe droughts. Vulnerable to increased urban and commercial, industrial, and institutional (CII) demand due to increased outside temperatures.
Water Supply and Quality	Vulnerable to decreased snowpack in the Sierra Nevada, shifts in timing of seasonal runoff, increased demands exacerbating groundwater overdraft, degraded surface and groundwater quality resulting from lower flows, exaggerated overdraft conditions, a reduction of meadows which can provide contaminant reduction, and more frequent/severe droughts and storm events increasing turbidity in surface supplies.
Flood Management	More severe/flashier storm events and earlier springtime runoff leading to increased flooding, and a reduction of meadows which help reduce floods in the winter.
Hydropower	Vulnerable to increased customer demand combined with changes in timing of seasonal runoff and flashier storm systems affecting reservoir storage.
Ecosystem and Habitat	Vulnerable to decreased snowpack, more frequent/severe droughts and wildfires, shift in seasonal runoff, increased low flow periods and increased water temperatures (degraded water quality).

16.2.1 Water Demand

Land use patterns in the Merced Region are dominated by agricultural uses, including animal confinement (dairy and poultry), grazing, forage, row crops, and nut and fruit trees, all of which rely heavily on water purveyors/districts and private groundwater and surface water supply sources. In general, irrigation water demand varies based on precipitation, and may or may not increase under future climate change conditions. Groundwater pumping is anticipated to increase as more irrigators and agricultural water users turn to groundwater to meet crop water requirements and farming needs (depending on surface water availability), and groundwater salinity increases with decreasing precipitation percolating to groundwater as a result of flashier and more variable precipitation events (Schoups et al. 2005). The effects of increased air temperatures on agriculture will include faster plant development, shorter growing seasons, changes to reference evapotranspiration (ET) and possible heat stress for some crops. Without accounting for evapotranspiration rates, agricultural crop and urban outdoor demands are expected to increase in the Sacramento Valley by as much as 6% in the future (Chung et al. 2009). In addition, fruit crops are more climate-sensitive than other crop types and may require additional water as the climate warms. Therefore, more water may be necessary to maintain yield and quality in future years of apricot or peach crops, for example, in the Merced Region.

If more water is required to maintain yield, and combined with potentially reduced supplies, the agricultural community may respond to these climate-induced changes primarily by increasing the acreage of land fallowing and retirement, augmenting crop water requirements by groundwater pumping, improving irrigation efficiency, and shifting to high-value and salt-tolerant crops (Hopmans et al. 2008). However, agricultural impacts resulting from climate changes are anticipated to be significant as Merced County ranks 5th in the state in agricultural production with a value of over $2.7 billion (Kahrl and Roland-Holst 2008). An example of potential impacts is on dairy production. Heat stress can have a variety of effects on livestock, including reduced milk production and reproduction in dairy cows (Valtorta, 2002). Based on modeling conducted by Hayhoe et al. and presented in their paper entitled Emissions pathways, climate change and impacts on California (Hayhoe et al. 2004), rising temperatures were found to reduce milk production by as much as 7 to 10% under the B1 scenario and by 11 to 22% under the A1 scenario.

Based upon a land use and water demand model created for the Merced Water Supply Plan Update – Final Status Report, the anticipated total water demand in the Merced Subbasin area, which is slightly smaller than the Merced IRWM Region, is anticipated to be 1,160,000 acre-feet (AF) in 2040 (City of Merced, MID, and UC Merced 2001). Table 2-5 provides an overview of the total anticipated 2040 demand in terms of demand type.

Table 16-2: Anticipated Total Applied Water Demand in the Merced Subbasin in 2040

Demand Type	Acre-feet[1]	Percentage of Total
Urban	118,000	10%
Agricultural within MID Service Area	384,000	33%
Agricultural outside of MID Service Area	658,000	57%
TOTAL	**1,160,000**	**100%**

Note: 1. Demand based on the Merced Water Supply Plan Update – Final Status Report (2001).

Groundwater modeling was completed which indicated that groundwater demands are highest during dry years, likely due to the fact that groundwater is primarily used for agricultural irrigation (MAGPI 2002). The seasonal variability of water demands is projected to increase with climate change as droughts become more common and more severe (DWR 2008).

Other seasonal uses such as landscape irrigation cooling demands are also expected to increase as a result of climate change (DWR 2008 and CNRA 2009). Identification of industrial cooling towers and similar facilities will help the Region gain better understanding of the potential increases in seasonal demands.

16.2.2 Water Supply and Quality

The Merced Region's water supplies include groundwater, local surface water, and imported surface water from the Central Valley Project (CVP) in the case of Chowchilla Water District. In general, impacts on urban users will be a function of behavioral response of individuals and organizations as well as hydrology (Hayhoe et al. 2004). Additional water storage will be required to ensure water supply reliability. Without additional storage, it will be difficult to capture and retain the extra runoff for use after April 1st without reducing the amount of flood storage space left in reserve. Both the need for empty storage for flood protection and the need for carryover storage for drought protection reflect the uncertainty about future weather conditions and the level of regional risk aversion (Hayhoe et al. 2004).

Currently, approximately 75% of total water use statewide currently occurs between April and September when lawns and crops are being irrigated (Hayhoe et al. 2004). Decreased summertime flows will likely result in increased groundwater pumping (and potential overdraft conditions) due to increased groundwater to offset surface water shortages. Additionally, rising temperatures are projected to increase the frequency of heat waves, which could also lead to increased water use and further exacerbate low flow conditions (Hayhoe et al. 2004).

Changes in water availability and timing will also affect the value of water rights statewide, as mid- and late-season natural stream flow water rights become less valuable and the value of rights to stored water (which has a higher degree of reliability) increase in value. Senior users without access to storage could face unprecedented shortages due to reduced summertime flows (Hayhoe et al. 2004). These same changes will also affect the level of hydropower generation on the Merced River, especially in the summer, when hydropower generation is needed most to meet peak demand (Moser et al. 2012).

Finally, climate change impacts may affect water quality in a multitude of ways.

- Water quality can be impacted by both extreme increases and decreases in precipitation. Increases in storm event severity may result in increased turbidity in surface water supplies while decreases in summertime precipitation may leave contaminants more concentrated in streamflows (DWR, 2008).
- Higher water temperatures may exacerbate reservoir water quality issues associated with reduced dissolved oxygen levels and increased algal blooms (DWR, 2008).

Water quality concerns not only impact drinking water supplies, but also environmental uses and wastewater treatment processes. The altered assimilative capacity of receiving waters may increase treatment requirements, and collection systems could be inundated in flooding events. More prevalent wildfires could result in aerial deposition and runoff of pollutants into water bodies, impacting surface water quality. Declining Sierra Nevada snowpack, earlier runoff and reduced spring and summer stream flows will likely affect surface water supplies and shift reliance to groundwater resources, which are already overdrafted in many places.

16.2.3 Groundwater Supply and Quality

The Merced Region overlies three groundwater subbasins within the San Joaquin Groundwater Basin as recognized by DWR in Bulletin 118. These include the entirety of the Merced Subbasin and portions of the Chowchilla and Turlock Subbasins. The Merced Subbasin and the portion of the Chowchilla Subbasin in the Region are actually one hydrologic subbasin bounded between the Merced River and the Chowchilla River.

According to the 2008 GWMP Update, groundwater elevations in the Merced Subbasin have been monitored by DWR, MID, and other entities since the 1950s. This monitoring data demonstrates that since 1980 average groundwater levels beneath the Merced Subbasin have declined on average, approximately 14 feet, with most of this decline occurring between 1980 and 1996. As such, the Merced Subbasin is considered to be in a state of mild long-term groundwater level decline. In addition to dropping groundwater levels, the Merced Subbasin has high concentrations of total dissolved solids (TDS), generally at depths between 400 and 800 feet below the ground surface, that increase in concentration from east to west. The San Joaquin River acts as a natural saline barrier, so generally, TDS concentrations are greater on the west side of the River and less on the east side. Reduced streamflows in the River could reduce the effect of the natural barrier and allow for further migration of salinity in the groundwater basin. Additionally, climate change impacts may cause increased evapotranspiration and a longer growing season, further exacerbating groundwater overdraft and high salinity levels.

Portions of the groundwater subbasins are subject to high nitrate concentrations; elevated iron and manganese concentrations; and contamination with MTBE, DBCP and other contaminants; which can impact the beneficial use of groundwater. Lastly, the variation in precipitation and streamflow in the future will influence how and when the groundwater subbasins are recharged in the Merced Region.

16.2.4 Surface Water Supply and Quality

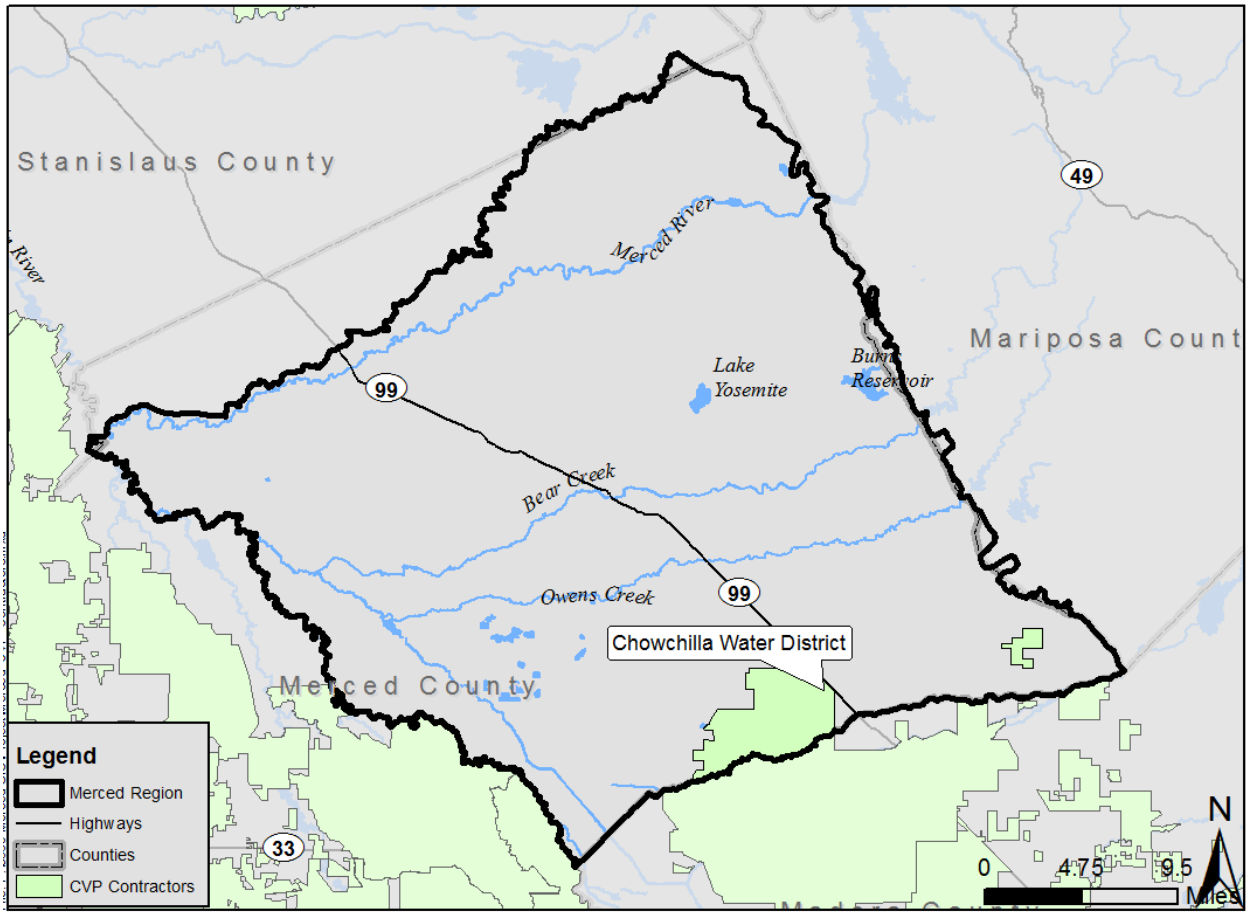
The Central Valley RWQCB compiled the 303(d) list of impaired water bodies within the Sacramento River and San Joaquin River Basins that suffer significant water quality impairments from a variety of pollutants and must be addressed through the development of TMDLs. The Lower Merced River (from McSwain Reservoir to the San Joaquin River) is included on this list. Irrigated agriculture has been identified as a significant anthropogenic source of both nitrate and sediment loading in surface water bodies. Additional sources of sediment loading include erosion, mining, and grazing, among others. Current climate change scenarios project lower stream flows and higher agricultural water use that would pose significant challenges in implementing the defined TMDLs and meeting water quality goals.

As the occurrence of wildfires increases, additional sediment would be deposited into water bodies, and turbidity would likely become more of a concern. Sediment and pollutants collected from upstream could be concentrated downstream, leading to water quality issues and the disturbance of critical habitats. In addition, earlier snowmelt and more intense precipitation events will likely increase turbidity in source waters. Shifts in the timing of runoff have already been observed; over the last one hundred years the fraction of total annual runoff occurring between April and July has decreased by 23% in the Sacramento Basin and by 19% in San Joaquin Basin (CEC 2008). Increased flooding may lead to sewage overflows, resulting in higher pathogen loading in the source waters. Increased water temperatures and shallower reservoirs may result in more prevalent eutrophic conditions in storage reservoirs, increasing the frequency and locations of cyanobacterial blooms. These potential changes could result in challenges for surface water treatment plants and require additional monitoring to quantify changes in source water quality and better control of finished water quality (CUWA 2007).

16.2.5 Imported Surface Water Supply

Only a small portion of Chowchilla Water District is within the boundaries of the Merced Region, but it is important to note that imported supplies from the CVP are delivered to CWD through contracts with USBR. The contract provides 24,000 AFY from Buchanan Dam and 55,000 AFY of Class 1 Water and 160,000 AFY of Class 2 Water from Friant Dam. As shown in the following figure, the only water district within the Merced Region that receives CVP water is CWD, and it is only partially in the Region. Less than 20% of the CWD service area lies within the Region.

Figure 16-4: CVP Contractors within the Merced Region



Due to delivery reductions by the USBR, the long-term average annual available CVP supply for agricultural and municipal and industrial (M&I) usage is estimated to be 53% and 83% of the contracted amount, respectively. On December 15, 2008, USFWS released its final Biological Opinion on CVP and SWP Operations Criteria and Plan (OCAP); the results of this study could also impact the long-term availability of CVP supplies.

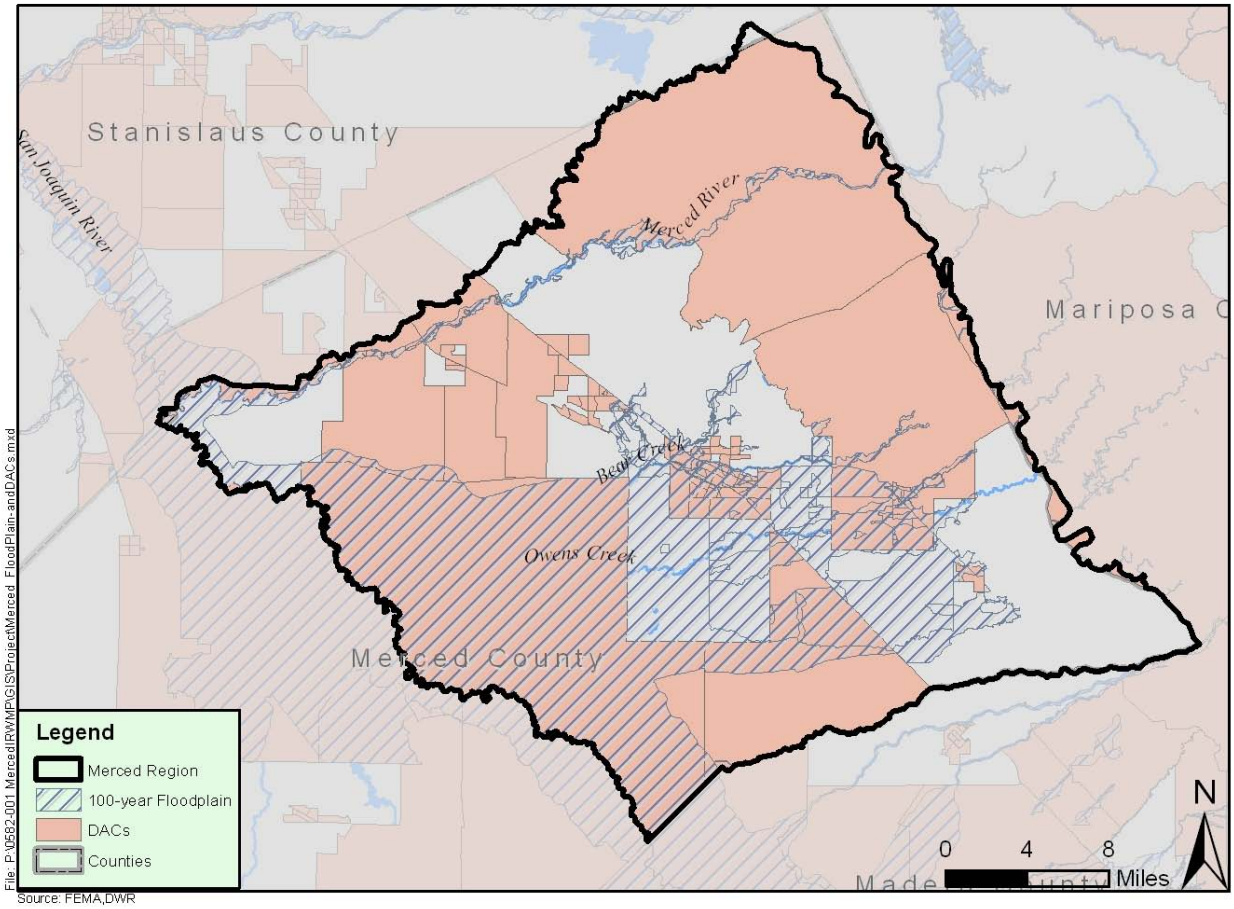
As a result of the increased temperature, DWR anticipates a 20% to 40% decrease in the state's snowpack by mid-century (DWR 2008). This reduction in snowpack impacts the SWP, CVP and water systems that rely on the Colorado River. The SWP 2009 Delivery Reliability Report (DWR 2010c) indicates that Delta exports may be reduced by up to 25% by the end of the century.

16.2.6 Flood Management

Sea level rise is not a direct potential climate change impact to the Merced Region, but if sea level rise occurs, the salinity of the Delta may increase, impacting reservoir operations in the Region and resulting in the potential need for freshwater releases from the Merced River. In addition to increased coastal flooding resulting from sea level rise, severity of non-coastal flooding will also increase in the future due to climate change. Extreme precipitation events will become more common, increasing the likelihood of extreme weather events and floods. Rising snowlines will also increase the surface area in watersheds receiving precipitation as rain instead of snow (DWR 2008), thereby increasing storm-related runoff. The Merced Region experienced two major flood events in recent years (1998 and 2006) that caused significant damage to homes, bridges, roads, and other structures, as well as geomorphic impacts to nearby creeks. These events could increase under anticipated future conditions.

There are significant portions of the Merced Region that lie within FEMA designated 100-year and 500-year flood zones. Low-lying DACs will be particularly vulnerable to flooding damages causing temporary and/or permanent displacement. Some of the DACs within the Merced Region lie within the 100-year floodplain as shown in the following figure.

Figure 16-5: DACs within 100-year Floodplain



16.2.7 Ecosystem and Habitat

Eastern Merced County supports the largest unfragmented blocks of high-density vernal pool grasslands remaining in California. These vernal pools contain numerous rare and endangered species such as fairy shrimp, tadpole shrimp and several rate Orcutt tribe grasses (Economic & Planning Systems, Inc. 2009b). These species and others that are susceptible to heat waves, droughts, and flooding may be in danger and invasive species may become even more challenging to manage (CCSP 2009).

Climate change impacts on the environment within the Merced Region also include changes in vegetation distribution and increases ecosystem stress. Specifically, temperature-induced declines in alpine/subalpine forests are expected to occur, in addition to major shifts from evergreen conifer forests to mixed evergreen conifer forests and expansion of grasslands (Hayhoe et al. 2004). Increasing stress on ecosystems resulting from rising temperatures will reduce capacity to resist pest attacks while increasing pest survival rates, accelerating their development and allowing them to expand their range. Increasing temperatures will also result in warmer freshwater temperatures which, along with changes in seasonal stream flows, are projected to cause sharp reductions in salmon populations and increased risks of extinction for some Central Valley subpopulations (Ackerman and Stanton 2011).

Projected hotter and possibly drier future conditions will also increase the frequency and extent of wildfires, worsen pest outbreaks, and stress precarious sensitive populations. Wildfires will play a significant role in converting woodlands to grassland as decreases in moisture shift the competitive balance in favor of the more drought-tolerant grasses and increases in grass biomass provide more fine fuels to support more frequent fires. Increased wildfires also favor grasses, which re-establish more rapidly than slower growing woody life forms after burning (Hayhoe et al. 2004)

Finally, decreases in precipitation will directly affect both surface water and groundwater quality. Warmer surface water will result in lower dissolved oxygen concentrations, which can directly impact aquatic and riparian habitats. Decreased precipitation and associated decreased groundwater percolation will result in increased dissolved concentrations of constituents in groundwater.

16.2.8 Hydropower

MID has generated wholesale electric power at its hydroelectric facilities for over 75 years. In 1967, McSwain and New Exchequer Dams were completed in Mariposa County, downstream of Lake McClure. Since then, MID has produced nearly 10 billion kilowatt hours of electricity, equating to an average of approximately 325 million kilowatts per year. Although the hydroelectric facilities and New Exchequer and McSwain Dams are outside the Merced regional boundary, they are operated by MID and currently provide power to the state open grid. The Merced River Hydroelectric Project is operated to provide water supply, flood control, recreation and hydropower, and it is a component of MID's water portfolio. New Exchequer Reservoir is primarily a water supply reservoir with incidental hydropower benefits. Power generation fluctuate based on diversion demands by the MID Water Operations Department. MID holds the original Federal Energy Regulatory Commission (FERC) license for the project, which was issued by the Federal Power Commission, FERC's predecessor, in 1964 (MID 2008b). The original license expires on February 28, 2014. MID filed an application for a new FERC license in February 2012 and is currently completing the relicensing process.

Lake McClure and the Merced River are supplied primarily by snowmelt from the Sierra Nevada. Changing volumes of snowfall and snowpack in the Sierra Nevada and the changing seasonal melting patterns may require changes in dam operation. As the timing of snowmelt shifts in the spring, hydroelectric power generation may also shift to accommodate enhanced flood control operations. Additionally, increasing temperatures will also increase energy demands, especially during peak demand times (DWR 2008). As previously described, the modeling completed as described in the Hydrologic Response and Watershed Sensitivity to Climate Warming in California's Sierra Nevada, showed that runoff centroid timing (CT) on the Merced River was 2 weeks, 4 weeks, and 6 weeks earlier given the respective 2oC, 4oC, and 6oC increases in air temperature, respectively. Change in seasonal runoff timing may affect electrical generation capabilities, flood protection, water storage and deliveries. Hydropower is often generated during high demand periods, which may be compromised if facilities are forced to spill due to higher magnitude flows or to accommodate early arrival of flows (Null, et. al. 2010).

16.2.9 Other

Climate change will also affect the Region in other ways, including impacting recreation and tourism industries (and therefore the Region's economy). As one of the gateways to Yosemite National Park, the City of Merced and surrounding communities rely on this industry as part of its economy. Stressed environments and increased wildfire will put these natural resources at risk. Projections of decreased snowpack have the potential to affect the ski industry as the State's 34 ski resorts are based between 6,500 and 8,200 feet, well into the elevations impacted by temperature increases. These same temperature increases will also delay the start of ski season and impact the economic viability of the industry (Hayhoe et al. 2004).

16.2.10 Prioritized Vulnerabilities

The Merced Region's vulnerabilities to anticipated climate changes were prioritized based on discussion with the RWMG and the RAC considering regional understanding and sensitivities and identified regional goals and objectives. The prioritized vulnerabilities for the Region were as follows:

1. Water Supply/Water Quality
2. Flood Management
3. Hydropower
4. Water Demand
5. Ecosystem and Habitat

The rationale behind the prioritization acknowledges that the groundwater basin is already in overdraft condition, and that additional water supply reductions will exacerbate this condition. Similarly, flooding and flood management is a major issue for the Region at present, and a flashier river/stream system is only going to worsen this condition and significantly impact hydropower operations (as would significant changes in river flows resulting from earlier springtime runoff and/or lower annual flows). Increasing water demands will also make the water supply conditions worse. Finally, while ecosystem and habitat issues are important, they derive from the other issues/vulnerabilities (e.g., water supply and quality, which is exacerbated by demand and flood issues), therefore ranking a lower vulnerability.

16.3 Adaptation and Mitigation

Global climate modeling carries a significant degree of uncertainty resulting from varying sensitivity to changes in atmospheric forcing (e.g. CO2, aerosol compounds), unpredictable human responses, and incomplete knowledge about the underlying geophysical processes of global change. Even though current scenarios encompass the "best" and "worst" cases to the greatest degree possible based on current knowledge, significant uncertainty associated with future global GHG emission levels remains, especially as timescales approach the end of the century. The historical data for calibrating global circulation models (GCMs) is not available worldwide, and is spatially biased towards developed nations.

Considering the great deal of uncertainty associated with climate change projections, a prudent approach to addressing climate change incorporates a combination of adaptation and mitigation strategies. Climate adaptation includes strategies (policies, programs or other actions) that bolster community resilience in the face of unavoidable climate impacts (CNRA and CEMA 2012), where mitigation strategies include BMPs or other measures that are taken to reduce GHG emissions.

The Prop 84 IRWM Guidelines require consideration of the California Water Plan RMS in identifying projects and water management approaches for the Region. RMS are being considered in the Merced IRWM planning process to meet the Region's objectives. Application of various RMSs diversifies water management approaches, and many of the RMSs apply to climate change adaptation and mitigation. Categories of applicable RMSs include:

- Reduce Water Demand
- Improve Operational Efficiency and Transfers
- Increase Water Supply
- Improve Water Quality
- Urban Runoff Management
- Practice Resource Stewardship
- Improve Flood Management
- Other Strategies

Within each RMS category listed above, a variety of specific RMS have been identified for the Region. For example, reducing water demand can be accomplished through agricultural water use efficiency and/or urban water use efficiency. As described in the Climate Change Handbook for Regional Planning (CDM 2011), not all of the RMS directly apply to climate change adaptation or mitigation, but are directed at overall system resiliency, which improves a system's resilience to the uncertain conditions climate change could bring.

16.3.1 Adaptation Strategies

The following table summarizes the ability of individual RMS to aid in climate change adaption. The application of the RMS that are applicable within the Merced Region as climate change adaptation strategies are described Chapter 5 Resource Management Strategies.

Table 16-3: Applicability of RMS to Climate Change Adaptation

Resource Management Strategies	Habitat Protection	Flood Control	Water Supply Reliability	Additional Water Supply	Water Demand Reduction	Sea Level Rise	Water Quality Protection	Hydropower
Reduce Water Demand								
Agricultural Water Use Efficiency			✓		✓		✓	
Urban Water Use Efficiency			✓		✓		✓	
Improve Operational Efficiency and Transfers								
Conveyance-Delta*	✓	✓	✓	✓		✓	✓	
Conveyance-Regional/Local	✓	✓	✓	✓			✓	
System Reoperation		✓	✓	✓				✓
Water Transfers			✓	✓				
Increase Water Supply								
Conjunctive Management and Groundwater Storage		✓	✓	✓			✓	
Desalination*			✓	✓				
Precipitation Enhancement*				✓				✓
Recycled Municipal Water			✓	✓				
Surface Storage-CALFED	✓	✓	✓	✓			✓	✓
Surface Storage-Regional/Local	✓	✓	✓	✓			✓	✓
Improve Water Quality								
Drinking Water Treatment and Distribution			✓	✓			✓	
Groundwater Remediation/Aquifer Remediation			✓	✓			✓	
Matching Quality to Use			✓	✓			✓	
Pollution Prevention	✓		✓				✓	
Salt and Salinity Management	✓		✓	✓			✓	
Urban Runoff Management	✓	✓					✓	
Practice Resource Stewardship								
Agricultural Lands Stewardship	✓	✓			✓		✓	
Economic Incentives	✓	✓	✓	✓	✓	✓	✓	✓
Ecosystem Restoration	✓	✓	✓			✓	✓	
Forest Management	✓	✓	✓				✓	
Land Use Planning and Management	✓	✓				✓	✓	
Recharge Area Protection		✓	✓	✓			✓	

Resource Management Strategies	Habitat Protection	Flood Control	Water Supply Reliability	Additional Water Supply	Water Demand Reduction	Sea Level Rise	Water Quality Protection	Hydropower
Water-dependent Recreation	✓	✓	✓				✓	
Watershed Management	✓	✓	✓	✓		✓	✓	✓
Improve Flood Management								
Flood Risk Management	✓	✓				✓	✓	✓
Other Strategies								
Crop Idling for Water Transfers			✓	✓	✓			
Dewvaporation or Atmospheric Pressure Desalination*				✓				
Fog Collection*				✓				
Irrigated Land Retirement			✓		✓			
Rainfed Agriculture					✓			
Waterbag Transport/Storage Technology*	✓		✓	✓		✓	✓	

* RMS deemed inappropriate for the Merced Region. See Section 3: RMS Evaluation of the Merced IRWMP for more detail.

16.3.2 Plan for Further Data Gathering

Identifying and implementing appropriate adaptation strategies requires having the data necessary to (1) understand the magnitude of climate change impacts and associated vulnerabilities and (2) plan for strategy implementation in a timely manner. To aid in this understanding, the Merced Region has developed a data gathering and analysis approach to collecting and assimilating data related to the prioritized climate change vulnerabilities.

As an umbrella document, the Merced IRWM Plan is intended to coalesce and build upon available planning information and studies, not supersede them. Currently, significant data collection efforts are underway at the state, national, and international levels by agencies including DWR, the California Air Resources Board (CARB), the USEPA, and the International Panel on Climate Change (IPCC), among others. In order to ensure that the Merced Plan is responsive to projected climate change impacts and prioritized vulnerabilities, it will be critical to assimilate the data and information being collected through these avenues into future Plan updates. Further, a variety of project-specific data and information will be collected as part of the project performance and monitoring program. This data could contribute additional information on climate change information on the regional level that could be used to augment information developed at the state and national levels.

In conjunction with future Merced IRWM Plan updates, the available body of climate change information, data, and literature will be evaluated and incorporated into the vulnerabilities analysis and throughout the Plan, as appropriate. In addition, the data collection tables completed in support of the Plan-level and project-level monitoring will be revised, as appropriate, to include additional climate change parameters.

At a minimum the following data collection and analysis actions will be implemented as part of future plan updates to ensure that the plan adequately addresses prioritized climate change vulnerabilities:

- Review statewide available data at the following sites:
    - DWR IRWM Climate Change Document Clearinghouse – http://www.water.ca.gov/climatechange/docs/IRWM-ClimateChangeClearinghouse.pdf
    - DWR's Climate Change Website – http://www.water.ca.gov/climatechange
    - Climate Change Handbook – http://www.water.ca.gov/climatechange/CCHandbook.cfm
    - State of California Climate Change Portal – http://www.climatechange.ca.gov
    - CARB website – http://www.arb.ca.gov/cc/cc.htm
    - The California CAT website – http://climatechange.ca.gov/climate_action_team/index.html
    - CEQA Greenhouse Gas Analysis Guidance for DWR Grantees – http://www.water.ca.gov/climatechange/docs/Guidance%20For%20Grantees-%20Calculating%20GHGs%20for%20CEQA2011.pdf
    - Association of Environmental Professionals. 2007. Alternative Approaches to Analyzing Greenhouse Gas Emissions and Global Climate Change in CEQA Documents. http://www.counties.org/images/public/Advocacy/ag_natres/AEP_Global_Climate_Change_June_29_Final%5B1%5D.pdf
    - California Climate Action Registry. (2009). General Reporting Protocol Version 3.1. http://www.climateregistry.org/resources/docs/protocols/grp/GRP_3.1_January2009.pdf
    - California Climate Adaptation Planning Guide – http://resources.ca.gov/climate_adaptation/local_government/adaptation_policy_guide.html
    - Center for Biological Diversity. 2007. The California Environmental Quality Act on the Front Lines of California's Fight Against Global Warming. http://www.biologicaldiversity.org/publications/papers/CBD-CEQA-white-paper.pdf
- Review national and international data at the following sites:
    - U.S. EPA. 2009. Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2007. http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html
    - World Resources Institute and World Business Council for Sustainable Development. N.d. The Greenhouse Gas Protocol for Project Accounting. http://www.wri.org/publication/greenhouse-gas-protocol-ghg-protocol-project-accounting
- Update plan performance monitoring and project-specific monitoring data collection tables to include climate change parameters as appropriate.

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