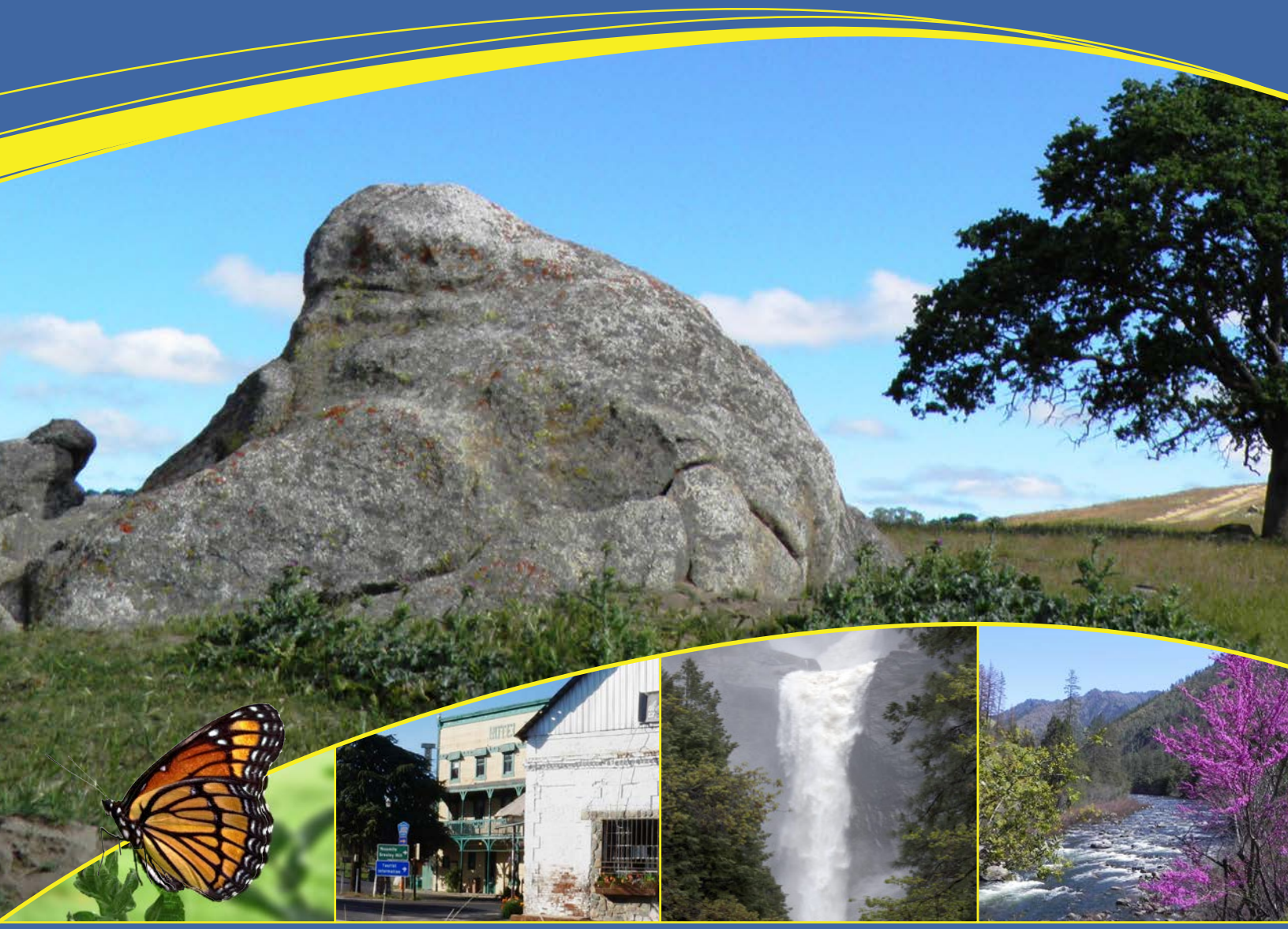
Yosemite-Mariposa

Integrated Regional Water Management Plan

July 2014



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Yosemite-Mariposa Integrated Regional Water Management Plan

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Abbreviations and Acronyms

Abbreviation	Description
AB	Assembly Bill
ACOE	Army Corps of Engineers
AF	acre-feet
AFY	acre-feet per year
Basin Plan	Sacramento/San Joaquin Water Quality Control Plan
BLM	United States Bureau of Land Management
BMP	best management practices
BSSC	California Bird Species Special Concern
C	community
CABY	Consumnes, American, Bear, and Yuba IRWM
CALFED	CALFED Bay-Delta Program
CAL FIRE	California Department of Forestry and Fire Protection
CCE	California Candidate Endangered
CCT	California Candidate Threatened
CDEC	California Data Exchange Center
CDF	California Department of Forestry
CDF & FP	California Department of Forestry and Fire Protection
CDFW	California Department of Fish and Wildlife
CE	California Endangered
CEDEN	California Environmental Data Exchange Network
CenCal	Central California
CEQA	California Environmental Quality Act
CFP	California Fully Protected
CFS	cubic feet per second
CIMIS	California Irrigation Management Information System
CIP	capital improvement plan
CO	company
CSA	county service area
CSA1-M/CWS	County Service Area 1-M, Coulterville Water and Sewer

Abbreviation	Description
CSA1-M/MP	County Service Area 1-M, Mariposa Pines
CSA1-M/SZ1	County Service Area 1-M, Sewer Zone No. 1
CSC	California Species of Special Concern
CSD	community service district
CT	California Threatened
CWA	Federal Clean Water Act
CWC	California Water Code
CWP	California Water Plan
CWPP	Community Wildfire Protection Plan
DAC	disadvantaged community
DBP	disinfection byproducts
DMS	data management system
DWR	California Department of Water Resources
E. COLI	Escherichia Coli
EDC	Economic Development Corporation of Mariposa County
EJ	environmental justice
FC	Federal Candidate
FE	Federal Endangered
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FT	Federal Threatened
GAMA	Groundwater Ambient Monitoring and Assessment
GHG	green house gas
GIS	geographic information system
GPM	gallons per minute
GUIDELINES	Integrated Regional Water Management Guidelines for Proposition 84 and Proposition 1E
ID	irrigation district
in.	inches
INC	incorporated
IRWM	Integrated Regional Water Management
IRWM Plan	Integrated Regional Water Management Plan
LA	Los Angeles

Abbreviation	Description
LAFCO	local agency formation commission
LDPCSD	Lake Don Pedro Community Services District
LHMP	local hazard mitigation planning
LUST	leaking underground storage tanks
MAC	Mokelumne/Amador/Calaveras IRWM
MAF	million acre-feet
MCFSC	Mountain Communities Fire Safe Council
MCRCD	Mariposa County Resource Conservation District
MERG	Mariposans for the Environment and Responsible Government
MG/L	milligrams per liter
MGD	million gallons per day
MHI	median household income
MID	Merced Irrigation District
MOU	memorandum of understanding
MPN	most probable number
MPT	measurable planning target
MPUD	Mariposa Public Utility District
MPWD	Mariposa Public Water District
MSG	Merced County Stream Group
MSR	Municipal Service Reviews
MT	mountain
MW	megawatts
NC	transient non-community
NEPA	National Environmental Policy Act
NGO	non-governmental organization
NPDES	National Pollution Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NTNC	non-transient non-community
NTU	nephelometric turbidity unit
OES	office of emergency services
PBMWC	Ponderosa Basin Mutual Water Company
PEC	project evaluation committee

Abbreviation	Description
PG&E	Pacific Gas and Electric
PIER	California Public Interest Energy Research
POC	public outreach committee
PVC	polyvinyl chloride pipe
RAP	regional acceptance process
RCD	resource conservation district
Region	Yosemite-Mariposa Region
RMS	resource management strategies
RWAC	regional water advisory council
RWMG	regional water management group
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SDAC	severely disadvantaged communities
SDWA	Safe Drinking Water Act
SFC	Sierra Foothill Conservancy
SMART	specific, measurable, attainable, relevant, time-based
SNC	Sierra Nevada Conservancy
SRA	state responsibility areas
SWAMP	Surface Water Ambient Monitoring Program
SWRCB	State Water Resources Control Board
TDN	total dissolved nitrogen
TMDL	total maximum daily load
TPA	town planning area
UC	University of California
UMRWC	Upper Merced River Watershed Council
US	United States
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
USEPA or EPA	United States Environmental Protection Agency
USFS	United States Forest Service
USGS	United States Geologic Survey
UV	ultraviolet
WDR	water discharge requirements

Abbreviation	Description
WF	wildfire
WFU	wildfire use
WUE	water use efficiency
WUI	Wildland Urban Interface
WWTP	wastewater treatment plant
YAAS	Yosemite Area Audubon Society
YACSD	Yosemite Alpine Community Services District
Y-M	Yosemite-Mariposa
YNP	Yosemite National Park

Executive Summary

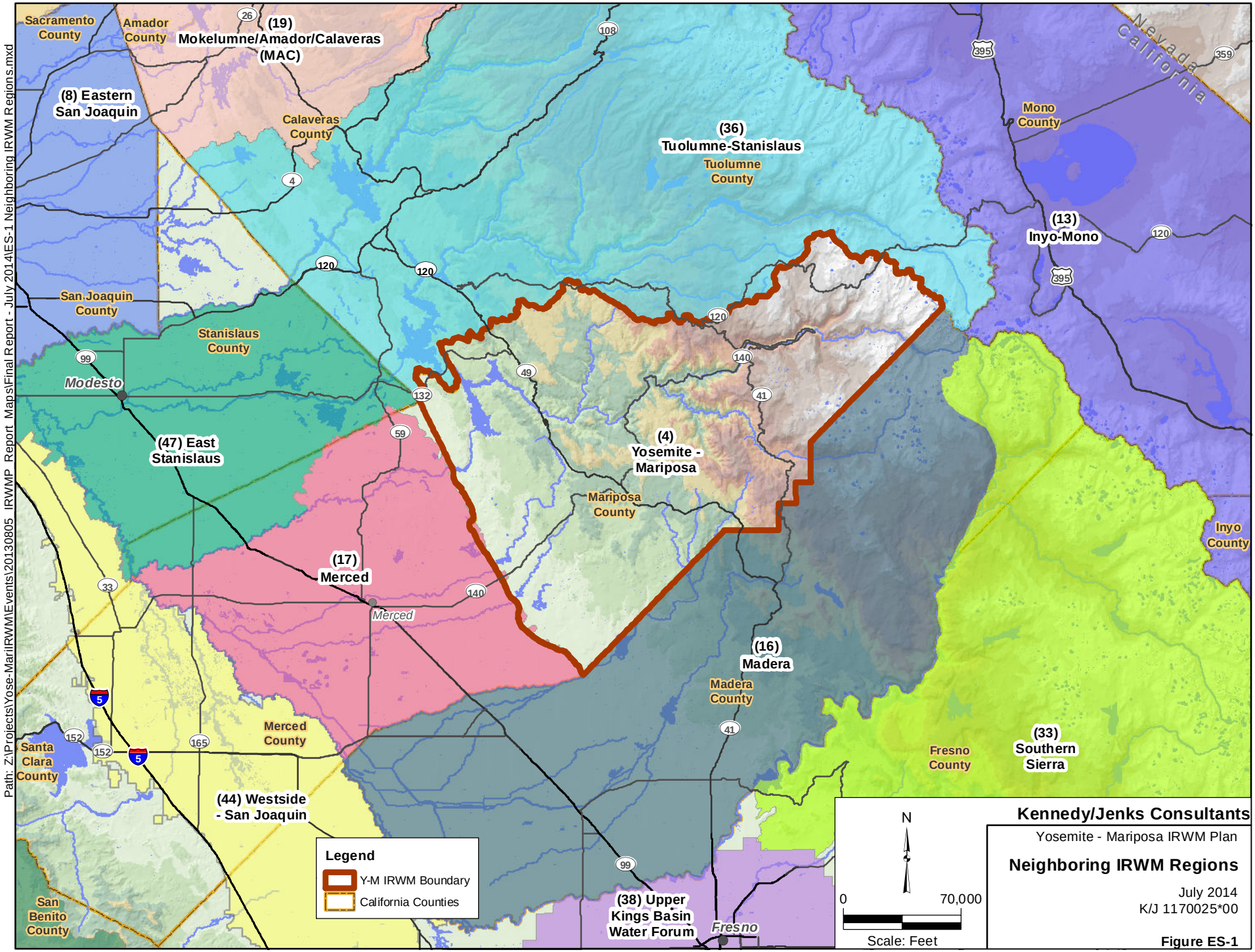
This Integrated Regional Water Management Plan (IRWM Plan) defines a clear vision of the management of water resources in the Yosemite-Mariposa Region (Region) and highlights important actions needed to help accomplish that vision through the year 2035. The Yosemite-Mariposa (Y-M) IRWM Plan is a volunteer, collaborative effort by local agencies, organizations and residents to develop strategies to manage the water and natural resources within the Region. The purpose is to meet long-term water needs providing both ecosystem and sustainable water supply benefits for end users. The Plan will also provide a way for the region to acquire funding to complete projects that address water quality, water supply, safe drinking water, water reliability, flood and stormwater management and ecosystem protections. This IRWM Plan is intended to be an integrated planning tool in compliance with the *Integrated Regional Water Management Guidelines for Proposition 84 and 1E* published by the California Department of Water Resources (DWR) in November 2012. This planning tool will help bring stakeholders together for the foreseeable future and identify, plan, and execute actions to better manage water in the Region and to accomplish more than agencies and organizations could do individually.

Efforts to compile this Plan have taken many years and the dedication, time and resources of more than 20 water purveyors; local, state and federal agencies; natural resources advocates, and other stakeholders. The effort has resulted in an opportunity to accomplish much more than any one agency could have achieved and has fostered better stewardship of resources throughout the planning horizon. This compilation of integrated goals, objectives, background, resource management strategies, and projects is the product of input gathered from stakeholder involvement, public contributions, research, and technical studies and is custom tailored to meet the needs of the Region.

Introduction (Section 1)

Y-M Landscape with View of Bagby Bridge
Credit: Pat Garcia

This IRWM Plan is the first regional watershed-management plan of its kind in the Y-M Region. Its intent is to address the many major water-related needs/challenges and conflicts within the Region, including water quality, local water supply reliability, and better integrate of water and land use management, fuel management for wildfire prevention and resource stewardship and ecosystem protection. The Y-M Region is an area with large forested areas, including 53% of the Region which is managed as federal lands by Yosemite National Park, the Bureau of Land Management, and the Sierra and Stanislaus National Forests. Although the Region does not have a large population, the Merced River watershed, which is about 64% of the Region, is a major tributary to the San Joaquin River, which combines with other Delta tributaries to provide water for millions of people in the San Joaquin Valley and Bay Area, and water for irrigating hundreds of thousands of acres of prime farmland.


Sacramento County
Amador County
(19) Mokelumne/Amador/Calaveras (MAC)
(8) Eastern San Joaquin
Calaveras County
(36) Tuolumne-Stanislaus
Tuolumne County
Mono County
Nevada
California
(13) Inyo-Mono
San Joaquin County
Stanislaus County
Modesto
(47) East Stanislaus
(4) Yosemite - Mariposa
Mariposa County
Inyo County
(17) Merced
Merced
(16) Madera
Madera County
Merced County
Santa Clara County
(44) Westside - San Joaquin
Fresno County
(33) Southern Sierra
San Benito County
(38) Upper Kings Basin Water Forum
Fresno
Legend
Y-M IRWM Boundary
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N
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Kennedy/Jenks Consultants
Yosemite - Mariposa IRWM Plan
Neighboring IRWM Regions
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Figure ES-1
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The formation of the Yosemite-Mariposa Region began with the larger CenCal Region that includes a group of stakeholders located in the central portion of California. This Region was submitted in response to the original Proposition 84 Integrated Regional Water Management Plan guidelines for the Regional Acceptance Process (RAP). Following the change as agreed by DWR, the Y-M Region boundary was settled coincident with the Mariposa County line and is bounded on all sides by other IRWM regions as shown on Figure ES-1. The region is fully located within the San Joaquin Funding area as defined by DWR.

The governance of the Y-M IRWM includes both a Regional Water Management Group (RWMG) of 5 entities and a broader Regional Water Advisory Council (RWAC) of community representatives who are signatories to a Memorandum of Understanding (MOU). In addition there are Agency Partners who are non-voting members of the RWAC. The RWAC's role is to identify regional water-management issues and needs, and establish goals and objectives, plans and projects, and future funding and governance.

Y-M IRWM Plan Meeting
Credit: Pat Garcia

Inclusion of stakeholders and a consensus-driven process have been the cornerstones to the work throughout the Y-M IRWM Plan development process. Extensive stakeholder outreach was conducted to help ensure that the Plan reflects the water-related needs of the entire Region, promotes the formation of regional partnerships, and encourages increased coordination with state and federal agencies. Stakeholder coordination and outreach was initiated for several years prior to the preparation of the IRWM Plan and has been a continual process throughout Plan development. The planning process centered around stakeholder meetings, which were open to the public. Stakeholders were invited to participate through facilitated discussions and review of draft documents; the meetings were announced to a broad distribution list via e-mailed invitations and a notice was published in the newspaper announcing the intent of the group to prepare the Plan as well as to adopt the Plan, with information on how to find more information regarding the process.

IRWM Plan development was iterative as plan content was prepared based on the discussion of each topic, as outlined in Figure ES-2, and then was provided for public review and comment. The draft content was discussed at the meeting and then revised through an iterative process based on comments received by the stakeholders until consensus was reached. As described below, a Plan Review Committee was convened on an as needed basis to assist in refining content and resolving any conflicting comments. At the end of the planning process, the agreed upon content was synthesized into this IRWM Plan for final public review and RWMG member adoption.

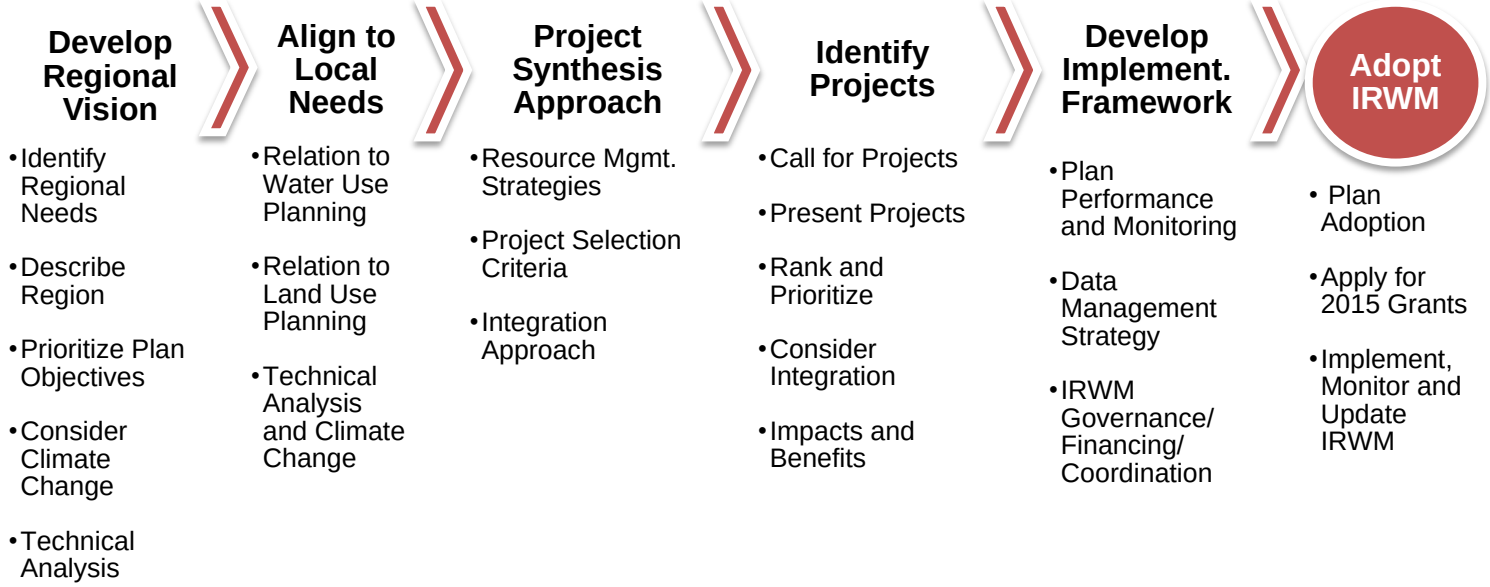
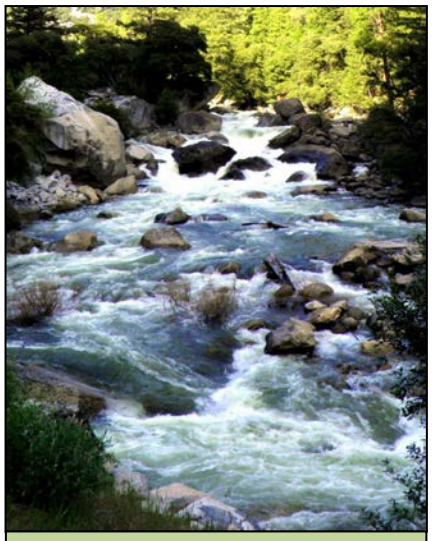


Figure ES-2: IRWM Planning Process Overview

The IRWM Plan will be adopted by the RWMG and any project proponents seeking IRWM program grant funding. An effort will be made to have the Plan adopted by all participants in the planning process, including each of the RWAC members. It is currently anticipated that the Plan adoption will begin once the final IRWM Plan has been released in the summer of 2014.

The Yosemite-Mariposa Region (Section 2)

This section describes the Region, focusing on the natural and manmade features that relate to the water and environmental resources of the Region. As it is impossible to describe in detail a vast region the size of Yosemite-Mariposa in just a few pages, this section introduces the many resources of the Region, and provides context for understanding many aspects of the Plan. For example, the depictions of water-related challenges and opportunities (presented in Sections 2 and 3) are designed to correlate with the objectives in subsequent sections. In this way the Plan incrementally builds an overall understanding of the Region's water management actions that will contribute towards addressing challenges and opportunities introduced in these initial sections.



Merced River
Credit: Kristen Boysen, Sierra Foothill Conservancy

The Region is located on the Western slope of the Sierra Nevada Mountain range entirely in Mariposa County, California bordering the Central Valley as shown on Figure 1-1. The Region has a varied terrain from rolling foothills in the western portion of the Region to rugged mountainous terrain in the east with a land area of about 1,461 square miles (935,228 acres). The Region encompasses much of the high Sierra headwaters of the Merced River which are in Yosemite National Park as well as the foothill watersheds of the lower Mariposa County and the

Fresno-Chowchilla River many of which are in the Stanislaus or Sierra National Forests. Terrain varies throughout the Region from granite peaks exceeding 11,000 feet in the east to grasslands below 1,000 feet at the western border of the Region. Variation throughout the middle of the Region includes conifer forests, glacially carved valleys, mountain meadows, and oak woodlands.

The Yosemite-Mariposa Region is sparsely populated, with approximately half the 18,000 residents living in small communities dotting the western portion of the Region. The remainder of the population resides in rural settings. There are no incorporated cities in Mariposa County although the larger communities include the Town of Mariposa, Yosemite Village, and Lake Don Pedro. Native American Tribes are also important to the region's history and present day culture. During late pre-contact and early contact times the Southern Sierra Miwok inhabited the lower banks of the Merced River and the Chowchilla River, as well as Mariposa Creek with an inhabited range from the Sierra Crest, the divide between the Tuolumne and Merced Rivers, the Fresno River and along the base of the Sierra foothills. They also actively travelled across the Sierra crest.

The water resources of the Yosemite-Mariposa Region have been developed to make use of the abundant water resources in the upper watersheds for agricultural, municipal, and other uses in the Central Valley. West of the Y-M Region, the Merced River and Mariposa Creek eventually flow into the Lower San Joaquin River, a tributary to the Sacramento-San Joaquin Bay-Delta estuary. The Merced River begins high in the Sierra Nevada and provides a reliable, year round water source through rain, snow melt and melting glaciers. Despite the vast surface water originating in the region, groundwater resources make up the majority of the Region's local water supplies. The majority of the Region's groundwater supplies originate from hard rock wells in the plutonic granites of the Sierra Nevada.

Existing and Future Conditions (Section 3)

Section 3 describes the existing and expected future conditions for the Yosemite-Mariposa Region (Y-M Region or Region) that are relevant to water resources management. The information is organized and presented as it relates to the major topic areas of water supply including a water balance, water demands, water-related infrastructure, water quality, flood protection, environmental resources, and the potential effects of climate change. Important information is provided regarding key water management infrastructure (both constructed and naturally occurring), summarizes and presents important water-related data, introduces some of the major challenges, and offers observations about the current water management system.

The Y-M IRWM Plan references and summarizes a number of original source data, technical reports and other information to provide an overview of conditions throughout this IRWM Plan. An IRWM Plan is a high level representation of many important topics, and as such the reference materials should be reviewed for a more comprehensive discussion of the issues raised throughout the Plan.

The section importantly outlines a range of major water related issues, needs, challenges and opportunities that are facing the region in each major category, as follows:

Water Demands

- Balancing local water demand growth with resource availability (especially as related to groundwater) and downstream water export needs
- Water use efficiency programs provide means to efficiently use local supplies

Water Supply

- Local surface supplies are limited and there are significant downstream exports
- Groundwater use is not managed and supply reliability is not well understood
- Climate change effects on supply are unknown

Lake Don Pedro CSD Water Treatment Plant
Credit: Ralph Felix, LDPCSD

Water-Related Infrastructure

- Aging water supply and distribution infrastructure is not being replaced in a timely manner
- Inadequate water storage and resources for adequate community fire protection
- Compliance with wastewater treatment regulatory standards for community wastewater systems and private septic systems

Water Quality Conditions

- Compliance with surface water and groundwater quality regulations
- Management and restoration of impaired surface water bodies
- Protection of groundwater quality
- Improvement of forest and watershed management actions
- Prevention of catastrophic wildfire and mitigation of resulting water quality impacts

Ecological Processes and Environmental Resources

- Protection and restoration of anadromous fisheries, threatened, endangered and sensitive aquatic and terrestrial species
- Restoration of functional wildlife habitat
- Management of the spread of aquatic and terrestrial invasive species

In addition to all of the challenges listed above, climate change is expected to have various impacts on the Region including: 1) changing hydrology due to a shift from snow to rain precipitation, 2) higher fire risk due to warmer, drier conditions over the year, and associated impacts on water quality and flooding, 3) longer and drier conditions over the year, and associated impacts on water quality and flooding, 4) longer and more severe multi-year droughts, 5) more evapotranspiration and thus less runoff from mountain headwaters due to longer annual growing seasons at higher elevations, 6) greater summer water demand from all categories of users and 7) habitats and species shifts.

Relation to Local Water and Land Use Planning (Section 4)

Water resources and land use planning in the Yosemite-Mariposa (Y-M) Region are inherently linked due to the connection between the uses of land (i.e., for rural residences, forestry, agricultural, and other activities) and the ways in which water is conveyed and used (i.e., for both consumptive and non-consumptive uses within and outside the Region). Land use changes that occur without proper planning or collaboration can significantly impact water resources/quality and the availability and reliability of supply for urban, agricultural, and ecosystem benefits. Collaboration between water managers and land use managers can help mitigate land use decisions to avoid detriment to water resources.

The Y-M IRWM Plan in no way replaces or supersedes local planning, but is intended to incorporate and strengthen local planning efforts and results. This Plan will support local water management organizations in making local decisions and taking local actions that help accomplish a shared vision for the whole Region. This section contains a description of how the Y-M IRWM Plan incorporates its water management planning and implementation activities with local resource management planning activities.

The RWAC and land use managers are considering ways in which to improve collaboration on a variety of topics and areas of focus that integrate land and water use planning, such as flood plain management, flood control planning, groundwater management, treatment and conveyance facilities, stormwater management, water conservation efforts, watershed management, recreational area management, land use changes, General Plan updates, water supply for emergency planning, and habitat management.

Goals and Objectives (Section 5)

The goals and objectives presented in section 5 represent the foundational intent of this IRWM Plan. Formulating meaningful and relevant goals and objectives for the Yosemite-Mariposa Region (Region) required more collaboration and collective interaction than the work documented in any other section of this Plan. The goals and objectives were developed over a 6-month period, with four discussions with participants at the main RWAC meetings and an additional two meetings and two conference calls with the Objectives subcommittee. The draft goals and objectives were circulated for review and comment to the RWAC or subcommittee five times to allow for thorough consideration and refinement of what ultimately will direct the Plan.

Table ES-1 provides a summary of the nine identified Plan Goals with their associated objectives and priority levels assigned based on consultation with stakeholders.

Table ES-1: Plan Objectives Prioritization

Plan Goal and Objective	Importance	Urgency
Goal #1: Provide/Improve Reliable Water Supply within the Region		
A. Provide reliable water supplies to meet all domestic water needs in the Region by 2035	High	High
B. Improve understanding of groundwater usage, quality, and reliability throughout key groundwater use areas the Region by 2020	High	Med
C. Promote Water Use Efficiency (WUE) practices throughout the Region and educate 80% of households and businesses by 2020	Med	Med
D. Identify by 2019 and manage and conserve forest, wetlands, and range lands for enhancement of water supply by 2035	High	High
Goal #2: Ensure Reliable Community Water and Wastewater Infrastructure		
E. Assess and identify the current condition of private and community water systems and their plans, if any, for future improvements by 2018	High	High
F. Assess and identify the current condition of community wastewater systems and their plans, if any, for future improvements by 2020	High	Med
G. Rehabilitate or replace aging and inadequate water and waste water distribution/collection, treatment, and disposal infrastructure by 2035	High	High
Goal #3: Maintain or Improve Water Quality in the Region		
H. Identify and prioritize impacted watersheds by 2020	High	Med
I. Conserve and restore 10,000 acres of watersheds through improved forest and rangeland management practices and appropriate land use by 2020. Conserve and restore 20,000 acres by 2035	High	High
J. Implement water quality improvement activities where pollutants are identified by 2035	High	High
K. Promote sustainable ecosystem and vegetation management on agricultural and production land, primarily near riparian corridors in the first five years of the IRWM Program	Med	Med
Goal #4: Protect and Improve Wildlife Habitat		
L. Improve watershed health by preventing the establishment of or reducing/eliminating aquatic and terrestrial invasive species in at least 2 locations per year starting in 2017	High	Med
M. Protect special status and sensitive species and preserve and restore 10,000 acres by 2025 and 20,000 acres by 2035	High	Med
N. Conserve and ensure the presence of unfragmented wildlife corridor habitats	High	Med
Goal #5: Assess and Enhance Recreational Opportunities in the Region		
O. Evaluate existing and potential recreational opportunities by 2019	Med	Med
P. Enhance public access for recreation to waterways by 2035	High	Med

Plan Goal and Objective	Importance	Urgency
Goal #6: Develop Collaborative and Sustainable Partnerships Both Within and in Adjacent Regions		
Q. Identify, review and evaluate the effectiveness of ordinances and county planning related to water management in the Region by 2020	High	Med
R. Develop opportunities/data management system so that current scientific data can be made available to make informed, collaborative choices regarding water resources and land use planning throughout the Planning Period	High	Med
Goal #7: Reduce Risk of Catastrophic Fire		
S. Facilitate and coordinate fuel management policies and strategies in at least two locations per year of high hazard lands in the Region	High	High
Goal #8: Educate Stakeholders and County Residents about Water Issues through the IRWM Process to Inspire Public Action		
T. Use education and outreach annually that maintains or increases watershed stewardship resulting in water quality and ecological improvements	High	Med
Goal #9: Prepare for Impacts of Climate Change		
U. Educate the public regarding the findings of the Climate Change Vulnerability Checklist for the Region by 2015 and periodically update the checklist with updated information	Med	Med
V. Mitigate impacts of climate change by implementing cost-effective renewable energy production in at least one location by 2035 and promoting energy/water use efficiency in the Region	Med	Med
W. Mitigate flood risk associated with climate change by cooperating with Local Hazard Mitigation Planning flood risk updates and educating the public regarding flood prevention and mitigation measures	Med	Med

Resource Management Strategies (Section 6)

The Goals, Objectives, and Strategies presented in Section 5 for the Yosemite-Mariposa (Y-M) Integrated Regional Water Management (IRWM) Plan describe a range of areas in which regional stakeholders intend to improve water-related conditions in the Region over the plan horizon. The broad categorical actions required to achieve the goals and objectives mostly align with the Resource Management Strategies (RMS) identified in the draft California Water Plan (CWP) Update 2013 which are to be considered for applicability in an IRWM Plan. A RMS is a project, program, or policy that helps local agencies and governments manage their water and related resources. A diversified portfolio of RMS will help the Y-M Region to better prepare and mitigate for potential future conditions, such as climate change and severe drought. This section introduces the 36 RMS from the draft 2013 CWP and identifies those selected for inclusion in the Y-M IRWM Plan. Table ES-2 provides a summary of the RMS described in Section 6, divided into six management outcomes.

Table ES-2: Draft 2013 California Water Plan Objectives and RMS Summary

CWP Objectives	Resource Management Strategies
Reduce Water Demand	Agricultural Water Use Efficiency Urban Water Use Efficiency
Improve Flood Management	Flood Management
Improve Operational Efficiency and Transfers	*Conveyance – Delta** Conveyance – Regional/local System Reoperation Water Transfers
Increase Water Supply	Conjunctive Management & Groundwater Storage *Desalination (Brackish and Sea Water)** *Precipitation Enhancement** Municipal Recycled Water *Surface Storage – CALFED/State** Surface Storage – Regional/local
Improve Water Quality	Drinking Water Treatment and Distribution Groundwater/Aquifer Remediation Matching Water Quality to Use Pollution Prevention *Salt and Salinity Management** Urban Stormwater Runoff Management
Practice Resources Stewardship	Agricultural Land Stewardship Ecosystem Restoration Forest Management Land Use Planning and Management Recharge Area Protection Sediment Management Watershed Management
People and Water	Economic Incentives Outreach and Engagement Water and Culture Water-Dependent Recreation
Other Strategies	*Crop Idling for Water Transfers** Irrigated Land Retirement *Waterbag Transport/Storage Technology ** *Dewvaporation or Atmospheric Pressure Desalination** Fog Collection ** *Rainfed agriculture**

* RMS not applicable to Y-M IRWM Plan.

Project Selection and Prioritization (Section 7)

Section 7 describes the project solicitation, development, and review process that was used to select and prioritize projects for inclusion in the Yosemite-Mariposa (Y-M) IRWM Plan. The project review and prioritization process was designed to identify those projects, programs, and actions that contribute towards achievement of the Y-M Integrated Regional Water Management (IRWM) Plan Goals and Objectives as described in Section 5. It is envisioned that a similar process to that described in the following sections will be used for including additional projects in the Plan in the future.

The Project Evaluation Committee (PEC) received 51 project submittals during the Call for Projects which are summarized in Table ES-3. During the March 26, 2014 stakeholder meeting, project proponents were given the opportunity to present their project to the PEC and meeting attendees. The purpose of the project presentations was to provide a better understanding of the projects to improve scoring, identify projects which have potential for integration and determine if there are gaps in meeting the Plan Objectives.

Table ES-3: Project Summary

Project No.	Agency	Title	Total Project Cost
1	County of Mariposa	Replace Water Distribution Piping in Yosemite West Subdivision	$2,900,000
2	County of Mariposa	Develop Second Water Source for the Coulterville community	$700,000
3	County of Mariposa	Water Treatment for Arsenic Exceedance	$500,000
4	County of Mariposa	Replace Sewage Collection Piping in Yosemite West Subdivision	$2,500,000
5	County of Mariposa	Develop Second Water Source for Yosemite West Subdivision	$1,600,000
6	County of Mariposa	Expansion and Repair of Leachfields in the Yosemite West Subdivision	$1,220,000
7	County of Mariposa	Construct a septage collection and metering tank at the Lake Don Pedro Sewage Treatment Plant	$400,000
8	County of Mariposa	Repairs and upgrades to Lake Don Pedro Wastewater Treatment System	$2,200,000
9	County of Mariposa	Install back-up power at Mariposa Pines Sewage Treatment Plant	$225,000
10	County of Mariposa	Replace Water Distribution Piping in Coulterville	$1,480,000
11	County of Mariposa	Replace Sewage Collection Piping in Coulterville	$2,200,000
12	Economic Development Corporation	Mariposa Biomass / Biochar Facility	$5,000,000
13	Lake Don Pedro Community Services District	Lake McClure Deep Water Intake Feasibility Study	$30,000
14	Mariposa Public Utility District	Stockton Creek Watershed Fuel Modification Project	$240,000
15	Mariposa Public Utility District	Mariposa PUD Waste Water Treatment Facility Improvements	$7,300,000
16	Mariposa Public Utility District	Saxon Creek Pump Station Access and Ventilation System Improvements	$150,000
17	Merced Irrigation District	Lake McClure Area Recreation Enhancements	$332,300
18	Point Blue Conservation Science	Rangeland Watershed Initiative Partner Biologist	$180,000
19	Lake Don Pedro Community Services District	Dead End Main Replacement Project	$6,500,000
20	Lake Don Pedro Community Services District	Lake McClure Intake Improvement Project Phase III	$700,000

Project No.	Agency	Title	Total Project Cost
21	Lake Don Pedro Community Services District	Water Service Replacement Project	$3,750,000
22	Lake Don Pedro Community Services District	Treatment Plant Pump Replacement Project	$100,000
23	Lake Don Pedro Community Services District	New potable water well	$125,000
24	Upper Merced River Watershed Council (UMRWC)	Water Quality Monitoring Bioassessment in Upper Merced River Watershed	$25,000
25	Upper Merced River Watershed Council	Merced River Watershed Wildfire Fuel Reduction Project	$750,000
26	National Park Service/Yosemite National Park	Supplement Wawona Water System with Biledo Spring	$17,000,000
27	National Park Service/Yosemite National Park	Rehabilitate The Wawona Wastewater Treatment Plant	$24,000,000
28	Sierra Foothill Conservancy	Bean Creek Meadow Restoration	$372,000
29	Sierra Foothill Conservancy	Conservation Easement	$2,000,000
30	Sierra Foothill Conservancy	Conservation Planning, Phase 2	$50,000
31	Sierra Foothill Conservancy	Stockton Creek Preserve Expansion	$1,500,000
32	Ponderosa Basin Mutual Water Company (PBMWC)	Rural Water Company Infrastructure Rehabilitation	$600,000
33	Mariposa Resource Conservation District (MCRCD)	Invasive Plant Species education and eradication	$600,000
34	Mariposa Resource Conservation District	Drought Preparedness for Landowners and Residents	$86,250
35	Mariposa County Resource Conservation District	Water & Energy Efficiency Incentives Assistance Program	$645,000
36	Yosemite Area Audubon Society	Mariposa Creek Parkway Extensions	$932,000
37	Yosemite Alpine Community Services District	Water Meter Replacement	$50,000
38	Yosemite Alpine Community Services District	Drill well on Yosemite Mtn. Ranch TPZ and pipe water to NEW TANKS.	$500,000
39	USFS, Sierra National Forest, Bass Lake Ranger District	Sierra National Forest Bass Lake Ranger District Fuels Reduction Project - Rush Timber Sale, near Wawona	$1,733,000
40	USFS, Sierra National Forest, Bass Lake Ranger District	Sierra National Forest Bass Lake Ranger District Fuels Reduction Project - Hites-Feleciana Fuels Project , N of Mariposa Pines	$2,533,000

Project No.	Agency	Title	Total Project Cost
41	To be determined. Anticipate National Park Service, Yosemite National Park	Wawona Water Supply and Wastewater Treatment Projects	-*
42	American Indian Council of Mariposa County	Bear Creek Tribal Water Storage Project	$90,500
43	American Indian Council of Mariposa County	Mariposa Creek Native Plants Restoration and Education Project	$87,240
44	American Indian Council of Mariposa County	Invasive Plant Eradication/Native Plant Enhancement, Wawona, Yosemite NP	$81,200
45	Fish Camp Volunteer Fire Association	Drought/Fire Storage with additional wells with distribution pipelines and hydrants	$591,000
46	Mariposa Pines Water Company	Sounding Tube Installation	$2,500
47	Mariposa Pines Water Company	Tank 1 Replacement	$40,000
48	Mariposa Pines Water Company	Hazardous Tree and Brush Removal from Right-of-ways and Improvements	$160,000
49	Mariposa Pines Water Company	Install Power and Telephone Lines (for internet) to Water Tanks	$50,000
50	Mariposa County Resource Conservation District	Private Land Water Storage Improvement Assistance Project	$225,000
51	Mariposa Public Utility District (MPUD)	Waste Water Collection System Improvements	$3,924,000

* No project cost information provided.

As introduced above, the process to decide which projects to include in the Plan and how to prioritize them relied on evaluation of the project scoring criteria, technical judgment about the relevancy of the submitted projects, and project presentations. The projects, programs and management actions submitted by the stakeholders were compiled, reviewed, and scored by the PEC based on the information provided by the project proponents.

Impacts and Benefits (Section 8)

Section 8 provides an overview of the potential impacts and benefits associated with implementation of the Yosemite-Mariposa (Y-M) Region (Region) Integrated Region Water Management Plan (IRWM Plan). Because of the nature of the IRWM planning process, the impacts and benefits discussed here are preliminary and not intended to be a complete list; more extensive and project-specific evaluations of impacts and benefits usually occur through project implementation. This overview may be used as a guide for deeper consideration of, and response to, impacts and benefits encountered during Plan implementation. Later, as plan performance is evaluated, the Y-M Regional Water Management Group (RWMG) may utilize this preliminary assessment to better understand the benefits that have been realized and whether unanticipated impacts have occurred.

Some of the primary benefits from development of the Plan include the strengthened partnerships between local, State, Tribal and Federal entities that may not have happened otherwise. The Y-M IRWM planning process fosters coordination, collaboration and communication among the many entities in the Region that previously had no formal forum for regional collaboration on similar topics. The IRWM planning process is intended to result in greater efficiencies (e.g., efforts are not duplicated, information is shared), enhance public and environmental benefits, and encourage greater public support for projects that are important to sustainable water management.

Implementation of projects will also create lasting physical and institutional benefits throughout the region. While periodic updates and addition of projects will be needed over the 20-year horizon, implementation of the planned projects will produce multiple benefits including improved water quality protection, resource stewardship, reduction in catastrophic wildfire risk, improved water supply reliability, and improved water use efficiency.

Negative impacts that may be associated with the Plan projects include (1) short-term, site-specific impacts related to site grading and construction, and (2) long-term impacts associated with project operation. For the purposes of this Plan, impacts are discussed at a screening level below.

Implementation Framework (Section 9)

The Implementation Framework documents the relationships and decision-making structure recommended for use during the continued development and implementation of the Yosemite-Mariposa Integrated Regional Water Management Plan (IRWM Plan or Plan) over the next 20 years. It also sets forward a proposed framework for Plan implementation and guidelines for performance monitoring to track progress, and it offers suggested initial Plan implementation activities. This section is intended to define the entity (or entities) that will implement the Plan, the responsibilities for Plan implementation and therefore serve as the cornerstone of actions the Region must take to continue the IRWM program into the future.

Once the Yosemite-Mariposa IRWM Plan has been adopted, the focus of the RWAC (signatories to the MOU) and stakeholders will change significantly. Some of the activities conducted prior to and during Plan development will continue, but the emphasis will shift from planning toward implementation of projects and tracking of progress towards achievement of IRWM Plan objectives. Implementation of the Yosemite-Mariposa IRWM Plan will rely on actions taken by existing agencies and organizations within the Region, with the support of the IRWM governance structure.

The narrative that follows summarizes the overall activities of Plan implementation. Table 9-1 describes some of the specific roles and responsibilities and identities of the RWMG/RWAC member that would lead the activity. IRWM Plan implementation is not intended to interfere with or supersede actions taken by local agencies to fulfill the local agencies' authorized duties.

1) Public outreach and involvement processes -
   a) Establish Point of Contact for IRWM Program
   b) Maintain e-mail list
   c) Schedule and announce meetings
   d) Prepare agendas and content
   e) Facilitate meetings
   f) Prepare meeting summaries
   g) Administer website, and update content with meeting materials, and other relevant information

2) Balanced access and opportunity for participation in the IRWM process
   a) Monitor and maintain DAC and Tribal contacts list through notification prior to RWAC meetings

3) Effective Communications External to The Region
   a) Communication external to the Region
   b) Coordination with neighboring IRWM efforts – Sierra Water Work Group and Madera, Tuolumne-Stanislaus, Merced, Inyo-Mono Region IRWMs
   c) Coordination with state and federal agencies (e.g., RWQCB)

4) Long-term implementation of the IRWM Plan
   a) Evaluate Plan performance and monitoring for meeting objectives
   b) Review and act on objectives/targets not accounted for in projects
   c) Gather and synthesize data related to Plan projects and report to stakeholders
   d) Manage and share related data and information (also could be Data Management System)

5) Update Yosemite-Mariposa IRWM Plan
   a) Review and update objectives
   b) Solicit new or revised/integrated projects, provide project evaluation/scoring and regularly revise project and update project priorities, as needed or at a minimum of every 2 years
   c) Review/revise Plan content at least every 5 years

6) Financing Plan Implementation
   a) Evaluate IRWM Plan implementation administration (e.g. local staff in-kind contributions, and/or grants, or other financial sources)
   b) Communicate information on upcoming funding
   c) Improve project integration and select projects for inclusion in grant applications
   d) Prepare and submit grant applications

All organizations and individuals with an interest in improving water management in the Region are invited to participate in Plan implementation. The RWAC recognizes that a committed public outreach and notification process is a necessary task to ensure the public is aware that there are multiple opportunities to become involved in the program. Disadvantaged Communities and Tribes will continue to be an important aspect of outreach in the Region.

Decisions during implementation will continue to be made using consensus based agreement, as during Plan development with matters considered by the entire RWAC. If for some reason broad agreement cannot be reached by 100% of the active members of the RWAC present, within a reasonable amount of time and effort, the matter will be referred to the RWMG for final decision with both majority and minority positions represented. Active participation means that the member has had a representative or alternative in attendance at half or more of the RWAC meetings held within the last year.

Implementation of an IRWM Plan is an enormous undertaking and requires the financial contributions and attention of local, state, and federal agencies to ensure success. Financing of this Yosemite-Mariposa IRWM Plan involves two distinct tracks: funding of IRWM Plan administration through local in-kind staff time and coordination and funding of project implementation. This section highlights the anticipated funding needs for both tracks, identifies potential funding sources, and documents some of the activities that the RWAC and others could employ to secure additional funding. As of March 2014, fifty-one projects are included in the IRWM Plan. All of the projects provided funding information, with a total estimated funding need of $99 million. Of the fifty-one projects, several are projects currently at the early planning or feasibility study stage, which is an indicator that the overall funding needs may increase as these projects progress and are developed into implementable projects, programs, or actions, and as other projects are added to the IRWM Plan.

Although the RWAC is not intending to develop a Data Management System (DMS) to help retain, organize and process key Plan performance and monitoring data, opportunities to do so may be available in the near future as the Sierra Water Work Group is endeavoring to provide interregional data management for the IRWM's in the Sierra Nevada. A data management system provides a web-based geographic information system (GIS) platform which can be used to store and track information to support the Region's understanding of water management activities within the IRWM context. A DMS can assist in the success of Plan implementation, and whether adjustments to objectives, projects, or strategies may be needed in the future.

Coordination (Section 10)

As described in previous sections of this IRWM Plan, management of water and related resources within the Yosemite-Mariposa Region (Region) is complex and has many interdependencies. Several stakeholder groups both have authorities and responsibilities for managing water and related resources within the Region. This complexity and the distributed network of shared responsibilities create the need for robust and effective coordination. This

section describes how the Region intends to continue to coordinate with neighboring IRWM regions and local, state, and federal agencies as well as other stakeholders both within and outside of the Region to improve integrated water management.

The primary benefit of this IRWM Plan is the development of a shared vision and objectives for regional water management and planning among the stakeholders both within and outside of the Region and a framework for maintaining that into the future. The process of developing this IRWM Plan has fostered improved coordination, collaboration, and communication among stakeholders, and a greater awareness of concerns throughout the Region.

A collaborative approach to water management is essential to meeting the Region's goals. Several projects included in this Plan, as described in Section 7, involve multiple agencies or organizations, which reinforces the need for collaboration to achieve efficient project execution. Several of the local water management agencies such as Mariposa County, Fish Camp Fire and Rescue, Yosemite Alpine Community Services District within the Region have developed cooperative relationships and processes for coordination with each other and with other local organizations.

Coordination with state and federal agencies has occurred during the initial formation of the Region and during Plan preparation. In the future, coordination with these agencies will occur on an as-needed basis for planning and implementation of specific projects and during future Plan updates.

Beyond the need for internal coordination, the Region also recognizes the importance of coordination with other nearby IRWM planning regions. Appropriate coordination among regions and agencies can help leverage shared activities, identify opportunities for cooperative projects, and reduce potential conflicts among IRWM projects. The Region is bounded by several neighboring IRWM regions, and is one of twelve IRWM regions in the San Joaquin funding area. The Sacramento funding area borders the Region to the North, the North/South Lahontan funding area borders the Region to the east, and the Tulare/Kern funding area borders the Region to the South.

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Section 1: Introduction

1.1 Introduction

The Integrated Regional Water Management Plan (IRWM Plan) defines a clear vision of the management of water resources in the Yosemite-Mariposa Region (Region) and highlights important actions needed to help accomplish that vision through the year 2035. The Yosemite-Mariposa (Y-M) IRWM Plan is a volunteer, collaborative effort by local agencies, organizations and residents to develop strategies to manage the water resources within the Region. The purpose is to meet long-term water needs. The plan will provide a way for the region to acquire funding to complete projects that address water quality, water supply, safe drinking water, water reliability, flood and stormwater management and ecosystem protections. This IRWM Plan is intended to be an integrated planning tool in compliance with the *Integrated Regional Water Management Guidelines for Proposition 84 and 1E* published by the California Department of Water Resources (DWR) in November 2012. This planning tool will help bring stakeholders together for the foreseeable future and identify, plan, and execute actions to better manage water in the Region and to accomplish more than agencies and organizations could do individually.

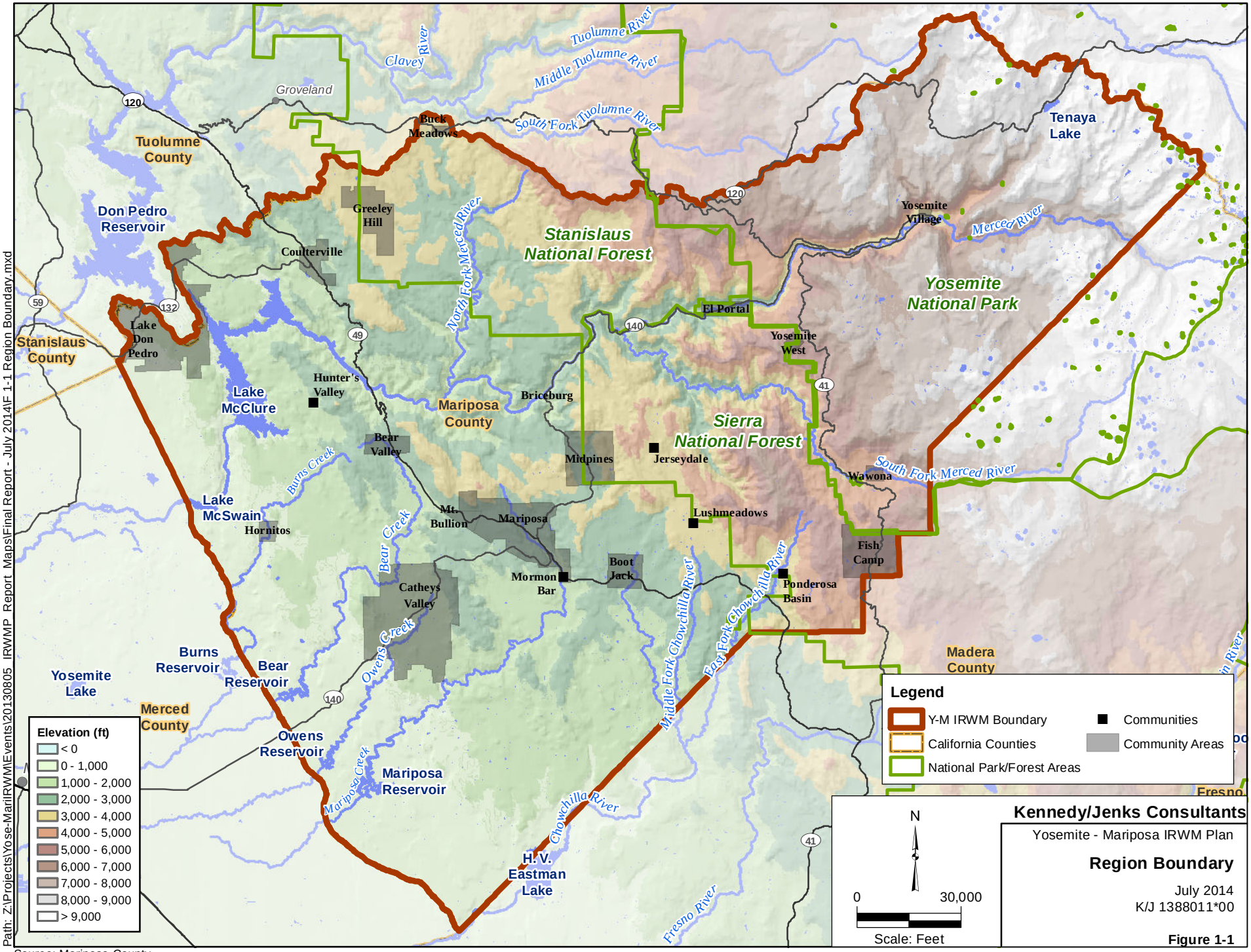
Efforts to compile this plan have taken multiple years and the time and resources of more than 20 water purveyors; local, state and federal agencies; natural resources advocates, and other stakeholders. The effort has resulted in an opportunity to accomplish much more than any one agency could have achieved and has fostered better stewardship of resources throughout the planning horizon. This compilation of integrated goals, objectives, background, resource management strategies, and projects is the product of input gathered from stakeholder involvement, public contributions, research, and technical studies and is custom tailored to meet the needs of the Region.

1.2 Background

1.2.1 Regional Features

Foothills in the Y-M Region
Credit: Kristen Boysen, Sierra Foothill Conservancy

The Region is located on the western slope of the Sierra Nevada Mountain range entirely in Mariposa County, California bordering the Central Valley as shown on Figure 1-1. The Region has a varied terrain from rolling foothills in the western portion of the Region to rugged mountainous terrain in the east with a land area of about 1,461 square miles (935,228 acres). The Region encompasses much of the high Sierra headwaters of the Merced River which are in Yosemite National Park as well as the foothill watersheds of the lower Mariposa County and the Fresno-Chowchilla River many of which are in the Stanislaus or Sierra National Forests. There are numerous alpine lakes and several man-made reservoirs throughout the watershed, including Lake McCLure and Lake McSwain on the Merced River and Bear, Owens, and Mariposa Reservoirs in the Lower Mariposa County group of streams. Despite the significant water and natural resources, the Region is a sparsely populated area with a total population of about 18,000 with no incorporated cities. Larger communities in the Region include Mariposa, El Portal, Yosemite Village, and Wawona as well as smaller communities such as Catheys Valley, Coulterville, Fish Camp and Midpines. A more detailed description of the Region is found in Section 2.

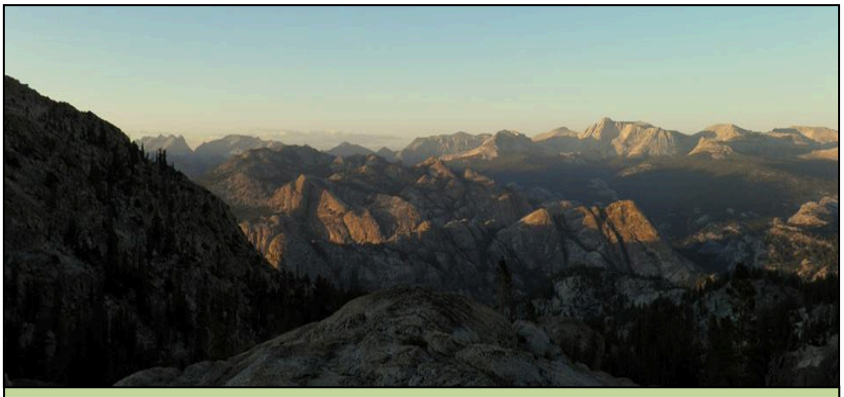


Source: Mariposa County

1.2.2 Primary Goals for the IRWM Plan

This IRWM Plan is the first regional watershed-management plan of its kind in the Y-M Region. Its intent is to address the many major water-related needs/challenges and conflicts within the Region, including water quality, local water supply reliability, and better integration of water and land use management, fuel management for wildfire prevention and resource stewardship and ecosystem protection.

The Y-M Region's landscape is predominantly made up of large forested areas, including 53% of the Region which is managed by Yosemite National Park, the Bureau of Land Management, and the U.S. Forest Service (Sierra and Stanislaus National Forests). Although the Region does not have a large population, the Merced River watershed, which is about 64% of the Region is a major tributary to the San Joaquin River, which combines with other Delta tributaries to provide water for millions of people in the San Joaquin Valley and Bay Area, and water for irrigating hundreds of thousands of acres of prime farmland. Therefore, the protection of the river's many beneficial uses and improvement of water quality is essential to both aquatic ecosystems and human health. Groundwater wells also provide the only source of domestic and municipal supplies for the majority of the residents in the Region, about half of whom are on private wells. For these reasons, preserving and improving surface and groundwater quality in the Region has been identified by stakeholders as a key topic to the continued viability of water resources. Issues such as sediment erosion, mercury contamination, and bacterial contamination are regional water quality concerns addressed in this IRWM Plan.



Sierra Crest Sunset
Credit: Kristen Boysen, Sierra Foothill Conservancy

Water within the Region is supplied mostly from groundwater wells with a limited quantity of surface water diversions. Improvement of water supply sources, reliability, quality, and distribution within disadvantaged communities (DAC) and urban areas is an ongoing need. There are several water systems in the Region that rely on a single source of water supply that put the communities at risk if that source becomes unavailable. The water agencies of the Region continuously strive to improve water supply reliability and quality.

Catastrophic disruptions to the Region's water resources can result from natural disturbances such as fire, and occasionally flooding, and the risk of these disturbances is influenced in part by land use management decisions. Land use decisions must also be balanced with the limited availability of supply, and the risk to water quality some developments can cause – particularly those that rely on onsite wastewater treatment (septic) systems.

Many opportunities exist to improve the general public's understanding of their role in the protection of the Region's water and natural resources. Many individuals and organizations throughout the Region that are interested in the water resource management are already engaged in efforts that support the work of water management entities. However, more can be done to develop and implement broader public education efforts to both local residents as well as

the approximately 4 million visitors per year to further improve stewardship of the Region's precious water resources.

The Region provides hundreds of square miles of habitat for countless species, including a broad range of terrestrial and aquatic, and over 50 state and federally recognized special-status and endangered species including the foothill yellow-legged frog, Yosemite toad, and western pond turtle. Improvement of aquatic and terrestrial habitat to promote the survival, restoration, and growth for these important species, and many others is critical as is to the eradication of invasive species.

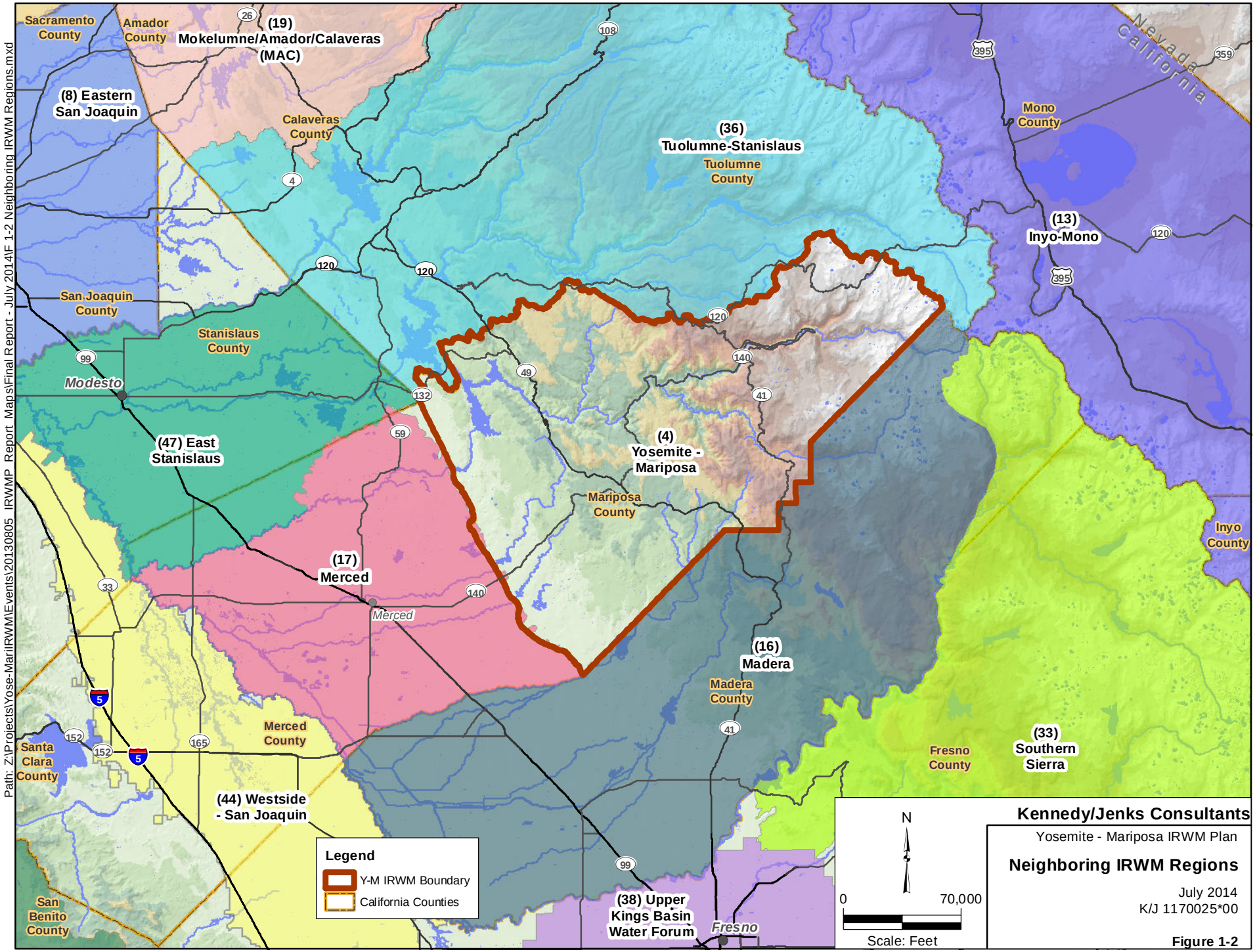
The Region provides an important flood management function as well, since several of the reservoirs, especially in the Mariposa County group of streams watershed, provide important flood protection for large cities downstream in the San Joaquin Valley. Other important issues included in the Plan are: improving efficiency of water systems, water conservation, better management of wastewater discharge/disposal, increasing renewable energy production, and addressing potential local flooding. Many of these topics can be linked to the need to understand the effects climate change may have on these predominately snow-fed surface water systems.

The primary goals of the plan were developed after extensive stakeholder interaction as described in Section 5, and include the following:

- Goal #1: Provide/Improve Reliable Water Supply within the Region
- Goal #2: Ensure Reliable Community Water and Wastewater Infrastructure
- Goal #3: Maintain or Improve Water Quality in the Region
- Goal #4: Protect and Improve Wildlife Habitat
- Goal #5: Assess and Enhance Recreational Opportunities in the Region
- Goal #6: Develop Collaborative and Sustainable Partnerships Both Within and in Adjacent Regions
- Goal #7: Reduce Risk of Catastrophic Fire
- Goal #8: Educate Stakeholders and County Residents about Water Issues through the IRWM Process to Inspire Public Action
- Goal #9: Prepare for Impacts of Climate Change

1.2.3 Formation of the Yosemite-Mariposa IRWM Region

The formation of the Yosemite-Mariposa Region began with the larger CenCal Region that includes a group of stakeholders located in the central portion of California. This Region was submitted in response to the original Proposition 84 Integrated Regional Watershed Management Plan guidelines for the Regional Acceptance Process (RAP). The Mariposa County Resource Conservation District (MCRCD) was the lead agency of the RAP process. The CenCal Region was conditionally accepted during the first RAP round. In a later meeting on July 7, 2010 between DWR, CenCal IRWM, Merced IRWM, and Madera IRWM, the boundary of the CenCal IRWM Region was revised so as to not overlap with neighboring regions and was renamed the Y-M Region. Following the change, the Y-M Region boundary is coincident with the Mariposa County line after the change and is bounded on all sides by other IRWM regions as shown on Figure 1-2. As noted earlier, Yosemite National Park, and the Sierra and Stanislaus National Forests overlap with the Y-M Region and other IRWM regions.


Sacramento County
Amador County
(19) Mokelumne/Amador/Calaveras (MAC)
(8) Eastern San Joaquin
Calaveras County
(36) Tuolumne-Stanislaus
Tuolumne County
Mono County
Nevada
California
(13) Inyo-Mono
San Joaquin County
Stanislaus County
Modesto
(47) East Stanislaus
(4) Yosemite - Mariposa
Mariposa County
Inyo County
(17) Merced
Merced
(16) Madera
Madera County
Merced County
Santa Clara County
(44) Westside - San Joaquin
Fresno County
(33) Southern Sierra
San Benito County
(38) Upper Kings Basin Water Forum
Fresno
Legend
Y-M IRWM Boundary
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Yosemite - Mariposa IRWM Plan
Neighboring IRWM Regions
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Figure 1-2
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1.3 Governance

The governance of the Y-M IRWM includes both a Regional Water Management Group (RWMG) of 5 entities and a broader Regional Water Advisory Council (RWAC) of community representatives who are signatories to a Memorandum of Understanding (MOU) found in Appendix 1-A. In addition there are Agency Partners who are non-voting members of the RWAC. The RWMG and RWAC are described as follows.

1.3.1 Regional Water Management Group

The five entities that comprise the RWMG include Mariposa County Resource Conservation District (fiscal lead agency and resource management entity), Mariposa County Water Agency (Land Use), Mariposa Public Utility District (water purveyor), Lake Don Pedro Community Services District (water purveyor) and Upper Merced River Watershed Council (non-governmental organization). In accordance with the MOU, the RWMG provides overall direction, funding and approval for the IRWM planning process and work products.

1.3.2 Regional Water Advisory Council

The RWAC is comprised of community representatives who are signatories to the MOU. Their role is to identify regional water-management issues and needs; establish goals and objectives, plans and projects, and future funding and governance. The RWAC also conducts outreach and involvement activities to inform and solicit input from the community. In addition to RWAC members, the RWAC has established partners, who are non-voting members who are not signatory to the MOU, but wish to be involved in the IRWM process. Table 1-1 provides the current list of RWAC members and partners. This table also indicates whether they are a member of the RWMG as well as if they have statutory authority over water supply or water management. DWR requires that at least two members of the RWMG include agencies with statutory authority.

Members of the public, non-member community organizations and other interested stakeholders are welcome to attend RWAC meetings and provide input during the public comment period of the meeting.

Table 1-1: RWAC Members

Agency/Organization	Organization Type	Statutory Authority for Water Management	RWMG Member
Economic Development Corporation of Mariposa County (EDC)	Corporation		
Fish Camp Fire/Rescue Association	Non-profit Corporation		
Lake Don Pedro Community Services District (LDPCSD)	Community Services District	X	X
Mariposa County Water Agency	Land Use Authority	X	X
Mariposa County Resource Conservation District (MCRCD)	Special District		X
Mariposa Pines Mutual Water Company	Mutual Water Company		
Mariposa Public Utility District (MPUD)	Special District/Public Utility	X	X
Mariposans for the Environment and Responsible Government (MERG)	Environmental Stewardship, Non-Profit		
Merced Irrigation District (Merced ID)	Special District	X	
Ponderosa Basin Mutual Water Company (PBMWC)	Mutual Water Company		
Sierra Foothill Conservancy (SFC)	Land Conservancy		
Upper Merced River Watershed Council (UMRWC)	Environmental Stewardship, Non-Profit		X
Yosemite Alpine Community Services District (YACSD)	Community Services District		
Yosemite Area Audubon Society (YAAS)	Environmental Stewardship, Non-Profit		
	PARTNERS		
Mariposa County Water Agency Advisory Board	Advisory Board		
Central Sierra Watershed Committee	Environmental Stewardship, Non-Profit		

1.4 Stakeholder Coordination and Outreach

1.4.1 Overview of the Stakeholder Coordination and Outreach Process

Inclusion of stakeholders and a consensus-driven process have been cornerstones to the work throughout the Y-M IRWM Plan development process. Extensive stakeholder outreach was conducted to help ensure that the Plan reflects the water-related needs of the entire Region, promotes the formation of regional partnerships, and encourages increased coordination with state and federal agencies. The term stakeholders is used to refer to representatives of agencies, NGOs, nonprofit groups, governmental organizations and the public who were interested and participated in the development of the IRWM Plan.

Y-M IRWM Plan Meeting
Credit: Pat Garcia

A benefit of the IRWM process is that it brings together a broad array of groups into a forum to discuss and better understand shared needs and opportunities. Members of the RWAC and other stakeholders participated in monthly stakeholder meetings, reviewed meeting materials that included handout materials prepared to discuss plan content, draft IRWM Plan sections, and provided extensive collaborative input to shape this IRWM Plan. In addition, through participation in meetings, stakeholders have been exposed to a variety of opportunities for discovering and establishing mutually beneficial partnerships.

Stakeholder coordination and outreach were initiated for several years prior to the preparation of the IRWM Plan and has been a continual process throughput plan development. A summary of meetings associated with the Y-M IRWM Plan is summarized in Table 1-2 and meeting summaries are included in Appendix 1-B. Outreach was managed and coordinated by the Public Outreach Committee (POC) made up of stakeholder volunteers who met on a regular basis. Outreach in the Region was a challenge due to the dispersed population, but efforts were made to connect with many residents by attending community meetings throughout the County. The public was also invited to attend RWAC meetings held in Mariposa.

Table 1-2: Summary of Yosemite-Mariposa Meetings

Meeting No.	Date	Key Topics	No. of Attendees
Summary of Development Work by the RWMG	June 29, 2011 Nov. 28, 2012	14 RWMG meetings and 17 sub-committee meetings were held to develop Planning Grant and Facilitation Support Services applications, governance and interregional MOUs, review and refine objectives, discuss potential water studies and public/DAC outreach, align project concepts with statewide priorities and hear presentations from member agencies and educational speakers. Meeting facilitation training classes were also held.	RWMG Avg. =17 Sub-com Avg. =7
1	12/6/2012	Governance-Updated MOU Adopted	14
2	1/24/2013	Application Update, Public Outreach, Invoicing	17
3	3/27/2013	Climate Change, Public Outreach Plan	20
4	5/22/2013	DWR Agreement, Outreach, Governance	23
5	6/26/2013	Regional Goals, Public Outreach	21
6	7/24/2013	Objectives, Outreach, Contracts	29
7	8/28/2013	Objectives, Region Description	23
8	9/25/2013	Objectives, RMS, Table of Contents, Region Description	24
9	10/23/2013	Region Description, Relation to Local Land Use Planning, Relation to Local Water Planning	27
10	12/4/2013	Outreach, Objectives Prioritization, Existing & Future Conditions, Project Selection Criteria	38
11	1/22/2014	Technical Studies, RMS, Project Selection Criteria Process	38
12	2/26/2014	Call for Projects, Climate Change Vulnerability, Region Description, Goals & Objectives, RMS	36
13	3/26/2014	Project Presentations, Project Evaluation Process	35
14	4/23/2014	Climate Change, Project Evaluation Process, Drought Funding, Future Governance	33
15	5/28/2014	Drought Funding, Future Governance, Accelerated Plan Schedule	19
16	6/25/2014	IRWM Plan Process Overview and Plan and MOU Adoption Process	20

1.4.2 Stakeholders

A list of all of the agencies and organizations that were involved in the development of the Y-M IRWM Plan is provided in Table 1-3. The broad array of stakeholders includes the agencies that constitute the RWAC, as well as an extensive mix of regulatory, environmental, tribal and land use planning entities that represent all areas of the Y-M Region including:

- Municipal and County Governments
- Wholesale and Retail Water Purveyors, Wastewater Agencies, and Special Districts
- State and Federal Regulatory and Resource Agencies
- Environmental Community
- Tribal Community
- Disadvantaged Community
- Others

Table 1-3: Participating Stakeholders

County Governments	Tribal Community
Mariposa County	American Indian Council of Mariposa

Wholesale and Retail Water Purveyors, Wastewater Agencies, and Special Districts	State and Federal Resource Agencies
Mariposa Public Utilities District (MPUD)	National Park Service (NPS)
Mariposa County Water Agency	United States Forest Service (USFS)
Yosemite Alpine Community Services District (YACSD)	Bureau of Land Management (BLM)
Yosemite West Maintenance District	USDA Natural Resources Conservation Service
Mariposa Pines Mutual Water Company	Department of Water Resources (DWR)
Merced Irrigation District (Merced ID)	Cal Fire
Ponderosa Basin Mutual Water Company (PBMWC)	Office of Emergency Services-Mariposa County
Mariposa Co. Resource Conservation District (MCRCD)	Department of Fish and Wildlife
Lake Don Pedro Community Services District (LDPCSD)	
Environmental Community	**Disadvantaged Community**
Mariposans for the Environment & Responsible Govt. (MERG)	Catheys Valley
Sierra Foothill Conservancy (SFC)	Coulterville
Upper Merced River Watershed Council (UMRWC)	Fish Camp
Yosemite Area Audubon Society (YAAS)	Greeley Hill
Point Blue Conservation Science	Hornitos
Sierra Club Tehipite Chapter	Midpines
	Mariposa

Other	
Fish Camp Fire Rescue Association	Mariposa County Fire Safe Council
Economic Development Corp of Mariposa County (EDC)	Inyo-Mono IRWMP
Madera RWMG	Mariposa County Water Agency Advisory Board
Merced Regional Advisory Council	Wawona Area Property Owners Association
Mariposa County Fire Department	Wawona Town Planning Advisory Committee
Sierra Water Workgroup	Central Sierra Watershed Committee
	Merced Regional Advisory Council

1.4.2.1 County Governments

Mariposa County is the only county in the Region. County staff and several county supervisors participated in the IRWM Plan process through the identification of issues, information on local public health and land use and planning activities, formation of objectives, development of projects and discussion in meetings. The County also helped to initiate the IRWM process for the Region and continued to play a part throughout the plan development.

1.4.2.2 Wholesale and Retail Water Purveyors, Wastewater Agencies, and Special Districts

The participation of agencies with water management including water purveyors and wastewater collection focus was particularly important to the IRWM Plan process as some of the greatest needs in the Region are associated with infrastructure to serve many of the County's residents.

1.4.2.3 State and Federal Regulatory Resource Agencies

With the majority of the Region being forested lands, the regulatory agencies play a key part in the integration of the plan. Federal agencies manage a large portion of these forest lands, while state agencies and districts, such as CAL FIRE and local fire entities are integral in the protection of the citizens in the privately held forest lands.

1.4.2.4 Environmental Community

Several of the stakeholder organizations exist to protect, analyze, or monitor the natural environment against misuse or degradation from human interaction and natural disasters such as wildfires. These organizations are part of the local environmental community and play a role in the planning process in order to minimize the impact of development decisions and to advocate for and implement watershed restoration activities.

1.4.2.5 Tribal Community

While there is one tribal community, the Southern Sierra Miwok Nation, currently centered in the Region, there are several others such as the North Fork Mono Tribe and the Picayune Rancheria of the Chukchansi Indians, whose peoples have cultural ties to the Region but are now centered elsewhere. Together, these tribes have a long and rich cultural history that is rooted in the Region.

1.4.2.6 Disadvantaged Community (DAC)

As described in greater detail in Section 2, the majority of the Region, outside of Yosemite National Park, is economically disadvantaged (i.e., has a median household income (MHI) less than 80% of the statewide MHI) which has posed challenges for planning and opportunities to provide assistance through the IRWM process.

1.4.2.7 Others

Other entities involved in the planning process were representatives from Fish Camp Fire Rescue Association, Mariposa County Fire Safe Council, and Wawona Area Property Owners Association as well as representatives from adjacent IRWM Plans. Several private citizens with interests in water and resource management were also in regular attendance.

1.4.3 Community Outreach Overview

The planning process included community outreach focused on building involvement and interest for a wide variety of stakeholders to recognize the diverse regional and local interests. The planning process centered on public stakeholder meetings. Stakeholders were invited to participate through facilitated discussions and review of draft documents; the meetings were announced to a broad distribution list via e-mailed invitations. All meeting materials were made available on the website after each meeting.

Public outreach activities occurring throughout the process included:

- Stakeholder Meetings – As summarized in Table 1-2, over 15 stakeholder meetings were held prior to the preparation of the IRWM Plan and an additional 15 meetings were held throughout the IRWM process. These meetings provided background on the planning process, facilitated development of Plan goals and objectives, considered opportunities for coordination among local and regional agencies, presented Plan sections to provide opportunity for comments on Plan sections, identified potential projects, and discussed project selection criteria, as well as Plan governance. In addition to the monthly RWAC

meetings, community outreach at meetings within the Y-M Region was headed by the public outreach committee.

- Informational Brochure – A brochure was mailed to all residents in the Region to provide information about the IRWM process, how to participate, and the groundwater sampling program open to residents.

- Review of Plan Sections – The sections of the IRWM were drafted incrementally and provided to stakeholders for review and input at multiple points during the Plan development process. Materials were accepted and finalized only after the stakeholders reached consensus.

- Website – The Y-M website (http://www.mcrcd.net/Pages/IRWMP.aspx) was published on part of MCRCD's website. As noted previously, handouts distributed at each stakeholder meeting were posted on the website after each meeting. Additional information regarding the IRWM Plan was also posted to this webpage.

- Electronic and Written Communication – Email was the main tool used to maintain stakeholder communication and engagement. The email list, which contained approximately 100 entries, was used to invite stakeholders to the meetings and provide materials for review.

- Contact Information – Consultant contact and MCRCD staff contact information were made available to any stakeholder or interested party to ask questions about the IRWM Plan and to receive feedback.

- Notices to Prepare and Adopt the IRWM Plan – Notices to Prepare and Adopt the IRWM Plan were published in accordance with Government Code §6066 in the local newspaper the Mariposa Gazette and are found in Appendix 1-C.

1.4.3.1 Disadvantaged Communities Outreach

A special effort during the IRWM Plan process was made to include DACs by making presentations at meetings of community groups. A significant portion of the Region qualifies as a DAC but is sometimes hard to contact due to the sparse population. Although no organizations specifically addressing Environmental Justice (EJ) concerns have been identified in the Region, opportunities to address EJ issues were coordinated with DAC outreach as appropriate.

1.4.3.2 Tribal Outreach

Consistent with the 2009 Update to the California Water Plan, the Y-M RWMG has used the term "California Native American Tribe" to signify all indigenous communities of California including those that are not federally recognized. The purpose of tribal outreach as part of the IRWM plan was to engage and identify issues and ultimately projects specific to water resources that would benefit each tribe. Early in the project, the California Native American Heritage Commission was contacted to provide information and participate in the planning process. Contact was made with fourteen individuals, most of whom were with the American Indian Council of Mariposa County and North Fork Rancheria. Representatives of these groups participated in meetings to gather information and identify projects beneficial to the tribes. Three tribal projects are included in the IRWM Plan.

1.4.4 Neighboring IRWM Regions

Given the Y-M Region's location in the California Sierra Nevada mountain range and extending to the Central Valley, it shares significant water resources with the surrounding regions. The Y-M Region is bounded by four regions: East Stanislaus, Merced, Madera, and Tuolumne-Stanislaus as shown on Figure 1-2. The Tuolumne-Stanislaus Region shares Yosemite National Park, a significant resource for both Regions. The Madera IRWM Region shares a portion of the headwaters of the Merced River watershed as well as some of the smaller water features with the southeastern portion of the Y-M Region. The Y-M Region is most interconnected with the Merced IRWM Region, which relies on the Merced River watershed for the bulk of its water supplies.

1.5 Plan Development

The IRWM Plan development process was organized around monthly stakeholder meetings. The topics and plan sections were introduced and discussed during the meetings. Stakeholders were provided the opportunity to review the content and sections prior to the meetings and submit written comments after the meetings. Content was then drafted and finalized by a consultant team led by Kennedy/Jenks Consultants.

The key topics discussed during the Plan development process are outlined in Figure 1-3. These topics consist of content items defined in DWR's published standards for IRWM Plans (see Proposition 84 and Proposition 1E Integrated Regional Water Management Grant Program Guidelines; November 2012). Although not specifically highlighted in Figure 1-3, the IRWM Plan Standards for stakeholder involvement and coordination were a key topic addressed throughout the process, as described in Section 1.4.

IRWM Plan development was iterative as plan content was prepared based on the discussion of each topic and then was provided for public review and comment. The draft content was discussed at the meeting and then revised through an iterative process based on comments received by the stakeholders until consensus was reached. As described below, a Plan Review Committee was convened on an as needed basis to assist in refining content and resolving any conflicting comments. At the end of the planning process, the agreed upon content was synthesized into this IRWM Plan for final public review and RWMG member adoption.

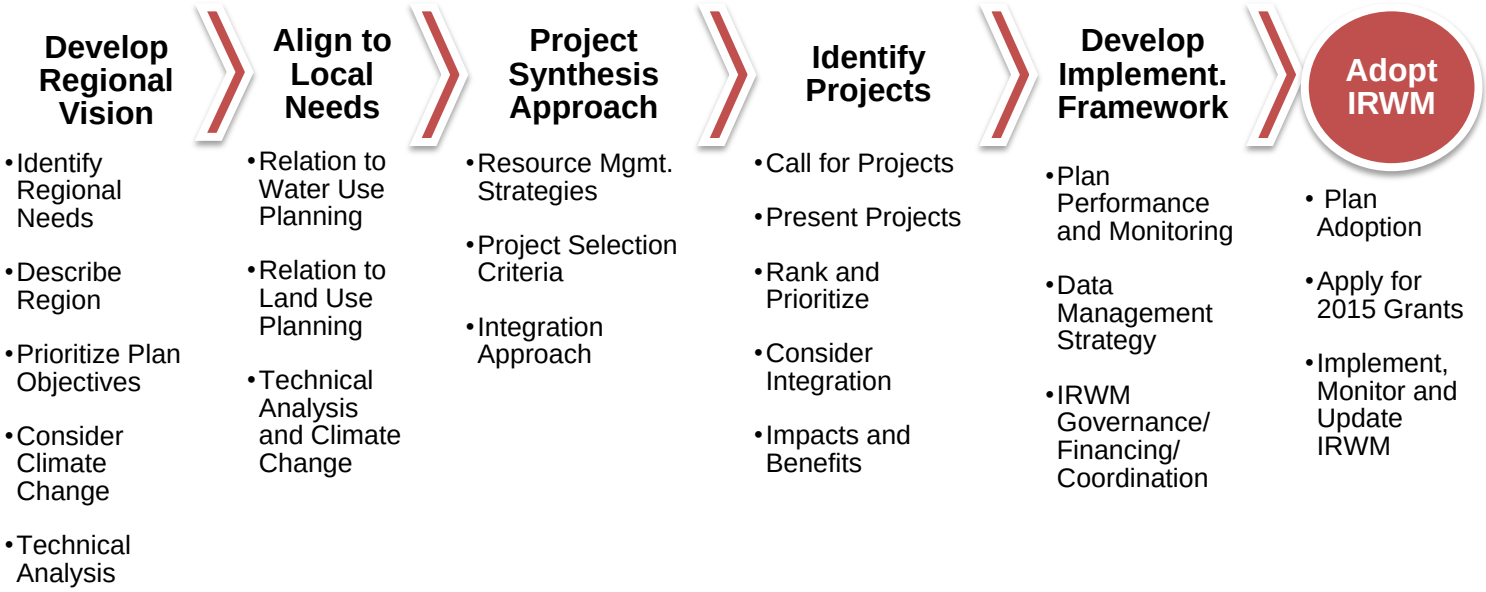

Figure 1-3: IRWM Planning Process Overview

1.5.1 Subcommittees

Subcommittees were formed during the process of developing the plan to allow for a more in-depth discussion of certain topics. These specialized committees focused on a single topic and were able to work more efficiently than in the large group setting. The committees met on a regular basis to participate and assist staff and consultants in matters that required more extensive stakeholder feedback. The subcommittees formed during the planning process are listed in Table 1-4.

Table 1-4: IRWM Plan Committee Participating Agencies

IRWM Plan Subcommittee Topic	Participating Agencies
Steering	Mariposa County Water Agency, MCRCD, MPUD, Sierra Nevada Conservancy (SNC)
Request for Proposals (RFP)	Mariposa County Water Agency, MCRCD, MPUD, MERG, Fire Safe Council, SNC
RFP Vendor Conference	LDPCSD, MPUD, MCRCD, Mariposa County, Mariposa County Water Agency Advisory Board, Mariposa Fire Safe Council, MERG, UMRWC, SNC
RFP Selection	MCRCD, MPUD, Mariposa County Water Agency, MERG, Water Agency Advisory Board
Application Review	MCRCD, MPUD, Mariposa County Water Agency, UMRWC, Merced ID, SNC
Objectives	MPUD, Merced ID, Sierra Foothill Conservancy (SFC), Fish Camp Fire Rescue Association, Yosemite Area Audubon Society
Public Outreach	Mariposa County Water Agency Advisory Board, Upper Merced River Watershed Council (UMRWC), Mariposans for Environmentally Responsible Government (MERG)
Project Evaluation	Mariposa County Water Agency, MPUD, MERG, SFC, MCRCD, UMRWC
Plan Review	All Member Agencies and Organizations

1.5.2 Plan Organization

The Region IRWM Plan is organized as a narrative, telling the story of the water-related conflicts, challenges and opportunities and how they shape the Region's goals and objectives. The Plan includes all elements required by the IRWM guidelines but has slightly different section headings to better fit the Region.

Table 1-5: Proposition 84 Required Elements Included in the Plan

IRWM Standard	Primary IRWM Plan Section
A. Governance	1, 9
B. Region Description	2, 3
C. Objectives	5
D. Resource Management Strategies (RMS)	6
E. Integration	7
F. Project Review Process	7
G. Impact and Benefit	8
H. Plan Performance and Monitoring	9
I. Data Management	9
J. Finance	9
K. Technical Analysis	3, Appendix 3-B & C
L. Relation to Local Water Planning	4
M. Relation to Local Land Use Planning	4
N. Stakeholder Involvement	1
O. Coordination	10
P. Climate Change	2,3

1.6 Plan Adoption

The IRWM plan will be adopted by the RWMG and any project proponents seeking IRWM program grant funding. An effort will be made to have the plan adopted by all participants in the planning process, including each of the RWAC members. It is currently anticipated that the plan adoption will begin once the final IRWM plan has been released in the summer of 2014. Additional information regarding the Plan adoption process and recommendations will be provided in later sections.

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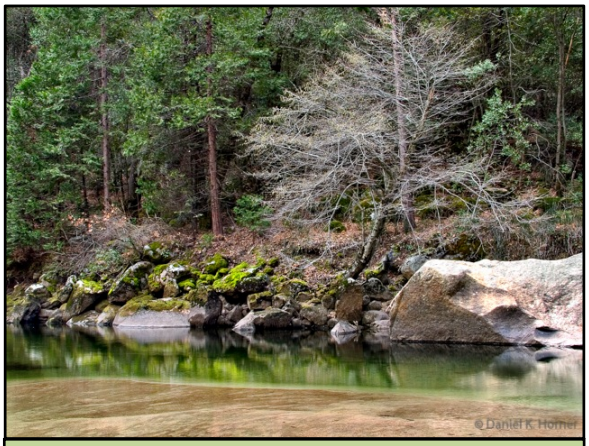
Section 2: Region Description

2.1 Introduction

Section 2 that follows focuses on many of the facts of the Yosemite-Mariposa Region (Y-M Region, Region) such as climate data, population, socioeconomics, geographic features, and hydrologic boundaries. When combined with Section 3: Existing and Future Conditions, both sections collectively address the IRWM Plan Guidelines of Proposition 84 for the Region Description standard.

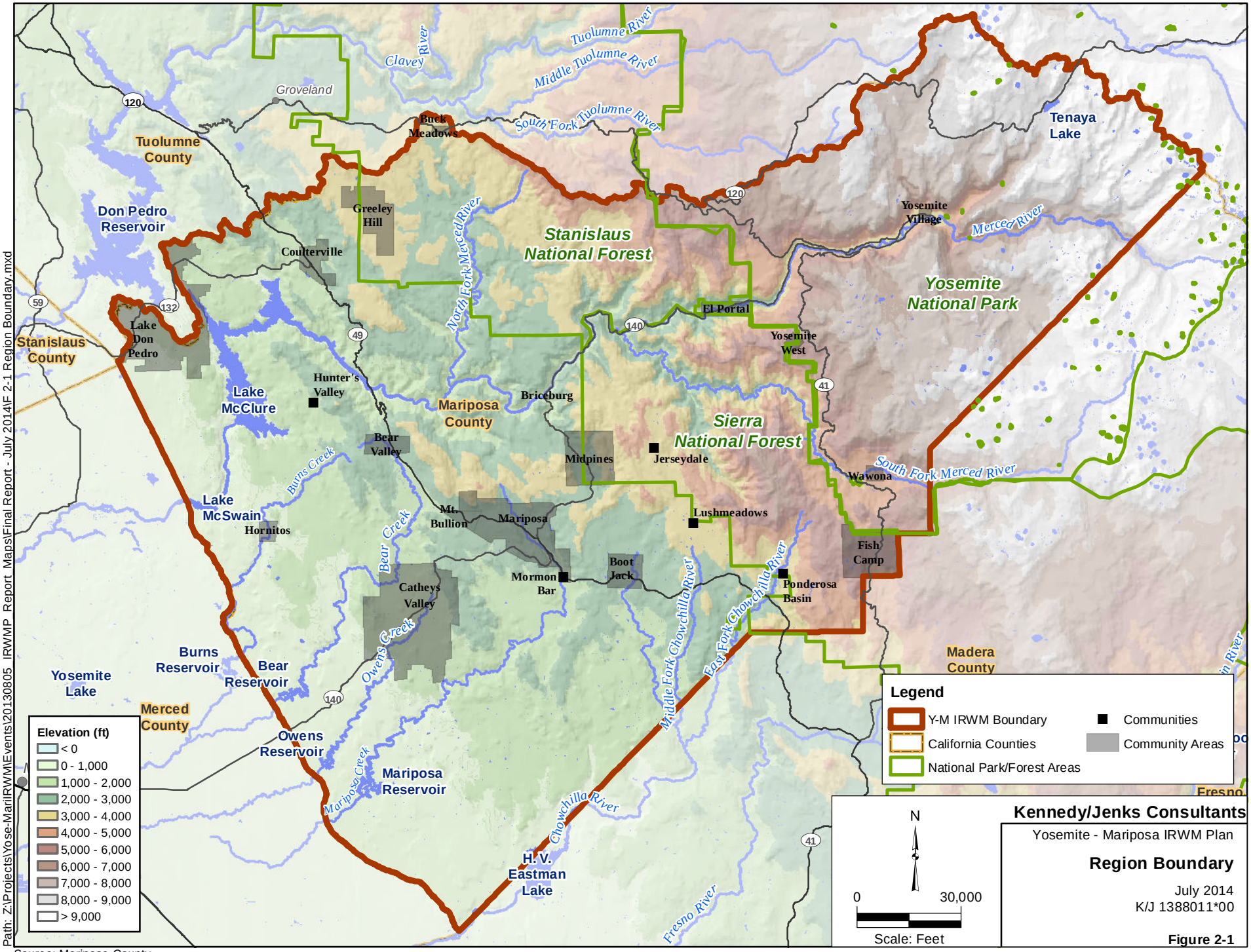
This section describes the Region, focusing on the natural and manmade features that relate to the water and environmental resources. As it is impossible to describe in detail a vast region the size of Yosemite-Mariposa in just a few pages, this section introduces the many resources of the Region, and provides context for understanding many aspects of the Plan. For example, the depictions of water-related challenges and opportunities (presented in Sections 2 and 3) are designed to correlate with the objectives in subsequent sections. In this way the Plan incrementally builds an overall understanding of the Region's water management actions that will contribute towards addressing challenges and opportunities introduced in these initial sections.

2.2 Region Overview

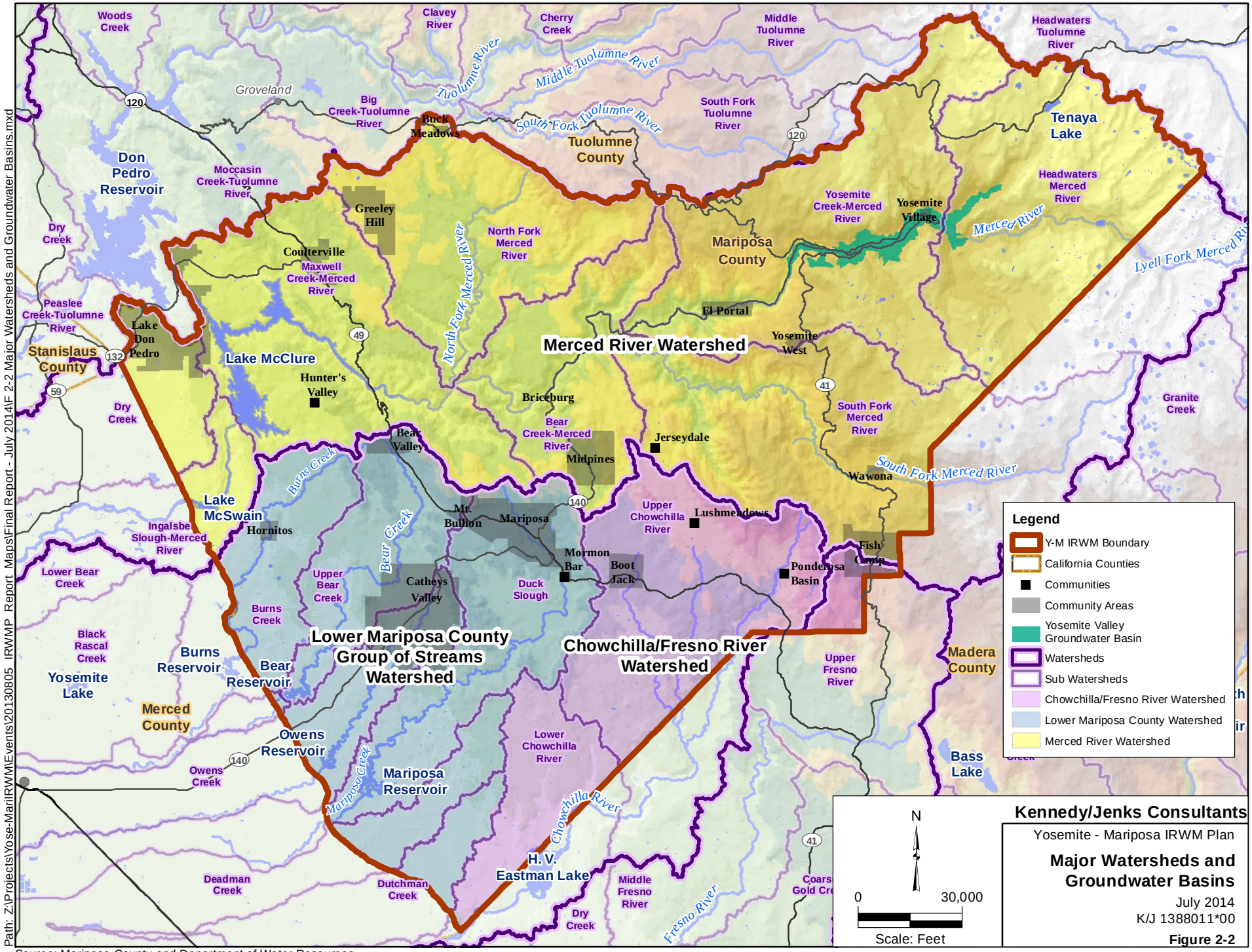


Cascades, Winter Riverbank
Credit: Dan Horner

The Y-M Region encompasses the entirety of Mariposa County, located in central California, adjacent to the San Joaquin Valley and is part of the historic Mother Lode region along the western slope of the central Sierra Nevada Mountains. The Y-M Region spans from forested National Park and National Forested lands to rolling oak woodlands in the foothill areas. The vast area and history bring unique physical characteristics and land ownership/management, but are brought together through their common linkage in sharing forests and waterways. Terrain varies throughout the Region from granite peaks exceeding 11,000 feet in the east to grasslands below 1,000 feet at the western border of the Region. Variation throughout the middle of the Region includes conifer forests, glacially carved valleys, mountain meadows, and oak woodlands. The impact of glaciation and water erosion throughout Yosemite National Park and Yosemite Valley have created the remarkable valleys, mountain meadows and other physical features for which the Region is renowned. The Region boundaries, topography, and key physical features are shown on Figure 2-1, with the hydrologic watershed boundaries and groundwater basins depicted on Figure 2-2.



Source: Mariposa County



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Major Watersheds and Groundwater Basins

July 2014

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Figure 2-2

Source: Mariposa County and Department of Water Resources.

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The Region includes portions of several watersheds including the Merced River, Lower Mariposa County Group of Streams, and the Chowchilla/Fresno (Department of Water Resources). The overall land area of each watershed is summarized in Table 2-1. Almost the entire upper Merced River watershed from high Sierra sources to dams at Lake McClure and McSwain lies within the Region with headwaters primarily on public lands: Yosemite National Park, Stanislaus National Forest, Sierra National Forest and BLM land (the headwaters of the Merced River is in Madera County). Downstream of Lake McClure and McSwain, the lower Merced River continues westerly to the west ending at the confluence with the San Joaquin River in Merced County. Similarly, upper tributaries of the Chowchilla and Fresno Rivers are in the Y-M Region but flow southerly to reservoirs in the adjacent Madera IRWM Region to the south. Other bordering regions include the Tuolumne-Stanislaus IRWM Region to the north, the Inyo-Mono IRWM Region to the east and the East Stanislaus IRWM Region to the northwest.

Table 2-1: Y-M Region Watershed Areas

Watershed	Acres within Region	Square Miles within Region	Percent of Total Region
Merced River Watershed	595,204	930	64
Lower Mariposa County Group of Streams Watershed	211,838	331	23
Chowchilla/Fresno River Watershed	128,186	200	13
Total Area within Region Boundary	935,228	1,461	100

Note: Total acreages of each watershed are only the portions of the watersheds located within the Y-M Region.

The Yosemite-Mariposa Region is sparsely populated, with approximately half the 18,000 residents living in small communities dotting the western portion of the Region. The remainder of the population resides in rural settings. There are no incorporated cities in Mariposa County. The larger communities include the Town of Mariposa with approximately 2,173 residents, Yosemite Village with approximately 1,035 residents, and Lake Don Pedro subdivision with a population of just fewer than 1,077. The majority of the land contained in the Region is unincorporated public lands managed by federal agencies including; the National Park Service (NPS), Bureau of Land Management (BLM), and the United States Forest Service (USFS).

The Region boundary is wholly included within the San Joaquin Funding Area as defined by the California Department of Water Resources (DWR) and was previously proposed to be included in a larger “Central California” IRWM Region. Under the direction of DWR to eliminate any areas of overlap, the “Central California” region was redefined and included formation of the Yosemite-Mariposa region. Ultimately three regions: Yosemite-Mariposa, Madera, and Merced were established in collaboration with DWR.

2.3 History of Water Development in the Region

The abundant water resources of the Yosemite-Mariposa Region have been developed for agricultural, municipal, and other uses in the Central Valley. West of the Y-M Region, the Merced River and Mariposa Creek eventually flow into the Lower San Joaquin River, a tributary to the Sacramento-San Joaquin Bay-Delta estuary. The Merced River begins high in the Sierra Nevada and provides a reliable, year round water source through rain, snow melt and melting glaciers. As a result, the upper watersheds of the Central Sierra have historically provided reliable water sources for the San Joaquin Valley; meeting needs of agricultural and municipal water users, and contributing to recharging groundwater basins. Within the Region, the water conveyed by the Merced River and other tributaries is a critical resource that supplies both Merced and Mariposa Counties with surface water and helps alleviate the draw on limited groundwater supplies. The Merced River and other tributary waterways provide invaluable ecosystem habitat, water supply, and sources of renewable hydroelectric power generation.

Lake McClure
Credit: Kristen Boysen, Sierra Foothill Conservancy

The following description of the historical human influences on water supply development and use in the Region provides essential context for understanding some of the complex relationships that surround water management, and the way these relationships have affected the water resources landscape over time. Historical understanding also provides a common foundation for addressing the Region's challenges and opportunities in the IRWM Plan.

2.3.1.1 Early History

The earliest known indigenous people of the Y-M Region are the Southern Sierra Miwok Nation, who have occupied their traditional territory for approximately 10,000 years. The indigenous people served as the first stewards of the water and other natural resources (Mariposa County 2006). Ethnohistoric information suggests that the inhabited range of the Southern Sierra Miwok extended approximately from the watershed division between the Tuolumne River and the Merced River on the north, the Sierra crest on the east, the Fresno River on the south, and to a line along the base of the Sierra foothills on the west. The Miwok occupied the lower western foothills of the Sierra and entered from the west, but actively travelled across the Sierra crest for trade and resource procurement. Representatives of the Miwok Tribe are still present in the Region today. (InteResources Planning, Inc., 2013)

2.3.1.2 19th Century

Before the discovery of gold, few westerners settled within the Region. Near the mid-1800s development was spurred by the gold rush that resulted in many settlements developed to support the mining activity including: Bagby, Coulterville, Mormon Bar, Haydensville (renamed Bear Valley), Hornitos, Greeley Hill, Mt. Bullion, Catheys Valley, and Wawona (County of Mariposa, 2006). Miners settled along waterways where they could placer mine. As mining developed, streams were engineered to support more efficient surface mining techniques and waterways were modified. Beginning in 1849, with the opening of the Mariposa Mine, the first stamp mill in the county, commercial mining began to transition to hard rock mining. In addition to hard rock mining, some areas were drag-line dredged in the early 1900s such as Mormon Bar, located in south-central Mariposa County (County of Mariposa, 2006).

As the 1850s came to a close, people were coming to the foothills more for its grazing and farming land than the gold in the mines (VM, 1998). Employment was offered on a seasonal basis by ranchers and some held mining claims on major streams which were to be worked sporadically. Many of the pioneer families who still live in Mariposa County were established. In 1864, Congress passed the Yosemite Grant Act giving guardianship of the Yosemite Valley and the Mariposa Grove to the State of California "upon the express conditions that the premises shall be held for public use, resort, and recreation," thereby helping protect the park from excessive development (Sierra Club, 2013). This act alone saved these mountain features for future generations. By 1913, all the properties were in the hands of the federal government and became the complete Yosemite National Park.

2.3.1.3 Development of Natural Water Systems and Water Supply Infrastructure

The rise of agriculture in the San Joaquin Valley during the early 1900s led water purveyors outside of the Region to build water infrastructure, including the creation of Exchequer Dam initially in 1926 and replaced in 1967 and McSwain dam just downstream near the Mariposa County line creating Lakes McClure and McSwain respectively in order to provide storage for hydroelectric power generation, and secure water supplies for agricultural and municipal water users in Merced County. Other small dams and impoundments were also constructed on some of the smaller watersheds in the Y-M Region. These facilities helped to regulate and control natural waterways to provide a seasonal water source for much of the year for both local and distant users. Limited water supply infrastructure was developed as the larger communities were formed. Residents outside these communities without access to community based water distribution systems relied and commonly still rely on individual domestic wells, stock ponds, rain water cisterns, and seasonal creeks for water supplies.

2.4 Population and Economic Conditions

The Y-M Region is characterized by an aging and slow growing residential population, with 38% of the population at 55 years or older and a projected population growth of only 12% by 2020. The Region provides a world-renowned travel destination and experiences an annual influx of over 3.8 million visitors that visit Yosemite National Park and other areas of interest such as the Stanislaus Forest, Sierra National Forest and BLM land. This influx occurs primarily in a 5-6 month period during the warmer months of the year. As a result, hotels and restaurants make up the Region's cornerstone industries, in addition to livestock production and government agencies. The Region has a strong middle class and a stable, educated workforce, however, despite generally low population growth rates; job growth has been unable to keep pace with employment needs. As a result, a large portion of the Region's workforce commutes to jobs in neighboring counties where employment opportunities are more available.

Downtown Coulterville
Credit: Pat Garcia

2.4.1 Population

The current population estimate for the Region is 18,251 according to the 2010 US Census. This makes the Y-M Region a very low population density consistent with a rural makeup, averaging 13 persons per square mile compared with a 240 persons per square mile statewide average. Historically, the Region has experienced sporadic population growth and declines, with overall slow growth. Between 1930 and 1970, the population grew by less than 3,000 to a population of barely over 6,000. After significant positive growth between 1930 and 1940, the population again declined until 1960. The most significant growth in the Region since 1930, was then seen between 1970 to 1980 when the population grew by 86 percent. The population in the Region continued its rapid growth in the 1990s, approximately 20% over the decade, and leveled off from 2000 to 2008 with a total population growth of less than four percent through the 8-year period, as shown on Figure 2-3. Population growth has been highest in the Coulterville Area, including Lake Don Pedro Community, and lowest in Catheys Valley (Sierra Institute, 2010).

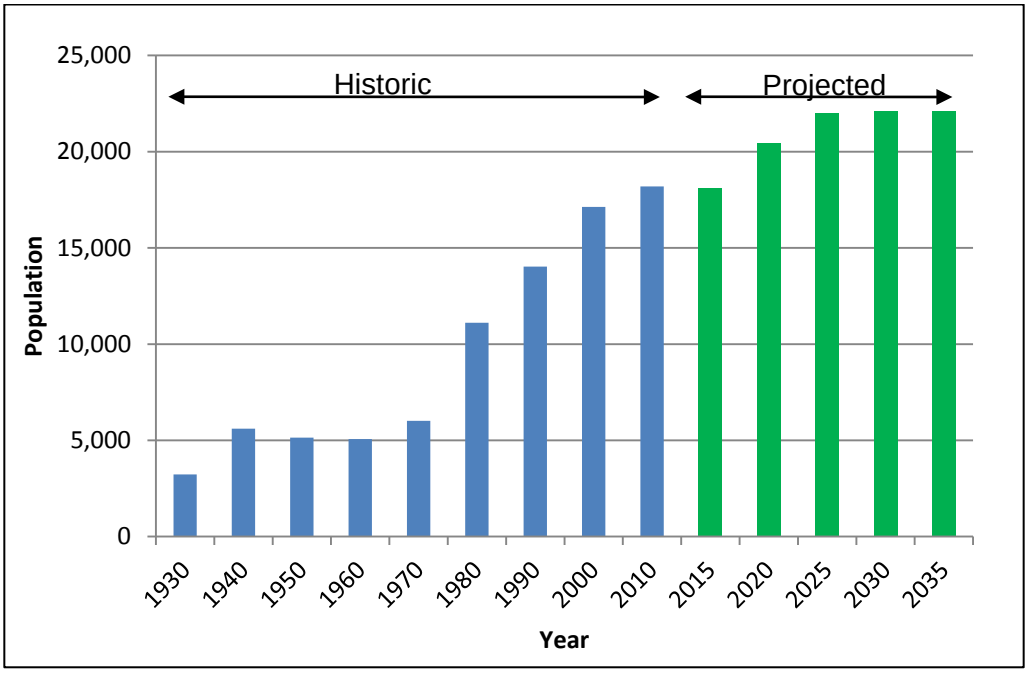


Figure 2-3: Historic and Projected Yosemite-Mariposa Region Population

The 2008 Mariposa County General Plan estimates a buildout population of 28,000 people. Using the California Department of Finance 2013 projections, Table 2-2 that follows provides an estimate of population growth from 2010 through the 2035 planning horizon. The population is projected to increase by approximately 23% by 2035; less than 1% annually.

Table 2-2: Mariposa County Population Projections

Year	Estimated Population
2010	18,193
2015	18,115
2020	20,463
2025	22,008
2030	22,186
2035	22,459

Source: California Department of Finance, 2013

2.4.2 Demographics

There are 18,251 people in Mariposa County that live in 2,430 single family owner occupied homes. Of these 18,251 people, 2,940 are over 65; 3,516 have a disability, and 9,150 people are in the workforce. Much of this work is seasonal employment centered on the service and hospitality based tourism industry (County of Mariposa, 2010). Specifically for the Mariposa community, limitations in infrastructure provided by MPUD have had a controlling effect on the area's ability to support sustained growth. The seasonal population in the Y-M Region can be attributed to the Yosemite National Park visitors, numbering up to four million per year. While some of the park is located outside the Region's boundary in Tuolumne and Madera Counties, Yosemite Valley is in the Region and serves as the main tourist destination.

The Region has historically been characterized by an older population with more than half of residents over the age of 45, and this proportion is steadily growing. Since the early 1980s and more significantly starting in 2000, the population has seen a declining trend in persons under 45, most significantly in the group of 35-44. Main factors in this trend include the attractiveness of the Region as a retirement location and a shortage of job opportunities for young adults. Age distributions and other metrics based on the American Community Survey are presented in Table 2-3.

Ethnic diversity is not significant in the Y-M Region and there is generally no particular sub-area with minority concentrations within the Region. The population is predominantly (80%) Caucasian. There is a relatively small Latino population of approximately 9 percent as of 2010 (U.S. Census, 2010). American Indians make up approximately 3 percent of the population, African Americans, Asian/Pacific Islanders, and multiracial individuals make up the remaining small proportion of the population.

Table 2-3: Demographic Data

	Mariposa County	Mariposa % of Total Population	California % of Total Population
Age			
Under 5 years	775	4.25%	6.79%
5 to 9 years	821	4.50%	6.73%
10 to 14 years	987	5.41%	6.95%
15 to 19 years	1,026	5.62%	7.58%
20 to 24 years	827	4.53%	7.42%
25 to 34 years	1,651	9.05%	14.27%
35 to 44 years	1,828	10.02%	13.91%
45 to 54 years	3,232	17.71%	14.10%
55 to 64 years	3,283	17.99%	10.84%
65 to 74 years	2,253	12.34%	6.11%
75 to 84 years	1,186	6.50%	3.68%
85 years and over	382	2.09%	1.61%
Gender			
Male		50.79%	49.71%
Female		49.21%	50.29%
Household Income Distribution			
Less than $10,000		7.39%	5.31%
$10,000 to $20,000		15.55%	9.76%
$20,000 to $30,000		8.51%	9.36%
$30,000 to $40,000		8.6%	8.9%
$40,000 to $50,000		11.15%	8.34%
$50,000 to $75,000		17.34%	17.62%
$75,000 to $100,000		13.27%	12.8%
$100,000 to $150,000		12.87%	15.02%
$150,000 to $200,000		2.99%	6.38%
$200,000 or more		2.34%	6.5%
Median household income (dollars)	$49,098		

Source: 2006-2010 American Community Survey

2.5 Economic Conditions and Trends

2.5.1 Socioeconomic Conditions

The socioeconomic conditions have changed significantly since the gold rush in the 1850s. The present day economy still includes some mining, but is primarily focused on tourism and secondarily on agriculture. Tourism, including the hospitality and leisure sectors, provides the most jobs in the area and the resulting transient occupancy taxes account for close to half of the County's discretionary budget. The travel and tourism industry generates approximately 4,000 full and part-time jobs in Mariposa County, or approximately 40% to 50% of the total employment in the County. A challenge for the County is that the sparse population does not generate a significant revenue stream. Agriculture is a focus due to the Region's rich rural history and suitability of the lower elevation foothill areas for grazing lands.

Median household income varies significantly across Mariposa County. In 2000, the Yosemite/El Portal/Wawona area had the highest median income in the Region, exceeding incomes in the rest of the Region by 25%. This is most likely due to the close proximity of Yosemite National Park, which provides steady but limited employment. Within this part of the Region, income and impoverishment are apparently quite diverse, as well: the Yosemite/El Portal/Wawona area had the highest median income but also the highest unemployment rate and highest percent of households below poverty level in 2000 (Sierra Institute, 2010). Income distribution based on the 2010 American Community Survey is provided

in Table 2-3. It should be noted that only a portion of Yosemite National Park is within the Region.

2.5.2 Disadvantaged Communities

Disadvantaged Communities (DACs), as defined by both Propositions 50 and 84, are communities whose average Median Household Income (MHI) is less than 80 percent of the statewide annual MHI. Severely disadvantaged communities are defined as communities with an average MHI less than 60 percent of the statewide annual MHI. In 2010, 80 percent of the state of California's MHI was $48,706, with a statewide MHI of $60,883. A number of communities within the Y-M Region have been identified as DACs. Figure 2-4 shows a graphical representation of the distribution of DACs within the census designated places, census tracts, and census block groups within Mariposa County.

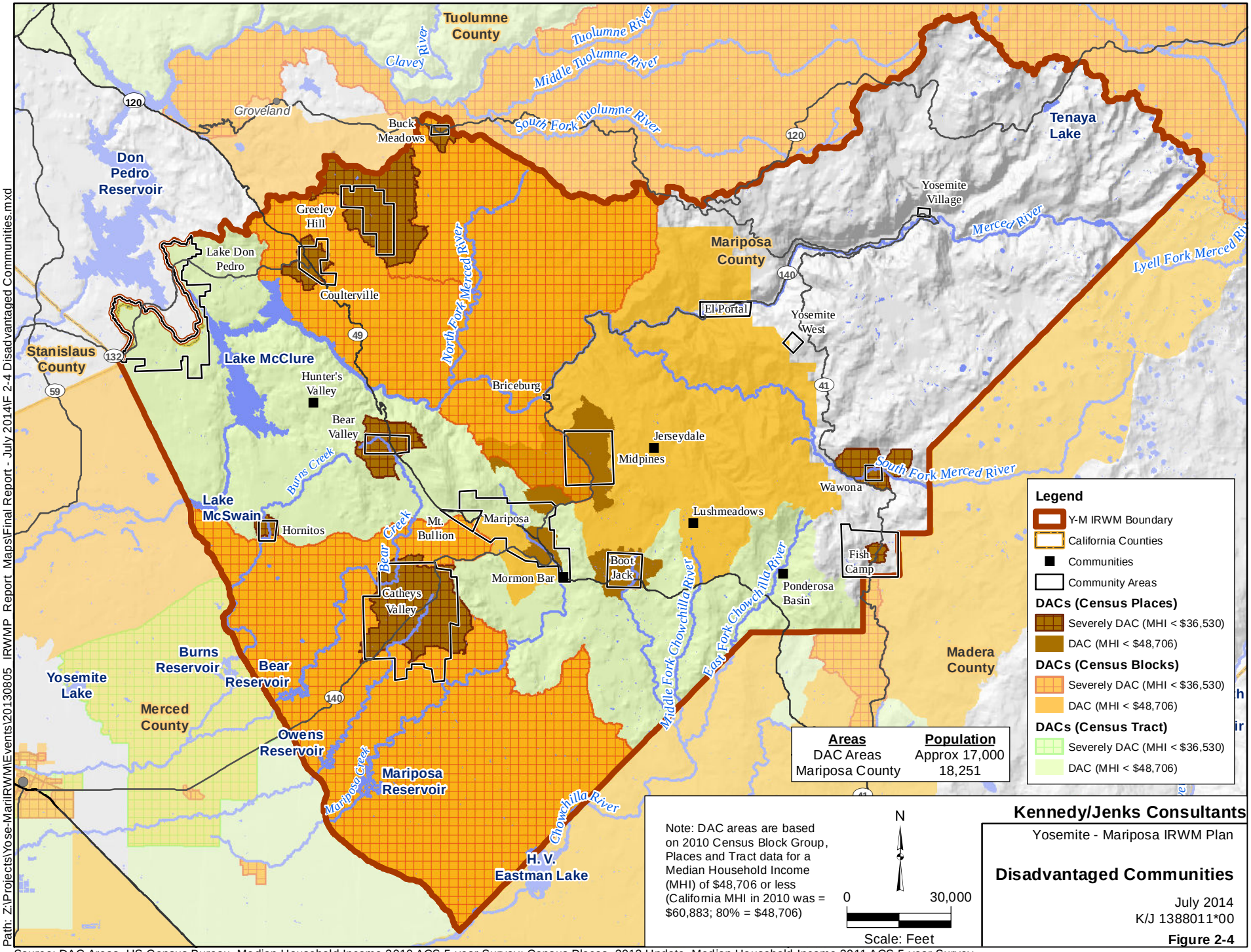
Gold Panning
Credit: Lauren Hubert

In the Region, unemployment and free and reduced school lunch enrollment trends suggest a significant increase in impoverishment over the past several years as related to the economic downturn. According to State data, unemployment increased from below 6% in 2006 to over 10% in 2009, and student enrollment in the free and reduced school program increased by 35% from 2006-2007 to the 2008-2009 school year. One of the focuses of this planning effort is to better understand and address the water related needs of DAC and SDAC throughout the Region, and provide multiple avenues for these communities to have a voice in the IRWM Planning process.

2.5.3 Recreation

Recreation is the foundation of most of the economic output in the Region, and much of the recreation and tourism industry is linked to water, either directly or indirectly. There are several sources of water-dependent recreation in the Region. The Merced River, Lake McClure, and Lake McSwain provide ample opportunity for fishing, boating, rafting, kayaking, and house boating. Whitewater rafting is permitted throughout Merced River Canyon from the downstream half of Yosemite Valley to the entrance of Lake McClure. The streams and creeks are also a fishing source when in season.

The Yosemite National Park is home to many waterfalls and meadows that attract a number of visitors each year. These falls range from a couple hundred feet to over two-thousand feet. Additional water features include frazil ice and horsetail falls that can appear to glow at sunset. Other activities at Yosemite including; photography, auto touring, backpacking, biking, bird watching, camping, fishing, hiking, horseback riding are centered around the park's water features (NPS, 1).



Source: DAC Areas, US Census Bureau, Median Household Income 2010 ACS 5-year Survey; Census Places, 2012 Update, Median Household Income 2011 ACS 5-year Survey.

A large portion of the Region is dominated by national forest lands, which also provide significant recreational opportunities to visitors of the Y-M Region. The Sierra and Stanislaus National Forests, that comprise approximately 19% of the Region's land area, are valuable and accessible overnight destinations that offer a full range of year-round recreational activities similar to those in Yosemite, including camping, hiking, hunting, biking, and horseback riding.

An additional source of recreation is the portion of the Merced River designated as Wild and Scenic. This designation requires that the National Park Service prepare a comprehensive management plan for the 81-mile river corridor that runs through Yosemite National Park. The Merced River Plan was released in final form in February 2014 after several attempts had been made to finalize the plan since a disastrous flood in 1997 hit the Yosemite Valley. The Plan would call for the restoration of 203 acres of meadow and riparian habitat in Yosemite Valley, as well as the addition of 174 campsites, and puts limits on daily peak visitors, in an effort to balance the preservation of this natural resource and its public use (Sacramento Bee, 2013).

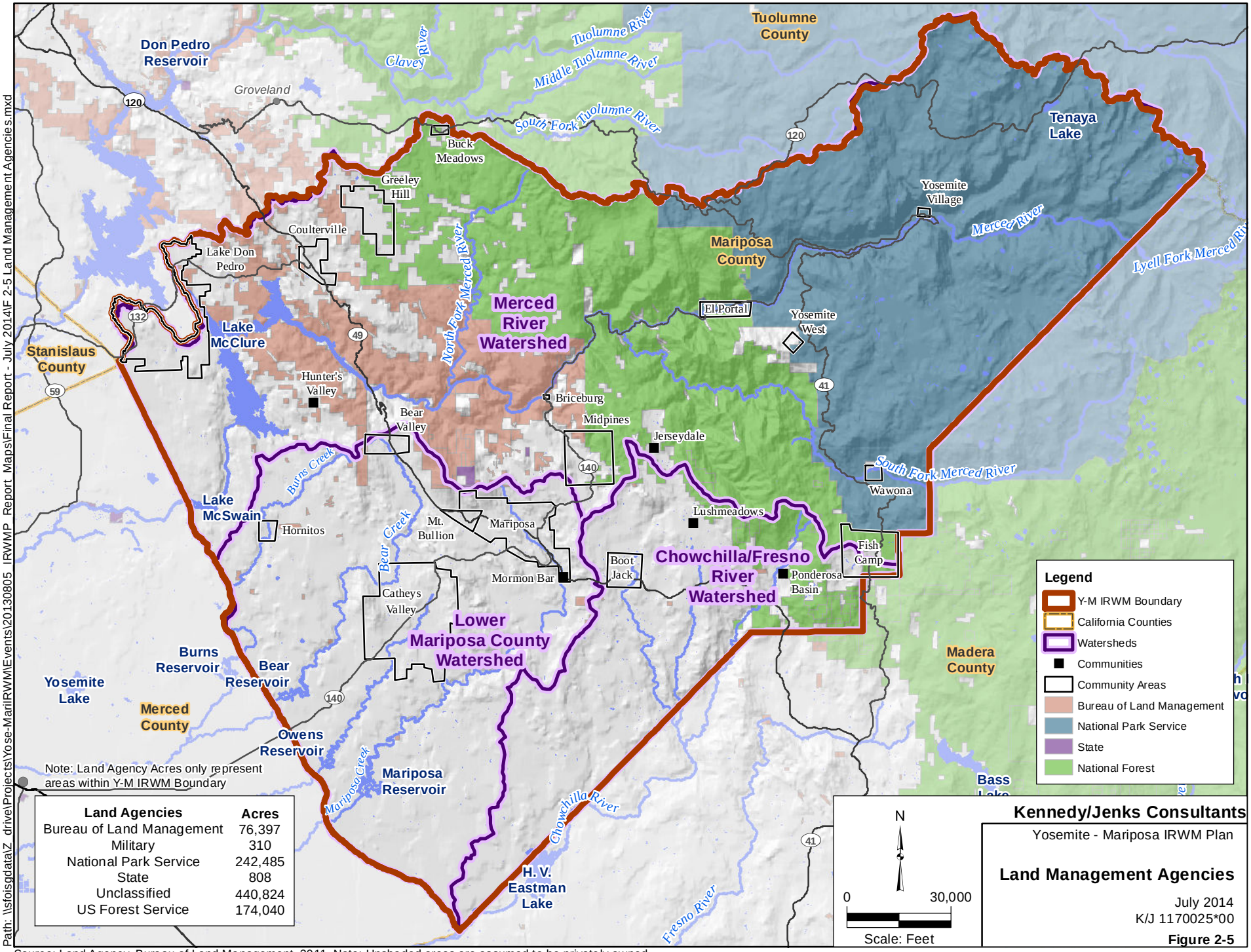
2.6 Land Use and Management

The Y-M Region contains approximately 1,461 square miles of land with approximately 53% being classified as federal lands managed by various agencies as shown on Figure 2-5. More specifically, the Sierra and Stanislaus National Forests comprise approximately 19% of the Region, the Yosemite National Park comprises approximately 26%, and the Bureau of Land Management controls approximately 8% of the land. These lands do not directly generate any tax revenue for the County and are managed for multiple and varied uses by their regulating agencies. The remainder of the land is privately owned and governed by Mariposa County. This area is rich in archeological and historic resources with many historic sites recognized nationally. Section 4 provides a description of the interrelationships between land management and planning efforts and water planning.

Current land ownership and land management constraints in the Region help maintain large areas of agricultural land and open space. Nearly 80% of the land is protected from significant development because it is publicly owned, enrolled in State Land Conservation Act of 1965 (better known as the Williamson Act) or Timberland Production Zone, or covered by a privately held conservation easement. Under County zoning, less than 14% of all land in the County is zoned to allow lot sizes below 160 acres. However, State or County policy changes or private landowner non-renewal in the Williamson Act or Timber Production Zone programs could increase the number of acres available for development along with the continued use of historic parcels to establish subdivisions and circumvent current County zoning (Sierra Institute, 2010). Table 2-4 that follows summarizes the land uses and acreages by land management agencies while Figure 2-6 shows the land uses as identified by Department of Water Resources.

Table 2-4: Governmental and Land Management Agencies

Agency	Agricultural (acres)	Industrial (acres)	Commercial (acres)	Residential (acres)	Mixed Use (acres)	Open Space (acres)	Urban (acres)	Total (acres)	Portion of Region
Army Corps of Engineers	310	0	0	0	0	0	0	310	0.03%
Sierra National Forest	5	0	0	184	0	2,236	0	2,425	0.26%
Stanislaus National Forest	113	23	35	751	0	170,654	40	171,615	18.4%
State Land	0	0	0	80	0	728	0	808	0.09%
Bureau of Land Management	3,048	88	0	775	0	72,465	21	76,397	8.2%
Yosemite National Park	0	0	0	0	0	242,456	29	242,485	25.9%
Other Non-Federal lands	265,681	530	72	80,958	0	88,132	5,451	440,824	47.2%
Total:	269,157	641	107	82,748	0	576,671	5,540	934,864	



Land Agencies	Acres
Bureau of Land Management	76,397
Military	310
National Park Service	242,485
State	808
Unclassified	440,824
US Forest Service	174,040

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Land Management Agencies

July 2014
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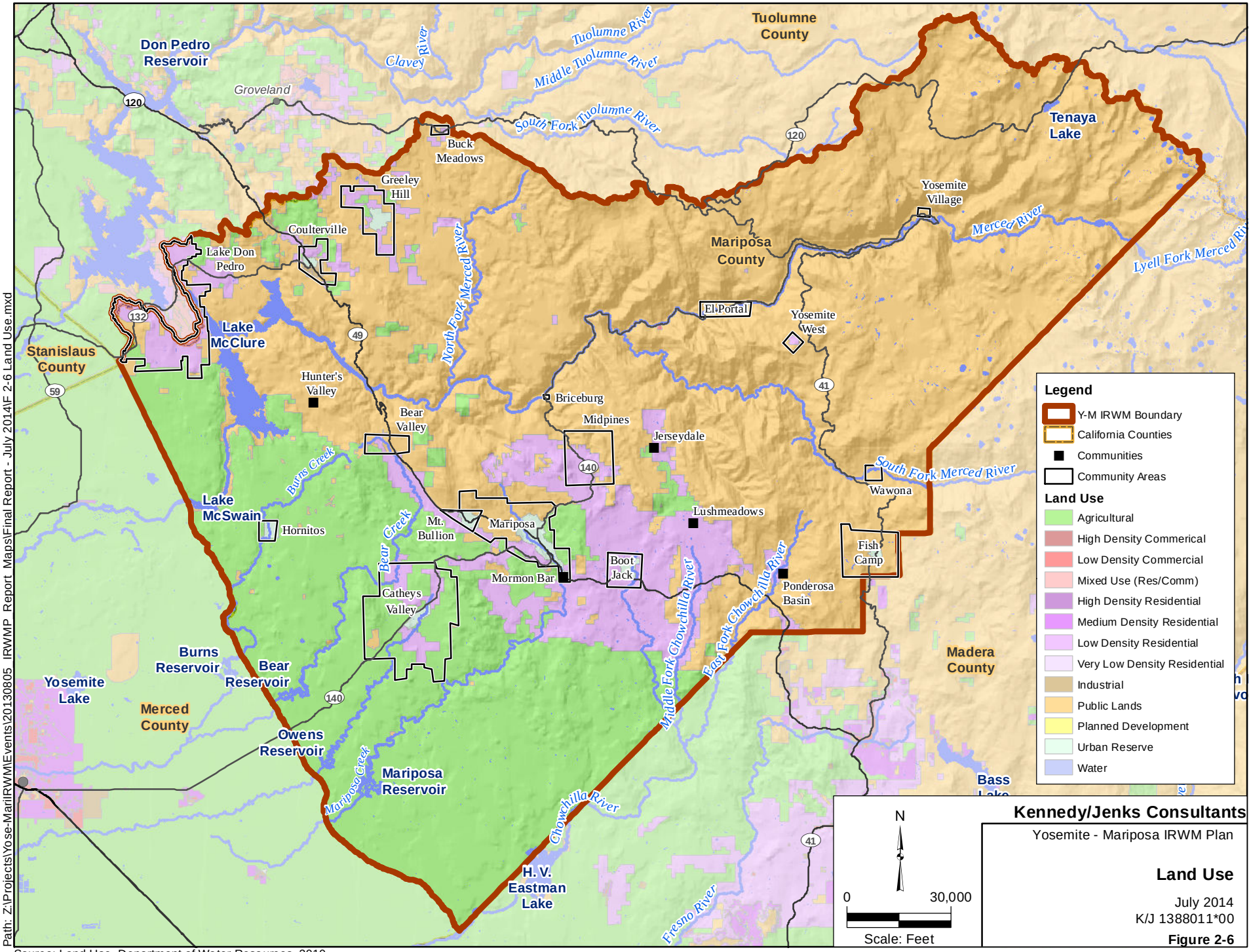
Figure 2-5

Source: Land Agency, Bureau of Land Management, 2011. Note: Unshaded areas are assumed to be privately owned.



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Land Use

July 2014
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Figure 2-6

Source: Land Use, Department of Water Resources, 2010

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2.6.1 Communities

There are no incorporated cities within the Y-M Region, instead population clusters are concentrated around numerous communities with varying planning policy approaches. These communities are briefly summarized below and shown on Figure 2-1.

Table 2-5: Communities of the Y-M Region

Community	Summary
Bear Valley	Bear Valley is a Planning Area of approximately 125 persons (County of Mariposa, 2010), located about 11 miles northwest of Mariposa. It was designated a California Historical Landmark as a result of its historical gold mining significance within the Mother Lode gold belt. It is a Planning area with a Community Plan.(http://en.wikipedia.org/wiki/Bear_Valley,_Mariposa_County,_California)
Bootjack	Bootjack is a Planning Area located just southeast of Mariposa with a total population of 960. (http://en.wikipedia.org/wiki/Bootjack; Mariposa County, 2010)
Catheys Valley	Catheys Valley is a rural community located in western Mariposa County. It is the fifth largest community in the Region with a population of approximately 825 (County of Mariposa, 2010). Few dwellings within this Community Planning Area are for occasional or seasonal use. The majority of the single-family dwelling units are owner occupied. A Community Plan has been adopted.(County of Mariposa, 2012a)
Coulterville	Coulterville is a Planning Area of approximately 194 acres located in the foothills of the Sierra Nevada with an adopted Community Specific Plan. Over 50 percent of the area population are permanent residents, with a predominately retired community make-up.
El Portal	El Portal is a Planning Area located along the western boundary of Yosemite National Park with a population of 474 (County of Mariposa, 2010). This community is partly under the administrative jurisdiction of Yosemite National Park. (http://en.wikipedia.org/wiki/El_Portal,_California)
Fish Camp	The Fish Camp Town Planning Area comprises approximately 280 acres in the Central Sierra Nevada. The majority of the community residences are utilized as second or vacation homes, occupied infrequently or on a seasonal basis. The total permanent resident population is estimated at approximately 59 (County of Mariposa, 2010). This Planning Area has an adopted Specific Plan. (Fish Camp Specific Plan)
Greeley Hill	The Greeley Hill Community is a large community located in the western portion of the Region with a population of approximately 915. (http://en.wikipedia.org/wiki/Greeley_hill; Mariposa County, 2010)
Hornitos	The Community of Hornitos is a very small community south of Coulterville with a population of just 75. (http://en.wikipedia.org/wiki/Hornitos,_California)
Lake Don Pedro	The Community of Lake Don Pedro is located partly in Tuolumne and Mariposa Counties and is situated between Lake Don Pedro and Lake McClure among the larger communities in the Region with a population of 1,077. (http://en.wikipedia.org/wiki/Lake_Don_Pedro,_California; Mariposa County, 2010)
Mariposa	The Mariposa Town Planning Area encompasses the historic community of Mariposa, extending over an area of approximately 1900 acres, within the western foothills. The town lies at the southern terminus of the Mother Lode. The population is approximately 2,173 (County of Mariposa, 2010), with a growing residential population. (Mariposa Specific Plan)
Midpines	The Community of Midpines is located north of Mariposa, among the Sierra Nevada foothills. It currently has a population of 1,204. (http://en.wikipedia.org/wiki/Midpines, Mariposa County, 2010)
Wawona	Wawona is a historic residential and resort community located within the boundary of Yosemite National Park. Approximately 169 people reside in the community County of Mariposa, 2010), the majority of which are employed by either the National Park Service or the Yosemite Concessionaire. (County of Mariposa, 2012c)
Yosemite Village	The Community of Yosemite Village is located within Yosemite National Park and is the primary developed place in the Yosemite Valley. The majority of the permanent population includes National Park Service staff and concession workers. (http://en.wikipedia.org/wiki/Yosemite_Village)
Yosemite West	Yosemite West is a private community of resort homes located just outside of Yosemite National Park, along the southern boundary. Homes in the area consist of permanent residences as well as vacation rentals. (http://en.wikipedia.org/wiki/Yosemite_West)

2.6.2 Native American Tribes

As noted earlier, during late pre-contact and early contact times the Southern Sierra Miwok inhabited the lower banks of the Merced River and the Chowchilla River, as well as Mariposa Creek with an inhabited range from the Sierra Crest, the divide between the Tuolumne and Merced Rivers, the Fresno River and along the base of the Sierra foothills. They also actively travelled across the Sierra crest.

Woman with Gathering Basket
Credit: Sierra National Forest Historical Photo Database 2011

The area, along with the upper elevations of the Sierra were also traversed and utilized by other groups including the Central Sierra Miwok and Northern Paiute. The Mono people (considered Northern Paiute) occupied the higher eastern Sierra and the Mono Lake Basin, and entered Yosemite from the east.

After Euro-Americans entered Yosemite and established Yosemite National Park, the residents were of both Paiute and Miwok origin: they had either fought to a stalemate or agreed to peaceful coexistence, and had intermixed to a limited extent. Today, several groups of Native Americans from both the west and east sides of the Sierra in the Yosemite region have active interest and ongoing activities within the Y-M IRWM Region. Such activities include: sacred practices, resource procurement/hunting and gathering, and residency. There is a wide array of Native American interest in water issues within the project area (InteResources Planning, Inc., 2013).

2.7 Climate

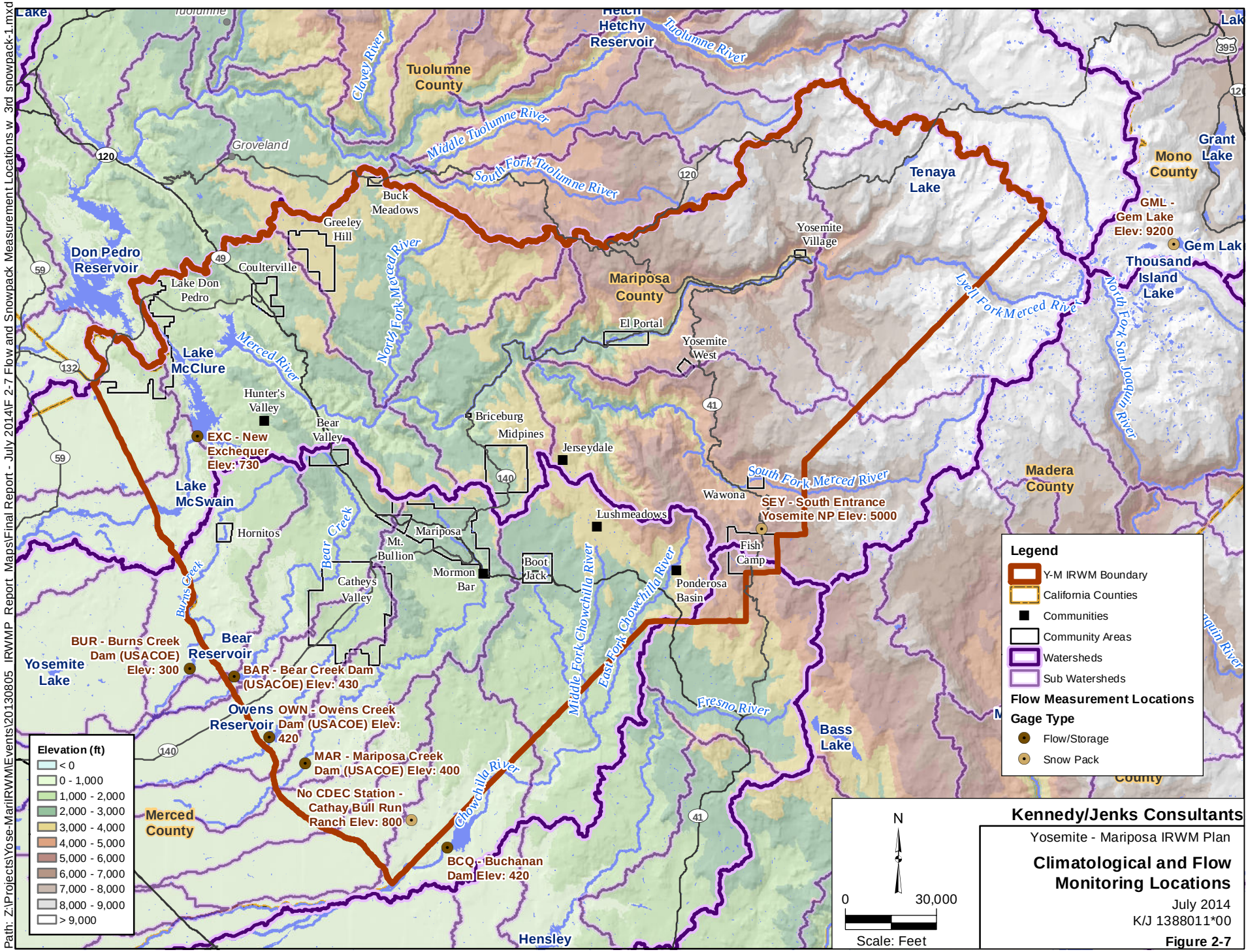
The Y-M Region has a varied terrain with the Sierra Nevada in the eastern portion of the region sloping down to the lower foothills near the Mariposa/Merced County line. The lower elevation foothill areas experience hot, dry summers with little to no precipitation and mild, wet winters with moderate to heavy precipitation. The higher elevations, generally above 5,000 feet, typically experience more severe winters, accompanied by heavy snowfall. The upper foothills experience moderate snowfall with the lower foothills receiving predominantly rainfall. The annual average rainfall ranges from 20 – 43 inches depending on the elevation.

Ice along Waterway
Credit: Pat Garcia

2.7.1 Precipitation and Snow Pack

The higher elevation, mountainous terrain of the Sierras, as shown on Figure 2-1, typically receives large amounts of snow fall each year, which during periods of snowmelt provides significant seasonal runoff, supplying the streams and rivers of the watersheds throughout the spring and early summer. Much of this snow pack, located in Yosemite National Park in the eastern side of the Region, provides a significant portion of water supply for use in the Central Valley, particularly Merced County and a small portion of the water supply used in the Y-M Region.

Snow depths throughout the Region vary widely due to terrain composition, vegetation, and significant elevation changes from approximately 300 ft. in the lower foothills to nearly 11,000 feet at the crest of the Sierra Nevada Mountains. There are several snow depth and precipitation monitoring locations shown on Figure 2-7. Most stations are monitored by the Department of Water Resources,


Path: Z:\Projects\Yose-Mari\RWM\Events\20130805_IRWMP_Report_Maps\Final Report - July 2014\F 2-7 Flow and Snowpack Measurement Locations w_3rd snowpack-1.mxd
Hetch Hetchy Reservoir
Tuolumne River
Tuolumne County
Clavey River
Middle Tuolumne River
South Fork Tuolumne River
Groveland
Buck Meadows
Greeley Hill
Coulterville
Lake Don Pedro
Don Pedro Reservoir
Lake McClure
Merced River
North Fork Merced River
Hunter's Valley
Bear Valley
EXC - New Exchequer Elev: 730
Lake McSwain
Hornitos
Bear Creek
Burns Creek
Mariposa
Mt. Bullion
Mormon Bar
Catheys Valley
Briceburg
Midpines
Jerseydale
Boot Jack
Lushmeadows
Wawona
Fish Camp
Ponderosa Basin
Yosemite Village
El Portal
Yosemite West
Mariposa County
Tenaya Lake
Lyell Fork Merced River
South Fork Merced River
SEY - South Entrance Yosemite NP Elev: 5000
Madera County
Mono County
Grant Lake
GML - Gem Lake Elev: 9200
Gem Lak
Thousand Island Lake
North Fork San Joaquin River
Middle Fork Chowchilla River
East Fork Chowchilla River
Chowchilla River
Fresno River
Bass Lake
Yosemite Lake
Bear Reservoir
BUR - Burns Creek Dam (USACOE) Elev: 300
BAR - Bear Creek Dam (USACOE) Elev: 430
Owens Reservoir
OWN - Owens Creek Dam (USACOE) Elev: 420
MAR - Mariposa Creek Dam (USACOE) Elev: 400
No CDEC Station - Cathay Bull Run Ranch Elev: 800
BCQ - Buchanan Dam Elev: 420
Merced County
Hensley
Elevation (ft)
< 0
0 - 1,000
1,000 - 2,000
2,000 - 3,000
3,000 - 4,000
4,000 - 5,000
5,000 - 6,000
6,000 - 7,000
7,000 - 8,000
8,000 - 9,000
> 9,000
Legend
Y-M IRWM Boundary
California Counties
Communities
Community Areas
Watersheds
Sub Watersheds
Flow Measurement Locations
Gage Type
Flow/Storage
Snow Pack
N
0
30,000
Scale: Feet
Kennedy/Jenks Consultants
Yosemite - Mariposa IRWM Plan
Climatological and Flow Monitoring Locations
July 2014
K/J 1388011*00
Figure 2-7

or the Western Regional Climate Center. Tables 2-6 through 2-8 show temperature, precipitation, average monthly snow depth variation and other climate information within the Y-M Region at three elevation zones. The tables are intended to provide an example of typical seasonal precipitation and climate data, but each year can vary considerably.

Table 2-6: Typical Lower Foothills Climate Data (Elev. 1,430 ft.)

	Average Total Precipitation (in.)	Average Total Snowfall (in.)	Average Snow Depth (in.)	Average Max Temperature (°F)	Average Min. Temperature (°F)
January	3.39	0	0	53.9	33.5
February	3.2	0	0	58.6	37.1
March	2.79	0	0	61.9	38.3
April	2.19	0	0	68	40.6
May	0.68	0	0	77.7	47
June	0.13	0	0	88	54.5
July	0.04	0	0	95.5	60.7
August	0.07	0	0	94.3	59.6
September	0.31	0	0	88.7	55
October	1.02	0	0	77.4	47
November	2.91	0	0	63.6	38.9
December	3.56	0	0	55	33.7
Total	20.29	0.00	Not applicable	Not applicable	Not applicable

Climate Data based on Station number 041588 (Cathay Bull Run Ranch), period of record 7/1/1948-5/31/1977. www.wrcc.dri.edu.

Table 2-7: Typical Lower Sierras Climate Data (Elev. 5,120 ft.)

	Average Total Precipitation (in.)	Average Total Snowfall (in.)	Average Snow Depth (in.)	Average Max Temperature (°F)	Average Min. Temperature (°F)
January	8.5	20.7	8	46.4	25.7
February	7.12	20.3	9	47.8	26.4
March	6.56	23.5	7	50.3	27.8
April	3.7	11.1	2	56.2	31.1
May	1.72	1.2	0	65	37.2
June	0.58	0.1	0	73.9	43.7
July	0.12	0	0	82	49.4
August	0.1	0	0	81.3	48.6
September	0.64	0	0	76	44.5
October	2.32	0.4	0	65.8	37.3
November	5.08	6.5	1	54.4	30.3
December	6.93	16.7	4	47.9	26.4
Total	43.37	100.50	Not applicable	Not applicable	Not applicable

Climate Data based on Station number 048380 (South Entr Yosemite NP), period of record 7/1/1941-3/31/2013. www.wrcc.dri.edu. Note snowfall is included in the total precipitation

Table 2-8: Typical Sierra Nevada Climate Data (Elev. 8,970 ft.)

	Average Total Precipitation (in.)	Average Total Snowfall (in.)	Average Snow Depth (in.)	Average Max Temperature (°F)	Average Min. Temperature (°F)
January	3.63	33.2	36	37.1	14.8
February	3.66	40.6	60	38.5	14.7
March	2.92	26.3	57	44.4	18.3
April	1.62	15.7	51	50.2	24.3
May	0.86	4.3	25	57.6	31.9
June	0.49	1.1	6	64.8	39.6
July	0.55	0	0	73.2	47.7
August	0.59	0	0	71.3	47.2
September	0.7	1.1	0	64.5	40.3
October	1.14	6.9	1	54.9	32.9
November	2.11	16.8	6	45.8	25.1
December	3.18	34.1	18	38.4	19.1
Total	21.45	180.10	Not applicable	Not applicable	Not applicable

Climate Data based on Station number 043369 (Gem Lake), period of record 11/1/1924-9/30/2009. www.wrcc.dri.edu. Note snowfall is included in the total precipitation

The higher elevations around 9,000 feet and higher typically receive about 180 inches of snowfall in an average year, which is equivalent to about 21 inches of rainfall. At lower elevations (~1,400 feet) in the foothills, there is little snowfall but average annual precipitation of 20 inches is typical. At mid-level elevations (~5,000 feet), there is a combination of snow and rain resulting in a total precipitation of about 43 inches. The equivalent precipitation of snowfall can vary dependent on the consistency of the snowfall, but on average is a ratio of 10 inches of snowfall to 1 inch of precipitation (National Weather Service). As discussed throughout this IRWM Plan, some of the challenges for ensuring reliable water supplies for domestic, agricultural, recreational, and ecologically beneficial uses are linked to the variability in precipitation and snowfall each year. While average climatological conditions provide a long range indicator of water production in the watershed, the water supply each year can vary significantly due to the amount of precipitation that is received. For example, the 2013 and 2014 water years have been unseasonably dry, creating drought conditions in much of California, including Mariposa County. The sections throughout this Plan regarding Climate Change and water supply reliability factors cover these challenges in greater detail.

2.8 Hydrologic Systems

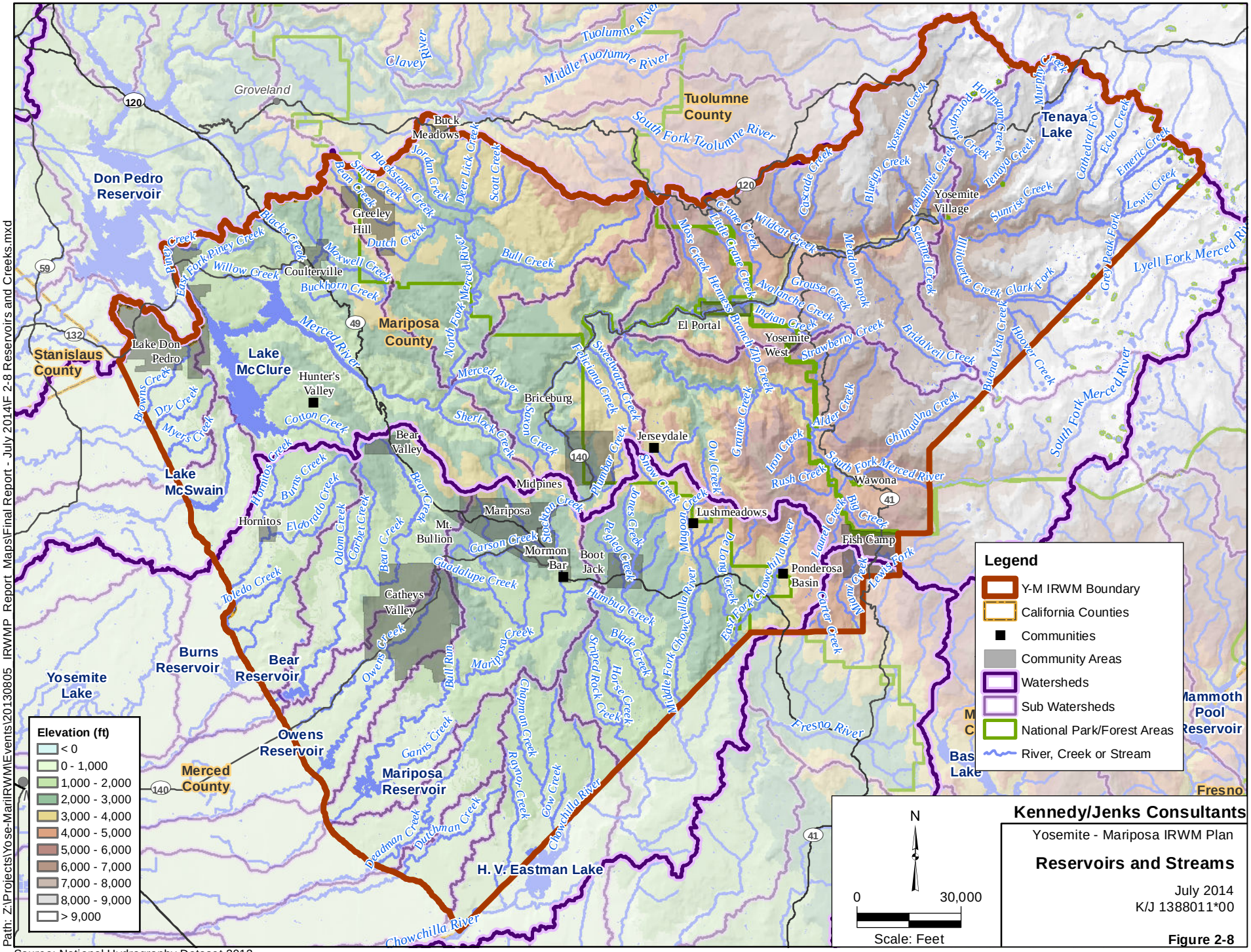
The three watersheds in the Y-M Region are the Upper Merced River Watershed, Chowchilla/Fresno River Watershed, and the Lower Mariposa Group of Streams each of which is described in greater detail below.

2.8.1 Surface Water

2.8.1.1 Upper Merced River Watershed

The Upper Merced River Watershed is the largest and most productive, comprising almost two-thirds of the entire Region area. The bulk of the Upper Merced watershed is located in the Yosemite National Park, surrounding National Forest and Bureau of Land Management lands. This affords protections by Federal agencies that are not typical of other western Sierra watersheds. Tributaries that feed the Upper Merced River include: Alder Creek, Bean Creek, Bear Creek, Big Creek, Bridalveil Creek, Cascade Creek, Chilnualna Creek, Devil Gulch, Echo Creek, Illinois Creek, Lewis Creek, Moss Creek, Tenaya Creek, and Yosemite Creek, as well as both the North and the South Forks of the Merced River as shown on Figure 2-8. At its source near Triple Divide, which is slightly south of the Region boundary, the watershed has been shaped by glaciation; jagged peaks, shallow lakes, and granite domes are characteristic of this zone. These features also characterize the upper reaches of the north fork of the upper Merced River as well.

The next zone is characterized by lodgepole pines and red firs in open meadows and canyons, interspersed among tumbled rock fields and granite slopes. The next zone of the watershed includes the broad U-shaped Yosemite Valley. The famous rock formations of Yosemite Valley – Half Dome, Cathedral Rocks, El Capitan – result from successive periods of glaciation. Glaciers left hanging valleys, from which descend the Valley's famous falls. Typical trees of this zone are ponderosa or yellow pine, incense cedar, and black oak. Stands of giant sequoias, the Tuolumne and Merced groves, are also found here. The next zone of the watershed is characterized by steep canyons that run in a generally southwest direction. The thin soils of the canyon walls support patches of grass, chaparral and oak woodland. The areas of lowest elevation in the watershed are the foothills which gradually descend toward the San Joaquin Valley floor. Characteristic vegetation for this zone includes gray pine, blue oak, and chaparral (CSWC, 2007).


Legend
Y-M IRWM Boundary
California Counties
Communities
Community Areas
Watersheds
Sub Watersheds
National Park/Forest Areas
River, Creek or Stream
Elevation (ft)
< 0
0 - 1,000
1,000 - 2,000
2,000 - 3,000
3,000 - 4,000
4,000 - 5,000
5,000 - 6,000
6,000 - 7,000
7,000 - 8,000
8,000 - 9,000
> 9,000
N
0
30,000
Scale: Feet
Kennedy/Jenks Consultants
Yosemite - Mariposa IRWM Plan
Reservoirs and Streams
July 2014
K/J 1388011*00
Figure 2-8
Don Pedro Reservoir
Lake McClure
Lake McSwain
Burns Reservoir
Bear Reservoir
Owens Reservoir
Mariposa Reservoir
H. V. Eastman Lake
Yosemite Lake
Tenaya Lake
Mammoth Pool Reservoir
Stanislaus County
Mariposa County
Tuolumne County
Merced County
Fresno
Groveland
Buck Meadows
Greeley Hill
Coulterville
Lake Don Pedro
Hunter's Valley
Bear Valley
Briceburg
Jerseydale
Midpines
Mariposa
Mt. Bullion
Mormon Bar
Boot Jack
Hornitos
Catheys Valley
El Portal
Yosemite West
Yosemite Village
Wawona
Lushmeadows
Fish Camp
Ponderosa Basin
Tuolumne River
Middle Tuolumne River
South Fork Tuolumne River
Merced River
South Fork Merced River
Lyell Fork Merced River
Chowchilla River
Fresno River
Clavey River
Bear Creek
Smith Creek
Blackstone Creek
Jordan Creek
Deer Lick Creek
Scott Creek
Dutch Creek
Maxwell Creek
Buckhorn Creek
Willow Creek
Piney Creek
East Fork Piney Creek
Blacks Creek
Bull Creek
North Fork Merced River
Moss Creek
Little Crane Creek
Crane Creek
Hennessy Branch
Wildcat Creek
Cascade Creek
Bluejay Creek
Yosemite Creek
Lehamite Creek
Porcupine Creek
Hoffmann Creek
Murphy Creek
Tenaya Creek
Sunrise Creek
Cathedral Fork
Echo Creek
Emeric Creek
Lewis Creek
Grey Peak Fork
Meadow Brook
Sentinel Creek
Illilouette Creek
Clark Fork
Grouse Creek
Avalanche Creek
Indian Creek
Strawberry Creek
Bridalveil Creek
Buena Vista Creek
Hoover Creek
South Fork Merced River
Chilnualna Creek
Alder Creek
Granite Creek
Iron Creek
Rush Creek
Big Creek
Launel Creek
Lewis Fork
Owl Creek
Magoon Creek
Show Creek
Bons Creek
Plumbar Creek
Sweetwater Creek
Pelkiana Creek
Sherlock Creek
Saxon Creek
Stockton Creek
Carson Creek
Guadalupe Creek
Bear Creek
Beegleg Creek
Humbug Creek
Blade Creek
Striped Rock Creek
Horse Creek
Middle Fork Chowchilla River
East Fork Chowchilla River
Long Creek
Carter Creek
Mariposa Creek
Bull Run
Owens Creek
Ganns Creek
Chapman Creek
Rayno Creek
Cow Creek
Deadman Creek
Dutchman Creek
Toledo Creek
Eldorado Creek
Corbet Creek
Odom Creek
Hornitos Creek
Burns Creek
Cotton Creek
Myers Creek
Dry Creek
Browns Creek
Lake Don Pedro
Source: National Hydrography Dataset 2012.
Path: Z:\Projects\Yose-Mari\RWM\Events\20130805_IRWMP_Report_Maps\Final Report - July 2014\F 2-8 Reservoirs and Creeks.mxd

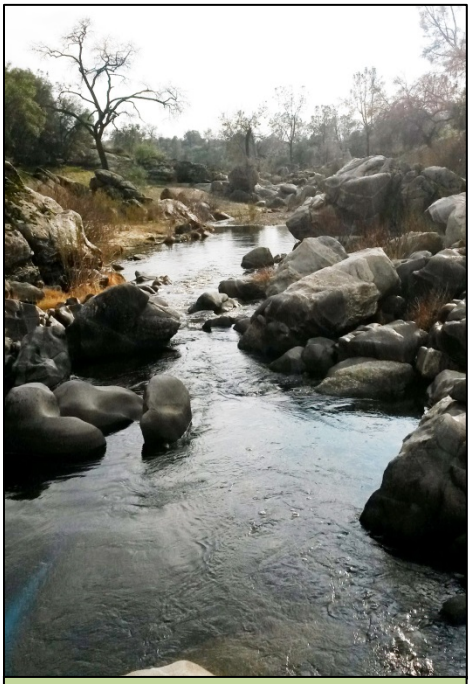
Bridalveil Fall
Credit: Daniel K. Horner

The Merced River flows west to Lake McClure, where it is impounded by the New Exchequer Dam owned and operated by the Merced Irrigation District (Merced ID). The tributary watershed area to Lake McClure is about 1,040 square miles. Merced ID diverts from the Merced River and delivers water to agricultural customers in Merced County. In 1987, the United States Congress designated portions of the Merced River as “Wild and Scenic” to protect its free-flowing condition and preserve its unique characteristics for the benefits and enjoyment of future generations. A comprehensive management plan known as the *Merced River Plan* has been formulated by the National Park Service and establishes a "River Protection Overlay" to ensure that the river channel and adjacent areas are protected. This overlay will provide a buffer area for natural flood-flows, channel formation, riparian vegetation, and wildlife habitat and will protect riverbanks from human caused impacts and associated erosion.

Yosemite National Park contains some of the dominant geographical features of Mariposa County; the three tallest waterfalls in North America are found in the County: Yosemite Falls at 2,425 feet, Sentinel Fall at 2,000 feet, and Ribbon Fall at 1,612 feet. In addition to the named waterfalls there are nine other waterfalls in the County area. The park is also the headwaters for the Merced River, located outside the Region, which is the principal watershed.

2.8.1.2 Chowchilla/Fresno River Watershed

The portion of the Chowchilla/Fresno River watershed in the Region includes the East, Middle, and West forks of the Chowchilla River. The East, Middle, and West Forks of the river merge and flow into Eastman Lake located in neighboring Madera County. The Bootjack, Chowchilla, and Ponderosa Basin areas are drained to the south by creeks that are tributaries of the Chowchilla River. Only the upper portion of the watershed is located in the Region with more than half located in the Madera IRWM Region. The following beneficial uses have been designated for the Upper Chowchilla River, source to Buchanan Reservoir: flood control, irrigation, water contact and non-contact recreation, warm water habitat, cold water habitat, and wildlife habitat (County of Mariposa, 2006).



Chowchilla River
Credit: Kristen Boysen, Sierra Foothill Conservancy

The Upper Chowchilla drainage area above Buchanan Dam which impounds Eastman Lake encompasses 235 square miles. The majority of this drainage area resides within the Y-M Region. The watershed is approximately 34 miles long and 10 miles wide ranging in elevation from 6,000 to 400 feet and terminating at the Buchanan Dam which is located near the Mariposa/Madera County line. The streams that supply the Chowchilla River flow in steep, narrow canyons that have slopes ranging from

approximately 1,000 feet per mile in the headwater area to 30 feet per mile near the reservoir area (CSWC, 2007).

2.8.1.3 Lower Mariposa Group of Streams

The Lower Mariposa Group of Streams includes Bear, Burns, Mariposa, and Owens Creeks and a variety of smaller creeks as shown on Figure 2-8. These major creeks all have DWR owned dams operated by the Army Corps of Engineers located near the Mariposa-Merced County line. Within federal lands, the section of Mariposa Creek above Mariposa Reservoir is considered an "Emphasis Watershed". Together with Agua Fria Creek and Stockton Creek, Mariposa Creek drains the largest area of the Lower Mariposa County group of streams with a drainage area of about 107 square miles. Upper portions of the Agua Fria Creek watershed drain the Mount Bullion area. Owens Creek drains part of the Catheys Valley and White Rock planning areas. The Bear Valley, Hornitos, and a portion of the Catheys Valley watersheds supply the majority of Bear Creek water (County of Mariposa, 2006).

2.8.2 Geology and Groundwater

2.8.2.1 Geology and Soils

Geology

The Y-M Region, located on the western slopes of the central Sierra Nevada Mountains ranges in elevations from 300 feet along the western portion and over 11,000 feet in the eastern, mountainous areas. The western portion is dominated by gently sloping foothills with generally thin soils above metamorphic bedrock. The northeastern portion is dominated by steep foothills and mountains.

Rocks found in the Region originate from marine sedimentation, tectonic subsidence and volcanic activity. The Sierra Nevada that frames the Region to the Northeast has developed out of the process of magma crystallizing below the surface, followed by erosion and uplift, with valleys being shaped from down dropping and glacier retreats that carved into the landscape. Bedrock in the western portion of the Region is dominated by a northwest-oriented grain.

El Capitan, Yosemite National Park
Credit: Kennedy/Jenks Consultants

The Region is divided by two major parallel fault and fracture zones that trend northwest-southeast. The Bear Mountains Fault Zone trends south-southeast crossing near the northwest corner of Lake McClure. The Melones Fault Zone closely follows Highway 49 through Bear Valley to Mariposa. It consists of a complex network of faults and fracture zones of several miles in width. This zone runs parallel to and is associated with the Mother Lode. Despite the Region's location along these fault zones, historic earthquake occurrences indicate a low probability of large magnitude earthquakes.

Major river drainages in the Region, running perpendicular to the Sierra Nevada ridgeline, have created deep canyons with steep slopes and cliffs in the eastern half of the Region. These features are generally susceptible to landslides and rock falls, which can be exacerbated where

development occurs along steepened slopes, such as Highway 140 from within the Yosemite Valley to the head waters of Lake McClure.

Several unique geological formations exist within the Region, including Bower Cave in the Stanislaus National Forest, Penon Blanco, located near Coulterville and the large rock formation of May Rock near Bear Valley. Undoubtedly, the most prominent and well-known feature in the Region is Yosemite National Park which is dominated by numerous granite peaks, including El Capitan and Half Dome. Most of the rocks in Yosemite consist of various types of granite, which are all part of the Sierra Nevada batholith. The straight, steep walls of the Yosemite Valley, popular for rock-climbing but atypical to glaciated mountain valleys, are a result of vertical fractures from glacial activity (County of Mariposa, 2006).

Soils

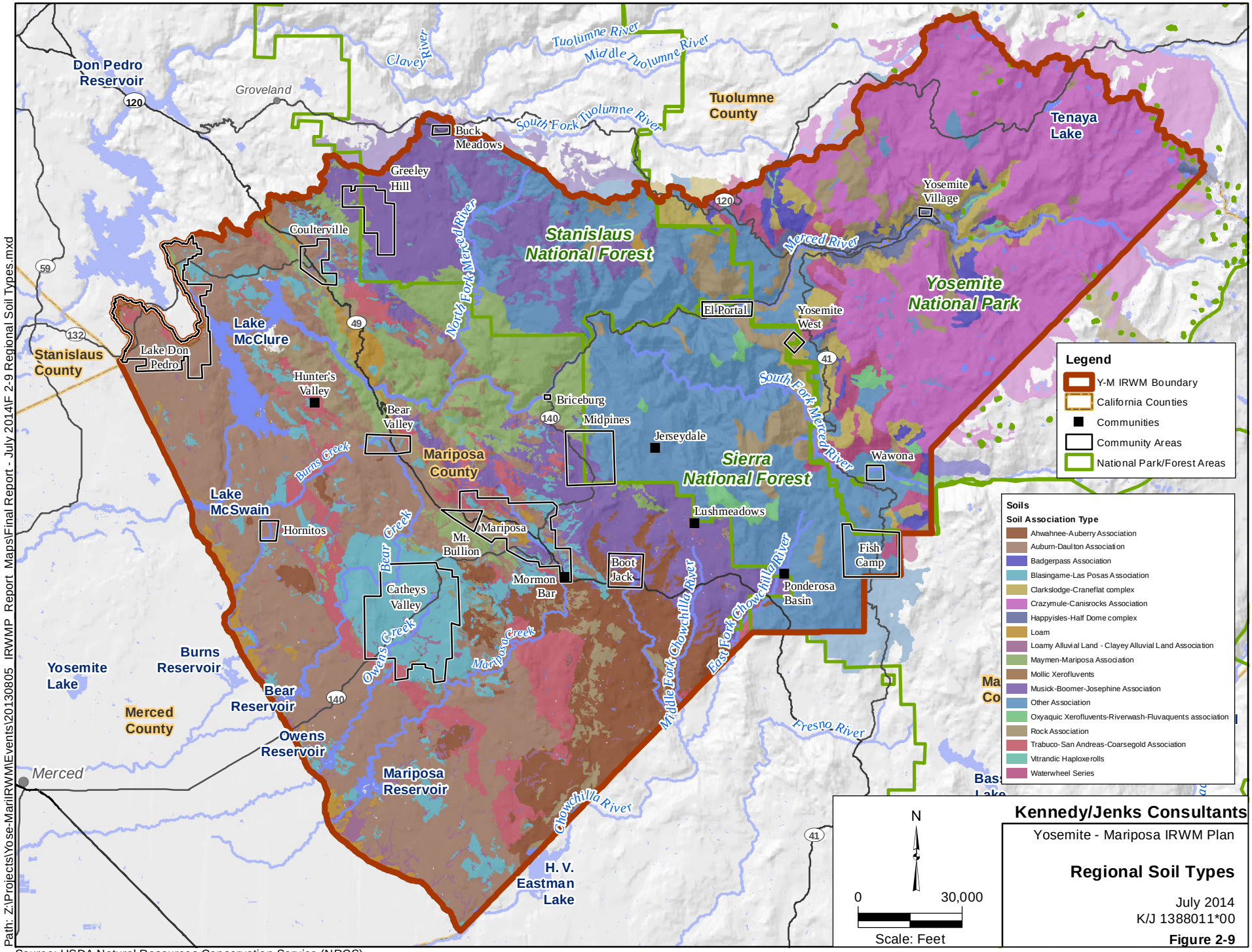
A soil survey conducted by the Soil Conservation Service in 1974 identified seven distinctive patterns of soils or land types, known as soil association types, in the County. These soil types are described in Table 2-9 below and shown in Figure 2-9.

Table 2-9: Summary of Soil Association Types in the Y-M Region

Soil Association Type	Description
Ahwahnee-Auberry Association	Covers approximately 14 percent of non-federal lands, primarily in the southeastern portion of the Region. The soil is generally well-drained, with gently sloping to very steep sandy loams originating from acid igneous rocks. These soils are often found in pastures, rangelands, and orchards, as well as some non-farm land uses.
Auburn-Dault Association	This soil association is found across approximately 42 percent of non-federal lands, in scattered locations throughout the Region. These well- to excessively-drained soils consist of gently sloping to very steep loams and stony loams formed from schist and slate. They are often used for cattle grazing.
Badgerpass Association	This association consists of gently sloping to steep soils found in mountain valley floors, along mountain slopes and ridge crests. Soils are moderately well drained to somewhat excessively drained and originate from alluvium and/or till derived from granitoid rock.
Blasingame-Las Posas Association	These soils are scattered throughout the Region, covering approximately 19 percent of non-federal lands. They consist of somewhat excessively drained to well-drained soils, of gently sloping to very steep loams and clay loams, formed from basic igneous rocks. They are often found under annual rangelands.
Clarkslodge-Craneflat complex	This association is made up of gently to moderately sloping soils, often found along mountain slopes, such as at mid-elevation areas in Yosemite National Park. Soil parent material is colluvium and/or residuum derived from granitoid and metasedimentary rock. Soils are well drained to somewhat excessively drained.
Crazymule-Canisrocks Association	This association consists of moderately to steeply sloping soils, often found along mountain slopes and flanks. Parent material is colluvium and/or till derived from granitoid rock. Soils are moderately well drained to excessively drained.
Happyisles-Half Dome complex	This association consists of gently to steeply sloping soils, found along mountain valley floors, mountain slopes and mountain flanks. Parent material is primarily colluvium and/or till derived from granitoid rock and some metamorphic, mafic rock. Soils are generally well drained.

Soil Association Type	Description
Loam	Loams range from stony, sandy loams to fine sandy and clay loams with gentle to moderate slopes, and in some cases, steep slopes. Soils are generally well drained. Fine sand loams are occasionally flooded.
Loamy Alluvial Land-Clayey Alluvial Land Association	This soil association is found in small valleys of the Region. The soils consist of well-drained to somewhat poorly drained, gently sloping to strongly sloping sandy loams to clays, formed in alluvium. These soil types are often used for annual range as well as for orchards and pasture at higher elevations. Soils are moderately well to well drained.
Maymen-Mariposa Association	This soil association is scattered throughout the northern part of the Region, covering about 11 percent of non-federal lands. These soils are used for limited range and woodland and consist of well-drained, moderately steep to extremely steep loams, gravelly loams, and gravelly silt from weathered schist and slate. Soils range from poorly drained to well drained.
Mollic Xerofluvents	This association primarily consists of El Capitan fine sandy loams generally found in mountain valleys and canyons on 0-2 percent slopes. Soils are somewhat poorly drained and frequently flooded. Parent material is fan alluvium derived from granitoid rock.
Musick-Boomer-Josephine Association	This association covers about 9 percent of non-federal lands in the Region, mainly in the east-central portion. This soil association consists of well-drained, gently sloping to very steep sandy loams, loams, cobbly loams, and gravelly loams from weathered basica and acid igneous rocks and schist. These soils are often used for woodlands and limited grazing.
Oxyaquic Xerofluvents-Riverwash-Fluvaquents association	Generally found in mountain valleys or canyons, this mesic association originates from coarse textured stream alluvium, derived from granitoid rock. The soils exhibit minimal slopes of 0-2 percent. Soils range from very poorly drained to somewhat excessively drained.
Rock Association	This association is dominated by rock outcrops and complexes with large percentages of rock along moderate to steep slopes. Parent material is granitoid rock and colluviums derived from granitoid rock. Soils can be somewhat drained to excessively drained.
Trabuco-San Andreas-Coarsegold Association	These soils cover approximately 9 percent of non-federal lands in the Region, with mainly Trabuco soils in the northern part and San Andreas and Coarsegold soils in the southern part. These well-drained soils contain gently sloping to steep clay loams, very fine to fine sandy loams, formed from basic igneous rocks and mica schist. They are generally found under pastures and rangelands.
Vitrandic Haploxerolls	This association consists of gently sloping sandy soils found in mountain valleys and canyons. Parent material is coarse textured stream alluvium derived from granitoid rock and reworked lake sediments. Soils are well drained.
Waterwheel Series	This association consists of moderately to steeply sloping soils generally found along mountain slopes. Parent material is colluviums derived from granitoid rock. Soils are well drained to somewhat excessively drained.

Source: Soil Conservation Service, 1974; USDA, NRCS, 2007.
Note: Various soils fall under an “other” category and were not described in this table.



Source: USDA Natural Resources Conservation Service (NRCS)

Soil characteristics can vary significantly in the Region and are important in determining the viability of human- related activities. Soil erosion rates, permeability and shrink-swell potential can affect potential groundwater recharge, agricultural productivity, septic tank functionality and development potential.

Septic tanks are commonly used in the Y-M Region. Generally, these systems consist of a tank with leach field where wastewater filters downward through the soil. Proper functioning of these systems is highly dependent on site-specific characteristics, including slope, soil depth, and soil permeability. In an effort to better identify septic suitability, the Model Mountain County Development Program, prepared by Mariposa County during 1979 and 1980 to evaluate physical development constraints (Mariposa County, 2006) inventoried soil depth and permeability in the Region. The inventory assigns septic suitability classifications from A-D which correlates to minimum, moderate, high and extreme constraint characteristics. A more constrained suitability classification requires additional planning to be conducted prior to installation of the septic system or a septic system at that location may not be recommended.

According to this inventory, very limited areas in the Region demonstrate the proper combination of soil depth and permeability to meet the septic suitability classification A (minimum constraints). Due to the rugged terrain and soil characteristics found in the Region, particular precautions are taken by Mariposa County Environmental Health to ensure adequacy of such septic disposal systems, and proper protection of environmental resources and public health.

The shrink-swell potential of soils is an important characteristic for planning development projects, as significant shrinking and swelling can result in property damage and potential human hazards. The majority of soils within the Region have low to moderate shrink-swell potential.

Soil erosion is a natural process and erosion rates can vary with slope and soil characteristics. Human activities can impact natural erosion processes and in the Region, wildfire is one of the main factors contributing to soil erosion. Another important factor is construction-caused soil erosion, which has largely been controlled by a County grading ordinance. Accelerated erosion can also occur around steep slopes and erosive soils and rocks, particularly granite slopes, commonly found in the Region.

The erosion potential of soils within the Region have been inventoried in the Model Mountain County Development Program, which is shown in the table below.

Table 2-10: Erosion Potential in the Y-M Region

Erosion Potential Category	Acres	% of Total
Minimum	69,714	14.79%
Moderate	21,502	4.56%
High	221,823	47.05%
Extreme	158,374	33.60%
Total Acreage	**471,413**	**100.00%**

Source: Mariposa County General Plan (Table 8-5), originally from Model Mountain County Development Program Document 1, Development Constraints Report, August 1980.

2.8.2.2 Groundwater Resources

Groundwater resources make up the majority of the Region's water supplies, however, the small Yosemite Valley Groundwater Basin is the only DWR-designated Bulletin 118 groundwater basin in the Region. The majority of the Region's groundwater supplies originate from hard rock wells in the plutonic granites of the Sierra Nevada. The Region's groundwater flow is governed by the granitic terrain of the overall landscape. The overlying soil mantle thereby acts as a filtration and

containment system, facilitating percolation and subsequent recharge in the fissure crack system, and serving as a temporary water reservoir. Specific granitic groundwater basins in the Region, however, have not been studied in depth.

Observations recorded from well drilling and hydrogeologists provide valuable insights into the average characteristics of Sierra hard rock wells found in the Region as follows (County of Mariposa, 2006):

- Wells have a mean depth of 115 feet, with an average pump depth between 50 to 100 feet.
- The average estimated yield is three to five gallons per minute (gpm) and most wells serve between two to three people. However, domestic well drilling is usually stopped when 5 to 10 gpm are obtained. It is possible that larger yields, greater than 50 gpm, could be obtained in some locations.
- Geologic observations indicate a rapid decrease in rock permeability and therefore water production with depth. As a result, domestic wells are preferably less than 150 to 250 feet deep, however the optimum depth of water wells in crystalline rocks is largely determined by economic factors.
- In the absence of geological and geophysical guidance, drilling in crystalline rocks can encounter highly variable amounts of water. In unweathered rock, 5 to 15 percent of wells are failures and roughly 10 percent will have yields of 50 gpm or more.

Metamorphic formations found in the Region can also contain useable groundwater resources and show high hydrologic versatility. Highly fractured zones in the Sierra Foothills are known to carry large amounts of water. The permeability of these rocks is a result of its joints, faults, and bedding plane partings. Highest well yields tend to occur in or near broad ravines as a result of associated joint systems and fault zones.

Groundwater is used in the Yosemite Valley, Wawona, and El Portal areas for domestic water supplies and for park visitors within the National Park. Existing uses indicate that the groundwater resources of the Region's mountainous areas have the potential to provide high quality drinking water for residential customers. There are some areas however, within the Region that contain some water quality challenges. Groundwater resources, for example, in some parts of the Catheys Valley planning area have been found to contain elevated levels of nitrates in the upper 50 to 100 feet of the water bearing unit, which has been attributed to historic turkey ranches (County of Mariposa, 2006).

Overall, geologic strata within the Region are not conducive to the formation of large groundwater basins. In addition, information regarding groundwater availability and quality in the Region is generally lacking. More detailed studies of the groundwater basins and analysis of existing data are necessary to provide improved knowledge of present groundwater conditions and potential trends for long term planning purposes. A focused hydrogeologic study of some areas within the Region will be prepared in parallel with the preparation of this IRWM Plan.

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Section 3: Existing and Future Conditions

This section describes the existing and expected future conditions for the Yosemite-Mariposa Region (Y-M Region or Region) that are relevant to water resources management. The information is organized and presented as it relates to the major topic areas of water supply including a water balance, water demands, water-related built infrastructure, water quality, flood protection, environmental resources, and the potential effects of climate change. Important information is provided regarding key water management infrastructure (both constructed and naturally occurring), summarizes and presents important water-related data, introduces some of the major challenges, and offers observations about the current water management system.

A number of original source data, technical reports and other information were reviewed and summarized to provide an overview of conditions throughout this IRWM Plan. An IRWM Plan is a high level representation of many important topics, and as such the reference materials should be reviewed for a more comprehensive discussion of the issues raised throughout the plan.

3.1 Water Demands

Water demand refers to the use of water for a specific purpose. In many cases a particular use will consume the water, such as for agricultural irrigation or residential uses. In other cases, water demands may be non-consumptive, such as for renewable hydroelectric power generation. The analysis of water demands can become complicated when reviewing in terms of the entire hydrologic cycle. The Y-M Region's consumptive water demands are limited mostly to municipal residential and commercial uses, with a limited amount of water used for industry and agriculture. While there are abundant surface water supplies in the Region, most of the water rights are held by agencies outside the Region for municipal and agricultural and ecosystem uses, as described in Section 3.2.2. Groundwater from fractured crystalline rocks comprises the majority of water supplies used in the Region. Current and future demand as well as sources of supply are discussed in greater detail in this section. Some of the potential climate change impacts to water demands are discussed in Section 3.7.

3.1.1 Water Demand Related Issues, Needs, Challenges and Opportunities

This subsection addresses the following key issues, needs, challenges and opportunities related to water demands:

- Balancing local water demand growth with resource availability (especially as related to groundwater) and downstream water export needs
- Water use efficiency programs provide means to efficiently use local supplies

3.1.2 Water Demand Estimates

Estimating the water demands of the Y-M Region is particularly difficult due to the number of small, geographically spread out water systems and highly variable transient water use associated with the recreation economy provided by the Yosemite National Park and other public lands that the Region supports. As a result, water demand estimates have been developed by reviewing select data from several water systems regulated by the California Department of Public Health (CDPH) which are estimated to serve about 9,000 of the 18,000 permanent residents of the Region. These estimates can be updated as additional information becomes available.

3.1.3 Municipal Water Systems

About half of the Region is served by one of approximately twenty community water systems regulated by the CDPH. The majority of these community water systems deliver groundwater while the remaining 9,000 residents use private wells to meet their water demands. CDPH categorizes water systems as follows:

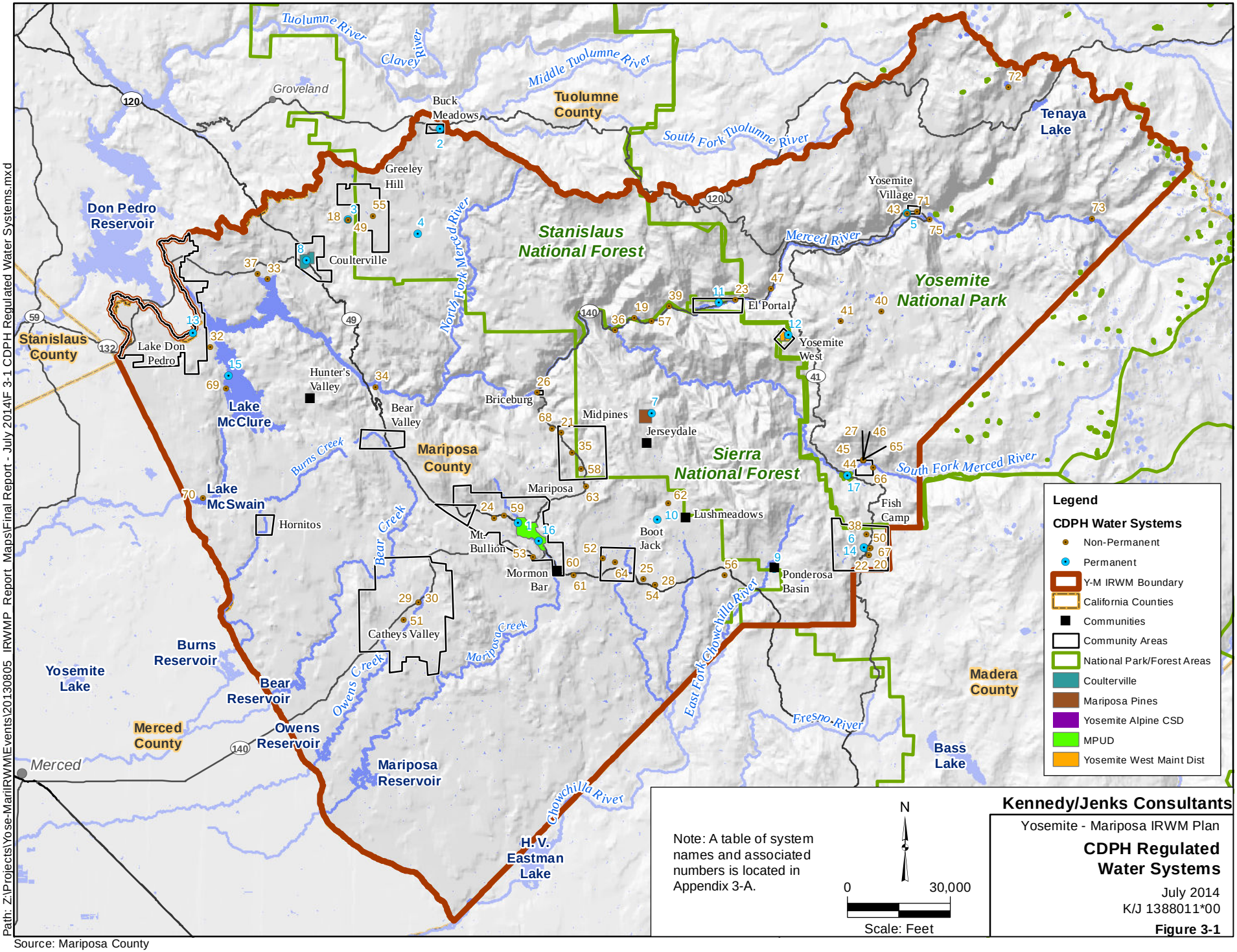
- **Community (C)** Serves at least 15 service connections used by year-round residents or regularly serves 25 year-round residents.
- **Non-Transient Non-Community (NTNC)** Serves at least the same 25 non-residential individuals during 6 months of the year.
- **Transient Non-Community (NC)** Regularly serves at least 25 non-residential individuals (transient) during 60 or more days per year.

Table 3-1 summarizes the larger community water systems that serve residential populations and some key information from these systems. Figure 3-1 shows the locations of these and other CDPH regulated water systems.

Table 3-1: CDPH Regulated Community Water Systems Serving Permanent Residents

Map Number	Water System Name	System Type	Community Served	Primary Water Source (Groundwater/ Surface Water)	Permanent Population Served	Service Connections (as of 2013)
1	CDF & FP - Mt. Bullion	C	Mt. Bullion	Groundwater	110	9
2	Yosemite Ridge Resort	C	Buck Meadows	Groundwater	45	35
3	Yosemite Westlake Mobile Estates	C	Coulterville	Groundwater	40	52
4	Wampum Hill Trailer Village	NC	Greeley Hill	Groundwater	70	35
5	Yosemite NPS-Yosemite Valley	C	Yosemite Village	Groundwater	1,000	235
6	Fish Camp Mutual Water Company	C	Fish Camp	Groundwater	200	76
7	Mariposa Pines Mutual	C	Mid Pines	Groundwater	168	84
8	MPWD-Coulterville CSA 1	C	Coulterville	Groundwater	165	95
9	Ponderosa Basin Mutual Water Co.	C	Ponderosa Basin	Groundwater	665	313
10	Whispering Pines Apartments	C	Midpines	Groundwater	55	26
11	Yosemite NPS - El Portal	C	El Portal	Groundwater	635	235
12	Yosemite West Water System	C	Mariposa	Groundwater	300	143
13	Lake Don Pedro CSD*	C	Lake Don Pedro	Surface Water	3,240	1,417
14	Yosemite Alpine CSD	NC	Fish Camp	Groundwater	50	36
15	McClure Boat Club, Inc.**	C	Lake McClure	Surface Water	48	68
16	Mariposa Public Utility District	C	Mariposa	Surface Water	2,000	678
17	Yosemite National Park – Wawona	C	Wawona	Surface Water	150	150
			Total		9,076	3,692

Source: CDPH database, 2013
* Lake Don Pedro CSD is listed as part of Tuolumne County by CDPH
** Has an additional 250 transient population



Source: Mariposa County

In addition to the CDPH-regulated community water systems serving permanent residents, there are over fifty other water system serving recreation areas, campgrounds, schools, and industries which are also shown on Figure 3-1. Table 3-2 that follows summarizes the water systems regulated by CDPH. A complete list of water systems with the numbers that correspond to those on Figure 3-1 is provided in Appendix 3-A.

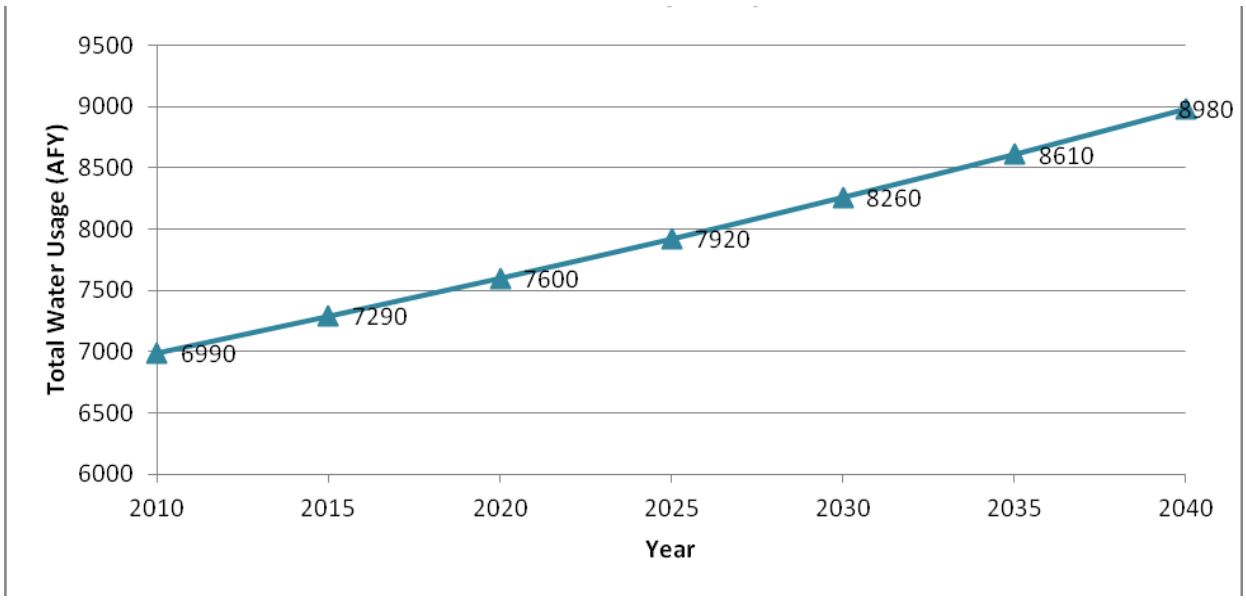
Table 3-2: Summary of Water Systems Regulated by CDPH

Primary Source	Type	Systems	Groundwater Wells[(a)]	Population Served[(b)]	Non-Permanent Population Served[(c)]	Service Connections
Groundwater	Hotel/Motel	6	20	0	726	65
	Industrial/Agricultural	2	3	0	65	14
	Institutional	1	6	110	0	9
	Mobile Home Park	3	5	155	0	122
	Recreation	19	23	1,000	4,143	609
	Residential	13	32	5,478	415	1,121
	School	7	9	0	1,135	15
	Transient	13	21	0	8,888	231
	Ground Water Total	**64**	**119**	**6,743**	**15,372**	**2,186**
Surface Water	Institutional	1	3	135	0	5
	Mobile Home Park	1	0	48	0	68
	Recreation	6	5	0	4,255	17
	Residential	3	4	2,150	0	2,245
	Transient	1	0	0	3,000	2
	Surface Water Total	**12**	**12**	**2,333**	**7,255**	**2,337**

Source: CDPH database
(a) Groundwater wells listed for entities with surface water are a secondary source.
(b) Non-Permanent/Permanent population estimated
(c) Includes transient population

3.1.4 Estimated Municipal and Domestic Water Demands

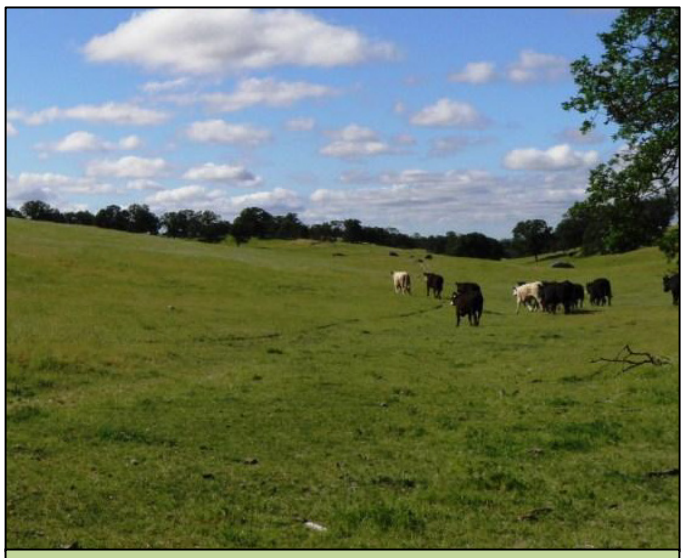
No known prior comprehensive water demand estimate for the Region has been prepared. Using population projections as discussed in Section 2.4 and average per person water demand of 342 gallons per day per capita obtained from data available from several community water systems, the current and future demands were estimated as shown on Figure 3-2. It is assumed that the average water use by a customer in a community water system is comparable to water users with individual water supply wells. The 2010 estimated municipal water demand is approximately 6,990 acre-feet per year (AFY) and is projected to grow to 8,980 AFY by 2040. These projections do not take into account water conservation or other programs that could reduce the average per capita water use. It is difficult to estimate the water demand related to the 4 million (estimated) visitors per year associated with Yosemite National Park as some of the demands of overnight visitors may be included in the local demand while those of day visitors are not. Overnight visitors also include hikers/backpackers that have nominal water use. If it is assumed that each visitor uses an average of about 60 gallons per visit, this could contribute about 746 AFY of additional demand.



Source: Based on data from Department of Finance, Ponderosa Basin Mutual Water Company, and Mariposa Public Utility Data

Figure 3-2: Estimated Existing and Future Mariposa County Residential Water Demand

3.1.5 Agricultural Demands



Rangeland
Credit: Kristen Boysen, Sierra Foothill Conservancy

The Mariposa County Agricultural Crop and Livestock Report indicates that there were about 500 acres of irrigated pasture, 535 acres of miscellaneous field crops and 282 acres of wine grapes and fruits and nuts under cultivation in 2012 with over 400,000 acres of non-irrigated rangeland making up the balance of agricultural lands. Based on a regional reference evapotranspiration from the California Irrigation Management Information System (CIMIS) of 53.1 inches/year, the approximately 1,100 acres of agriculture could add an estimated water demand of about 3,400 AFY. This demand estimate is corroborated by the Department of Water Resources water balance discussed in Section 3.3 which indicates a range of 2,300 to 5,000 AFY of agricultural water demand depending on the annual hydrologic conditions. The majority of the agricultural demands are likely at lower elevations but there are no data available on the proportion of demands that are met by groundwater and surface water diversions.

3.1.6 Water Demands Outside the Region

As noted earlier, the majority of surface water from the Y-M Region leaves the Region for agricultural and municipal uses. The bulk of surface water rights detailed in Section 3.2.2 in the Region are controlled by irrigation districts in the Central Valley. The rights to the majority of the Merced River water resources are allocated to the Merced Irrigation District (Merced ID) from a permit issued by the State Water Resources Control Board (SWRCB). The New Exchequer Dam forming Lake McClure and the McSwain Dam forming Lake McSwain are operated by Merced ID and used for hydroelectricity and the regulation of water to downstream users. Merced ID delivers approximately 320,000 AFY of surface and groundwater per year for irrigating about 100,000 acres of a variety of crops, such as almonds, cotton, tomatoes, wine grapes and hay and corn to support dairy, chicken, and beef livestock.

Big Creek Diversion
Credit: Fish Camp Fire/Rescue Association, Donn Harter

3.1.7 Non-Consumptive Demands – Hydropower Generation

In coordination with the water storage for out of region consumptive uses, there are two hydropower generation projects in the Region; Merced River Hydroelectric Project owned and operated by Merced ID and Merced Falls Hydroelectric Project owned and operated by Pacific Gas and Electric Company (PG&E). Hydropower generation is one of the essential products of the Y-M Region that have resulted in capturing the renewable and natural energy potential of the Merced River. Hydroelectric power generation facilities are a significant user of water in the Y-M Region. However, hydroelectric generation is also “non-consumptive”, in that water used is generally returned to the natural water system downstream of the power production facilities and the quality is not significantly affected. The Merced ID Merced River Project has a flow ranging from 900-2,700 cfs in the dry season and 200-300 cfs in the wet season (USGS, 2013b). The PG&E Merced Falls Project has a flow of about 1,371 cfs (MWH, 2003). This results in a dependable power generation capacity of 103.5 megawatts (MW) and 1.7 MW, respectively.

3.1.8 Total Estimated Water Demands

The total estimated water demands for the region are summarized in the table that follows. It is assumed that agricultural and visitor demands do not change although year-to-year variation can occur based on hydrologic conditions and visitation, which is often tied to economic conditions.

Table 3-3: Summary of Y-M Region Estimated Water Demands

	Estimated Average Demand by Year						
Demand Type	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
Residential	6,990	7,290	7,600	7,920	8,260	8,610	8,980
Visitor	746	746	746	746	746	746	746
Agricultural	3,400	3,400	3,400	3,400	3,400	3,400	3,400
Total Estimated Average Demand	13,146	13,451	13,766	14,091	14,436	14,791	15,166

3.2 Water Supply

Surface water resources in the Y-M Region are typically abundant with surface water runoff from the three watersheds providing essential water for local and downstream users. Groundwater sources which are used extensively can be more scarce due to the challenging subsurface geology. This section describes the current and projected water supply conditions and demands of the Y-M Region. A summary of water-supply related climate change vulnerabilities is discussed in Section 3.7.

3.2.1 Water Supply Related Issues, Needs, Challenges and Opportunities

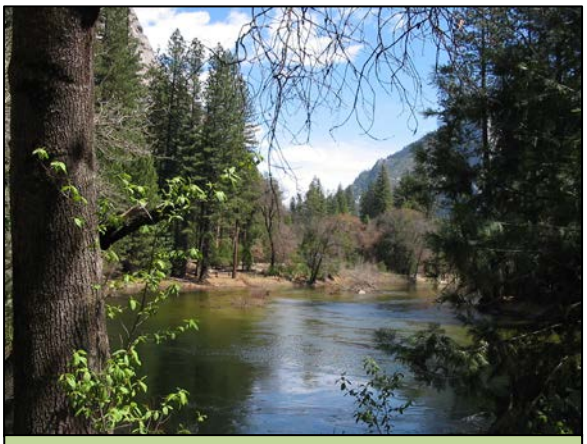
This subsection addresses the following key issues, needs, challenges and opportunities related to water supply management:

- Local surface supplies are limited and there are significant downstream exports
- Groundwater use is not managed and supply reliability is not well understood
- Climate change effects on supply are unknown

3.2.2 Water Rights Background

The ownership, diversion, and storage of water in California is complex and has been an evolving process over the 160 years of California's statehood. The following provides a brief summary of surface water and groundwater regulations that generally apply to the Region as described in the SWRCB Water Transfer Guide from 1999. Legal counsel should be consulted in any water rights determination.

3.2.2.1 Surface Water Rights



Merced River
Credit: Pat Garcia

By law, the State of California SWRCB Division of Water Rights administers water rights law so that water is protected for the use and benefit of all Californians. While surface water cannot be privately owned, rights to use water can be granted to individuals or organizations. A water right is a legally protected right to take possession of water and put it to beneficial use. Under the California Water Code, the SWRCB is responsible for allocating surface water rights and permitting the diversion and use of water throughout the state. Through its Division of Water Rights, the SWRCB issues permits to divert water for new appropriations or to change existing water rights. An important aspect of California water rights is that those granted the oldest rights have priority over those granted more recent (i.e. junior) water rights ("First in time, first in right"). There are two major types of water rights under California State Law: riparian rights and appropriative rights.

Riparian rights are those where water is extracted for use on lands that directly border a water course. A property owner has a riparian right to water that flows through the property. Any owner of a parcel immediately adjacent to a water course has the right to take water for domestic and agricultural use at any time unless specific deed restrictions are stated in the title to the land. The water can only be used on the property and cannot be impounded or stored or exported to another property or sold to another. Any removal of water from a surface water body for delivery

to non-adjacent parcels constitutes appropriative use, which requires a permit from the SWRCB that establishes an appropriative right.

Appropriative rights are those that are permitted or licensed by the SWRCB. Appropriative water rights allow the use of natural flow of the stream provided riparian rights are satisfied. In addition to the diversion of water that is applied directly to beneficial use, appropriative rights may be used for the storage of water. Appropriators can also divert or store water that is "foreign" to the stream system in time or imported into the watershed. Appropriative rights are permitted specifying the actual point of diversion on a waterway and detailed description of the area of use. Appropriative water rights work on a priority system and depend on the time and nature of the water right. However, all appropriative rights are subject to the prevention of waste or unreasonable uses affecting public trust resources, and appropriative rights can be lost if they are not used over a period of years.

- Pre-1914 water rights pre-date statewide permitting authority and are the oldest type of appropriate water rights. Diversion priorities are based on first use of the water and is considered “first come, first served”. Pre-1914 water rights have significantly greater flexibility in terms of points of diversions and places of use than post-1914 water rights.

- Post-1914 appropriative water rights are the modern day administrative system utilized by the State to provide oversight of water rights. Post-1914 rights require licenses or permits to be issued by the SWRCB. The priority for post-1914 water rights is based on the date of the water right application filing with the SWRCB.

State law affords some protections from export of waters from counties that are considered watersheds or “areas of origin”. There are numerous provisions and statements in California code that describe the intentions to protect upstream water users from being “deprived directly or indirectly of the priority right to all the water reasonably required to adequately supply the beneficial needs of the protected area”, however, these provisions are largely unproven and have yet to be fully resolved (SWRCB, 1999).

3.2.2.2 Groundwater Rights

Groundwater is treated differently from surface water in California. Generally, groundwater is shared by landowners who pump water for use on their lands that overlie the groundwater basin or source. Pumped groundwater can be put to reasonable and beneficial use. In water short times they are expected to share the water equitably. Water may be taken to lands that are not owned by the person pumping the water or that does not overlie the groundwater basin provided the overlying landowners are not harmed (SWRCB, 1999).

No state water right permits are required to pump groundwater. Each groundwater user can drill a well and pump groundwater without the need of a water right permit. However, there are often local ordinances that must be obeyed and there are statewide regulations governing well drillers related to recording of the wells they drill. In addition, some groundwater basins, mostly in southern California, have been adjudicated and many groundwater basins have local groundwater management plans adopted under Water Code 10750 et. seq. (also known as AB 3030 for the Assembly bill that enacted these statues) or other laws. There are no adjudicated basins or other known state-issues groundwater restrictions in the Y-M Region.

3.2.2.3 Mariposa County Water Rights and Agreements

There are numerous water users in Mariposa County, although there are only a few significant water rights holders. According to the SWRCB electronic water rights database, there are 290 active appropriative water rights licenses and 103 active filed Statements of Diversion. Statements of Diversion can include both riparian as well as pre-1914 appropriative water rights. In addition, there may be direct riparian users, without storage, throughout the Region who do not make filings with the SWRCB. The following describes, in general terms, the water rights associated with the three major watersheds in the Region.

3.2.2.3.1 Merced River Watershed

The Merced River is by far the largest watershed in the Y-M Region and lies primarily in the Region although the upper south Fork Merced watershed also lies within Madera County. Merced ID is the primary holder of water rights on the Merced River. Merced ID has several water rights, some date back to the 1880s. Even though the agency was incorporated or formed in 1919, they took over the Crocker Huffman Irrigation company that acquired rights from other irrigation companies which ultimately became Merced ID rights. The rights Merced ID took over in 1919 are mostly pre-1914 appropriative. Merced ID water rights include both consumptive, for irrigation and non-consumptive, for hydropower generation. Merced ID also retains a storage license to permit diversions of stored water up to 516,000 AFY in Lake McClure. Merced ID's FERC hydropower license does require certain instream flows to be maintained downstream of Lake McClure (CHM2HILL, 2001).

Neither Mariposa Public Utility District (MPUD) nor Mariposa County have appropriative rights on the Merced River. Applying for a right up stream of Lake McClure (including Merced River tributaries) would require Merced ID (and the SWRCB) participation and probably both agencies approval. MPUD obtains surface water from the Merced River via the Saxon Creek project. MPUD's diversion is provided for through an amendment to Merced ID's water right area of use to include the Mariposa Town Planning Area (map on file with the SWRCB). MPUD's current water rights amendment that includes the Mariposa Town Planning Area could be expanded in the future, but this would require negotiation with Merced ID and the SWRCB.

There are many riparian users on the Merced between the Merced ID impoundments and diversions at Exchequer, McSwain and Crocker Huffman. Monitoring diversions of the many riparian diverters, using regulatory gauging stations can be challenging for downstream appropriative water rights holders such as Merced ID, because the riparian users affect the minimum flow measurements at Exchequer and McSwain used to evaluate permitted minimum bypass flows.

Federal agencies such as the Sierra National Forest, the Stanislaus National Forest, National Park Service, and the Bureau of Land Management have licenses or permits for quantities ranging from 0.1 to 76.5 AFY which are small quantities relative to those of the largest diverter in the Region, Merced ID.

3.2.2.3.2 Lower Mariposa Group of Streams

The Lower Mariposa Group of Streams includes several creeks that flow in a westerly direction and eventually flow outside the western Region boundary. The primary creeks with water rights diversions and impoundments include Mariposa Creek, Bear Creek, and Owens Creek.

Appropriative water rights on Mariposa Creek were held by El Nido Irrigation District until the irrigation district was annexed by Merced ID, in 2005. The rights were transferred to Merced ID in the annexation process. Water rights applications on streams in the Mariposa Creek watershed would require negotiations with SWRCB and Merced ID. MPUD does have appropriative rights on Stockton Creek, a tributary to Mariposa Creek.

Mariposa Reservoir, Owens Creek Reservoir and Bear Creek Reservoirs are Army Corps of Engineers flood control facilities located near the westerly Mariposa County boundary. They are facilities dedicated to reducing flood risk in the lower elevation San Joaquin valley floor and have fixed discharges with no valves. The dams and reservoir areas are on private land. The Army Corps either leases or has easements for the facilities. Closing the discharge to impound water would require permits from SWRCB and negotiation with Merced ID.

3.2.2.3.3 Chowchilla/Fresno Rivers Watersheds

The Chowchilla River is the primary drainage in the Fresno/Chowchilla watershed in the Region. The Chowchilla River is impounded at the Madera/Mariposa County line at Eastman Lake. Eastman is an Army Corps of Engineers facility and the dam is used to store water for flood control, irrigation, and recreational uses. Water rights are held by the U.S. Bureau of Reclamation, which has incorporated the reservoir into the Central Valley Project (CWD, 2013). Chowchilla Water District also has appropriative water rights on the Chowchilla River as well as contracts with the USBR to receive about 43,000 AFY from Eastman Lake. Water use and appropriations in the Chowchilla watershed would include SWRCB and Madera Irrigation District participation.

Within the Region, Lewis Creek and Miami Creek are in the Upper Fresno River watershed, and no water rights filings were found for Lewis or Miami Creek.

3.2.3 Surface Water Sources

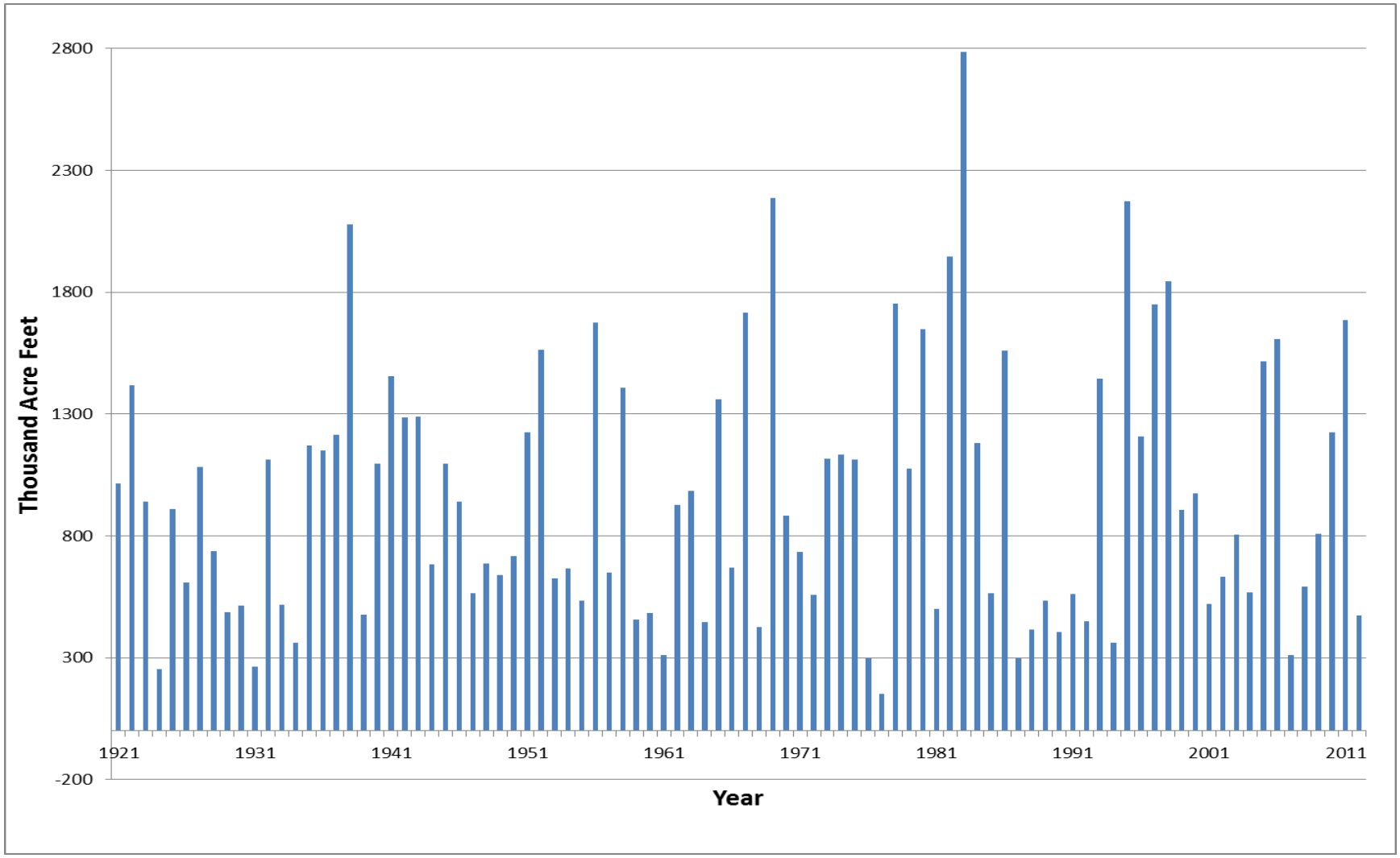
Surface water is the most abundant of the water resources in the Region. As described earlier, the primary surface water supply in the Merced River watershed is the snow pack that accumulates in the various subwatersheds. A significant part of the Upper Merced River watershed is under the control of federal government agencies and are managed by Yosemite National Park, Stanislaus National Forest, Bureau of Land Management (BLM), and Sierra National Forest as shown on Figure 2-5. The Lower Mariposa Group of Streams and the Chowchilla/Fresno River Basins, which are at lower elevations contain watersheds mostly on private lands. Proactive measures by federal agencies have contributed to improved management and maintenance of the overall health of the watershed.

One way to evaluate potentially available surface water supply is to estimate the unimpaired flow for a drainage basin. The unimpaired flow is stream flow that would have occurred had water flow remained unaltered within the watershed. The average annual estimated unimpaired flow for the Merced River from 1921-2003 is 0.96 million acre-feet (MAF) at Lake McClure which, represents a watershed drainage area of about 1,040 square miles (DWR, 2007). The annual flow fluctuates significantly based on precipitation, snow pack conditions and the timing of snowmelt.

In comparison, the Chowchilla River, which has its headwaters in the Y-M Region averaged 70,000 AFY at the Eastman Lake formed by Buchanan Dam, which represents a watershed area of about 235 square miles. There are reservoir inflow estimates for four creeks within the Lower Mariposa Groups of Streams watersheds from the US Army Corps of Engineers' that are used to monitor flood conditions. Four gauged creeks (Burns, Bear, Owens, and Mariposa) in the Lower Mariposa Groups of Streams have a total drainage area of about 279 square miles which is 84 percent of the 331 square miles of the entire watershed. Individual creeks range in drainage area from 26 square miles for the Owens Creek drainage up to 107 square miles for the Mariposa Creek drainage (DWR, 2007).

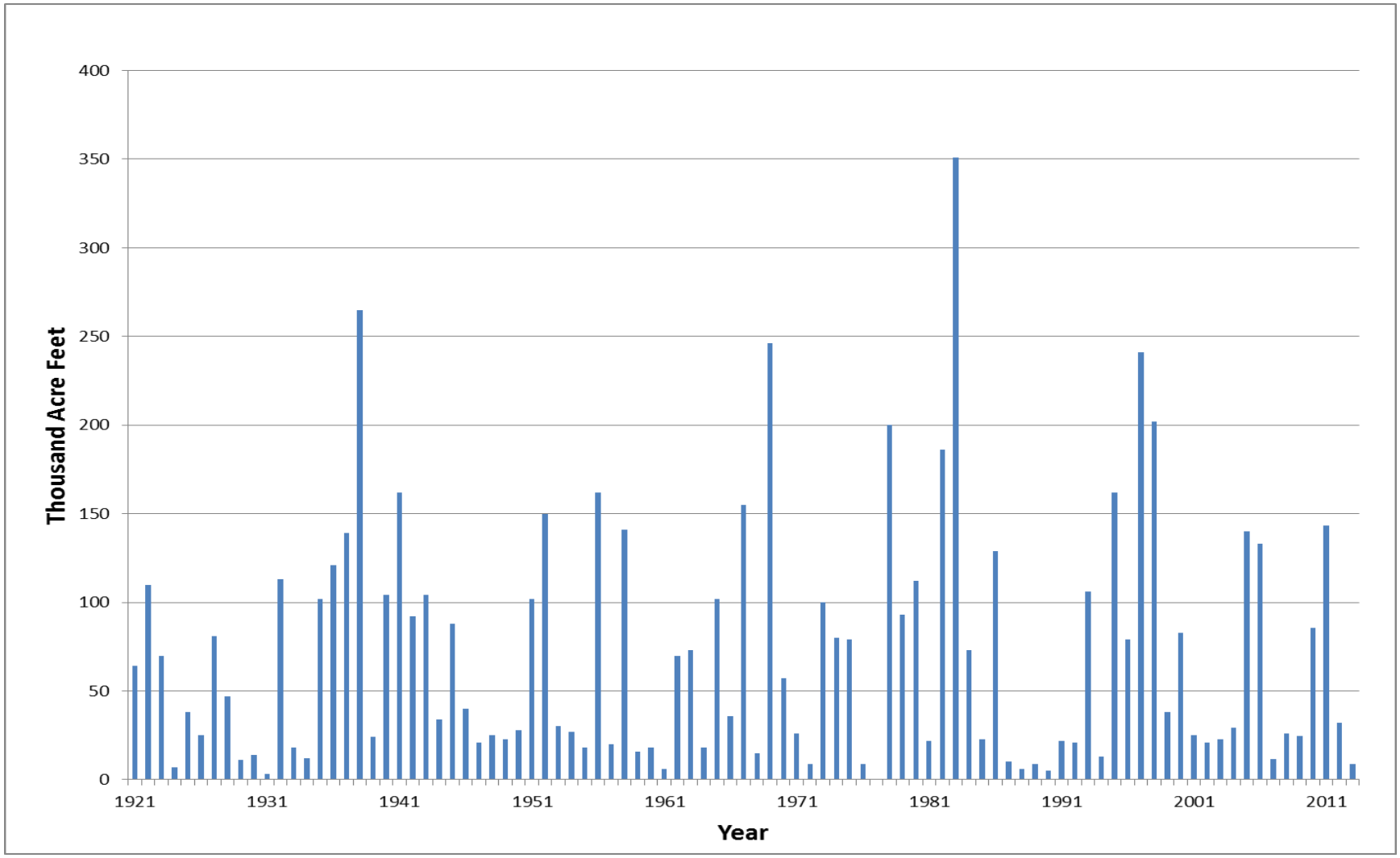
As discussed in section 3.4.1, the larger municipal surface water users include MPUD which draws water from both Stockton Creek a tributary to Mariposa Creek and the Merced River near Saxon Creek. Lake Don Pedro Community Services District (LDPCSD) also draws Merced River water from Lake McClure. As discussed earlier, both MPUD and LDPCSD use Merced River water under contract to Merced ID, the water rights holder. In addition, the Merced River provides water for the NPS Wawona and several other recreational water users.

The Chowchilla River and the Lower Mariposa Groups of Streams are subject to similar seasonal fluctuations in flow as the Merced River. (DWR, 2007). Figure 3-3 shows the annual unimpaired flow for the Merced River Watershed, Figure 3-4 shows the annual unimpaired flow for the Chowchilla River. Figure 3-5 shows the gauged reservoir inflow for the four major creeks in the Lower Mariposa Groups of Streams. It is expected that under climate change conditions these flows may have higher variation causing more prevalent drought/flood cycles.



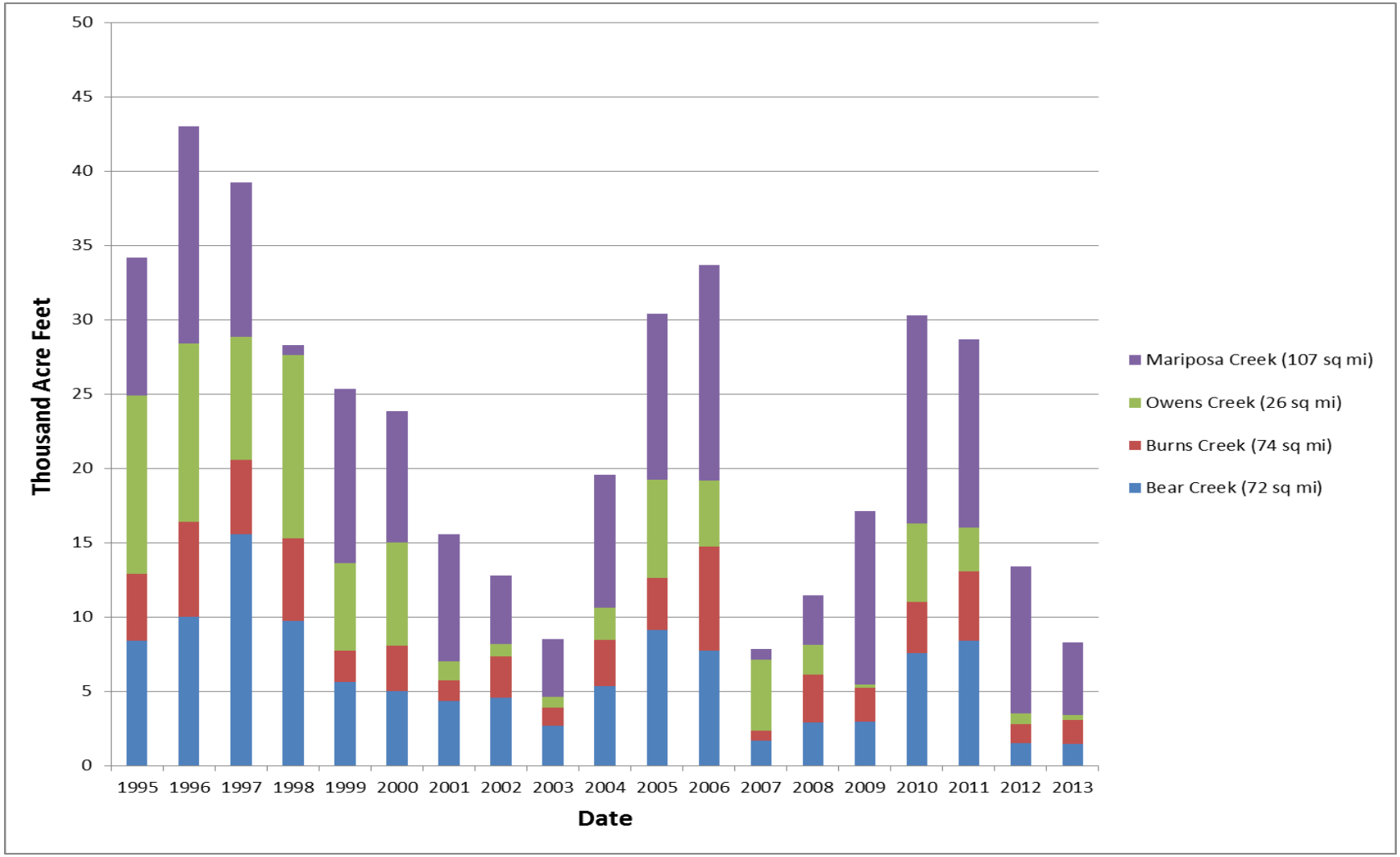
Source: DWR, 2007 and CDEC, 2013

Figure 3-3: Annual Estimated Unimpaired Flow for the Merced River Watershed (1,040 square mile drainage area) at Exchequer Dam (Lake McClure)



Source: DWR, 2007 and CDEC, 2013

Figure 3-4: Annual Estimated Unimpaired Flow for the Chowchilla River at Buchanan Dam (235 square mile drainage area) (Eastman Lake)



Source: CDEC, 2013

Figure 3-5: Annual Reservoir Inflow for Select Mariposa Groups of Streams (279 square mile drainage area)

3.2.4 Groundwater Supply and Extraction

Groundwater is estimated to be the only water source for an estimated 15,000 residents, over 80 percent of the population. As described in Section 2.8.2.2, it is very difficult to predict the reliability of these sources due to the fractured rock geology of the aquifers. Granite masses are encountered beneath the top soil with groundwater being stored in the fissure crack system that developed. The water bearing characteristics of these rock structures are primarily controlled by weathering and structure. Wells drilled in the Region are often unpredictable and encounter highly variable amounts and levels of water. The accepted depth of wells in rock is typically determined by cost, unless depth and quantity of groundwater is known from the surrounding geologic structure.

Typical groundwater statistics cited in the Mariposa County General Plan include:

- In unweathered rock 5 to 15 percent of wells fail annually
- Median yields are less than 8 gallons per minute (gpm) with roughly ten percent reaching a yield greater than 50 gpm
- Groundwater on high on slopes or on top of mountains tends to have more seasonal variation in depth to water and yield

The only DWR recognized contiguous groundwater basin in the Region is the Yosemite Valley Basin. This basin supplies water to the various communities in Yosemite National Park and has much better well yields than other parts of the Region. The Yosemite Valley basin is approximately 7,500 acres with well yields averaging 900 gpm and peaking at 1,200 gpm and has high quality water (DWR, 2003).

Concurrent with the preparation of the IRWM Plan, a focused groundwater study is being prepared for portions of Mariposa County using both existing well logs as well as some field sampling for water levels and water quality. The study is intended to focus on areas where there are relatively high densities of private and community wells where water levels, particularly during dry periods, may decrease to where supplies become limited. The full study is included as Appendix 3-B.

3.2.5 Recycled Water

Recycled water use in the Region is limited to golf course irrigation in Wawona using tertiary wastewater from the National Park Service's (NPS) wastewater treatment plant which produces up to 100 AFY of recycled water and pasture irrigation using secondary wastewater from the Mariposa County Service Area, 1-M, Sewer Zone #1 wastewater treatment plant which produces up to 90 AFY (Kennedy/Jenks 2010, RWQCB 2013). At this time, the other wastewater treatment facilities at Mariposa Public Utility District, at NPS El Portal (which also treats Yosemite Valley wastewater), Coulterville, Yosemite Alpine CSD in Fish Camp, and Yosemite West do not have areas and/or facilities to cost-effectively produce and/or apply recycled water. Wastewater collection and treatment facilities are discussed in Section 3.4.4 in greater detail.

3.2.6 Total Estimated Water Supplies

The total estimated water supplies for the region are summarized in the table that follows. It is assumed that surface water supplies do not change over time although it is acknowledged that annual variation may occur based on hydrologic conditions.

Table 3-4: Summary of Y-M Region Estimated Water Supplies

Supply Type (Acre Feet/Year)	Year						
	2010	2015	2020	2025	2030	2035	2040
Surface Water	1,300	1,300	1,300	1,300	1,300	1,300	1,300
Recycled Water	110	140	170	190	190	190	190
Groundwater	11,736	12,016	12,296,	12,601	12,946	13,301	13,676
Total	15,156	15,471	15,786	16,116	16,466	16,826	17,206

3.3 Regional Water Balance

The hydrologic cycle dictates the generation, conveyance, storage, and use of water throughout the Region. The figure below depicts the hydrologic cycle in terms of a “water balance”, which is useful to improve understanding of the water flows in the system. As the headwaters and an area of origin region, the many watersheds begin within the Y-M Region. Water enters the Region in the form of rainfall or snow, flows through the watersheds through the many streams and rivers. At points along the way, water may be diverted or stored for different uses. At the western downstream extents of the Region, water that has not been used flows into the lower watersheds, where it may be used by others. All of the watersheds are tributaries to the San Joaquin River.

The figure that follow is based on water balances prepared by DWR for Mariposa County, which is contiguous with the Y-M Region, using data from 1999 and 2002 through 2010 as part of the DWR 2013 California Water Plan (CWP) Update. These water balances for single years account for “applied water” or demand such as consumptive water uses such as residential, commercial, agricultural based on the DWRs land use data as well as non-consumptive uses such as environmental releases (accounted for in downstream releases) the vast majority of which leave the Region. Many elements of the water balance are not quantified as the data are not available. A water balance based on data from a single year can provide a useful “snapshot” of water management conditions, but does not depict some important long-term management factors such as changes in groundwater and surface water storage that may be relevant for regions where groundwater and surface water are conjunctively managed.

Given the ten years of available data, years were selected to represent average, dry and wet years. Figure 3-6 presents the information for an average year which was 2009 for the period of record, a dry year which was 2007, and a wet year which was 2006.

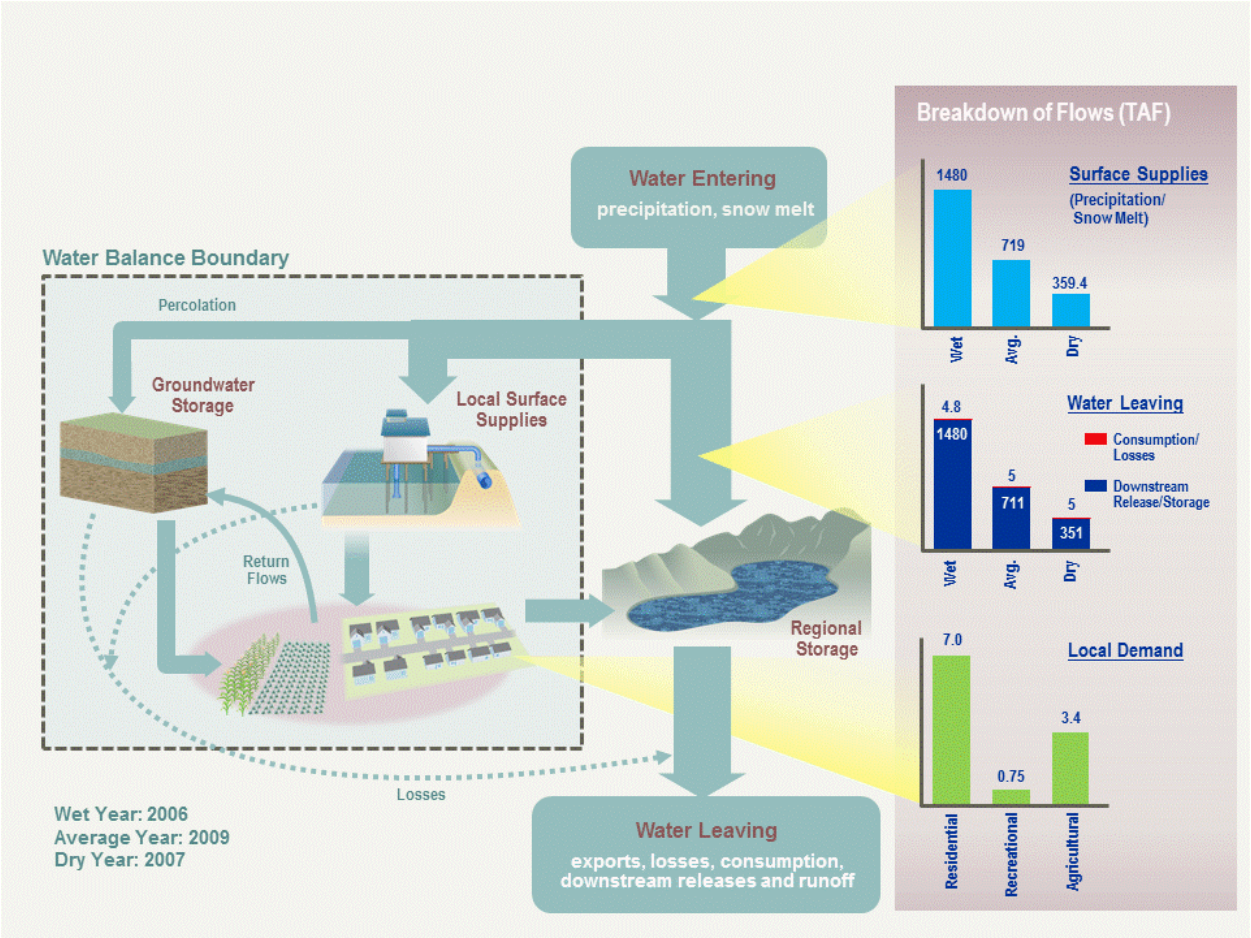


Figure 3-6: Water Balance for Y-M Region

3.4 Water-Related Infrastructure

Water-related infrastructure in the Y-M Region ranges from systems that deliver groundwater and surface water for potable supply as well as the associated water distribution and fire prevention including pipelines, tanks, and pump stations. Large water storage reservoirs provide facilities for hydroelectric power generation and flood control. Wastewater collection and treatment facilities in several communities are also a critical component of the Region's water-related infrastructure. An overview of this range of facilities is described in this section.

3.4.1 Water Infrastructure Related Issues, Needs, Challenges and Opportunities

This subsection addresses the following key issues, needs, challenges and opportunities related to water infrastructure management:

- Aging water supply and distribution infrastructure is not being replaced in a timely manner
- Inadequate water storage and resources for adequate community fire protection
- Compliance with wastewater treatment regulatory standards for community wastewater systems and private septic systems

3.4.2 Drinking Water Infrastructure

As discussed earlier in Section 3.2.1 there are approximately 20 CDPH regulated public water systems that serve primarily groundwater to about 9,000 permanent residents of the Y-M Region as well as 58 other CDPH regulated water systems serving a range of facilities. Table 3-2 provided a summary of the types of agencies, the water source, and population and service connection information. A more detailed table of the individual water systems with identifying numbers associated with Figure 3-1 is found in Appendix 3-A.

Each of these systems has pipelines, pump stations, disinfection and storage facilities. In addition, many agencies only have groundwater wells with disinfection while surface water facilities have more sophisticated treatment facilities, often with groundwater as a back-up. The 2008 draft Local Agency Formation Commission (LAFCO) Water and Wastewater Municipal Service Review Report identifies six special districts or local agencies of the County subject to LAFCO. These six systems represent about 100 miles in distribution pipeline, over 10 water storage tanks, over 10 groundwater wells, and two surface water treatment plants. At this time, data from the other water systems is not available to fully quantify the potable water infrastructure of the Region.

3.4.2.1 Municipal Surface Water Treatment Facilities

Surface water is used on a limited basis for drinking water for permanent residents in the Region by MPUD, LDPCSD, and the National Park Service (NPS) in Wawona. In addition, the following systems serve surface water to visitors and/or recreational facilities.

- Merced ID – McClure Point Recreation Area
- Merced ID – McSwain Recreation Area
- NPS – Glacier Point
- NPS – May Lake Camp
- NPS – Merced Lake Camp
- NPS – Sunrise High Sierra Camp
- NPS – Vernal Falls
- McClure Boat Club

A more detailed description of the MPUD and LDPCSD surface water facilities which combined serve over 5,000 persons follows.

MPUD Surface Water Facilities

MPUD uses water both from Stockton Creek, a tributary to Mariposa Creek which drains to the Lower Mariposa County Group of Streams watershed and the Merced River near Saxon Creek as shown on Figure 3-1. MPUD also has 4 groundwater wells that pump up to 135 gallons per minute (gpm) directly into the water distribution system.

Stockton Creek, one of the primary sources of water for MPUD, is impounded by the Stockton Creek Dam to create a 440 AF reservoir. Source water feed from the Stockton Creek Dam to the Surface Water Treatment Facility (SWTF) flows through a 10-inch diameter 7,000 linear feet raw water pipeline. The estimated maximum flow through the 10" pipeline is 2,000 gpm. However there is approximately 400' of 6" diameter pipe from the valve operating tower in the reservoir pool to the toe of the dam which restricts the flow from the reservoir to approximately 650 gpm. MPUD also uses the pump station on the Merced River (Saxon Creek Pump Station) as a secondary source of up to 2,400 gpm. MPUD holds water rights permits and licenses to Stockton Creek while the use of the Merced River is by contract with Merced ID. Water rights are discussed in Section 3.2.1 in greater detail.

MPUD owns and operates a pump station on the Merced River approximately one mile west of Briceburg. The project title (Saxon Creek Water Project) was derived from the point of diversion being located near the confluence of Saxon Creek and the Merced River. Water is actually pumped from the Merced River. The pump station is equipped with two 1000 hp pumps expandable to include a third pump. Pumping is restricted by water right and BLM land use permits (pumping may not result in a stream flow of less than 50 cfs downstream of the diversion). The current capacity of the pump station is 2400 gpm, expandable (with the third pump installed) to 3200 gpm. Water from the Merced River is transported through a 43,000-foot, 12-inch pipeline which connects to the 10" pipeline at the toe of the Stockton Creek dam. A one million-gallon steel raw water tank is located at the high elevation point in the pipeline. Raw water from the storage tank is then transported by gravity lines to a surface water treatment facility. Alternatively water from the Merced River may be diverted from the 43,000 foot pipeline directly to the Stockton Creek Reservoir. This allows the District to store water from the Merced River during low water runoff years in the spring for use throughout the rest of the year. The flexibility of the water source is especially valuable in critically dry years.

Water Treatment Plant
Credit: MPUD, Mark Rowney

The SWTF was replaced in 2013 with funding from California Proposition 50 grant of $2 million and a State Revolving Fund grant of $3 million. The primary components of the new facility include a clarifier/flocculation tank, Ultrafiltration membrane filters, granular activated carbon reactors, Chlorine disinfection system emergency power generator, replacement of all chemical feed systems and a new operations building. The new SWTF capacity is one million gallons per day. The SWTF is required to meet a 0.1 nephelometric turbidity unit (NTU) standard.

LDP CSD Facilities

The Lake Don Pedro CSD also provides surface water from Lake McClure to its customers with supplemental water from a well. Lake Don Pedro CSD has two intake pumps that draw water down to an elevation of 700 feet. Below that level, a Float Pump Barge is employed, which adjusts to water levels below 700 feet. The water is pumped from Lake McClure into a 1.5 million gallon raw water storage tank which provides a constant flow rate to the water treatment plant. The 2 mgd capacity conventional water treatment plant includes the addition of chemical coagulant followed by a coagulation/flocculation basin and sedimentation of large floc particles. Smaller particles are removed in two multi-media pressure filters that contain anthracite, sand, and garnet media. Following disinfection, the treated water is pumped to a series of distribution system storage tanks for gravity delivery to the customers (Lake Don Pedro CSD, 2013).

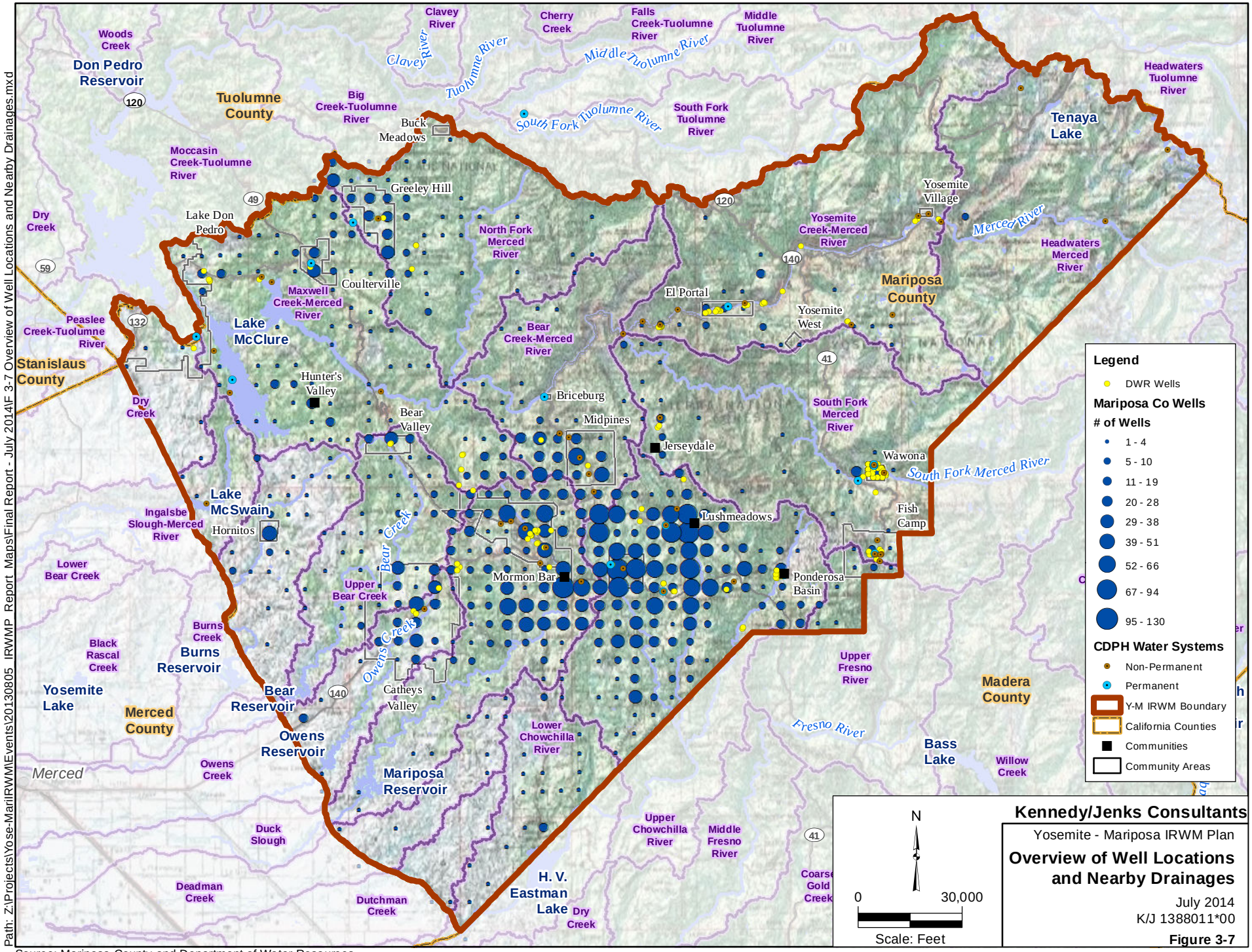
3.4.2.2 Groundwater

The majority of private and community drinking water in the Region is obtained from groundwater. DWR's well log database identifies approximately 6,000 existing, abandoned, and/or deepened wells in Mariposa County. The number of these 6,000 well logs within the township, range, and section of the well location is provided on Figure 3-7. The majority of the wells are located within 12 miles of Mariposa where much of the population of the Region resides.

As discussed earlier, the geology of the Region consists of a hard rock which has the result of small and inconsistent groundwater aquifers. Typical domestic wells can be between 50 and 200 feet deep and produce around ten gallons per minute (gpm). Large yields greater than 50 gpm are rare and usually unsustainable (County of Mariposa, 2006). The topographic location is significant in the productivity of hard rock wells.

As part of this IRWM Plan, a groundwater study was conducted that investigated 10 subareas within the Region. The subareas were derived based on surface watersheds in the areas with the highest well densities (see Figure 3-8). For each subarea, the following evaluations were investigated:

- Pre-development water budget
- Estimation of consumptive use due to groundwater pumping
- Summary of well depths and yields (~3,000 wells) – Not included for Fish Camp



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Source: Mariposa County and Department of Water Resources.

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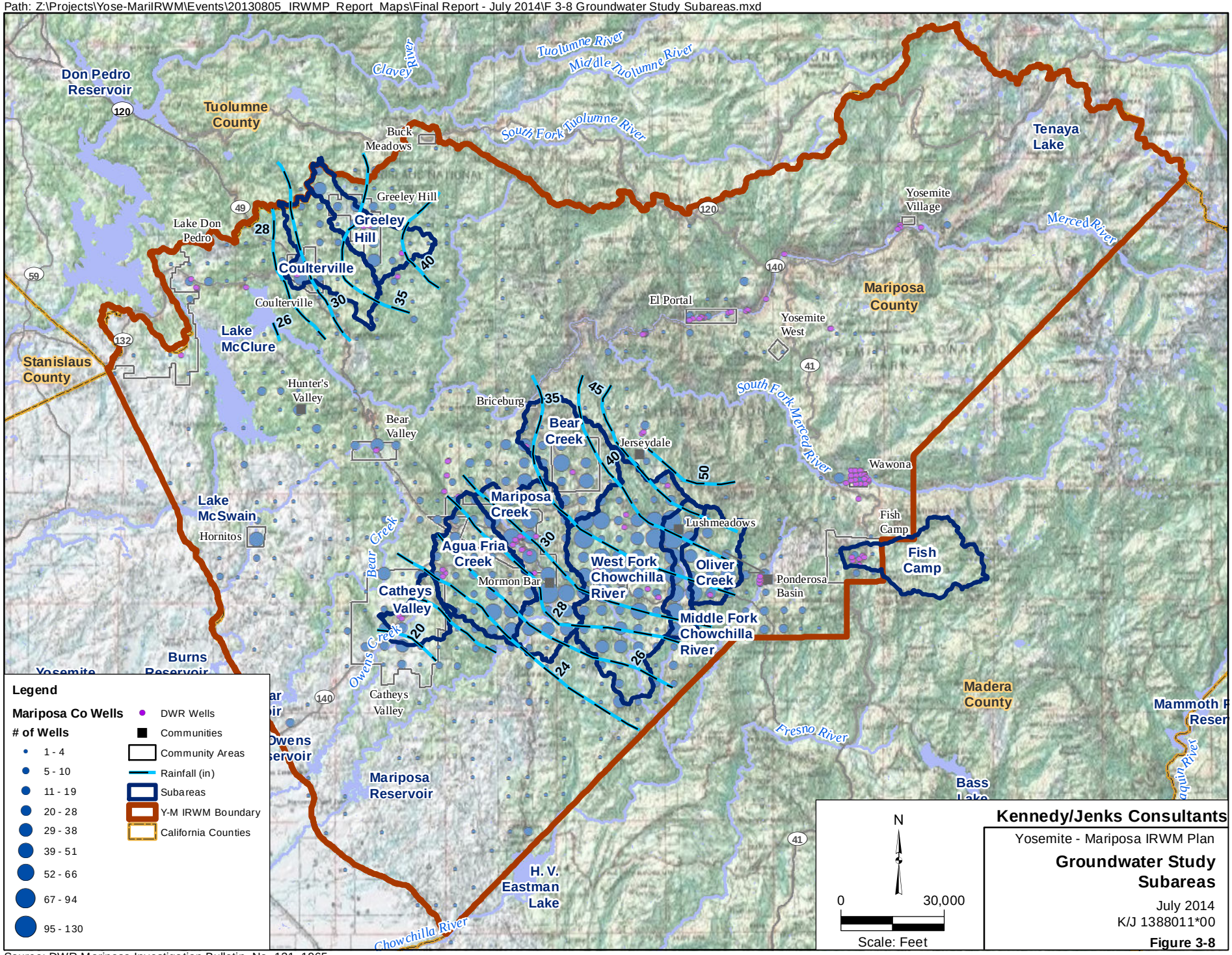


Source: DWR Mariposa Investigation Bulletin, No. 131, 1965.
1. Average precipitation between 1905-1959.

As part of the water budget analysis, isohyetal contours (i.e. lines of equal rainfall) were overlaid to correlate average rainfall over each subarea. In general, precipitation is the source of water for groundwater in each watershed. Under pre-development conditions, this water either was consumed by native plants or evaporated (evapotranspiration), or ran off as streamflow. The groundwater study includes estimates for average natural runoff for each subarea. Estimates for groundwater pumping for each subarea were made including groundwater pumping and estimated consumptive use. In general groundwater recharge appears to be more than groundwater consumption, on an annual basis, based on this high level analysis. The quantity of groundwater available, especially during an extended drought period, could be highly variable within each subarea and would require more detailed study.

Based on the summary of well logs within the Region, more than 80% of the almost 3,000 wells reviewed were less than 400 feet below ground surface (bgs), with approximately 40% of these wells less than 200 feet bgs. Within the Region, the following distribution of well depths was found. The complete groundwater study can be found in Appendix 3-B:

1. **< 200 ft:** 40-55% of wells in all subareas were completed less than 200 ft bgs (1,285 wells).

2. **200-399 ft**: 30-50% of wells in all subareas were between 200-399 ft. bgs (1,327 wells)

3. **400-599 ft**: 9-15% of wells in all subareas were between 400-599 ft. bgs (298 wells)

4. **600-1000 ft**: <10% of wells in all subareas were deeper than 600 ft. bgs (83 wells)

Shallower wells are much more susceptible to falling groundwater levels that could occur either as a result of drought or as a result of higher pumping rates. More recent wells have typically been deeper to provide greater longevity and reliability of the wells.

3.4.3 Water Storage

As shown on Figure 3-1, there are a number of large water storage impoundments that provide a range of function from flood control, private stock ponds, drinking water, and hydroelectric and irrigation storage. The impoundments that have dams with heights in excess of 25 feet requiring regulation by the DWR, Division of Safety of Dams, some of which are shown on Figure 3-1, are summarized in Table 3-5. Smaller creek impoundments are shown on Figure 2-8.

Table 3-5: Dams and Storage Reservoirs

Type	Name	Waterway	Owner	Year Built	Height	Capacity (AF)
Private	McMahon	Maxwell Creek	Carol Menzel	1957	52	520
	Metzger	Dutch Creek	Dennis Seastrom	1956	30	75
	Whispering Oaks	Bear Creek	Whispering Oaks West Home Owners Association	1968	31	69
	Green Valley	Smith Creek	Traian And Alina Micu	1957	33	240
	Hendricks	Horse Creek	Joe Surprenant	1958	33	130
Drinking Water	Stockton Creek	Stockton Creek	MPUD	1950	95	440[(a)]
Hydroelectric/ Irrigation	New Exchequer (Lake McClure)	Merced River	Merced ID	1964	479	1,024,600[(b)]
	Lake McSwain	Merced River	Merced ID	1967	97	9,730
	Merced Falls	Merced River	PG&E	1901	37	579
Flood Control	Bear	Bear Creek	ACOE	1954	92	7,700
	Mariposa	Mariposa Creek	ACOE	1948	88	15,000
	Owens	Owens Creek	ACOE	1949	Not availab le	3,600

Source: DWR, Division of Safety of Dams, 2012;
(a) MPUD.
(b) Includes 350,000 AF of flood storage

Regulated private dams used for stock water or personal water supply include: Whispering Oaks, Hendrick's, McMahon, Green Valley, and Metzger Dams. These dams are typically smaller than public dams with less than 1,000 AF in capacity. The larger dams are discussed in greater detail below.

3.4.3.1 Storage for Fire Protection

Fire can present a significant danger with approximately seventy percent of the communities listed in the Federal Register in 2001 as at high or very high risk from wildfires (County of Mariposa, 2010). With its sparse and distributed population, firefighting water resources in the Region can be extremely limited depending on the location. Fire protection services are provided in the Region by various entities including: California Department of Forestry and Fire Protection (CAL FIRE), Mariposa County Fire Department with many volunteer fire entities such as Fish Camp Fire and Rescue, Mariposa Utility Public District Fire Department and NPS and US Forest Service in the federally managed lands.

In addition to the larger storage facilities listed in Table 3-5 above, Table 3-6 that follows shows the nearest location of water in case of a fire emergency. A Community Wildfire Protection Plan prepared in 2010 indicates that portions of the county have inadequate fire suppression resources and without improvement, additional community systems will become inadequate with future population growth.

Table 3-6: Summary of Available Fire Fighting Water Sources

Community	Nearest Water Source
Bear Valley	Bagby, there is no reliable fire suppression water source in Bear Valley
Bootjack	Privately owned water tank (28,000 gallons), ponds, seasonal water in large creeks and rivers
Cathey's Valley	Bear Creek Reservoir, Owens Reservoir, ponds
Coulterville	Lake McClure, ponds
Fish Camp	Three community water systems and some hydrants, Tenaya Lodge, Tenaya Cottages/Apple Tree Inn, and White Chief, Big Creek
Greeley Hill/ Buck Meadows	Stanislaus National Forest, Buck Meadows Station (60,000 gallons in water tanks), Merced River, ponds
Hornitos	Lake McSwain, Lake McClure
Hunters Valley	Lake McClure, Merced River
Jerseydale/Mariposa Pines	Community water system and hydrants in Mariposa Pines (186,000 gallons with a recharge of 100 gpm), ponds
Lake Don Pedro	Rated hydrants, Lake Don Pedro, Lake McClure
Lushmeadows Mountain Estates	Dawn Lake and Mallard Lake outfitted with dry hydrants
Mariposa [(a)]	Stockton Creek Reservoir, community water system and hydrants (2,000,000 gallons storage tank)
Midpines	No near water sources. More distant water sources are: Merced River, 1M gallon tank on Colorado Road available to service a hydrant system
Mormon Bar/Ben Hur Area	Greenamyers Pond, Hensley Lake, ponds
Mt. Bullion[(a)]	Airport storage and hydrants system
Ponderosa Basin	Hydrants, ponds, swimming pools, seasonal Chowchilla River

Source: Mariposa County, Community Wildfire Protection Plan, 2010
(a) MPUD, 2014

3.4.3.2 Hydroelectric Storage

There are two hydroelectric projects on the Merced River regulated by the Federal Energy Regulatory Commission in the Region including the Merced River Hydroelectric Project and the Merced Falls Project, each of which is described in greater detail below. The storage facilities for these projects serve other purposes including flood control, recreation, and irrigation.

The Merced River Hydroelectric Project is owned by Merced ID and located on the Merced River in Mariposa County. The project occupies approximately 3,153 acres of federal land managed by the Bureau of Land Management. Merced ID was formed in 1919 and established their first hydroelectric dam, Exchequer, in 1926 which originally allowed for the storage of 281,000 AF of water in Lake McClure, and had two generators each with a 15,625 kilowatt capacity. In 1964 the District was granted a license from the Federal Power Commission to expand the irrigation and power facilities on the Merced River which resulted in the construction of the existing New Exchequer Dam in 1964. New Exchequer has a crest elevation of 879 feet with a maximum length of 1,220 feet. This increased Lake McClure's storage to 1,024,600 AF. A second hydroelectric dam was built in 1967 called McSwain Dam to form a regulating reservoir. McSwain Dam was constructed with a crest elevation of 425 feet and a maximum length of 1,620 feet forming Lake McSwain with a capacity of 9,730 AF. Exchequer Dam and McSwain Dam have a combined dependable capacity of 103.5 MW and an annual generation of 385 gigawatt-hours. Merced ID is required to maintain a minimum pool elevation in Lake McClure and Lake McSwain in the dry season for environmental purposes and a maximum pool elevation in the wet season for flood control capacity.

The Merced Falls Project is owned and operated by PG&E and is located on the Merced River on the border of Mariposa and Merced counties downstream from the Merced River Project. This Project is much smaller in scale with a dependable capacity of 1.7 MW and an annual generation of 13.5 gigawatt-hours.

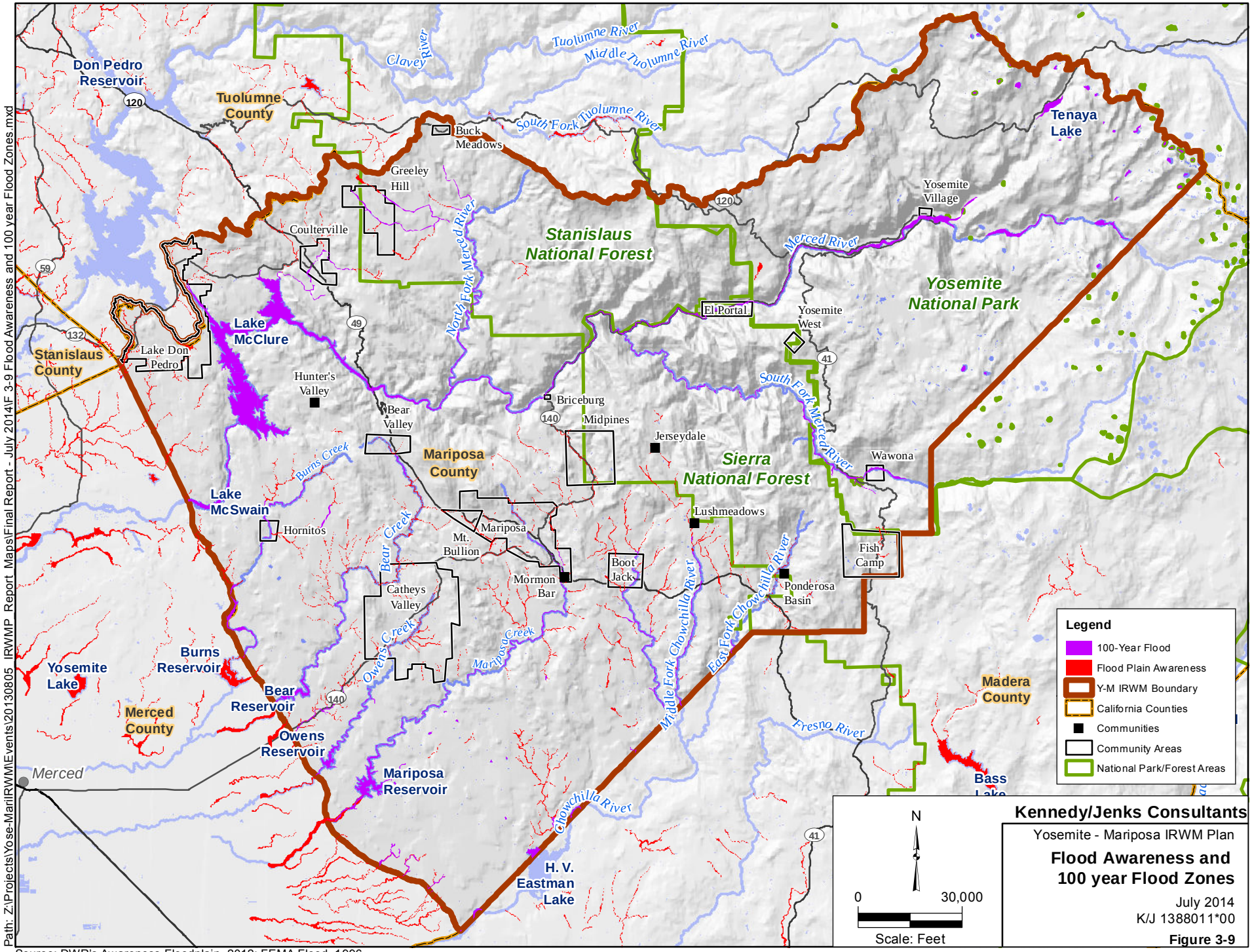
3.4.3.3 Local Flooding and Downstream Flood Management Storage

Catastrophic local flooding occurred in Yosemite Valley in 1997 and as well as to El Portal, Foresta, and Wawona and highways 41, 120 and 140 along the Merced River corridor. Road damage (and associated wastewater pipeline damage) along the Merced River initially closed Yosemite National Park then restricted travel to 1 lane and was not permanently reconstructed until 2000 since the majority of the work occurred during the off season. The resulting economic damage is estimated to have been about $18 million county-wide or about 6.6% of the county economy as well as contributing to the loss of almost 1,000 jobs (UNEP, 2013).

Flooding was the result of an intense 24-hour period of warm tropical rain that also melted snowpack and was estimated to have a return interval of 89-years (i.e. not quite a 100-year flood event). Following that event, the DWR prepared floodplain awareness maps which have been combined with the Federal Emergency Management Agency (FEMA) 100-year flood zone maps that are presented on Figure 3-9.

Much of the flood management infrastructure in the Region is to reduce flood damage downstream in Merced County. In addition to the 350,000 AF of flood storage set aside in Lake McClure, there are several flood control facilities located near the region boundary in the Lower Mariposa Group of Streams watershed. Several of the projects were originally authorized by the Flood Control Act of 1944 as the Merced County Stream Group (MSG) project which is a part of comprehensive flood management for the Sacramento and San Joaquin drainage basins. Bear Reservoir in Mariposa County and Burns Reservoir which is located partially in Mariposa County was part of the original MSG project. Dams on Owens and Mariposa Creeks which are also in Mariposa County were constructed at a later date (Merced IRWM, 2010). The Burns, Bear Creek, Mariposa, and Owens dams are owned and operated by Army Corps of Engineers. These dams are used to regulate and stem large flows during the rainy season (typically the beginning of November until the end of February).

The flood-related vulnerabilities to climate change are discussed in Section 3.7.



Source: DWR's Awareness Floodplain, 2012; FEMA Flood, 1996.

3.4.4 Wastewater Collection and Treatment

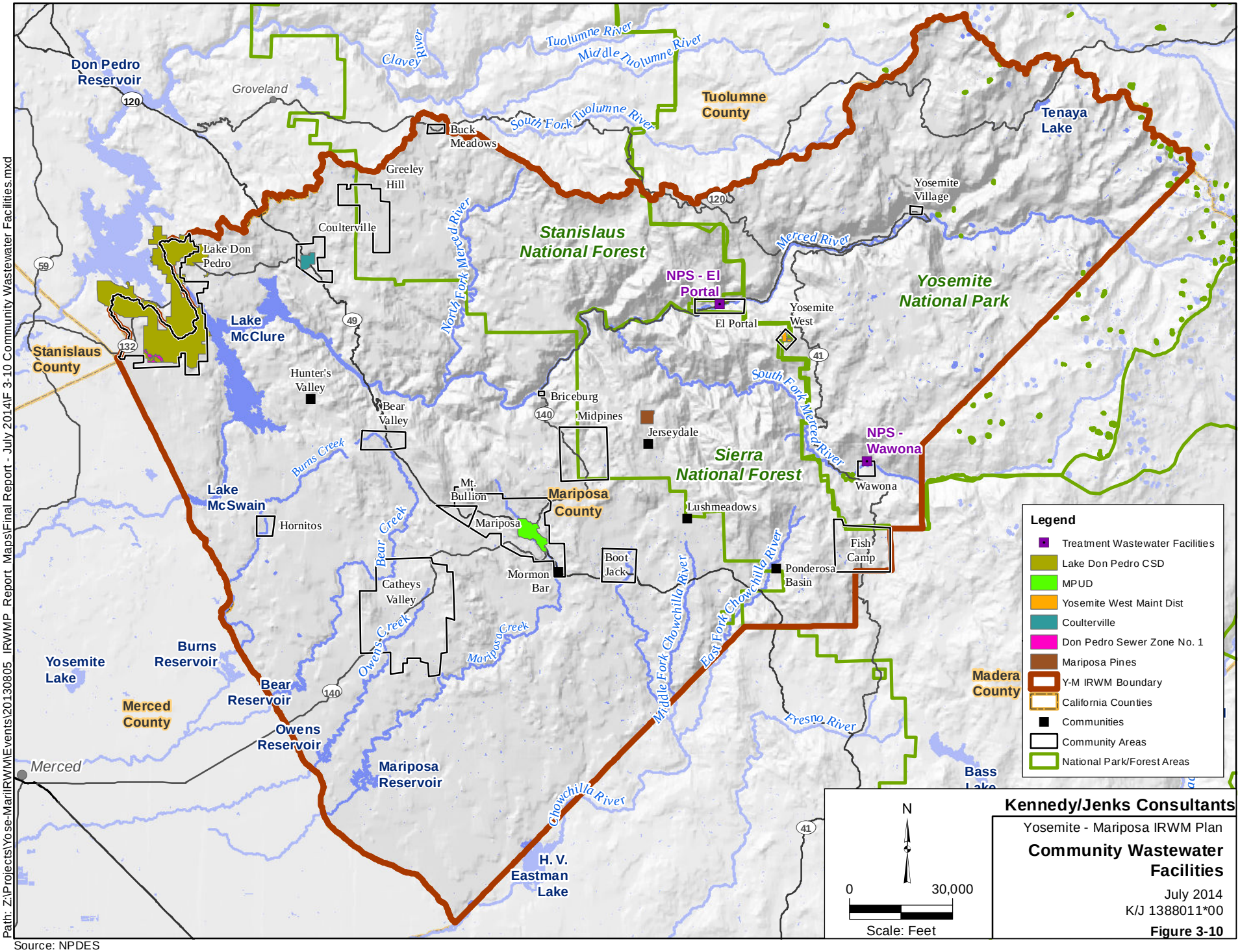
Wastewater treatment and recycled water systems are much like drinking water systems in the Region, in that there are a few centralized wastewater facilities located mainly in community areas. LAFCO has identified five special districts/public agencies that provide wastewater services in the Region which include:

- The Mariposa Public Utility District
- County Service Area 1-M, Coulterville Water and Sewer (CSA1-M/CWS)
- County Service Area 1-M, Sewer Zone No. 1 (CSA1-M/SZ1)
- County Service Area 1-M, Mariposa Pines Wastewater
- Yosemite West Maintenance District

The Regional Water Quality Control Board (RWQCB) also regulates other wastewater collection, treatment, and disposal facilities in Yosemite National Park in El Portal (which also treats wastewater from Yosemite Valley) and Wawona both of which discharge to surface water and on-site systems at Glacier Point and Badger Pass Ski Area. These systems serve approximately 7,500 permanent residents as well as the visitors to these areas and are shown on Figure 3-10.

El Portal Wastewater Treatment Facility
Credit: Kennedy/Jenks Consultants

The larger community wastewater systems are detailed in Table 3-7 that follows. Thirteen other smaller facilities that mostly serve visitors are regulated by the RWQCB and include recreation areas, mobilehome,/RV parks, campgrounds, and hotels/resorts and have estimated flows of 2,500 gallons per day up to 76,000 gallons per day. The remaining 10,500 residents of the Region use individual septic tank/leachfields for wastewater treatment and disposal which are generally suitable for rural and low density residences.



Source: NPDES

Table 3-7: Community Wastewater Systems

Agency	Estimated Connections	Facilities	Effluent Disposal	Capacity (mgd)
Mariposa Public Utility District	700	Collection system, headworks, two oxidation ditches, two secondary clarifiers, and a chlorine contact chamber	Discharge into Mariposa Creek	0.610
County Service Area 1-M, Coulterville Water and Sewer (CSA1-M/CWS)	165	4.3 MG storage reservoir and an aeration basin	Discharge to Maxwell Creek or Land Application – spray field	0.025
County Service Area 1-M, Sewer Zone No. 1 (CSA-M/SZ1) – Lake Don Pedro	3,200 (many of whom are in Tuolumne County)	Collection system, headworks, extended aeration basin, clarifier, chlorine contact basin, lined storage pond, four concrete lined sludge drying beds and decanting structures	Land application	0.080
Mariposa Pines CSA (aka. County Service Area 1-M, Mariposa Pines (CSA1MMP)	23			0.005
Yosemite West Maintenance District	294 (total parcels)	Collection system, aerated pond, inoperable filter, 2000 of leach lines	Groundwater – leach field	0.1
NPS – El Portal	635 (El Portal) 1,000 (Yosemite Valley)	Headworks, two primary clarifiers, aerated flow equalization tank, secondary treatment in three aeration tanks, two secondary clarifiers, tertiary treatment, and UV light disinfection	Discharge into Merced River	1.0
NPS – Wawona	150	Headworks with two grinders, equalization tank, activated sludge treatment system, coagulant and polymer injections, rapid mixing, flocculation, final sedimentation, and sand filtration, chlorine disinfected	South Fork Merced River and Land Application	0.105

Source: EPA, 2013; LAFCO, 2008; RWQCB, 2013.

The largest centralized sanitary collection and treatment system is located in Mariposa and is operated by MPUD. MPUD was formed in 1947 under the Public Utilities Act of 1921. MPUD provides water and wastewater services, as well as, fire protection services. The Coulterville, Mariposa Pines Sewer Zone, and Yosemite West Maintenance District systems are operated by Mariposa County Public Works.

The wastewater treatment plant in Mariposa was constructed in 1984 and has a capacity of 0.610 mgd. The average dry weather flow is about 0.24 MGD. The system contains 73,000 feet of wastewater collection mains, the majority being six to eight inch vitrified clay pipe. This pipe has proved to be a source of infiltration/inflow during the wet season of the year and the District has replaced portions of the collection system with Polyvinyl Chloride (PVC) pipe.

The most recent National Pollution Discharge Elimination System (NPDES) permit adopted by the RWQCB on Dec. 6, 2007 requires the MPUD to provide additional tertiary treatment to the existing secondary treatment facility. Tertiary treatment is typically achieved by providing filtration before treated wastewater is discharged off site.

The wastewater system CSA-1M -Coulterville Water and Sewer became operational in 1979 with the ability to accommodate approximately 76 initial and a total of 102 connections. With minor upgrades, the total number of connections could be increased to around 200.

The CSA-1M/SZ1 encompasses approximately 135 acres of land in the Lake Don Pedro area providing wastewater services to residents and the Lake Don Pedro Golf Course and Resort. The current collection system is composed of approximately 28,300 feet of 4 inch and six-inch sewer mains, with 71 manholes for access and maintenance. There are also seven lift stations in the collection system in addition to the before mentioned wastewater treatment plant. The facilities for treatment include one storage reservoir, an aeration basin, and a clarifier with a spray field utilized for final disposal of the liquids and a drying bed for solids. Since the completion of the new wastewater treatment plant, Mariposa County has not developed a further Capital Improvement Plan (CIP). The new wastewater treatment facility was constructed to address both the needs of existing parcels and perceived future development in the area.

The Yosemite West Maintenance District encompasses approximately 110 acres that includes the subdivision and condominiums for almost 300 connections. There are approximately 31,700 linear feet of 4-inch and 6-inch sewer mains, sixteen manholes for access and maintenance and 2 lift stations. As of 2008, a new wastewater treatment plant including an upper and lower aeration basin with a volume of 480,000 gallons had been constructed. Effluent is disposed of in a drip field. (LAFCO, 2008).

The NPS El Portal and Wawona wastewater treatment plants (WWTP) serve the El Portal/Yosemite Valley and Wawona areas respectively. Both of these WWTP provide tertiary treatment. The El Portal WWTP discharges the treated effluent to percolation ponds adjacent to the Merced River while the Wawona WWTP applies the treated effluent to the adjacent golf course for irrigation; both WWTP have the option of a direct Merced River discharge which are rarely used.

The rural nature of the Y-M Region poses practical limits for expanding community wastewater collection, treatment, and disposal facilities. The wastewater facilities that remain are often constrained by increasing regulations requiring improved treatment processes to improve water quality. The majority of the County's residents use individual septic tanks and leachfields for sanitation and wastewater treatment. County staff reported that while there are periodic reports regarding system failures, mostly with very old systems, the instances of failures are quite infrequent.

3.5 Water Quality Conditions

The water quality of the higher elevation areas of the Y-M Region are generally excellent, as much of the lands are within Yosemite National Park and the activities that may impact water quality are restricted. The lower elevation portions of the Region that are managed by Mariposa County or are under National Forest and/or BLM management also have generally good water quality, although the non-wilderness/wildlands areas of these lands may allow activities such as timber harvest, grazing, and/or mining that could be sources of pollutants that impact water quality. The narrative that follows describes the current water quality regulatory framework provides an overview of surface water and groundwater quality, and identifies activities/natural occurrences such as wildfires that may impact water quality now or in the future.

3.5.1 Water Quality Related Issues, Needs, Challenges and Opportunities

This subsection addresses the following key issues, needs, challenges and opportunities related to water quality management:

- Compliance with surface water and groundwater quality regulations
- Management and restoration of impaired surface water bodies
- Protection of groundwater quality
- Improvement of forest and watershed management actions
- Prevention of catastrophic wildfire and mitigation of resulting water quality impacts

3.5.2 Water Quality Regulatory Framework Overview

There are many tools, whether regulatory, voluntary, or incentive based, currently available for preventing pollution. The USEPA, SWRCB, and RWQCBs have permitting, enforcement, remediation, monitoring, and watershed-based programs to prevent pollution. Pollution can enter a water body from point sources like wastewater treatment plants (WWTP) and/or other industries that directly discharge to the river, and from nonpoint sources over a broad area, such as runoff from a community and/or agricultural farmland or grazing areas located adjacent to stretches of the river reach. The Central Valley RWQCB has recently focused on upgrading WWTP discharge to advanced treatment tertiary standards for all NPDES permittees that discharge to the San Joaquin River (and its tributaries) in an effort to further reduce the water quality impacts of wastewater discharges. Individual WWTPs are discussed more specifically in Section 3.4.

Some nonpoint source contaminants are naturally occurring in local rocks and soil, such as heavy metals, (arsenic, chromium, selenium). Preventing pollution from most point sources relies on a combination of source control and treatment, while preventing nonpoint source pollution generally involves the use of best management practices (BMPs), efficient water management practices, and source control. Nonpoint source pollution is not typically associated with discrete conveyances, in other words, the origin of the pollution cannot always be readily identified.

The Safe Drinking Water Act (SDWA) was originally passed by Congress in 1974 to protect public health by regulating the nation's public drinking water supply. SDWA applies to every public water system in the United States. SDWA authorizes the USEPA to set national health based standards for drinking water to protect against both naturally-occurring and man-made contaminants that may be found in drinking water. Originally, SDWA focused primarily on treatment as the means of providing safe drinking water at the tap and drinking water standards are based on health risk balanced by economic factors. Amendments in 1996 greatly enhanced the existing law by recognizing source water protection, operator training, funding for water system improvements, and public information as important components of safe drinking water. Under the SDWA, technical and financial aid is available for certain source water protection activities. In California, the California Department of Public Health regulates drinking water in community water systems.

The Federal Clean Water Act (CWA) contains two strategies for managing water quality including: (1) a technology-based approach that envisions requirements to maintain a minimum level of pollutant management using the best available technology; and (2) a water quality based approach that relies on evaluating the condition of surface waters and setting limitations on the amount of pollution that the water can be exposed to without adversely affecting the beneficial uses of those waters. Oftentimes, limits to water quality are based on the sensitivity of the ecosystem in the receiving water to contaminants, often at trace levels well below drinking water standards. The RWQCB issues NPDES permits for discharges to surface water and waste discharge requirements (WDRs) for discharges to land and regulates the wastewater discharges in the Region. The RWQCB also implements Section 303(d) of the CWA, discussed later, which regulates water quality for ecosystem values.

The federal CWA, as well as the State Porter-Cologne Water Quality Control Act, requires water quality control plans to establish water quality standards, which address beneficial uses of water sources. Specifically, the RWQCB has established and adopted the Water Quality Control Plan for the Sacramento/San Joaquin (Basin Plan). The Basin Plan describes designated beneficial uses to be protected, water quality objectives to protect those uses, and a program of implementation needed for achieving the objectives. Beneficial uses, together with their corresponding water quality objectives, meet federal regulatory criteria for water quality standards. Hence, the Basin Plan serves as regulatory references for meeting both state and federal requirements for surface and groundwater water quality control in the Region.

3.5.3 Surface Water Quality

The surface waters within the Y-M Region support a variety of beneficial uses, including municipal and domestic supply, agriculture water supply, industrial water supply, recreation, commercial and sport fishing, freshwater habitat, migration and spawning of aquatic organisms and wildlife habitat for terrestrial species. Table 3-8 presents the beneficial use designations for major surface water bodies in the Region as identified in the Basin Plan. The Basin Plan does not identify beneficial uses for all water bodies in the Region; however the tributary streams of any specifically identified water body can generally be assumed to have the same beneficial use designations.

Table 3-8: Y-M Region Surface Water Bodies and Beneficial Uses

	Drinking Water	Agricultural Supply	Industrial (Power)	Recreation	Freshwater Habitat	Wildlife Habitat
Chowchilla River Source to Buchanan Reservoir (Eastman Lake)				E	E	E
Merced River	P	E	E	E	E	E
McClure Lake	P	E	E	E	E	E
McSwain Reservoir	P	E	E	E	E	E

E = Existing; P = Potential
Source: Water Quality Control Plan for the Sacramento and San Joaquin Basins, 2010.

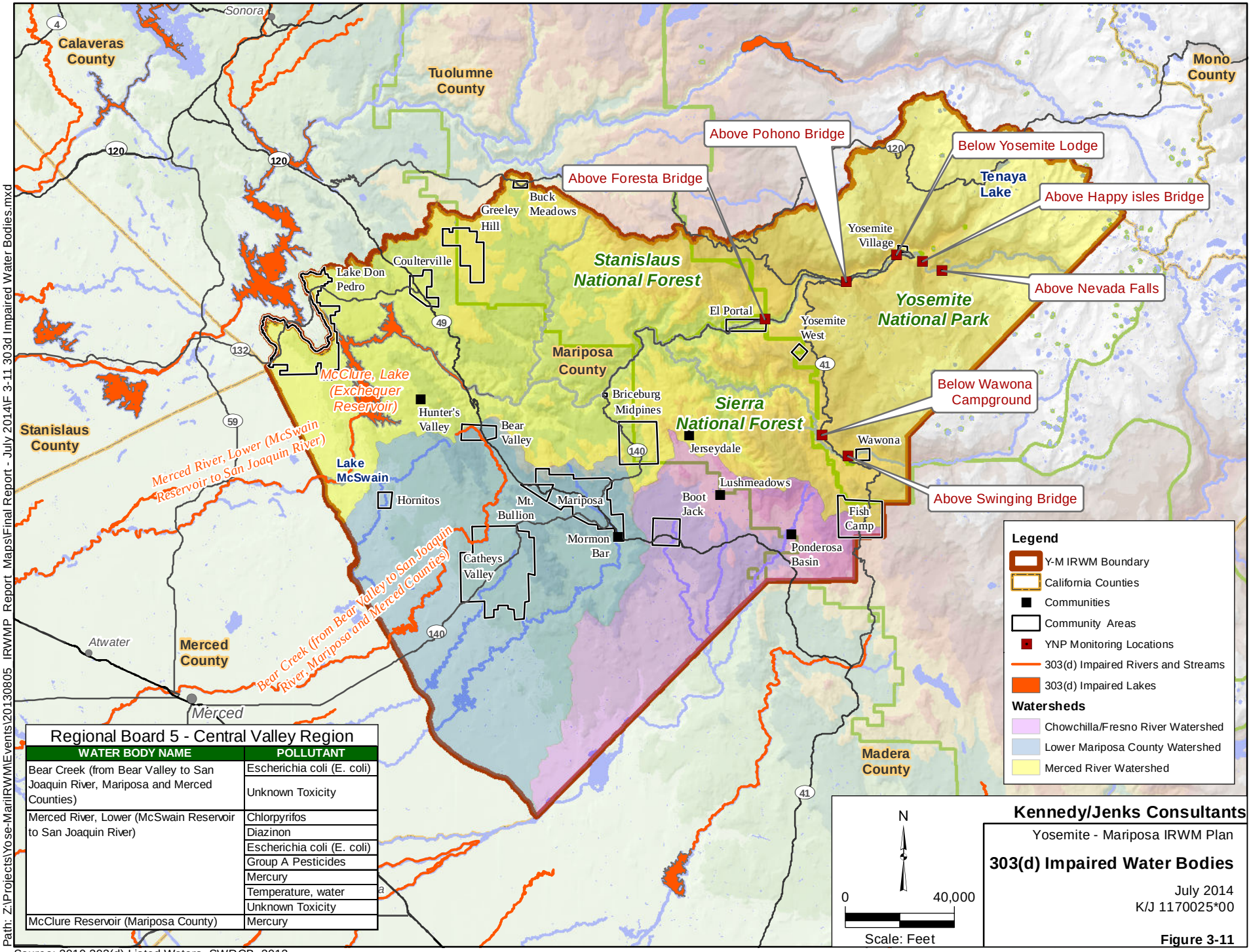
The majority of the surface water quality issues identified within the Region can be linked back to current or historical land use practices. Stakeholders in the Region have expressed concern about the possible negative impacts that increased development may provide to Big Creek, including soil erosion, septic contamination and siltation. (County of Mariposa, 2009) These same concerns are an issue throughout the Region due to the predominant use of septic systems and the steep terrain combined with dirt roads and heavy rainfall. Additional water quality concerns limited to specific drinking water supply diversion points have resulted in production of disinfection byproducts (DBPs) which have required the installation of an upgraded filtration system of the Saxon Creek water diverted by MPUD. DBP formation is usually linked to elevated organic carbon concentrations in source water.

As noted earlier, Section 303(d) requires that the states regulate waters that are not attaining standards (i.e. are impaired) to meet beneficial uses after the technology-based limits are put into place. For waters on this list (and where the USEPA administrator deems they are appropriate) the states are required to determine all the sources of the pollutants that caused the water to be listed, including contributions from point sources and non-point sources. These impaired water bodies within the Y-M Region are listed in Table 3-9 and shown on Figure 3-11. This table identifies pathogens and pesticides as the two major pollutants, although there are a number of other pollutants such as metals, toxicity and mercury. It should be noted that a majority of the impacted reach of the Merced River is outside of the Region. As well, a portion of the Bear Creek stretch listed is outside of the Region. Impacts to these portions may be due to activities within Mariposa County in part as well as due to activities outside of the Region. The agriculturally based pollutants listed including chlorpyrifos, diazinon, and Group A pesticides are generally used for production of orchard and field crops. Because the District has limited acreages of these crop types it is likely that a majority of the pollutant source is outside the Region.

Table 3-9: Impaired Water Bodies

Water Body Name	Est. Affected Area	Unit	Pollutant	Final Listing Decision	Potential Sources
Bear Creek (from Bear Valley to San Joaquin River, Mariposa and Merced Counties)	84	Miles	E. Coli	List on 303(d) list (TMDL required list)	Source Unknown
	84	Miles	Unknown Toxicity	List on 303(d) list (TMDL required list)	Source Unknown
Merced River, Lower (McSwain Reservoir to San Joaquin River)	50	Miles	Chlorpyrifos	Do not delist from 303(d) list (TMDL required list)	Agriculture
	50	Miles	Diazinon	Do not delist from 303(d) list (TMDL required list)	Agriculture
	50	Miles	E. Coli	List on 303(d) list (TMDL required list)	Source Unknown
	50	Miles	Group A Pesticides	List on 303(d) list (TMDL required list)	Agriculture
	50	Miles	Mercury	List on 303(d) list (TMDL required list)	Resource Extraction
	50	Miles	Temperature	List on 303(d) list (TMDL required list)	Source Unknown
	50	Miles	Unknown Toxicity	List on 303(d) list (TMDL required list)	Source Unknown
Lake McClure (Mariposa County)	5605	Acres	Mercury	List on 303(d) list (TMDL required list)	Resource Extraction

Source: USEPA database, 2013



Regional Board 5 - Central Valley Region

WATER BODY NAME	POLLUTANT
Bear Creek (from Bear Valley to San Joaquin River, Mariposa and Merced Counties)	Escherichia coli (E. coli)
	Unknown Toxicity
Merced River, Lower (McSwain Reservoir to San Joaquin River)	Chlorpyrifos
	Diazinon
	Escherichia coli (E. coli)
	Group A Pesticides
	Mercury
	Temperature, water
	Unknown Toxicity
McClure Reservoir (Mariposa County)	Mercury

Source: 2010 303(d) Listed Waters, SWRCB, 2012.

Kennedy/Jenks Consultants

Yosemite - Mariposa IRWM Plan

303(d) Impaired Water Bodies

July 2014
K/J 1170025*00

Figure 3-11

Path: Z:\Projects\Yose-Mari\RWM\Events\20130805_IRWMP_Report_Maps\Final Report - July 2014\F 3-11 303d Impaired Water Bodies.mxd

3.5.3.1 Sources of Surface Water Quality Impairments

There are several potential sources of surface water quality impairments, including historic and continued gold mining, historic, current and future wildfire, and inadequately maintained roads. Pathogen sources could come from failing septic systems as well as livestock and wild animals.

Mercury is a significant source of water quality impairment throughout the Y-M Region and is a legacy left by the extensive gold mining that occurred during the mid to late 1800s gold rush period. Mercury was often used in the sluice boxes to concentrate the gold to ease recovery. A more detailed discussion of historic mining follows.

While the 303(d) listing for mercury in the Region is in response to human health concerns from consumption of fish, accumulation of mercury in fish can also impact the health of higher order birds and mammals that feed on fish in the Region. The impact to reproductive health of wildlife, particularly waterfowl, although not currently an area of regulatory attention, is an issue that is being monitored in the San Joaquin and Sacramento Rivers by stakeholder groups such as the San Francisco Estuary Institute and may affect management actions in the future.

Erosion and sedimentation can also present a water quality concern, primarily because of sediment impacts on habitat. Sources of sediment loading in the Region include runoff from cultivated agricultural lands, over-grazing, construction activities, erosion of unpaved roads and trails, silviculture and increased sedimentation from precipitation following wildfires. Reducing undesirable sediment loads can benefit habitat and reduce the risk of flooding. Erosion and sedimentation are a necessary component in healthy geomorphic processes, but they also can reduce the quality of aquatic habitat by covering gravel needed for fish spawning, harming aquatic invertebrates and increasing biochemical oxygen demand through the introduction of organic matter and nutrients to the waterway. Another impact of sediment deposition (even as a result of normal geomorphic processes) can be reduced channel conveyance capacity, especially at lower elevations, and a corresponding increased risk of flooding.

3.5.3.2 Water Quality Sampling Results

Water quality sampling programs are important components of surface water management, because they allow water managers to review water quality data over time to identify trends (both positive and negative). The Upper Merced River Watershed Council (UMRWC) and Yosemite National Park (YNP) have conducted water quality sampling on the Merced River since 2004 and 2003, respectively as described in detail below. In addition, districts such as MPUD and LDPCSD both monitor Merced River water quality as part of their drinking water treatment processes and/or to meet wastewater discharge requirements. The lower Mariposa Group of Streams and the Chowchilla/Fresno River watersheds generally have limited water quality data available.

UMRWC has 17 monitoring locations on the Upper Merced River tributaries that are sampled quarterly by volunteers for temperature, dissolved oxygen, pH, total dissolved solids, and turbidity. YNP has seven stations for which they analyze for both field and laboratory parameters including flow, temperature, dissolved oxygen, nutrients, bacteria, conductivity, minerals, and hydrocarbons on a monthly basis.

Figures 3-12, 3-13 and 3-14 that follow represent a subset of the data from three downstream YNP stations: below Wawona Campground on the South Fork Merced River, on the main stem of Merced River above Pohono Bridge at the downstream end of Yosemite Valley, and above the Foresta Bridge near El Portal as located on Figure 3-11. The Pohono Bridge station is the most upstream followed by the Foresta Bridge location and followed lastly by the Wawona monitoring site on the South Fork of the Merced River which joins the main stem of the Merced River downstream of the other two monitoring sites. These stations capture flow from approximately a third of the Merced River Watershed representing an area with the largest snowpack in the Region.

The parameters shown in the graphs include: flow measured in cubic feet per second (cfs) obtained from a rating curve, E. coli (Escherichia coli) measured in most probable number per 100 milliliters (MPN/100 ml), Total Coliform also measured in MPN/100 ml, and Total Dissolved Nitrogen (TDN) measured in milligrams per liter (mg/l). The testing period was from the 2003-04 water year through the 2012-13 water, however not every parameter was tested each year or at each monthly (approximately) sampling event. When data was not present for a constituent it was represented by a gap in the line on the graph so that the data are more accurately conveyed than interpolating for missing data. The E. coli and Total Coliform values were typically low with occasional spikes precipitated by a lower flow event, however it is difficult to trend due to the data being recorded for E. coli and Total Coliform only in more recent water years.

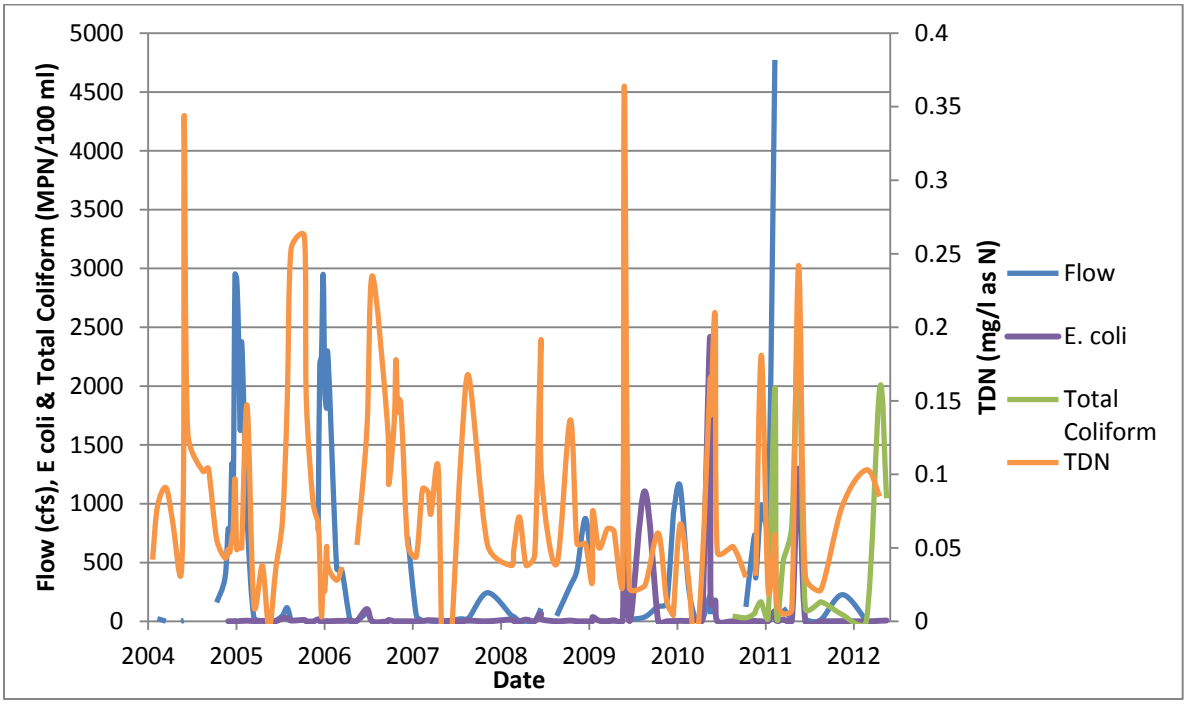


Figure 3-12: Water Quality Below Wawona Campground on S. Fork Merced River

Source: Yosemite National Park Water Quality Monitoring Program

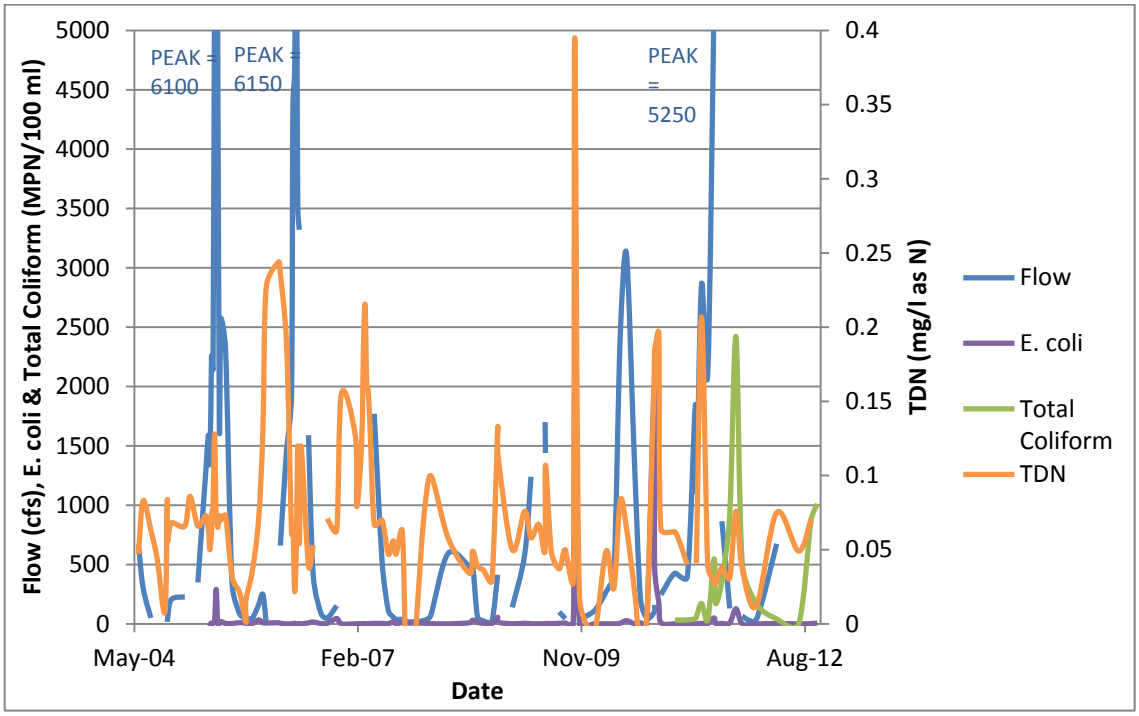


Figure 3-13: Water Quality Above Pohono Bridge on Main Stem Merced River

Source: Yosemite National Park Water Quality Monitoring Program

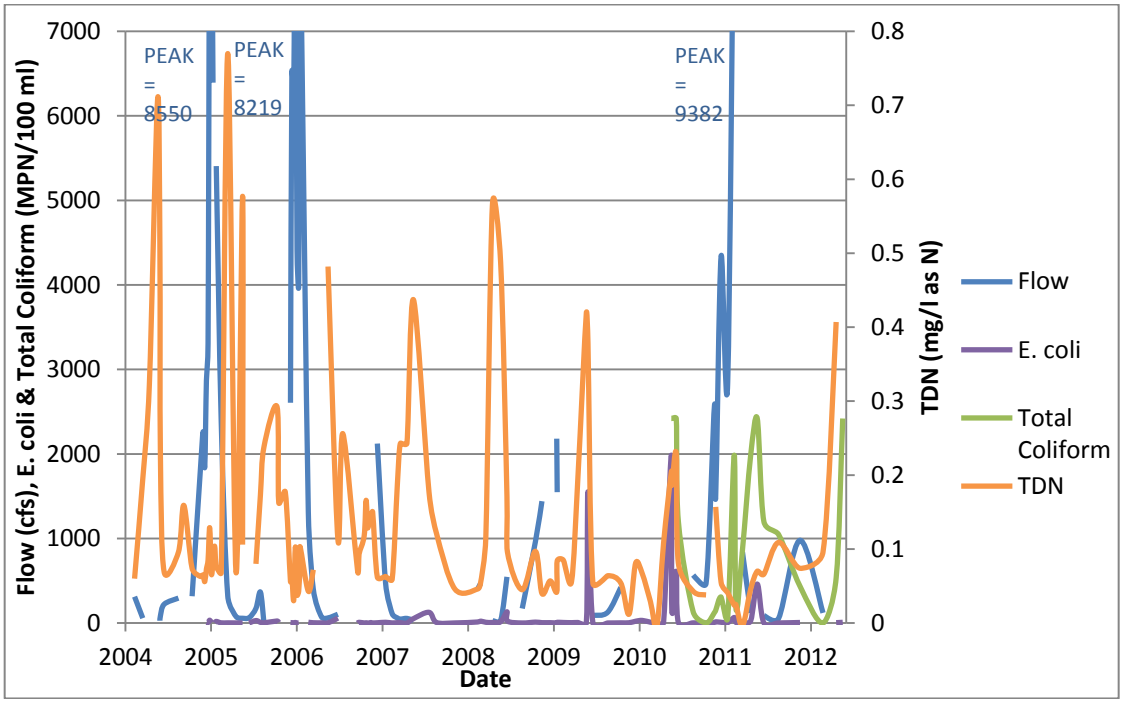


Figure 3-14: Water Quality Above Forest Bridge on Main Stem Merced River

Source: Yosemite National Park Water Quality Monitoring Program

3.5.3.3 Historic Mining

The US Geological Survey maintains the Mineral Resources Data System that is a compilation of mining related data utilizing multiple documents and sources. The data for Mariposa County are derived from information maintained by the USGS and its predecessor agencies as early as the 1900s through the 1980s. The database is separated into occurrences (i.e. claims), prospects, past producers, producers, plants and unknown mine types for a range of minerals. As mercury is the contaminant associated with water quality impairments, the data associated with gold mining which historically used mercury for processing, were used. The database indicates that there may have been almost 1,300 locations including claims, with gold mining and one location associated with mercury mining. Figure 3-15 that follows identifies where gold has been produced and/or processed as well as the mercury mine. The mines are scattered throughout the lower portions of the Region with the majority occurring in the Merced River and Mariposa Group of Streams watersheds. Because mercury has discharged from the mines through runoff which flows downstream, mercury impairment has been identified in Lake McClure and Bear Creek as well as further downstream into the San Joaquin River.

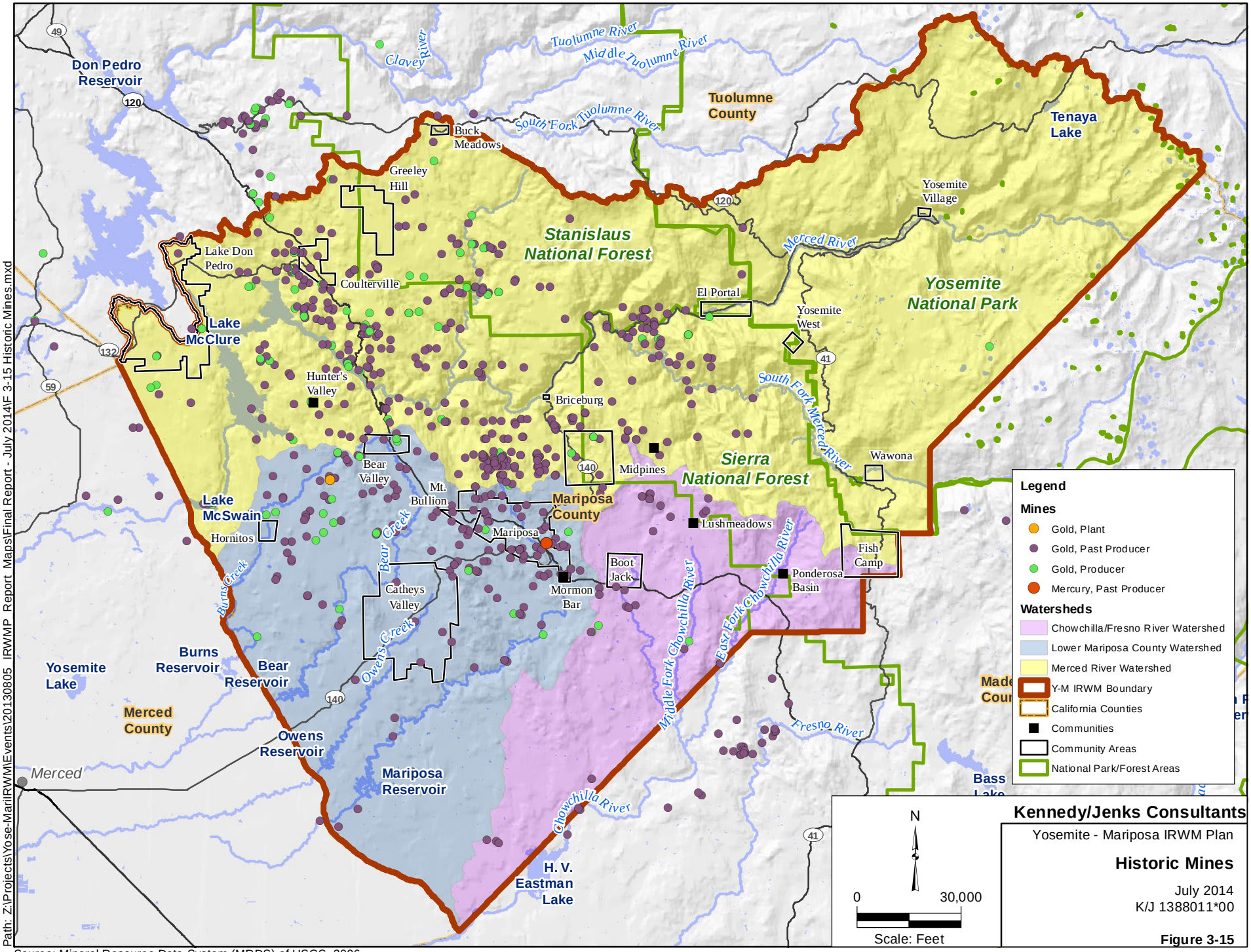
3.5.3.4 Wildfire and Forest Management

Another potential significant contributor to water quality impacts are wildfires that have historically occurred in the Region. As described in previous sections, the majority of the Region is covered by the Sierra National Forest, Stanislaus National Forest, BLM-managed lands and Yosemite National Park. Altogether, approximately 56% of the Region is federally managed lands, (County of Mariposa, 2010) fires in the upper watersheds have the potential to travel downhill and impact both public and private lands. This results in coordination of forest and wildland management becoming a significant issue for water quality management. This is particularly the case, since wildfires that cross institutional boundaries occur with some frequency. In addition, various areas in the Region have been altered significantly in part as a result of changes to historic fuel and fire management philosophies within different institutions. These changes have direct implications for water quality in the Region, which are discussed in the following sections. A detailed discussion on wildfire and forest management is provided in Section 4 Land Use.

Wildfire
Credit: Burt Stalter, Sierra National Forest, Bass Lake Ranger District

3.5.3.4.1 Historic and Existing Forest Conditions and Fire Susceptibility

Wildfires are prevalent in the Region and are the number one natural disaster threatening residents. The Mediterranean climate with its dry summer season combined with mixed chaparral, grass and oak lands, as well as ponderosa pine and mixed conifer forests found within the Region are highly susceptible to wildland fire. The fire risk is especially high when there is hazardous fuel buildup coupled with dry years, which occur with some regularity. Increased fuels also generally lead to more intense burns.



Source: Mineral Resource Data System (MRDS) of USGS, 2006.

Significant fuel buildup has occurred in many areas of the Region as a result of various historic factors, including over a century of fire suppression in forests and wildlands. Prior to European settlement, the Region's forests were significantly less dense, with around 50-100 trees per acre than they are today. Natural wildfires played an important role in determining the density and composition of the forests. The fire regime was characterized by frequent small and low intensity fires ignited by lightning strikes, which was reflected in forest management techniques of Native Americans. Upon arrival of settlers, the natural fire regime was disrupted and with it the natural influence of wildland fires on the structure of the forest.

Starting in the mining period and into the early decades of the twentieth century, forests were extensively logged and clear cut without proactive revegetation or post-management to maintain previous natural conditions. These activities resulted in a high accumulation of fuels on the ground and less robust forests as the diverse native plant community became replaced by fast-establishing shrubs and invasive species, and dense stands of trees of a uniform age.

Compounding the effects of clear-cutting came increased fire suppression. With the formation and increased public visitation of national parks and other natural protected areas, forest management has become increasingly dominated by fire suppression in an effort to protect human interests, including property and recreational values. This has often occurred despite the benefits of more frequent low intensity fires that reduce fuel accumulation and enhance natural propagation of native species, as well as to maintain low density stands. As a result, existing forests have developed significantly different from the natural forests from pre-European settlement. Forest stands have reached densities of 400 to 500 trees per acre, which is often publicly perceived as healthy and natural because that is what is familiar to most members of the public.

Despite growing knowledge of more appropriate fuel and forest management, which may include regular prescribed burns, these management strategies can often stand in conflict with public interests and have to be carefully weighed by federal land managers. Controlled burns are often undesirable from a public perspective due to aesthetic impacts in highly visited natural areas, such as Yosemite National Park, including visual and air quality impacts. Air quality impacts are a particular concern in the Y-M Region, as Mariposa County (and neighboring Counties in the Central Valley) are currently designated as a nonattainment area for ozone requiring specific actions to meet air quality standards (EPA, 2013a). Other environmental concerns associated with prescribed burns may result in conflicting interests with forest managers and environmentalists, and equally important to consider are the practical hazards and risks of conducting burns in forest systems susceptible to high-intensity stand-replacement fires. (Franklin, G., 2013; County of Mariposa, 2010; YWPHI, 2007; Conard, S.G. and Weise, D.R., 1998)

In addition to above-mentioned management activities conducted on public lands, inadequate private land management which comprises over 45 percent of the Region is increasingly contributing to more prevalent and devastating wildfire risks in the Region. The Region is experiencing continuous population growth within the Wildland Urban Interface (WUI). In these areas, proactive management of fuels and maintenance of defensible space is imperative and legally mandated for mitigating wildfire risks. However, the majority of new residents moving to the Region relocate from urban areas and are often unaware of the high wildfire danger throughout the County and the necessity to actively manage fuels. In addition, a large part of the population includes senior, low income, and disabled residents that can find it difficult to keep up with brush and tree clearing. Private landowners are faced with managing large lots, which pose added challenges, often requiring significant time and financial investment. As a result, effective mitigation measures are not always consistently or adequately implemented on private lands (MCFSC, 2013; County of Mariposa, 2010; YWPHI, 2007).

In combination, these factors have resulted in forests changing from wildfire-adapted systems to lands more prone to catastrophic wildfires. Management objectives are now increasingly a matter of preventing a devastating fire storm.

3.5.3.4.2 Wild Fires

In the Sierra Nevada mountains and foothills, fires have occurred on average every seven years up to 5,000 feet in elevation. Since the mid-1940s stand replacing fires, which until that time were extremely rare, have become increasingly common as a result of the accumulation of heavy fuel loads in the area. In addition, wildland fires burning over 5,000 acres have occurred at least once annually since 1983.

As far back as the 1800s, fires have caused devastation to communities in the Region including several occurrences where the entire Town of Mariposa burned down. In the past twenty years, every community has been threatened by major wildland fires at least once (County of Mariposa, 2010) and approximately seventy percent of the communities in the Region are listed in the Federal Register in 2001 as at high or very high risk from wildfires. These listed communities include Bootjack, Coulterville, El Portal, Fish Camp, Foresta, Greeley Hill, Hunter Valley, Jerseydale, Lushmeadows Mountain Estates, Mariposa, Midpines, Mormon Bar/Ben Hur, Wawona, and Yosemite Valley (County of Mariposa, 2010).

In the last approximately 50 years, there have been nearly 80 wildfires greater than 500 acres within Mariposa County, the most recent of which burned a total of over 257,000 acres. A list of these fires is presented in the Table 3-10, and Figure 3-15 shows a map of historical fires in the Region.

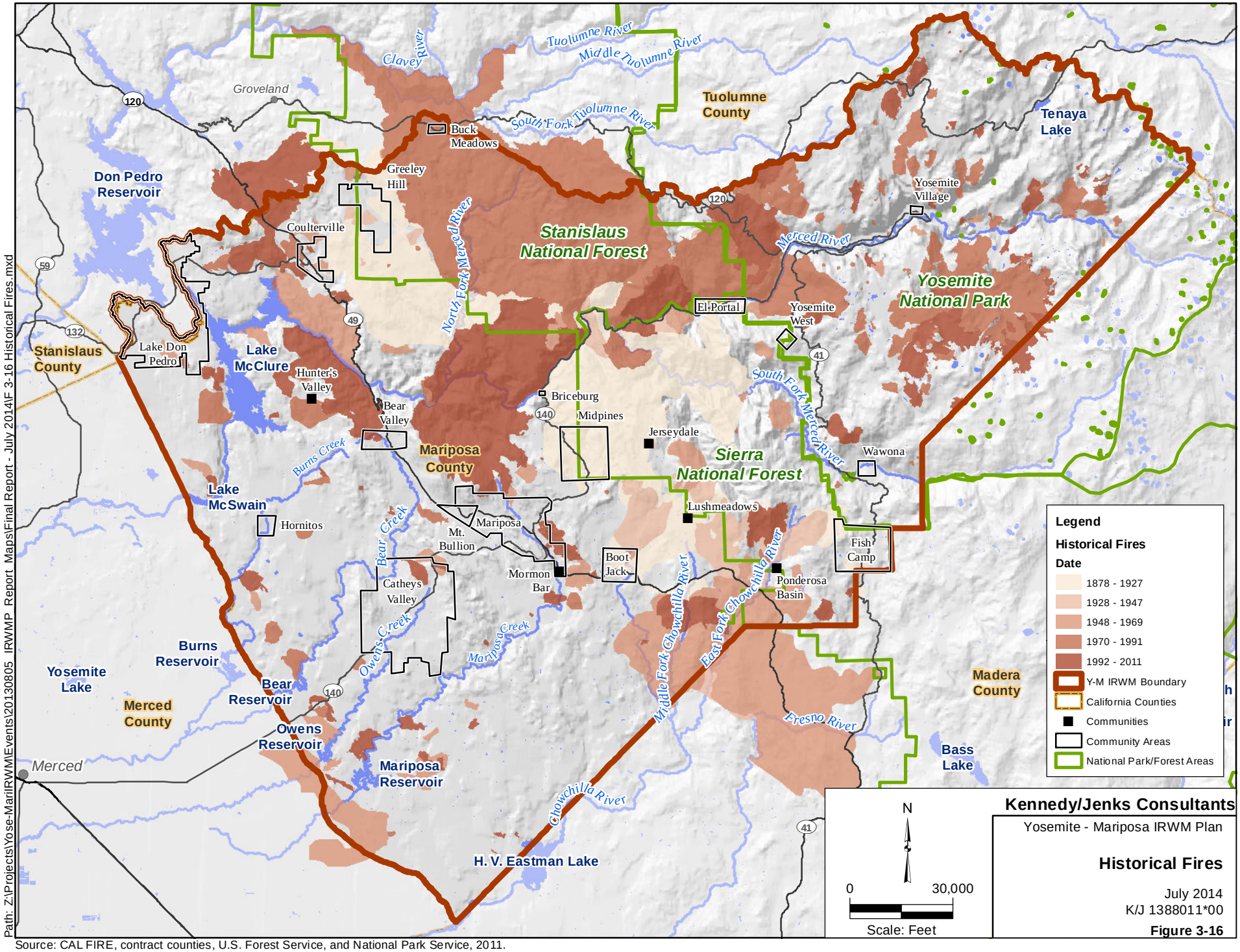
The 2013 Rim Fire burned a total of 257,314 acres of which approximately 6,000 acres encroached into the Y-M Region. Caused by an illegal campfire that got out of control, the destruction was significant and full containment was attained only after one month. Eleven (11) homes, 3 commercial properties, and 98 outbuildings were destroyed. Total costs were preliminarily estimated at nearly $126 million (InciWeb, 2013). The fire burned through expanses of ponderosa pine and other conifers, burning young tree plantations planted after previous wildfires as well as some of the last remaining old growth in the Stanislaus Forest (LA Times, 2013). The portion of the Rim Fire in the Region is within the top 15 fires by acreage in the Region since 1961.

Given the dense vegetation in many parts of the Region, the probability for future fires is high, especially if extended dry years occur.

Table 3-10: Mariposa County Historic Fires of the Last 50 Years

Year	Fire Name	Acreage Burned
1961	HARLOW	43,331
1962	BOWERS	7,738
1966	IRON MT.	1,101
1968	CANYON	1,690
	EAGLE	1,075
	ENGINEERS ROAD	8,074
	MERCED FALLS	669
1970	WILLIAMS	1,702
1972	TRUMBULL	582
1974	BAKER	717
	HORSESHOE BEND	577
	LIGHTNING #2	814
	STARR KING	3,906
1975	THREE BUTTES	589
	(blank)	532
1978	HOOVER	628
1980	(blank)	1,963
1981	BASKET	624
	CONCOURS	2,233
	GRANITE SPRINGS	711
1983	LIGHTNING #7	705
	OLD TOLL	521
1984	(blank)	738
1985	BRICEBURG	982
	BRICEBURG	982
	LOST BEAR	1,018
1986	CASCADE CREEK	2,069
	COULTERVILLE	711
	GLACIER POINT	686
1987	CALF	4,929
	CAMPGROUND	1,207
	HAMM	33,144
	HASLOE	6,524
	LARSON	48,087
	LOST BEAR	1,999
	MERCED FALLS	1,723
1988	ALASKA	1,877
	CLEARHOUSE	2,500
	ECHO	1,424
	HORIZON	674
	QUARTZITE	613
	WALKER	2,650
1990	A-ROCK	17,758
	SAVAGE	1,942
	STEAMBOAT	6,102
1991	ILL	3,102
1992	HORNITOS	654
1994	HUNTER	669
	(blank)	3,252
1995	SOUTH TURNER	610
1996	COTTON	826
	STUMPFIELD	3,710
1999	COULTERVILLE	543
	DARK	866
	LOST BEAR	2,144
	LOST VALLEY	889
	MERCED FIRE	713
2000	GRANITE	2,592
	HUNTER	8,206
2001	BRICEBERG	718
	CREEK FIRE	22,190
	HOOVER	7,231
2003	WHISKEY	1,041
2004	MEADOW WFU	5,031
	OLD HWY/MPUD 149	1,335
2005	LA PALOMA	751
	(blank)	545
2007	JACK WF	1,106
2008	HWY 140	1,566
	OLIVER	2,806
	SILVER KNOB	570
	TELEGRAPH	34,084
2009	BIG MEADOW	7,553
	GROUSE	3,040
2011	AVALANCHE	1,068
	MOTOR	5,230
	TAMARACK	1,014
2013	RIM	257,314[(a)]

Source: Community Wildfire Protection Plan, 2010
(a)About 6,000 acres in Mariposa County



Source: CAL FIRE, contract counties, U.S. Forest Service, and National Park Service, 2011.

3.5.3.4.3 Wildfire Impacts in the Watershed

Watershed hydrology dynamics can be considerably affected by wildfires through accelerated erosion and sedimentation. Among the most destructive impacts of wildfires are the increased post-fire flood peak flows which can exacerbate erosion on the steep slopes that are characteristic of the Region. The impacts of wildfire disturbances and ensuing hydrologic impacts are particularly relevant in the forested watersheds of the Region and are critical to consider in forest management.

Vegetation generally provides valuable protection from soil erosion for various reasons. It intercepts rainfall and reduces its impact, increases water infiltration into soils and can reduce runoff velocities. Additionally, vegetation can filter out sediment and hold the soil together with its root systems. The removal of vegetation from fires therefore contributes significantly to altered hydrology and increased erosion rates. Soils often develop a hydrophobic layer, which reduces water infiltration rates and moisture storage capacity, thereby further contributing to increased runoff and erosion rates. Reduced rain infiltration rates following fires result in increased overland flows, peak flows and sediment yield in the watershed. The hydrophobic soil layers prevent nutrients from infiltrating the soil, resulting in more nutrients running off with the sediments. Post-fire floods, mud flows and debris flows often ensue when winter rains soak the previously burned hill slopes. The effects can produce significant water quality impairments, can affect stream physical conditions, aquatic habitat and pose risks to human health and safety (Forrest, L.C. and Harding, M.V., 1994; Neary, et al., 2003).

The removal of vegetation by intense fires also impacts the abundance and diversity of native plant species. Invasive plant species generally re-establish more quickly after fires, which lead to crowding out of native species. Regrowth of trees is also typically slow, resulting in a higher abundance of shrubs moving in that contribute to fuels accumulation again. Invasive species and fuels accumulation in turn lead to larger, more frequent, high-intensity burns which contribute to water quality impairments and overall degradation of the Region's watersheds.

The impacts and threats from post-fire damages are a serious issue that were recently assessed after the Rim fire. USGS assessed the potential for debris flows to help land and emergency managers prioritize mitigation treatments. One of the major efforts is establishing stream gauge and water quality monitoring to document the quantity and quality of water entering the downstream Lake Don Pedro and to model post-fire streamflow changes. Ongoing work will be performed using the hydrologic models developed that incorporate data on soil properties, burn severity and expected rates of vegetation recovery, to help improve understanding of runoff and stream flows in subsequent years (USGS, 2013a).

3.5.3.4.4 Overview of Fuel and Fire Management

There is a high level of collaboration and partnerships among numerous agencies, organizations and individuals to actively manage fuels and fires on private and federal lands in the Region. A more detailed discussion is provided in Section 4.

Assistance for private property owners is provided through various organizations, which include the Mariposa County Fire Safe Council, the Mariposa County Resource Conservation District and the California Department of Forestry and Fire Protection (CAL FIRE). The Mariposa County Fire Safe Council, a non-profit community partnership, implements various fire prevention and fuel reduction projects, as well as education and outreach events to increase fire safety in the County. The Mariposa County Resource Conservation District provides resources to preserve the natural resources in Mariposa County and supports increased interagency efforts. The District also actively participates in Mariposa County Fire Safe Council events. CAL FIRE provides important services for fire protection and stewardship on privately-owned wildlands, including critical fire and emergency response to Mariposa County. The US Department of Agriculture Natural Resources Conservation Services (NRCS) also provides technical and financial assistance to private landowners to conserve natural resources.

Forest Thinning
Credit: Fish Camp Fire/Rescue Association, Donn Harter

Community Wildfire Protection Plans (CWPPs) are also valuable resources that help guide the management of forests and rangelands for hazardous fuel reduction and fire resilience and facilitates acquisition of grant funding for related projects. The Council was a major participant in the development of the Mariposa Countywide Community Wildfire Protection Plan. The communities of Yosemite West and Foresta have also developed individual CWPPs with assistance from the National Park Service.

Fuels and fire management on federal lands is led by the US Forest Service, BLM, and National Park Service. Fire management in Yosemite National Park has taken on a very progressive approach with highly monitored prescribed burns that can be a model for other areas in the Region.

3.5.4 Groundwater Quality

Groundwater within the Region generally is obtained from fractured bedrock formations. These basins are susceptible to contamination from surface infiltration and thus have variable water quality. In addition to fractured bedrock formations, there is one recognized groundwater basin in the Region, Yosemite Valley Basin, which has exceptionally high quality groundwater (DWR, 2003). Other than the Yosemite Valley Basin, the lack of contiguous basins combined with the many, dispersed individual groundwater users in the Region has resulted in limited study of groundwater quality in the Region.

The Region's wells each serve between 2 and 3 people on average (County of Mariposa, 2006), and sampling is not mandatory for all wells, which makes identification of contaminated wells more problematic. The exception is in areas where contamination is brought to the attention of local health authorities. Based on conversations with the Mariposa County Environmental Health Department, the most common contaminants have been from agricultural uses such as historic turkey and chicken farming, leaking underground storage tanks, and septic systems, and are often evidenced in aging drinking water wells.

While most of the agriculture in the County is associated with rangeland and grazing cattle, there were previously some turkey ranches and chicken farms within the Region. Concentrated animals with improper manure management can be associated with high nitrates that can impact shallow groundwater (typically shallower than 75 feet deep) in a fairly localized area. Grazing cattle, in moderation and when managed properly, typically do not impact water quality, and can improve habitat, especially in vernal pools. Other potential sources of nitrates are septic systems, particularly if they are associated with small lots. To date, about 10 wells have been identified with nitrates in excess of drinking water standards in the County (Mariposa County Environmental Health, 2014).

Mariposa County Environmental Health Department now requires testing for nitrates in groundwater for new homes and/or subdivisions, particularly in areas of historic high nitrates. The presence of nitrates in groundwater can require construction of deeper wells that are sealed in the shallower groundwater to both prevent a migration path for nitrates as well as to provide drinking water from a deeper, unimpaired zone. (Mariposa County Environmental Health, 2014).

Septic tanks can also be the source of bacteriological contamination. Many septic systems were installed prior to the requirement of a soil investigation and health study to demonstrate long term feasibility of the septic system prior to its installation; thus, the areas of most concern are generally associated with older residences where septic systems were installed prior to the passing of these regulations. Septic system contamination leads to bacteriological contamination within groundwater wells that can become problematic for domestic use of local groundwater. In a few isolated cases, bacteriological contamination in older drinking water wells has occurred which are likely the result of poor sanitary seals that allow surface contaminants to enter the well and/or intersection of a fracture zone that is an immediate conduit for surface contaminants and/or septic tank effluent to the well.

Other sources of groundwater contamination within the Region are leaking underground storage tanks (LUSTs). The GEOTRACKER on-line database has identified twelve open LUST sites that are currently under the RWQCB oversight. Of these cases, most are petroleum tanks while one is a clandestine lab waste site and another is an airplane crash site. The twelve cases are categorized as follows: five cases are undergoing remediation, five cases are undergoing site assessment, one is eligible for closure, and one is undergoing verification monitoring. In addition, there are over 80 sites that have been cleaned up and the case is closed.

Comprehensive information regarding groundwater in Mariposa County is generally lacking and specific issues as to water quality, quantity, and recharge capabilities require further investigation. Water quality samples of 64 private wells throughout the Region were collected as part of the groundwater study conducted for this IRWM Plan. The constituents that were analyzed for include:

- Major Cations and Anions
- pH, Fluoride, Electrical Conductivity, and Total Dissolved Solids
- Metals
- Asbestos
- Alpha Activity and Stable Isotopes of Water

Overall the water quality of the wells sampled was good. Three wells exceeded a Primary Maximum Contaminant Level (MCL) for arsenic, with values ranging from 10 to 21 ppb, compared to an MCL of 10 ppb. Most wells however were below 2 ppb. Although approximately 2/3 of the wells were non-detect for manganese, eight wells exceeded the Secondary MCL, with concentrations ranging from 0.36 to 0.84 ppm, compared to an MCL of 0.05 ppm. In addition to arsenic and manganese, one well exceeded the Secondary MCL for iron, with a value of

1.5 mg/l, compared to an MCL of 0.3 mg/l. The other water quality concern noted was an area of low pH groundwater in the Lush Meadows-Bootjack area.

3.5.5 Other Water Quality Impacts

Illegal marijuana cultivation is a continued issue in Mariposa County that can have negative impacts on water quality within the Region. There are a variety of activities that can occur during illegal marijuana cultivation that threaten or damage riparian and aquatic habitat, including:

- grading, terracing, dam, and road construction without permits, leading to the filling of streams through erosion and sediment deposition;
- deforestation and habitat fragmentation;
- illegal use of rodenticides, fungicides, herbicides and insecticides;
- use of soil amendments and fertilizers in situations where run off to surface waters may occur;
- discarding of trash and haphazard management of human waste;
- substandard storage of hazardous materials such as diesel and gasoline; and
- unauthorized diversion of water from streams.

These activities impair beneficial uses of the water, from municipal drinking water to swimming, and from agriculture to preserving habitat for endangered fish and wildlife (RWQCB, 2013). Impacts from marijuana cultivation can affect both surface water and groundwater quality within the Region and Mariposa County Sheriff's department estimates that up to 30 wilderness marijuana gardens are removed annually with associated water supply and water quality issues. In some areas, Federal agencies are able to use volunteers to supplement local responders to assist in clean up and restoration of these sites.

3.6 Ecological Processes and Environmental Resources

Watershed health is also a major concern for stakeholders and has a significant effect on this Region, as well as the neighboring Merced IRWM Region. The lakes, creeks, meadows and other water features that form the Region provide key habitat for many of California's most important aquatic and terrestrial species, including many fish and wildlife species. Anadromous fish once migrated into the Region, using its waterways for spawning as far upstream as the waterfalls that did not allow further fish passage; fish passage is now limited to reaches below downstream dams. Over 50 special status species are found in the Region today, many of which are federally or state listed species. Protection and restoration of these species is an important aspect of this IRWM program.

3.6.1 Environmental Resource Related Issues, Needs, Challenges and Opportunities

This subsection addresses the following key issues, needs, challenges and opportunities related to environmental resources management:

- Protection and restoration of anadromous fisheries, threatened, endangered and sensitive aquatic and terrestrial species
- Restoration of functional wildlife habitat
- Management of the spread of invasive aquatic and terrestrial invasive species

3.6.2 Aquatic Ecosystems and Fisheries

There are many valuable aquatic ecosystems in the Region including high elevation lakes, streams and rivers that traverse the Region as well as forested riparian areas and meadows at a range of elevations. These ecosystems, much of which occurs within federally managed lands, provide habitat for both native and non-native introduced species. These aquatic ecosystems are also a focal point for Native American cultural resources. The largest water feature in the Y-M Region, the upper Merced River, was designated a Wild and Scenic river system, by Congress in 1987. This designation which originated in 1968 preserves selected rivers with remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values. The goal is to counterbalance dams and other construction in order to preserve these selected rivers/portions of rivers in their free-flowing condition to protect water quality and wildlife habitat for the benefit of future generations. The Upper Merced River and associated 81 miles of tributaries is the only Wild and Scenic river in the Y-M Region. The designation preserves the Upper Merced River's free-flowing condition and resulting unique values for present and future generations.

Kayaker on Lake Tenaya
Credit: Melissa Odell

Some of the more valuable aquatic ecosystems in the Region support sensitive species such as foothill yellow-legged frogs, Yosemite Toad, and western pond turtles. This is particularly true in the upper North Fork Merced River watershed including the Smith, Bean, Bull, Moore and Jordan Creek areas. Most of these streams support small, possibly interconnected populations of these two sensitive species and is the largest area within the Region in which they occur (YSS, 2011). Amphibian inventories from the early 1900s were resurveyed in the last 20 years; the results indicate changes in the relative abundance in the survey area of the five key amphibian species and an associated aquatic species, the western pond turtle. This species, like the foothill yellow-legged frog, exists in multiple locations within the survey area, but populations are generally small and skewed toward older individuals with limited apparent recruitment of young individuals into those populations (YSS, 2011).

Across the remainder of the Region, small population of foothill yellow-legged frog and western pond turtle are highly isolated, lacking other populations in close proximity for breeding and genetic exchange (YSS, 2012). Within Yosemite National Park, the NPS is preparing an Aquatic Resources Management Plan to improve habitats for both the foothill yellow-legged frog and the Yosemite toad. Similarly, the Sierra and Stanislaus National Forests conducted a Yosemite Toad Adaptive Management Project from 2005-2010 which evaluated impacts of public lands grazing and toad breeding pools in high elevation mountain meadows. The survey portion conducted from 2006-2008 found that cattle select for higher forage quality diets in drier meadows and that toads are more prevalent in wetter meadows, indicating that grazing and Yosemite Toad can coexist within the same environment (Tate, K. and Roche, L.; USFS, 2012 and 2013).

In addition, many of the rivers in the Region historically supported anadromous fisheries of steelhead and Chinook salmon; some runs were reported up to the headwaters in Yosemite Valley until the 1950s although access to high elevations was likely limited in distribution by large

geologic features (waterfalls, very steep gradients). All of the anadromous fisheries in the Region are now disconnected from the downstream San Joaquin River because of the construction of water storage and/or flood control dams on all of the major tributaries flowing out of the Region. Currently there are reported to be 11 species of fish in the upper Merced River which is well studied because of its proximity in Yosemite National Park. At lower elevations (<4,000 feet), the native fish community was comprised of few species and included hardhead, Sacramento pikeminnow, California roach, Sacramento sucker, resident rainbow trout, and riffle sculpin. Beginning in the early 1900s, trout were extensively stocked to provide recreational opportunities. Currently there are few streams without fish, typically headwater, intermittent and seasonal streams (YSS, 2012). Fishery studies of the lower Mariposa Group of streams and upper Fresno/Chowchilla Rivers are not readily available.

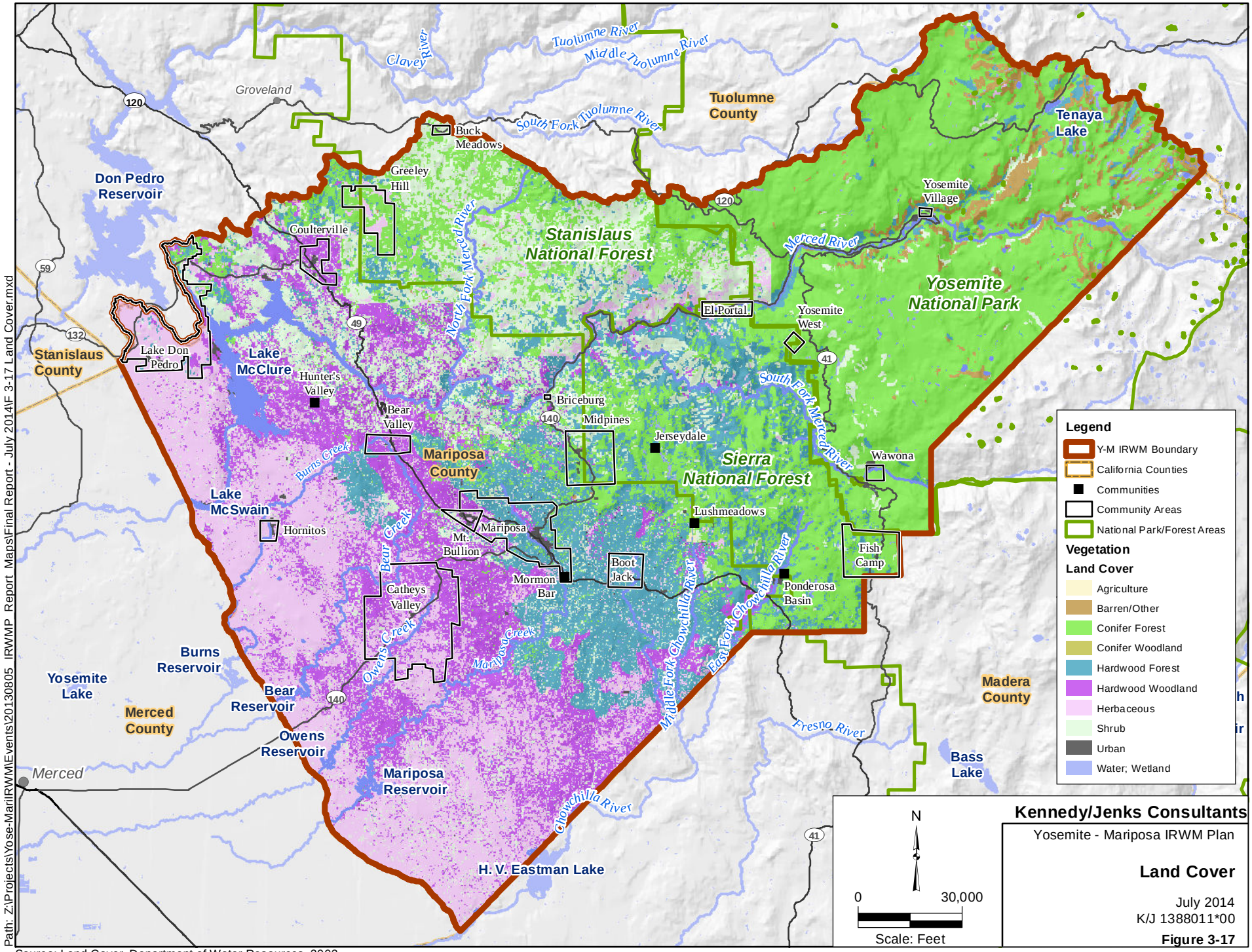
3.6.2.1 Aquatic Invasive Species

Invasive species are a concern for the Y-M Region because of their negative effect on native ecosystems. One example is the invasive bullfrog, a non-native competitor, having the potential to severely impact foothill yellow-legged frog and western pond turtle populations. These adult bullfrogs can prey on all terrestrial life stages of the foothill frog and early life stages of the turtle effectively reducing native populations. Perennial ponds within this area have been a source for breeding populations of the bullfrog. In addition, species of non-native trout such as rainbow, brook, brown, cutthroat, and golden as well as small mouth bass, and blue gill can also prey on amphibians and invertebrates thus impacting populations of several native species (NPS, 2014b). Invasive terrestrial species such as yellow star thistle can also negatively impact aquatic native species as discussed in Section 3.6.3.

In addition, non-native plants such as Arundo donax which have a high evapotranspiration rate in riparian areas can result in water losses that reduce habitat suitability for aquatic native species as well. Mariposa County Department of Agriculture uses Integrated Pest Management techniques in cooperation with other agencies to remove Arundo, star thistle and other non-native species in the County. (County of Mariposa, 2012d)

3.6.3 Terrestrial Ecosystems

The Y-M Region contains a wide variety of terrestrial ecosystems consisting mainly of forested and range land over a several thousand foot elevation band. This large elevation span represents an important movement corridor for migrating species such as mule deer and other large mammals. Providing unconstrained movement between elevations will be important for climate change adaptation for many species (CDFW, 2013). Meadows and other riparian areas are interspersed in the Region and, while limited in acreage, provide valuable resources including water storage and habitat for native animals and plants; many of the plants are important to Native American tribes for ceremony, basket making, and medicines. There are approximately 700,000 acres of forested or range lands with a range of vegetation out of the 930,000 acres in the Region as shown on Figure 3-17 that follows.



Source: Land Cover, Department of Water Resources, 2002.

Mariposa County also has approximately 6,500 acres of lower elevation vernal pools which are ephemeral wetland ecosystems that provide habitat to some localized special status species and are therefore a focus for conservation organizations. Mariposa County is unique to the Central Valley in that comparative aerial photo surveys of vernal pools from 1976 – 2005 indicate no loss of the 6,500 acres of vernal pool during this period, while the remainder of the Central Valley saw losses of about 135,000 acres or about 13 percent of the total area (Holland, R.F., 2009). In addition, studies by The Nature Conservancy and others indicate that moderate, well-managed cattle grazing are not damaging to vernal pools, and in fact, can benefit the habitat by removing non-native invasive species (Marty, J.T. 2004 and 2006; Robins, J.D. and Vollmar, J.E., 2002).

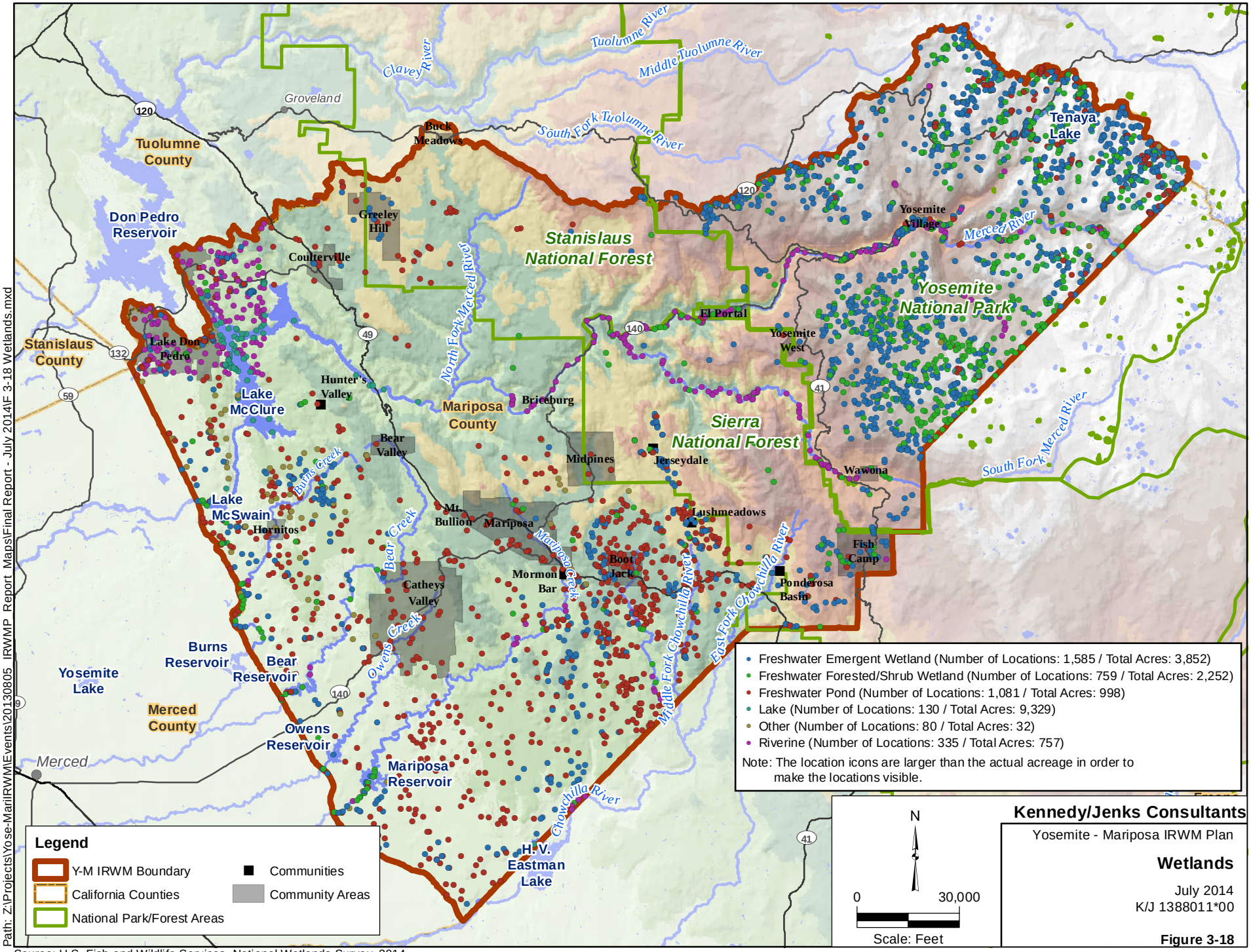
The U.S. Fish & Wildlife Service created an inventory of wetland, riparian, deep water and related aquatic habitats in priority areas to promote the understanding and conservation of resources. This inventory is shown in Figure 3-18 with dots depicting each wetland area and shows almost 6,000 acres of wetland areas, not including lakes, in almost 4,000 various locations throughout the Region. It should be noted that the dots on Figure 3-18 are much larger than the actual wetland acreages in order to make them visible on the map.

Mariposa County Wildflower - Shooting Star
Credit: Pat Garcia

As discussed earlier, wildfire and forest fuel management are integrally linked to the health of terrestrial ecosystems as non-native plants often out compete native plants in the post-fire regime. In addition, for some key terrestrial wildlife species in the Sierra, such as the Pacific fisher and the California spotted owl, habitat needs include large areas that have large trees, dead trees, and other characteristics of mature forests. The habitat requirements of these higher level carnivores are complex as they require environments to sustain prey as well as nests/dens. Monitoring is a key element of management of these species. In the Sierra National Forest, for example, these and similar species are used to assess management decisions because if these higher level species are well supported, then it stands to reason lower level species also benefit (USFS, 2013b). Opportunities to improve the terrestrial ecosystem within the Region include restoration of vegetation density to a more historic regime, reintroducing fire to maintain important terrestrial habitat elements, and reducing densities of aquatic and terrestrial invasive species.

3.6.3.1 Terrestrial Invasive Species

Across the western United States, aggressive, non-native plants have permanently taken over millions of acres of formerly productive agricultural and wildlands to the detriment of ecosystems and the economies that depend on them. A major concern is the noxious weeds within the Region that vary from absent to almost total degradation of terrestrial habitat. Sources have estimated that almost 60% of the Region contains some type of noxious weed infestation. Examples of the more threatening noxious weed species known to occur in the landscape include yellow-star thistle (*Centaurea solstitialis*), Italian thistle (*Carduus pycnocephalus*), tocalote (*Centaurea melitensis*), diffuse knapweed (*Centaurea diffusa*), medusahead (*Taeniatherum caput-medusae*), Klamath weed (*Hypericum perforatum*), barbed goatgrass



Source: U.S. Fish and Wildlife Services, National Wetlands Survey, 2014.

(*Aegilops triuncialis*), Arundo (*Arundo donax*), Tree of Heaven (*Ailanthus altissima*), Armenian or Himalayan Blackberry (*Rubus armeniacus*),puncturevine (Tribulus terrestris), and bull thistle (*Cirsium vulgare*). Wildlife habitat, native plant species, rangeland health, ecosystem integrity and fire regimes are all adversely affected by annual expansion of invasive noxious weed species in the landscape.

There have been several movements in the Region to eradicate or at least reduce the amount of harmful invasive plant life. The yellow-star thistle has collectively received a great amount of attention. Two major areas of the Merced River Canyon, El Portal and Briceburg, have significant infestations. Treatments have been ongoing for several years, including hand pulling and applying herbicides with boom trucks on steep slopes. Burning, hand pulling, herbicide spraying and even targeted grazing can be used alone or in combination to control or eradicate noxious weeds from wildlands. The Mariposa County Department of Agriculture actively manages several programs to treat and reduce invasive species including thistles and Arundo (County of Mariposa, 2012d).

Another method of fighting invasive species is to educate people about the impacts so that they will be motivated to take action. The principles of Integrated Weed Management is one such example. The idea is to combine education and prevention with the appropriate control tools for each particular weed and location. Preventative measures have proved more cost effective than treatment when an invasive is widespread.

Noxious terrestrial weed species have contributed to the degradation of terrestrial habitat used by the western pond turtle and, to a lesser extent, the foothill yellow-legged frog. Dense stands of yellow-star thistle along Jordan Creek and North Fork Merced River may inhibit very small hatchling turtles from reaching stream habitat as they emerge from nests (YSS, 2011)

3.6.4 Endangered and Special Status Species

This subsection presents a sampling of wildlife and plant species that occur or have been known to historically occur in the Region. The species listed in Table 3-11 below have special status designations of endangered, threatened or special status. Some species, while not federally or state listed, have been identified as a ranked species on the heritage global, heritage state, or rare plant lists. A more extensive table can be found in Appendix 3-C including information in addition to the common name and status in Table 3-11 on scientific name, other status, common habitats, as well as an explanation of the Heritage and Rare Plant ranking systems.

Larval California Tiger Salamander
Credit: Kristen Boysen, Sierra Foothill Conservancy

Table 3-11: Special Status Species

#	Common Name	Federal List	California List	Heritage Global Rank	Heritage State Rank	Rare Plant Rank
	Amphibians					
1	California Tiger Salamander	Threatened	Threatened	G2G3	S2S3	-
2	Mount Lyell Salamander	None	None	G3	S3	-
3	Yosemite Toad	Proposed Threatened	None	G2	S2	-
4	Foothill Yellow-legged Frog	None	None	G3	S2S3	-
5	Limestone Salamander	None	Threatened	G1	S1	-
6	Sierra Nevada yellow-legged Frog	Proposed Endangered	Threatened	G1	S1	-
	Arachnids					
7	Crane Flat Harvestman	None	None	G1	S1	-
	Birds					
8	Great Gray Owl	None	Endangered	G5	S1	-
9	Northern Goshawk	None	None	G5	S3	-
10	Willow Flycatcher	None	Endangered	G5	S1S2	-
11	Prairie Falcon	None	None	G5	S3	-
12	Black-backed Woodpecker	None	None	G5	SNR	-
13	Least Bell's Vireo	Endangered	Endangered	G5T2	S2	-
14	Double-crested Cormorant	None	None	G5	S3	-
	Bryophytes					
15	Elongate Copper Moss	None	None	G4	S2	2B.2
16	Norris' Beard Moss	None	None	G3G4	S3S4	2B.2
17	Shevock's Copper Moss	None	None	G1	S1	1B.2
18	Slender Silver Moss	None	None	G4G5	S2	2B.2
19	Bolander's Bruchia	None	None	G3	S3?	2B.2
20	Koch's Cord Moss	None	None	G1	S1	1B.3
	Crustaceans					
21	Wengerors' Cave Amphipod	None	None	G1	S1	-
	Dicots					
22	Hoover's Calycadenia	None	None	G3	S3	1B.3
23	Merced Clarkia	None	Endangered	G1	S1	1B.1
24	Mariposa Daisy	None	None	GH	SH	1A
25	Big-scale Balsamroot	None	None	G2	S2	1B.2
26	Mariposa Pussypaws	Threatened	None	G1	S1	1B.1
27	Parry's Horkelia	None	None	G2	S2.2	1B.2
28	Yosemite Ivesia	None	None	G3	S3.2	4.2
29	Congdon's Lomatium	None	None	G2	S2.2	1B.2
30	Yosemite Popcornflower	None	None	G4T2Q	S2.2	1B.2
31	Mariposa Cryptantha	None	None	G3	S3	1B.3
32	Slender-stemmed Monkeyflower	None	None	G2	S2	1B.2
33	Succulent Owl's-clover	Threatened	Endangered	G4?T2	S2	1B.2
34	Fell-fields Claytonia	None	None	G4G5	S2S3	2B.3
35	Congdon's Lewisia	None	Rare	G2	S2	1B.3
36	Yosemite Lewisia	None	None	G2	S2.2	1B.2
37	Yellow-lip Pansy Monkeyflower	None	None	G2G3	S2S3	1B.2
38	Congdon's Woolly Sunflower	None	Rare	G2	S2.2	1B.2
39	Mono Hot Springs Evening-primrose	None	None	G3T2	S2	1B.2
40	Slender-stalked Monkeyflower	None	None	G2G3	S2S3	1B.2
41	Tulare Rockcress	None	None	G2	S2	1B.3
42	Small's Southern Clarkia	None	None	G2	S2	1B.2
43	Yosemite Woolly Sunflower	None	None	G2	S2.3	1B.3
44	Short-leaved Hulsea	None	None	G3	S3	1B.2
45	Mariposa Lupine	None	Threatened	G2T1	S1	1B.2

#	Common Name	Federal List	California List	Heritage Global Rank	Heritage State Rank	Rare Plant Rank
	Dicots (cont'd)					
46	Bolander's Clover	None	None	G2G3	S2S3	1B.2
47	Mariposa Clarkia	None	None	G4G5T2T3	S2S3	1B.2
48	Beaked Clarkia	None	None	G2G3	S2S3	1B.3
49	Madera Leptosiphon	None	None	G1?	S1?	1B.2
50	Slender Lupine	None	None	G2	S2	1B.3
51	Shaggyhair Lupine	None	None	G2	S2.2	1B.2
52	Merced Phacelia	None	None	G5TH	SH	3.2
	Ferns					
53	Moosewort	None	None	G3?	S1	2B.1
54	Paradox Moonwort	None	None	G3G4	S1	2B.1
	Forest					
55	Big Tree Forest	None	None	G3	S3.2	-
	Inland Waters					
56	Central Valley Drainage Hardhead/Squawfish Stream	None	None	GNR	SNR	-
	Insects					
57	Wawona Riffle Beetle	None	None	G1G3	S1S2	-
58	Boharts' Blue Butterfly	None	None	G3G4T1	S1	-
59	Sierra Pygmy Grasshopper	None	None	G1G2	S1S2	-
60	Valley Elderberry Longhorn Beetle	Threatened	None	G3T2	S2	-
61	Leech's Skyline Diving Beetle	None	None	G1?	S1?	-
	Mammals					
62	Long-eared Myotis	None	None	G5	S4?	-
63	American Badger	None	None	G5	S4	-
64	Yuma Myotis	None	None	G5	S4?	-
65	Gray-headed Pika	None	None	G5T2T4	S2S4	-
66	Sierra Nevada Mountain Beaver	None	None	G5T3T4	S2S3	-
67	Spotted Bat	None	None	G4	S2S3	-
68	Sierra Nevada Red Fox	None	Threatened	G5T1T2	S1	-
69	Townsend's Big-eared Bat	None	Candidate Threatened	G3G4	S2S3	-
70	Silver-haired Bat	None	None	G5	S3S4	-
71	Western Red Bat	None	None	G5	S3?	-
72	Fisher - West Coast DPS	Candidate	Candidate Threatened	G5T2T3Q	S2S3	-
73	Pallid Bat	None	None	G5	S3	-
74	Western Mastiff Bat	None	None	G5T4	S3?	-
75	California Wolverine	Proposed Threatened	Threatened	G4	S1	-
76	Sierra Marten	None	None	G5T3T4	S3S4	-
77	Western Small-footed Myotis	None	None	G5	S2S3	-
78	Fringed Myotis	None	None	G4	S4	-
79	Hoary Bat	None	None	G5	S4?	-
80	Long-legged Myotis	None	None	G5	S4?	-
81	Mount Lyell Shrew	None	None	G2G3	S2S3	-
82	Merced Kangaroo Rat	None	None	G3G4T2T3	S2S3	-
	Mollusks					
83	Merced Canyon Shoulderband	None	None	G1	S1	-
84	Yosemite Mariposa Sideband	None	None	G1	S1	-
85	Trinity Spot	None	None	G1G3	S1S3	-
	Monocots					
86	Sanford's Arrowhead	None	None	G3	S3	1B.2
87	Tompkins' Sedge	None	Rare	G3	S3.3	4.3
88	Yosemite Bog Orchid	None	None	G2	S2.2	1B.2
89	Brownish Beaked-rush	None	None	G5	S1	2B.2
90	Northern Clustered Sedge	None	None	G5	S2	2B.2

#	Common Name	Federal List	California List	Heritage Global Rank	Heritage State Rank	Rare Plant Rank
			Monocots (cont'd)			
91	Bolander's woodreed	None	None	G2	S2	1B.2
92	Pilot Ridge Fawn Lily	None	None	G1	S1	1B.2
93	Slender-leaved Pondweed	None	None	G5T5	S3	2B.2
94	Mountain Bent Grass	None	None	G4Q	S2	2B.3
95	Pleasant Valley Mariposa-lily	None	None	G4T2	S2	1B.2
96	Stinkbells	None	None	G3	S3.2	4.2
97	Robbins' Pondweed	None	None	G5	S3	2B.3
98	White beaked-rush	None	None	G5	S2	2B.2
99	Yosemite Onion	None	Rare	G3	S3	1B.3
100	Nuttall's Ribbon-leaved Pondweed	None	None	G5	S2S3	2B.2
			Reptiles			
101	Western Pond Turtle	None	None	G3G4	S3	-

Source: California Natural Diversity Database (CNDDB) program managed by the California Department of Fish and Wildlife, April 2014.

3.7 Vulnerability to Climate Change

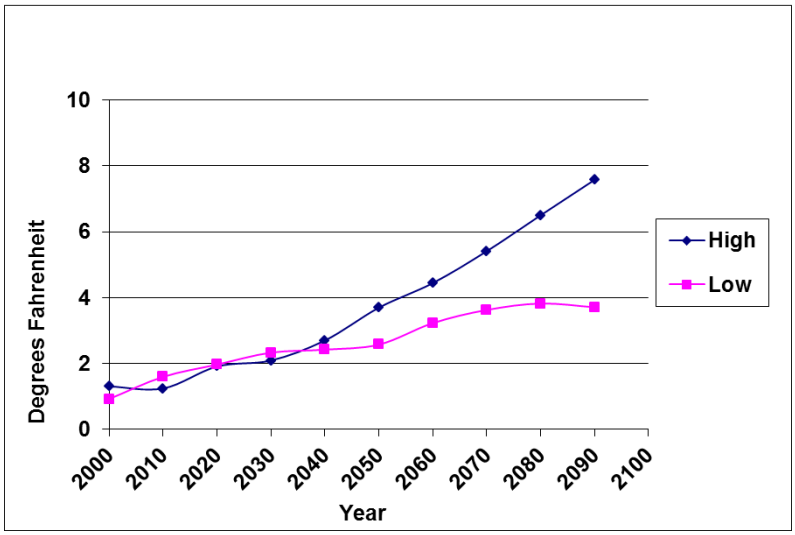
This section provides a discussion of the projected climate change impacts in the Region as well as a summary of the key vulnerabilities of the Region to climate change and potential future actions to mitigate the vulnerabilities to Climate Change. The more detailed Climate Change Vulnerability Checklist is found in Appendix 3-D.

3.7.1 Projected Climate Change Impacts

Climate change has the potential to have significant impacts on the Yosemite-Mariposa Region. The U.S. Bureau of Reclamation (Reclamation), State of California (CalAdapt.org), and others continue to study climate change and its potential impacts on water and other resources in the western states. Reclamation has completed a Global Climate Model, which includes modeling and hydrologic modeling steps and released the results for several western U.S. rivers including the San Joaquin River. Cal-Adapt.org has used four general circulation models (GCM) of climate with 2 emissions scenarios for each model to project 15 parameters for the state of California. Cal-Adapt.org provides projected wildfire risk, increase in temperature, decrease in snow water equivalent as well as other metrics for analysis of climate change impacts.

Climate change is expected to have various impacts on the Region including: 1) changing hydrology due to a shift from snow to rain precipitation, 2) higher fire risk due to warmer, drier conditions over the year, and associated impacts on water quality and flooding, 3) longer and drier conditions over the year, and associated impacts on water quality and flooding, 4) longer and more severe multi-year droughts, 5) more evapotranspiration and thus less runoff from mountain headwaters due to longer annual growing seasons at higher elevations, 6) greater summer water demand from all categories of users and 7) habitats and species shifts.

Cal-adapt projects that temperature for the Yosemite-Mariposa Region will increase by 4-8 degrees Fahrenheit over the next 90 years as shown on Figure 3-19. The projected increases to temperature will likely result in a higher portion of rain over snow in the winter and earlier melting of the snowpack. Increased temperatures could lead to increased fishery stress, increased invasive species infestations, and increased wildfire risk, which is shown in Figure 3-20 (High Emissions Scenario). Additionally, increasing temperatures without an increase in precipitation could result in increased applied water requirements for crops, landscaping and instream ecosystems.



Note: Cal-adapt.org. Based on average of 4 Climate Models for 2 Emission Scenarios (High, Low) using Base Period, 1951-1990. Location projected near City of Mariposa.

Figure 3-19: Projected Annual Temperature Increases

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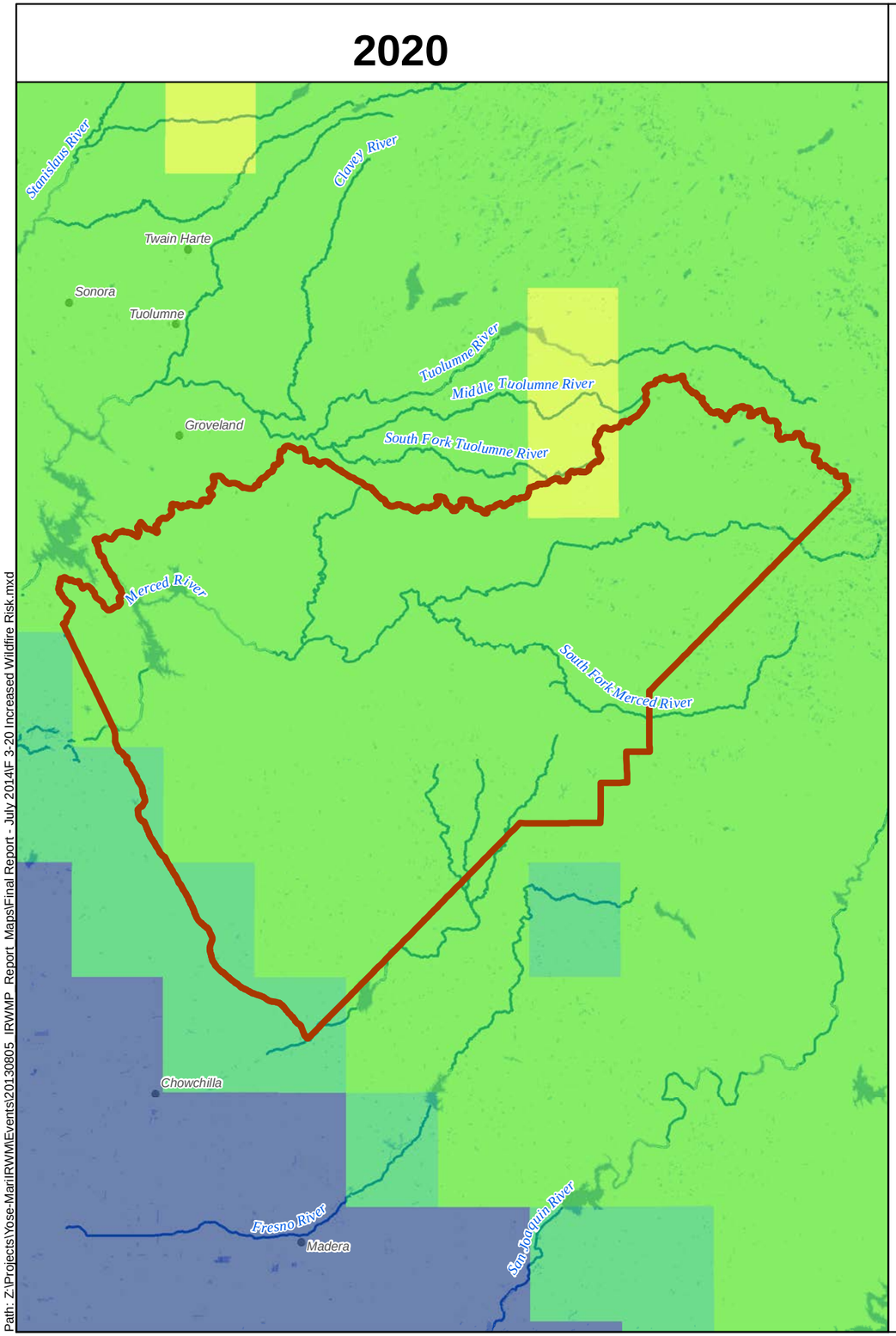

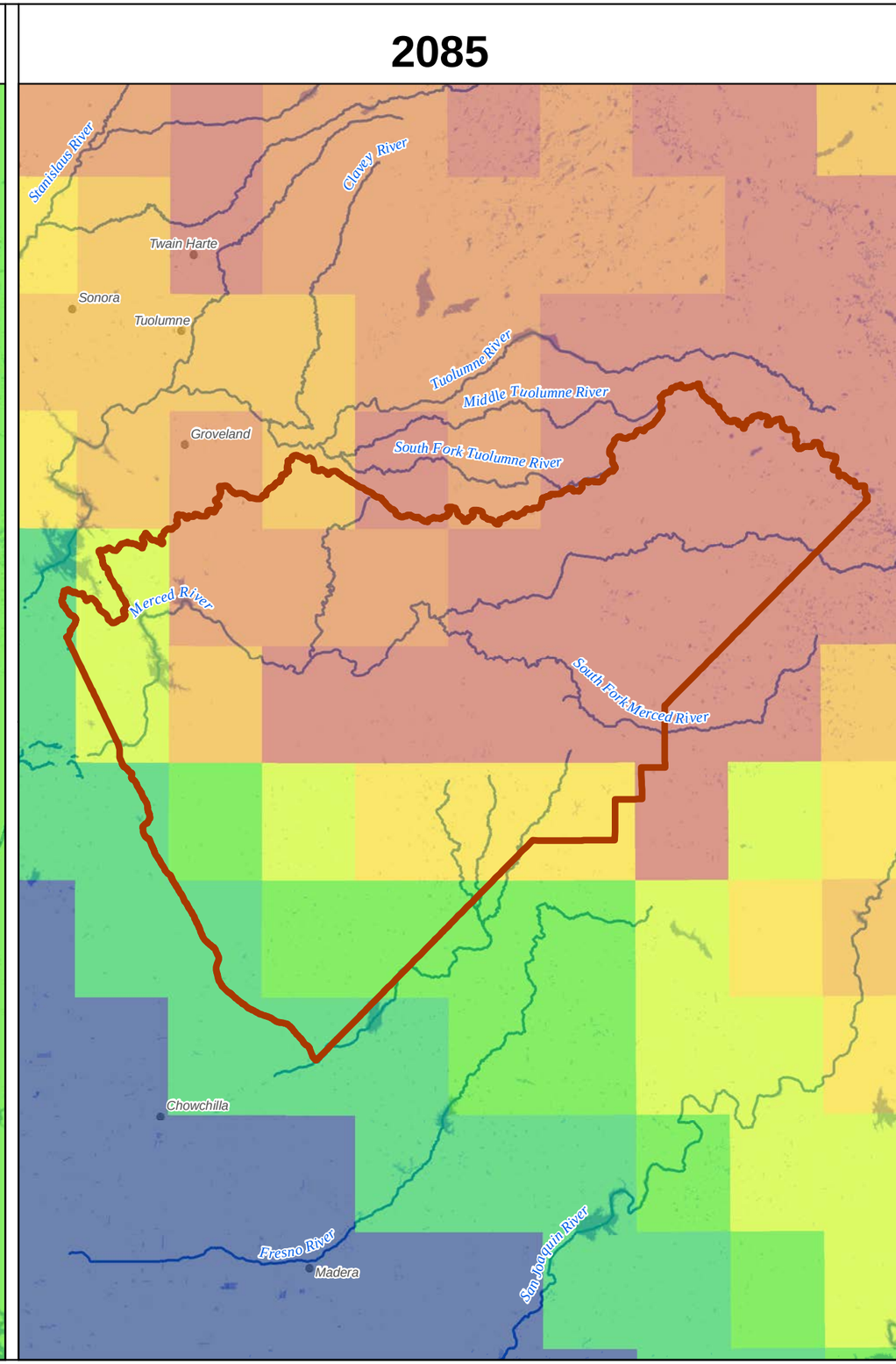

Legend

- Y-M IRWM Boundary
- River/Stream
- Waterbodies

Projected Increase in Area Burned (Base Period 1961-1990)

- 0.25
- 0.5
- 0.75
- 1
- 1.25
- 1.5
- 1.75
- 2
- 2.25
- >2.25

Source:
Fire Risk Data. PCM1; B1. UC Merced Climate Application Lab, 2008

N

0 5 10
Miles

Kennedy/Jenks Consultants

Yosemite - Mariposa IRWM Plan

Climate Change
Increase in Fire Risk
Medium-High Emissions Scenario

July 2014
K/J 1388011*00

Figure 3-20

Path: Z:\Projects\Yose-Mari\IRWM\Events\20130805_IRWMP_Report_Maps\Final Report - July 2014\F 3-20 Increased Wildfire Risk.mxd

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3.7.2 Summary of Climate Change Vulnerability Checklist

The Climate Change Vulnerability Checklist encompasses seven major topic areas that include:

1. Water Demand
2. Water Supply
3. Water Quality
4. Sea Level Rise
5. Flooding
6. Ecosystem and Habitat Vulnerability
7. Hydropower

All of these areas are likely to be of concern for the Region excluding sea level rise and flooding. The region's foothill location is a higher elevation than would be affected by sea level rise. Changes in flow regimes due to climate change may affect flooding for areas downstream of the major rim dams in the San Joaquin Valley, but is not anticipated to be a regional challenge in the steeply sloped, mountainous Yosemite-Mariposa Region, although certain areas may be subject to localized flooding impacts. The completed checklist can be found in Appendix 3-D, while a summary of these topic areas follows.

Based on the vulnerabilities, future efforts of the Region with regard to Climate Change will likely focus on reducing wildfire risk through reducing fuel load; increased restoration efforts which has water supply, water quality, and ecosystem benefits; improving water demand estimates for municipal, commercial, and agricultural uses, especially those using groundwater; and improving understanding of water quality risks associated with wildfire.

3.7.2.1 Water Demand

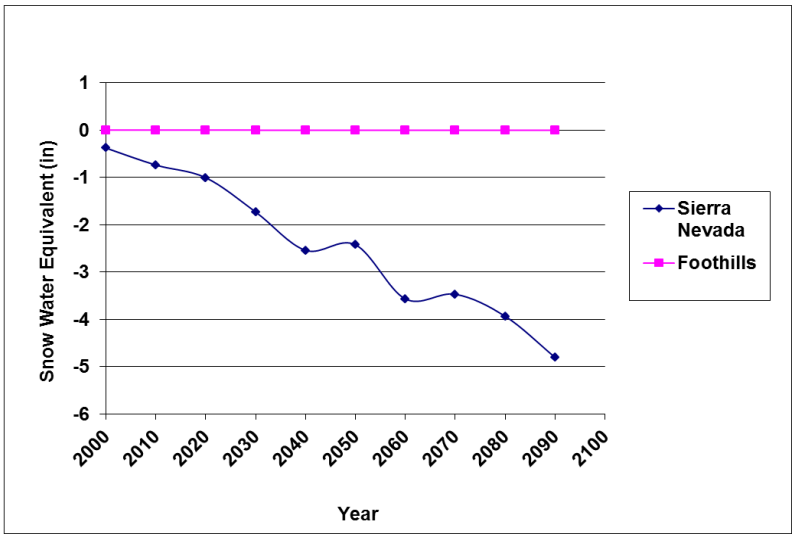
Demand in the Region varies by season for two major reasons: (1) increase in agricultural production in the summer and (2) increase in summer tourism. Agricultural water use, mostly from dry farming, within the Region could account for up to 25% of the total water use (although minimal irrigated agriculture occurs). Additionally, the Region has a significant tourism industry, which contributes to a higher summertime domestic water use. If agriculture becomes a larger industry within the Region, especially if it is focused on the growth of permanent crops such as vineyards or fruit and nut trees, this could harden the water demand requiring an increased reliance on groundwater, which could be problematic in those subareas with many other users. Likewise, the tourism industry is an important part of the Y-M Region's economy and measures should be taken to ensure supplies are available to meet peak summertime tourist-related demands. Overall, it is possible that water demands may increase as a result of climate change due to higher temperatures and prolonged droughts.

Agriculture has a variety of water demand management options including fallowing fields of annual crops and changing the crop itself to one that may be less water intensive, yet economically viable. Additionally, in some cases, farmers may be able to switch their water source from surface water to groundwater. Additional water demand management options include mandates and incentives to reduce water use by homes and businesses. An example of an incentive to reduce water use would be installation of water meters on homes and businesses with implementation of metered rates or low flow shower and toilet rebate programs.

3.7.2.2 Water Supply

Groundwater is the primary source of water within the Region while the Merced River and other local waterways provide water to limited portions of the Region. The Merced River watershed is fed primarily by snowmelt. The carryover storage and available water supply from the major

reservoirs could be affected by changing snowfall and snowmelt patterns which may also change, as noted earlier, coniferous forest species composition and density. Figure 3-21 shows the projected change in average snow water equivalent based on the high emissions scenario projections (CalAdapt.org). Although a direct correlation between snow water equivalent and how it will affect the watershed is not available, a continued decrease in snow production, or poor forest conditions within the watershed could alter groundwater recharge, and therefore, the reliability of water supply within the Region.



Source: Caladapt.org, 2014. Based on average of 4 Climate Models for the High Emission Scenario using Base Period, 1951-1990. Location projected near City of Mariposa (Foothills) and Half Dome in Yosemite Valley National Park (Sierra Nevada).

Figure 3-21: Average Projected Change in Snow Water Equivalent with Climate Change

The Region relies on both surface water and groundwater for agricultural and M&I water supplies. Approximately 80% of the Region relies on groundwater for its supplies with approximately 9,000 persons relying on private wells. The groundwater in the Region may be subject to decreasing reliability related to the extent and duration of longer drought periods that may occur due to climate change. There are limited data available to quantify the sustainable groundwater supplies and therefore to assess the resiliency of these supplies after drought events. A better understanding of groundwater supplies will be important to continued resiliency against climate change, as water supply management becomes a more important issue in the Region.

3.7.2.3 Water Quality

Increased threat of wildfire and resultant threat to water quality from sediment runoff of the burned landscape containing nutrients, are a significant climate change vulnerability in the Region, although current water quality monitoring may not be sufficient to identify trends. Water quality of the reservoirs in the upper watershed that are directly located in forested areas and where erosion from peak runoff is enhanced by mountainous topography will likely be impacted the greatest by wildfires. Additional potential impacts may include increased algal blooms and increased bacterial activity in waterways. Adaptation strategies include watershed management to reduce wildfire risks. The Region already has many forest management projects through the USFS, NPS as well as local entities; however, continued forest management will be important for mitigating the future effects of climate change.

3.7.2.4 Flooding

Localized flooding and large scale flood protection are potential climate change vulnerabilities. Local flood control facilities have historically provided adequate levels of flood protection in most areas, although there are areas of localized flooding. Areas within the Region susceptible to local flooding include Mariposa, El Portal, Coulterville, Wawona and Hornitos. Efforts to mitigate future flood impacts include removal of nonessential infrastructure from high flood risk areas. The largest reservoir in the Region, Lake McClure was constructed in part to provide flood protection for the flat, low-lying urban and agricultural areas in the San Joaquin Valley below the Region that would see significant peak flood flows from the Merced River.

3.7.2.5 Ecosystem and Habitat Vulnerability

The Region contains a portion of the California Sierra Nevada Mountains, which have been identified by the Endangered Species Coalition as one of the top 10 habitats vulnerable to climate change. Studies show that ecosystems at high elevations are greatly impacted by climate change effects. Species that have been identified to be particularly sensitive to temperature changes resulting from climate change include the American Pika, native amphibians and the alpine chipmunk, which is endemic to the Sierra Nevada and found throughout Yosemite National Park.

Another concern is the lengthening of growing season at higher elevations, where transpiration by forest vegetation is currently limited by cold winter temperatures. Warmer winters allow longer growing seasons and thus more annual water use in the forest. Predictions of how this will affect recruitment, disease, mortality and fire remain uncertain due to a lack of information.

Continued research and understanding of ecosystem and habitat vulnerabilities and management will aid the Region in understanding what adaptation strategies will best protect the Region's ecosystem and habitat from the effects of climate change. Yosemite National Park has an ongoing Natural Resource Condition Assessment (http://www.nature.nps.gov/water/nrca/) which when completed will provide a comprehensive view of the vulnerability of various resources within that portion of the Region to climate change.

In addition, various studies of specific resources have also been completed or are in progress. For example, the Sierra Nevada Network Inventory and Monitoring Program provides regional assessments of climate impacts on resources such as birds, forests, lakes, rivers, wetlands and snowpack (Westerling, A.L., 2006). A common feature in these assessments is the response of ecosystems and resources to a shift from snow to rain as the climate warms (Rice, R. and Bales, R., 2013).

3.7.2.6 Hydropower

There are 2 hydroelectric facility licenses within the Region, with capacities of 103.5 and 1.7 megawatts. These facilities are a major source of power for the Region and users in the Central Valley. Since the Region is highly affected by changes in snowpack and resulting changes in flow regimes, hydropower production will be affected by climate change requiring changes to the timing and availability of water releases through changes in water storage operations. Changes in these water releases could impact the overall reliability of hydropower in the Region and availability of municipal supplies that are associated with hydropower storage facilities.

3.7.2.7 Prioritized Climate Change Vulnerabilities and Adaptation Strategies

The climate change vulnerabilities were prioritized according to their relative linkage to the Plan objectives. Note that not all climate change vulnerabilities or objectives were included.

Table 3-12: Prioritized Climate Change Vulnerabilities

Climate Change Vulnerability Area /Subtopic		Associated Objectives	Priority
1. Water Demand	1.2 Water use varies more than 50% seasonally in parts of the Region.		Medium
	1.4 Groundwater supplies in parts of the region lack resiliency after drought events.	A, B	High
	1.5 Water use curtailment measures are effective and can harden demand.	C	Medium
2. Water Supply	2.1 A portion of the water supply in the Region comes from snowmelt.	A	High
	2.4 The Region may have difficulty storing carryover supply surpluses from year to year.	A	High
	2.5 The Region faced a drought which it failed to meet local water demands.	A	High
3. Water Quality	3.1 Increased wildfires are a threat in the Region.	S	High
	3.5 Part of the Region observes water quality shifts during rain events that impact treatment facility operation.	I, K, S	High
5. Flooding	5.5 Wildfires are a concern in parts of the Region.	S	High
6. Ecosystem and Habitat Vulnerability	6.1 The Region includes inland aquatic habitats vulnerable to erosion and sedimentation issues.	I, K	High
	6.3 Climate-sensitive fauna or flora populations live in the Region.	M	High
	6.4 Endangered and threatened species exist in the Region.	M	High
	6.5 The Region relies on aquatic or water-dependent habitats for recreation.	P	High
	6.8 The Region includes the California Sierra Nevada Mountains which has ecosystems vulnerable to climate change.	L, M, N	High
	6.9 The Region includes areas if fragmented aquatic and wetland wildlife habitat.	N	High

The Y-M IRWM Plan objectives and strategies contain a number of considerations that will facilitate the Region's preparedness and ability to adapt to climate change in the future. The objectives and/or strategies shown in Table 3-13 are each associated with adaptation to the following climate change factors:

- Changes in the amount, intensity, timing, quality and variability of runoff and recharge.
- Reducing emissions which includes consideration of the energy embedded in water use, and ultimately reducing GHG emissions.

Table 3-13: Potential Climate Change Adaptation Strategies

Summary of Objective		Description
C.	Promote Water Use Efficiency (WUE) practices throughout the Region and educate 80% of households and businesses.	Reducing water use will facilitate improved local water supply reliability
D.	Identify, manage and conserve forest, wetland, and range lands for enhancement of water supply.	Improved management of forests, wetland and range lands can improve base flows to meet critical ecological and other water supply needs, especially during dry periods.
L.	Improve watershed health by preventing the establishment of or, reducing/eliminating aquatic and terrestrial invasive species.	Several terrestrial invasive species consume significant water which, when removed, can make additional supply available to meet ecological and water supply needs during dry periods.
M.	Protect special status and sensitive species and preserve and restore 10,000 acres.	Climate change is expected to affect species in the Region negatively and may have a larger effect on species that are already special status; therefore improving existing habitat for these species will improve their ability to adapt to climate change.
R.	Develop opportunities/data management system so that current scientific data can be made available to make informed, collaborative choices regarding water resources and land use management.	Improved understanding of existing conditions will help provide scientists and water resource managers the tools to make informed decisions regarding water resources needs, under climate change, in the Region.
S.	Facilitate and coordinate fuel management policies and strategies.	Improved fuel management policies will help mitigate increased fire risk due to climate change.
V.	Mitigate impacts of climate change by implementing cost-effective renewable energy production.	The Region already produces hydroelectric power; meeting this objective increases renewable energy production from the Region.
W.	Mitigate flood risk associated with climate change by cooperating with Local Hazard Mitigation Planning flood risk updates and public education..	Mitigation of flood risk within the Region will decrease the negative impacts of increased flooding due to climate change.

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Section 4: Relation to Local Water and Land Use Planning

Water resources and land use planning in the Yosemite-Mariposa (Y-M) Region are inherently linked due to the connection between the uses of land (i.e., for rural residences, forestry, agricultural, and other activities) and the ways in which water is conveyed and used (i.e., for both consumptive and non-consumptive uses within and outside the Region). Land use changes that occur without proper planning or collaboration can significantly impact water resources/quality and the availability and reliability of supply for urban, agricultural, and ecosystem benefits. Collaboration between water managers and land use managers can help mitigate land use decisions to avoid detriment to water resources. Historical events such as water storage, and hydroelectric generation projects in the Region have significantly altered the natural hydrology of water systems. These changes to the water systems have provided considerable human benefit, but in some cases have also resulted in adverse environmental consequences. Efforts have been undertaken to reduce the impacts, such as, establishing a Wild and Scenic protected corridor on the Merced River.

Recognizing that collaboration between land and water use managers is an important linkage; IRWM Plans are required to describe the relationships and interactions between local water planning, local land use planning, and regional planning efforts fostered by the Yosemite-Mariposa Regional Water Advisory Council (RWAC).This section identifies some of those points of collaboration and highlights opportunities for improved communication and action in the future. It is broadly understood that water resources can be better protected, managed, and restored when water managers provide early input to, and ongoing coordination with, entities responsible for making land use decisions and implementing land use changes. Although many land use planning documents set appropriate goals related to water resources management, active implementation of land use policies that benefit water resources may require more interaction and collaboration between water managers, land use planners, and the elected officials that set policies.

Numerous plans and studies related to water resources and land use management in the Y-M Region have been reviewed to support the development of this IRWM Plan. The Y-M IRWM Plan contains information from local planning efforts that have occurred throughout the Region, and is consistent with and supports locally-led planning and implementation of integrated water management. The reference list provides additional information about the planning documents used in development of the Y-M IRWM Plan.

4.1 Relation to Local Water Planning

The Y-M IRWM Plan in no way replaces or supersedes local planning, but is intended to incorporate, strengthen, and provide tools for local planning efforts. This Plan will support local water management organizations in making local decisions and taking local actions that help accomplish a shared vision for the whole Region. This section contains a description of how the Y-M IRWM Plan incorporates its water management planning and implementation activities with local resource management planning activities.

4.1.1 Local Water Supply Planning

Local water supply planning responsibilities in the Y-M Region are generally carried out by the county and local agencies providing water/wastewater services. Residents in the Y-M Region live in small communities or in rural settings. Much of the Region consists of unincorporated public lands managed by the NPS, BLM, and USFS. Water systems are made up of numerous small, geographically dispersed systems with about half of the residents served by community water systems with the remaining residents on private wells. Approximately twenty community water systems serve a large portion of the permanent residents and there are over fifty non-residential community water systems, serving uses such as recreation areas and campgrounds. Similarly there are only a few centralized wastewater facilities, mainly located in community areas. None of the water systems in the Y-M Region are Urban Water Suppliers (i.e., have over 3,000 customers or deliver more than 3,000 acre-feet per year of potable water), therefore formal water planning is limited.

4.1.2 Incorporation of Water Planning

The Y-M IRWM Plan incorporates elements of local resource management planning documents, including watershed and forestry management plans, emergency response plans, and the General Plan. Many of these planning documents (included in the Technical Analysis Appendix 3-C) focus on improving natural resources with consideration of water resources in the Y-M Region. There only a few water resources planning documents that provide the basis for understanding the water supply and demand conditions, water quality, and water-related infrastructure in the Region. This information also has been used to develop the Region Description (Section 2) and Resource Management Strategies (Section 6). The water management documents used in preparation of the IRWM Plan are listed in the references.

The water management needs, challenges, and conflicts identified and addressed in the Y-M IRWM Plan (see Section 3) were developed through consideration of local water planning activities and stakeholder input. Most of the IRWM Plan goals and objectives detailed in Section 5 relate to improving water planning such as:

- Objective B, improve understanding of groundwater usage, private groundwater wells provide water supply to the majority of the County residents:
- Objective D, identify, manage, and conserve lands for water supply enhancement;
- Objective Q to review ordinances and planning related to water management; and
- Objective W, mitigate flood risk by cooperating with Local Hazard Mitigation Planning activities.

Resource Management Strategies (Section 6) and Project Review and Prioritization (Section 7) for the Y-M IRWM Plan were subsequently developed from the Challenges and Opportunities and Objectives. Furthermore, the Coordination discussion in the Section 9 – Plan Implementation Framework addresses how local water management issues and potential climate change adaptation strategies could be better coordinated at a regional level. In this way, local water planning is woven through the Y-M IRWM Plan in a multi-layered approach.

4.1.3 Climate Change

Climate change is a growing concern of water managers and could likely increase the variability of seasonal runoff and affect water quality, among other factors. Policies and programs to address GHG emission reductions and climate change impacts have been incorporated into Catheys Valley Community Plan Policies and Implementation Measures. 32 energy efficiency mandates have been addressed by the Housing Element of the General Plan (County of Mariposa, 2013a). Mariposa County completed a baseline GHG inventory in 2014 which identified community transportation as the largest contributor, at 55 percent of total GHG, which is consistent with the rural nature of the Region. Climate change impacts have also been considered in the process of developing this Plan and are presented in the Climate Change Vulnerability Checklist, which is available as an appendix to Section 3. This information may provide valuable insight for resource management and planning throughout the Region.

4.2 Relation to Local Land Use Planning

Land use decisions and planning often have a direct influence on water management actions. State policies often attempt to link land use decisions and water management decisions, such as Senate Bill 221 (SB 221) and Senate Bill 610 (SB 610) which require evaluation of water supplies and demands for developments over 500 dwelling units or for developments with similar water demands. However, the Region's low urban development does not meet these policy thresholds, so that integration of land use and water resource management often remains a challenge to be managed by local policies. This section considers the current land use management structure, characterizes the current relationship between land use planners and water managers, and identifies additional opportunities for collaboration between the RWAC and land use planners.

4.2.1 Land Use Management Agencies

There are several entities responsible for land management in the Y-M Region. Land use and water supply planning within the Y-M Region are typically managed by separate agencies. The Region encompasses the entirety of Mariposa County, which does not have any incorporated cities. As such, land use planning in the Region's communities falls under the jurisdiction of Mariposa County. In addition, over half of the Region is public lands managed by federal agencies including the National Park Service, Stanislaus National Forest, Sierra National Forest, and the US Bureau of Land Management. These agencies seek local input in their planning, including updates of forests, wild and scenic rivers, the General Plan and other planning documents as described in Section 4.2.6.

As mentioned above, several planning efforts improve collaboration between and integration of water resource management and land use planning. There are often opportunities during the development of public documents for water managers to provide input to planning managers. Local land use planning efforts that include water supply, distribution and usage planning include the Mariposa County General Plan, Mariposa County Codes and the Local Agency Formation Commission (LAFCO) sphere of influence and municipal service reviews. In addition, activities such as the California Environmental Quality Act (CEQA) document review and commitments provide opportunities to consider water service and availability during land use decision-making of individual developments.

4.2.2 Mariposa County General Plan

Although water resources are not typically discussed as a separate 'element' in the general plan, they play an important role in the land use decisions that are made under the guidance of general plans. General plan development, implementation and updates provide a forum for coordination and collaboration between land use planning agencies and water managers. One challenge for land use planning is that comprehensive General Plan updates are not always prepared on a consistent basis and can take a long time to complete.

The Mariposa County Planning Agency prepares the General Plan for the administration of specific plans, zoning and subdivision ordinances. The planning agency is comprised of the County Board of Supervisors, Planning Commission, Planning Department, Planning Director and various Planning Advisory Committees. This Agency is separate from LAFCO.

In the process of the General Plan development, the Planning Agency consults with various local agencies and County departments to ensure consistency of the General Plan with ongoing programs and projects. Additionally, the County Planning Agency promotes public interest in and input to the General Plan. Public participation is also encouraged for reviewing County Code Amendments and reviewing discretionary projects subject to CEQA.

The General Plan provides a long-range vision and policy direction for the County, serving as a land use regulation tool. The Plan includes seven mandatory elements: Circulation, Conservation, Housing, Land Use, Noise, Open Space and Safety. The Plan also includes six optional elements of local interest: Agriculture, Arts and Culture, Economic Development, Historic and Cultural Resources, Local Recreation and Regional Tourism.

Importantly, the County General Plan also includes various water-specific policies and provisions that enhance efficient use and protection of local water resources and other natural resources. For the Residential Land Use and Circulation, Infrastructure and Services Elements, provisions and policies state:

- New subdivision lots must be served by a Health Department – approved potable water supply
- A disclosure statement is required if a property is to be served in the future by a well
- "New projects and subdivisions should be served by basic water and wastewater infrastructure"
- "New parcels must have approved areas for onsite or community system sewage disposal"

Water resources are also discussed in depth within the Conservation and Open Space Element. The goal is to "Protect and manage the use of Mariposa County's limited water resources," which is to be accomplished by the following policies:

- "Conserve water to accommodate County growth and sustainable agriculture" (Policy 11-2a)
- "Preserve surface and sub-surface water quality" (Policy 11-2b)
- "Preserve the existing or potential sources of a sustainable water supply" (Policy 11-2c)

Of high importance and relevance to this IRWM Plan is also the goal to "Conserve the natural and scenic resources, and open space lands to protect and enhance the County's quality of life and character ensuring a viable economy." In order to reach this goal, the County is required to "Collaborate with other public and private agencies for conservation management plans and programs." This collaboration with the County, which should involve federal, State and other public and private agencies, is also a crucial component of this IRWM Plan (County of Mariposa, 2013b; County of Mariposa, 2006).

Generally, the policies and provisions set forth in the County General Plan are implemented through County ordinances and standards. Numerous County Code requirements consider local water and other natural resources, including ordinances related to Health and Safety, Water and Sewers, Subdivisions, Zoning, Mining, and other land use regulations. Among these ordinances, are requirements related to waste and hazardous substances disposal and storage, controlled burns and clearing of brush and vegetation, water supply, well and sewer regulations, construction ordinances, and mining regulations (County of Mariposa, 2013a). These County ordinances provide valuable tools to protect and improve the health of the Region's watersheds and natural resources.

4.2.3 Local Agency Formation Commission

LAFCOs are similar to regional planning bodies in that they promote orderly growth and development, as well as, logical formation and determination of local agency boundaries. However they are prohibited from directly regulating land use, property development, and subdivision requirements. LAFCO responsibilities in Mariposa County include the formation of new special districts, and boundary changes for districts, which may lead to the creation of new services or increase the level of existing services. LAFCO activities encourage public participation and enhance agency collaboration. For example, LAFCO municipal service reviews (MSR), which are required to update an existing agency Sphere of Influence, help identify opportunities for greater coordination and cooperation between providers (County of Mariposa, 2013a). It should be noted that LAFCO does not apply to private water providers, of which there are over 50 in the County.

4.2.4 CEQA

The development review process for projects subject to CEQA enhances agency collaboration and integration of water and land use planning. Among the multiple elements analyzed for impacts are hydrology and water quality, land use/planning, and utilities and service systems, which together include water supply, water quality, flood hazard, and wastewater treatment capacity considerations. Comments during this process may come from diverse agencies including the California Department of Public Health, the State Water Resources Control Board, California Department of Fish and Wildlife, US Army Corps of Engineers, National Park Service, BLM, National Forest Service, County Health Department, Mariposa County Public Works Department, and County Building Department as well as other local agencies and private citizens. This process thereby provides opportunities for enhanced collaboration and coordination between water and land use management (County of Mariposa, 2013a).

4.2.5 Agricultural Land Use and the Williamson Act

The agricultural and ranching sectors in the Region have benefited widely from participation in the Williamson Act, which enables local governments to enter into restrictive contracts with private landowners of agricultural lands to preserve agriculture in exchange for reduced taxes. It is a non-mandated state program administered by counties and cities to preserve agricultural land and discourage the premature conversion of agricultural land to urban uses. Mariposa County's 20-year rolling contracts significantly restrict land uses and development.

As of 2010, within Mariposa County, 208,586 acres are under the Williamson Act contract, which is 48% of all county lands in private ownership (County of Mariposa, 2013b). Until recently, the state offered financial support to the Williamson Act by providing subvention payments to county governments to help offset county property tax losses. Recent state budget cuts have eliminated state funding for the Williamson Act, resulting in the need for county governments to either fund the program at the county level or allow Williamson Act contracts to expire. While some counties chose not to renew their contracts as a result of non-payment by the State, Mariposa County has maintained the program based on strong local policies supporting agriculture and in the hopes that State funding will resume as the economy improves.

4.2.6 Public Land Use and Management

Public lands make up approximately 53% of the total Y-M Region, and are managed by the National Park Service, US Forest Service (USFS) Stanislaus National Forest, USFS Sierra National Forest, and the US Bureau of Land Management (BLM). More specifically, USFS-managed lands comprise 174,040 acres, NPS-managed lands comprise about 242,485 acres and BLM-managed lands comprise 76,397 acres (BLM, 2011).

Each agency has a unique set of land use and resource management directives and objectives, but all are interested in balancing water resources management with land use objectives. Stanislaus National Forest goals, objectives and management practices, for example, include protection and improvement of water quality and watershed conditions through implementation of the Stanislaus National Forest Plan – Forest Plan Direction, the Merced River Wild and Scenic River Management Plan and the Forest Service Manual. Currently, there is limited comprehensive coordination between these public land use managers and the RWAC or local water managers, as no formalized forums for collaboration are in place.

In addition, many of the broad Federal resource plan documents are over 20 years old such as the BLM South Fork Merced River Implementation Plan and the Yosemite National Park General Management Plan. Broad plans have been replaced with more topic or geographic specific plans such as the Yosemite Valley Plan, Invasive Species Management Plans, and Forest Roads analyses. A pilot effort to update the Forest Plan is underway in the Sierra National Forest which follows the completion of the Bio-regional assessment and other assessments that document current forest ecological, air, soil, water resources, and quality, at-risk species as well as social, cultural and economic conditions.

4.2.7 Fuels and Fire Management

Given the large proportion of undeveloped forest lands within the Y-M Region, forest and wildland management is an issue of high priority. As discussed in Section 3, wildfires are prevalent in the Region and their frequency and intensity have direct implications on water resources and water quality. As a result, the management of fuels and fire is a critical factor in integrated water resource management.

The following sections provide a discussion on fuels and fire management on privately and publicly owned lands as well as potential future developments in wildfire management.

4.2.7.1 Fuels and Fire Management on Private Lands

Various efforts exist to provide assistance to private property owners for managing fuels, such as in the form of financial, technical and educational assistance.

Active participation by the citizens is considered to be an essential factor in reducing the risk of wildfires. There is a large influx of new residents to the Y-M Region, generally coming from more urbanized areas and are therefore often unaware of the wildfire risk in the Region. Wildfire education to increase public understanding of living in the fire-adapted ecosystem is a high priority in the Region and is needed on an ongoing basis for highest effectiveness.

Mariposa County Fire Safe Council

The Mariposa County Fire Safe Council, is a 501(c)3 non-profit, non-governmental and non-regulatory community partnership of Mariposa County residents, property owners, businesses, organizations, and agencies. The Council was formed in 1998 as a grassroots community effort to increase awareness for the dangers of wildfire in the wildland urban interface (WUI) and mobilize Mariposa County residents to make their homes and communities fire safe. In efforts to reduce the vulnerability to wildfire threats, the Council provides valuable resources to residents through education and outreach events, and implements various fire prevention and fuel reduction projects, such as chipping services. The Council depends on grant funding to implement their projects (MCFSC, 2013).

Mariposa County Resource Conservation District

The Mariposa County Resource Conservation District (MCRCD) provides technical, financial and educational resources to assist communities in preserving the natural resources of Mariposa County. The MCRCD supports increased interagency efforts and develops cooperative alliances with other agencies and community organizations, including a partnership with the Natural Resources Conservation Service. Among MCRCD activities is participation in Fire Safe Council events (MCRCD, 2012)

Community Wildfire Protection Plans

Community Wildfire Protection Plans (CWPPs), which are encouraged under the Healthy Forest Restoration Act of 2003, are also valuable resources that help guide the management of forests and rangelands on private property to protect human life and reduce property loss and facilitate acquisition of grant funding for hazardous fire management projects.

The Mariposa Countywide CWPP was developed in a collaborative effort between fire districts, local government, community-based organizations and federal land management agencies. The Mariposa County Fire Safe Council was among the major participants in its development. A major component of the plan is the management of forests and rangelands for hazardous fuel reduction and fire resilience. Overall, it provides an essential resource for understanding wildfire risk and prioritizing measures to reduce potential wildfire risk and associated losses in the Region. In addition, the CWPP enhances the County's ability to acquire grant funding for projects related to wildfire management and protection (County of Mariposa, 2010).

The purpose of the Mariposa Countywide CWPP is as follows:

- Protect human life and property from wildland fires
- Restore fire-adapted ecosystems
- Increase public understanding of living in a fire-adapted ecosystem
- Instill a sense of personal responsibility for taking preventative actions regarding wildland fire
- Increase communities' ability to prepare for and respond to wildland fires
- Improve the landscape's fire resilience while protecting other social and ecological values.

The goals of the plan are to: (1) coordinate hazardous fuel reduction treatments across boundaries because wildland fires do not pay attention to political boundaries; (2) promote a better understanding of living in a fire-adapted environment; and (3) promote personal responsibility for taking preventative action.

The communities of Yosemite West and Foresta have developed their own CWPPs with assistance from the National Park Service. Both communities are susceptible to a large-scale, stand-replacing wildfire and pose direct fire threats to Yosemite National Park. The Yosemite West and Foresta CWPPs provide prioritized courses of actions to mitigate impacts of wildfires to those communities and implement effective management measures to reduce wildfire threats.

California Department of Forestry and Fire Protection

The California Department of Forestry and Fire Protection (CAL FIRE) provides important services for fire protection and stewardship on privately-owned wildlands. It provides critical fire response to numerous counties in the state, including Mariposa County. Among the valuable services provided through CAL FIRE is the administration of cost-share assistance programs, such as under the California Forest Improvement Plan and Proposition 40. These programs help reduce wildland fuel loads and improve the overall health of private forest lands with grant funding of up to 75 percent and in special instances, up to 90 percent. CAL FIRE also provides education on fire prevention, fire safety and natural resource protection through exhibits, printed materials, school programs and other media (CAL FIRE, 2013).

CAL FIRE also assesses annual fire prevention fees that are imposed on rural residents living in State Responsibility Areas (SRA). These areas lie outside of incorporated city boundaries and not on federally owned land, where the State is financially responsible for prevention and suppression of wildfires. A fee of $150 is assessed per habitable structure (BOE, 2013).

4.2.7.2 Fuels and Fire Management on Public Lands

Fuels and fire management on federal lands is led by the US Forest Service, BLM, and National Park Service. As mentioned in Section 3, fire suppression has been a major component of forest management in the Region and has contributed to fuels buildup and modified fire regimes. Forest management on federally owned properties is often influenced by public opinion, which may limit implementation of more progressive management techniques. However, high intensity, disastrous fires in past years is causing a shift in fire management towards enhanced fuels reduction and restoration of fire dependent ecosystems.

The US Forest Service, BLM and National Park Service are cooperating with other federal agencies in a comprehensive strategy for managing wildland fires. This National Cohesive Wildland Fire Management Strategy focuses on ecosystem restoration, community preparedness and wildfire response. Management techniques under this strategy include prescribed fires and forest thinning, increasing community resilience to fires and enhancing preparedness of response teams (Forests and Rangelands, 2013).

US Forest Service

The US Forest Service recognizes the large role that natural fire plays in the health of natural ecosystems and the importance of research and technology for improved fire management. The US Forest Service manages prescribed fires and conducts thinning of overgrown sites. The US Forest Service also provides assistance for enhancing community resilience to fires, which may include grants to develop community wildfire protection plans (USFS, 2013a).

Bureau of Land Management

BLM works collaboratively with other agencies and local communities to protect people and property from wildfires. In efforts to address hazardous fuels accumulation and threats of increasingly disastrous fires, BLM uses suppression crews to reduce hazardous fuels and restore fire dependent ecosystems on public lands. During times of high fire risk, BLM may issue fire restrictions that prohibit open fires on public lands, such as was issued in June 2013 for Mariposa County (BLM, 2013a; BLM 2013b).

National Park Service

The National Park Service has taken a very proactive approach in the management of fuels and fire in Yosemite National Park. Highly monitored and extensively studied prescribed burns are a major component of forest management in this national Park. Fuels are reduced by burning unwanted understory, which can enhance the re-establishment of native vegetation and reduce risks of high intensity fires. This approach aligns with management techniques of pre-European settlement and has shown a high level of success in Yosemite National Park.

Studies indicate that this progressive method of managing understory may also have positive result in increased groundwater storage of affected watersheds, which provides another critical link to water resources management (Franklin, G. 2013).

4.2.7.3 Future Fuels and Fire Management

Wildfire trends in the Y-M Region have shown increased frequency and intensity in fires in recent years. Climate change impacts, which include overall warmer and drier conditions, will

likely impact fire regimes and increase susceptibility to disastrous fires in the Region. Efforts to prevent wildfires including fuel management as well as public education and participation, will therefore become increasingly important.

Wildfire threats have implications for water quality and water supply in the Region. As a result, effective integrated resource management is critical. An approach that may come under more consideration in the future may be the concept of community forests to increasingly integrate private and public land management and enhance the community role in forest management and land use decision making.

4.2.8 Potential Areas of Improved Land and Water Resources Planning Collaboration

A strong relationship between land use planning and water resources planning is essential to optimizing resource management in the Y-M Region. It is therefore important to understand where improvements may be needed. The IRWM process provides a collaborative forum between land use management agencies and water suppliers that focuses on developing a common understanding of regional water supply and growth capacity. However, specific, local land use decisions are often not based on the broader regional water supply context. Conversely, water agencies may not have an understanding of long-term development plans, which hinders their ability to ensure a reliable and sustainable supply.

When updating the General Plan, land use planners may wish to consider implementing policies that consider water resources, such as conservation and supply reliability in the future and including drought conditions, before approving new development and take into account long-term water infrastructure planning and water utility capacity when reviewing new development.

With the high priority on forest and fire management in the Y-M Region, improved coordination between forest managers, County representatives, and water managers may provide additional benefits to the Region's resources management.

The RWAC and land use managers are considering ways in which to improve collaboration on a variety of topics and areas of focus, such as flood plain management, flood control planning, groundwater management, treatment and conveyance facilities, stormwater management, water conservation efforts, watershed management, recreational area management, land use changes, general plan updates, water supply for emergency planning, and habitat management.

Much of the collaboration and coordination in the past occurred through the development and implementation of formal documents, such as the General Plans, flood insurance studies, watershed assessments, watershed sanitary surveys, and stormwater management programs. However, there is limited formal consultation between planning agencies and the public and water interests during the preparation of these documents and when entitlement decisions about land use are under consideration by land use managers. The IRWM Plan may be another forum to improve education on these land use decisions.

The RWAC is encouraged to consult and collaborate with land use managers in the planning and development of projects that address water resources-related objectives. Section 9, Plan Implementation Framework, provides additional discussion about opportunities for improved collaboration going forward as projects are developed and implemented.

Section 5: Goals and Objectives

5.1 Introduction

The goals and objectives presented in this section represent the foundational intent of this IRWM Plan. Formulating meaningful and relevant goals and objectives for the Yosemite-Mariposa Region (Region) required more collaboration and collective interaction than the work documented in any other section of this Plan. The goals and objectives were developed over a 6-month period, with four discussions with participants at the main RWAC meetings and an additional two meetings and two conference calls with the Objectives subcommittee. The draft goals and objectives were circulated for review and comment to the RWAC or subcommittee five times to allow for thorough consideration and refinement of what ultimately will direct the Plan.

IRWM Plan Meeting
Credit: Pat Garcia

5.2 Key Terms

People familiar with the broad discipline of planning recognize that different agencies and organizations may use similar terms in slightly different ways in their processes. The following set of terms were established and used during the IRWM Plan preparation process:

- Goal
- Objectives
- Strategies

The *Goals* establish the foundational guiding principles and benchmarks that the Region has agreed should be completed over the course of Plan implementation. The Goals are often broad and encompass a number of issues in the Region. *Goals* are not always fully completed, but rather present the long-term ambitions of the Region to improve water resources management in an area. The Goals are defined and broken down into specific targets called *Objectives*. An *Objective* is a specific and tangible outcome of a *Goal* that is intended to be achieved by or during a designated time. Each *Goal* may have one or more specific *Objective*. The *Objectives* are the building blocks and "checkpoints" that will be used by the Region to confirm progress towards achieving each *Goal*. Finally, the *Objectives* were designed to accommodate *Strategies* as a means to achieve the *Objectives*. These *Strategies* will help the Region accomplish the Vision over time by implementing specific actions, projects or other means to achieve the plan *Objectives*.

Collectively, *Objectives* were developed using the "SMART" criteria, meaning that each objective should be **S**pecific, **M**easurable, **A**ttainable, **R**elevant, and **T**ime-based. When crafted properly, SMART planning targets help to promote actions that lead to measurable results.

Objectives written using the SMART format are designed to allow people to measure and track progress toward improving integrated water management within the Region over time.

Some of the Objectives are quantitative, while others are qualitative. Quantitative Objectives have specific defined targets, such as a certain volume of water saved per year. Qualitative Objectives are less specific, and might measure progress by tracking the number of meetings held, or attendance. Quantitative Objectives have been developed wherever possible; in some cases, initial qualitative Objectives have been formulated to inform and better define quantitative Objectives that will be developed later during Plan implementation. In this way, some of the Objectives are designed to collect fundamental information that is needed to fully understand and complete the overall plan Goals.

The Plan Goals were intended to focus on key areas of need throughout the Plan horizon, while specific dates for completion were assigned to the Objectives to be achieved during the 20-year planning period. It is expected that the Plan Goals and Objectives will be reviewed and potentially revised over time to reflect the benefits of increased coordination by Plan stakeholders.

5.3 Goals and Objectives Development Process

The Plan Goals and Objectives were developed using an iterative and collaborative approach that included three phases:

- Identify the major water-related needs and challenges within the Region
- Propose draft Plan Goals that address the major water-related needs and challenges, discuss, review and refine
- Propose draft Objectives and associated Strategies that will demonstrate progress towards achieving Plan Goals, discuss, review and refine

The first step in developing Plan Goals was to identify the water-related needs and challenges that people believed to be important in the Region today. This effort was initiated by the RWAC as part of the Region Acceptance Process and discussed in a general way during discussions at RWAC meetings in September and October 2012. A more focused brainstorming of Goals occurred with all attendees in June 2013. Once the Consultant team was engaged, draft Plan Goals, Objectives and Strategies were then developed building on the prior work of the RWAC and discussed for prioritization in July 2013. A sub-committee was formed in September 2013 and worked into January of 2014 to finalize the Goals, Objectives, and Strategies.

Quantification of Objectives and Strategies were developed and refined through discussion with the RWAC and sub-committee during the meetings and conference calls. In total, 23 Objectives and 55 quantifiable Strategies were identified in support of the 9 Plan Goals. Each Goal and Objective is summarized in Section 5.4 and described in Section 5.5 with the associated Strategies for each Objective. It should also be noted that there is potential for some overlap between certain Objectives because of the integrated nature of the needs and challenges; however, they were developed to be as specific and stand-alone as practical.

5.4 Goal and Objective Summary and Prioritization

An Objectives prioritization methodology was initiated by the RWAC and confirmed by the sub-committee. Since all 23 Objectives represent an important aspect of IRWM planning that warrants action, only Medium and High priorities were assigned as it was decided that low priority objectives would garner minimal attention and would not be useful to the IRWM Plan. Priorities were given for both importance and urgency (i.e., time sensitivity). The following Table 5-1 provides a summary of the objectives with the associated prioritization as assigned by stakeholders.

Table 5-1: Plan Objectives Prioritization

Plan Goal and Objective	Importance	Urgency
Goal #1: Provide/Improve Reliable Water Supply within the Region		
A. Provide reliable water supplies to meet all domestic water needs in the Region by 2035	High	High
B. Improve understanding of groundwater usage, quality, and reliability throughout key groundwater use areas the Region by 2020	High	Med
C. Promote Water Use Efficiency (WUE) practices throughout the Region and educate 80% of households and businesses by 2020	Med	Med
D. Identify by 2019 and manage and conserve forest, wetlands, and range lands for enhancement of water supply by 2035	High	High
Goal #2: Ensure Reliable Community Water and Wastewater Infrastructure		
E. Assess and identify the current condition of private and community water systems and their plans, if any, for future improvements by 2018	High	High
F. Assess and identify the current condition of community wastewater systems and their plans, if any, for future improvements by 2020	High	Med
G. Rehabilitate or replace aging and inadequate water and waste water distribution/collection, treatment, and disposal infrastructure by 2035	High	High
Goal #3: Maintain or Improve Water Quality in the Region		
H. Identify and prioritize impacted watersheds by 2020	High	Med
I. Conserve and restore 10,000 acres of watersheds through improved forest and rangeland management practices and appropriate land use by 2020. Conserve and restore 20,000 acres by 2035	High	High
J. Implement water quality improvement activities where pollutants are identified by 2035	High	High
K. Promote sustainable ecosystem and vegetation management on agricultural and production land, primarily near riparian corridors in the first five years of the IRWM Program	Med	Med

Plan Goal and Objective	Importance	Urgency
Goal #4: Protect and Improve Wildlife Habitat		
L. Improve watershed health by preventing the establishment of or , reducing/eliminating aquatic and terrestrial invasive species in at least 2 locations per year starting in 2017	High	Med
M. Protect special status and sensitive species and preserve and restore 10,000 acres by 2025 and 20,000 acres by 2035	High	Med
N. Conserve and ensure the presence of non-fragmented wildlife corridor habitats	High	Med
Goal #5: Assess and Enhance Recreational Opportunities in the Region		
O. Evaluate existing and potential recreational opportunities by 2019	Med	Med
P. Enhance public access for recreation to waterways by 2035	High	Med
Goal #6: Develop Collaborative and Sustainable Partnerships Both Within and in Adjacent Regions		
Q. Identify, review and evaluate the effectiveness of ordinances and county planning related to water management in the Region by 2020	High	Med
R. Develop opportunities/data management system so that current scientific data can be made available to make informed, collaborative choices regarding water resources and land use planning throughout the Planning Period	High	Med
Goal #7: Reduce Risk of Catastrophic Fire		
S. Facilitate and coordinate fuel management policies and strategies in at least two locations per year of high hazard lands in the Region	High	High
Goal #8: Educate Stakeholders and County Residents about Water Issues through the IRWM Process to Inspire Public Action		
T. Use education and outreach annually that maintains or increases watershed stewardship resulting in water quality and ecological improvements	High	Med
Goal #9: Prepare for Impacts of Climate Change		
U. Educate the public regarding the findings of the Climate Change Vulnerability Checklist for the Region by 2015 and periodically update the checklist with updated information	Med	Med
V. Mitigate impacts of climate change by implementing cost-effective renewable energy production in at least one location by 2035 and promoting energy/water use efficiency in the Region	Med	Med
W. Mitigate flood risk associated with climate change by cooperating with Local Hazard Mitigation Planning flood risk updates and educating the public regarding flood prevention and mitigation measures	Med	Med

5.5 Plan Goals and Objectives

5.5.1 Goal #1: Provide/Improve Reliable Water Supply within the Region

Objective A. Provide reliable water supplies to meet all domestic water needs in the Region by 2035.

Priority: Importance = High, Urgency = High

Narrative:
While the Region is the source of a large quantity of water, much of the water leaves the Region for downstream uses. Extended drought and/or climate change has and will restrict local water supply availability, especially the groundwater extracted from the fractured bedrock aquifers. Increased water supply reliability measures, such as enhanced recharge, water use efficiency, additional storage or multiple sources of supply can provide protection against potential water supply shortfalls. The Strategies associated with this Objective focuses on a range of activities to improve water supply reliability through identification and evaluation of both public water system and private water user needs and initiation of a range of implementation measures to meet this IRWM Plan objective.

Strategies:

1. Identify public water systems in the Region that currently do not have reliable water supplies and conduct water rate survey by 2015
2. Improve understanding of the Region's water supply needs for individual water users (not only community systems) and identify which sources and geographies are at greatest risk by 2015
3. Complete evaluation by 2018 and initiate implementation measures (including status reports every 5 years thereafter) to improve water supply reliability (e.g., water use efficiency, rain/stormwater capture, surface water diversion, conjunctive use, recycled water etc.) to increase supply. Also provides potential climate change adaptation strategy.

Objective B. Improve understanding of groundwater usage, quality, and reliability throughout key groundwater use areas the Region by 2020

Priority: Importance = High, Urgency = Medium

Narrative:
Groundwater is the primary source of water supply for most communities and individuals within the Region. However, limited study has occurred regarding the risks of water quality, reliability and use in these small, fractured granitic groundwater aquifers. The measurable strategies below build on information developed in a groundwater study conducted concurrently with the IRWM plan development.

Strategies:

1. Identify key groundwater use areas; quantify groundwater recharge and extraction rates and potential availability; and identify potential groundwater monitoring activities in those areas by 2020.

2. Evaluate and develop groundwater management practices including
    a. Establish sustainable groundwater extraction targets in key groundwater use areas
    b. Improve groundwater recharge to reduce number of dry wells and the need for new well drilling by encouraging/facilitating residential and urban water recharge by slowing seasonal drainages and channeling run-off to settling ponds/swales.
    c. Reduce groundwater extractions by implementing conjunctive use (e.g., surface water storage, alternative supplies, etc.) where feasible.
    d. Utilize existing flood control reservoirs to retain water for groundwater recharge

Objective C. Promote Water Use Efficiency (WUE) practices throughout the Region and educate 80% of households and businesses by 2020.

Priority: Importance = Medium, Urgency = Medium

Narrative:
Water use efficiency is one way to manage water demands including strategies such as public education about efficient water practices and retrofit of high water use devises such as toilets, shower heads, etc. Improvements can be made by municipal (i.e., individuals and businesses), and agricultural water users if appropriate education and incentives are offered. The Strategies focus on using existing educational resources for implementation of WUE programs to meet this IRWM Plan objective.

Strategies:
1. Work with entities such as Master Gardener/ UC Cooperative Extension/NRCS to identify, define and foster implementation of water use efficiency measures and proper water development practices by both residential and agricultural end users throughout the county, as potential climate change adaptation strategies.
2. Educate the public in the WUE best management practices (BMPs) (i.e., demand management measures) for water usage and wastewater management (i.e., reuse, drip irrigation, etc.), as potential climate change adaptation strategies. Examples include:
    a. Encourage & promote use of natural landscaping rather than lawns to reduce water consumption
    b. Encourage metering of individual connections on public water systems
    c. Economical grey water reclamation for garden and dust control
    d. Encourage and facilitate adoption of recommended WUE BMPs

Objective D. Identify by 2019 and manage and conserve forest, wetlands, and range lands for enhancement of water supply by 2035.

Priority: Importance = High, Urgency = High

Narrative:
Many of the Region's lands, including high Sierra meadows/wetlands, forests, and rangelands can provide significant benefits not only to improve ecosystem function, but also increase water supply yield. The impacts of land degradation from eroded banks,

headcuts, depressed water tables, encroaching conifers, non-native vegetation, off-highway vehicle travel and grazing/agricultural uses can be improved so that the natural water retention, habitat, and Native American cultural values of the lands are restored. As there are several organizations in the Region working on forest, wetlands, and rangelands the associated Strategies focuses on inventory and coordination to address this IRWM Plan objective.

Strategies:

1. Annually educate forest and range land owners of BMPs to enhance recharge using resources such as UC Merced studies
2. Work with federal land managers and other agencies to identify key forest and range lands that can be enhanced to maximize water supply by 2019
3. Partner with organizations like NRCS, SFC, and University of California to identify critical forest/range lands by 2019 for conservation and management
4. Use conservation tools, such as land planning, conservation easements, and land acquisition to conserve those lands identified for water supply protection by 2035

5.5.2 Goal #2: Ensure Reliable Community Water and Wastewater Infrastructure

Objective E. Assess and identify the current condition of private and community water systems and their plans, if any, for future improvements by 2018.

Priority: Importance = High, Urgency = High

Narrative:

There are almost 80 California Department of Health regulated small private and community water systems in the Region, many of which likely may have deteriorating infrastructure and that lack the financial resources to make improvements. In addition, fire suppression storage infrastructure has been identified as a concern because of the potential for wildfire in the Region. Because of the large number of water systems, the Strategies focus on inventory and identification of infrastructure improvements to address this IRWM Plan objective. Implementation of improvements is addressed in Objective G.

Strategies:

1. By 2015, conduct a study analyzing community water systems and potential upgrades/expansion
2. By 2025, assist public drinking water systems in meeting both primary and secondary drinking water standards
3. By 2015, review Community Wildfire Protection Plans to identify locations without sufficient water storage within each major watershed area storage
4. By 2020 improve fire suppression resources at those locations without storage

Objective F. Assess and identify the current condition of community wastewater systems and their plans, if any, for future improvements by 2020.

Priority: Importance = High, Urgency = Medium

Narrative:
It is estimated that about half of the Region's residents are served by five community wastewater collection, treatment and disposal systems. This Objective is based on the challenge that these wastewater systems must meet regulatory requirements for treatment and discharge within the financial limitations of its customer base. While some of the wastewater treatment systems have been recently improved, others have aging treatment and collection systems requiring improvement. The associated Strategies focus on the assessment and identification of activities that would address this IRWM Plan objective. Implementation of improvements is addressed in Objective G.

Strategies:

1. Coordinate with LAFCO Municipal Service Reviews to evaluate the current condition of the five non-Federal community wastewater systems by 2020

Objective G. Rehabilitate or replace aging and inadequate water and waste water distribution/collection, treatment, and disposal infrastructure by 2035.

Priority: Importance = High, Urgency = High

Narrative:
Many of the small, disconnected community water and wastewater systems require rehabilitation and/or replacement, which will be better understood following completion of Objectives E and F. Therefore, the associated Strategy was developed to prioritize and implement specific infrastructure improvements that would address this IRWM Plan objective.

Strategies:

1. Bi-annually survey water and wastewater agencies for highest priority infrastructure needs.
2. Develop and implement a regional water/wastewater infrastructure capital improvement program.

5.5.3 Goal #3: Maintain or Improve Water Quality in the Region

Objective H. Identify and prioritize impacted watersheds by 2020.

Priority: Importance = High, Urgency = Medium

Narrative:
The three main watersheds and associated sub watersheds within the Region are under Federal, State, local, and private land management. The IRWM process provides an important venue for coordination of watershed assessment and management activities. The Strategies to meet this Objective are focused on identification and prioritization of watersheds both from a water quality, ecosystem, and tribal perspective. In addition,

since the watersheds provide water both for the Y-M Region, as well as, neighboring Regions these activities are also an important interregional concern.

Strategies:

1. Develop integrated plans with public land agencies to protect and improve upper watershed water quality
2. Improve understanding of lands and cultural practices valuable to the tribes
3. Determine ecosystems that are impaired including those at risk to climate change

Objective I. Conserve and restore 10,000 acres of watersheds through improved forest and rangeland management practices and appropriate land use by 2020. Conserve and restore 20,000 acres by 2035.

Priority: Importance = High, Urgency = High

Narrative:
Improvements to the watershed particularly associated with forest and rangeland management practices (e.g., fuel management for fire risk reduction, forest thinning, erosion reduction etc.) can result in long-term benefits not only to improve water supply yield, but also to ecosystem value. Catastrophic wildfires in poorly managed forests are understood to result in increased erosion and sediment loading from runoff from the burned landscape, with resulting long lasting water quality and ecosystem impacts. The associated Strategies focus on the activities such as fuel load and soil erosion reduction that improve watershed health to address this IRWM Plan objective.

Strategies:

1. Protect important watershed regions using conservation easements and land acquisition.
2. Improve watershed health and function in rangelands by promoting water holding capacity of soil, erosion reduction, and soil carbon sequestration through improved grazing practices
3. Improve the health and ecological function of mountain meadows to increase water storage capacity and long-term water release

Objective J. Implement water quality protection and improvement activities where pollutants are identified by 2035.

Priority: Importance = High, Urgency = High

Narrative:
This Objective recognizes the variety of water quality challenges of historic and current practices such as mining, impervious surfaces, leaking underground storage tanks, septic tanks, and agriculture that may contribute a range of pollutants to be addressed through mitigation activities. This Objective will assist in identifying the means of correcting the existing and preventing future water quality problems.

Strategies:

1. Mitigate pollutants in surface water (e.g., road/impervious area drainage, sanitary sewer overflows, mining contamination, etc.) by implementing policies for future

developments/disturbances and remedial actions in existing development/disturbances

2. Reduce risk of contamination (e.g., nitrates, bacteria, etc.) in groundwater and adjacent streams from failing septic systems by implementing policies for future developments and remedial actions in existing development

Objective K. Promote sustainable ecosystem and vegetation management on agricultural and production land, primarily near riparian corridors in the first five years of the IRWM Program.

Priority: Importance = Medium, Urgency = Medium

Narrative:
This Objective recognizes the challenge raised by stakeholders with regard to sustainable land management, with particular focus on the riparian corridors near agricultural lands. This Objective will assist in identifying lands that could benefit from improved management, and working with existing organizations to promote management improvements.

Strategies:

1. By 2015 identify landowners and land managers and quantify acres under economic production
2. By 2018, work with/support NRCS, UC Extension, Upper Merced River Watershed Council, Sierra Foothill Conservancy and other groups to conduct county-wide workshops to promote environmental stewardship/management of forest, meadow, and foothill ecosystems through use of (best management practices) BMPs such as manure management and erosion/sediment control to control and improve water quality run-off from farm/ranch property from activities such as
    a. Stock Animals
    b. Agriculture
    c. Foresters/ timber harvest operations
3. Conduct projects to improve vegetation quality and quantity, especially in the county's rangelands. Improved vegetation equates to less bare soil, more infiltration of water and nutrients to the soil, and improved water quality in riparian zones

5.5.4 Goal #4: Protect and Improve Wildlife Habitat

Objective L. Improve watershed health by preventing the establishment of or, reducing/eliminating aquatic and terrestrial invasive species in at least 2 locations per year starting in 2017.

Priority: Importance = High, Urgency = Medium

Narrative:
Sensitive wetlands, vernal pools, and native riparian habitats are highly vulnerable to terrestrial and aquatic invasive species. It is estimated that 60 percent of the Region's lands are may have the presence of terrestrial invasive species. The Strategies focus on

both coordination to focus the IRWM energies and implementation to minimize the presence of non-native species.

Strategies:

1. Use available information from federal agencies (e.g., USFS, NPS, BLM, NRCS), Mariposa County Agricultural Commissioner, Upper Merced River Watershed Council, Sierra- San Joaquin Noxious Weed Alliance, California Native Plant Society, and other sources to identify areas to target for invasive species management activities by 2016.
2. Implement at least 2 projects per year which remove and/or prevent the spread of aquatic and terrestrial invasive species within areas targeted in Strategy L-1

Objective M. Protect special status and sensitive species and preserve and restore 10,000 acres by 2025 and 20,000 acres by 2035.

Priority: Importance = High, Urgency = Medium

Narrative:
There are a significant number of special status (threatened, endangered or otherwise imperiled) aquatic or riparian plant, fish, amphibian, reptile, or invertebrate species in the Region. In addition, a portion of the Merced River is designated as a National Wild and Scenic River. Preservation and restoration of special status species populations is of critical importance, as is protection of unique habitat corridors through the national and state designations of the various waterways. As there are several organizations in the Region working on species and habitat issues, the associated Strategies focus on the coordination necessary to address this IRWM Plan objective.

Strategies:

1. Identify targeted species and habitats for protection, preservation, and/or restoration within the Plan Area by 2016.
2. Working with NRCS, SFC, federal and state agencies, conserve and restore at 2 locations per year, habitats for special status or sensitive species such as riparian habitat, meadows, vernal pools and other waterways using management techniques and land conservation strategies.

Objective N. Conserve and ensure the presence of non-fragmented wildlife habitat corridors.

Priority: Importance = High, Urgency = Medium

Narrative:
The majority of the Region consists of forested and open space lands managed by State and Federal agencies that serve as prime wildlife habitat; some of the corridors may also transition across private lands. These Strategies will help integrate and coordinate the efforts to retain wildlife corridors protecting them from the various pressures and impacts of human action.

Strategies:

1. Work with state and federal agencies, researchers, and nonprofits such as Audubon Society and SFC, to identify priority wildlife migration corridors and seasonal uses within the Region by 2016.
2. Assist in the conservation, protection, or restoration of 10 acres of corridor habitat per year starting in 2017 by partnering with organizations that conduct restoration, by encouraging appropriate land use planning and by using conservation tools such as conservation easements.

5.5.5 Goal #5: Assess and Enhance Recreational Opportunities in the Region

Objective O. Evaluate existing and potential recreational opportunities by 2019

Priority: Importance = Medium, Urgency = Medium

Narrative:
Recreation and tourism are key industries that have a significant economic impact to the Region. It is estimated that up to 4 million visitors per year come to Yosemite National Park, a portion of which is in the Region, as well as neighboring state and federal facilities. Many of the recreational opportunities are located within the forests and watersheds that also provide important water resources and ecosystem habitat. Therefore, the Strategies are targeted at activities that improve recreation to achieve additional economic and non-economic benefits to the Region.

Strategies:

1. Leverage partnerships with area federal agencies (Forest Service, Park Service, BLM) to promote recreation in and along waterways and lakes
2. Improve pedestrian access to and along waterways and riparian corridors - especially sections of the Wild and Scenic Merced River- for swimming and tubing, fishing, hiking, bird watching, biking, etc.
3. Improve facilities for commercial rafting input and take-out along the Merced River and Bagby Recreational area. Identify new and enhanced aquatic/riparian opportunities with local environmental, conservation, governmental and commercial groups - for example: MID - Merced River Trail, Friends of Bear Creek - Bear Creek Trail, MPUD - Stockton Creek Preserve, Mariposa County Transportation Department

Objective P. Enhance public access for recreation to waterways by 2035

Priority: Importance = High, Urgency = Medium

Narrative:
This Objective and associated Strategies focuses on implementation of the actions identified in Objective O to implement projects by using the resources of existing public and private entities to enhance public access to waterways for recreation in the Region.

Strategies:

1. Leverage partnerships with area federal agencies (Forest Service, Park Service, BLM) to improve access for parking, trails and access to lakes and riverbanks.
2. Leverage partnerships with local conservation, environmental, commercial and governmental groups to identify target locations for better access.
3. Create 10 miles of trails by 2035

5.5.6 Goal #6: Develop Collaborative and Sustainable Partnerships both within and in Adjacent Regions

Objective Q. Identify, review and evaluate the effectiveness of ordinances and county planning related to water management in the Region by 2020

Priority: Importance = High, Urgency = Medium

Narrative:
Improved integration of land use and natural resource planning will help improve watershed protection. The associated Strategies focuses on providing water resource managers with opportunities for increased review and input into land use and natural resources planning and standard development at the local, Tribal, regional, and federal level to meet this IRWM Plan objective.

Strategies:

1. Review zoning and planning rules / regulations and make recommendations to address adequacy of water availability, balancing land development with protection of water supply quality and quantity, wastewater management and potential impacts of climate change (Resource: Mariposa County Planning/LAFCO).
2. Preserve the water quality within each watershed within Mariposa County by proposing/enforcing development standards including erosion control during and after earth disturbing activities, and restoration of natural hydrology in disturbed and impervious areas through infiltration of runoff, restoration of streams /rivers , and conservative water use for new construction projects

Objective R. Develop opportunities/data management system so that current scientific data can be made available to make informed, collaborative choices regarding water resources and land use management throughout the Planning Period.

Priority: Importance = High, Urgency = Medium

Narrative:
There are numerous water resources and scientific data sources with helpful information that could improve management practices, however there is not a single repository for this information and there are likely many data gaps. This Objective and associated Strategies focuses on developing data management systems and the IRWM processes to improve technical understanding to enhance the public's knowledge in order to improve water-related planning and decision-making in the Region.

Strategies:

1. Evaluate data management system for technical information sharing by working with UC Merced's Spatial Laboratory and other organizations
2. Continue to use RWAC meetings as an opportunity to discuss/evaluate current science and promote actions for improved water management including coordination activities to share water supply information to promote optimal use of resources and minimize risks of legal non-compliance – information sharing.

Coordination activities to share water supply information to promote optimal use of resources and minimize risks of legal non-compliance – information sharing

5.5.7 Goal #7: Reduce Risk of Catastrophic Fire

Objective S. Facilitate and coordinate fuel management policies and strategies in at least two locations per year in high hazard lands in the Region.

Priority: Importance = High, Urgency = High

Narrative:
This Objective was included in recognition of the significant risk of wildfire in the Region. Therefore, the Strategies are targeted at activities to improve coordination with other agencies as well as to implement projects to reduce fuel loading in the Region.

Strategies:

1. Leverage partnerships with area federal agencies (Forest Service, Park Service, BLM) to identify, educate the public, and implement effective fuel management strategies with which to collaborate on such as
    a. managing existing roads and maintain access to watershed ecosystems to improve fire suppression access while reducing erosion
    b. conducting selective logging (thinning) to reduce forest die-off and increase underground water storage
2. Working with CAL FIRE, NRCS, and the Forest Service, and State OES through LHMP encourage private landowners to utilize best management practices on their forested property to reduce fuel loads.

5.5.8 Goal #8: Educate Stakeholders and County Residents about Water Issues through the IRWM Process to Inspire Public Action

Objective T. Use education and outreach annually that maintains or increases watershed stewardship resulting in water quality and ecological improvements.

Priority: Importance = High, Urgency = Medium

Narrative:
This Objective was included because of the potential benefits of building widespread stakeholder interest in and acknowledgement of the benefits of the IRWM process and

resulting actions. Therefore, the Strategies are targeted at activities to improve public education and outreach in the Region.

Strategies:

1. Educate water users to increase cooperative stewardship of water resources
2. Educate people on all aspects of water quality Best Management Practices (BMPs)
3. Implement a Continuing Education Program for water supply, water quality, fire protection, environment stewardship, flood control and climate change impacts to water-related natural resources
4. Promote recreation in the Region

5.5.9 Goal #9: Prepare for Impacts of Climate Change

Objective U. Educate the public regarding the findings of the Climate Change Vulnerability Checklist for the Region by 2015 and periodically update the checklist with updated information.

Priority: Importance = Medium, Urgency = Medium

Narrative:
This Objective was included to acknowledge the potential impacts of Climate Change and to make sure the public is educated regarding those impacts and possible adaptation strategies. Therefore, the Strategies are targeted to coordinate with Goal #8 regarding public education in the Region.

Strategies:

1. Align education with strategies in Goal #8 – including discussion of the potential effects of climate change on the range of water management topics including water supply, flood/storm water drainage management, water quality, wildfire risk, and ecosystems

Objective V. Mitigate impacts of climate change by implementing cost-effective renewable energy production in at least one location by 2035 and promoting energy/water use efficiency in the Region.

Priority: Importance = Medium, Urgency = Medium

Narrative:
Significant elevation changes in the various water systems that convey water from the higher elevation mountains towards the lower elevation foothills exists, which provides opportunities for renewable energy generation in the Region. There are three hydroelectric facilities on the Merced River and this Objective seeks to expand those opportunities by harnessing the potential from existing infrastructure systems. The associated Strategies focus on screening and evaluation of opportunities on waterways and residences and implementation of cost-effective projects to meet this IRWM Plan objective.

Strategies:

1. Annually promote PG&E energy-efficiency and renewable energy programs
    a. Home/business energy audits
    b. Improved well pump efficiency for all well owners
    c. In-line and other hydroelectric power opportunities.

Objective W. Mitigate flood risk associated with climate change by cooperating with Local Hazard Mitigation Planning flood risk updates and educating the public.

Priority: Importance = Medium, Urgency = Medium

Narrative:

Localized flooding occurs in some more urbanized areas such as Yosemite Valley and Mariposa, as well as on some rural roads, where flooding could impact buildings and infrastructure. In addition, the flood and water quality benefits of low impact development measures are recognized. The associated Strategies contain a range of activities to better understand and address the challenges to meet this IRWM Plan objective.

Strategies:

1. Potential integrated mitigation measures to be considered include
    a. Reducing impermeable areas to improve water infiltration and flood control and increase groundwater recharge, as potential climate change adaptation strategies.
    b. Repairing road-stream crossings to reduce major flood-related erosion and improve native aquatic organism passage
2. Conserve land in flood plains, and lands that are critical to water storage and filtration.
3. Clearing debris and vegetation from smaller waterways near properties to minimize localized flooding

Section 6: Resource Management Strategies

6.1 Introduction

The Goals, Objectives, and Strategies presented in Section 5 for the Yosemite-Mariposa (Y-M) Integrated Regional Water Management (IRWM) Plan describe a range of areas in which regional stakeholders intend to improve water-related conditions in the Region over the plan horizon. The broad categorical actions required to achieve the goals and objectives mostly align with the Resource Management Strategies (RMS) identified in the draft California Water Plan (CWP) Update 2013 which are to be considered for applicability in an IRWM Plan. A RMS is a project, program, or policy that helps local agencies and governments manage their water and related resources. A diversified portfolio of RMS will help the Y-M Region to better prepare and mitigate for potential future conditions, such as climate change and severe drought. This section introduces the 36 RMS from the draft 2013 CWP and identifies those selected for inclusion in the Y-M IRWM Plan. The projects, programs, and actions described in Section 7 are then derived from the selected RMS.

6.2 Resource Management Strategy (RMS) Summary

The draft CWP Update 2013 groups its RMS into seven management objectives. In addition, the CWP includes “other” resource management strategies that can potentially contribute to various management objectives, but which are largely still under development. These draft 2013 RMS have been somewhat reorganized since the CWP Update 2009 and a new management objective, People and Water, has been added. This section considers all 29 RMS of the 2009 CWP as well as the new strategies: Sediment Management, Outreach and Education, Water and Culture, Waterbag Transport/Storage Technology, Dewvaporation or Atmospheric Pressure Desalination, and Rainfed Agriculture

Table 6-1 that follows provides a summary of the CWP Objectives and associated RMS that were considered by the RWAC at the September 25, 2013 RWAC meeting for inclusion in the plan. RMS that are asterisked and italicized are considered not currently applicable to the Y-M Region.

Table 6-1: Draft 2013 CWP Objectives and RMS Summary

CWP Objectives	Resource Management Strategies
Reduce Water Demand	Agricultural Water Use Efficiency Urban Water Use Efficiency
Improve Flood Management	Flood Management
Improve Operational Efficiency and Transfers	*Conveyance – Delta** Conveyance – Regional/local System Reoperation Water Transfers
Increase Water Supply	Conjunctive Management & Groundwater Storage *Desalination (Brackish and Sea Water)** *Precipitation Enhancement** Municipal Recycled Water *Surface Storage – CALFED/State** Surface Storage – Regional/local
Improve Water Quality	Drinking Water Treatment and Distribution Groundwater/Aquifer Remediation Matching Water Quality to Use Pollution Prevention *Salt and Salinity Management** Urban Stormwater Runoff Management

CWP Objectives	Resource Management Strategies
Practice Resources Stewardship	Agricultural Land Stewardship Ecosystem Restoration Forest Management Land Use Planning and Management Recharge Area Protection Sediment Management Watershed Management
People and Water	Economic Incentives Outreach and Engagement Water and Culture Water-Dependent Recreation
Other Strategies	*Crop Idling for Water Transfers** Irrigated Land Retirement *Waterbag Transport/Storage Technology ** *Dewvaporation or Atmospheric Pressure Desalination** *Fog Collection ** *Rainfed agriculture**

* RMS not applicable to Y-M IRWM Plan.

6.3 RMS Applicable to the Region

RMS that are applicable to implementation of the Y-M IRWM Plan are those which align with the major water related conditions discussed in Section 3 and contribute to achieving the Plan goals, objectives, and strategies discussed in Section 5. For each Plan objective, the RMS that could assist in meeting the objective identified and their applicability to the Region are discussed below:

6.3.1 Reduce Water Demand

This CWP Management Objective aligns directly with the Y-M IRWM Plan Goal 1: Provide/Improve Reliable Water Supply within the Region and its associated objectives.

6.3.1.1 Agricultural Water Use Efficiency

While irrigated agriculture in the Region is limited to some permanent crops such as wine grapes and nuts and a limited amount of forage for cattle, agricultural water use efficiency could be relevant to the Region. Additionally, some of the major water exports from the Region are to the San Joaquin Valley, where water from the Region is used to irrigate approximately 174,000 acres of farmland, therefore interregional coordination is also important to this RMS. The agricultural water use efficiency strategy involves measures that reduce the amount of water used for agricultural irrigation while maintaining agricultural productivity. This strategy includes improvements in irrigation technology and water management practices that result in direct improvements in water use efficiency as well as education and training efforts that lead to improved water management.

This strategy aligns with the IRWM Objectives c and d which are geared toward the decrease of water usage across the Region. This RMS would mainly be applicable for groundwater wells and/or surface diversions that supply the agricultural operations that occur primarily in the western portion of the Region, as well as downstream water users in the San Joaquin Valley.

6.3.1.2 Urban Water Use Efficiency

The urban water use efficiency strategy addresses indoor and outdoor residential, commercial, industrial and institutional water uses in the more densely developed portions of the Region that are primarily served by centralized community water systems. This strategy includes improvements in technology or water management measures that lower water use or increase beneficial uses from existing water quantities. This strategy also includes educational programs and other measures that

result in the adoption of technological improvements or behavioral changes that reduce water demand.

There is interest and acknowledgement of the value of this RMS amongst the stakeholders as identified in Objective C related to water use efficiency. Smaller water suppliers will likely coordinate their efforts to improve water use efficiency, particularly through educational outreach as feasible. Improving water use efficiency in the Region also brings potential benefits to individual groundwater users who often are dependent on fractured rock aquifers which may be an unreliable water supply.

6.3.2 Improve Flood Management

6.3.2.1 Flood Risk Management

The flood risk management strategy involves both structural and non-structural measures to reduce overall flood risk, manage flood flows and programs that improve flood preparedness, response and recovery. Structural approaches to flood management include dams and reservoirs, levees, channel modifications and diversions. Non-structural measures focus on land use management such as floodplain restoration and development policies.

While the Region itself has limited areas of floodplain due to the steep terrain, flooding danger in and downstream of the Region is usually most prevalent during the spring months when snowmelt is typically at its peak. Waterways can become over burdened with especially high periods of snowmelt and threaten communities in the flood plain. Structural flood control measures include US Army Corps of Engineers dams along the western and southern edge of the Y-M Region; these dams mainly benefit areas downstream of the Region. The nonstructural measures for flood management used in the Region include preservation of the natural landscape through forestry and post fire management which could assist in reducing flood risk. Development adjacent to the larger waterways is naturally limited because much of those lands are under public ownership. This RMS links to Objective W related to flood risk mitigation, particularly under climate change conditions discussed in Section 5.

6.3.3 Improve Operational Efficiency and Transfers

*6.3.3.1 Conveyance-Delta**

Delta conveyance refers to the movement of water within the network of streams, sloughs and channels of the Sacramento-San Joaquin Delta and movement of water out of the Delta through constructed water conveyance systems.

This RMS is not applicable to the Y-M Region because entities in the Region do not use Delta conveyance to obtain water supply. There are entities within the Region that divert water from the Merced River (a tributary to the Delta) to meet local beneficial uses but these have no significant influence upon Delta conveyance as discussed in Section 3. The consumptive water demands of the Y-M Region are minor in comparison to the productivity of the watersheds and the amount of water annually exported out of the Delta. Water flowing from the Region is managed to meet water quality standards and stream flow downstream in the Delta. This Region's watersheds are important to the Delta because of the snow-pack storage and resultant benefits to the life-cycle of several species of native fish, for recreation, and other uses.

*6.3.3.2 Conveyance - Regional/Local**

Regional/local conveyance refers to the use of both natural waterways and built infrastructure to move water to areas where it is needed or to move water away from areas to protect existing resources. The regional/local conveyance strategy covers the distribution and conveyance of local

sources of water and imported water for the purposes of improving water supply, water quality, recreation, habitat, and flood management.

This RMS is applicable on an interregional level. For example, a conveyance system to a future Montgomery Dam and reservoir in Merced County may decrease the Rain/Flood space in New Exchequer Dam, increasing water supply conservation volume in New Exchequer. This improvement is particularly important to the Lake Don Pedro Community Services District. Other potential improvements in conveyance could include draining New Exchequer Dam with a water supply benefit and, levee system improvements on the Merced River downstream from New Exchequer Dam. The maximum allowed flow rate in Merced River is 6,000 cubic feet per second (cfs) when the difference in the San Joaquin River capacity upstream versus downstream from Merced River Confluence with the San Joaquin River is 19,000 cfs. Any incremental gain in the flow on the Merced will translate to more water supply behind New Exchequer Dam.

6.3.3.3 System Reoperation

System reoperation involves changes to the existing operation of water systems to address existing problems, to increase water supply reliability or to adapt to future changes. The system reoperation strategy includes reoperation of surface water storage facilities, groundwater sourced water systems and associated conveyance infrastructure. These resources may be related to the Conjunctive Management and Groundwater Storage RMS depending upon location.

In the Y-M Region, the reoperation of existing surface storage reservoirs is currently under consideration as an opportunity for developing sufficient reliable and affordable water supplies now and into the future, particularly for downstream water users outside the Region. Given the nature of the water systems in the Region and their water rights, this may involve altering the amount or timing of water production. Besides two communities and the Merced Irrigation District Parks on the Merced River Development Project, surface water systems mainly affect users outside the Region. Reoperation may create opportunities for conjunctive use (see Section 6.3.4.1) that could benefit local water systems relying on both groundwater and surface by providing an alternative surface water source. This would allow groundwater to remain in storage during periods of abundant surface water saving the groundwater for use during periods of low surface water availability.

In the case of New Exchequer Reservoir, these reoperations may restore only a portion of the water supply depending on the outcome of the State Water Resources Control Board current plan which will not impound 25% to 45% of the unimpaired flows of the Merced River between February and June. Reoperation may also help restore portion of lost hydroelectric power revenue when most generation occurs in the winter and spring months with other impacts such as chronic lower elevations in Lake McClure as a result.

6.3.3.4 Water Transfers

Water transfers are voluntary exchanges of water or water rights among water users. A water transfer can be a change in point of diversion, place of use or type of use. Water transfers typically occur using one of the following: transfer of water from reservoirs that would otherwise have been carried over to the following year, use of groundwater instead of surface water deliveries and transfer of the surface water rights, transfer of previously banked groundwater, reduction of existing consumptive use and transfer of the resulting water savings, and reduction of water losses and transfer of the recovered water.

In the Y-M Region, water movement transactions primarily involve the long-standing export of in-Region water for environmental, agricultural and municipal uses within and outside of the Region. While there are two agencies in the Region with water purchase agreements from a downstream water rights holder, other water transfers, in the sense of exchanges, have not recently been

actively pursued by entities in the Y-M Region. They may become a tool to help achieve the objective of developing water supplies to meet Regional demands but will be subject to water availability and/or reductions in water use elsewhere to meet a local need.

6.3.4 Increase Water Supply

6.3.4.1 Conjunctive Management and Groundwater Storage

Conjunctive management is the coordinated use of surface water and groundwater to maximize the water available to a region. The conjunctive management and groundwater storage strategy involves recharge of groundwater basins when excess surface water is available.

The Y-M Region does not have a defined groundwater basin, except for a small basin in the Yosemite Valley. Limited recharge occurs with treated wastewater in the small alluvial groundwater basin in El Portal, but available storage is constrained by the close proximity of the Merced River. The majority of groundwater supplies are located within small, fractured rock structures of unknown capacity which can result in difficulties quantifying storage and also in quantifying recharge. In addition, there is limited understanding of the usage of groundwater by individual well owners. While an increased usage of seasonally abundant riparian surface water is a possible future option to help relieve pressure on groundwater supplies the water must be used immediately, often during periods of low water demand, and cannot be stored. If surface water is to be stored locally, there are complex water rights and surface water availability issues to overcome. This results in many challenges for conjunctive management of groundwater storage with surface storage.

*6.3.4.2 Desalination (Brackish and Sea Water)**

Desalination refers to treatment processes that remove salts from water to achieve salinity concentrations that are acceptable for municipal and agricultural uses. The desalination strategy covers treatment of seawater, brackish water and wastewater.

Groundwater constitutes a large portion of the potable water supply for the Region because of the limited access and water right allocation of surface water supplies. Some of the groundwater that is currently used in the Region is impacted by nitrate and volatile organic compounds, often associated with leaking underground storage tanks for petroleum products. The groundwater study that is planned concurrent with IRWM Plan preparation will include water sampling to better understand groundwater quality in portions of the Region. It is not yet known the degree to which this RMS could benefit Regional supplies and is not a RMS in the Y-M Region at this time.

*6.3.4.3 Precipitation Enhancement**

Precipitation enhancement, commonly called “cloud seeding,” artificially stimulates clouds to produce more rainfall or snowfall than they would naturally. Cloud seeding injects special substances into the clouds that enable snowflakes and raindrops to form more easily. Precipitation enhancement is the one form of weather modification done in California.

While this RMS is not initiated by entities in the Region and is not a likely project, the Region may benefit from the cloud seeding activities of other agencies such as Southern California Edison who seek to enhance snow pack for hydropower production and/or water supply. Precipitation enhancement has been utilized in nearby Regions. As climate change impacts are better understood cloud seeding may be desirable in the Region.

6.3.4.4 Municipal Recycled Water

Water recycling is the treatment and reuse of wastewater. The recycled municipal water strategy applies specifically to the application of municipal wastewater with the intention of putting the water to a beneficial use that would not occur through discharge of the wastewater.

As described in the Existing and Current Conditions, Section 3, recycled water is currently being produced and used at a few limited locations in the Region primarily for pasture and golf course irrigation. There are a few facilities throughout the Region that could consider treatment expansion to include recycled water production where cost effective.

*6.3.4.5 Surface Storage – CALFED/State**

Surface storage encompasses strategies related to potential CALFED storage reservoir investigations: Shasta Lake Water Resources Investigation, North-of the Delta Offstream Storage, In-Delta Storage Project, Los Vaqueros Reservoir Expansion, and Upper San Joaquin River Basin Storage Investigation.

The Y-M Region may benefit from the construction of Montgomery reservoir on Dry Creek, a CALFED storage project, mainly in Merced County, which has positive impact on New Exchequer Reservoir. However, the Y-M Region has large existing water storage reservoirs and has a very low potential of being involved with these projects for additional storage rendering this RMS not applicable.

6.3.4.6 Surface Storage - Regional/Local

Surface storage consists of the collection and storage of water within on-stream or off-stream reservoirs for later release. This strategy includes the use surface storage for water supply as well as flood management.

The numerous reservoirs existing in the Y-M Region are operated primarily for environmental, flood control, municipal, irrigation, recreation, and hydroelectric production. Except for municipal and recreational uses, the remaining identified uses benefit areas outside of the Region. Storage capacity for local consumptive use is limited to a couple of small private reservoirs and one municipal reservoir on Stockton Creek operated by Mariposa Public Utilities District. The largest water supply reservoirs in the Region, Lake McClure and Lake McSwain are utilized primarily by Merced Irrigation District which supplies municipal water to the Lake Don Pedro Community Services District and Boat Club subdivision both fed directly from Lake McClure. Merced Irrigation District is pursuing increasing the water supply storage of New Exchequer Dam as part of its New Exchequer Dam Spillway Modification project.

6.3.5 Improve Water Quality

6.3.5.1 Drinking Water Treatment and Distribution

The drinking water treatment and distribution strategy is focused on ensuring that water provided by public water systems for human consumption is safe for drinking. Drinking water treatment includes processes that treat, blend or condition water to meet potable standards, and drinking water distribution includes the storage, pumping and delivery of potable water to customers of centralized water systems. This strategy includes measures both within the treatment processes and distribution system that are necessary to produce and maintain safe drinking quality.

Delivering drinking water that meets water quality standards and improving infrastructure in order to do so is a high priority in the Region as noted in Goal 2 to provide reliable water infrastructure and associated Objectives e and g. This may include improvements to the distribution system or the

actual water treatment system. It should be noted that the low population density of the Region means a limited funding base for the various agencies making capital improvements and operations difficult. Managing sources of pollution is also seen as an important means for facilitating compliance with water quality regulations and increasing the reliability and safety for all drinking water users in the Region.

*6.3.5.2 Groundwater and Aquifer Remediation**

Groundwater and aquifer remediation is the improvement of groundwater quality to meet intended beneficial uses. Groundwater impairment may be the result of naturally occurring constituents or anthropogenic contamination. The groundwater and aquifer remediation strategy includes both in-situ techniques (soil vapor removal, application of electrical current) and active treatment (pumping and treating) which remove the contaminants through chemical, biological or physical processes.

This RMS is not being considered by the Region for implementation at this time. The main threat to groundwater quality in the Region includes leaking underground storage tanks (LUST) and various non-point sources, such as cattle grazing as well as historic discharges from industrial/agricultural activities, dispersed septic systems and naturally occurring constituents within the hard rock formations. Few groundwater quality concerns that do not have regulatory oversight have been identified by Stakeholders. Actions currently considered necessary for addressing existing contamination and minimizing future contamination of groundwater focus on identifying, evaluating and monitoring impacts. Mariposa County received a grant in 2011 from California Environmental Protection Agency to develop training and implement inspection and enforcement for LUST cases.

6.3.5.3 Matching Water Quality to Use

The strategy of matching water quality to use aims to optimize water resources by directing higher quality sources of water to end uses that require that higher quality, such as drinking water or certain industrial processes, and using sources of water with lower quality in applications where the lower quality is adequate. This strategy reduces the treatment costs associated with water supply.

Generally, the water users of this rural Region use the water that is readily available to them and do not have a broad portfolio of supply. There are limited locations where more than one supply is available. For example, some agencies may be required to upgrade wastewater treatment processes in order to improve the quality of effluent as a result of stringent discharge requirements of the Central Valley Regional Water Quality Control Board. This may result in a recycled water that may be suitable for beneficial reuse in the Region if the water can be cost-effectively conveyed.

6.3.5.4 Pollution Prevention

The pollution prevention strategy addresses both point sources, such as wastewater treatment plants, and nonpoint sources, such as most storm water discharges from urbanized areas, road erosion especially unpaved roads in steep forest areas, agricultural runoff (e.g. sediments, fertilizers, herbicides, pesticides) and unauthorized land uses. This strategy includes efforts to identify sources of pollutant load, reduce pollution causing activities and capture pollutants before they enter waterways.

Few water quality concerns have been identified that are impacting surface and groundwater resources in the Region. Overall, surface water quality has been generally very high mainly due to the relatively undistributed lands in much of the Region. However, some pollution can stem from major wild fires and erosion. Land management agencies actively study and track water quality impacts, particularly after wildfires and are developing methods for post-fire stabilization to minimize those impacts. The potential effects of pollution, especially to surface water, from historical mining operations are recognized in the Region. Pollution from point sources, such as, septic tanks and

leaking underground storage tanks can be a concern for groundwater wells. This RMS links to Goal 3 related to water quality, and associated Objective J discussed in Section 5.

*6.3.5.5 Salt and Salinity Management**

Salt and salinity management requires an understanding of how salts enter a region, often from irrigated agriculture and large scale wastewater discharge, and how they are diluted and displaced within the region. As such, this strategy necessitates studies to improve the understanding of regional salt loading and the extent and magnitude of a region's salt problems. It also includes steps that reduce salt inputs and sequester or dispose of salts.

Currently, salt and salinity management is not a problem in the Y-M Region because of the limited acreage of irrigated agriculture and the dispersed wastewater discharges and is not expected to become a problem in the future. This will be corroborated with the limited groundwater quality sampling that will occur concurrent with the IRWM Plan preparation.

6.3.5.6 Urban Stormwater Runoff Management

The urban stormwater runoff management strategy involves the capture, conveyance and treatment of stormwater and dry weather runoff for purposes of improving flood management, water quality or water supply.

The Y-M Region has recognized that even limited urban runoff (including unpaved roads in less urbanized areas of the Region) can contribute to water quality concerns and includes targets for improved urban runoff management to reduce contamination. Urban runoff management may include the evaluation of runoff on conveyance and storage, implementation of roadside erosion management and identification of appropriate stormwater BMPs. As in the Pollution Prevention RMS, this RMS also links to Goal 3 related to water quality, and Objective J as discussed in Section 5.

6.3.6 Practice Resources Stewardship

6.3.6.1 Agricultural Lands Stewardship

The agricultural lands stewardship strategy includes measures that promote the continued use of agricultural lands and the protection of natural resources through the maintenance of agricultural lands. Erosion control measures are an example of agricultural land stewardship practices that support the viability of croplands while offering water resource and water quality benefits. Other agricultural land stewardship practices such as wetlands restoration and the use of agricultural lands for nonstructural flood management preserve the open space characteristics of agricultural lands that can offer water resources and environmental benefits.

While agricultural land use makes up a fairly small proportion of land uses in the Region, agricultural lands stewardship can help to improve watershed health, identify, preserve, and promote the regeneration and restoration of wetlands which are the focus of Objectives I, J, and K related to water quality and Objective N related to wildlife corridors.

6.3.6.2 Ecosystem Restoration

Ecosystem restoration addresses natural landscapes and biological communities that have been modified by past activities. The ecosystem restoration strategy aims to increase the diversity of native species and biological communities and the abundance and connectivity of habitats, particularly in aquatic, riparian and floodplain ecosystems. This strategy includes protection and recovery of at-risk species, wetlands restoration and construction, floodplain reconnection and invasive species removal.

This RMS aligns with several objectives developed during the IRWM Plan process especially as they relate to improving forest and rangeland management, improving the health and ecologic function of mountain meadows, and promotion of ecosystem and vegetation near riparian corridors; all of which serve to meet Goal 3 – Maintain or Improve Water Quality in the Region and Goal 4 – Protect and Improve Wildlife Habitat and their associated objectives.

6.3.6.3 Forest Management

The forest management strategy focuses on forest management activities that are designed to improve the availability and quality of water for downstream users, on both publicly and privately owned forest lands as part of a broader effort to maintain a sustainable, resilient forest ecosystem.

This RMS is particularly relevant to the Region as forest lands, in private and federal ownership, comprise the majority of its land base. Identified forest management needs include reduction in fuel loads, identification of fire hazards, post fire restoration/management, proper management of hydrologically-connected road segments, and sediment loads. Balanced forest management could also increase generated run-off; UC Merced is completing studies in the Merced River watershed for this purpose. Fire is an integral part of maintaining a resilient forest. As discussed in Section 3, a natural, low intensity fire regime helps to reduce fuels and destructive fire potential, which protects local communities and landscapes, recycles nutrients into the soil, and creates fertile seed beds for plants and tree seedlings (USDA-NRCS, 2013). The consequences of high intensity, destructive fires are extensive from a water quality, water quantity, and ecosystem perspective. This topic is of such importance to the Region that Goal 7 specifically addresses fuel management in forests to reduce fire risk.

6.3.6.4 Land Use Planning and Management

The land use planning and management strategy incorporates the availability of water supplies, water quality requirements and flooding and drainage considerations into land use decisions. Improved coordination of land use and water planning has been identified as a need in the State.

Coordination between the various land use planning and management entities is an important RMS for the Region particularly at jurisdictional boundaries. In addition, limited staff and financial resources as a result of small population relative to land area can make coordinating, prioritizing and enforcing codes, ordinances, and regulation difficult. This RMS is addressed in Goal 6 related to collaboration and Objective Q specifically addressing county ordinances and planning.

6.3.6.5 Recharge Areas Protection

The recharge areas protection strategy includes the protection and enhancement of groundwater recharge areas. The strategy includes methods such as low impact development and land conservation to ensure areas suitable for recharge remain accessible. It also includes measures to protect groundwater recharge areas from contamination.

Although only a few prime recharge areas are known, this strategy is relevant in terms of both water quality and quantity. This strategy is closely related to IRWM Plan goals including Goal 3 – Water Quality, Goal 4 – Wildlife Habitat, and Goal 7 Fire Risk Reduction. Additional insight into important groundwater recharge areas is likely to come to light after the completion of the groundwater study.

6.3.6.6 Sediment Management

The sediment management strategy acknowledges both the benefits and impacts of sediments. Sediments are beneficial when of appropriate size and in the correct location such as for spawning gravels as well as flood plain and beach replenishment. The negative attributes of sediment occur

when it accumulates in reservoirs and flood channels and/or causes clouding in water with associated impacts to fish and invertebrate life.

One of the most significant sediment impacts in the Region occurs after a wildfire event as discussed in Section 3. The IRWM goals and objectives encompass sediment management as a RMS from both a forest and range land conservation element as in Objectives D and I, water quality in Goal 3, wildlife habitat in Goal 4, regional partnerships as in Goal 6, and catastrophic fire risk reduction as in Goal 7.

6.3.6.7 Watershed Management

The watershed management strategy uses watershed boundaries as the basis for managing natural resources. Watershed management is the process of creating and implementing plans, programs, projects, and activities to restore, sustain, and enhance watershed functions.

The IRWM Planning process has helped to enhance relationships that contribute to improving management of the Y-M Region's three watersheds. Goals 3 – Water Quality, 4 - Wildlife Habitat, and 8 - Education and their associated objectives target effective management of water resources and improvement to water quality, ecosystems and habitats in the Region, all of which relate to this RMS.

6.3.7 People and Water

6.3.7.1 Economic Incentives

Economic incentives is the use of financial tools such as grants, loans, rebates and water pricing to influence water management. Financial assistance incentives in the form of grants, loans and rebates can be used to promote implementation of projects that improve water management and protect water resources. Water rate incentives can be used to promote more efficient use of water.

Meeting the Y-M IRWM Plan objectives to implement the IRWM Plan will require resources beyond those that are locally available. Therefore, identifying funding sources and developing grant applications will be an important element to IRWM Plan implementation. The Y-M Region contains a small and dispersed population with a small tax base. These conditions make the utilization of economic tools essential for the successful execution of most IRWM Plan projects.

6.3.7.2 Outreach and Engagement

The outreach and engagement strategy describes the shifts in early water management decision-making from strictly technically-based decisions that over time have resulted in unintended consequences such as degraded ecosystems and/or social injustices. The strategy acknowledges the need for improved outreach and engagement so that citizens can be more knowledgeable and participate more effectively in debates regarding water which can, in turn, gain valuable support for a range of water management programs.

The targeted outreach to the citizenry of the Region for the preparation of the Y-M IRWM Plan has included a brochure that has been mailed to all residents within the Region, attendance at local meetings throughout the Region (including meetings targeted at the tribal communities) to inform the public regarding the Y-M IRWM Plan goals and communication process, and hosting and updating of the IRWM website. These outreach and engagement activities will continue throughout the IRWM Plan preparation process meeting with Goal 8 - Education and associated Objective T which speaks directly to education of stakeholders and County residents regarding water issues.

6.3.7.3 Water and Culture

The water and culture strategy recognizes the inherent role and value of water in many cultures whether they are Native American, agriculture and ranching, fishing or environmental cultures. The cultural considerations in water management can include subsistence activities such as traditional hunting, fishing and plant collecting; recreation activities such as swimming, boating, wildlife viewing or hiking; spiritual activities that acknowledge the cleansing and renewing properties of water; and historic preservation of artifacts, buildings, flumes, mills, and other significant sites.

Native American Bedrock Mortar
Credit: Kristen Boysen, Sierra Foothill Conservancy

From a tribal perspective, the Y-M Region is part of the historic range of the Southern Sierra Miwok tribe as described in Section 2. The American Indian Council of Mariposa County, Inc. is a focal point for tribal activities in the Region and targeted outreach through this organization is occurring through the IRWM Plan preparation process. In addition, contact with other tribes whose cultures may include the Y-M Region was also made. Other cultures of significance in the Region are the recreation culture represented by the extensive public lands as well as agricultural and ranching culture, particularly in the western part of the Region, and the active, long-term participation of the environmental community in the IRWM process. Goal 3 regarding water quality, Goal 4 regarding wildlife habitat, and Goal 5 regarding recreation and their associated objectives all speak to the various cultural values of the Region's stakeholders.

6.3.7.4 Water-Dependent Recreation

The water-dependent recreation strategy includes recreational activities that are dependent on water, including fishing, swimming, waterfowl hunting and birding, boating, canoeing, and kayaking, as well as activities that do not require water but are enhanced by water, including wildlife viewing, picnicking, camping, and hiking, biking, and riding on trails.

Recreational access to the Merced River and its tributaries within Yosemite National Park and BLM lands along with Lake McClure and Lake McSwain provide abundant opportunities for water-dependent recreation in the Region, which also contributes significantly to the local economies. All efforts employed to improve watershed health, improve water quality and protect and restore aquatic ecosystems contribute to enhancing these opportunities. Improvement of recreational opportunities is a focus in the Region as represented by Goal 5 – Recreation and associated objectives O and P.

6.3.8 Other Strategies

*6.3.8.1 Crop Idling for Water Transfers**

The crop idling for water transfers strategy is a specific water transfer strategy in which irrigated lands are removed from production or dry farmed in order to make water available for transfer.

This RMS is not applicable to the Y-M Region. At present, agricultural water demand is limited in the Y-M Region and agricultural water demand and use is managed at the farm-level. While no

formal programs for crop idling exist, individual farmers, particularly those who received surface water, make choices on plantings and/or crop idling depending on the available water supply.

6.3.8.2 Irrigated Land Retirement

The irrigated land retirement strategy permanently removes farmland from irrigated agriculture.

This strategy is not being considered at this time because of the limited acreage of irrigated lands. It is used in other parts of the State to make water available for transfer or to solve drainage-related problems. Similar to crop-idling, individual farmers may seasonally or annually retire land from irrigation based on available water supply which could reduce water demand and improve water supply reliability. However, this strategy would need to be implemented in a way to avoid conflict with the goal of respecting cultural values of the Region, which includes preservation of agricultural lands, many of which are managed under the Williamson Act.

*6.3.8.3 Waterbag Transport/Storage Technology**

The waterbag transport/storage technology strategy takes water from coastal areas with unallocated freshwater supplies, stores water in inflatable bladders and delivers the water to another coastal area.

This RMS is not applicable to the Y-M Region. This technology currently has limited capacity for strategically addressing long-term regional water planning needs and may still require further research and development before full-scale implementation in the coastal areas of California. This technology is not applicable due to the fact that the Y-M Region is not located in a coastal location to take advantage of this technology.

*6.3.8.4 Dewvaporation or Atmospheric Pressure Desalination**

Dewvaporation is a specific process of humidification-dehumidification desalination. Brackish water is evaporated by heated air, which deposits fresh water as dew on the opposite side of a heat transfer wall.

This technology is not being considered in the Y-M Region. There is uncertainty as the technology is currently still under development and the fact that brackish water desalination is not currently being considered for augmenting water supplies in the Region.

*6.3.8.5 Fog Collection**

Fog collection is a type of precipitation enhancement, which has not yet been implemented as a management technique in California and may still require further research and development.

This technology is not being considered in the Y-M Region due to the inland location and climatic conditions of the Region that are not conducive to significant fog development and the limited water benefits this technology produces.

*6.3.8.6 Rainfed Agriculture**

Rainfed agriculture relies solely on rainfall to provide all crop consumptive water use. In California where little precipitation occurs during the spring and summer growing seasons, the use of the rainfed agriculture strategy is very limited. Implementation of rainfed agriculture would require matching cropping patterns to precipitation patterns likely resulting in single cropping, most likely of low value products like hay.

Rainfed agriculture (also known as dry farming) is currently a common practice throughout the Y-M Region for thousands of acres of pasture grass used for cattle grazing rangeland. However, that is

more of an ongoing, historic rangeland management action rather than a specific management action anticipated in the Region. Although this practice exists, no specific objectives have been identified that align with this RMS.

6.4 RMS And Y-M Goals and Objectives

In order to evaluate how the Y-M goals and objectives described in Section 5 meet with the draft 2013 CWP RMS, Table 6-2 has been prepared as a cross-reference.

Table 6-2: CWP RMS and Yosemite-Mariposa Goals/Objectives Cross-Reference Table

CWP Objectives	CWP Resource Management Strategies	Y-M Goals/Objectives
Reduce Water Demand	Agricultural Water Use Efficiency	Goal 1: Objectives c and d
	Urban Water Use Efficiency	Objective C
Improve Flood Management	Flood Management	Objective W
Improve Operational Efficiency and Transfers	*Conveyance – Delta**	*Not Applicable*
	Conveyance – Regional/local	Other RMS applicable to the Region
	System Reoperation	Other RMS applicable to the Region
	Water Transfers	Other RMS applicable to the Region
Increase Water Supply	Conjunctive Management & Groundwater Storage	Other RMS applicable to the Region
	*Desalination (Brackish and Sea Water)**	*Not Applicable*
	*Precipitation Enhancement**	*Not Applicable*
	Municipal Recycled Water	Other RMS applicable to the Region
	*Surface Storage – CALFED/State**	*Not Applicable*
	Surface Storage – Regional/local	Other RMS applicable to the Region
Improve Water Quality	Drinking Water Treatment and Distribution	Goal 2: Objectives e and g
	Groundwater/Aquifer Remediation	Other RMS applicable to the Region
	Matching Water Quality to Use	Other RMS applicable to the Region
	Pollution Prevention	Goal 3: Objective j
	*Salt and Salinity Management**	*Not Applicable*
	Urban Stormwater Runoff Management	Goal 3: Objective j
Practice Resources Stewardship	Agricultural Land Stewardship	Objectives I, j, k, and n
	Ecosystem Restoration	Goals 3 and 4
	Forest Management	Goal 7
	Land Use Planning and Management	Goal 6: Objective q
	Recharge Area Protection	Goals 3, 4 and 7
	Sediment Management	Goals 3, 4 and 6, and 7: Objectives d and i
	Watershed Management	Goals 3, 4 and 8
People and Water	Economic Incentives	Other RMS applicable to the Region
	Outreach and Engagement	Goal 8: Objective t
	Water and Culture	Goals 3, 4 and 5
	Water-Dependent Recreation	Goal 5: Objectives o and p
Other Strategies	*Crop Idling for Water Transfers**	*Not Applicable*
	Irrigated Land Retirement	Other RMS applicable to the Region
	*Waterbag Transport/Storage Technology **	*Not Applicable*
	*Dewvaporation or Atmospheric Pressure Desalination**	*Not Applicable*
	*Fog Collection **	*Not Applicable*
	*Rainfed agriculture**	Other RMS applicable to the Region

* RMS not applicable to Y-M IRWM Plan.

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Section 7: Project Selection and Prioritization

This section describes the project solicitation, development, and review process that was used to select and prioritize projects for inclusion in the Yosemite-Mariposa (Y-M) Integrated Regional Water Management (IRWM) Plan. The project review and prioritization process was designed to identify those projects, programs, and actions that contribute towards achievement of the Y-M IRWM Plan Goals and Objectives as described in Section 5. It is envisioned that a similar process to that described in the following sections will be used for including additional projects in the Plan in the future.

7.1 Project Solicitation and Integration Process

The project solicitation process began with a discussion of how potential project submittals would be evaluated and considered for inclusion into the IRWM Plan. The Regional Water Advisory Council (RWAC) decided that all potential projects, programs, or actions would be submitted using a Project Information Form. A draft list of project scoring criteria was discussed and made available for comment as part of the draft Project Information Form. The potential project scoring criteria were chosen to facilitate project comparison, review, selection, and prioritization. The next step of the process was to receive, evaluate, and review all project submittals. The RWAC proposed designation of a Project Evaluation Committee (PEC) which was responsible for recommending a score for each project chosen for inclusion. The final step of the process was to discuss the recommendations made by the PEC with participants at a RWAC Meeting to formally accept the projects into the Plan.

Following agreement on the process, the RWAC distributed a Project Information Form template (see Appendix 7-A for a blank form example) to all stakeholders at the January 22, 2014 meeting with a formal “Call for Projects” announcement at the February 26, 2014 Stakeholder Meeting. The Call for Projects and Project Information Form was also posted to the IRWM Plan website and e-mailed to the stakeholder distribution list. The project forms were due on March 31, 2014. Stakeholders were provided approximately one month to identify projects for potential inclusion in the IRWM Plan and complete and submit forms to the Y-M RWAC. Project information form webinars were held on March 12 and 20, 2014 to provide assistance to project proponents. In addition, additional assistance was provided to tribal representatives in the identification and development of several project information forms that specifically addressed tribal concerns. General IRWM information and initial project identification occurred during a meeting on February 21, 2014 and a follow-up project development meeting was held on March 25, 2014.

Project forms were submitted via e-mail. Stakeholders were invited to submit any projects, programs, and action ideas they thought could help contribute to fulfilling the Plan Objectives irrespective of the project’s current funding, level of development, or readiness to proceed. The RWAC wanted to identify both projects and programs that were implementable and “ready to proceed”, and also identify other ideas that have not yet been developed into mature project proposals. This approach was intended to provide a mechanism for stakeholders to share information and identify opportunities to integrate projects and more effectively fulfill the objectives of the IRWM Plan.

The PEC received 51 project submittals during the Call for Projects which are summarized in Tables 7-1 and 7-2 in Section 7.3. During the March 26, 2014 stakeholder meeting, project proponents were given the opportunity to present their project to the PEC and meeting attendees. The purpose of the project presentations was to provide a better understanding of the projects to improve scoring, identify projects which have potential for integration and determine if there are gaps in meeting the Plan Objectives.

7.2 Project Scoring, Selection and Prioritization Process

As introduced above, the process to decide which projects to include in the Plan and how to prioritize them relied on evaluation of the project scoring criteria, technical judgment about the relevancy of the submitted projects, and project presentations. The projects, programs and management actions submitted by the stakeholders were compiled, reviewed, and scored by the PEC based on the information provided by the project proponents. No efforts were made to verify the information submitted by each project proponent. The PEC consisted of 9 individual stakeholders from 6 agencies throughout the Region; representing a broad spectrum of water management interests as listed below. Agencies with multiple representatives submitted a single scoresheet for the range of projects for a total of 6 scores for each project. PEC agencies did not score their own projects.

- Disadvantaged Community
- Environmental
- Forest Service
- Land Use
- Water District
- Sewer District
- RCD

7.2.1 Project Scoring

As described above, the information submitted on the Project Information Form for each project was scored, and the sum of all factors yielded a total criteria score. This score was a useful tool to help the team understand and compare the attributes of the broad range of projects under consideration. The total criteria scores are not intended to be the basis for final decisions about inclusion or prioritization, but rather, are one indicator of how projects compare with each other.

Twenty unique criteria are used to prioritize projects as grouped into the following categories:

- Readiness to proceed,
- Regional support and integration,
- Implementation feasibility, and
- Impacts and benefits.

Scores do not consider whether a potential project may be eligible to receive Proposition 84 or 1E grant funds or any specific funding.

The maximum possible score for a project was 22 as distributed between the criteria that are described in the following narrative.

Readiness to Proceed (total points possible: 9)

- **Has a strong project proponent** – It is important for the success of a project to have a strong proponent committed to the project who has authority, capability, and funding (or qualify for match waiver as involving a disadvantaged community [DAC] for a critical water supply/quality project). Projects that indicate they had a strong project proponent receive 1 point.

- **Has early implementation start date** – Stakeholders are encouraged to submit any water management project that is important to the Region, independent of readiness to proceed; however, for the purposes of scoring, projects planned to be implemented within 36 months without CEQA/NEPA or 48 months with CEQA/NEPA required receive 1 point.

- **Cost estimates prepared (with some detail)** – Stakeholders were encouraged to submit project concepts, and thus cost estimates were not always well developed. If a detailed cost estimate is available, the project receives 1 point.

- **Source of funding identified** – Projects that identify sources of funding for implementation receive 1 point.

- **Planning completed** – If the initial planning process for the project has been completed, it receives 1 point.

- **California Environmental Quality Act/National Environmental Policy Act (CEQA/NEPA) requirements completed or not relevant** – Activities funded under Proposition 84 must be in compliance with CEQA, while federal projects such as for NPS, USFS, or BLM require compliance with NEPA. Projects that have completed CEQA/NEPA analyses or do not require them receive 1 point.

- **Permitting completed or not needed** – Permitting is an important element of most implementable projects and can be a critical path item in project implementation. Projects that have completed the required permitting or do not require permitting receive 1 point.

- **Design partly completed or not needed** – Design is an important milestone in most implementable projects. Projects that have completed the design portion of the project or do not require design received 1 point.

- **Construction/implementation commenced** – Projects that have begun construction or implementation demonstrate their readiness to proceed with subsequent work phases. Such projects receive 1 point.

Regional Support and Integration (total points possible: 2)

- **Encourages or supports regional cooperation and collaboration** – Projects that encourage regional support receive 1 point.

- **Integrates easily with other projects** – A key criterion for developing and implementing integrated projects is the ability of a project to work well with and maximize linkages

between projects. Projects that can be integrated easily with other projects receive 1 point.

Implementation Feasibility (total points possible: 3)

- **Consistent with general plans** – It is important that the Region's projects are consistent with the goals and objectives of the applicable county and city general plans. Such projects receive 1 point.

- **Technically and economically feasible** – If a project is indicated to be both technically and economically feasible, it receives 2 points. If the project is one or the other, it receives 1 point.

Impacts and Benefits (total points possible: 8)

- **Addresses more IRWM Plan objectives** – The IRWM Plan objectives, which were described in Section 5, were used to evaluate projects. Integrated water management calls for projects that provide multiple benefits and meet more than one IRWM Plan objective. Therefore, if a project meets more than 5 objectives, it receives 2 points. If the project meets between 2-5 objectives, it receives 1 point. If the project meets 0-1 objectives, it receives 0 points.

- **Has potential negative impacts** – It is important to understand whether projects are creating negative impacts such as short-term construction impacts or longer-term environmental impacts. Projects that may cause a negative impact receive -1 (minus 1) point; if no potential negative impact are identified, the project receives 0 points.

- **Addresses more Statewide Program Preferences** – Statewide IRWM Program preferences and priorities are identified in the Public Resources Code Section 75026. (b) and California Water Code Section 10544. (See Section 12 – Glossary) Projects that address one or more Statewide Program Preference receive 1 point.

- **Serves a DAC or tribal community or responds to environmental justice concerns** – Projects that serve a DAC or tribal community or answer an environmental justice concern receive 1 point.

- **Contributes to climate change adaptation** – Projects that contribute to climate change adaptation receive 1 point.

- **Helps reduce greenhouses gas (GHG) emissions** – Projects that contribute to a reduction in greenhouse gas emission receive 1 point.

- **Addresses more resource management strategies (RMSs)** – Section 6 describes the RMSs selected for the Plan and how they compare with those included in the California Water Plan. Projects that include more than 5 RMSs receive 2 points, those with 2-5 RMSs receive 1 point, and those with 0-1 RMSs receive 0 points.

As part of the current plan, the PEC reviewed the project summary sheets developed that included detailed information for each proposed project. They adjusted initial scoring recommendations made by the consultant team and then met as a group on April 17, 2014 to

discuss any changes to their scoring recommendations. As a group, the PEC decided that any projects that were submitted by their own agency would not be scored by that PEC member. In place of that PEC member's score, the Consultant score was included. The scores for each project were averaged and included as a final score for each project and was included in the Plan.

7.2.2 Project Selection Process

The PEC then reviewed all submitted projects to determine if they were consistent with the Plan objectives. The PEC concluded that all of the submitted projects were consistent with the Plan objectives. Based on these considerations, the PEC recommended that all 51 submitted projects be included in the IRWM Plan. Upon discussion at April 23, 2014 Stakeholder Input Meeting, the RWAC and Stakeholder Group supported the PEC recommendation. It should be noted that this current project list is simply a "snapshot" of the projects included in the Plan. It is fully expected that projects will be added, modified, and removed from the Plan in a much more dynamic process going forward. Appendix 7-B includes a brief synopsis of the projects included in the Plan along with the project scoring sorts and other supporting materials. Each Project Information Form can be found on the Y-M website, located at: http://www.mcrcd.net/Pages/IRWMP.aspx.

7.2.3 Future Updates to the Project List

The RWAC plans to provide opportunities for regional stakeholders to propose changes to the project list annually. New projects may be added, scored, and prioritized in accordance with the project submittal process. Projects may also be removed at the request of a project proponent, or once the project has been completed. The RWAC may choose to use the same project submittal, review, and selection process used to develop this Plan, or may modify the process before inviting potential revisions. The RWAC can hold a "Call for Projects" and update the IRWM Plan Project list at any time. Revision of the project list does not require that the entire IRWM Plan be revised and re-adopted; rather the updated project list can be amended to the existing plan.

As this IRWM plan is funded by a Round 2 Planning Grant, it was initially prepared under the DWR July 2010 Guidelines. However, during the course of the IRWM Plan preparation, it was prepared in accordance with the DWR November 2012 Guidelines to meet the drought funding opportunity requirements. In an effort to also comply with CWC §85021 regarding reduced reliance on Delta water supplies, any future project solicitations for the Y-M IRWM Plan will include a specific request to identify the means in which projects will improve its regional self-reliance for water. The measures that could be used include investment in water use efficiency, water recycling, advanced water technologies, local and regional water supply projects and improved regional coordination of local and regional water supply efforts. Some of these measures are already occurring or are represented in the current project list (e.g., water recycling, water use efficiency and local water supply projects) while others may not be economically feasible given the dispersed nature of the residents of the Region.

Future updates to the project list will be included in Appendix 7-B.

7.3 Summary of Projects Included in the Plan

The projects that were submitted by stakeholders under the Call for Projects demonstrate the breadth of activities needed for Y-M to meet its water management objectives. These 51 projects were submitted by 18 different organizations and cover, to some extent, most of the IRWM Plan objectives. Several projects will help achieve multiple Plan Objectives. Projects ranged from water and wastewater facility improvements to habitat restoration programs, water efficiency initiatives, fuels reduction projects, and water quality enhancement programs. The range of projects presented multiple opportunities for resource and project integration; integration screening should also be considered for future project solicitations. The projects were unanimously accepted by the RWAC for inclusion in the Plan.

There were 32 water and wastewater infrastructure projects, 5 fire risk reduction projects, 9 restoration projects, 1 water quality project, 1 recreation project and 3 projects not in the above categories as summarized in Table 7-1. The projects included in the Plan as of initial adoption are identified in Table 7-1. Figure 7-1 shows a map of the Region with project locations for all of the submitted projects by project proponent and Figure 7-2 shows a map of the Region with the DAC areas and projects.

7.3.1 Prioritized and Sorted Project Lists

The highest score assigned to a submitted project was 19 out of a maximum of 22 points; the average of all project scores was 12. The total criteria score for each of the 51 projects sorted from high score to low is provided as Table 7-3. The same table sorted by project type then by high score to low is provided as Table 2 of Appendix 7-B. One observation that can be made regarding project scoring was that there was a weighting towards readiness to proceed which put some of the infrastructure projects at a disadvantage because of the long lead time necessary to complete design, CEQA/NEPA, permitting which not all projects require.

All projects included in the IRWM Plan are important to meet the objectives of the Region. The RWAC will encourage and support actions that advance all of the projects, regardless of their score. The purpose of sorting the project list in different ways is to allow stakeholders to “drill” down into the project list, and possibly find collaboration opportunities between efforts, or ways to enhance the project in the future. The RWAC and stakeholder group participated in deciding the different ways to sort the project list.

Table 7-1: Summary of Yosemite-Mariposa IRWM Projects Received By Type

Lead Agency Organization	Water Infrastructure	Wastewater Infrastructure	Other	Fire Risk Reduction	Recreation	Restoration	Water Quality	Total Projects Submitted
County of Mariposa	5	6						11
Economic Development Corporation			1					1
Lake Don Pedro Community Services District	6							6
Mariposa Public Utility District	1	2		1				4
Merced Irrigation District					1			1
Point Blue Conservation Science						1		1
Upper Merced River Watershed Council				1			1	2
National Park Service/Yosemite National Park	1	1						2
Sierra Foothill Conservancy						4		4
Ponderosa Basin Mutual Water Company (PBMWC)	1							1
Mariposa Resource Conservation District (MCRCD)			2	1		1		4
Yosemite Area Audubon Society						1		1
Yosemite Alpine Community Services District	2							2
USFS, Sierra National Forest, Bass Lake Ranger District				2				2
To be determined. Anticipate National Park Service, Yosemite National Park		1						1
American Indian Council of Mariposa County	1					2		3
Fish Camp Volunteer Fire Association	1							1
Mariposa Pines Water Company	4							4
Total Number of Projects	**22**	**10**	**3**	**5**	**1**	**9**	**1**	**51**
Total Project Cost by Type	**$37,619,000**	**$43,969,000**	**$5,731,250**	**$5,481,000**	**$332,300**	**$5,802,440**	**$25,000**	**$98,959,990**

Table 7-2: Summary of Organizations, Project Titles, and Costs

Project No.	Agency	Title	Total Project Cost
1	County of Mariposa	Replace Water Distribution Piping in Yosemite West Subdivision	$2,900,000
2	County of Mariposa	Develop Second Water Source for the Coulterville community	$700,000
3	County of Mariposa	Water Treatment for Arsenic Exceedance	$500,000
4	County of Mariposa	Replace Sewage Collection Piping in Yosemite West Subdivision	$2,500,000
5	County of Mariposa	Develop Second Water Source for Yosemite West Subdivision	$1,600,000
6	County of Mariposa	Expansion and Repair of Leachfields in the Yosemite West Subdivision	$1,220,000
7	County of Mariposa	Construct a septage collection and metering tank at the Lake Don Pedro Sewage Treatment Plant	$400,000
8	County of Mariposa	Repairs and upgrades to Lake Don Pedro Wastewater Treatment System	$2,200,000
9	County of Mariposa	Install back-up power at Mariposa Pines Sewage Treatment Plant	$225,000
10	County of Mariposa	Replace Water Distribution Piping in Coulterville	$1,480,000
11	County of Mariposa	Replace Sewage Collection Piping in Coulterville	$2,200,000
12	Economic Development Corporation	Mariposa Biomass / Biochar Facility	$5,000,000
13	Lake Don Pedro Community Services District	Lake McClure Deep Water Intake Feasibility Study	$30,000
14	Mariposa Public Utility District	Stockton Creek Watershed Fuel Modification Project	$240,000
15	Mariposa Public Utility District	Mariposa PUD Waste Water Treatment Facility Improvements	$7,300,000
16	Mariposa Public Utility District	Saxon Creek Pump Station Access and Ventilation System Improvements	$150,000
17	Merced Irrigation District	Lake McClure Area Recreation Enhancements	$332,300
18	Point Blue Conservation Science	Rangeland Watershed Initiative Partner Biologist	$180,000
19	Lake Don Pedro Community Services District	Dead End Main Replacement Project	$6,500,000
20	Lake Don Pedro Community Services District	Lake McClure Intake Improvement Project Phase III	$700,000
21	Lake Don Pedro Community Services District	Water Service Replacement Project	$3,750,000
22	Lake Don Pedro Community Services District	Treatment Plant Pump Replacement Project	$100,000

Project No.	Agency	Title	Total Project Cost
23	Lake Don Pedro Community Services District	New potable water well	$125,000
24	Upper Merced River Watershed Council (UMRWC)	Water Quality Monitoring Bioassessment in Upper Merced River Watershed	$25,000
25	Upper Merced River Watershed Council	Merced River Watershed Wildfire Fuel Reduction Project	$750,000
26	National Park Service/Yosemite National Park	Supplement Wawona Water System with Biledo Spring	$17,000,000
27	National Park Service/Yosemite National Park	Rehabilitate The Wawona Wastewater Treatment Plant	$24,000,000
28	Sierra Foothill Conservancy	Bean Creek Meadow Restoration	$372,000
29	Sierra Foothill Conservancy	Conservation Easement	$2,000,000
30	Sierra Foothill Conservancy	Conservation Planning, Phase 2	$50,000
31	Sierra Foothill Conservancy	Stockton Creek Preserve Expansion	$1,500,000
32	Ponderosa Basin Mutual Water Company (PBMWC)	Rural Water Company Infrastructure Rehabilitation	$600,000
33	Mariposa Resource Conservation District (MCRCD)	Invasive Plant Species education and eradication	$600,000
34	Mariposa Resource Conservation District	Drought Preparedness for Landowners and Residents	$86,250
35	Mariposa County Resource Conservation District	Water & Energy Efficiency Incentives Assistance Program	$645,000
36	Yosemite Area Audubon Society	Mariposa Creek Parkway Extensions	$932,000
37	Yosemite Alpine Community Services District	Water Meter Replacement	$50,000
38	Yosemite Alpine Community Services District	Drill well on Yosemite Mtn. Ranch TPZ and pipe water to NEW TANKS.	$500,000
39	USFS, Sierra National Forest, Bass Lake Ranger District	Sierra National Forest Bass Lake Ranger District Fuels Reduction Project - Rush Timber Sale, near Wawona	$1,733,000
40	USFS, Sierra National Forest, Bass Lake Ranger District	Sierra National Forest Bass Lake Ranger District Fuels Reduction Project - Hites-Feleciana Fuels Project , N of Mariposa Pines	$2,533,000
41	To be determined. Anticipate National Park Service, Yosemite National Park	Wawona Water Supply and Wastewater Treatment Projects	-

Project No.	Agency	Title	Total Project Cost
42	American Indian Council of Mariposa County	Bear Creek Tribal Water Storage Project	$90,500
43	American Indian Council of Mariposa County	Mariposa Creek Native Plants Restoration and Education Project	$87,240
44	American Indian Council of Mariposa County	Invasive Plant Eradication/Native Plant Enhancement, Wawona, Yosemite NP	$81,200
45	Fish Camp Volunteer Fire Association	Drought/Fire Storage with additional wells with distribution pipelines and hydrants	$591,000
46	Mariposa Pines Water Company	Sounding Tube Installation	$2,500
47	Mariposa Pines Water Company	Tank 1 Replacement	$40,000
48	Mariposa Pines Water Company	Hazardous Tree and Brush Removal from Right-of-ways and Improvements	$160,000
49	Mariposa Pines Water Company	Install Power and Telephone Lines (for internet) to Water Tanks	$50,000
50	Mariposa County Resource Conservation District	Private Land Water Storage Improvement Assistance Project	$225,000
51	Mariposa Public Utility District (MPUD)	Waste Water Collection System Improvements	$3,924,000

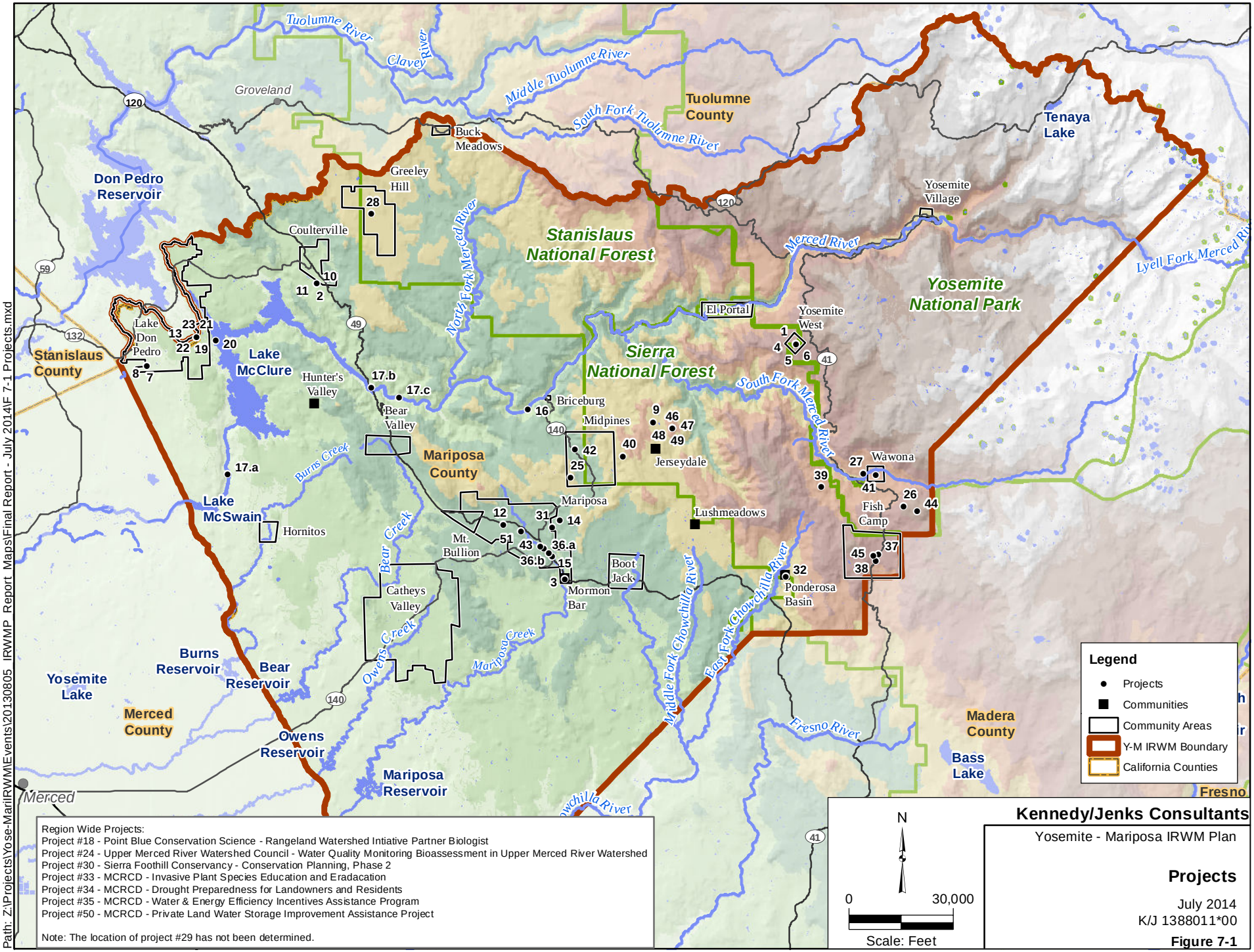
Note: More detailed project descriptions for each project are found in Table 1 of Appendix 7-B.

Table 7-3: Project Summary Sorted by Average Score

Project #	Project Title	Agency	Project Type	Average (out of 22 pts)	Total Project Cost
18	Rangeland Watershed Initiative Partner Biologist	Point Blue Conservation Science	Restoration	**19**	$ 180,000
31	Stockton Creek Preserve Expansion	Sierra Foothill Conservancy	Restoration	**18**	$ 1,500,000
39	Sierra National Forest Bass Lake Ranger District Fuels Reduction Project - Rush Timber Sale, near Wawona	USFS, Sierra National Forest, Bass Lake Ranger District	Fire Risk Reduction	**18**	$ 1,733,000
28	Bean Creek Meadow Restoration	Sierra Foothill Conservancy	Restoration	**16**	$ 372,000
40	Sierra National Forest Bass Lake Ranger District Fuels Reduction Project - Hites-Feleciana Fuels Project , N of Mariposa Pines	USFS, Sierra National Forest, Bass Lake Ranger District	Fire Risk Reduction	**16**	$ 2,533,000
14	Stockton Creek Watershed Fuel Modification Project	MARIPOSA PUBLIC UTILITY DISTRICT	Fire Risk Reduction	**16**	$ 240,000
44	Invasive Plant Eradication/Native Plant Enhancement, Wawona, Yosemite NP	American Indian Council of Mariposa County	Restoration	**15**	$ 81,200
33	Invasive Plant Species education and eradication	Mariposa Resource Conservation District (MCRCD)	Restoration	**15**	$ 600,000
50	Private Land Water Storage Improvement Assistance Project	Mariposa County Resource Conservation District	Fire Risk Reduction	**15**	$ 225,000
29	Conservation Easement	Sierra Foothill Conservancy	Restoration	**15**	$ 2,000,000
34	Drought Preparedness for Landowners and Residents	Mariposa Resource Conservation District	Other	**15**	$ 86,250
30	Conservation Planning, Phase 2	Sierra Foothill Conservancy	Restoration	**15**	$ 50,000
24	Water Quality Monitoring Bioassessment in Upper Merced River Watershed	Upper Merced River Watershed Council (UMRWC)	Water Quality	**15**	$ 25,000
35	Water & Energy Efficiency Incentives Assistance Program	Mariposa County Resource Conservation District	Other	**14**	$ 645,000
45	Drought/Fire Storage with additional wells with distribution pipelines and hydrants	Fish Camp Volunteer Fire Association	Water Infrastructure	**14**	$ 591,000
36	Mariposa Creek Parkway Extensions	Yosemite Area Audubon Society	Restoration	**14**	$ 932,000
25	Merced River Watershed Wildfire Fuel Reduction Project	Upper Merced River Watershed Council	Fire Risk Reduction	**14**	$ 750,000
43	Mariposa Creek Native Plants Restoration and Education Project	American Indian Council of Mariposa County	Restoration	**13**	$ 87,240

Project #	Project Title	Agency	Project Type	Average (out of 22 pts)	Total Project Cost
15	Mariposa PUD Waste Water Treatment Facility Improvements	Mariposa Public Utility District	Wastewater Infrastructure	**13**	$ 7,300,000
51	Waste Water Collection System Improvements	Mariposa Public Utility District (MPUD)	Wastewater Infrastructure	**12**	$ 3,924,000
1	Replace Water Distribution Piping in Yosemite West Subdivision	County of Mariposa	Water Infrastructure	**12**	$ 2,900,000
22	Treatment Plant Pump Replacement Project	Lake Don Pedro Community Services District	Water Infrastructure	**12**	$ 100,000
12	Mariposa Biomass / Biochar Facility	Economic Development Corporation	Other	**12**	$ 5,000,000
38	DRILL WELL on Yosemite Mtn. Ranch TPZ and pipe water to NEW TANKS.	Yosemite Alpine Community Services District	Water Infrastructure	**12**	$ 500,000
8	Repairs and upgrades to Lake Don Pedro Wastewater Treatment System	County of Mariposa	Wastewater Infrastructure	**12**	$ 2,200,000
6	Expansion and Repair of Leachfields in the Yosemite West Subdivision	County of Mariposa	Wastewater Infrastructure	**11**	$ 1,220,000
10	Replace Water Distribution Piping in Coulterville	County of Mariposa	Water Infrastructure	**11**	$ 1,480,000
21	Water Service Replacement Project	Lake Don Pedro Community Services District	Water Infrastructure	**11**	$ 3,750,000
27	Rehabilitate The Wawona Wastewater Treatment Plant	National Park Service/Yosemite National Park	Wastewater Infrastructure	**11**	$ 24,000,000
19	Dead End Main Replacement Project	Lake Don Pedro Community Services District	Water Infrastructure	**11**	$ 6,500,000
7	Construct a septage collection and metering tank at the Lake Don Pedro Sewage Treatment Plant	County of Mariposa	Wastewater Infrastructure	**11**	$ 400,000
11	Replace Sewage Collection Piping in Coulterville	County of Mariposa	Wastewater Infrastructure	**11**	$ 2,200,000
17	Lake McClure Area Recreation Enhancements	Merced Irrigation District	Recreation	**11**	$ 332,300
26	Supplement Wawona Water System with Biledo Spring	National Park Service/Yosemite National Park	Water Infrastructure	**11**	$ 17,000,000
16	Saxon Creek Pump Station Access and Ventilation System Improvements	Mariposa Public Utility District	Water Infrastructure	**10**	$ 150,000
23	New potable water well	Lake Don Pedro Community Services District	Water Infrastructure	**10**	$ 125,000

Project #	Project Title	Agency	Project Type	Average (out of 22 pts)	Total Project Cost
32	Rural Water Company Infrastructure Rehabilitation	Ponderosa Basin Mutual Water Company (PBMWC)	Water Infrastructure	**10**	$ 600,000
37	Water Meter Replacement	Yosemite Alpine Community Services District	Water Infrastructure	**10**	$ 50,000
4	Replace Sewage Collection Piping in Yosemite West Subdivision	County of Mariposa	Wastewater Infrastructure	**10**	$ 2,500,000
9	Install back-up power at Mariposa Pines Sewage Treatment Plant	County of Mariposa	Wastewater Infrastructure	**10**	$ 225,000
20	Lake McClure Intake Improvement Project Phase III	Lake Don Pedro Community Services District	Water Infrastructure	**10**	$ 700,000
5	Develop Second Water Source for Yosemite West Subdivision	County of Mariposa	Water Infrastructure	**10**	$ 1,600,000
13	Lake McClure Deep Water Intake Feasibility Study	Lake Don Pedro Community Services District	Water Infrastructure	**10**	$ 30,000
42	Bear Creek Tribal Water Storage Project	American Indian Council of Mariposa County	Water Infrastructure	**10**	$ 90,500
2	Develop Second Water Source for the Coulterville community	County of Mariposa	Water Infrastructure	**9**	$ 700,000
3	Water Treatment for Arsenic Exceedance	County of Mariposa	Water Infrastructure	**9**	$ 500,000
47	Tank 1 Replacement	Mariposa Pines Water Company	Water Infrastructure	**9**	$ 40,000
41	Wawona Water Supply and Wastewater Treatment Projects	To be determined. Anticipate National Park Service, Yosemite National Park	Wastewater Infrastructure	**8**	$ -
46	Sounding Tube Installation	Mariposa Pines Water Company	Water Infrastructure	**8**	$ 2,500
48	Hazardous Tree and Brush Removal from Right-of-ways and Improvements	Mariposa Pines Water Company	Water Infrastructure	**7**	$ 160,000
49	Install Power and Telephone Lines (for internet) to Water Tanks	Mariposa Pines Water Company	Water Infrastructure	**5**	$ 50,000
			Average	**12**	$ 98,959,990



Region Wide Projects:
Project #18 - Point Blue Conservation Science - Rangeland Watershed Intiative Partner Biologist
Project #24 - Upper Merced River Watershed Council - Water Quality Monitoring Bioassessment in Upper Merced River Watershed
Project #30 - Sierra Foothill Conservancy - Conservation Planning, Phase 2
Project #33 - MCRCD - Invasive Plant Species Education and Eradacation
Project #34 - MCRCD - Drought Preparedness for Landowners and Residents
Project #35 - MCRCD - Water & Energy Efficiency Incentives Assistance Program
Project #50 - MCRCD - Private Land Water Storage Improvement Assistance Project

Note: The location of project #29 has not been determined.

Kennedy/Jenks Consultants

Yosemite - Mariposa IRWM Plan

Projects

July 2014
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Figure 7-1

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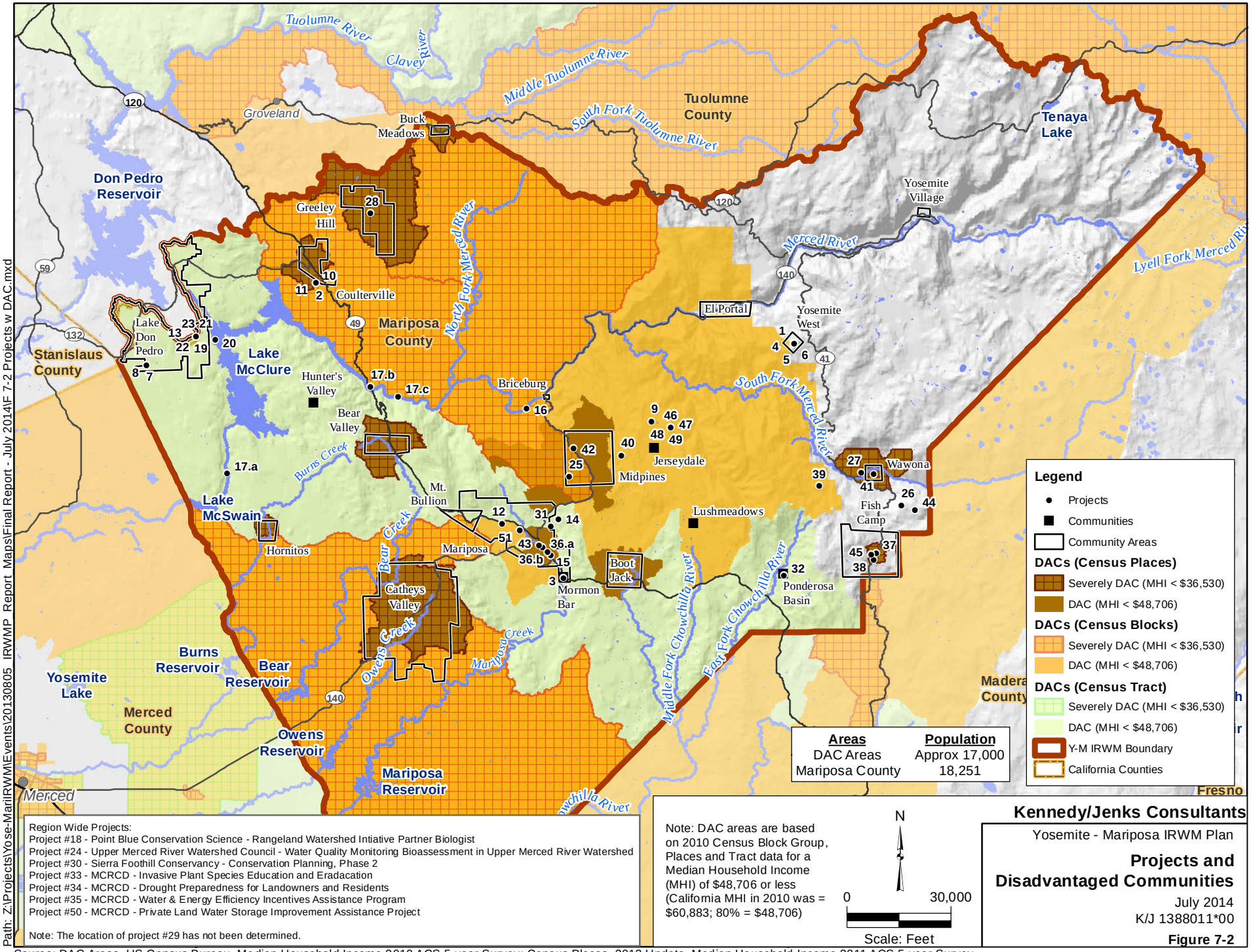

Source: DAC Areas, US Census Bureau, Median Household Income 2010 ACS 5-year Survey; Census Places, 2012 Update, Median Household Income 2011 ACS 5-year Survey.

7.3.2 Development of Future Projects to Achieve Plan Objectives

In addition to the projects or programs submitted, additional projects are likely to be needed to fully satisfy all Plan objectives and the strategies. The existing list of 51 projects, fulfill the 23 Objectives to varying degrees. However, several Objectives do not have any linked primary projects. Future projects will be necessary for the Plan to address objectives that were not covered by projects submitted during this initial Call for Projects. Project proponents have not yet been identified for all of these projects, and the details of the projects or programs will need to be developed further in the future. In the future, the IRWM Plan will have other actions/projects associated with meeting IRWM Plan objectives.

Section 8: Impacts and Benefits

This section provides an overview of the potential impacts and benefits associated with implementation of the Yosemite-Mariposa (Y-M) Region (Region) Integrated Region Water Management Plan (IRWM Plan). Because of the nature of the IRWM planning process, the impacts and benefits discussed here are preliminary and not intended to be a complete list; more extensive and project-specific evaluations of impacts and benefits usually occur through project implementation. This overview may be used as a guide for deeper consideration of, and response to, impacts and benefits encountered during Plan implementation. Later, as plan performance is evaluated, the Y-M Regional Water Management Group (RWMG) may utilize this preliminary assessment to better understand the benefits that have been realized and whether unanticipated impacts have occurred.

8.1 Benefits of Plan Implementation

8.1.1 Plan Benefits

The Y-M IRWM Plan documents a shared vision for integrated water management and outlines a cooperative approach to achieve that vision. It provides regional water resources benefits largely by fostering improved coordination, collaboration, and communication among entities in the Region. Such collaboration is supported both by the Plan development process and the resulting, newly formed Plan Implementation Framework.

Development of the Plan has created strengthened partnerships between local, State, Tribal and Federal entities that may not have happened otherwise. The Y-M IRWM planning process fosters coordination, collaboration and communication among the many entities in the Region that previously had no formal forum for regional collaboration on similar topics. The IRWM planning process is intended to result in greater efficiencies (e.g., efforts are not duplicated, information is shared), enhance public and environmental benefits, and encourage greater public support for projects that are important to sustainable water management. As part of preparing this IRWM Plan, stakeholders have provided input as to their ongoing water management activities, priorities, and projects. Knowledge of these activities and projects assists other agencies from duplicating efforts, and helps to identify common synergies between efforts. For example, an outgrowth of this IRWM Plan is the regional effort currently underway to study groundwater use and quality throughout the County. The groundwater study is the first step in what is hopefully a long standing and beneficial effort to better manage and protect groundwater supplies, which are a critical supply source to many individuals and communities. During IRWM Plan preparation, many of the agencies and non-profit groups shared the experience gained in implementing past projects – passing their knowledge and lessons-learned to others.

This collaborative approach to regional planning helps ensure that multiple elements of watershed planning are considered together rather than allowing one particular geographic area or project type to dominate. In this way, development of an open and collaborative forum for discussion and response to water issues helps distribute the benefits and impacts of the Plan instead of allowing one group or geographic area to reap benefits while another withstands impacts. Also, regional planning helps ensure that projects designed to achieve one particular objective (e.g., water supply enhancement) will be supportive of (or at least compatible with) other objectives (e.g., forest management, water quality protection, or habitat preservation).

The 51 projects identified by this Plan meet, at some level, all nine goals and 23 plan objectives described in Section 5. While periodic updates and addition of projects will be needed over the 20-year horizon, implementation of the planned projects will produce multiple benefits. Below is an overview of some of the benefits, as it is expected that many more benefits will be realized through project development implementation.

- **Improve and Protect Water Quality** – Y-M IRWM Plan projects include actions to reduce contaminants in water sources by addressing causes such as nonpoint source pollution control and renewal or replacement of aging sewer infrastructure. Nonpoint source pollution control including improved cattle grazing practices will help reduce coliform, nitrates and other contaminants that could find their way into streams, and even shallow groundwater sources. Similarly, several upgrades involve wastewater treatment plant upgrades to bring the facilities up to current regulatory standards that are designed to be protective of the environment. The primary benefit from these water quality projects is the reduced potential for human and ecological exposure to potentially harmful contaminants. Likewise, by ensuring a protected water source these efforts will benefit other types of water users, such as agricultural users and water-dependent wildlife.

- **Improve Resource Stewardship** – The Plan projects include invasive species removal programs and land restoration and acquisition projects. Proposed projects will attempt to develop a regional plan to map and manage to prevent of the spread of non-native plants such as Arundo donax and yellow starthistle. Other projects will procure land and restore at-risk areas such as Bean Creek Meadow. These projects will improve overall habitat quality by restoring and rehabilitating native vegetation in riparian and aquatic corridors and improving fish habitat. Benefits of the Plan include broader-scale, regionally coordinated efforts to approach these complex challenges.

- **Catastrophic Wildfire Risk Reduction Projects** – Plan projects of this type primarily focus on removing vegetative fuel loading across several hundred acres. Proposed projects will aim to remove potential fuel loads by means such as burning, slashing, and thinning. Implementation of these projects will reduce the risk of large wildfires that could damage homes or native species habitat within the Region. Large wildfires also reduce air and water quality. Plan projects implementation also reduces the risk of water quality degradation to downstream regions such as the Merced Region.

- **Improve Water Supply Reliability** – Projects related to water supply management include improving the reliability of municipal supplies on a sub-regional scale, rehabilitating or replacing aging infrastructure such as wells, storage tanks, and pipelines, studying new sources of water supply, and improving drought preparedness on an individual and community scale. These projects are beneficial in maintaining the long-term sustainability of water supplies in the Region as well as accommodate future risk measures such as drought preparedness.

- **Improve Water Use Efficiency** – Projects related to water use efficiency focus on increasing public awareness, improving monitoring efforts through water meters, and making water efficient appliances more accessible to disadvantaged communities (DACs)[1] through incentive programs that alleviate the large capital costs to individuals and families alike. Projects aimed at more efficient water use will result in lower unit

[1] As described in Section 2, a DAC is defined as having an annual median household income that is less than 80 percent of the statewide annual median household income.

demands, less energy use for treatment and delivery of water, and, potentially, a reduced need for expansion of water supply infrastructure.

Table 8-1 summarizes the benefits and impacts of Plan implementation. The benefits and impacts are summarized on a regional scale, and also consider interregional benefits of projects and actions that will span beyond the borders of the Y-M Region. Regions that are hydrologically connected, such as the lower Merced River watershed of the Merced Region, are of particular focus in assessing potential interregional benefits.

Table 8-1: Potential Benefits and Impacts from Plan Implementation

	Within IRWM Region		**Interregional**	
	Potential Benefits	*Potential Impacts*	*Potential Benefits*	*Potential Impacts*
Projects to Improve and Protect Water Quality	• Reduced human and ecological exposure to pollutants • Improved drinking water supply and wastewater treatment regulatory compliance • Protection of aquatic habitat • Improvement of water-based recreation • Benefits extend to broad Region, including DACs	• Projects to improve water quality that involve construction could result in temporary impacts to aesthetics, air quality, biological resources, noise, soils, and transportation systems. • No environmental justice or DAC impacts are anticipated.	• Improved water quality in the Region would also benefit the downstream regions in the lower watersheds, such as the Merced and Madera IRWM Regions, and associated groundwater basins.	• No interregional impacts are anticipated.
Projects to Promote Resource Stewardship	• Improved habitat quality and quantity • Reduced risk to native species from invasive species • Improved water supply • Improved water quality • Enhanced public awareness • Benefits extend to broad Region, including DACs	• Projects to remove invasive species could have temporary negative impacts to aesthetics, biological resources, and soils. • No environmental justice or negative impacts to DACs are anticipated.	• Prevention and removal of invasive species in the Region may reduce the transport and deposition of invasive species to the Sacramento-San Joaquin Delta and adjacent regions.	• No interregional impacts are anticipated.
Water Supply and Demand Management Projects	• Enhanced supply reliability • Improved groundwater management • Reduced water demands • Less energy usage for treatment and delivery of water • Reduced need to expand water supply infrastructure • Benefits extend to broad Region, including DACs	• Development of water supply projects could result in ground disturbance and have temporary impacts to aesthetics, air quality, biological resources, noise, soils, and transportation systems. • No environmental justice or negative impacts to DACs are anticipated.	• Improved water supply reliability and reduced water demands within the Region could improve regional and statewide water supply reliability.	• No interregional impacts are anticipated.

	Within IRWM Region		Interregional	
	Potential Benefits	*Potential Impacts*	*Potential Benefits*	*Potential Impacts*
Efficiency-Related Projects	• Reduced greenhouse gases • Climate change adaptation • Potentially improve air quality • Improved efficiency of existing infrastructure and home appliances • Lower energy usage • Reduce the need for new infrastructure • Maximize beneficial use of resources • Benefits extend to broad Region, including DACs	• Development of efficiency-related projects could result in ground disturbance and have temporary impacts to aesthetics, air quality, biological resources, noise, soils, and transportation systems. • No environmental justice or negative impacts to DACs anticipated.	• Lowered energy and water demands may serve as a model for other nearby regions with DAC and Tribal communities. Improved air quality, lowered energy and water demands could improve regional and statewide energy and water supply reliability.	• No interregional impacts are anticipated.
Catastrophic Wildfire Risk Reduction Projects	• Reduce wildfire risk • Protection of critical habitat and communities • Reduce risk to nearby agriculture • Potentially improve water quality • Potentially improve air quality • Potential source of biomass • Benefits extend to broad Region, including DACs	• Development of fuel reduction projects could result in temporary impacts to aesthetics, air quality, biological resources, cultural resources, soils, and transportation systems. • No environmental justice or DACs impacts anticipated.	• Reduced fuel loads will reduce the risk of large wildfires which can spread to adjacent regions and potentially lower water and air quality. Reduce wildfire risk to endangered and protected species.	• No interregional impacts are anticipated.
Actions to Adapt to Climate Change	Actions to respond to climate change will occur in conjunction with the projects described above, as appropriate.			
Actions to Reduce Greenhouse Gas Emissions	Actions to help reduce greenhouse gas emissions will occur in conjunction with the projects described above, as appropriate.			

8.1.2 Plan Beneficiaries

Accomplishment of the IRWM objectives and projects will benefit the Region as a whole, and in many cases stakeholders in neighboring regions, not just areas in the vicinity of individual projects. The potential beneficiaries of the IRWM Plan are residents of the Region, water agencies, local, state, and federal agencies, businesses, wildlife and associated habitats, neighboring regions, Native American tribes, and others within the jurisdictions served by Plan projects. These beneficiaries are represented by members of the RWAC and the larger IRWM stakeholder group.

As most of the communities in the Region qualify as DACs (the larger exceptions are Yosemite West and Yosemite Village), IRWM Plan implementation will primarily benefit DACs. DACs are expected to play a role in projects by sponsoring or cosponsoring projects throughout Plan implementation.

Native American tribes have also participated actively in Plan development, including providing input on the development of goals and objectives, and have submitted projects (primarily for water storage, invasive species management and restoration of native vegetation) for implementation. Tribes are encouraged to continue their participation and to submit additional projects for inclusion in the Plan that can further benefit the Tribes.

8.1.3 Interregional Benefits

The Y-M Region is located at the foothills of the Sierra Nevada and extends westward into the Central Valley. Hydrologically, the Region is upstream of the Merced Region. A large portion of Merced River water users are located outside of the Region itself. Because of this, water quality protection and supply availability are closely integrated with the needs adjacent Merced Region. Habitat and large scale watershed and forest management projects implemented within the Region are likely to directly impact IRWM Plan efforts in the neighboring Regions. Projects to enhance and protect the watershed, and reduce consumptive water usage, will likely have downstream benefits.

Wildfires are a continual risk to this Region and adjacent regions, as evidenced by the catastrophic 2013 Rim Fire. Projects reducing fuel loading over several hundred acres lower the risk of large wildfires that can spread to nearby communities outside of the Region. They also reduce the risk of air and water quality degradation for downstream users. The large amount of unmanaged overgrowth in the Region requires a large amount of water and transpires the water before it can fully infiltrate to deeper groundwater aquifers, recharging groundwater supplies and raising the groundwater table.

8.2 Impacts of Plan Implementation

Negative impacts that may be associated with the Plan projects include (1) short-term, site-specific impacts related to site grading and construction, and (2) long-term impacts associated with project operation. For the purposes of this Plan, impacts are discussed at a screening level below.

During project planning, project-specific and/or programmatic environmental compliance processes (consistent with California Environmental Quality Act [CEQA] and, if applicable, the National Environmental Policy Act [NEPA]) will be used to evaluate the significance of project impacts. Under CEQA, impacts determined to be significant must be mitigated to a level of non-significance (unless the lead agency makes findings of overriding consideration). The IRWM Plan itself does not lead directly to the implementation of any specific project; as a result, the IRWM Plan is exempt from CEQA. The following provisions of the State CEQA Guidelines apply:

- Statutory Exemption (15262 for Feasibility and Planning Studies)
- Categorical Exemption (15306-Information Collection)

CEQA review associated with specific projects by relevant agencies will evaluate impacts in much greater detail than is given in the discussion below.

- **Aesthetics** – Projects that include construction activities and new infrastructure could affect aesthetics. However, projects will likely be constructed in areas that are already disturbed or include mitigation measures to return disturbed areas to their pre-construction conditions.

- **Air Quality** – Short-term air quality impacts could result from construction of Plan projects. However, through the CEQA process, potential air emissions would be minimized through application of best management practices (BMPs) identified by the air quality management district or other mitigation measures.

- **Biological Resources** – Short-term biological impacts could result from construction activities as well as non-native plant removal. Most of these negative effects would be avoided or minimized through mitigation efforts related to CEQA. Additionally, several of the IRWM Plan objectives focus on preservation and improvement of ecosystem health and would thus result in a net increase of benefits to biological resources.

- **Cultural Resources** – Impacts to cultural resources (historical, archeological, and paleontological resources) could result from construction of Plan projects. As part of the CEQA process, it will be necessary to develop mitigation measures to avoid or minimize any such impacts. In addition, participation of Tribes in the IRWM process could include informal consultation on projects that could impact cultural resources.

- **Geology and Soils** – Plan projects with the potential to impact geologic resources would be required to undergo geological feasibility studies, which would specify the appropriate engineering standards the contractor would have to comply with during construction to mitigate project site geological and soil impacts.

- **Hydrology and Water Quality** – Impacts to hydrology and water quality are anticipated to be generally beneficial because Plan projects are intended to improve water supply reliability and water quality in the long term. For short-term erosion or sedimentation, project-specific BMPs would be identified as part of the National Pollutant Discharge Elimination System (NPDES) or local permitting process.

- **Land Use and Planning** – The Plan projects were screened for their compatibility with other planning documents for the Region, including local and regional general plans. No significant land use changes or inconsistencies with policies are anticipated. In fact, collaboration between land use and water management agencies could reduce incompatibilities in the future.

- **Noise** – Noise impacts could result from construction activities from some of the proposed projects. However, through the CEQA process, most of these impacts would be minimized by mitigation efforts. No long-term noise impacts are expected.

- **Population and Housing** – No adverse impacts to population and housing are anticipated. Plan implementation would help to meet the water demands of the existing and anticipated future population.

- **Public Services and Utilities** – Many of the Plan projects are intended to enhance water supply and water quality and improve storm water and flood management. Such projects would benefit the utilities and service systems in the Region.

- **Recreation** – One of the Plan objectives is to preserve and enhance water-dependent recreation; recreation impacts are likely to be beneficial.

- **Transportation and Circulation** – Transportation and circulation could be temporarily impacted during construction of some of the Plan projects. Construction can temporarily increase traffic congestion because of transportation of equipment and trips by workers. Construction near roadways can result in temporary lane closures and detours. However, through the CEQA process, most of these activities would be avoided or minimized. No long-term transportation and circulation impacts are expected.

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Section 9: Implementation Framework

9.1 Introduction

This section documents the relationships and decision-making structure recommended for use during the continued development and implementation of the Yosemite-Mariposa Integrated Regional Water Management Plan (IRWM Plan or Plan) over the next 20 years. It also sets forward a proposed framework for Plan implementation and guidelines for performance monitoring to track progress, and it offers suggested initial Plan implementation activities. This section is intended to define the entity (or entities) that will implement the Plan, the responsibilities for Plan implementation and therefore serve as the cornerstone of actions the Region must take to continue the IRWM program into the future.

The governance structure recommendations included in this section are intended to be consistent with the Integrated Regional Water Management Guidelines for Proposition 84 and Proposition 1E (Guidelines) published by the California Department of Water Resources (DWR) in November 2012. The Guidelines require that the governance structure address the following:

- Public outreach and involvement processes*
- Effective decision making
- Balanced access and opportunity for participation in the IRWM process*
- Effective communication – both internal and external to the IRWM Region*
- Long-term implementation of the IRWM Plan*
- Coordination with neighboring IRWM efforts and state and federal agencies*
- The collaborative process(es) used to establish plan objectives (discussed in Section 5)
- How interim changes and formal changes to the IRWM Plan will be performed
- Updating or amending the IRWM Plan*

* The individual IRWM governance topics bulleted above are discussed in the sections that follow with items that are asterisked (*) the focus of the activities discussed in Section 9.2.

The Guidelines also describe that the IRWM Plan must also include:

> "The name of the Regional Water Management Group (RWMG) responsible for development and implementation of the Plan." A RWMG must meet the definition of the California Water Code (CWC) §10539, which states:
>
> > "RWMG means 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 those persons who may be necessary for the development and implementation of a plan that

meets the requirements of CWC §10540 and §10541, participates 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"

9.2 Existing Governance Structure

The existing Yosemite-Mariposa Region governance structure used for development of the IRWM Plan as described in Section 1.3 relies on a Memorandum of Understanding to form the RWMG, which is the primary governance entity. As described in the 2012 MOU found in Appendix 1-A, the Yosemite-Mariposa IRWM defines the RWMG as follows:

> "RWMG – Overall direction, funding and approval for the IRWM planning process and work products are provided by five bodies –Mariposa County Resource Conservation District (fiscal lead agency), Mariposa County (water purveyor), Mariposa Public Utility District (water purveyor) and two other organizational representatives* selected by the Regional Water Advisory Council (RWAC)."

* As of May 2014, the two other representatives are the Lake Don Pedro Community Services District and the Upper Merced River Watershed Council.

The MOU also created an advisory group known as the Regional Water Advisory Committee. Beyond the RWMG, the RWAC provides the Yosemite-Mariposa IRWM a broader base of community support which came together as:

> "community representatives [who] will identify regional water-management issues and needs; establish goals and objectives, plans and projects, and future funding and governance."

Many of the current RWAC members have been working together since 2009 to further the mission of IRWM under the leadership of several of the RWMG members which resulted in the selection for a Proposition 84, Round 2 Planning grant.

9.3 Recommended Governance Structure

Once the Yosemite-Mariposa IRWM Plan has been adopted the focus of the RWAC, who are the signatories to the MOU, and stakeholders will change significantly. Some of the activities conducted prior to and during Plan development will continue, but the emphasis will shift from planning toward implementation of projects and tracking of progress towards achievement of IRWM Plan objectives. Implementation of the Yosemite-Mariposa IRWM Plan will rely on actions taken by existing agencies and organizations within the Region, with the support of the IRWM governance structure.

In order to implement the Plan in an open and definitive way, each Region is required to develop a governance structure consistent with the Propositions 84 and 1E IRWM Guidelines. The guidelines state:

> "The IRWM Plan must document a governance structure that ensures the IRWM Plan will be updated and implemented beyond existing State grant programs."

The proposed governance structure was developed to reflect the discussions of the RWAC and stakeholders to provide a means for the Region to maintain functionality, encourage open participation in the Plan, and help assure the region's longevity and stability.

9.3.1 Organizational Structure and Function

The following provides the proposed governance model for consideration by the RWMG and RWAC. After consideration of potential alternative governance structures, it is proposed that the Region consider implementing a modified version of the current governance structure, utilizing an updated Memorandum of Understanding or similar document. The RWMG will be responsible for the bulk of decision leadership, management and administrative functions, while seeking input and guidance from the RWAC and other subcommittees as described in the following section. The recommendations in this section are not binding but are intended to provide guidance to the RWAC and other Plan participants.

9.3.2 Roles and Responsibilities

The stakeholders and the RWAC will need to work together to ensure successful Plan implementation. For this reason, each of the following groups will have varying roles and responsibilities, which must be clearly defined in the final adopted governance structure:

- Yosemite-Mariposa RWAC who are also MOU Signatories
- Yosemite-Mariposa RWMG, a sub-group of the RWAC
- Agency Partners who are non-voting members of the RWAC but whose missions are important to water management in the Region
- Interested Parties or IRWM Participants (non MOU signatories)
- Project Proponents must adopt the IRWM Plan to be included in a grant application and participate in RWAC. Project Proponents are strongly encouraged, but not required to sign the MOU and become RWAC members.
- As-needed sub-committees, committee(s), or working groups

It should be noted that individuals may participate in more than one group fulfilling different roles as needed.

While individual agencies within the Yosemite-Mariposa Region are responsible for implementing the projects that accomplish the objectives of the IRWM Plan, individuals within the RWAC will provide leadership for fostering cooperation, continuing coordination, tracking of Plan performance, and updating of the IRWM Plan through the participation of the RWMG, who are leaders in the IRWM program. This is similar to how the RWAC has been functioning since its inception. Stakeholders can also support the activities of the RWMG members through participation in Committees as well as attending and providing input at scheduled RWAC meetings.

Committees may be formed on an as-needed basis to help focus collaboration and progress on specific topics or objectives such as preparation of a collaborative grant application, integration of projects, or coordination of related activities. Some of the Committees may be “ad hoc” and only exist for a few meetings to accomplish a specific task, while others may be long lasting with regular reporting responsibilities to the broader RWAC. Section 1 describes the 9 committees that have come together during the life of the Y-M IRWM program.

The narrative that follows describes some of the specific roles and responsibilities of various participants involved in Plan implementation. Table 9-1 that follows summarizes the overall activities of IRWM Plan implementation with the identification of the RWMG/RWAC member that would lead the activity. IRWM Plan implementation is not intended to interfere with or supersede actions taken by local agencies to fulfill the local agencies’ authorized duties.

Table 9-1: Activities, Participants, and Roles for Implementing the Yosemite-Mariposa IRWM Plan

IRWM Activities	RWMG Role	RWAC Role	Committee Role	Project Proponents Role	Other/ Notes
1. Public outreach and involvement processes -					
a. Establish Point of Contact for IRWM Program		Support	Lead		
b. Maintain e-mail list		Support	Lead		both internal and external to the Region
c. Schedule and Announce meetings		Support	Lead		both internal and external to the Region
d. Prepare agendas and content		Support	Lead		
e. Facilitate meetings		Support	Lead		
f. Prepare meeting summaries		Support	Lead		
g. Administer website, and update content with meeting materials, and other relevant information		Support	Lead		both internal and external to the Region
2. Balanced access and opportunity for participation in the IRWM process					
a. Monitor and maintain DAC and Tribal Contacts list through Notification Prior to RWAC Meetings		Support	Lead		
3. Effective Communications External to The Region					
a. Communication External to the Region –		Support	Lead		See also 1
b. Coordination with neighboring IRWM efforts - Sierra Water Work Group and Madera, Tuolumne-Stanislaus, Merced, Inyo-Mono Region IRWMs		Support	Lead		See also 1
c. Coordination with state and federal agencies (e.g. RWQCB)			Lead and Report to RWMG/RWAC		

IRWM Activities	RWMG Role	RWAC Role	Committee Role	Project Proponents Role	Other/ Notes
4. Long-term implementation of the IRWM Plan					
a. Evaluate Plan Performance and Monitoring for Meeting Objectives		Support	Lead		
b. Review and act on objectives/targets not accounted for in projects		Support	Lead		
c. Gather and synthesize data related to Plan projects and report to stakeholders		Support	Lead		
d. Manage and share related data and information (also could be Data Management System)		Support	Lead		
5. Update Yosemite-Mariposa IRWM Plan					
a. Review and update objectives		Support	Lead		
b. Solicit new or revised/integrated projects, provide project evaluation/scoring and regularly revise project and update project priorities, as needed or at a minimum of every 2 years		Support	Lead	Support	
c. Review/Revise Plan content at least every 5 years	Support	Support	Lead	Support	RWMG to determine if Committee should be convened
6. Financing Plan Implementation					
a. Evaluate IRWM Plan Implementation Administration (e.g. Local Staff in-kind contributions, and/or grants, or other financial sources)	Lead	Support			
b. Communicate information on upcoming funding		Support	Lead		See also 1
c. Improve project integration and select projects for inclusion in grant applications		Support	Lead	Support	
d. Prepare and submit grant applications		Support	Support	Lead	

9.3.2.1 RWMG (Regional Water Management Group)

As described earlier, the RWMG is a group of three or more local agencies, at least two of which have statutory authority over water supply or water management. Within the Yosemite-Mariposa RWAC, Mariposa Public Utility District, Mariposa County Water Agency, Yosemite Alpine CSD and Lake Don Pedro CSD, all have statutory authority over water supply or water management. At least two of these agencies will formally join the RWMG thereby fulfilling this requirement. The primary function of the RWMG will be to provide core leadership necessary for IRWM Plan implementation and decision making for instances when the RWAC cannot resolve a certain topic.

9.3.2.2 RWAC (Regional Water Advisory Council)

The RWAC is a broader group of stakeholders where the majority of the activities necessary for IRWM Plan implementation will occur. RWAC membership requires signing the MOU and represents a spectrum of public agencies, special districts, non-profit organizations and

education institutions throughout the Region. All project proponents who apply for grants through the IRWM process are required to adopt the IRWM Plan.

9.3.2.3 Agency Partners

Yosemite-Mariposa IRWM Agency Partners include entities such as Federal or State agencies who manage natural resources in the Region, who attend RWAC meetings and who choose to participate in the Yosemite-Mariposa implementation activities but in a non-voting role.

9.3.2.4 Interested Parties

Yosemite-Mariposa IRWM Plan Interested Parties include members of the public, non-RWAC member community organizations and other stakeholders who can attend RWAC meetings and provide input during the public comment period of the meeting.

9.3.2.5 Project Proponents

Agencies or organizations who are implementing projects (including feasibility studies, data collection and analysis, etc.) are project proponents of the Plan. Projects included and tracked by the Yosemite-Mariposa IRWM Plan may include projects funded (in whole or in part) by IRWM grant funds, as well as projects and programs funded independently. Project proponents will be responsible for implementing the projects contained in the Yosemite-Mariposa IRWM Plan, must formally adopt the IRWM Plan if they become IRWM fund applicants and, if funded by IRWM grant funds, will be required to submit project specific monitoring information to inform progress towards achieving Plan objectives.

It is envisioned that the project proponents will have the following roles and responsibilities:

1. Provide project specific information for the regional project list maintained by the RWMG that may aid in advancing the Plan's regional objectives.

2. Seek opportunities to integrate, where possible and practical, and develop Plan projects in the list to most efficiently achieve the regional objectives. This process may be initiated and facilitated at stakeholder meetings, but it is expected that project proponents will further develop these opportunities outside of that forum.

3. Provide updated project specific information for the regional project list as necessary to reflect major project milestones (e.g., CEQA completion, 100% design, construction underway, construction complete, and project completion). This particular role is a critical element of Plan implementation and is in the best interest of the project proponents, since having updated information available will help projects when applying for financial assistance. This can also include adding or removing projects from the list and will occur at least every two years.

4. Identify a point person for each project who will provide, in a timely manner, requested information for projects for inclusion in a grant application.

5. Identify a point person for each project who will provide, in a timely manner, to the potential grantee, requested information for projects selected for funding through a funding agency.

6. Comply with grant requirements, as identified by the funding agency, to qualify for grant funding, including and not limited to formally adopting the IRWM Plan.

9.3.2.6 As-Needed Sub-committees, Committees, or Working Groups

Sub-Committees, Committees, and/or Working Groups, should it be decided one is needed by the RWAC, are comprised of a smaller group of stakeholders/participants or project proponents who provide leadership and focus on a more detailed project/program level toward coordination and cooperation on behalf of the RWAC. Any member of the RWAC is welcome to join a Committee but no subcommittee has the power to bind the RWAC unless agreed to in advance by decision of the RWAC. The various roles of a Committee could include:

- Coordinate preparation of grant funding applications.
- Conduct public outreach meetings to provide opportunities for discussion regarding Plan implementation and future updates or revisions to the Yosemite-Mariposa IRWM Plan.
- Improve collaboration efforts to support development of integrated, regionally focused projects.
- Review projects that have been submitted.
- Foster continued communication among stakeholders within the Region that support implementation of the Yosemite-Mariposa IRWM Plan.
- Assist project proponents in pursuit of grant funds to help implement projects included in the IRWM Plan.
- Promote, track and report on progress toward meeting the Plan objectives.
- Recommend process for updating or amending the Yosemite-Mariposa IRWM Plan.

9.3.3 Access and Opportunity for Participation

One of the most important aspects of Plan implementation is a process to ensure that the public and interested stakeholders continue to be involved. This will be accomplished through multiple avenues of communication and engagement among the RWAC and IRWM participants, including, at minimum, the following:

- The RWAC will conduct outreach, create content and facilitate at quarterly (minimum frequency) RWAC meetings. In addition, the RWAC will support any Committees that may be formed on separate topics. During the meetings, all MOU signatories are invited to participate as equals in the interaction to reach consensus on the implementation of the Plan.
- The RWAC will continue to foster dialog with Tribes and representatives of the Disadvantaged Communities (DAC) and environmental justice communities within the Region as needed to support meeting the objectives of the Plan. Extra contacts will be made prior to meetings to notify Tribal and DAC representatives of topics of interest.

The RWAC will e-mail and will post meeting materials and other relevant information to the program website and invite review and comment from any interested person or organization.

9.3.3.1 Internal and External Communication

As summarized in Table 8-1, multiple avenues of internal and external communication will be facilitated by the RWAC including:

- Prepare communication materials for distribution, posting on the project website, and for use in meetings with governing boards and other interested parties.
- Conduct meetings at least quarterly that are announced and open to any stakeholder.
- Ensure that individuals are assigned to meet and coordinate with neighboring IRWM planning efforts, other local, state, and federal agencies as they relate to accomplishing the objectives in the Yosemite-Mariposa IRWM Plan.
- Ensure that engagement occurs with neighboring IRWM efforts and other state and federal agencies that have interests or could impact meeting the objectives of the Plan. The RWAC will continue to communicate with DWR regional representatives.

9.3.3.2 Public Involvement Processes

All organizations and individuals with an interest in improving water management in the Region are invited to participate in Plan implementation. The RWAC recognizes that a committed public outreach and notification process is a necessary task to ensure the public is aware that there are multiple opportunities to become involved in the program. Disadvantaged Communities and Tribes will continue to be an important aspect of outreach in the Region. The public involvement processes to be completed by the RWAC include:

- Coordinate RWAC Input meetings at least four times per year to discuss relevant topics of progress on implementation of the Yosemite-Mariposa IRWM Plan. The RWAC may convene additional meetings as desired to support fulfilling the objectives of the Plan.
- Maintain and update content to the Yosemite-Mariposa IRWM Plan website.
- Maintain a contact e-mail and phone number for people to send comments or ask questions about the Yosemite-Mariposa IRWM Plan.
- Maintain the Yosemite-Mariposa stakeholder e-mail list and send updates and meeting invitations as appropriate.

9.3.4 Decision Making

Decisions during implementation will continue to be made using consensus based agreement, as during Plan development with matters considered by the entire RWAC. If for some reason broad agreement cannot be reached by 100% of the active members of the RWAC present, within a reasonable amount of time and effort, the matter will be referred to the RWMG for final decision with both majority and minority positions represented. Active participation means that the member has had a representative or alternative in attendance at half or more of the RWAC

meetings held within the last year. Additional details regarding decision-making are found in the current MOU which is found in Appendix 1-A. A revised MOU for IRWM Plan implementation was adopted on June 25, 2014 and is also included in Appendix 1-A.

9.4 Plan Financing

Implementation of an IRWM Plan is an enormous undertaking and requires the financial contributions and attention of local, state, and federal agencies to ensure success. Financing of this Yosemite-Mariposa IRWM Plan involves two distinct tracks: funding of IRWM Plan administration through local in-kind staff time and coordination and funding of project implementation. This section highlights the anticipated funding needs for both tracks, identifies potential funding sources, and documents some of the activities that the RWAC and others could employ to secure additional funding.

9.4.1 Funding Needs

9.4.1.1 Implementation Coordination Funding

Development of the IRWM Plan was funded by the RWAC and an IRWM Planning grant from the DWR. While these funds cannot be spent on implementation projects, IRWM implementation coordination may be supported in the near term, with supplement by local funds, if Planning grant funds remain. Implementation Coordination could include activities undertaken by the RWAC to plan and conduct stakeholder input meetings, track plan implementation (including progress towards completing plan objectives and projects), and conduct ongoing public outreach and engagement as described in the governance sections.

Following the completion and adoption of the IRWM Plan, the Yosemite-Mariposa IRWM anticipates continuing with the RWMG providing the leadership focus for IRWM Plan implementation.

- Members of the RWAC (and potentially other agencies/organizations within the Region) may provide in-kind services to fulfill the roles of the RWMG and administrative support.
- The RWAC may seek additional local and/or other funding to fulfill the activities required for Plan implementation.

9.4.1.2 Project Implementation Funding

As of March 2014, fifty-one projects are included in the IRWM Plan. All of the projects provided funding information, with a total estimated funding need of $ 99 million. Of the fifty-one projects, several are projects currently at the early planning or feasibility study stage, which is an indicator that the overall funding needs may increase as these projects progress and are developed into implementable projects, programs, or actions, and as other projects are added to the IRWM Plan. Table 9-2 summarizes financing needs and the availability of capital and operations and maintenance funding sources based on information provided by project proponents. It is recommended that this table be updated at a minimum every two years or as needed.

Table 9-2: Project Financing Summary

Project Number	Lead Agency Organization	Project Title	Approximate Cost	Funding Source	% of Total Cost of Funding Source	Funding Certainty/ Longevity	Subtotal Cost by Project Type
Fuels Reduction							
14	Mariposa Public Utility District	Stockton Creek Watershed Fuel Modification Project	$240,000	Unknown	4%	Unsecured	
25	Upper Merced River Watershed Council	Merced River Watershed Wildfire Fuel Reduction Project	$750,000	NRCS	47%	Unsecured	
39	USFS, Sierra National Forest, Bass Lake Ranger District	Sierra National Forest Bass Lake Ranger District Fuels Reduction Project - Rush Timber Sale, near Wawona	$1,733,000	Completed (20%); Under Contract (4%); KV/BD (3%)	27%	Secured	
40	USFS, Sierra National Forest, Bass Lake Ranger District	Sierra National Forest Bass Lake Ranger District Fuels Reduction Project -Hites-Feleciana Fuels Project, N of Mariposa Pines	$2,533,000	Federally appropriated funding	25%	Unsecured	
50	Mariposa County Resource Conservation District	Private Land Water Storage Improvement Assistance Project	$225,000	Natural Resources Conservation Service and other partners; sale of soil and other sources	44%	$25,000 secured; $75,000 unsecured	**$5,481,000**
Other							
12	Economic Development Corporation	Mariposa Biomass / Biochar Facility	$5,000,000	None	0%	N/A	
34	Mariposa Resource Conservation District	Drought Preparedness for Landowners and Residents	$86,250	MCRCD/Local government	13%	Unsecured	
35	Mariposa County Resource Conservation District	Water & Energy Efficiency Incentives Assistance Program	$645,000	Unknown	3%	Unsecured	**$5,731,250**
Recreation							
17	Merced Irrigation District	Lake McClure Area Recreation Enhancements	$332,300	None	0%	N/A	**$332,300**

Project Number	Lead Agency Organization	Project Title	Approximate Cost	Funding Source	% of Total Cost of Funding Source	Funding Certainty/ Longevity	Subtotal Cost by Project Type
Restoration							
18	Point Blue Conservation Science	Rangeland Watershed Initiative Partner Biologist	$180,000	NRCS	50%	Secured	
28	Sierra Foothill Conservancy	Bean Creek Meadow Restoration	$372,000	American Rivers (5%); Tuolumne County (35%); Pulvino Foundation (6%)	46%	Secured	
29	Sierra Foothill Conservancy	Conservation Easement	$2,000,000	Landowner and SFC	25%	Unsecured	
30	Sierra Foothill Conservancy	Conservation Planning, Phase 2	$50,000	Unknown	30%	Unsecured	
31	Sierra Foothill Conservancy	Stockton Creek Preserve Expansion	$1,500,000	CalTrans EEMP Grant	20%	Unsecured	
33	Mariposa Resource Conservation District (MCRCD)	Invasive Plant Species education and eradication	$600,000	MCRCD, Co Government	13%	Secured	
36	Yosemite Area Audubon Society	Mariposa Creek Parkway Extensions	$932,000	None	0%	N/A	
43	American Indian Council of Mariposa County	Mariposa Creek Native Plants Restoration and Education Project	$87,240	Volunteer labor	7%	Secured	
44	American Indian Council of Mariposa County	Invasive Plant Eradication/Native Plant Enhancement, Wawona, Yosemite NP	$81,200	NPS	53%	Unsecured	**$5,802,440**

Project Number	Lead Agency Organization	Project Title	Approximate Cost	Funding Source	% of Total Cost of Funding Source	Funding Certainty/ Longevity	Subtotal Cost by Project Type
Wastewater Infrastructure							
4	County of Mariposa	Replace Sewage Collection Piping in Yosemite West Subdivision	$2,500,000	Bonds	23%	Secured	
6	County of Mariposa	Expansion and Repair of Leachfields in the Yosemite West Subdivision	$1,220,000	Existing Sewer Rates	25%	Unsecured	
7	County of Mariposa	Construct a seepage collection and metering tank at the Lake Don Pedro Sewage Treatment Plant	$400,000	None	0%	N/A	
8	County of Mariposa	Repairs and upgrades to Lake Don Pedro Wastewater Treatment System	$2,200,000	Existing Sewer Rates	0%	Unsecured	
9	County of Mariposa	Install back-up power at Mariposa Pines Sewage Treatment Plant	$225,000	Existing Sewer Rates	25%	Unsecured	
11	County of Mariposa	Replace Sewage Collection Piping in Coulterville	$2,200,000	None	0%	N/A	
15	Mariposa Public Utility District	Mariposa PUD Waste Water Treatment Facility Improvements	$7,300,000	State Revolving fund/ Clean Water Grants/USAD Rural Development	0%	Unsecured	
27	National Park Service/Yosemite National Park	Rehabilitate The Wawona Wastewater Treatment Plant	$24,000,000	NPS	0%	Unsecured	
41	To be determined. Anticipate National Park Service, Yosemite National Park	Wawona Water Supply and Wastewater Treatment Projects	$0	None	0%	N/A	
51	Mariposa Public Utility District (MPUD)	Waste Water Collection System Improvements	$3,924,000	None	0%	N/A	**$43,969,000**

Project Number	Lead Agency Organization	Project Title	Approximate Cost	Funding Source	% of Total Cost of Funding Source	Funding Certainty/ Longevity	Subtotal Cost by Project Type
Water Infrastructure							
1	County of Mariposa	Replace Water Distribution Piping in Yosemite West Subdivision	$2,900,000	Bonds	25%	Secured	
2	County of Mariposa	Develop Second Water Source for the Coulterville community	$700,000	None	0%	N/A	
3	County of Mariposa	Water Treatment for Arsenic Exceedance	$500,000	Budgeted funds	20%	Unsecured	
5	County of Mariposa	Develop Second Water Source for Yosemite West Subdivision	$1,600,000	Bonds	25%	Unsecured	
10	County of Mariposa	Replace Water Distribution Piping in Coulterville	$1,480,000	Customer rate increase	0%	Unsecured	
13	Lake Don Pedro Community Services District	Lake McClure Deep Water Intake Feasibility Study	$30,000	Capital reserves	25%	Secured	
16	MARIPOSA PUBLIC UTILITY DISTRICT	Saxon Creek Pump Station Access and Ventilation System Improvements	$150,000	None	0%	N/A	
19	Lake Don Pedro Community Services District	Dead End Main Replacement Project	$6,500,000	Capital reserves	25%	Secured	
20	Lake Don Pedro Community Services District	Lake McClure Intake Improvement Project Phase III	$700,000	Capital reserves	29%	Secured	
21	Lake Don Pedro Community Services District	Water Service Replacement Project	$3,750,000	Capital reserves	25%	Secured	
22	Lake Don Pedro Community Services District	Treatment Plant Pump Replacement Project	$100,000	Capital reserves	25%	Secured	
23	Lake Don Pedro Community Services District	New potable water well	$125,000	Capital reserves	20%	Secured	

Project Number	Lead Agency Organization	Project Title	Approximate Cost	Funding Source	% of Total Cost of Funding Source	Funding Certainty/ Longevity	Subtotal Cost by Project Type
26	National Park Service/Yosemite National Park	Supplement Wawona Water System with Biledo Spring	$17,000,000	NPS	0%	Unsecured	
32	PONDEROSA BASIN MUTUAL WATER COMPANY (PBMWC)	Rural Water Company Infrastructure Rehabilitation	$600,000	Capital reserves	3%	Secured	
37	Yosemite Alpine Community Services District	Water Meter Replacement	$50,000	None	0%	N/A	
38	Yosemite Alpine Community Services District	DRILL WELL on Yosemite Mtn. Ranch TPZ and pipe water to NEW TANKS.	$500,000	Fish Camp Fire Rescue	40%	Secured	
42	American Indian Council of Mariposa County	Bear Creek Tribal Water Storage Project	$90,500	None	0%	N/A	
45	Fish Camp Volunteer Fire Association	Drought/Fire Storage with additional wells with distribution pipelines and hydrants	$591,000	Capital reserves	34%	Secured	
46	Mariposa Pines Water Company	Sounding Tube Installation	$2,500	Capital reserves	10%	Secured	
47	Mariposa Pines Water Company	Tank 1 Replacement	$40,000	None	0%	N/A	
48	Mariposa Pines Water Company	Hazardous Tree and Brush Removal from Right-of-ways and Improvements	$160,000	None	0%	N/A	
49	Mariposa Pines Water Company	Install Power and Telephone Lines (for internet) to Water Tanks	$50,000	None	0%	N/A	**$37,619,000**
24	Upper Merced River Watershed Council (UMRWC)	Water Quality Monitoring Bioassessment in Upper Merced River Watershed	$25,000	In-kind	40%	Unsecured	**$25,000**
						Total	**$ 98,959,990**

9.4.2 Potential Funding Sources

9.4.2.1 Stakeholder Funding

Funding sources are rarely assured far in advance of project implementation. Additionally, many agencies have encountered challenges to securing project funding as grant programs have become more competitive and agency budgets have become significantly constrained during the recent economic downturn. It is understood that funding is required to implement (that is, to construct) projects, as well as operate and maintain the project after initial construction is completed. In most cases, it will be the responsibility of the project proponents to ensure that initial construction and operations and maintenance funding needs are met for specific projects. Despite limited funds, most agencies do have a variety of funding tools available including:

- Ratepayers,
- Operating funds,
- Water enterprise funds,
- Special taxes, assessments, and fees,
- State or federal grants and loans,
- Private loans, and
- Local bonds.

9.4.2.2 Grants and Other Sources

The RWAC will research, identify and pursue grant funds that could help implement the projects and meet the objectives included in the Yosemite-Mariposa IRWM Plan. A list of potential grant opportunities are located on the website and will be updated periodically (http://www.mcrcd.net/Pages/IRWMFunding.aspx). The RWAC will not serve as a fiscal agent for grant funds, but rather will identify a willing agency or organization with the appropriate authority and financial management capacity to serve as a fiscal agent on behalf of the Region, as necessary, for each specific grant opportunity that is pursued. Some grant programs may require a single grantee for a Region while others can be applied for by individual member agencies.

The fiscal agent(s) may distribute grant funds to other project proponents within the Region according to the specific terms of the grant program that provides funds. The project proponents that receive grant funds will be responsible to complete their project(s) as described in the relevant grant application and/or grant agreement. The fiscal agent will not be responsible to fund or complete projects for other project proponents outside of the specific commitments made in a particular grant agreement.

The RWAC will track the amount of grant funds brought into the Region to support implementation of the IRWM Plan and the specific projects being funded (or partially funded) with grant funds. The RWAC will include this information in their annual report of Plan performance.

9.5 Plan Performance and Monitoring

Another important element of successful Plan implementation is a well-developed approach to performance and monitoring. This section describes such an approach, including monitoring, adjustments, and data sharing in order to meet the 2012 IRWM Guidelines. The key elements of plan performance and monitoring involve tracking of project implementation and progress towards achieving goals and the individual objectives. This tracking will be monitored in a Data Management System described in the following section and will provide key information to inform the RWAC and stakeholders as to whether the Plan is being implemented as intended, or whether updates or other changes are needed to keep the Plan on track.

The tracking and monitoring of plan performance does not replace required regulatory reporting by specific agencies within the Region or project monitoring required by a grant agreement. Plan performance tracking is being done to monitor progress on Plan implementation and provide information that can be useful for continuing implementation of, updating or amending the Plan.

9.5.1 Project-Focused Performance Monitoring

Project implementation will be tracked as part of the IRWM Plan Implementation activities included in the Table 9-1 topic area: Update IRWM Plan and Manage and Share Related Data and Information. It is expected that project implementation tracking will include:

- Every two-year (minimum) call for new/revised projects.
- Update of status of the existing project list including project archival following completion of projects every two years.
- Monitoring of in-progress project performance including project status, data results, budget and schedule.
- Consideration of opportunities to integrate or enhance existing projects.

Information about projects can be maintained in an excel spreadsheet or on the Data Management System described further in Section 9.4.3. It is anticipated that the RWAC will have primary responsibility for maintaining information regarding project focused monitoring sufficient for the IRWM Plan and will periodically request current project status information from proponents.

Table 9-3 outlines several considerations for monitoring efforts as articulated in the Proposition 84/1E guidelines (required for Proposition 84/1E grant-funded projects and recommended for all other projects in the Plan) for purposes of this Plan:

Table 9-3: Project Specific Monitoring Plans

Category	Description
Responsibility for developing project specific monitoring plans and monitoring activities	Project proponent responsibilities include development of project specific monitoring plans and monitoring of project performance after implementation. Project proponents shall report this information to the RWAC and to any lead agency responsible for grant or loan funding contributions.
Stage of project development when a project specific monitoring plan will be prepared	Project specific monitoring plans will be developed by the project proponent before the start of project implementation.
Typical project specific monitoring plan requirements	Monitoring plans will include delineation of the following components: ▪ Description of what will be monitored for each project, ▪ Methods for monitoring problems that occur during project implementation and their correction, ▪ Monitoring location(s), ▪ Monitoring frequency, ▪ Monitoring protocols, procedures, and responsibilities, ▪ Reporting of data collected to the data management system (DMS) described in Section 9.4.2 for sharing with project stakeholders as well as to statewide databases, and ▪ Procedures and funding assurances to document that the monitoring will take place as intended during the entire monitoring period.

Lessons learned will be applied to future project implementation by evaluating the extent to which the Plan objectives and targets are accomplished, and reviewing and refining the types of projects or targets themselves based on the various experiences. For example, technical information and data collected will contribute to a greater body of understanding about certain challenges faced by the Region. Likewise, financial performance and reporting experiences will help inform more efficient ways of planning and implementing important projects. These experiences will be shared through the quarterly interactions with the RWAC and stakeholders, and through project reporting mechanisms.

9.5.2 Objectives Focused Performance Monitoring

For the RWAC, the tracking of Plan Goals and Objectives and the associated measurable strategies will require more effort and coordination than tracking of IRWM Plan projects. The Objectives Tracking table found in Appendix 9-A was created in Excel and focuses on individual strategies. The table identifies the projects that can contribute to meeting the strategies and where appropriate, identifies specific activities or projects that may be needed to achieve the strategies and is sorted by goal, objective, strategy. The activities and dates are suggested and can and should be periodically reviewed and updated by the RWAC. The data associated with this table could also be maintained in the Data Management System.

9.5.3 Data Management

Although the RWAC is not intending to develop a Data Management System (DMS) to help retain, organize and process key Plan performance and monitoring data, opportunities to do so may be available in the near future as the Sierra Water Workgroup is endeavoring to provide interregional data management for the IRWMs in the Sierra Nevada. A data management system provides a web-based geographic information system (GIS) platform which can be used to store and track information to support the Region's understanding of water management activities within the IRWM context. A DMS can assist in the success of Plan implementation, and whether adjustments to objectives, projects, or strategies may be needed in the future.

As data are collected, whether linked to implementation grant programs or other funding mechanisms, there are typically reporting requirements. Many water resources linked efforts are also attached to mandatory regulatory reporting requirements to statewide databases. To make data from the Region accessible and compatible with State databases (such as SWAMP, Geotracker, GAMA, CEDEC, the California Water Data Library and many others – links are provided in Appendix 9-B-1), the RWAC can ask implementation projects to document the nature of the data being collected (parameters, units), the timeframe associated with the data, and the location associated with the data. A future Yosemite-Mariposa DMS is not intended to supersede or duplicate the statewide data collection efforts, but instead work together with the databases as resources to draw important information.

9.5.3.1 Data Management System

An on-line DMS relies on a combination of systems such as GIS, spreadsheets, and databases to track important Plan information. The DMS is a hybrid solution and provides a user friendly ESRI-software based GIS front-end interface that is supported by databases and spreadsheets for specific data. A DMS could include the following features which were used in preparing mapping for this IRWM Plan:

- Topographic Base map with layers for water organization boundaries, watershed boundaries with rivers and lakes, DAC areas, Tribal lands (partial), 303d listed streams and water bodies, watersheds, General Plan and DWR Land Use classifications
- Production of custom maps with available information
- Project Locations
- IRWM Projects and project information forms
- Flood hazard areas
- Hydrologic and other types of models
- Document library and document search tool
- Reference documents
- Plan sections when complete

- Project and objective tracking tables

Other DMS Elements that could be included are:

- Water quality data for surface and groundwater to either be hosted directly within or live-linked to other web sources

- Water quantity data through live links with gauging stations, meter data, flow data, and diversion data

- Water rights data

- Project Tracking Database. A future DMS phase could include an on-line database which will require an administrator to manage and add the projects. A sample tracking table is found in Appendix 9-C. The spreadsheet will track information including:
  - Project name
  - Project proponent
  - Project location
  - Short description
  - Estimated cost and funding sources (such as Proposition 84/1E funded)
  - Project schedule and current status
  - Type and location of project specific monitoring information
  - Objectives and MPTs the project will contribute to

- Objectives Tracking database- Similar to the project tracking database, this would be an on-line database specifically for periodic updating (likely biannual with project updates) and evaluation of progress with meeting IRWM Plan objectives. A tracking spreadsheet will be developed as described in Section 9.4.2 and is included in Appendix 9-A to this Plan as a first level tracking effort.

- Maintenance of list of updated links to stakeholders, state and federal agencies and neighboring IRWMs (links are provided in Appendix 9-B-2).

9.5.3.2 Potential Long-Term Data Management Options

As noted earlier, discussions have been initiated with both the Sierra Water Workgroup as well as other Sierra IRWMs that may resolve both long-term maintenance concerns and to have the DMS be potentially more broadly available to other IRWMs. These will be resolved and specific actions documented in an appendix to be added to the IRWM Plan. Potential DMS options and opportunities to further enhance the DMS in the future that should be considered are summarized below.

Options under discussion include:

i. Partnerships with the Sierra Nevada Alliance or neighboring IRWM with DMS Hardware and Software for DMS hosting

ii. Partnerships with Sierra Water Work Group (SWWG) for maintenance

iii. Partnerships with other Sierra IRWM Groups to contribute DMS data for sharing
   a. Upper Feather IRWM
   b. Tuolumne-Stanislaus IRWM
   c. Cosumnes, American, Bear and Yuba IRWM
   d. Southern Sierra IRWM
   e. Inyo-Mono IRWM (potential partner for pilot DMS development)
   f. Tahoe Sierra IRWM (potential partner for pilot DMS development)
   g. Mokelumne/Amador/Calaveras (MAC) IRWM
   h. Upper Pit River Watershed IRWM
   i. Madera IRWM
   j. Yuba County IRWM
   k. Lahontan Basins IRWM

9.6 Suggested Initial Steps for Plan Implementation

In order to bring focus to the specific implementation action recommendations described in Table 9-2, the following near-term activities and schedules are suggested as shown in Table 9-4.

Table 9-4: IRWM Plan Near-Term Implementation Activities and Schedule

Activity/Action	Lead Entity	Planned Schedule
1. Establish an annual operating mechanism (RWMG) for implementation support and manage expenditures of administration support activities.	RWAC	By September 2014
2. Convene Plan Implementation Meetings to develop proposed meeting schedule for 2015 and 2016. It is suggested that at minimum one Plan implementation meeting be held per year.	RWMG	Schedule 2015 and 2016 meetings
3. Explore long-term DMS plan and pilot DMS for transition and maintenance by partner.	RWAC/Partner	By December 2014
4. Issue a Call for Projects to add, delete, or integrate existing projects and project status updates.	RWMG	By February 2015
5. Prepare for applying for 2015 DWR Implementation Grant funds and other grant funding opportunities.	Committee	By Fall 2015
6. Coordinate with neighboring IRWM regions and local, state and federal agencies.	RWAC	On-going - annually

9.7 Plan Updates and Changes

9.7.1 Making Changes to the IRWM Plan

The RWAC will convene a Committee to review the Yosemite-Mariposa IRWM Plan at least once every five years to determine if the content of the Plan needs to be changed in a significant way other than the periodic updates or amendments of the objectives and projects as described below. If significant changes are needed, the RWAC will lead the process for revising the Plan. Once substantial revisions are made, the RWAC will request that RWMG, RWAC members and project proponents adopt the revised Plan.

9.7.2 Updating and Amending the IRWM Plan

Minor updates or amendments to the IRWM Plan will not require a complete re-adoption of the entire IRWM Plan by the RWMG or individual RWAC members. Instead specific changes will be submitted to the RWAC for consideration to adopt as an amendment to the existing Plan. Updates or amendments specifically include changes to the project lists and refinements to the IRWM Plan objectives.

The RWAC will invite stakeholders and project proponents at least once every two years to submit additional projects for consideration to be included in the IRWM Plan or provide updates to projects already included in the IRWM Plan. The RWAC will publicize the opportunity and process to submit new projects (or updates) for consideration. The RWAC will present and discuss the potential additions/revisions to the project list within the Yosemite-Mariposa IRWM Plan in one or more stakeholder input meetings, and recommend the project list and/or objective refinement for inclusion in the Plan as an amendment. Following acceptance of the addition/revisions to the project list by the RWAC, adoption of IRWM Plan amendment may be required on a case by case basis by individual project proponents to meet requirements of the IRWM Guidelines or individual proposal solicitation packages.

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Section 10: Coordination

As described in previous sections of this IRWM Plan, management of water and related resources within the Yosemite-Mariposa Region (Region) is complex and has many interdependencies. Several stakeholder groups both have authorities and responsibilities for managing water and related resources within the Region. This complexity and the distributed network of shared responsibilities create the need for robust and effective coordination. This section describes how the Region intends to continue to coordinate with neighboring IRWM regions and local, state, and federal agencies as well as other stakeholders both within and outside of the Region to improve integrated water management.

Coordination is one of the most essential components of integrated regional water management, and subsequently is described in several sections of this Plan, summarized below.

- Section 1, "Introduction," discusses the stakeholder coordination and public outreach activities that were conducted during the development of the Plan, including outreach to tribal entities and disadvantaged communities (DACs).

- Section 4, "Relation to Local Water and Land Use Planning" describes how water management relates to land use planning and ways that planning agencies currently collaborate.

- Section 5, "Objectives" describes Plan goals and objectives that consider coordination such as:

  Goal #6: Develop Collaborative Sustainable Partnerships Both Within and in Adjacent Regions with associated *Objective: R Develop opportunities/data management system…*

  which targets the use of current scientific data to make informed, collaborative choices regarding water resources and land use planning. The goals/objectives were developed to ensure continuing communication and collaboration within the Region into the future.

- Section 9, "Implementation Framework," describes the specific responsibilities of the Regional Water Management Group (RWMG), Regional Water Advisory Council (RWAC), and other stakeholders for coordination during Plan implementation.

10.1 Intra-Regional Coordination

The primary benefit of this IRWM Plan is the development of a shared vision and objectives for regional water management and planning among the stakeholders both within and outside of the Region and a framework for maintaining that into the future. The process of developing this IRWM Plan has fostered improved coordination, collaboration, and communication among stakeholders, and a greater awareness of concerns throughout the Region.

10.1.1 Coordination by the RWAC

One of the critical ingredients for improving water resources management is to provide multiple opportunities for water managers, community stakeholders, and other organizations with interests related to water resources to be informed about and participate in the IRWM program. A structured approach to coordination helps prevent conflicts and can help provide more effective and efficient management of resources. The Region is committed to fostering improved coordination through the following activities which are detailed in Section 9.2:

- Continue to conduct outreach, create and distribute meeting agendas and content by e-mail and web posting, facilitate stakeholder input meetings, and help track and communicate progress toward Plan implementation. During the RWAC meetings all people who are interested have been and will continue to be invited to participate in a collaborative approach to implement projects that help meet Plan objectives. Success of the Plan is dependent on the contributions of stakeholders throughout the Region.

- Continue to foster an open dialog with representatives of Native American Tribes and DACs within the Region to help meet Plan objectives. Coordination efforts including focused attention during regular RWAC meetings as well as Outreach Committee activities will continue in order to identify issues and continue to find assistance in the development of projects specific to water-related needs of these groups.

- Continue to conduct stakeholder input meetings as needed, which will be announced and open to any interested person or organization. The RWMG and other stakeholders will meet and coordinate with local, state, and federal agencies, in addition to reaching out to those active in neighboring IRWM planning efforts to accomplish the Plan objectives.

- Continue to use the IRWM Plan webpage (http://www.mcrcd.net/Pages/IRWMP.aspx) to provide current information on the IRWM process as well as ongoing opportunities for stakeholder involvement during Plan implementation. This will include posting the status of proposed projects, providing notice of stakeholder meetings, and providing notices for coordination and evaluation of ongoing and future project needs.

10.1.2 Coordination among Local Agencies and Organizations

A collaborative approach to water management is essential to meeting the Region's goals. Several projects included in this Plan, as described in Section 7, involve multiple agencies or organizations, which reinforces the need for collaboration to achieve efficient project execution. Several of the local water management agencies such as Mariposa County, Fish Camp Fire and Rescue, Yosemite Alpine Community Services District within the Region have developed cooperative relationships and processes for coordination with each other and with other local organizations. An example of this cooperation can be seen in their willingness to share sensitive information regarding issues common to many of the water providers such as water metering, leakages, and current drought response.

Some of those relationships have been strengthened during the development of this Plan and through the RWAC activities and meetings, it is anticipated that opportunities for future collaboration and coordination will occur. Some examples of collaboration include coordination of forest fuel management activities between non-profit organizations, local, state, and federal

agencies and coordination between local residents and the National Park Service for expansion of water service in the Wawona area. Additionally, through the IRWM process, land and water management agencies in the Region have taken steps towards improved understanding, which can result in better collaboration regarding regional water management issues. These strong working relationships serve as a basis for local water managers and other organizations to continue to collaborate in the future.

10.1.3 Coordination with State and Federal Agencies

Coordination with state and federal agencies has occurred during the initial formation of the Region and during Plan preparation. In the future, coordination with these agencies will occur on an as-needed basis for planning and implementation of specific projects and during future Plan updates.

Representatives from the following federal and state organizations received emails and notifications related to RWAC meetings, opportunities to submit projects, and opportunities to review and comment on IRWM Plan sections, and/or are cooperating on a Plan project.

<u>Federal</u>

- U.S. Bureau of Land Management
- U.S. Department of Agriculture Natural Resources Conservation Service
- U.S. Forest Service
- U.S. National Park Service

<u>State</u>

- Department of Fish and Wildlife
- Department of Forestry and Fire Protection
- Department of Water Resources (DWR)
- Sierra Nevada Conservancy
- Office of Emergency Services
- University of California, Merced – Sierra Nevada Research Institute

While the majority of Plan projects were submitted by local entities, the National Park Service and US Forest Service, which are federal agencies, submitted several projects as well. Additionally, several of the Plan projects listed at least one cooperating state or federal agency. With the presence of Yosemite National Park and extensive lands within National Forests within the Region, coordination with all of these entities is an important component in the IRWM planning process and may improve the understanding of the interrelationship between groundwater and surface water, forest, land use, water use efficiency, and economic and urban objectives.

Much of the Region's future interaction with state and federal agencies will also occur during project planning and implementation, when consultation will occur during planning stages, environmental document preparation and permitting prior to construction as well as preparation of funding applications.

10.2 Interregional Coordination

Beyond the need for internal coordination, the Region also recognizes the importance of coordination with other nearby IRWM planning regions. Appropriate coordination among regions and agencies can help leverage shared activities, identify opportunities for cooperative projects, and reduce potential conflicts among IRWM projects. The Region is bounded by several neighboring IRWM regions, as discussed in Section 1, and is one of twelve IRWM regions in the San Joaquin funding area. The Sacramento funding area borders the Region to the North, the North/South Lahontan funding area borders the Region to the east, and the Tulare/Kern funding area borders the Region to the South.

Initial outreach efforts have been conducted as part of the IRWM planning process to foster communication and program coordination with the neighboring IRWM regions, described below, through discussions, conversations and direct participation. Representatives of the adjacent IRWM regions or organizations that participate in multiple IRWM groups receive e-mail notifications regarding information about the Region and potential coordination opportunities.

Members of the RWAC, with support from other stakeholders in the Region, will engage with neighboring IRWM regional water management groups, described below, and communicate with DWR on statewide IRWM issues that involve or could impact Plan objectives. The neighboring IRWM regions and associated interregional coordination activities with the Region are summarized in the sections that follow.

10.2.1 Neighboring IRWMs

The Tuolumne-Stanislaus IRWM borders the Region to the North, the Merced IRWM borders the Region to the West, the Madera IRWM borders the Region to the South, East Stanislaus IRWM share a small border to the Northeast, and the Inyo-Mono IRWM in the North/South Lahontan funding area borders the Region to the East. These neighboring IRWMs are shown on Figure 1-2 in Section 1.

Tuolumne-Stanislaus (http://www.tcrcd.org/): The Tuolumne-Stanislaus region borders the northern and eastern borders of the Yosemite-Mariposa Region and lies along the southern tip of the Tahoe-Sierra Region border in Alpine County. The Tuolumne-Stanislaus region is on the western side of the Sierra Nevada and extends from the crest, through the foothills, and down to the Central Valley. Primary sources of water in the Tuolumne-Stanislaus region include large river watersheds fed by snowmelt and rainfall from the Sierra Nevada. The Tuolumne-Stanislaus IRWM Plan was completed in mid-2013 and the Tuolumne-Stanislaus region is now implementing a Round 2 Implementation grant. The Tuolumne-Stanislaus IRWM has been contacted regarding governance options and data management systems and IRWM projects were evaluated for potential coordination.

Merced (http://mercedirwmp.org/): The Merced region is east of the San Joaquin River and borders the Yosemite-Mariposa Region to the southwest. The Merced River flows through the Yosemite-Mariposa Region prior to reaching the Merced region. However, stakeholders within the Merced region have the majority of water rights to the Merced River compared to water rights users in the Yosemite-Mariposa Region. The Merced region is primarily defined by the Merced Groundwater Basin and parts of the Merced River Watershed. The final Merced IRWM Plan was completed in August 2013. Merced River stakeholders from the Merced region are

currently involved in the Yosemite-Mariposa IRWM Plan and the Merced Irrigation District is a RWAC member. Merced IRWM projects were evaluated for potential coordination

Madera (http://www.madera-county.com/index.php/forms-and-documents/category/167-the-integrated-regional-water-management-plan-irwmp): The Madera region shares the southern border with the Yosemite-Mariposa Region, which are the headwaters of the Fresno/Chowchilla River. The Madera region has typically relied on groundwater as their primary source of urban and agricultural water in the past. The Madera region faces challenges related to groundwater overdraft and flooding in the western third of the region (valley floor). The Madera region has a similar composition of terrain to that of the Yosemite-Mariposa Region; part of the region is composed of foothills and mountains of the Sierra Nevada while the other portion is composed of relatively flat terrain, typical of the Central Valley. The Madera region IRWM Plan was completed in 2008 and Madera IRWM representatives attended several RWAC meetings and Madera IRWM projects were evaluated for potential coordination.

East Stanislaus (http://www.eaststanirwm.org/): The East Stanislaus region is west of the Yosemite-Mariposa Region and is a part of the larger San Joaquin River Basin. The southeast corner of the East Stanislaus region and the northwest corner of the Yosemite-Mariposa have shared borders. Of the surrounding regions, the East Stanislaus region shares the smallest length of border with the Yosemite-Mariposa Region relative to the Merced, Madera, and Tuolumne-Stanislaus regions. Similar to other Central Valley regions, East Stanislaus faces challenges regarding agricultural and urban demands. The East Stanislaus region IRWM Plan was completed in December 2013. Involvement with the East Stanislaus IRWM has been limited to contacts regarding plan status and evaluation of IRWM projects for potential coordination.

Inyo-Mono (http://inyo-monowater.org/): While the Inyo-Mono IRWM is in a different funding area than the Yosemite-Mariposa IRWM, they share the crest of the Sierra-Nevada and a portion of Yosemite National Park in the northern portion of the Inyo-Mono IRWM. There are several commonalities between the Regions including the high-sierra terrain, sparse population, and large proportion of federal lands. An Inyo-Mono representative attended a Yosemite-Mariposa RWAC meeting and led a subsequent DAC discussion with Mariposa, Merced and Madera representatives.

10.2.2 Ideal Project Types for Coordination and Integration

Neighboring regions have several similar projects to the Yosemite-Mariposa Region, ranging from riparian restoration to water infrastructure improvements. Project data have been collected from the neighboring regions' IRWM Plans. While many projects have the potential to be integrated and coordinated, some types are considerably more difficult to coordinate. Constraints such as schedules (time), budgets, geographic locations, and applicability can cause complications. Water infrastructure and restoration projects are subject to these constraints.

Other project types that involve programs and plans, studies, and data collection are significantly easier to coordinate. These projects are not as sensitive to constraints mentioned above, and tend to be on-going, making it easier to integrate without greatly disrupting existing implementation practices. Additionally, these projects may span a larger region than can be

practically covered for an infrastructure project. Below is a list of suggested projects that have potential to be integrated with the Yosemite-Mariposa Region's projects.

Madera Region

- Ultra-Low Flush Toilet Replacement Program

Merced Region

- Main Canal Off-stream Regulating Reservoir Study
- Water Meter Conversion Project
- Water Meter Project for Le Grand CSD
- Modify Land use Designations
- Develop Emergency Response Plans
- Increase Public Awareness of Flooding
- Merced Region Water Use Efficiency Program
- Merced IRWM Region Climate Change Modeling
- Merced IRWM Regional GHG Emissions Inventory
- Promote LID Concepts and Professional Training
- Tablet PC's for GIS Data Collection for Water Staff
- Water Education and Public Education
- Merced River Education and Enhancement Project

Tuolumne-Stanislaus Region

- Mi-Wok Complex Thinning, Murphy Ranch Area
- In-Home Water Conservation for the DAC

East Stanislaus Region

- DAC & Native American Outreach and Technical Assistance
- Online Data Management System

References

BLM. 2013a. BLM Starts Additional Fire Restrictions in Mariposa County. United States Department of the Interior, Bureau of Land Management. June 28, 2013. http://www.blm.gov/ca/st/en/info/newsroom/2013/june/mariposacountyfirerestrictions.html.

BLM. 2013b. Surprise Valley Fire Station. United States Department of the Interior, Bureau of Land Management. April 29, 2013. http://www.blm.gov/ca/st/en/fo/surprise/fire_brochure.html.

BOE. 2013. Fire Prevention Fee. California State Board of Equalization. http://www.boe.ca.gov/sptaxprog/fire_prev_fee.htm.

Cal Fire. 2013. Fire Safety Education. California Department of Forestry and Fire Protection. November 2013. http://calfire.ca.gov/communications/communications_firesafety.php.

CDEC. 2013. California Data Exchange Center. Department of Water Resources. http://cdec.water.ca.gov/.

CDFW. 2014. Special Vascular Plants, Bryophytes, and Lichens List. California Department of Fish and Wildlife, Natural Diversity Database. April 2014.

CDFW. 2013. Sierra Nevada Foothills Wildlife Connectivity Modeling Project Goals and Objectives. California Department of Fish and Wildlife. April 2013.

CDPH. 2013. Drinking Water Branch - Water System Details. California Department of Public Health. http://drinc.ca.gov/DWW/.

CEC. 2014. Cal-adapt Database. California Energy Commissions. http://cal-adapt.org/.

Central Sierra Watershed Committee. 2007. Eastern Madera County and Mariposa County Watersheds Current Conditions Report (MC2CCR). January 2007.

CH2MHILL. 2001. Merced Water Supply Plan: Final Status Report. September 2001.

Conard, S.G. and Weise, D.R. 1998. Management of Fire Regime, Fuels, and Fire Effects in Southern California Chaparral: Lessons from the Past and Thoughts for the Future. United States Department of Agriculture, Forest Services, Forest Fire Laboratory, Pacific Southwest Research Station.

County of Mariposa. 2013a. 2013 Annual Report on the Mariposa County General Plan. County of Mariposa, Planning Department. April 19, 2013.

County of Mariposa. 2013b. Mariposa County Planning and the IRWM Plan Process Presentation at RWAC Meeting. County of Mariposa, Planning Department. October 23, 2013.

County of Mariposa. 2012a. Catheys Valley Community Plan. County of Mariposa, Planning Department. December 2012.

County of Mariposa. 2012b. Mariposa Town Planning Specific Plan. County of Mariposa, Planning Department. July 10, 2012.

County of Mariposa. 2012c. Wawona Town Planning Area Specific Plan Update. County of Mariposa, Planning Department. January, 17 2012.

County of Mariposa. 2012d. 2012 Agricultural Crop and Livestock Report. County of Mariposa, Department of Agriculture.

County of Mariposa. 2010. Mariposa County Hazard Profile Community Wildfire Protection Plan (C.W.P.P.). Mariposa County Fire Safety Council.

County of Mariposa. 2009. Fish Camp TPA Specific Plan Part 1. County of Mariposa, Planning Department.

County of Mariposa. 2006. County of Mariposa General Plan. County of Mariposa, Planning Department. December 18, 2006.

CWD. 2013. Chowchilla Water District Website. Chowchilla Water District. http://cwdwater.com/.

DSOD. 2012. Dams Within the Jurisdiction of the State of California. California Department of Water Resources, Division of Safety Dams. http://www.water.ca.gov/damsafety/damlisting/index.cfm.

DWR. 2013. California Water Plan Update 2013- Public Review Draft. California Department of Water Resources. October 2013.

DWR. 2012. Guidelines: Integrated Regional water Management Proposition 84 and 1E. California Department of Water Resources. November 2012. http://www.water.ca.gov/irwm/grants/docs/Archives/Prop84/Guidelines_PSPs/GL_2012_FINAL.pdf.

DWR. 2007. California Central Valley Unimpaired Flow Data 4th Edition - Draft. California Department of Water Resources, Bay-Delta Office. May 2007.

DWR. 2003. Bulletin 118 Groundwater Update. California Department of Water Resources. October 2003.

EPA. 2013a. Currently Designated Nonattainment Areas for All Criteria Pollutants. United States Environmental Protection Agency. December 5, 2013. http://www.epa.gov/oaqps001/greenbk/ancl.html.

EOA. 2013b. Envirofacts. United States Environmental Protection Agency. November, 2013. http://www.epa.gov/enviro/index.html

EPA. 2010a. Water Quality Control Plan for the Sacramento and San Joaquin River Basins. United States Environmental Protection Agency.

EPA. 2010b. USEPA Approved 2008-2010 303(d) List. United States Environmental Protection Agency. http://www.swrcb.ca.gov/centralvalley/water_issues/tmdl/impaired_waters_list/.

FERC. 2012a. Hydroelectric Application No. 2179-043. Federal Energy Regulation Commission. March 12, 2012.

FERC. 2012b. Hydroelectric Application No. 2467-020. Federal Energy Regulation Commission. February 22, 2012.

Forest and Rangelands. 2013. Forest and Rangelands Website. Forest and Rangelands. http://www.forestsandrangelands.gov/

Forrest, L.C. and Harding, M.V. 1994. Erosion and Sediment Control: Preventing Additional Disasters after the Southern California Fires. Woodward-Clyde Consultants\ and Weyerhaeuser Company. http://www.waterboards.ca.gov/rwqcb9/press_room/announcements/firestorm/docs/erosioncontrol_socalfires.pdf.

Franklin, G. 2013. Personal Correspondence, November 5, 2013.

Holland, R. F. 2009. California's Great Valley Vernal Pool Habitat Status and Loss: Rephotorevised 2005. December 2009.

InciWeb. 2013. Rim Fire Final Update. Incident Information System. September 27,2013. http://inciweb.nwcg.gov/incident/article/3660/21586/.

InteResources Planning, Inc. 2013. Personal Correspondence.

Kennedy/Jenks. 2010. Report of Waste Discharge Wawona Wastewater Treatment Facility NPDES Permit Renewal. Kennedy/Jenks Consultants. April 2010.

LA Times. 2013. Rim fire's effects likely to last for decades to come. Los Angeles Times. September 23, 2013. http://articles.latimes.com/2013/sep/23/local/la-me-rim-burn-20130924.

LAFCO. 2008. Water and Wastewater Municipal Service Review Report, Mariposa County - Draft. Local Agency Formation Commission of Mariposa County. March 21, 2008.

Lake Don Pedro CSD. 2013. Lake Don Pedro Community Service IRWM Presentation 2013. Lake Don Pedro Community Services District.

Mariposa County Environmental Health. 2014. Personal Correspondence.

Marty, J. T. 2006. Grazing Effects on Biodiversity and Ecosystem Function in California Vernal Pool Grasslands. June 23, 2006.

Marty, J. T. 2004. Effects of Cattle Grazing on Diversity in Ephemeral Wetlands.

MCFSC. 2013. Mariposa County Fire Safe Council Title III Funding Request for 2013-2014. Mariposa County Fire Safe Council.

MCRCD. 2012. Mariposa County Resource Conservation District Annual Work Plan, CY 2012. Mariposa County Resource Conservation District. January 5, 2012. http://www.mcrcd.net/Documents/MCRCD%20Annual%20Plan%202012.pdf.

MPUD. 2014. Mariposa Public Utility District. http://www.mariposapud.org/

MWH. 2003. Delta-Mendota Canal Recirculation Study, Final Report on Hydrologic Modeling. Montgomery Watson Harza. May 2003.

http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/sds_srjf/sjr/dmcrs/dmcrs_final-report-on-hydrologic-modeling-50503.pdf

Neary, D.G., Gottfried, G. and Ffolloitt, P.F. 2003. Post-Wildfire Watershed Flood Responses. USDA Forest Service, Rocky Mountain Research Station, AZ and School of Renewable Natural Resources, University of Arizona, Tucson, AZ.

NPS. 2014a. Yosemite National Park: Things to Do. National Park Services. http://www.nps.gov/yose/planyourvisit/things2do.htm, last accessed on November 2013.

NPS. 2014b. Yosemite Fish. National Park Services. http://www.nps.gov/yose/naturescience/fish.htm, last accessed on November 2013.

NPS. 2014c. Natural Resource Condition Assessment. National Park Services. http://www.nature.nps.gov/water/nrca/, last accessed on November 2013.

Rice, R. and Bales, R. 2013. An Assessment of Snowcover in Major River Basins of Sierra Nevada Network Parks and Potential Approaches for Long-term Monitoring. National Park Service. Natural Resource Technical Report NPS/SIEN/NTR-2013/800. September 2013.

RMC. 2012 Merced Integrated Regional Water Management Plan. June 12, 2012.

Robins, J.D. and Vollmar, J.E. 2002. Chapter 11 Livestock Grazing and Vernal Pools in *Wildlife and Rare Plant Ecology of Eastern Merced County's Vernal Pool Grasslands*. Berkeley: Vollmar Consulting.

RWQCB. 2013. Waste Discharge Requirements Orders for Mariposa County. California Regional Water Quality Control Board. http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/index.shtml#mariposa.

Sacramento Bee. 2013. Viewpoints: Plan is best chance to restore Merced River. Sacramento Bee. http://www.sacbee.com/2013/08/17/5658046/plan-is-best-chance-to-restore.html

Sierra Club. 2013. Appendix A Legislation about Yosemite. http://www.sierraclub.org/john_muir_exhibit/writings/the_yosemite/appendix_a.aspx.

Sierra Institute. 2010. Socio Economic Indicators for Watersheds with application in Mariposa County, California. Sierra Institute for Community and Environment. November 2010.

SWRCB. 1999. A Guide to Water Transfer Guide - Draft. California State Water Resources Control Board. July 1999.

Tate, K. and Roche, L. 2013. USFS Cattle Grazing, Yosemite Toad, & Water Quality Research. University of California Cooperative Extension, UC Davis.

UNEP. 2013. Tourism and Economic Conservation. United Nations Environment Programme. http://www.unep.org/resourceefficiency/Business/SectoralActivities/Tourism/FactsandFiguresaboutTourism/ImpactsofTourism/EconomicImpactsofTourism/TourismandEconomicConservation/tabid/78785/Default.aspx.

U.S. Census Bureau. 2010. State and County Quick Facts. United States Census Bureau. http://quickfacts.census.gov/qfd/states/06/06043.html.

U.S. Census Bureau. 2006-10. American Community Survey.

USDA. 2013. Draft Sierra National Forest Assessment. United States Department of Agriculture and United States Forest Service.

USDA and NRCS. 2007. Soil Survey of Yosemite National Park, California. United States Department of Agriculture and Natural Resources Conservation Service.

USFS. 2013a. Managing Wildland Fires. United States Forest Service. http://www.fs.fed.us/fire/management/index.html.

USFS. 2013b. Pacific Southwest Research Station. United States Forest Service.

USFS. 2013c. Science Synthesis to Promote Resilience of Social-ecological Systems in the Sierra Nevada and Southern Cascades. January 9, 2013.

USGS. 2013a. Wildfire Science Returns to Rim Fire. United States Geological Survey. November 7, 2013.

USGS. 2013b. Merced Falls Project USGS 1968-2012. United States Geological Survey. http://waterdata.usgs.gov/nwis/annual?referred_module=sw&=1901&=2012&site_no=11270900&por_11270900_1=2208802,00060,1,1901,2012&year_type=W&format=html_table&date_format=YYYYMMDD&rdb_compression=file&submitted_form=parameter_selection_list.

VM. 1998. Mariposa County History. Visitmariposa.net. http://visitmariposa.net/, last accessed on November 2013.

Westerling, A.L., et al. 2006. Warming and Earlier Spring Increases Western U.S. Forest Wildfire Activity. August 18, 2006.

WRCC. 2014a. Cathay Bull Run Ranch, California: Period of Record Monthly Climate Summary. Western Regional Climate Center. http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca1588.

WRCC. 2014b. South Entr Yosemite NP, California: Period of Record Monthly Climate Summary. Western Regional Climate Center. http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca8380.

WRCC. 2014c. Gem Lake, California: Period of Record Monthly Climate Summary. Western Regional Climate Center. http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca3369.

Yosemite-Stanislaus Solutions. 2011. Yosemite Stanislaus Solutions Collaborative Landscape Strategy-Draft. http://yssolutions.wordpress.com/?s=landscape.

YWPHI and Sikora Forest Consulting. 2007. Yosemite West Community Wildfire Protection Plan. Yosemite West Property & Homeowners, Inc. and Sikora Forest Consulting. November 2007.

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